

## Chambers, Danielle

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**To:** Dave Favero  
**Cc:** Tomka, Mike; Rousseau, Matthew; Project Email Filing  
**Subject:** ~COR-007878~Former Quench Pit Area LNAPL Evaluation Summary - SMI  
**Attachments:** 007878-RPT-24-Former Quench Pit Area LNAPL.pdf

Dave,

As requested, please find attached a pdf of the report that we went over with Sue in yesterday's meeting.

Thanks

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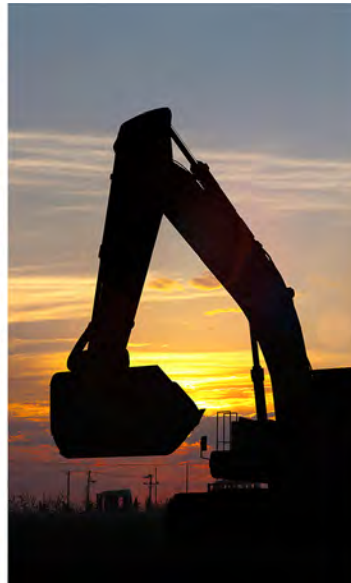
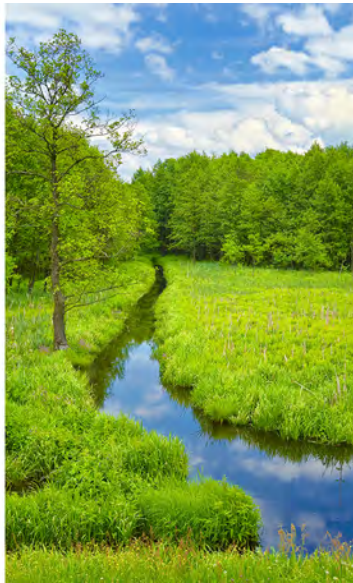
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Preliminary Draft for Discussion

## Former Quench Pit Area LNAPL Evaluation Summary

RACER Malleable Iron Industrial Plant

Saginaw, Michigan

Prepared for: Revitalizing Auto Communities Environmental  
Response (RACER) Trust

### Conestoga-Rovers & Associates

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## List of Acronyms

|                      |                                                      |
|----------------------|------------------------------------------------------|
| API                  | American Petroleum Institute                         |
| ASTM                 | American Society for Testing and Materials           |
| CRA                  | Conestoga-Rovers & Associates                        |
| DRO                  | Diesel-range organics                                |
| ft <sup>2</sup> /day | Square feet per day                                  |
| GSI                  | Groundwater/surface water interface                  |
| ITRC                 | Interstate Technology & Regulatory Council           |
| LCSM                 | LNAPL Conceptual Site Model                          |
| LNAPL                | Light non-aqueous phase liquid                       |
| MDEQ                 | Michigan Department of Environmental Quality         |
| NSZD                 | Natural source zone depletion                        |
| PCBs                 | Polychlorinated biphenyls                            |
| PID                  | Photoionization detector                             |
| RACER                | Revitalizing Auto Communities Environmental Response |
| Site                 | Malleable Iron Industrial Land                       |
| SMI                  | Saginaw Malleable Iron                               |
| SVOCs                | Semi-volatile organic compounds                      |
| VOCs                 | Volatile organic compounds                           |
| µg/kg                | Microgram per kilogram                               |

## **Section 1.0 Introduction**

Conestoga-Rovers and Associates (CRA), on behalf of Revitalizing Auto Communities Environmental Response (RACER) Trust, has prepared the following report to summarize the Light Non-Aqueous Phase Liquid (LNAPL) evaluation activities completed in the former Quench Pit Area at the former Saginaw Malleable Iron (SMI) Plant, now referred to as Malleable Iron Industrial Land, Saginaw, Michigan (Site) and to provide recommendations for future work associated with the former Quench Pit Area. This report is organized as follows:

- Section 1.0 – Introduction
- Section 2.0 – Background
- Section 3.0 – LNAPL Conceptual Site Model
- Section 4.0 – Remedial Drivers
- Section 5.0 – Conclusions & Recommendations

## **Section 2.0 Background**

### **2.1 Site Operational History**

The Site consists of approximately 150 acres (excluding the Green Point Landfill) located in the City of Saginaw, Michigan. The former SMI Plant occupied an area of approximately 1 million square feet (23 acres). The former SMI Plant was in continuous operation from 1917 until manufacturing operations ceased in 2007. Historical manufacturing operations at the former SMI Plant involved casting and heat treating iron which utilized large volumes of quench and hydraulic oils. Demolition of the former SMI Plant was initiated in 2009 and completed in December 2010. Remaining features at the Site include: the former building concrete floor slab, parking areas associated with the former SMI Plant, landfills, and the former secondary settling pond, as presented on Figure 2.1.

The former Quench Pit Area is located in the former Annealing Department inside the south-central portion of the former SMI Plant. The area contains the three former quench pits (#1, #2, and #3). Former Quench Pit #1 was installed in 1966. Former Quench Pits #2 and #3 were installed in 1970. The quench pits were constructed of stainless steel panels welded together to form a double box or shell. Each quench pit typically held approximately 25,000 gallons of quench oils used during a heat treatment process.

As part of quench pit construction assessment activities completed in December 1997, the quench pits were emptied, cleaned, and leaks repaired. In addition, shells were built inside the three quench pits, allowing the outer tank to act as secondary containment.

Demolition of the quench pits was completed in the summer of 2010, which involved removing the quench pit metal lining, punching holes in the concrete bottom and sides of the pits, installation of LNAPL recovery wells QP-1 (16-inch diameter stainless steel with 10 foot screen), QP-2 (4-inch diameter PVC with 10 foot screen), and QP-3 (16-inch diameter stainless steel with 10 foot screen), backfilled with gravel, and capped with concrete.

## **2.2 Site Investigation and Monitoring History**

Remedial activities at the Site are being completed pursuant to a Consent Judgment executed between the Michigan Department of Environmental Quality (MDEQ), the Michigan Attorney General's (MAG's) Office, GM, and WMI, and entered by the State of Michigan Circuit Court for Saginaw County on March 16, 1998, Case No. 98-22686-CE-2(Consent Judgment). Following the GM bankruptcy in July 2009, initially Motor Liquidation Company (MLC) and now the RACER Trust continue to conduct remedial activities in accordance with the Consent Judgment.

The Remedial Investigation (RI) was completed between December 1994 and August 2000 in accordance with the MDEQ approved Work Plan as well as additional phases of RI activities. The RI report was submitted to the MDEQ on November 27, 2000 and approved on July 5, 2001. A feasibility study, including Human Health Evaluation Report (HHE) and Ecological Risk Assessment (ERA) was completed and submitted in July of 2003 and approved by MDEQ in a letter dated November 18, 2003. Environmental Indicator (EI) CA 750 and CA 725 were filed for the Site on September 15, 2006 and September 27, 2007, respectively. A Remedial Action Plan (RAP) was initially submitted on July 30, 2008, was modified on December 31, 2008 and approved with conditions on February 27, 2009. A revised RAP was submitted on May 29, 2009. Specifically the RAP includes a monitoring program for the former Quench Pit Area that involves measuring LNAPL thicknesses and water-levels from monitoring wells QPTW-01, QPTW-02, QPTW-03, QPTW-04, QPTW-05, QPTW-10, and QPTW-13. Measurements are used to track seasonal fluctuations in the groundwater table beneath the plant and monitor the LNAPL thickness at various locations. Figure 2.2 presents the most recent round of LNAPL thicknesses measured from the former Quench Pit Area.

## **Section 3.0 LNAPL Conceptual Site Model**

### **3.1 Decision-Making Process**

The MDEQ Remediation and Redevelopment Division Resource Document entitled *Non-Aqueous Phase Liquid (NAPL) Characterization, Remediation, and Management for Petroleum Releases* (MDEQ Petroleum NAPL Policy or Policy – see Appendix A)<sup>1</sup> and the LNAPL remedial/management decision-making process developed by the RACER Trust (in partnership with MDEQ) (Decision Tree - see Appendix B)<sup>2</sup> are based upon the development of a technically sound LNAPL Conceptual Site Model (LCSM) that contains the appropriate amount and kinds of data necessary to evaluate potential remedial drivers and remedial/management strategies. The LCSM is the body of information describing aspects of the LNAPL and site setting necessary to satisfy the LNAPL remedial/management objectives (ASTM, 2007; ITRC, 2009). The LCSM is similar to a Conceptual Site Model, which includes the source, pathway, and receptor, but the emphasis in the LCSM is on the source component (i.e., the LNAPL). An LCSM includes both "scientific" information regarding the LNAPL, soil and site conditions/setting, and "other" considerations and factors that are necessary to establish the true remedial drivers (risk-based or non-risk factors) for the area in question. The remedial drivers (Section 4.0), in turn, are used to establish the overall LNAPL remedial/management objectives, and follow-up technology-specific goals, metrics and endpoints, where applicable.

The LCSM may be comprised of some or all of the following scientific and technological information:

- Release history
- Remedial history
- Land use (historical and current)
- Geological and hydrogeological information/setting
- LNAPL physical (density, viscosity, interfacial tensions) and chemical properties (fingerprinting, constituents, mole fractions, etc.) characteristics
- LNAPL spatial distribution (vertical and horizontal delineation)
- Potential exposure scenarios
- LNAPL mobility/recoverability information
- LNAPL body stability information

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<sup>1</sup> Final dated June 2014.

<sup>2</sup> Latest working draft dated February 2013.

A detailed LNAPL evaluation was completed for the former Quench Pit Area LNAPL consistent with the MDEQ Petroleum NAPL Policy and RACER's LNAPL Decision Tree. Generally, the Policy and Decision Tree assist with identifying acceptable remedial actions based on site-specific conditions.

### **3.2 LCSM for the Former Quench Pit Area**

A detailed LNAPL evaluation was completed for the former Quench Pit Area LNAPL consistent with the MDEQ's Policy and RACER's LNAPL Decision Tree. The more pertinent elements of the LCSM for the former Quench Pit Area are summarized in the following sections. Figure 3.1 presents an overall Site Plan of the former Quench Pit Area.

#### **3.2.1 Release History**

LNAPL was first identified in the former Quench Pit Area during the Quench Pit Investigation conducted in March 1997 when 13 monitoring wells (QPTW-01 to QPTW-13) were installed around the quench pits. Figure 3.1 presents the location of the monitoring wells. At the time of the investigation, there were no existing process lines, underground conveyance piping, or petroleum storage tanks associated with the existing quenching operations that could have been a source of LNAPL in the area. Therefore, the suspected source of the LNAPL detected in the investigation was the quench pits and/or the associated drip lines, which were used to collect and recycle quench oil that dripped from the parts removed from the quench pits following heat treatment. Samples of quench oils were periodically analyzed for polychlorinated biphenyls (PCBs) since 1976, and detections were noted in 1977 and 1979. Since 1979, PCBs were not detected in the quench oil used at the former SMI Plant. Therefore, detections of PCBs in the LNAPL samples suggest that initial release may have occurred in the late 1970s. It is likely there were multiple releases of LNAPL from operation of the quench pits over time.

The former SMI Plant was closed in 2007 and demolition of the quench pits was completed in the summer of 2010. There have therefore been no possible additional releases to add to the existing LNAPL in at least 4 years. Consequently, the most likely scenario is that the head of the release that might have driven migration has dissipated. Well gauging data confirm that the areal extent of where LNAPL is observed in wells has remained stable over time.

#### **3.2.2 Remedial History**

As part of quench pit construction assessment activities completed in December 1997, the quench pits were emptied, cleaned, and leaks repaired. In addition, shells were built inside the three quench pits, allowing the outer tank to act as secondary containment. Between 1997 and 2002, approximately 6,500 gallons of LNAPL was manually recovered from the former Quench

Pit Area. During a separate site-wide sewer investigation LNAPL was identified in a 50-inch abandoned sewer line immediately adjacent to former Quench Pit #1. Subsequently, approximately 4,000 gallons of LNAPL was removed from the 50-inch abandoned sewer line. In addition, two bulkheads were installed on the 50-inch abandoned line downgradient of the quench pits at manhole L12.2 and manhole I8.8. The 50-inch abandoned sewer line was previously bulkheaded at the property boundary to the west of the Quench Pit Area by the adjacent facility. The locations of the bulkheads are presented on Figure 3.1.

In February 2002, an active LNAPL recovery system (skimmer pump) was installed in QPTW-03. Between 2002 and 2007, approximately 2,400 gallons of LNAPL was extracted from QPTW-03. In December 2007, operation of the active LNAPL recovery system ceased as a result of SMI Plant demolition activities but manual bailing of LNAPL continued while there was no power. After the demolition of the SMI Plant, QPTW-03 was decommissioned due to damages sustained during plant demolition.

As part of the plant demolition bulkheads were installed in the "green" sewers (as depicted on Figure 3.1) to remove all discharges from the Site to the City sewer (pink). Demolition of the quench pits was completed in the summer of 2010. During demolition of the quench pits, approximately 55,000 gallons of LNAPL was recovered from former Quench Pits #1, #2, and #3 (33,000, 5,000, and 16,500 gallons, respectively). The LNAPL was containerized and disposed of as part of demolition activities. Three LNAPL recovery wells (QP-1, QP-2, and QP-3) were installed, one in each of the quench pits and were added to the monitoring program. The LNAPL recovery wells are presented on Figure 3.1. In October 2011, the LNAPL building from the Southwest Plant LNAPL Area was moved to the former Quench Pit Area and the LNAPL skimmer pump from QPTW-03 was installed in QPTW-10. On January 9, 2012 the skimmer pump installed in QPTW-10 was commissioned and recovery has been performed continuously since commissioning. To date, approximately 60 gallons of LNAPL have been recovered from the former Quench Pit Area since January 2012.

Figures 3.2 and 3.3 present graphical representations of LNAPL thicknesses in monitoring wells QP-2, QPTW-10, QPTW-05, QPTW-04, and QPTW-01, since the commissioning of LNAPL recovery in QPTW-10. Table 2.1 presents a summary of the LNAPL thicknesses over time in the former Quench Pit Area. The volumes of LNAPL that have been recovered from QP-2, QPTW-01 and QPTW-04 since the commissioning of LNAPL recovery in QPTW-10 have been negligible. The continuous skimming LNAPL recovery rate at QPTW-10 was initially on the order of 0.57 gallons per day when skimming commenced in January 2012, and had diminished to approximately 0.03 gallons per day as of May 2013.

On October 10, 2013 a replacement well was installed within 3-feet of the abandoned QPTW-03 monitoring well since QPTW-03 was still recovering LNAPL at the time it was damaged and subsequently abandoned. QPTW-03R (replacement to QPTW-03) was therefore added to the monitoring program. No LNAPL was identified in QPTW-03R at the time of installation. LNAPL was first observed in QPTW-03R on April 25, 2014 with a LNAPL thickness of 0.37 feet and the most recent LNAPL measurements collected on July 31, 2014 identified a LNAPL thickness of 0.08 feet.

Currently, active LNAPL recovery continues in the former Quench Pit Area at QPTW-10. Monitoring for the presence of LNAPL is completed at other monitoring wells within the former Quench Pit Area periodically with manual bailing of LNAPL performed when measurable LNAPL thicknesses are observed. In addition to the monitoring and bailing, maintenance of the LNAPL recovery system is completed regularly. Recovered LNAPL is stored on-Site in a 300 gallon tote and disposed of off-Site as required.

### **3.2.3 Land Use**

The former Quench Pit Area LNAPL is within the confines of a former heavy industrial site with any future land use to be restricted to non-residential. The Site is serviced by municipal water supply and the LNAPL is overlain by a concrete slab that remains following the demolition of the Plant.

Adjacent land uses include the following:

- To the north is a residential area.
- To the south is the Greenpoint Landfill (RACER Trust property).
- To the west is the former Delphi Plant 2 which historically cut and ground metal automotive parts. Delphi Plant 2 was closed in 2001.
- To the east is the Saginaw River.

### **3.2.4 Geological and Hydrogeological Setting**

Overburden at the Site is approximately 86 feet thick and is comprised generally of (in descending order): fill materials, glaciolacustrine silts and clays, a sand unit which becomes coarser with depth, glaciolacustrine silty clay, and glacial till. The Site lies over bedrock units in the central part of the Michigan basin, the shallowest of which consists of Pennsylvanian age bedrock of the Grand River and Saginaw Formations. Cross-sections showing the stratigraphy in the former Quench Pit Area are provided in Figures 3.4 and 3.5.

Shallow groundwater at the Site exists in an unconfined condition at depths ranging from 2 to 10 feet below ground surface (bgs). The underlying bedrock aquifer is hydraulically disconnected from the shallower overburden groundwater by a continuous lower silty clay layer. Groundwater flow is controlled on a regional scale by the Saginaw River, which acts as a discharge point for overburden groundwater (east of the Site).

The water table elevation has generally risen in the former Quench Pit Area between 2008 and 2010, reflecting the establishment of new equilibrium hydraulic conditions following the demolition of the Site buildings in 2009. Appendix C provides graphical depictions of well gauging data from 2005 to the present which show an approximate 4-5 foot increase in water table elevation at most wells during this time. The graphs in Appendix C also show that there appears to have been some pressurization of the subsurface during this time where in-well LNAPL thickness response to the rising water table exhibits more of a confined relationship (i.e., in-well LNAPL thickness increases with increasing water table elevation and vice versa) compared to the more prevalent unconfined behavior (i.e., predominantly inverse relationship between in-well LNAPL thickness and water table elevation changes) seen before and after.

### **3.2.5 LNAPL Properties**

The LNAPL consists of quench oil that is similar to hydraulic oil in physical properties. This type of LNAPL is non-volatile and has a viscosity ranging from 65 to 1,200 centipoises based on testing performed in 1998 (BBL, 1998). As a comparison, gasoline will typically have a viscosity of approximately 1 centipoise. In other words, the quench oil LNAPL is as much as 1,000 times less able to flow than a typical gasoline LNAPL. Dissolution and volatilization of LNAPL constituents would not be expected to be occurring at sufficient rates to present unacceptable levels of impacts in groundwater or soil gas given the LNAPL type and age (weathering/degradation of the LNAPL will have taken place to some extent since its original release years ago). Historical results from LNAPL testing for certain VOCs and SVOCs (see BBL, 1998 and 2001) indicated a low volatile content.

Historical LNAPL analytical results indicate the presence of PCBs in the LNAPL. Samples of LNAPL were most recently collected from the Quench Pit monitoring wells in March 2007. PCBs were detected in LNAPL at QPTW-04 (2,700 µg/kg), QPTW-05 (3,300 µg/kg), QPTW-10 (6,000 µg/kg) and QPTW-13 (4,000 µg/kg). The detailed analytical report is included as Appendix D.

### **3.2.6 LNAPL Spatial Distribution**

The extent of LNAPL has been delineated via monitoring wells, with the extent of the area where LNAPL is observed in wells being approximately 200 feet by 200 feet in size (see

Figure 2.2). The location of LNAPL-impacted area is in excess of 350 feet from the nearest property line. The approximate vertical extent of the LNAPL smear zone is shown on Figures 3.4 and 3.5.

The only potential preferential migration pathway in the area of the quench pits is the abandoned 50-inch diameter sewer line, which currently intersects the groundwater table. However, this sewer line has been bulkheaded and LNAPL is not observed in monitoring wells QPTW-09 and QPTW-11 installed in the respective sewer bedding downgradient (with respect to the sewer) of the area.

### **3.2.7 LNAPL Mobility and Recoverability**

The presence of LNAPL in wells indicates a theoretical presence of mobile LNAPL; however, the fraction of LNAPL that remains potentially mobile is likely negligible given the age of the LNAPL and the historical LNAPL recovery efforts (i.e., LNAPL saturation reduction) that were continued until performance was observed to diminish to very low levels. In addition, the in-well LNAPL behavior depicted in Appendix C generally correlates with water table fluctuations and the elevated water table elevation post-demolition will have caused significant smearing and, consequently, will have reduced localized LNAPL saturations and further immobilized the LNAPL.

With respect to recoverability, CRA developed estimates of LNAPL transmissivity pursuant to ASTM E2856-13 *Standard Guide for Estimation of LNAPL Transmissivity* (see Table 3.1) using the following data:

- Longer-term continuous skimming data from the automated skimmer system for QPTW-10
- The results of shorter-term manual skimming tests at QPTW-01, QPTW-04, QPTW-05, and QP-2

As noted in Table 3.1, all transmissivity results are below the draft MDEQ de minimis recoverability criterion of  $0.5 \text{ ft}^2/\text{day}$ . It is noted that LNAPL transmissivity has not been evaluated at QPTW-03R (replacement well for QPTW-03 which was the historical location of active LNAPL recovery) as it took some time for LNAPL to be observed in the well following installation. The field data and calculations associated with the LNAPL transmissivity estimates are provided in Appendix E.

Given the preceding LNAPL mobility discussion and the de minimis LNAPL transmissivity, it can be assumed that LNAPL is predominantly present at residual saturation (i.e., effectively immobile, unrecoverable) levels at this point.

It is noted that a potential preferential pathway for LNAPL migration exists in the form of the 50-inch sewer traveling through the LNAPL area, particularly in light of the post-demolition water table rise that has been observed at the Site. However, this sewer has been abandoned/bulkheaded downgradient of the LNAPL area and LNAPL has never been observed in monitoring wells screened in the downgradient sewer bedding. In addition, the residual LNAPL is effectively immobile/unrecoverable; therefore, there is little risk that LNAPL might be present in sufficient saturations and under sufficient LNAPL gradients to migrate through sewer bedding materials at this point. The most likely scenario is that a rising water table will only further trap and smear (i.e., immobilize) the residual LNAPL.

### **3.2.8 LNAPL Stability**

In general, the driving mechanism for LNAPL migration is the LNAPL head that exists during and shortly after a release. Previously it was commonly believed that the hydraulic gradient "causes" LNAPL to spread. However, the generally accepted current understanding is that in most cases the hydraulic gradient will not cause LNAPL spreading; rather, it will only influence the preferred direction of spreading where a sufficient LNAPL head exists to drive the migration. Experience has shown that the LNAPL head will dissipate relatively quickly following the cessation of a release, with most LNAPL achieving overall stability (stable perimeter/footprint) within a few years. Localized areas of mobile/recoverable LNAPL may still exist within the stable perimeter of LNAPL at this point; however, the overall footprint of LNAPL will not expand further.

The older the LNAPL body, the more likely it will be stable. This is partly due to the dissipation of the LNAPL head, and partly due to the seasonal fluctuations in the water table that will "smear" the LNAPL or spread the now fixed volume of LNAPL over larger vertical extents over time. Smearing causes a progressive decrease in localized LNAPL saturations and, consequently, the mobility potential of the LNAPL. Based solely on the time since there was any possibility of an active release (at least 4 years), the LNAPL would be expected to be stable overall (i.e., not migrating). The well gauging, remedial history and LNAPL transmissivity estimates confirm that the potential mobility of the LNAPL is very low and, most importantly, the footprint of where LNAPL is observed in wells has decreased over time (see Figure 2.2). The LNAPL body is therefore concluded to be stable.

### **3.2.9 Potential Exposure Scenarios**

The available historical groundwater analytical data are summarized and compared against the generic State of Michigan criteria in Table 3.2. These results indicate that exceedances of generic State of Michigan criteria were noted historically for various metals for the

groundwater/surface water interface (GSI) and drinking water pathways. However, these are not considered relevant pathways for the following reasons:

- **Drinking Water Pathway:** This pathway is incomplete based on the following:
  - a resource use restriction is included in the conditionally approved RAP. The restriction will prohibit installation or use of drinking water or irrigation wells on the Property and also prohibit installation or use of groundwater extraction wells on the Property except for wells and devices that are part of an MDEQ-approved response activity or for short-term dewatering for construction purposes, provided the dewatering, including management and disposal of the groundwater, is conducted in accordance with all applicable environmental laws and does not cause or result in a new release, exacerbation of any pre-existing environmental condition, or any other violation of environmental laws; and
  - the Site is serviced by municipal water supply.
- **GSI Pathway:** This pathway is not relevant based on the following points:
  - **LNAPL:** The Quench Pit Area LNAPL is stable and is a significant distance from the Saginaw River. The 50-inch sewer that travels through the LNAPL area has been bulkheaded and downgradient wells in the sewer bedding have never exhibited LNAPL.
  - **Groundwater:** Some sewers in the vicinity of the LNAPL area discharge to the former Secondary Settling Pond. From there, water infiltrates the subsurface and discharges as groundwater to the Saginaw River. It is noted that groundwater sampled between the former Secondary Settling Pond and the Saginaw River has indicated that constituent concentrations are below applicable criteria and/or within acceptable concentrations established through the Site mixing zone (e.g., see ARCADIS, 2012).

Considering these points and the preceding LCSM discussion, the drinking water pathway will be addressed by a resource use restriction and the GSI pathway is not currently a relevant pathway. It is noted that no volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) or PCBs have been detected in groundwater in the Quench Pit Area. It is further noted that groundwater quality would only be expected to improve over time due to the lack of new releases and the fact that natural source zone depletion processes (NSZD) will act on the LNAPL such that the residual mass will decrease and it will only become progressively less soluble over time.

As previously noted, the LNAPL consists of a non-volatile petroleum product that would not be expected to present soil vapor concerns. This is perhaps best-evidenced by historical boring logs for the area (Appendix F) that do not exhibit elevated photoionization detector (PID) readings where LNAPL is observed in the soil. Similar to dissolution potential, NSZD processes

will also progressively reduce the volatility of the LNAPL over time. In addition, any concerns relating to vapor intrusion can be also be addressed through a restrictive covenant.

Direct contact is not currently a relevant pathway. However, it is a potential pathway in the future should the concrete slab be removed and/or the area is excavated for redevelopment or other purposes. As with the other potential exposure scenarios described herein, potential future direct contact issues can be best addressed through a restrictive covenant.

### **3.3 Summary**

In summary, the following list represents the most pertinent points of the LCSM:

- The LNAPL is a viscous, non-volatile hydraulic oil range fuel type
- The LNAPL body is effectively immobile, unrecoverable and stable/non-migrating overall due to the length of time in the ground, historical LNAPL recovery efforts and LNAPL transmissivity estimates
- There are no current unacceptable exposure scenarios associated with the LNAPL in place
- The Site restrictive covenant will address any potential future exposures

## **Section 4.0 Remedial Drivers**

The revised Part 213 regulations and draft MDEQ NAPL Policy are primarily based on concepts from ASTM (2007) and ITRC (2009). Similar to ITRC, MDEQ considers two types of risks with respect to the presence of LNAPL: compositional risk and saturation-based risk. Compositional risks represent the 'traditional' risk concerns associated with groundwater, direct contact or soil vapor-related exposures. Compositional risks therefore represent concerns where a change in LNAPL chemistry may be advantageous to limit dissolution, volatilization, etc. of petroleum constituents. Examples of compositional change techniques include enhanced biodegradation, in-situ chemical oxidation and air sparging. Saturation-based risk primarily relates to the potential for LNAPL migration into areas not already impacted where the reduction of LNAPL saturations may be warranted. Saturation-based remedial techniques are therefore based on the mass recovery of LNAPL.

As indicated above, the typical compositional risks associated with the presence of LNAPL would be unacceptable levels of dissolved phase contamination, potential for direct contact, or soil vapor concerns. As noted in the LCSM discussion, there is no current risk with respect to actual or potential dissolved and/or vapor phase impacts and potential future risks can be addressed by a restrictive covenant. In addition, the direct contact pathway is not currently

complete at the Site and the implementation of an appropriate health and safety plan with any future soil excavation in the area will most efficiently and effectively mitigate any potential future direct contact exposure concerns. This can also be accomplished through a restrictive covenant. This institutional control also likely represents the most sustainable approach since it does not involve the resource usage, emissions (direct or indirect) or remediation risk that are typically generated with engineered remedies.

As previously discussed, all indications are that the LNAPL is stable/non-migrating and immobile from a practical standpoint with LNAPL transmissivity estimates indicating that the recoverability of the LNAPL is less than the associated draft MDEQ criterion at all wells with sufficient LNAPL thickness for testing. Therefore, there is no saturation-based risk.

The pathway through the draft RACER LNAPL decision-making framework resulting from the preceding discussion is illustrated in Figure 4.1 along with the associated decision-making rationale for each decision point.

## **Section 5.0 Conclusions & Recommendations**

Based on the information provided in the previous sections the following conclusions are provided:

- The LNAPL is a viscous, non-volatile hydraulic oil range fuel type
- The LNAPL body is effectively immobile, unrecoverable and stable/non-migrating overall
  - LNAPL transmissivity estimates for all wells (with the possible exception of QPTW-03R) with greater than 0.2 feet of LNAPL (i.e., enough LNAPL for recoverability testing) are below 0.5 ft<sup>2</sup>/day
  - No applicable saturation-based remedial drivers
- There are no current unacceptable exposure scenarios associated with the LNAPL in place
  - No applicable compositional remedial drivers

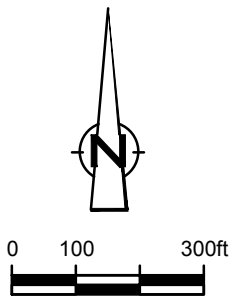
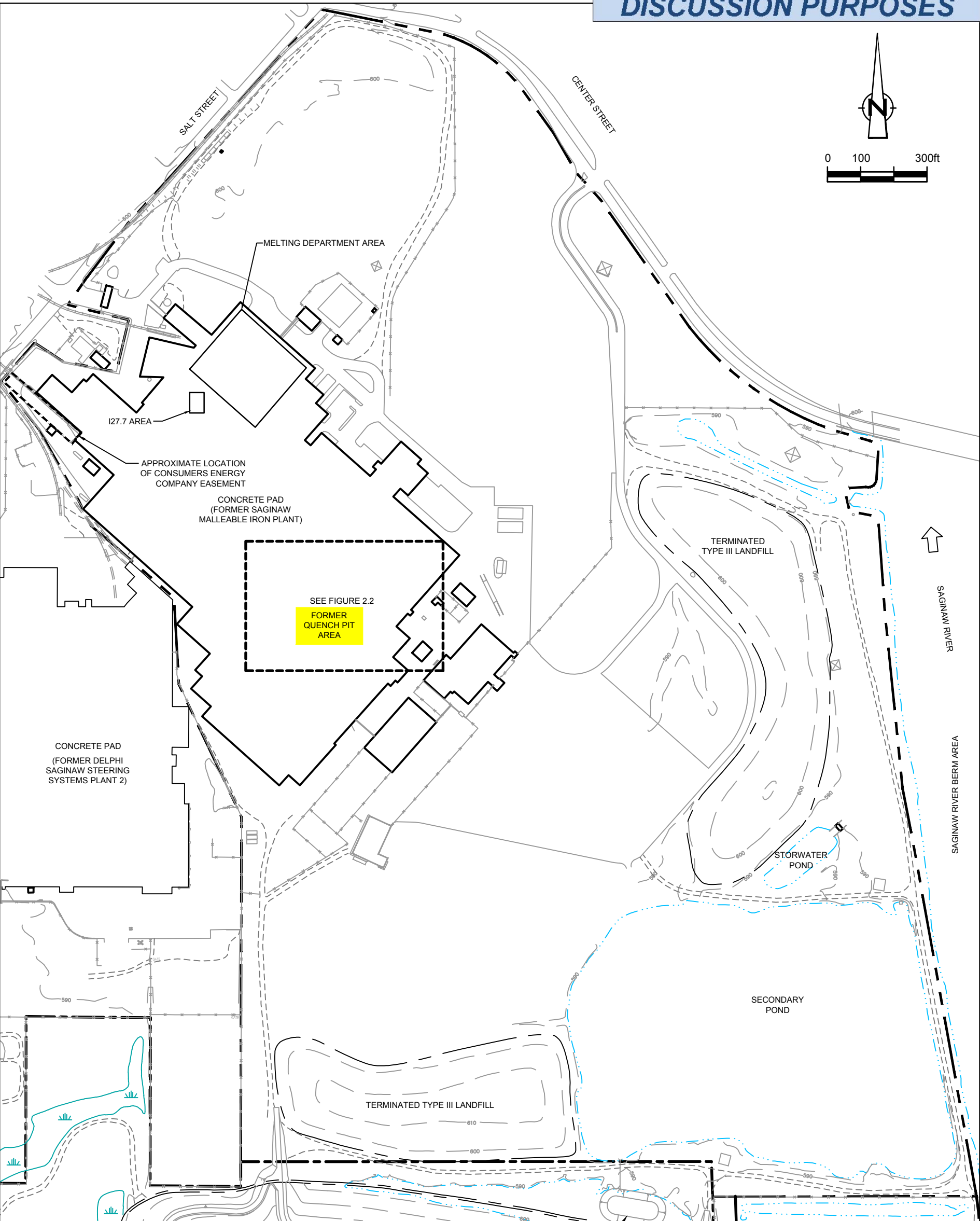
A Site restrictive covenant can be developed to address any potential future exposures.

CRA proposes the following closure strategy for the area:

- Monitor the downgradient sewer bedding monitoring wells (QPTW-09 and QPTW-11) quarterly for two years to confirm that LNAPL is not migrating along sewer bedding under post-demolition hydraulic conditions

- Monitor nearby active sewers (MH K8.9 and MH L8.8) that discharge to the secondary pond quarterly for two years to confirm they are not impacted by LNAPL
- Evaluate LNAPL transmissivity at QPTW-03R if in-well LNAPL thickness is greater than 0.2 feet for two consecutive rounds of measurements
- Abandon the remaining wells in the area
- Prepare, obtain, MDEQ approval and record a Site restrictive covenant to notify potential future property owners of the presence of NAPL and to ensure that land use changes do not alter site conditions without proper evaluation
- Submit a closure report for MDEQ review/approval that demonstrates the following (pursuant to Section 7.0 of the Petroleum NAPL Policy):
  - recoverable NAPL has been recovered to the "maximum extent practicable" as defined in the Petroleum NAPL Policy (e.g., transmissivity of residual LNAPL is less than 0.5 ft<sup>2</sup>/day)
  - all unacceptable risks have been mitigated
  - proper institutional controls are recorded on the deed

**PRELIMINARY DRAFT FOR  
DISCUSSION PURPOSES**



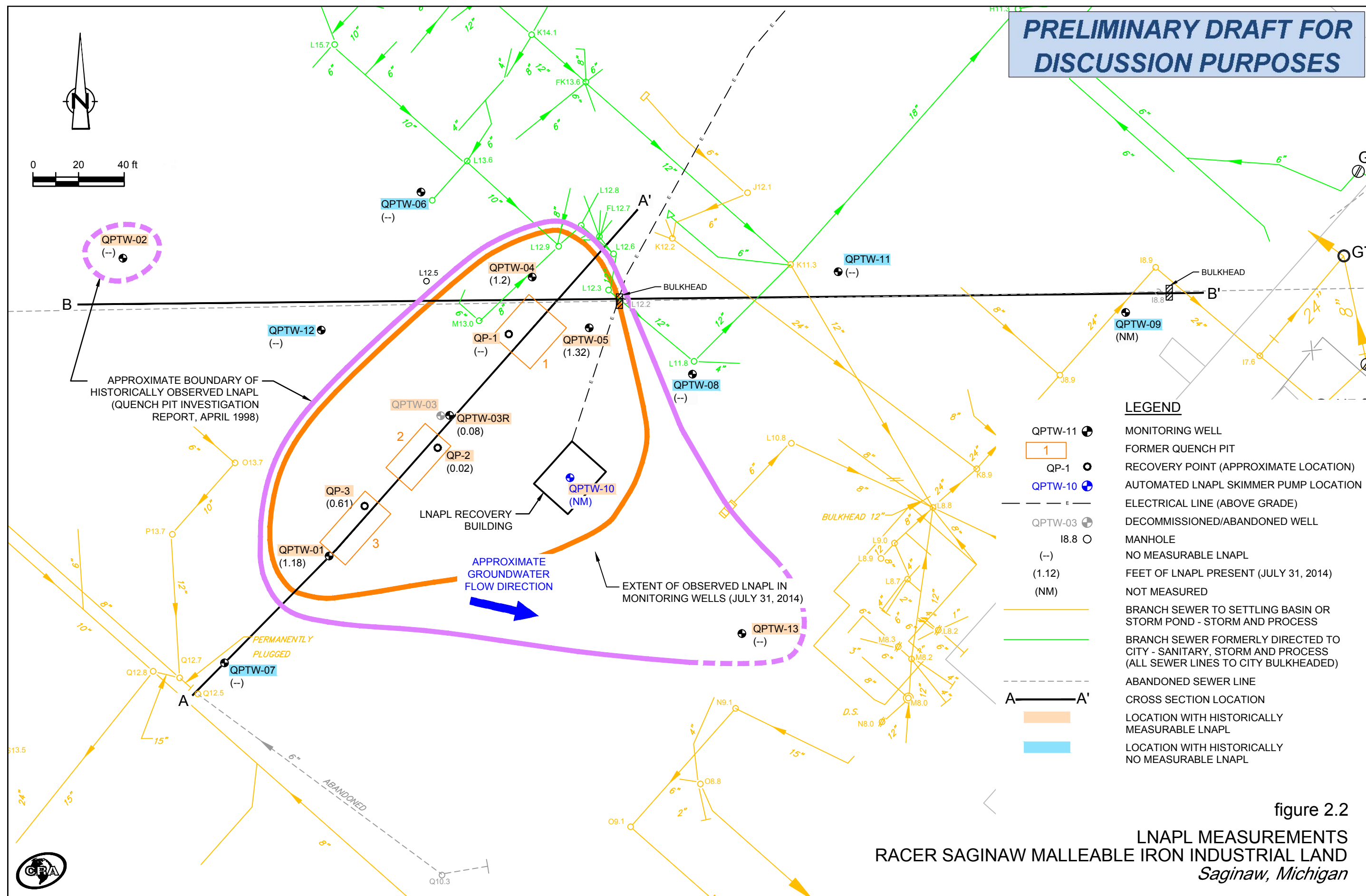
**LEGEND**

- RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND PROPERTY LINE (APPROX.)
- - - UNPAVED ROAD
- - - GROUND SURFACE ELEVATION CONTOUR (10 FT INTERVAL)
- x - x - FENCE LINE

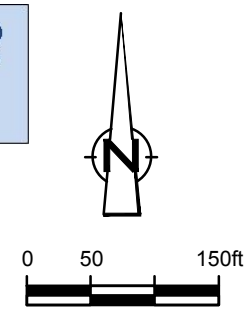
NOTE:  
THIS DRAWING HAS BEEN PREPARED  
UTILIZING THE BEST AVAILABLE INFORMATION.



figure 2.1  
SITE PLAN  
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND  
*Saginaw, Michigan*



**PRELIMINARY DRAFT FOR  
DISCUSSION PURPOSES**



**LEGEND**

- MALLEABLE IRON INDUSTRIAL LAND PROPERTY LINE (APPROX.)
- FENCE LINE
- MONITORING WELL
- FORMER QUENCH PIT
- RECOVERY POINT (APPROXIMATE LOCATION)
- AUTOMATED LNAPL SKIMMER SYSTEM
- ELECTRICAL LINE (ABOVE GRADE)
- UTILITY POLE
- LNAPL BUILDING
- DECOMMISSIONED/ABANDONED WELL
- MANHOLE
- CITY SEWER LINE
- MAIN SEWERS TO CITY - SANITARY, STORM AND PROCESS
- MAIN SEWERS TO SETTLING BASIN OR STORM POND - STORM AND PROCESS
- BRANCH SEWERS TO SETTLING BASIN OR STORM POND - STORM AND PROCESS
- BRANCH SEWERS TO CITY - SANITARY, STORM AND PROCESS
- BRANCH SEWERS TO CITY - SANITARY
- AUXILIARY WASTE SEWER
- ABANDONED SEWER LINES
- BULKHEAD

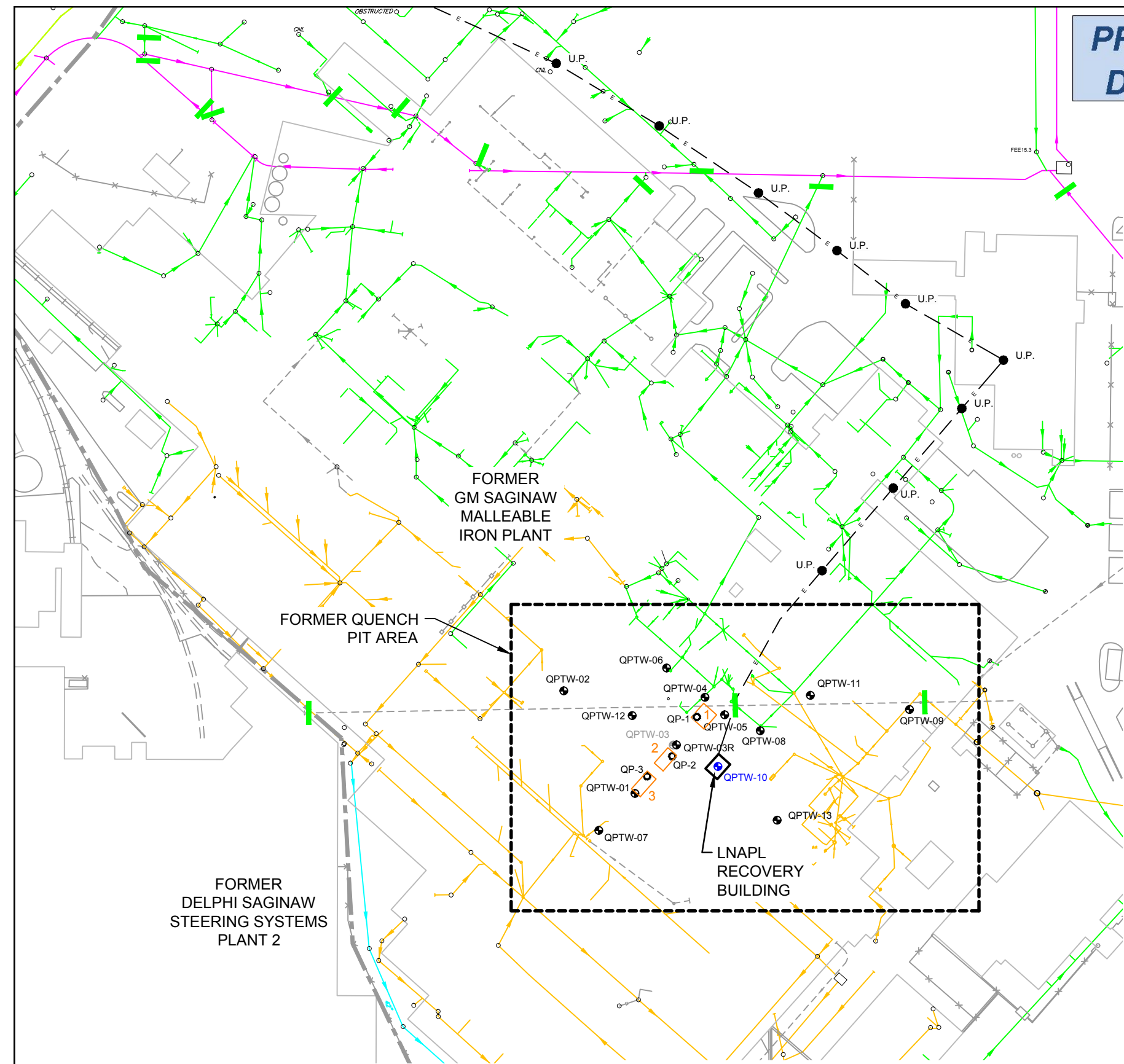
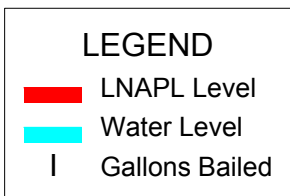
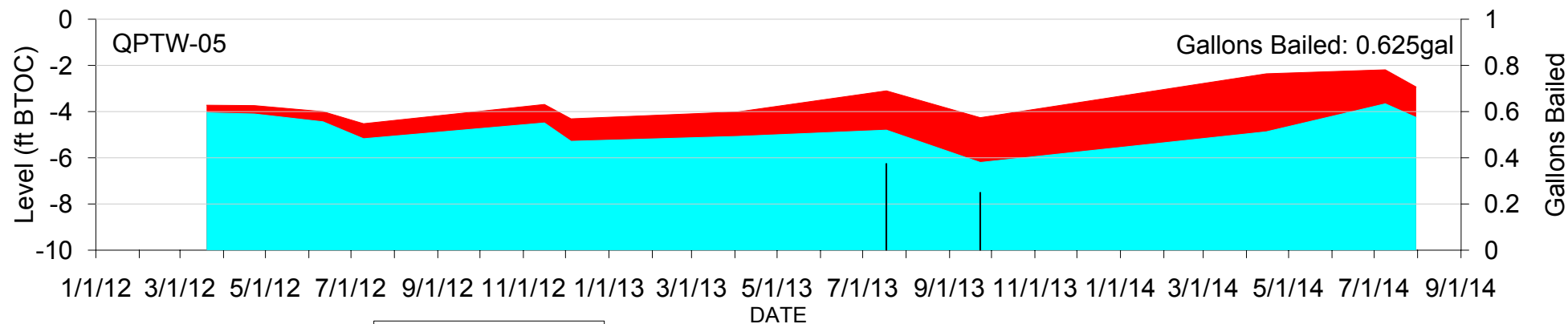
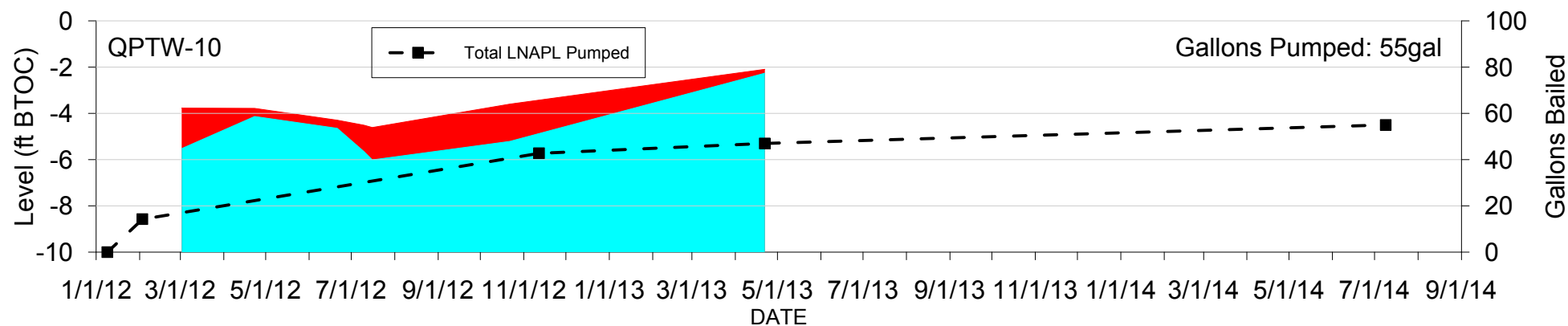
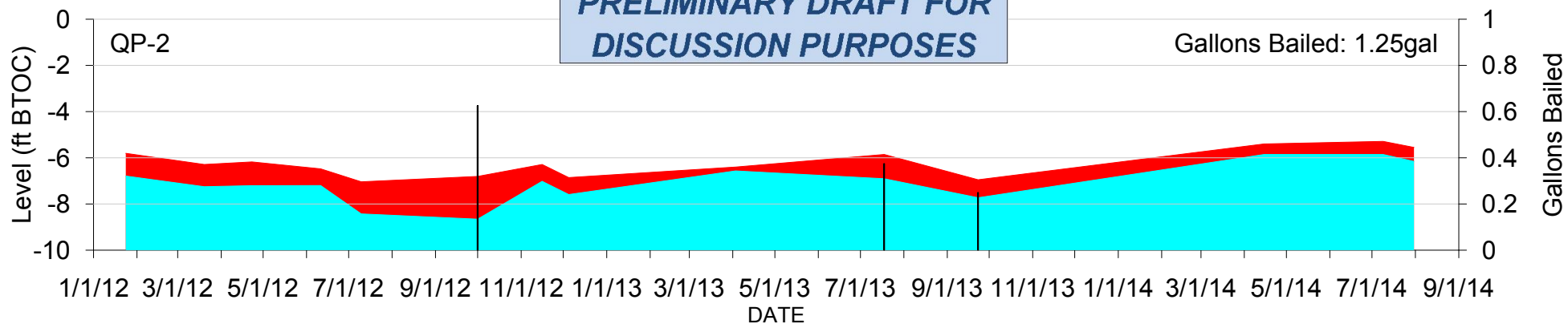


figure 3.1

**FORMER QUENCH PIT AREA AND BULKHEAD LOCATIONS  
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND  
*Saginaw, Michigan***



**PRELIMINARY DRAFT FOR  
DISCUSSION PURPOSES**



NOTES:  
ft BTOC - feet below top of casing

**SUMMARY OF LNAPL MEASUREMENTS: QP-2, QPTW-10, AND QPTW-05**  
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND  
Saginaw, Michigan

figure 3.2

**PRELIMINARY DRAFT FOR  
DISCUSSION PURPOSES**

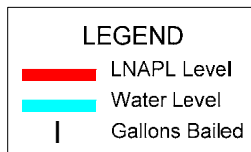
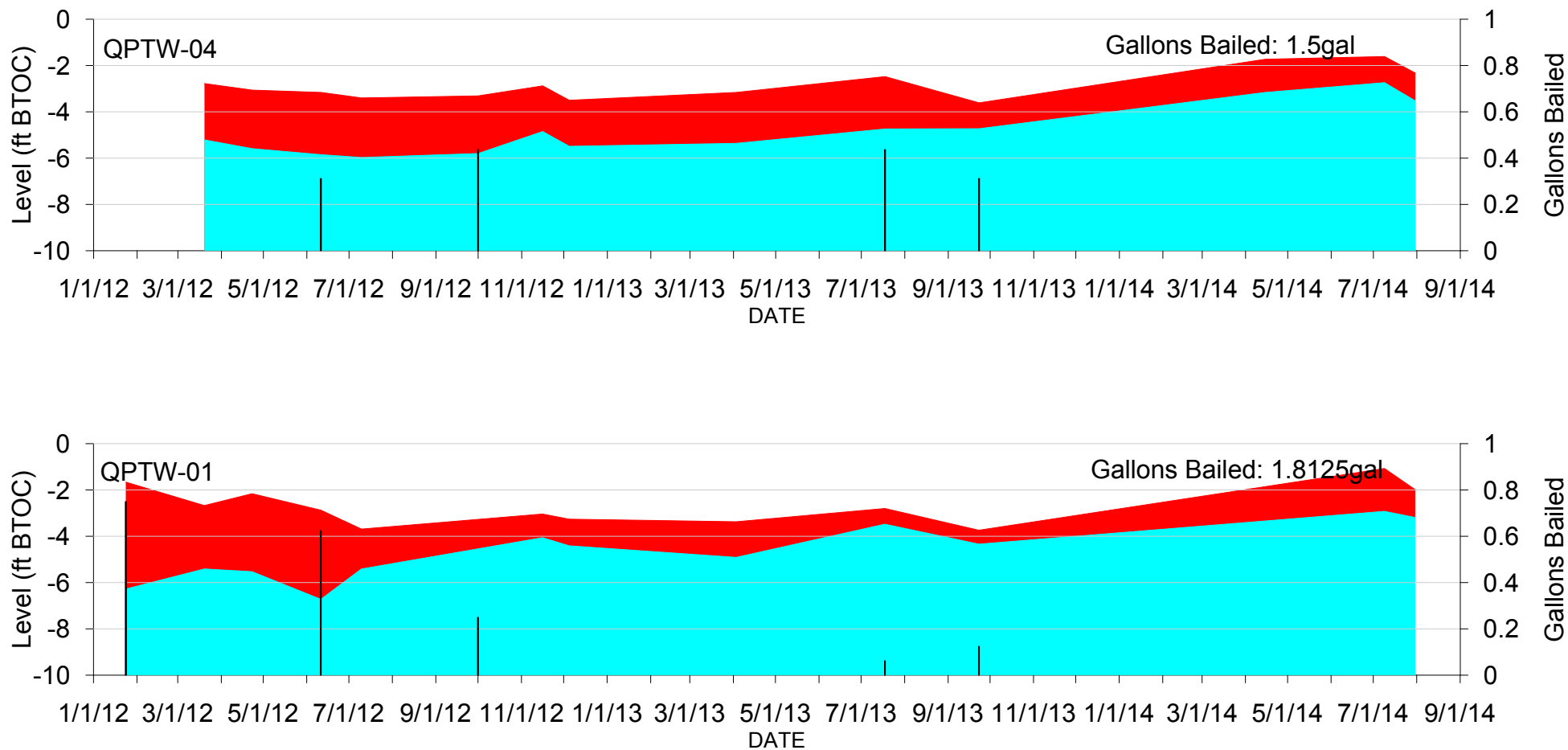
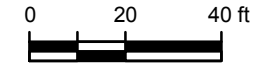
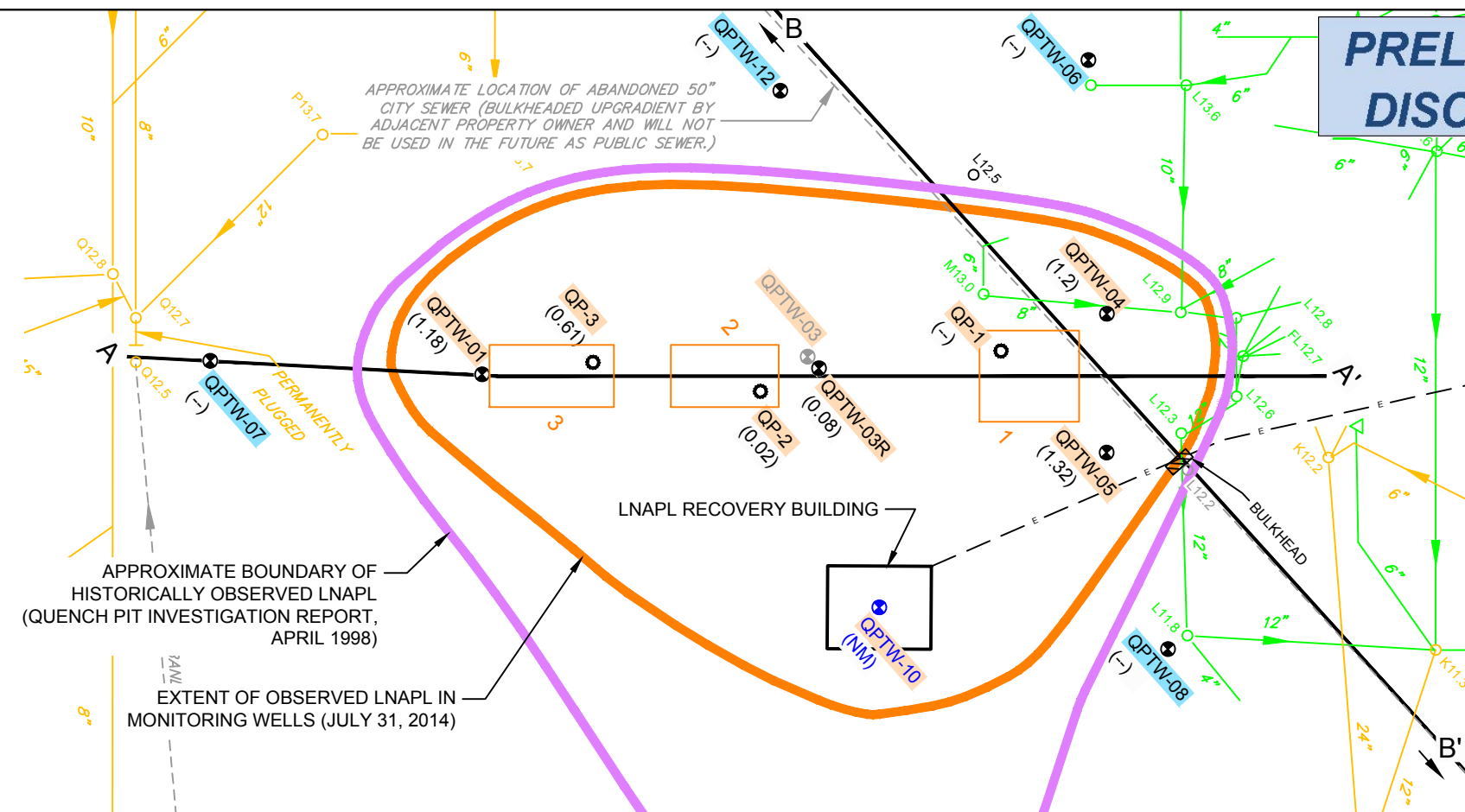


figure 3.3

NOTES:  
ft BTOC - feet below top of casing

SUMMARY OF LNAPL MEASUREMENTS: QPTW-01 AND QPTW-04  
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND  
Saginaw, Michigan

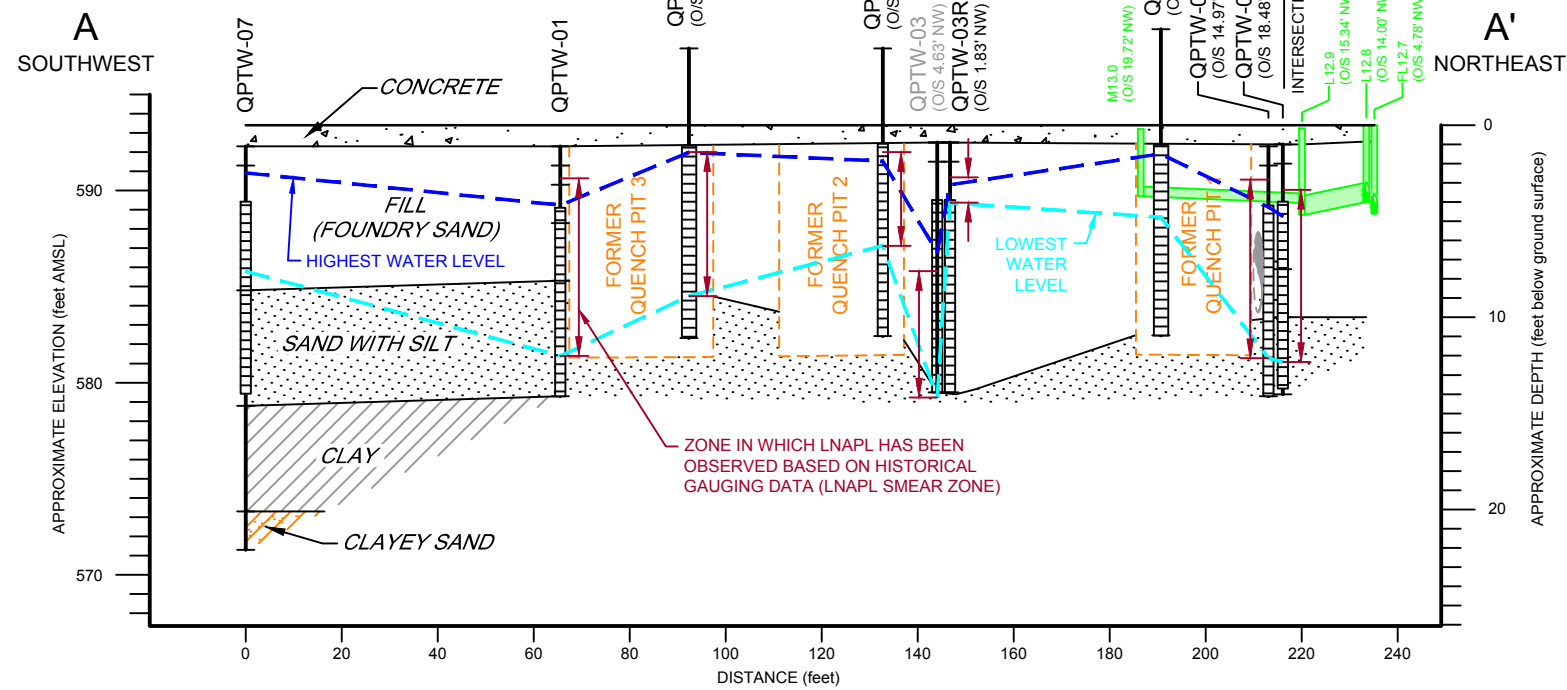
# PRELIMINARY DRAFT FOR DISCUSSION PURPOSES

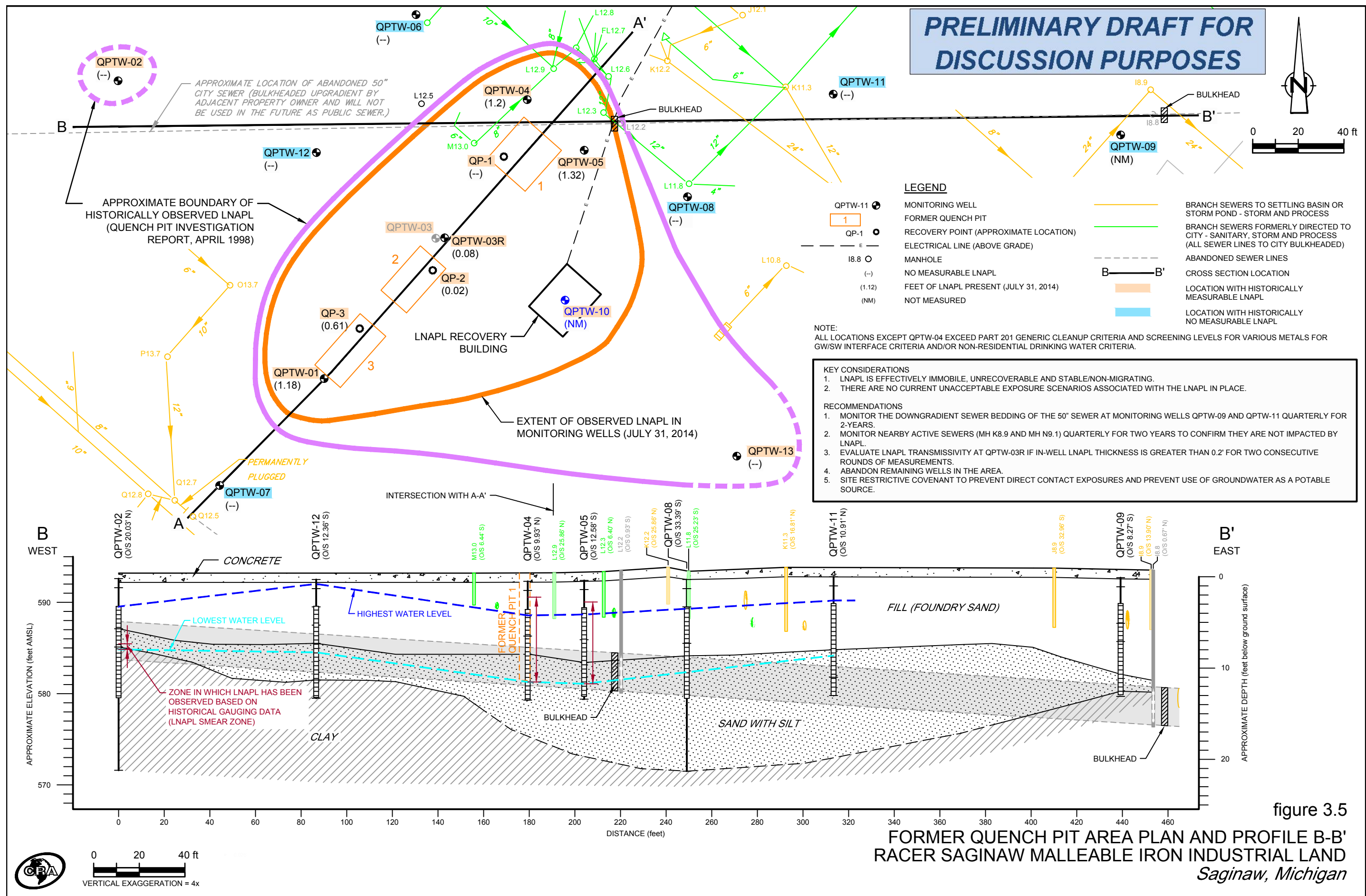


## LEGEND

- QPTW-11 ● MONITORING WELL
- 1 FORMER QUENCH PIT
- QP-1 ● RECOVERY POINT (APPROXIMATE LOCATION)
- QPTW-10 ● AUTOMATED LNAPL SKIMMER PUMP LOCATION
- E — ELECTRICAL LINE (ABOVE GRADE)
- QPTW-03 ● DECOMMISSIONED/ABANDONED WELL
- 18.8 ○ MANHOLE
- (-) NO MEASURABLE LNAPL
- (1.12) FEET OF LNAPL PRESENT (JULY 31, 2014)
- (NM) NOT MEASURED
- BRANCH SEWERS TO SETTLING BASIN OR STORM POND - STORM AND PROCESS
- BRANCH SEWERS FORMERLY DIRECTED TO CITY - SANITARY, STORM AND PROCESS (ALL SEWER LINES TO CITY BULKHEADED)
- ABANDONED SEWER LINES
- A—A' CROSS SECTION LOCATION
- LOCATION WITH HISTORICALLY MEASURABLE LNAPL
- LOCATION WITH HISTORICALLY NO MEASURABLE LNAPL

NOTE:  
ALL LOCATIONS EXCEPT QPTW-04 EXCEED PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS FOR VARIOUS METALS FOR GW/SW INTERFACE CRITERIA AND/OR NON-RESIDENTIAL DRINKING WATER CRITERIA.





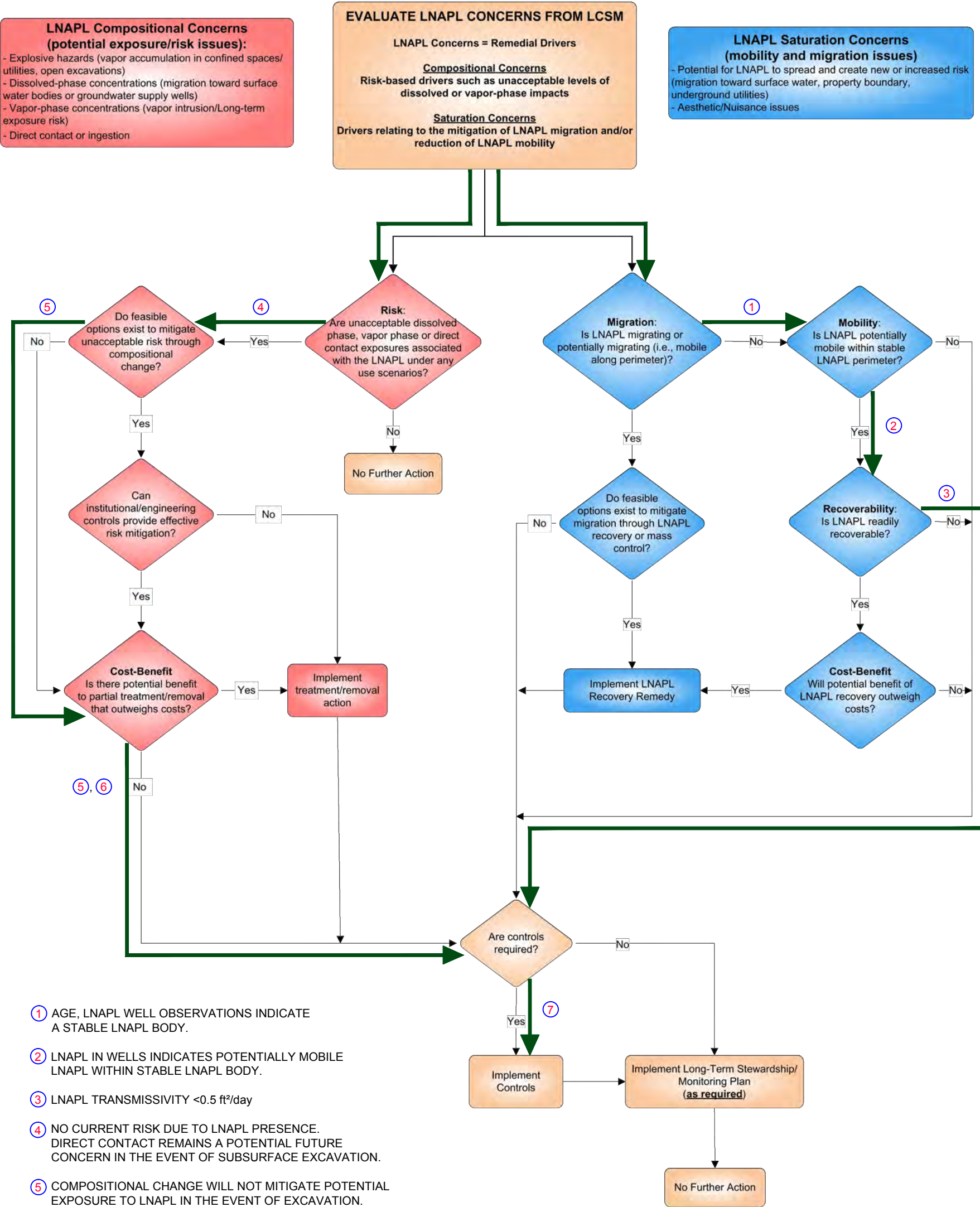


figure 4.1

DRAFT LNAPL / RISK MANAGEMENT DECISION - MAKING PROCESS  
RACER TRUST  
MALLEABLE IRON INDUSTRIAL LAND  
Saginaw, Michigan



**TABLE 2.1**  
**SUMMARY OF IN-WELL LNAPL THICKNESS DATA**  
**FORMER QUENCH PIT LNAPL AREA**  
**RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND**  
**SAGINAW, MICHIGAN**

| <i>Well ID</i> | <i>Date</i> | <i>Ground Surface<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Casing<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Screen<br/>(ft btoc)</i> | <i>Total Depth<br/>(ft btoc)</i> | <i>Depth to Water<br/>(ft btoc)</i> | <i>Depth to Product<br/>(ft btoc)</i> | <i>LNAPL<br/>Thickness<br/>(ft)</i> | <i>Corrected<br/>Groundwater<br/>Elevation <sup>1</sup><br/>(ft amsl)</i> | <i>Corrected Water<br/>Table Depth <sup>1</sup><br/>(ft btoc)</i> |
|----------------|-------------|---------------------------------------------------|--------------------------------------------------|------------------------------------|----------------------------------|-------------------------------------|---------------------------------------|-------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------|
| QPTW-01        | 03/17/05    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.48                               | 7.28                                  | 3.20                                | 584.29                                                                    | 7.66                                                              |
|                | 04/12/05    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.63                               | 7.30                                  | 3.33                                | 584.25                                                                    | 7.70                                                              |
|                | 05/31/05    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.69                               | 7.36                                  | 3.33                                | 584.19                                                                    | 7.76                                                              |
|                | 06/24/05    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.45                               | 7.04                                  | 3.41                                | 584.50                                                                    | 7.45                                                              |
|                | 08/12/05    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.20                               | 6.95                                  | 3.25                                | 584.61                                                                    | 7.34                                                              |
|                | 10/14/05    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.58                               | 7.29                                  | 3.29                                | 584.27                                                                    | 7.68                                                              |
|                | 11/08/05    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.82                               | 7.44                                  | 3.38                                | 584.10                                                                    | 7.85                                                              |
|                | 12/19/05    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.91                               | 7.52                                  | 3.39                                | 584.02                                                                    | 7.93                                                              |
|                | 01/31/06    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.53                               | 7.29                                  | 3.24                                | 584.27                                                                    | 7.68                                                              |
|                | 02/15/06    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.46                               | 7.21                                  | 3.25                                | 584.35                                                                    | 7.60                                                              |
|                | 03/13/06    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 9.71                                | 6.93                                  | 2.78                                | 584.69                                                                    | 7.26                                                              |
|                | 04/10/06    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.02                               | 7.04                                  | 2.98                                | 584.55                                                                    | 7.40                                                              |
|                | 05/22/06    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.23                               | 7.11                                  | 3.12                                | 584.47                                                                    | 7.48                                                              |
|                | 06/21/06    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.22                               | 7.05                                  | 3.17                                | 584.52                                                                    | 7.43                                                              |
|                | 07/11/06    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 9.67                                | 6.82                                  | 2.85                                | 584.79                                                                    | 7.16                                                              |
|                | 08/23/06    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 9.99                                | 6.78                                  | 3.21                                | 584.78                                                                    | 7.17                                                              |
|                | 09/26/06    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 9.90                                | 6.82                                  | 3.08                                | 584.76                                                                    | 7.19                                                              |
|                | 10/30/06    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 9.62                                | 6.83                                  | 2.79                                | 584.79                                                                    | 7.16                                                              |
|                | 11/27/06    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 9.79                                | 6.91                                  | 2.88                                | 584.69                                                                    | 7.26                                                              |
|                | 12/27/06    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 9.97                                | 6.96                                  | 3.01                                | 584.63                                                                    | 7.32                                                              |
|                | 01/15/07    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 9.79                                | 6.94                                  | 2.85                                | 584.67                                                                    | 7.28                                                              |
|                | 02/21/07    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.35                               | 7.29                                  | 3.06                                | 584.29                                                                    | 7.66                                                              |
|                | 03/23/07    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.18                               | 7.27                                  | 2.91                                | 584.33                                                                    | 7.62                                                              |
|                | 04/09/07    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.39                               | 7.25                                  | 3.14                                | 584.32                                                                    | 7.63                                                              |
|                | 05/15/07    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.09                               | 7.32                                  | 2.77                                | 584.30                                                                    | 7.65                                                              |
|                | 06/11/07    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.36                               | 7.47                                  | 2.89                                | 584.13                                                                    | 7.82                                                              |
|                | 07/11/07    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.36                               | 7.43                                  | 2.93                                | 584.17                                                                    | 7.78                                                              |
|                | 08/16/07    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.41                               | 7.48                                  | 2.93                                | 584.12                                                                    | 7.83                                                              |
|                | 09/17/07    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.11                               | 7.38                                  | 2.73                                | 584.24                                                                    | 7.71                                                              |
|                | 11/26/07    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.62                               | 7.64                                  | 2.98                                | 583.95                                                                    | 8.00                                                              |
|                | 12/12/07    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.79                               | 7.77                                  | 3.02                                | 583.82                                                                    | 8.13                                                              |
|                | 01/11/08    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 10.32                               | 7.56                                  | 2.76                                | 584.06                                                                    | 7.89                                                              |
|                | 02/05/08    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 9.91                                | 7.42                                  | 2.49                                | 584.23                                                                    | 7.72                                                              |
|                | 04/11/08    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 8.41                                | 6.60                                  | 1.81                                | 585.13                                                                    | 6.82                                                              |
|                | 05/16/08    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 8.65                                | 6.56                                  | 2.09                                | 585.14                                                                    | 6.81                                                              |
|                | 10/29/08    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 8.71                                | 6.39                                  | 2.32                                | 585.28                                                                    | 6.67                                                              |
|                | 01/21/09    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 8.22                                | 6.26                                  | 1.96                                | 585.45                                                                    | 6.50                                                              |
|                | 03/18/09    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | <b>8.07</b>                         | <b>6.16</b>                           | 1.91                                | 585.56                                                                    | 6.39                                                              |
|                | 10/17/09    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 8.46                                | 6.39                                  | 2.07                                | 585.31                                                                    | 6.64                                                              |
|                | 10/23/09    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 8.07                                | 6.34                                  | 1.73                                | 585.40                                                                    | 6.55                                                              |
|                | 06/24/10    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 8.31                                | 5.06                                  | 3.25                                | 586.50                                                                    | 5.45                                                              |
|                | 07/08/10    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 8.88                                | 4.62                                  | 4.26                                | 586.82                                                                    | 5.13                                                              |
|                | 07/22/10    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 9.86                                | 4.81                                  | 5.05                                | 586.53                                                                    | 5.42                                                              |
|                | 07/29/10    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 8.27                                | 5.11                                  | 3.16                                | 586.46                                                                    | 5.49                                                              |
|                | 08/06/10    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 8.13                                | 5.41                                  | 2.72                                | 586.21                                                                    | 5.74                                                              |
|                | 08/13/10    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 6.83                                | 4.04                                  | 2.79                                | 587.58                                                                    | 4.37                                                              |
|                | 08/27/10    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 7.40                                | 4.42                                  | 2.98                                | 587.17                                                                    | 4.78                                                              |
|                | 09/23/10    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 5.54                                | 3.05                                  | 2.49                                | 588.60                                                                    | 3.35                                                              |
|                | 10/15/10    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 7.14                                | 4.01                                  | 3.13                                | 587.56                                                                    | 4.39                                                              |
|                | 10/29/10    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 6.90                                | 3.99                                  | 2.91                                | 587.61                                                                    | 4.34                                                              |
|                | 12/07/10    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 7.61                                | 3.87                                  | 3.74                                | 587.63                                                                    | 4.32                                                              |
|                | 03/18/11    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 6.57                                | 3.54                                  | 3.03                                | 588.05                                                                    | 3.90                                                              |
|                | 04/08/11    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 6.15                                | 2.77                                  | 3.38                                | 588.77                                                                    | 3.18                                                              |
|                | 05/09/11    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 5.98                                | 3.11                                  | 2.87                                | 588.50                                                                    | 3.45                                                              |
|                | 06/09/11    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 6.31                                | 3.16                                  | 3.15                                | 588.41                                                                    | 3.54                                                              |
|                | 07/05/11    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 5.62                                | 3.31                                  | 2.31                                | 588.36                                                                    | 3.59                                                              |
|                | 08/23/11    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 4.21                                | 2.88                                  | 1.33                                | 588.91                                                                    | 3.04                                                              |
|                | 10/14/11    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 5.72                                | 3.81                                  | 1.91                                | 587.91                                                                    | 4.04                                                              |
|                | 01/24/12    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 6.28                                | 1.66                                  | 4.62                                | 589.74                                                                    | 2.21                                                              |
|                | 03/20/12    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 5.41                                | 2.67                                  | 2.74                                | 588.95                                                                    | 3.00                                                              |
|                | 04/23/12    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 5.53                                | 2.16                                  | 3.37                                | 589.39                                                                    | 2.56                                                              |
|                | 06/11/12    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 6.72                                | 2.87                                  | 3.85                                | 588.62                                                                    | 3.33                                                              |
|                | 07/10/12    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 5.41                                | 3.69                                  | 1.72                                | 588.05                                                                    | 3.90                                                              |
|                | 08/29/12    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 5.75                                | 3.04                                  | 2.71                                | 588.58                                                                    | 3.37                                                              |
|                | 09/12/12    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 4.25                                | 2.90                                  | 1.35                                | 588.89                                                                    | 3.06                                                              |
|                | 11/06/12    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 4.06                                | 3.04                                  | 1.02                                | 588.79                                                                    | 3.16                                                              |

TABLE 2.1

**SUMMARY OF IN-WELL LNAPL THICKNESS DATA  
FORMER QUENCH PIT LNAPL AREA  
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND  
SAGINAW, MICHIGAN**

| <i>Well ID</i> | <i>Date</i> | <i>Ground Surface<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Casing<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Screen<br/>(ft btoc)</i> | <i>Total Depth<br/>(ft btoc)</i> | <i>Depth to Water<br/>(ft btoc)</i> | <i>Depth to Product<br/>(ft btoc)</i> | <i>LNAPL<br/>Thickness<br/>(ft)</i> | <i>Corrected<br/>Groundwater<br/>Elevation <sup>1</sup><br/>(ft amsl)</i> | <i>Corrected Water<br/>Table Depth <sup>1</sup><br/>(ft btoc)</i> |
|----------------|-------------|---------------------------------------------------|--------------------------------------------------|------------------------------------|----------------------------------|-------------------------------------|---------------------------------------|-------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------|
|                | 12/05/12    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 4.41                                | 3.26                                  | 1.15                                | 588.55                                                                    | 3.40                                                              |
|                | 04/03/13    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 4.91                                | 3.37                                  | 1.54                                | 588.40                                                                    | 3.55                                                              |
|                | 07/18/13    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 3.48                                | 2.80                                  | 0.68                                | 589.07                                                                    | 2.88                                                              |
|                | 09/23/13    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 4.34                                | 3.74                                  | 0.60                                | 588.14                                                                    | 3.81                                                              |
|                | 06/02/14    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 3.06                                | 2.36                                  | 0.70                                | 589.51                                                                    | 2.44                                                              |
|                | 07/09/14    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 2.92                                | 1.07                                  | 1.85                                | 590.66                                                                    | 1.29                                                              |
|                | 07/31/14    | 592.3                                             | 591.95                                           | 2.85                               | 12.85                            | 3.17                                | 1.99                                  | 1.18                                | 589.82                                                                    | 2.13                                                              |
| QPTW-02        | 03/17/05    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.54                                | 7.51                                  | 0.03                                | 584.84                                                                    | 7.51                                                              |
|                | 04/12/05    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.64                                | 7.58                                  | 0.06                                | 584.76                                                                    | 7.59                                                              |
|                | 05/31/05    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.54                                | 7.50                                  | 0.04                                | 584.85                                                                    | 7.50                                                              |
|                | 06/24/05    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.41                                | 7.38                                  | 0.03                                | 584.97                                                                    | 7.38                                                              |
|                | 08/12/05    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.30                                | 7.26                                  | 0.04                                | 585.09                                                                    | 7.26                                                              |
|                | 10/14/05    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.50                                | 7.44                                  | 0.06                                | 584.90                                                                    | 7.45                                                              |
|                | 11/08/05    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.52                                | 7.49                                  | 0.03                                | 584.86                                                                    | 7.49                                                              |
|                | 12/19/05    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.67                                | 7.63                                  | 0.04                                | 584.72                                                                    | 7.63                                                              |
|                | 01/31/06    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.53                                | 7.48                                  | 0.05                                | 584.86                                                                    | 7.49                                                              |
|                | 02/15/06    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.50                                | 7.47                                  | 0.03                                | 584.88                                                                    | 7.47                                                              |
|                | 03/13/06    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.30                                | 7.26                                  | 0.04                                | 585.09                                                                    | 7.26                                                              |
|                | 04/10/06    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.39                                | 7.36                                  | 0.03                                | 584.99                                                                    | 7.36                                                              |
|                | 05/22/06    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.38                                | 7.35                                  | 0.03                                | 585.00                                                                    | 7.35                                                              |
|                | 06/21/06    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.33                                | 7.29                                  | 0.04                                | 585.06                                                                    | 7.29                                                              |
|                | 07/11/06    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.29                                | 7.26                                  | 0.03                                | 585.09                                                                    | 7.26                                                              |
|                | 08/23/06    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.28                                | 7.26                                  | 0.02                                | 585.09                                                                    | 7.26                                                              |
|                | 09/26/06    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.39                                | 7.37                                  | 0.02                                | 584.98                                                                    | 7.37                                                              |
|                | 10/30/06    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.38                                | 7.35                                  | 0.03                                | 585.00                                                                    | 7.35                                                              |
|                | 11/27/06    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.41                                | 7.38                                  | 0.03                                | 584.97                                                                    | 7.38                                                              |
|                | 12/27/06    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.44                                | 7.42                                  | 0.02                                | 584.93                                                                    | 7.42                                                              |
|                | 01/15/07    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.46                                | 7.42                                  | 0.04                                | 584.93                                                                    | 7.42                                                              |
|                | 02/21/07    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.47                                | 7.46                                  | 0.01                                | 584.89                                                                    | 7.46                                                              |
|                | 03/23/07    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.42                                | 7.40                                  | 0.02                                | 584.95                                                                    | 7.40                                                              |
|                | 04/09/07    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.45                                | 7.43                                  | 0.02                                | 584.92                                                                    | 7.43                                                              |
|                | 05/15/07    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.50                                | 7.48                                  | 0.02                                | 584.87                                                                    | 7.48                                                              |
|                | 08/16/07    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.65                                | 7.62                                  | 0.03                                | 584.73                                                                    | 7.62                                                              |
|                | 09/17/07    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.51                                | 7.48                                  | 0.03                                | 584.87                                                                    | 7.48                                                              |
|                | 11/26/07    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.73                                | 7.71                                  | 0.02                                | 584.64                                                                    | 7.71                                                              |
|                | 12/12/07    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.76                                | 7.74                                  | 0.02                                | 584.61                                                                    | 7.74                                                              |
|                | 01/11/08    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.15                                | 7.14                                  | 0.01                                | 585.21                                                                    | 7.14                                                              |
|                | 02/05/08    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.27                                | 7.26                                  | 0.01                                | 585.09                                                                    | 7.26                                                              |
|                | 04/11/08    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 6.79                                | ---                                   | ---                                 | 585.56                                                                    | 6.79                                                              |
|                | 05/16/08    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.30                                | ---                                   | ---                                 | 585.05                                                                    | 7.30                                                              |
|                | 10/29/08    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 6.99                                | ---                                   | ---                                 | 585.36                                                                    | 6.99                                                              |
|                | 01/21/09    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 6.53                                | ---                                   | ---                                 | 585.82                                                                    | 6.53                                                              |
|                | 03/18/09    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 6.28                                | ---                                   | ---                                 | 586.07                                                                    | 6.28                                                              |
|                | 10/17/09    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 6.93                                | ---                                   | ---                                 | 585.42                                                                    | 6.93                                                              |
|                | 10/23/09    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 7.08                                | ---                                   | ---                                 | 585.27                                                                    | 7.08                                                              |
|                | 10/15/10    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 5.23                                | ---                                   | ---                                 | 587.12                                                                    | 5.23                                                              |
|                | 10/29/10    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 5.30                                | ---                                   | ---                                 | 587.05                                                                    | 5.30                                                              |
|                | 03/18/11    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.96                                | ---                                   | ---                                 | 588.39                                                                    | 3.96                                                              |
|                | 04/08/11    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.19                                | ---                                   | ---                                 | 589.16                                                                    | 3.19                                                              |
|                | 05/09/11    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.47                                | ---                                   | ---                                 | 588.88                                                                    | 3.47                                                              |
|                | 06/09/11    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.58                                | ---                                   | ---                                 | 588.77                                                                    | 3.58                                                              |
|                | 07/05/11    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.79                                | ---                                   | ---                                 | 588.56                                                                    | 3.79                                                              |
|                | 08/23/11    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.11                                | ---                                   | ---                                 | 589.24                                                                    | 3.11                                                              |
|                | 10/14/11    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 4.04                                | ---                                   | ---                                 | 588.31                                                                    | 4.04                                                              |
|                | 11/23/11    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.81                                | ---                                   | ---                                 | 588.54                                                                    | 3.81                                                              |
|                | 03/20/12    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 2.77                                | ---                                   | ---                                 | 589.58                                                                    | 2.77                                                              |
|                | 04/23/12    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.02                                | ---                                   | ---                                 | 589.33                                                                    | 3.02                                                              |
|                | 06/11/12    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.22                                | ---                                   | ---                                 | 589.13                                                                    | 3.22                                                              |
|                | 07/10/12    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.88                                | ---                                   | ---                                 | 588.47                                                                    | 3.88                                                              |
|                | 08/29/12    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.22                                | ---                                   | ---                                 | 589.13                                                                    | 3.22                                                              |
|                | 09/12/12    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.01                                | ---                                   | ---                                 | 589.34                                                                    | 3.01                                                              |
|                | 10/01/12    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.79                                | ---                                   | ---                                 | 588.56                                                                    | 3.79                                                              |
|                | 11/06/12    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 2.98                                | ---                                   | ---                                 | 589.37                                                                    | 2.98                                                              |
|                | 12/05/12    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.61                                | ---                                   | ---                                 | 588.74                                                                    | 3.61                                                              |
|                | 04/03/13    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.25                                | ---                                   | ---                                 | 589.10                                                                    | 3.25                                                              |
|                | 07/18/13    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 2.59                                | ---                                   | ---                                 | 589.76                                                                    | 2.59                                                              |
|                | 09/23/13    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 3.94                                | ---                                   | ---                                 | 588.41                                                                    | 3.94                                                              |
|                | 04/25/14    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 1.81                                | ---                                   | ---                                 | 590.54                                                                    | 1.81                                                              |
|                | 06/02/14    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 2.62                                | ---                                   | ---                                 | 589.73                                                                    | 2.62                                                              |

TABLE 2.1

**SUMMARY OF IN-WELL LNAPL THICKNESS DATA  
FORMER QUENCH PIT LNAPL AREA  
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND  
SAGINAW, MICHIGAN**

| <i>Well ID</i> | <i>Date</i> | <i>Ground Surface<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Casing<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Screen<br/>(ft btoc)</i> | <i>Total Depth<br/>(ft btoc)</i> | <i>Depth to Water<br/>(ft btoc)</i> | <i>Depth to Product<br/>(ft btoc)</i> | <i>LNAPL<br/>Thickness<br/>(ft)</i> | <i>Corrected<br/>Groundwater<br/>Elevation <sup>1</sup><br/>(ft amsl)</i> | <i>Corrected Water<br/>Table Depth <sup>1</sup><br/>(ft btoc)</i> |
|----------------|-------------|---------------------------------------------------|--------------------------------------------------|------------------------------------|----------------------------------|-------------------------------------|---------------------------------------|-------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------|
| QPTW-03R       | 07/31/14    | 592.6                                             | 592.35                                           | 2.80                               | 12.80                            | 2.31                                | ---                                   | ---                                 | 590.04                                                                    | 2.31                                                              |
|                | 04/25/14    | 592.5                                             | 592.13                                           | 2.75                               | 12.75                            | 2.19                                | 1.82                                  | 0.37                                | 590.27                                                                    | 1.86                                                              |
|                | 06/02/14    | 592.5                                             | 592.13                                           | 2.75                               | 12.75                            | 3.13                                | 2.86                                  | 0.27                                | 589.24                                                                    | 2.89                                                              |
|                | 07/09/14    | 592.5                                             | 592.13                                           | 2.75                               | 12.75                            | 2.10                                | 1.98                                  | 0.12                                | 590.14                                                                    | 1.99                                                              |
|                | 07/31/14    | 592.5                                             | 592.13                                           | 2.75                               | 12.75                            | 2.74                                | 2.66                                  | 0.08                                | 589.46                                                                    | 2.67                                                              |
| QPTW-04        | 03/17/05    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.54                                | 7.51                                  | 1.03                                | 584.10                                                                    | 7.63                                                              |
|                | 04/12/05    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.53                                | 7.54                                  | 0.99                                | 584.07                                                                    | 7.66                                                              |
|                | 05/31/05    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.58                                | 7.50                                  | 1.08                                | 584.10                                                                    | 7.63                                                              |
|                | 06/24/05    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.34                                | 7.29                                  | 1.05                                | 584.31                                                                    | 7.42                                                              |
|                | 08/12/05    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.28                                | 7.26                                  | 1.02                                | 584.35                                                                    | 7.38                                                              |
|                | 10/14/05    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.61                                | 7.68                                  | 0.93                                | 583.94                                                                    | 7.79                                                              |
|                | 11/08/05    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.70                                | 7.72                                  | 0.98                                | 583.89                                                                    | 7.84                                                              |
|                | 12/19/05    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.87                                | 7.83                                  | 1.04                                | 583.78                                                                    | 7.95                                                              |
|                | 01/31/06    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.58                                | 7.46                                  | 1.12                                | 584.14                                                                    | 7.59                                                              |
|                | 02/15/06    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.45                                | 7.33                                  | 1.12                                | 584.27                                                                    | 7.46                                                              |
|                | 03/13/06    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.14                                | 7.16                                  | 0.98                                | 584.45                                                                    | 7.28                                                              |
|                | 04/10/06    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.29                                | 7.32                                  | 0.97                                | 584.29                                                                    | 7.44                                                              |
|                | 05/22/06    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.41                                | 7.39                                  | 1.02                                | 584.22                                                                    | 7.51                                                              |
|                | 06/21/06    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.34                                | 7.41                                  | 0.93                                | 584.21                                                                    | 7.52                                                              |
|                | 07/11/06    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.16                                | 7.12                                  | 1.04                                | 584.49                                                                    | 7.24                                                              |
|                | 08/23/06    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.39                                | 7.10                                  | 1.29                                | 584.48                                                                    | 7.25                                                              |
|                | 09/26/06    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.09                                | 7.11                                  | 0.98                                | 584.50                                                                    | 7.23                                                              |
|                | 10/30/06    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.05                                | 7.08                                  | 0.97                                | 584.53                                                                    | 7.20                                                              |
|                | 11/27/06    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.08                                | 7.19                                  | 0.89                                | 584.43                                                                    | 7.30                                                              |
|                | 12/27/06    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.58                                | 7.48                                  | 1.10                                | 584.12                                                                    | 7.61                                                              |
|                | 01/15/07    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.07                                | 7.29                                  | 0.78                                | 584.35                                                                    | 7.38                                                              |
|                | 02/21/07    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.45                                | 7.57                                  | 0.88                                | 584.05                                                                    | 7.68                                                              |
|                | 03/23/07    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.32                                | 7.56                                  | 0.76                                | 584.08                                                                    | 7.65                                                              |
|                | 04/09/07    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.47                                | 7.52                                  | 0.95                                | 584.10                                                                    | 7.63                                                              |
|                | 05/15/07    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.42                                | 7.51                                  | 0.91                                | 584.11                                                                    | 7.62                                                              |
|                | 06/11/07    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.61                                | 7.64                                  | 0.97                                | 583.97                                                                    | 7.76                                                              |
|                | 07/11/07    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.67                                | 7.61                                  | 1.06                                | 583.99                                                                    | 7.74                                                              |
|                | 08/16/07    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.80                                | 7.69                                  | 1.11                                | 583.91                                                                    | 7.82                                                              |
|                | 09/17/07    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.62                                | 7.54                                  | 1.08                                | 584.06                                                                    | 7.67                                                              |
|                | 11/26/07    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 9.05                                | 7.99                                  | 1.06                                | 583.61                                                                    | 8.12                                                              |
|                | 12/12/07    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 9.15                                | 8.09                                  | 1.06                                | 583.51                                                                    | 8.22                                                              |
|                | 01/11/08    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.81                                | 7.82                                  | 0.99                                | 583.79                                                                    | 7.94                                                              |
|                | 02/05/08    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 8.69                                | 7.64                                  | 1.05                                | 583.96                                                                    | 7.77                                                              |
|                | 04/11/08    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 7.75                                | 6.68                                  | 1.07                                | 584.92                                                                    | 6.81                                                              |
|                | 05/16/08    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 7.82                                | 6.81                                  | 1.01                                | 584.80                                                                    | 6.93                                                              |
|                | 10/29/08    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 7.70                                | 6.69                                  | 1.01                                | 584.92                                                                    | 6.81                                                              |
|                | 01/21/09    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 7.35                                | 6.61                                  | 0.74                                | 585.03                                                                    | 6.70                                                              |
|                | 03/18/09    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 6.86                                | 6.12                                  | 0.74                                | 585.52                                                                    | 6.21                                                              |
|                | 10/17/09    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 7.76                                | 6.85                                  | 0.91                                | 584.77                                                                    | 6.96                                                              |
|                | 10/23/09    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 7.76                                | 6.83                                  | 0.93                                | 584.79                                                                    | 6.94                                                              |
|                | 06/09/10    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 6.23                                | 5.65                                  | 0.58                                | 586.01                                                                    | 5.72                                                              |
|                | 08/27/10    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 7.06                                | 6.17                                  | 0.89                                | 585.45                                                                    | 6.28                                                              |
|                | 09/17/10    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 5.61                                | 5.02                                  | 0.59                                | 586.64                                                                    | 5.09                                                              |
|                | 09/23/10    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 5.47                                | 4.87                                  | 0.60                                | 586.79                                                                    | 4.94                                                              |
|                | 10/15/10    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 6.03                                | 5.20                                  | 0.83                                | 586.43                                                                    | 5.30                                                              |
|                | 10/29/10    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 6.39                                | 5.86                                  | 0.53                                | 585.81                                                                    | 5.92                                                              |
|                | 03/18/11    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 5.16                                | 4.20                                  | 0.96                                | 587.41                                                                    | 4.32                                                              |
|                | 04/08/11    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 4.27                                | 3.54                                  | 0.73                                | 588.10                                                                    | 3.63                                                              |
|                | 05/09/11    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 4.60                                | 3.64                                  | 0.96                                | 587.97                                                                    | 3.76                                                              |
|                | 06/09/11    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 4.35                                | 3.63                                  | 0.72                                | 588.01                                                                    | 3.72                                                              |
|                | 07/05/11    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 4.84                                | 3.87                                  | 0.97                                | 587.74                                                                    | 3.99                                                              |
|                | 08/23/11    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 4.16                                | 3.34                                  | 0.82                                | 588.29                                                                    | 3.44                                                              |
|                | 03/20/12    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 5.21                                | 2.78                                  | 2.43                                | 588.66                                                                    | 3.07                                                              |
|                | 04/23/12    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 5.59                                | 3.06                                  | 2.53                                | 588.37                                                                    | 3.36                                                              |
|                | 06/11/12    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 5.85                                | 3.16                                  | 2.69                                | 588.25                                                                    | 3.48                                                              |
|                | 07/10/12    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 5.97                                | 3.40                                  | 2.57                                | 588.02                                                                    | 3.71                                                              |
|                | 08/29/12    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 5.32                                | 2.99                                  | 2.33                                | 588.46                                                                    | 3.27                                                              |
|                | 09/12/12    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 5.03                                | 2.68                                  | 2.35                                | 588.77                                                                    | 2.96                                                              |
|                | 10/01/12    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 5.80                                | 3.31                                  | 2.49                                | 588.12                                                                    | 3.61                                                              |
|                | 11/06/12    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 4.85                                | 2.88                                  | 1.97                                | 588.61                                                                    | 3.12                                                              |
|                | 12/05/12    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 5.49                                | 3.50                                  | 1.99                                | 587.99                                                                    | 3.74                                                              |
|                | 04/03/13    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 5.36                                | 3.16                                  | 2.20                                | 588.31                                                                    | 3.42                                                              |
|                | 07/18/13    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 4.74                                | 2.48                                  | 2.26                                | 588.98                                                                    | 2.75                                                              |

**TABLE 2.1**  
**SUMMARY OF IN-WELL LNAPL THICKNESS DATA**  
**FORMER QUENCH PIT LNAPL AREA**  
**RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND**  
**SAGINAW, MICHIGAN**

| <i>Well ID</i> | <i>Date</i> | <i>Ground Surface<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Casing<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Screen<br/>(ft btoc)</i> | <i>Total Depth<br/>(ft btoc)</i> | <i>Depth to Water<br/>(ft btoc)</i> | <i>Depth to Product<br/>(ft btoc)</i> | <i>LNAPL<br/>Thickness<br/>(ft)</i> | <i>Corrected<br/>Groundwater<br/>Elevation <sup>1</sup><br/>(ft amsl)</i> | <i>Corrected Water<br/>Table Depth <sup>1</sup><br/>(ft btoc)</i> |
|----------------|-------------|---------------------------------------------------|--------------------------------------------------|------------------------------------|----------------------------------|-------------------------------------|---------------------------------------|-------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------|
|                | 09/23/13    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 4.73                                | 3.61                                  | 1.12                                | 587.99                                                                    | 3.74                                                              |
|                | 04/25/14    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 3.16                                | 1.73                                  | 1.43                                | 589.83                                                                    | 1.90                                                              |
|                | 06/02/14    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 3.98                                | 2.39                                  | 1.59                                | 589.15                                                                    | 2.58                                                              |
|                | 07/09/14    | 593.3                                             | 592.73                                           | 2.50                               | 12.50                            | 2.74                                | 1.61                                  | 1.13                                | 590.98                                                                    | 1.75                                                              |
|                | 07/31/14    | 592.3                                             | 591.73                                           | 2.50                               | 12.50                            | 3.53                                | 2.33                                  | 1.20                                | 589.26                                                                    | 2.47                                                              |
| QPTW-05        | 03/17/05    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.94                                | 7.67                                  | 1.27                                | 584.31                                                                    | 7.82                                                              |
|                | 04/12/05    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.98                                | 7.69                                  | 1.29                                | 584.29                                                                    | 7.84                                                              |
|                | 05/31/05    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.10                                | 7.73                                  | 1.37                                | 584.24                                                                    | 7.89                                                              |
|                | 06/24/05    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.65                                | 7.50                                  | 1.15                                | 584.49                                                                    | 7.64                                                              |
|                | 08/12/05    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.76                                | 7.68                                  | 1.08                                | 584.32                                                                    | 7.81                                                              |
|                | 10/14/05    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.38                                | 7.91                                  | 1.47                                | 584.04                                                                    | 8.09                                                              |
|                | 11/08/05    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.55                                | 7.99                                  | 1.56                                | 583.95                                                                    | 8.18                                                              |
|                | 12/19/05    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.74                                | 8.05                                  | 1.69                                | 583.88                                                                    | 8.25                                                              |
|                | 01/31/06    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.84                                | 7.68                                  | 1.16                                | 584.31                                                                    | 7.82                                                              |
|                | 02/15/06    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.63                                | 7.54                                  | 1.09                                | 584.46                                                                    | 7.67                                                              |
|                | 03/13/06    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.20                                | 7.33                                  | 0.87                                | 584.70                                                                    | 7.43                                                              |
|                | 04/10/06    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.44                                | 7.47                                  | 0.97                                | 584.54                                                                    | 7.59                                                              |
|                | 05/22/06    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.65                                | 7.58                                  | 1.07                                | 584.42                                                                    | 7.71                                                              |
|                | 06/21/06    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.70                                | 6.71                                  | 1.99                                | 585.18                                                                    | 6.95                                                              |
|                | 07/11/06    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.35                                | 7.38                                  | 0.97                                | 584.63                                                                    | 7.50                                                              |
|                | 08/23/06    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.52                                | 7.46                                  | 1.06                                | 584.54                                                                    | 7.59                                                              |
|                | 09/26/06    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.46                                | 7.45                                  | 1.01                                | 584.56                                                                    | 7.57                                                              |
|                | 10/30/06    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.32                                | 7.33                                  | 0.99                                | 584.68                                                                    | 7.45                                                              |
|                | 11/27/06    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.50                                | 7.44                                  | 1.06                                | 584.56                                                                    | 7.57                                                              |
|                | 12/27/06    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.18                                | 7.23                                  | 0.95                                | 584.79                                                                    | 7.34                                                              |
|                | 01/15/07    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 8.55                                | 7.49                                  | 1.06                                | 584.51                                                                    | 7.62                                                              |
|                | 02/21/07    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.27                                | 7.84                                  | 1.43                                | 584.12                                                                    | 8.01                                                              |
|                | 03/23/07    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.19                                | 7.81                                  | 1.38                                | 584.15                                                                    | 7.98                                                              |
|                | 04/09/07    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.27                                | 7.77                                  | 1.50                                | 584.18                                                                    | 7.95                                                              |
|                | 05/15/07    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.11                                | 7.74                                  | 1.37                                | 584.23                                                                    | 7.90                                                              |
|                | 06/11/07    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.41                                | 7.92                                  | 1.49                                | 584.03                                                                    | 8.10                                                              |
|                | 07/11/07    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.52                                | 7.96                                  | 1.56                                | 583.98                                                                    | 8.15                                                              |
|                | 08/16/07    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.71                                | 8.04                                  | 1.67                                | 583.89                                                                    | 8.24                                                              |
|                | 09/17/07    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.25                                | 7.82                                  | 1.43                                | 584.14                                                                    | 7.99                                                              |
|                | 11/26/07    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 10.10                               | 8.21                                  | 1.89                                | 583.69                                                                    | 8.44                                                              |
|                | 12/12/07    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 10.31                               | 8.30                                  | 2.01                                | 583.59                                                                    | 8.54                                                              |
|                | 01/11/08    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.62                                | 8.07                                  | 1.55                                | 583.87                                                                    | 8.26                                                              |
|                | 02/05/08    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 9.05                                | 7.90                                  | 1.15                                | 584.09                                                                    | 8.04                                                              |
|                | 04/11/08    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 7.50                                | 7.00                                  | 0.50                                | 585.07                                                                    | 7.06                                                              |
|                | 05/16/08    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 7.67                                | 7.12                                  | 0.55                                | 584.94                                                                    | 7.19                                                              |
|                | 10/29/08    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 7.71                                | 7.23                                  | 0.48                                | 584.84                                                                    | 7.29                                                              |
|                | 01/21/09    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 7.43                                | 6.87                                  | 0.56                                | 585.19                                                                    | 6.94                                                              |
|                | 03/18/09    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 7.11                                | 6.57                                  | 0.54                                | 585.50                                                                    | 6.63                                                              |
|                | 10/17/09    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 7.98                                | 7.18                                  | 0.80                                | 584.85                                                                    | 7.28                                                              |
|                | 10/23/09    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 7.68                                | 7.09                                  | 0.59                                | 584.97                                                                    | 7.16                                                              |
|                | 06/09/10    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 7.07                                | 6.23                                  | 0.84                                | 585.80                                                                    | 6.33                                                              |
|                | 06/24/10    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 7.40                                | 6.59                                  | 0.81                                | 585.44                                                                    | 6.69                                                              |
|                | 07/29/10    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 7.34                                | 6.14                                  | 1.20                                | 585.85                                                                    | 6.28                                                              |
|                | 08/06/10    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 7.31                                | 6.28                                  | 1.03                                | 585.73                                                                    | 6.40                                                              |
|                | 08/13/10    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 6.08                                | 5.57                                  | 0.51                                | 586.50                                                                    | 5.63                                                              |
|                | 08/27/10    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 6.51                                | 5.70                                  | 0.81                                | 586.33                                                                    | 5.80                                                              |
|                | 09/17/10    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 6.36                                | 5.83                                  | 0.53                                | 586.24                                                                    | 5.89                                                              |
|                | 09/23/10    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 6.12                                | 5.59                                  | 0.53                                | 586.48                                                                    | 5.65                                                              |
|                | 10/15/10    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 6.31                                | 6.01                                  | 0.30                                | 586.08                                                                    | 6.05                                                              |
|                | 10/29/10    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 5.48                                | 5.14                                  | 0.34                                | 586.95                                                                    | 5.18                                                              |
|                | 12/07/10    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 6.46                                | 5.72                                  | 0.74                                | 586.32                                                                    | 5.81                                                              |
|                | 01/03/11    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 5.99                                | 5.71                                  | 0.28                                | 586.39                                                                    | 5.74                                                              |
|                | 03/18/11    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 5.43                                | 5.11                                  | 0.32                                | 586.98                                                                    | 5.15                                                              |
|                | 04/08/11    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.63                                | 4.32                                  | 0.31                                | 587.77                                                                    | 4.36                                                              |
|                | 05/09/11    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.55                                | 4.31                                  | 0.24                                | 587.79                                                                    | 4.34                                                              |
|                | 06/09/11    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.83                                | 4.56                                  | 0.27                                | 587.54                                                                    | 4.59                                                              |
|                | 07/05/11    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 5.11                                | 4.64                                  | 0.47                                | 587.43                                                                    | 4.70                                                              |
|                | 08/23/11    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.26                                | 4.03                                  | 0.23                                | 588.07                                                                    | 4.06                                                              |
|                | 10/14/11    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 5.28                                | 4.94                                  | 0.34                                | 587.15                                                                    | 4.98                                                              |
|                | 11/23/11    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.75                                | 4.42                                  | 0.33                                | 587.67                                                                    | 4.46                                                              |
|                | 01/24/12    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 3.73                                | 3.58                                  | 0.15                                | 588.53                                                                    | 3.60                                                              |
|                | 03/20/12    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.05                                | 3.72                                  | 0.33                                | 588.37                                                                    | 3.76                                                              |
|                | 04/23/12    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.10                                | 3.74                                  | 0.36                                | 588.35                                                                    | 3.78                                                              |
|                | 06/11/12    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.44                                | 4.00                                  | 0.44                                | 588.08                                                                    | 4.05                                                              |

TABLE 2.1

**SUMMARY OF IN-WELL LNAPL THICKNESS DATA  
FORMER QUENCH PIT LNAPL AREA  
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND  
SAGINAW, MICHIGAN**

| <i>Well ID</i> | <i>Date</i> | <i>Ground Surface<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Casing<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Screen<br/>(ft btoc)</i> | <i>Total Depth<br/>(ft btoc)</i> | <i>Depth to Water<br/>(ft btoc)</i> | <i>Depth to Product<br/>(ft btoc)</i> | <i>LNAPL<br/>Thickness<br/>(ft)</i> | <i>Corrected<br/>Groundwater<br/>Elevation <sup>1</sup><br/>(ft amsl)</i> | <i>Corrected Water<br/>Table Depth <sup>1</sup><br/>(ft btoc)</i> |
|----------------|-------------|---------------------------------------------------|--------------------------------------------------|------------------------------------|----------------------------------|-------------------------------------|---------------------------------------|-------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------|
|                | 07/10/12    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 5.17                                | 4.52                                  | 0.65                                | 587.53                                                                    | 4.60                                                              |
|                | 08/29/12    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.44                                | 3.80                                  | 0.64                                | 588.25                                                                    | 3.88                                                              |
|                | 09/12/12    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.39                                | 3.63                                  | 0.76                                | 588.41                                                                    | 3.72                                                              |
|                | 11/06/12    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.49                                | 3.69                                  | 0.80                                | 588.34                                                                    | 3.79                                                              |
|                | 12/05/12    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 5.28                                | 4.31                                  | 0.97                                | 587.70                                                                    | 4.43                                                              |
|                | 04/03/13    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 5.07                                | 4.01                                  | 1.06                                | 587.99                                                                    | 4.14                                                              |
|                | 07/18/13    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.80                                | 3.10                                  | 1.70                                | 588.83                                                                    | 3.30                                                              |
|                | 09/23/13    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 6.20                                | 4.26                                  | 1.94                                | 587.64                                                                    | 4.49                                                              |
|                | 04/25/14    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.87                                | 2.36                                  | 2.51                                | 589.47                                                                    | 2.66                                                              |
|                | 06/02/14    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.45                                | 3.16                                  | 1.29                                | 588.82                                                                    | 3.31                                                              |
|                | 07/09/14    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 3.66                                | 2.19                                  | 1.47                                | 589.76                                                                    | 2.37                                                              |
|                | 07/31/14    | 592.4                                             | 592.13                                           | 2.70                               | 12.70                            | 4.25                                | 2.93                                  | 1.32                                | 589.04                                                                    | 3.09                                                              |
| QPTW-10        | 03/17/05    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.83                                | 7.58                                  | 2.25                                | 584.30                                                                    | 7.85                                                              |
|                | 04/12/05    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.96                                | 7.63                                  | 2.33                                | 584.24                                                                    | 7.91                                                              |
|                | 05/31/05    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 10.29                               | 7.83                                  | 2.46                                | 584.02                                                                    | 8.13                                                              |
|                | 06/24/05    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.72                                | 7.43                                  | 2.29                                | 584.45                                                                    | 7.70                                                              |
|                | 08/12/05    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.79                                | 7.58                                  | 2.21                                | 584.30                                                                    | 7.85                                                              |
|                | 10/14/05    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 10.56                               | 7.80                                  | 2.76                                | 584.02                                                                    | 8.13                                                              |
|                | 11/08/05    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 10.82                               | 7.88                                  | 2.94                                | 583.92                                                                    | 8.23                                                              |
|                | 12/19/05    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 11.01                               | 7.95                                  | 3.06                                | 583.83                                                                    | 8.32                                                              |
|                | 01/31/06    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.79                                | 7.54                                  | 2.25                                | 584.34                                                                    | 7.81                                                              |
|                | 02/15/06    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.73                                | 7.44                                  | 2.29                                | 584.44                                                                    | 7.71                                                              |
|                | 03/13/06    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.22                                | 7.23                                  | 1.99                                | 584.68                                                                    | 7.47                                                              |
|                | 04/10/06    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.59                                | 7.34                                  | 2.25                                | 584.54                                                                    | 7.61                                                              |
|                | 05/22/06    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.95                                | 7.43                                  | 2.52                                | 584.42                                                                    | 7.73                                                              |
|                | 06/21/06    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 10.00                               | 7.49                                  | 2.51                                | 584.36                                                                    | 7.79                                                              |
|                | 07/11/06    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.69                                | 7.30                                  | 2.39                                | 584.56                                                                    | 7.59                                                              |
|                | 08/23/06    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.58                                | 7.30                                  | 2.28                                | 584.58                                                                    | 7.57                                                              |
|                | 09/26/06    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.85                                | 7.33                                  | 2.52                                | 584.52                                                                    | 7.63                                                              |
|                | 10/30/06    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.68                                | 7.19                                  | 2.49                                | 584.66                                                                    | 7.49                                                              |
|                | 11/27/06    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.91                                | 7.33                                  | 2.58                                | 584.51                                                                    | 7.64                                                              |
|                | 12/27/06    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.99                                | 7.34                                  | 2.65                                | 584.49                                                                    | 7.66                                                              |
|                | 01/15/07    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.90                                | 7.37                                  | 2.53                                | 584.48                                                                    | 7.67                                                              |
|                | 02/21/07    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 10.81                               | 7.78                                  | 3.03                                | 584.01                                                                    | 8.14                                                              |
|                | 03/23/07    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 10.71                               | 7.72                                  | 2.99                                | 584.07                                                                    | 8.08                                                              |
|                | 04/09/07    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 10.63                               | 7.64                                  | 2.99                                | 584.15                                                                    | 8.00                                                              |
|                | 05/15/07    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 10.38                               | 7.46                                  | 2.92                                | 584.34                                                                    | 7.81                                                              |
|                | 06/11/07    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 10.81                               | 7.81                                  | 3.00                                | 583.98                                                                    | 8.17                                                              |
|                | 07/11/07    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 11.05                               | 7.86                                  | 3.19                                | 583.91                                                                    | 8.24                                                              |
|                | 08/16/07    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 11.27                               | 7.95                                  | 3.32                                | 583.80                                                                    | 8.35                                                              |
|                | 09/17/07    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 10.54                               | 7.73                                  | 2.81                                | 584.08                                                                    | 8.07                                                              |
|                | 11/26/07    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 11.57                               | 8.11                                  | 3.46                                | 583.62                                                                    | 8.53                                                              |
|                | 12/12/07    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 11.80                               | 8.18                                  | 3.62                                | 583.54                                                                    | 8.61                                                              |
|                | 01/11/08    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 10.96                               | 7.95                                  | 3.01                                | 583.84                                                                    | 8.31                                                              |
|                | 02/05/08    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 10.21                               | 7.78                                  | 2.43                                | 584.08                                                                    | 8.07                                                              |
|                | 04/11/08    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.71                                | 6.83                                  | 1.88                                | 585.09                                                                    | 7.06                                                              |
|                | 05/16/08    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.91                                | 6.95                                  | 1.96                                | 584.96                                                                    | 7.19                                                              |
|                | 10/29/08    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.12                                | 6.94                                  | 2.18                                | 584.95                                                                    | 7.20                                                              |
|                | 01/21/09    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 7.96                                | 6.68                                  | 1.28                                | 585.32                                                                    | 6.83                                                              |
|                | 03/18/09    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.69                                | 6.36                                  | 2.33                                | 585.51                                                                    | 6.64                                                              |
|                | 10/17/09    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.10                                | 7.04                                  | 2.06                                | 584.86                                                                    | 7.29                                                              |
|                | 10/23/09    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.67                                | 6.97                                  | 1.70                                | 584.98                                                                    | 7.17                                                              |
|                | 06/09/10    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.42                                | 6.23                                  | 2.19                                | 585.66                                                                    | 6.49                                                              |
|                | 06/24/10    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.91                                | 6.48                                  | 2.43                                | 585.38                                                                    | 6.77                                                              |
|                | 07/29/10    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.37                                | 6.51                                  | 2.86                                | 585.30                                                                    | 6.85                                                              |
|                | 08/06/10    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 9.22                                | 6.71                                  | 2.51                                | 585.14                                                                    | 7.01                                                              |
|                | 08/13/10    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.06                                | 5.73                                  | 2.33                                | 586.14                                                                    | 6.01                                                              |
|                | 08/27/10    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.83                                | 6.03                                  | 2.80                                | 585.78                                                                    | 6.37                                                              |
|                | 09/17/10    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.68                                | 5.72                                  | 2.96                                | 586.07                                                                    | 6.08                                                              |
|                | 09/23/10    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.54                                | 5.64                                  | 2.90                                | 586.16                                                                    | 5.99                                                              |
|                | 10/15/10    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.92                                | 5.82                                  | 3.10                                | 585.96                                                                    | 6.19                                                              |
|                | 10/29/10    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.87                                | 5.68                                  | 3.19                                | 586.09                                                                    | 6.06                                                              |
|                | 03/18/11    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.03                                | 4.92                                  | 3.11                                | 586.86                                                                    | 5.29                                                              |
|                | 04/08/11    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 7.75                                | 4.06                                  | 3.69                                | 587.65                                                                    | 4.50                                                              |
|                | 05/09/11    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.24                                | 3.95                                  | 4.29                                | 587.69                                                                    | 4.46                                                              |
|                | 06/09/11    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.28                                | 4.24                                  | 4.04                                | 587.43                                                                    | 4.72                                                              |
|                | 07/05/11    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.75                                | 4.38                                  | 4.37                                | 587.25                                                                    | 4.90                                                              |
|                | 08/23/11    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.50                                | 3.67                                  | 4.83                                | 587.90                                                                    | 4.25                                                              |
|                | 10/14/11    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.64                                | 4.58                                  | 4.06                                | 587.08                                                                    | 5.07                                                              |

TABLE 2.1

**SUMMARY OF IN-WELL LNAPL THICKNESS DATA  
FORMER QUENCH PIT LNAPL AREA  
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND  
SAGINAW, MICHIGAN**

| <i>Well ID</i> | <i>Date</i> | <i>Ground Surface<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Casing<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Screen<br/>(ft btoc)</i> | <i>Total Depth<br/>(ft btoc)</i> | <i>Depth to Water<br/>(ft btoc)</i> | <i>Depth to Product<br/>(ft btoc)</i> | <i>LNAPL<br/>Thickness<br/>(ft)</i> | <i>Corrected<br/>Groundwater<br/>Elevation <sup>1</sup><br/>(ft amsl)</i> | <i>Corrected Water<br/>Table Depth <sup>1</sup><br/>(ft btoc)</i> |
|----------------|-------------|---------------------------------------------------|--------------------------------------------------|------------------------------------|----------------------------------|-------------------------------------|---------------------------------------|-------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------|
| QPTW-13        | 11/23/11    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 8.38                                | 3.98                                  | 4.40                                | 587.64                                                                    | 4.51                                                              |
|                | 04/23/12    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 4.13                                | 3.78                                  | 0.35                                | 588.33                                                                    | 3.82                                                              |
|                | 07/10/12    | 592.4                                             | 592.15                                           | 2.60                               | 12.60                            | 5.65                                | 4.51                                  | 1.14                                | 587.50                                                                    | 4.65                                                              |
|                | 10/15/10    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 7.17                                | 6.65                                  | 0.52                                | 585.65                                                                    | 6.71                                                              |
|                | 10/29/10    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 6.77                                | 6.49                                  | 0.28                                | 585.84                                                                    | 6.52                                                              |
|                | 03/18/11    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 4.56                                | 4.47                                  | 0.09                                | 587.88                                                                    | 4.48                                                              |
|                | 05/09/11    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 4.59                                | 4.56                                  | 0.03                                | 587.80                                                                    | 4.56                                                              |
|                | 06/09/11    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 4.88                                | 4.85                                  | 0.03                                | 587.51                                                                    | 4.85                                                              |
|                | 07/05/11    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 5.08                                | 5.02                                  | 0.06                                | 587.33                                                                    | 5.03                                                              |
|                | 08/23/11    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 4.43                                | 4.38                                  | 0.05                                | 587.97                                                                    | 4.39                                                              |
|                | 10/14/11    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 5.12                                | 5.03                                  | 0.09                                | 587.32                                                                    | 5.04                                                              |
|                | 03/20/12    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 4.12                                | ---                                   | ---                                 | 588.24                                                                    | 4.12                                                              |
|                | 04/23/12    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 4.16                                | 4.15                                  | 0.01                                | 588.21                                                                    | 4.15                                                              |
|                | 06/11/12    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 4.38                                | ---                                   | ---                                 | 587.98                                                                    | 4.38                                                              |
|                | 07/10/12    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 5.06                                | 4.84                                  | 0.22                                | 587.49                                                                    | 4.87                                                              |
|                | 08/29/12    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 4.30                                | 4.24                                  | 0.06                                | 588.11                                                                    | 4.25                                                              |
|                | 09/12/12    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 4.13                                | 4.09                                  | 0.04                                | 588.27                                                                    | 4.09                                                              |
|                | 04/15/13    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 2.85                                | ---                                   | ---                                 | 589.51                                                                    | 2.85                                                              |
|                | 07/18/13    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 3.54                                | ---                                   | ---                                 | 588.82                                                                    | 3.54                                                              |
|                | 09/23/13    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 4.74                                | 4.71                                  | 0.03                                | 587.65                                                                    | 4.71                                                              |
|                | 04/25/14    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 2.98                                | ---                                   | ---                                 | 589.38                                                                    | 2.98                                                              |
|                | 06/02/14    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 3.65                                | ---                                   | ---                                 | 588.71                                                                    | 3.65                                                              |
|                | 07/09/14    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 2.73                                | ---                                   | ---                                 | 589.63                                                                    | 2.73                                                              |
|                | 07/31/14    | 592.7                                             | 592.36                                           | 2.76                               | 12.76                            | 3.41                                | ---                                   | ---                                 | 588.95                                                                    | 3.41                                                              |
| QP-2           | 06/24/10    | ---                                               | ---                                              | 5                                  | 15                               | 10.27                               | 10.25                                 | 0.02                                | ---                                                                       | 10.25                                                             |
|                | 06/28/10    | ---                                               | ---                                              | 5                                  | 15                               | 9.49                                | 9.45                                  | 0.04                                | ---                                                                       | 9.45                                                              |
|                | 07/08/10    | ---                                               | ---                                              | 5                                  | 15                               | 8.57                                | 8.48                                  | 0.09                                | ---                                                                       | 8.49                                                              |
|                | 07/22/10    | ---                                               | ---                                              | 5                                  | 15                               | 8.31                                | 8.22                                  | 0.09                                | ---                                                                       | 8.23                                                              |
|                | 07/29/10    | ---                                               | ---                                              | 5                                  | 15                               | 8.55                                | 8.46                                  | 0.09                                | ---                                                                       | 8.47                                                              |
|                | 08/06/10    | ---                                               | ---                                              | 5                                  | 15                               | 8.88                                | 8.74                                  | 0.14                                | ---                                                                       | 8.76                                                              |
|                | 08/13/10    | ---                                               | ---                                              | 5                                  | 15                               | 6.70                                | 6.61                                  | 0.09                                | ---                                                                       | 6.62                                                              |
|                | 08/27/10    | ---                                               | ---                                              | 5                                  | 15                               | 7.76                                | 7.66                                  | 0.10                                | ---                                                                       | 7.67                                                              |
|                | 09/17/10    | ---                                               | ---                                              | 5                                  | 15                               | 7.44                                | 7.28                                  | 0.16                                | ---                                                                       | 7.30                                                              |
|                | 09/23/10    | ---                                               | ---                                              | 5                                  | 15                               | 7.14                                | 6.98                                  | 0.16                                | ---                                                                       | 7.00                                                              |
|                | 10/15/10    | ---                                               | ---                                              | 5                                  | 15                               | 7.96                                | 7.73                                  | 0.23                                | ---                                                                       | 7.76                                                              |
|                | 10/29/10    | ---                                               | ---                                              | 5                                  | 15                               | 7.74                                | 7.48                                  | 0.26                                | ---                                                                       | 7.51                                                              |
|                | 12/07/10    | ---                                               | ---                                              | 5                                  | 15                               | 7.71                                | 7.40                                  | 0.31                                | ---                                                                       | 7.44                                                              |
|                | 01/03/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.62                                | 7.31                                  | 0.31                                | ---                                                                       | 7.35                                                              |
|                | 03/18/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.51                                | 7.25                                  | 0.26                                | ---                                                                       | 7.28                                                              |
|                | 04/08/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.03                                | 6.73                                  | 0.30                                | ---                                                                       | 6.77                                                              |
|                | 05/09/11    | ---                                               | ---                                              | 5                                  | 15                               | 6.97                                | 6.61                                  | 0.36                                | ---                                                                       | 6.65                                                              |
|                | 06/09/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.36                                | 6.93                                  | 0.43                                | ---                                                                       | 6.98                                                              |
|                | 07/05/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.45                                | 6.92                                  | 0.53                                | ---                                                                       | 6.98                                                              |
|                | 08/23/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.13                                | 6.42                                  | 0.71                                | ---                                                                       | 6.51                                                              |
|                | 10/14/11    | ---                                               | ---                                              | 5                                  | 15                               | 8.31                                | 7.34                                  | 0.97                                | ---                                                                       | 7.46                                                              |
|                | 11/23/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.99                                | 7.07                                  | 0.92                                | ---                                                                       | 7.18                                                              |
|                | 01/24/12    | ---                                               | ---                                              | 5                                  | 15                               | 6.79                                | 5.81                                  | 0.98                                | ---                                                                       | 5.93                                                              |
|                | 03/20/12    | ---                                               | ---                                              | 5                                  | 15                               | 7.25                                | 6.29                                  | 0.96                                | ---                                                                       | 6.41                                                              |
|                | 04/23/12    | ---                                               | ---                                              | 5                                  | 15                               | 7.21                                | 6.18                                  | 1.03                                | ---                                                                       | 6.30                                                              |
|                | 06/11/12    | ---                                               | ---                                              | 5                                  | 15                               | 7.20                                | 6.48                                  | 0.72                                | ---                                                                       | 6.57                                                              |
|                | 07/10/12    | ---                                               | ---                                              | 5                                  | 15                               | 8.43                                | 7.04                                  | 1.39                                | ---                                                                       | 7.21                                                              |
|                | 08/29/12    | ---                                               | ---                                              | 5                                  | 15                               | 8.00                                | 6.44                                  | 1.56                                | ---                                                                       | 6.63                                                              |
|                | 09/12/12    | ---                                               | ---                                              | 5                                  | 15                               | 7.75                                | 6.17                                  | 1.58                                | ---                                                                       | 6.36                                                              |
|                | 10/01/12    | ---                                               | ---                                              | 5                                  | 15                               | 8.66                                | 6.81                                  | 1.85                                | ---                                                                       | 7.03                                                              |
|                | 11/06/12    | ---                                               | ---                                              | 5                                  | 15                               | 7.02                                | 6.29                                  | 0.73                                | ---                                                                       | 6.38                                                              |
|                | 12/05/12    | ---                                               | ---                                              | 5                                  | 15                               | 7.59                                | 6.86                                  | 0.73                                | ---                                                                       | 6.95                                                              |
|                | 04/03/13    | ---                                               | ---                                              | 5                                  | 15                               | 7.12                                | 6.40                                  | 0.72                                | ---                                                                       | 6.49                                                              |
|                | 07/18/13    | ---                                               | ---                                              | 5                                  | 15                               | 6.91                                | 5.86                                  | 1.05                                | ---                                                                       | 5.99                                                              |
|                | 09/23/13    | ---                                               | ---                                              | 5                                  | 15                               | 7.73                                | 6.95                                  | 0.78                                | ---                                                                       | 7.04                                                              |
|                | 04/25/14    | ---                                               | ---                                              | 5                                  | 15                               | 5.86                                | 5.40                                  | 0.46                                | ---                                                                       | 5.46                                                              |
|                | 06/02/14    | ---                                               | ---                                              | 5                                  | 15                               | 6.24                                | 5.74                                  | 0.50                                | ---                                                                       | 5.80                                                              |
|                | 07/09/14    | ---                                               | ---                                              | 5                                  | 15                               | 5.86                                | 5.29                                  | 0.57                                | ---                                                                       | 5.36                                                              |
|                | 07/31/14    | ---                                               | ---                                              | 5                                  | 15                               | 6.16                                | 5.55                                  | 0.61                                | ---                                                                       | 5.62                                                              |
| QP-3           | 06/24/10    | ---                                               | ---                                              | 5                                  | 15                               | 17.53                               | 16.80                                 | 0.73                                | ---                                                                       | 16.89                                                             |
|                | 06/28/10    | ---                                               | ---                                              | 5                                  | 15                               | 12.56                               | 12.53                                 | 0.03                                | ---                                                                       | 12.53                                                             |
|                | 07/08/10    | ---                                               | ---                                              | 5                                  | 15                               | 12.37                               | 12.32                                 | 0.05                                | ---                                                                       | 12.33                                                             |
|                | 07/29/10    | ---                                               | ---                                              | 5                                  | 15                               | 12.47                               | 12.35                                 | 0.12                                | ---                                                                       | 12.36                                                             |

**TABLE 2.1**  
**SUMMARY OF IN-WELL LNAPL THICKNESS DATA**  
**FORMER QUENCH PIT LNAPL AREA**  
**RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND**  
**SAGINAW, MICHIGAN**

| <i>Well ID</i> | <i>Date</i> | <i>Ground Surface<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Casing<br/>Elevation<br/>(ft amsl)</i> | <i>Top of Screen<br/>(ft btoc)</i> | <i>Total Depth<br/>(ft btoc)</i> | <i>Depth to Water<br/>(ft btoc)</i> | <i>Depth to Product<br/>(ft btoc)</i> | <i>LNAPL<br/>Thickness<br/>(ft)</i> | <i>Corrected<br/>Groundwater<br/>Elevation <sup>1</sup><br/>(ft amsl)</i> | <i>Corrected Water<br/>Table Depth <sup>1</sup><br/>(ft btoc)</i> |
|----------------|-------------|---------------------------------------------------|--------------------------------------------------|------------------------------------|----------------------------------|-------------------------------------|---------------------------------------|-------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------|
|                | 08/06/10    | ---                                               | ---                                              | 5                                  | 15                               | 12.89                               | 12.81                                 | 0.08                                | ---                                                                       | 12.82                                                             |
|                | 08/13/10    | ---                                               | ---                                              | 5                                  | 15                               | 11.69                               | 11.62                                 | 0.07                                | ---                                                                       | 11.63                                                             |
|                | 08/27/10    | ---                                               | ---                                              | 5                                  | 15                               | 11.78                               | 11.71                                 | 0.07                                | ---                                                                       | 11.72                                                             |
|                | 09/17/10    | ---                                               | ---                                              | 5                                  | 15                               | 11.78                               | 11.69                                 | 0.09                                | ---                                                                       | 11.70                                                             |
|                | 09/23/10    | ---                                               | ---                                              | 5                                  | 15                               | 11.55                               | 11.41                                 | 0.14                                | ---                                                                       | 11.43                                                             |
|                | 10/15/10    | ---                                               | ---                                              | 5                                  | 15                               | 8.19                                | 8.03                                  | 0.16                                | ---                                                                       | 8.05                                                              |
|                | 10/29/10    | ---                                               | ---                                              | 5                                  | 15                               | 8.27                                | 8.09                                  | 0.18                                | ---                                                                       | 8.11                                                              |
|                | 12/07/10    | ---                                               | ---                                              | 5                                  | 15                               | 7.92                                | 7.82                                  | 0.10                                | ---                                                                       | 7.83                                                              |
|                | 01/03/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.70                                | 7.57                                  | 0.13                                | ---                                                                       | 7.59                                                              |
|                | 03/18/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.69                                | 7.59                                  | 0.10                                | ---                                                                       | 7.60                                                              |
|                | 04/08/11    | ---                                               | ---                                              | 5                                  | 15                               | 6.78                                | 6.72                                  | 0.06                                | ---                                                                       | 6.73                                                              |
|                | 05/09/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.08                                | 7.02                                  | 0.06                                | ---                                                                       | 7.03                                                              |
|                | 06/09/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.33                                | 7.25                                  | 0.08                                | ---                                                                       | 7.26                                                              |
|                | 07/05/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.26                                | 7.18                                  | 0.08                                | ---                                                                       | 7.19                                                              |
|                | 08/23/11    | ---                                               | ---                                              | 5                                  | 15                               | 6.41                                | 6.37                                  | 0.04                                | ---                                                                       | 6.37                                                              |
|                | 10/14/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.44                                | 7.35                                  | 0.09                                | ---                                                                       | 7.36                                                              |
|                | 11/23/11    | ---                                               | ---                                              | 5                                  | 15                               | 7.06                                | 7.00                                  | 0.06                                | ---                                                                       | 7.01                                                              |
|                | 01/24/12    | ---                                               | ---                                              | 5                                  | 15                               | 5.63                                | 5.60                                  | 0.03                                | ---                                                                       | 5.60                                                              |
|                | 03/20/12    | ---                                               | ---                                              | 5                                  | 15                               | 6.25                                | 6.22                                  | 0.03                                | ---                                                                       | 6.22                                                              |
|                | 04/23/12    | ---                                               | ---                                              | 5                                  | 15                               | 6.02                                | 6.00                                  | 0.02                                | ---                                                                       | 6.00                                                              |
|                | 06/11/12    | ---                                               | ---                                              | 5                                  | 15                               | 6.55                                | 6.51                                  | 0.04                                | ---                                                                       | 6.51                                                              |
|                | 07/10/12    | ---                                               | ---                                              | 5                                  | 15                               | 7.21                                | 7.11                                  | 0.10                                | ---                                                                       | 7.12                                                              |
|                | 08/29/12    | ---                                               | ---                                              | 5                                  | 15                               | 6.58                                | 6.49                                  | 0.09                                | ---                                                                       | 6.50                                                              |
|                | 09/12/12    | ---                                               | ---                                              | 5                                  | 15                               | 6.16                                | 6.10                                  | 0.06                                | ---                                                                       | 6.11                                                              |
|                | 10/01/12    | ---                                               | ---                                              | 5                                  | 15                               | 7.11                                | 7.01                                  | 0.10                                | ---                                                                       | 7.02                                                              |
|                | 11/06/12    | ---                                               | ---                                              | 5                                  | 15                               | 7.07                                | 7.01                                  | 0.06                                | ---                                                                       | 7.02                                                              |
|                | 12/05/12    | ---                                               | ---                                              | 5                                  | 15                               | 6.58                                | 6.55                                  | 0.03                                | ---                                                                       | 6.55                                                              |
|                | 04/03/13    | ---                                               | ---                                              | 5                                  | 15                               | 6.57                                | 6.54                                  | 0.03                                | ---                                                                       | 6.54                                                              |
|                | 07/18/13    | ---                                               | ---                                              | 5                                  | 15                               | 5.98                                | 5.92                                  | 0.06                                | ---                                                                       | 5.93                                                              |
|                | 09/23/13    | ---                                               | ---                                              | 5                                  | 15                               | 7.01                                | 6.91                                  | 0.10                                | ---                                                                       | 6.92                                                              |
|                | 04/25/14    | ---                                               | ---                                              | 5                                  | 15                               | 5.41                                | 5.39                                  | 0.02                                | ---                                                                       | 5.39                                                              |
|                | 06/02/14    | ---                                               | ---                                              | 5                                  | 15                               | 5.74                                | 5.71                                  | 0.03                                | ---                                                                       | 5.71                                                              |
|                | 07/09/14    | ---                                               | ---                                              | 5                                  | 15                               | 5.17                                | 5.13                                  | 0.04                                | ---                                                                       | 5.13                                                              |
|                | 07/31/14    | ---                                               | ---                                              | 5                                  | 15                               | 5.25                                | 5.24                                  | 0.01                                | ---                                                                       | 5.24                                                              |

## Notes:

LNAPL Light Non-Aqueous Phase Liquid

ft Feet

ft amsl Feet Above Mean Sea Level

ft btoc Feet Below Top of Casing

--- No LNAPL measured

<sup>1</sup> A specific gravity of 0.88 (quench/hydraulic oil) was used to calculate corrected groundwater levels

TABLE 3.1

**LNAPL TRANSMISSIVITY ESTIMATES  
FORMER QUENCH PIT LNAPL AREA  
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND  
SAGINAW, MICHIGAN**

| <i>Well</i>            | <i>LNAPL Recovery Rate<br/>(gal/day)</i> |      | <i>LNAPL Drawdown<br/>(ft)</i> | <i>Estimated LNAPL Transmissivity<sup>3,4</sup><br/>(ft<sup>2</sup>/day)</i> |
|------------------------|------------------------------------------|------|--------------------------------|------------------------------------------------------------------------------|
| QPTW-1                 |                                          | 0.28 | 0.09                           | 0.31                                                                         |
| QP-2                   |                                          | 0.64 | 0.16                           | 0.39                                                                         |
| QPTW-4                 |                                          | 0.66 | 0.26                           | 0.25                                                                         |
| QPTW-5                 |                                          | 1.11 | 0.24                           | 0.46                                                                         |
|                        | Maximum                                  | 0.57 | 0.26                           | 0.21                                                                         |
| QPTW-10 <sup>1,2</sup> | Average                                  | 0.11 | 0.26                           | 0.04                                                                         |
|                        | Current                                  | 0.03 | 0.26                           | 0.01                                                                         |

## Notes:

1. Recovery rates based on tracking of LNAPL skimmer performance and operational days
2. LNAPL drawdown based on theoretical maximum LNAPL drawdown for unconfined conditions (Eq. 17 of ASTM E2856-11)
3. Based on Eq. 16 of ASTM E2856-11 (transmissivity based on LNAPL skimming data)
4. DRAFT MDEQ de minimis LNAPL transmissivity/recoverability criterion = 0.5 ft<sup>2</sup>/day

TABLE 3.2

SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS: FORMER QUENCH PIT AREA  
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND  
SAGINAW, MICHIGAN

| Location ID:                                                |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    | QPTW-1   | QPTW-3   | QPTW-4   | QPTW-5   | QPTW-6     | QPTW-7     | QPTW-8     | QPTW-9     | QPTW-10  | QPTW-11   | QPTW-12   | QPTW-13   | QPTW-13L |
|-------------------------------------------------------------|-------|--------------------------|--------------------|-----------------------------|--------------|-------------------|-------------------------|----------------------------|----------------------|------------------------------|--------------------|----------|----------|----------|----------|------------|------------|------------|------------|----------|-----------|-----------|-----------|----------|
| Sample Name:                                                |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    | QPTW-1   | QPTW-3   | QPTW-4   | QPTW-5   | QPTW-6     | QPTW-7     | QPTW-8     | QPTW-9     | QPTW-10  | QPTW-11   | QPTW-12   | QPTW-13   | QPTW-13L |
| Sample Date:                                                |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    | 3/1/2007 | 3/1/2007 | 3/1/2007 | 3/1/2007 | 4/12/1997  | 4/12/1997  | 4/12/1997  | 4/12/1997  | 3/1/2007 | 4/12/1997 | 4/12/1997 | 4/12/1997 | 3/1/2007 |
| Parameters                                                  | Units | Site-Specific Background | Acute Inhalation a | Flammability/ Explosivity b | GW Contact c | GW SW Interface d | NonRes Drinking Water e | NonRes GW Volatilization f | Vapor Intrusion GW g | Vapor Intrusion Shallow GW h | Water Solubility i |          |          |          |          |            |            |            |            |          |           |           |           |          |
| Volatile Organic Compounds                                  |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    |          |          |          |          |            |            |            |            |          |           |           |           |          |
| 1,1,1-Trichloroethane                                       | mg/L  |                          | 1300               | NC                          | 1300         | 0.089             | 0.2                     | 1300                       | 71                   | 0.2                          | 1330               | -        | -        | -        | -        | 0.00037 J  | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| 1,1,2,2-Tetrachloroethane                                   | mg/L  |                          | NC                 | NC                          | 4.7          | 0.078             | 0.035                   | 77                         | 0.3                  | 0.001                        | 2970               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| 1,1,2-Trichloroethane                                       | mg/L  |                          | NC                 | NC                          | 21           | 0.33              | 0.005                   | 110                        | 0.48                 | 0.005                        | 4420               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| 1,1-Dichloroethane                                          | mg/L  |                          | NC                 | 380                         | 2400         | 0.74              | 2.5                     | 2300                       | 18                   | 0.018                        | 5060               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| 1,1-Dichloroethene                                          | mg/L  |                          | 140                | 97                          | 11           | 0.13              | 0.007                   | 1.3                        | 1.6                  | 0.007                        | 2250               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| 1,2-Dichlorobenzene                                         | mg/L  |                          | 160                | NC                          | 160          | 0.013             | 0.6                     | 160                        | 32                   | 0.6                          | 156                | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.00017 J | 0.001 U   | 0.001 U   | -        |
| 1,2-Dichloroethane                                          | mg/L  |                          | NC                 | 2500                        | 19           | 0.36              | 0.005                   | 59                         | 0.21                 | 0.005                        | 8520               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| 1,2-Dichloropropane                                         | mg/L  |                          | 2800               | 550                         | 16           | 0.23              | 0.005                   | 36                         | 0.29                 | 0.005                        | 2800               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| 1,3-Dichlorobenzene                                         | mg/L  |                          | NC                 | NC                          | 2            | 0.028             | 0.019                   | 41                         | 0.23                 | 0.001                        | 111                | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| 1,4-Dichlorobenzene                                         | mg/L  |                          | NC                 | NC                          | 6.4          | 0.017             | 0.075                   | 74                         | 0.38                 | 0.075                        | 73.8               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.00013 J | 0.001 U   | 0.001 U   | -        |
| 2-Butanone (Methyl ethyl ketone) (MEK)                      | mg/L  |                          | 240000             | NC                          | 240000       | 2.2               | 38                      | 240000                     | 18000                | 18                           | 240000             | -        | -        | -        | -        | 0.05 U     | 0.05 U     | 0.05 U     | 0.05 U     | -        | 0.05 U    | 0.05 U    | 0.05 U    | -        |
| 2-Hexanone                                                  | mg/L  |                          | NC                 | NC                          | 5200         | NC                | 2.9                     | 8700                       | 67                   | 0.067                        | 16000              | -        | -        | -        | -        | 0.05 U     | 0.05 U     | 0.05 U     | 0.05 U     | -        | 0.05 U    | 0.05 U    | 0.05 U    | -        |
| 4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)        | mg/L  |                          | 20000              | NC                          | 13000        | NC                | 5.2                     | 20000                      | 4400                 | 4.4                          | 20000              | -        | -        | -        | -        | 0.05 U     | 0.05 U     | 0.05 U     | 0.05 U     | -        | 0.05 U    | 0.05 U    | 0.05 U    | -        |
| Acetone                                                     | mg/L  |                          | 1000000            | 15000                       | 31000        | 1.7               | 2.1                     | 1000000                    | 34000                | 34                           | 1000000            | -        | -        | -        | -        | 0.1 U      | 0.0089 J   | 0.1 U      | 0.1 U      | -        | 0.1 U     | 0.009 J   | 0.1 U     | -        |
| Benzene                                                     | mg/L  |                          | 67                 | 68                          | 11           | 0.2               | 0.005                   | 35                         | 0.14                 | 0.005                        | 1750               | -        | -        | -        | -        | 0.005 U    | 0.005 U    | 0.005 U    | 0.005 U    | -        | 0.00029 J | 0.005 U   | 0.005 U   | -        |
| Bromodichloromethane                                        | mg/L  |                          | NC                 | NC                          | 14           | NC                | 0.08                    | 37                         | 0.17                 | 0.08                         | 6740               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Bromoform                                                   | mg/L  |                          | NC                 | NC                          | 140          | NC                | 0.08                    | 3100                       | 11                   | 0.08                         | 3100               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Bromomethane (Methyl bromide)                               | mg/L  |                          | NC                 | NC                          | 70           | 0.035             | 0.029                   | 9                          | 0.14                 | 0.005                        | 14500              | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Carbon disulfide                                            | mg/L  |                          | NC                 | 13                          | 1200         | NC                | 2.3                     | 550                        | 9.9                  | 0.0099                       | 1190               | -        | -        | -        | -        | 0.05 U     | 0.000081 J | 0.00022 J  | 0.00072 J  | -        | 0.05 U    | 0.00021 J | 0.05 U    | -        |
| Carbon tetrachloride                                        | mg/L  |                          | 96                 | NC                          | 4.6          | 0.045             | 0.005                   | 2.4                        | 0.038                | 0.005                        | 793                | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Chlorobenzene                                               | mg/L  |                          | NC                 | 160                         | 86           | 0.025             | 0.1                     | 470                        | 4.6                  | 0.1                          | 472                | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.00019 J | 0.001 U   | 0.001 U   | -        |
| Chloroethane                                                | mg/L  |                          | NC                 | 110                         | 440          | 1.1               | 1.7                     | 5700                       | 180                  | 0.18                         | 5740               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Chloroform (Trichloromethane)                               | mg/L  |                          | NC                 | NC                          | 150          | 0.35              | 0.08                    | 180                        | 0.72                 | 0.08                         | 7920               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Chloromethane (Methyl chloride)                             | mg/L  |                          | 210                | 36                          | 490          | NC                | 1.1                     | 45                         | 1.1                  | 0.005                        | 6340               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| cis-1,2-Dichloroethene                                      | mg/L  |                          | NC                 | 530                         | 200          | 0.62              | 0.07                    | 210                        | 0.35                 | 0.07                         | 3500               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| cis-1,3-Dichloropropene                                     | mg/L  |                          | NC                 | NC                          | NC           | NC                | NC                      | NC                         | NC                   | NC                           | NC                 | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Dibromochloromethane                                        | mg/L  |                          | NC                 | NC                          | 18           | NC                | 0.08                    | 110                        | 0.33                 | 0.08                         | 2600               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Ethylbenzene                                                | mg/L  |                          | 170                | 43                          | 170          | 0.018             | 0.074                   | 170                        | 2.6                  | 0.7                          | 169                | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Methylene chloride                                          | mg/L  |                          | NC                 | NC                          | 220          | 1.5               | 0.005                   | 1400                       | 4.2                  | 0.005                        | 17000              | -        | -        | -        | -        | 0.00018 JB | 0.0002 JB  | 0.00022 JB | 0.00017 JB | -        | 0.00034 J | 0.00045 J | 0.00055 J | -        |
| Styrene                                                     | mg/L  |                          | 310                | 140                         | 9.7          | 0.08              | 0.1                     | 310                        | 4.1                  | 0.1                          | 310                | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Tetrachloroethene                                           | mg/L  |                          | 200                | NC                          | 12           | 0.06              | 0.005                   | 170                        | 0.46                 | 0.005                        | 200                | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Toluene                                                     | mg/L  |                          | NC                 | 61                          | 530          | 0.27              | 0.79                    | 530                        | 150                  | 1                            | 526                | -        | -        | -        | -        | 0.00015 J  | 0.00011 J  | 0.000086 J | 0.000091 J | -        | 0.0002 J  | 0.00017 J | 0.001 U   | -        |
| trans-1,2-Dichloroethene                                    | mg/L  |                          | NC                 | 230                         | 220          | 1.5               | 0.1                     | 200                        | 1.5                  | 0.1                          | 6300               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| trans-1,3-Dichloropropene                                   | mg/L  |                          | NC                 | NC                          | NC           | NC                | NC                      | NC                         | NC                   | NC                           | NC                 | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Trichloroethene                                             | mg/L  |                          | 1100               | NC                          | 22           | 0.2               | 0.005                   | 4.9                        | 0.041                | 0.005                        | 1100               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Vinyl chloride                                              | mg/L  |                          | NC                 | 33                          | 1            | 0.013             | 0.002                   | 13                         | 0.052                | 0.002                        | 2760               | -        | -        | -        | -        | 0.001 U    | 0.001 U    | 0.001 U    | 0.001 U    | -        | 0.001 U   | 0.001 U   | 0.001 U   | -        |
| Xylenes (total)                                             | mg/L  |                          | 190                | 70                          | 190          | 0.041             | 0.28                    | 190                        | 10                   | 10                           | 186                | -        | -        | -        | -        | 0.003 U    | 0.003 U    | 0.003 U    | 0.003 U    | -        | 0.003 U   | 0.003 U   | 0.003 U   | -        |
| Semivolatile Organic Compounds                              |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    |          |          |          |          |            |            |            |            |          |           |           |           |          |
| 1,2,4-Trichlorobenzene                                      | mg/L  |                          | 300                | NC                          | 19           | 0.099             | 0.07                    | 300                        | 0.57                 | 0.07                         | 300                | -        | -        | -        | -        | 0.005 U    | 0.005 U    | 0.005 U    | 0.005 U    | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| 2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether) | mg/L  |                          | NC                 | NC                          | NC           | NC                | NC                      | NC                         | NC                   | NC                           | NC                 | -        | -        | -        | -        |            |            |            |            |          |           |           |           |          |

TABLE 3.2

SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS: FORMER QUENCH PIT AREA  
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND  
SAGINAW, MICHIGAN

|                                   |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    | QPTW-1   | QPTW-3   | QPTW-4   | QPTW-5   | QPTW-6    | QPTW-7    | QPTW-8    | QPTW-9    | QPTW-10  | QPTW-11   | QPTW-12   | QPTW-13   | QPTW-13L |
|-----------------------------------|-------|--------------------------|--------------------|-----------------------------|--------------|-------------------|-------------------------|----------------------------|----------------------|------------------------------|--------------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|-----------|----------|
|                                   |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    | QPTW-1   | QPTW-3   | QPTW-4   | QPTW-5   | QPTW-6    | QPTW-7    | QPTW-8    | QPTW-9    | QPTW-10  | QPTW-11   | QPTW-12   | QPTW-13   | QPTW-13L |
|                                   |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    | 3/1/2007 | 3/1/2007 | 3/1/2007 | 3/1/2007 | 4/12/1997 | 4/12/1997 | 4/12/1997 | 4/12/1997 | 3/1/2007 | 4/12/1997 | 4/12/1997 | 4/12/1997 | 3/1/2007 |
|                                   |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    |          |          |          |          |           |           |           |           |          |           |           |           |          |
| Parameters                        | Units | Site-Specific Background | Acute Inhalation a | Flammability/ Explosivity b | GW Contact c | GW SW Interface d | NonRes Drinking Water e | NonRes GW Volatilization f | Vapor Intrusion GW g | Vapor Intrusion Shallow GW h | Water Solubility i |          |          |          |          |           |           |           |           |          |           |           |           |          |
| 4-Nitroaniline                    | mg/L  |                          | NC                 | NC                          | NC           | NC                | NC                      | NC                         | NC                   | NC                           | NC                 | -        | -        | -        | -        | 0.02 U    | 0.02 U    | 0.02 U    | 0.02 U    | -        | 0.02 U    | 0.02 U    | 0.02 U    | -        |
| 4-Nitrophenol                     | mg/L  |                          | NC                 | NC                          | NC           | NC                | NC                      | NC                         | NC                   | NC                           | NC                 | -        | -        | -        | -        | 0.02 U    | 0.02 U    | 0.02 U    | 0.02 U    | -        | 0.02 U    | 0.02 U    | 0.02 U    | -        |
| Acenaphthene                      | mg/L  |                          | NC                 | NC                          | 4.2          | 0.038             | 3.8                     | 4.2                        | 230                  | 0.23                         | 4.24               | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Acenaphthylene                    | mg/L  |                          | NC                 | NC                          | 3.9          | NC                | 0.15                    | 3.9                        | 62                   | 0.062                        | 3.93               | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Anthracene                        | mg/L  |                          | NC                 | NC                          | 0.043        | NC                | 0.043                   | 0.043                      | 3700                 | 3.7                          | 0.0434             | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Benzo(a)anthracene                | mg/L  |                          | NC                 | NC                          | 0.0094       | NC                | 0.0085                  | NC                         | NC                   | NC                           | 0.0094             | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Benzo(a)pyrene                    | mg/L  |                          | NC                 | NC                          | 0.001        | NC                | 0.005                   | NC                         | NC                   | NC                           | 0.00162            | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Benzo(b)fluoranthene              | mg/L  |                          | NC                 | NC                          | 0.0015       | NC                | 0.0015                  | NC                         | NC                   | NC                           | 0.0015             | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Benzo(g,h,i)perylene              | mg/L  |                          | NC                 | NC                          | 0.001        | NC                | 0.001                   | NC                         | NC                   | NC                           | 0.00026            | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Benzo(k)fluoranthene              | mg/L  |                          | NC                 | NC                          | 0.001        | NC                | 0.001                   | NC                         | NC                   | NC                           | 0.0008             | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| bis(2-Chloroethoxy)methane        | mg/L  |                          | NC                 | NC                          | NC           | NC                | NC                      | NC                         | NC                   | NC                           | NC                 | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| bis(2-Chloroethyl)ether           | mg/L  |                          | 17000              | 17000                       | 5.7          | 0.001             | 0.0083                  | 210                        | 1.1                  | 0.0011                       | 17200              | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| bis(2-Ethylhexyl)phthalate (DEHP) | mg/L  |                          | 0.34               | NC                          | 0.32         | 0.025             | 0.006                   | NC                         | NC                   | NC                           | 0.34               | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.0014 J  | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Butyl benzylphthalate (BBP)       | mg/L  |                          | NC                 | NC                          | 2.7          | 0.067             | 2.7                     | NC                         | NC                   | NC                           | 2.69               | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Carbazole                         | mg/L  |                          | NC                 | NC                          | 7.4          | 0.01              | 0.35                    | NC                         | NC                   | NC                           | 7.48               | -        | -        | -        | -        | 0.01 U    | 0.01 U    | 0.01 U    | 0.01 U    | -        | 0.01 U    | 0.01 U    | 0.01 U    | -        |
| Chrysene                          | mg/L  |                          | NC                 | NC                          | 0.0016       | NC                | 0.0016                  | NC                         | NC                   | NC                           | 0.0016             | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Dibenz(a,h)anthracene             | mg/L  |                          | NC                 | NC                          | 0.002        | NC                | 0.002                   | NC                         | NC                   | NC                           | 0.00249            | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Dibenzofuran                      | mg/L  |                          | NC                 | NC                          | NC           | 0.004             | NC                      | 10                         | 0.096                | 0.004                        | 10                 | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Diethyl phthalate                 | mg/L  |                          | NC                 | NC                          | 1100         | 0.11              | 16                      | NC                         | NC                   | NC                           | 1080               | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Dimethyl phthalate                | mg/L  |                          | NC                 | NC                          | 4200         | NC                | 210                     | NC                         | NC                   | NC                           | 4190               | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Di-n-butylphthalate (DBP)         | mg/L  |                          | NC                 | NC                          | 11           | 0.0097            | 2.5                     | NC                         | NC                   | NC                           | 11.2               | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.0013 J  | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Di-n-octyl phthalate (DnOP)       | mg/L  |                          | NC                 | NC                          | 0.4          | NC                | 0.38                    | NC                         | NC                   | NC                           | 3                  | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Fluoranthene                      | mg/L  |                          | NC                 | NC                          | 0.21         | 0.0016            | 0.21                    | 0.21                       | NC                   | NC                           | 0.206              | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Fluorene                          | mg/L  |                          | NC                 | NC                          | 2            | 0.012             | 2                       | 2                          | 300                  | 0.3                          | 1.98               | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Hexachlorobenzene                 | mg/L  |                          | NC                 | NC                          | 0.0046       | 0.0002            | 0.001                   | 3                          | 0.0081               | 0.001                        | 6.2                | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Hexachlorobutadiene               | mg/L  |                          | NC                 | NC                          | 0.4          | 0.000053          | 0.042                   | 3.2                        | 0.028                | 0.00005                      | 3.23               | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Hexachlorocyclopentadiene         | mg/L  |                          | NC                 | NC                          | 1.6          | NC                | 0.05                    | 0.42                       | 0.05                 | 0.05                         | 1.8                | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Hexachloroethane                  | mg/L  |                          | NC                 | NC                          | 1.9          | 0.0067            | 0.021                   | 50                         | 0.18                 | 0.005                        | 50                 | -        | -        | -        | -        | 0.002 U   | 0.002 U   | 0.002 U   | 0.002 U   | -        | 0.002 U   | 0.002 U   | 0.002 U   | -        |
| Indeno(1,2,3-cd)pyrene            | mg/L  |                          | NC                 | NC                          | 0.002        | NC                | 0.002                   | NC                         | NC                   | NC                           | 0.000022           | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Isophorone                        | mg/L  |                          | 12000              | NC                          | 990          | 1.3               | 3.1                     | NC                         | NC                   | NC                           | 12000              | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Naphthalene                       | mg/L  |                          | 31                 | NC                          | 31           | 0.011             | 1.5                     | 31                         | 1.2                  | 0.005                        | 31                 | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Nitrobenzene                      | mg/L  |                          | NC                 | NC                          | 11           | 0.18              | 0.0096                  | 550                        | 6.6                  | 0.0066                       | 2090               | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| N-Nitrosodi-n-propylamine         | mg/L  |                          | NC                 | NC                          | 0.36         | NC                | 0.005                   | NC                         | NC                   | NC                           | 9890               | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| N-Nitrosodiphenylamine            | mg/L  |                          | NC                 | NC                          | 35           | NC                | 1.1                     | NC                         | NC                   | NC                           | 35.1               | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Pentachlorophenol                 | mg/L  |                          | NC                 | NC                          | 0.2          | NC                | 0.001                   | NC                         | NC                   | NC                           | 1850               | -        | -        | -        | -        | 0.025 U   | 0.025 U   | 0.025 U   | 0.025 U   | -        | 0.025 U   | 0.025 U   | 0.025 U   | -        |
| Phenanthrene                      | mg/L  |                          | NC                 | NC                          | 1            | 0.002             | 0.15                    | 1                          | 0.48                 | 0.002                        | 1                  | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Phenol                            | mg/L  |                          | NC                 | NC                          | 29000        | 0.45              | 13                      | NC                         | NC                   | NC                           | 82800              | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Pyrene                            | mg/L  |                          | NC                 | NC                          | 0.14         | NC                | 0.14                    | 0.14                       | 1700                 | 1.7                          | 0.135              | -        | -        | -        | -        | 0.005 U   | 0.005 U   | 0.005 U   | 0.005 U   | -        | 0.005 U   | 0.005 U   | 0.005 U   | -        |
| Metals                            |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    |          |          |          |          |           |           |           |           |          |           |           |           |          |
| Aluminum (dissolved)              | mg/L  | 0.24                     | NC                 | NC                          | 64000        | NC                | 0.05                    | NC                         | NC                   | NC                           | NC                 | -        | -        | -        | -        | 0.1 U     | 0.1 U     | 0.1 U     | 0.1 U     | -        | 0.1 U     | 0.1 U     | 0.1 U     | -        |
| Antimony (dissolved)              | mg/L  |                          | NC                 | NC                          | 68           | 0.13              | 0.006                   | NC                         | NC                   | NC                           | NC                 | -        | -        | -        | -        | 0.005 U   | 0.00      |           |           |          |           |           |           |          |

TABLE 3.2

SUMMARY OF HISTORICAL GROUNDWATER ANALYTICAL RESULTS: FORMER QUENCH PIT AREA  
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND  
SAGINAW, MICHIGAN

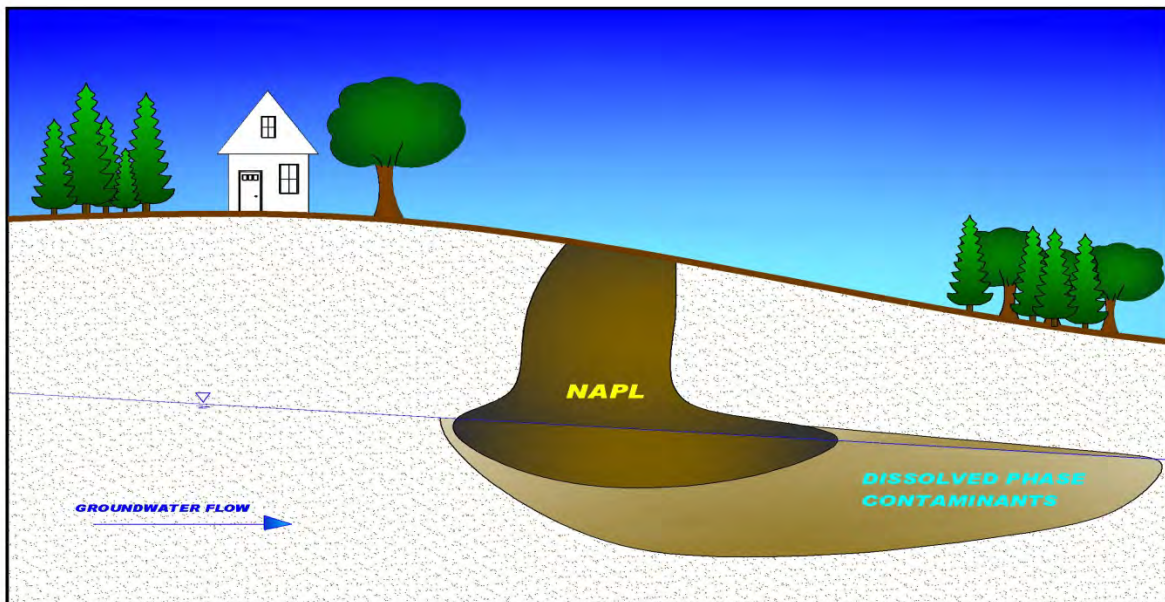
|                                     |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    |                    |                   |          |                    |           |           |           |           |                    |           |           |           |          |                    |
|-------------------------------------|-------|--------------------------|--------------------|-----------------------------|--------------|-------------------|-------------------------|----------------------------|----------------------|------------------------------|--------------------|--------------------|-------------------|----------|--------------------|-----------|-----------|-----------|-----------|--------------------|-----------|-----------|-----------|----------|--------------------|
| Location ID:                        |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    | QPTW-1             | QPTW-3            | QPTW-4   | QPTW-5             | QPTW-6    | QPTW-7    | QPTW-8    | QPTW-9    | QPTW-10            | QPTW-11   | QPTW-12   | QPTW-13   | QPTW-13  |                    |
| Sample Name:                        |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    | QPTW-1             | QPTW-3            | QPTW-4   | QPTW-5             | QPTW-6    | QPTW-7    | QPTW-8    | QPTW-9    | QPTW-10            | QPTW-11   | QPTW-12   | QPTW-13   | QPTW-13L |                    |
| Sample Date:                        |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    | 3/1/2007           | 3/1/2007          | 3/1/2007 | 3/1/2007           | 4/12/1997 | 4/12/1997 | 4/12/1997 | 4/12/1997 | 3/1/2007           | 4/12/1997 | 4/12/1997 | 4/12/1997 | 3/1/2007 |                    |
| Parameters                          | Units | Site-Specific Background | Acute Inhalation a | Flammability/ Explosivity b | GW Contact c | GW SW Interface d | NonRes Drinking Water e | NonRes GW Volatilization f | Vapor Intrusion GW g | Vapor Intrusion Shallow GW h | Water Solubility i |                    |                   |          |                    |           |           |           |           |                    |           |           |           |          |                    |
|                                     |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    |                    |                   |          |                    |           |           |           |           |                    |           |           |           |          |                    |
| TCLP Metals                         |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    |                    |                   |          |                    |           |           |           |           |                    |           |           |           |          |                    |
| Arsenic                             | mg/L  | 0.007                    | NC                 | NC                          | 4.3          | 0.01              | 0.01                    | NC                         | NC                   | NC                           | NC                 | 0.09 <sup>de</sup> | 0.03 U            | 0.03 U   | 0.04 <sup>de</sup> | -         | -         | -         | -         | 0.06 <sup>de</sup> | -         | -         | -         | -        | 0.03 U             |
| Barium                              | mg/L  | 0.99                     | NC                 | NC                          | 14000        | NC                | 2                       | NC                         | NC                   | NC                           | NC                 | 0.12               | 0.05              | 0.05 U   | 0.05 U             | -         | -         | -         | -         | 0.05 U             | -         | -         | -         | -        | 0.10               |
| Cadmium                             | mg/L  | 0.003                    | NC                 | NC                          | 190          | NC                | 0.005                   | NC                         | NC                   | NC                           | NC                 | 0.009 <sup>e</sup> | 0.005 U           | 0.005 U  | 0.005 U            | -         | -         | -         | -         | 0.005 U            | -         | -         | -         | -        | 0.014 <sup>e</sup> |
| Chromium                            | mg/L  |                          | NC                 | NC                          | 460          | 0.011             | 0.1                     | NC                         | NC                   | NC                           | NC                 | 0.05 U             | 0.05 U            | 0.05 U   | 0.05 U             | -         | -         | -         | -         | 0.05 U             | -         | -         | -         | -        | 0.05 <sup>d</sup>  |
| Lead                                | mg/L  | 0.006                    | NC                 | NC                          | NC           | NC                | 0.004                   | NC                         | NC                   | NC                           | NC                 | 0.03 U             | 0.07 <sup>e</sup> | 0.03 U   | 0.03 U             | -         | -         | -         | -         | 0.03 <sup>e</sup>  | -         | -         | -         | -        | 0.03 U             |
| Mercury                             | mg/L  |                          | NC                 | NC                          | 0.056        | 0.0000013         | 0.002                   | 0.056                      | NC                   | NC                           | 0.056              | 0.0025 U           | 0.0025 U          | 0.0025 U | 0.0025 U           | -         | -         | -         | -         | 0.0025 U           | -         | -         | -         | -        | 0.0025 U           |
| Selenium                            | mg/L  |                          | NC                 | NC                          | 970          | 0.005             | 0.05                    | NC                         | NC                   | NC                           | NC                 | 0.07 <sup>de</sup> | 0.05 U            | 0.05 U   | 0.05 U             | -         | -         | -         | -         | 0.05 U             | -         | -         | -         | -        | 0.05 U             |
| Silver                              | mg/L  |                          | NC                 | NC                          | 1500         | 0.0002            | 0.098                   | NC                         | NC                   | NC                           | NC                 | 0.007 <sup>d</sup> | 0.005 U           | 0.005 U  | 0.005 U            | -         | -         | -         | -         | 0.005 U            | -         | -         | -         | -        | 0.005 U            |
| Pesticides                          |       |                          |                    |                             |              |                   |                         |                            |                      |                              |                    |                    |                   |          |                    |           |           |           |           |                    |           |           |           |          |                    |
| Aroclor-1016 (PCB-1016)             | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | 0.0005               | 0.025                        | 0.0447             | -                  | -                 | -        | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -        | -                  |
| Aroclor-1016 (PCB-1016) (dissolved) | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | NC                   | NC                           | 0.0447             | -                  | -                 | -        | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -        | -                  |
| Aroclor-1221 (PCB-1221)             | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | 0.0005               | 0.025                        | 0.0447             | -                  | -                 | -        | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -        | -                  |
| Aroclor-1221 (PCB-1221) (dissolved) | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | NC                   | NC                           | 0.0447             | -                  | -                 | -        | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -        | -                  |
| Aroclor-1232 (PCB-1232)             | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | 0.0005               | 0.025                        | 0.0447             | -                  | -                 | -        | -                  | 0.0004 U  | 0.0004 U  | 0.0004 U  | 0.0004 U  | -                  | 0.0004 U  | 0.0004 U  | 0.0004 U  | -        | -                  |
| Aroclor-1232 (PCB-1232) (dissolved) | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | NC                   | NC                           | 0.0447             | -                  | -                 | -        | -                  | 0.0004 U  | 0.0004 U  | 0.0004 U  | 0.0004 U  | -                  | 0.0004 U  | 0.0004 U  | 0.0004 U  | -        | -                  |
| Aroclor-1242 (PCB-1242)             | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | 0.0005               | 0.025                        | 0.0447             | -                  | -                 | -        | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -        | -                  |
| Aroclor-1242 (PCB-1242) (dissolved) | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | NC                   | NC                           | 0.0447             | -                  | -                 | -        | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -        | -                  |
| Aroclor-1248 (PCB-1248)             | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | 0.0005               | 0.025                        | 0.0447             | -                  | -                 | -        | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -        | -                  |
| Aroclor-1248 (PCB-1248) (dissolved) | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | NC                   | NC                           | 0.0447             | -                  | -                 | -        | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -        | -                  |
| Aroclor-1254 (PCB-1254)             | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | 0.0005               | 0.025                        | 0.0447             | -                  | -                 | -        | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -        | -                  |
| Aroclor-1254 (PCB-1254) (dissolved) | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | NC                   | NC                           | 0.0447             | -                  | -                 | -        | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -        | -                  |
| Aroclor-1260 (PCB-1260)             | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | 0.0005               | 0.025                        | 0.0447             | -                  | -                 | -        | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -        | -                  |
| Aroclor-1260 (PCB-1260) (dissolved) | mg/L  |                          | NC                 | NC                          | 0.0033       | 0.0002            | 0.0005                  | 0.045                      | NC                   | NC                           | 0.0447             | -                  | -                 | -        | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -                  | 0.0002 U  | 0.0002 U  | 0.0002 U  | -        | -                  |

## **Appendix A**

### **MDEQ Petroleum NAPL Policy**

# ***NON-AQUEOUS PHASE LIQUID (NAPL) CHARACTERIZATION, REMEDIATION, AND MANAGEMENT FOR PETROLEUM RELEASES***

REMEDIATION AND REDEVELOPMENT DIVISION  
RESOURCE MATERIALS



***Prepared by:***

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RRD RESOURCE MATERIALS-25-2014-01  
June 2014



**Protecting Michigan's Environment. Ensuring Michigan's Future.**



*In order to promote a consistent and informed approach for Michigan Department of Environmental Quality (MDEQ) staff, this document was developed to provide information to MDEQ staff and contractors for characterizing, remediating and managing non-aqueous phase liquids (NAPL) related to petroleum releases.*

*This document is available as a technical reference to assist any party conducting investigations and evaluating NAPL associated with petroleum releases to support recovery and risk management decisions.*

*This document is explanatory and does not contain any regulatory requirements. It does not establish or affect the legal rights or obligations for petroleum NAPL management. It does not have the force or effect of law and is not legally binding on the public or the regulated community. Any regulatory decisions made by the MDEQ regarding NAPL management related to petroleum releases will be made by applying the governing statutes and Administrative Rules to relevant facts.*

A handwritten signature in dark ink, appearing to read 'Robert Wagner', is positioned above a horizontal line.

Approved:

Robert Wagner, Chief  
Remediation and Redevelopment Division  
June 24, 2014



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## SUMMARY

This document is provided as a resource for MDEQ staff and other environmental professionals working on characterizing, remediating, evaluating risk, and managing non-aqueous phase liquids (NAPL) resulting from releases of petroleum products to the environment.

The state of Michigan has thousands of sites that are contaminated with petroleum NAPL. These petroleum-based liquids have limited solubility in water and can degrade over time, but typically will remain in the subsurface for many years. The presence of NAPL in the subsurface can lead to unacceptable risks to human health and the environment if improperly characterized, remediated, and/or managed. However, unacceptable risks can be avoided using appropriate management practices that will reduce NAPL toxicity, remove constituents of concern, recover the NAPL, and/or prevent exposures. Characterization of the NAPL, both chemically and geographically, and the identification of all associated risks is critical for developing a conceptual site model (CSM) and implementing an effective and efficient remedial and management strategy. Conceptual site models (CSM) are communication tools that can provide a clear understanding of the characterization, site conditions, and risks.

In some cases, recovery or remediation of the NAPL is necessary to abate risks. The NAPL management decisions will be risk-based, but if mobile NAPL is present at a site and can be easily recovered in an efficient and cost effective manner, then the MDEQ encourages recovery of the NAPL wherever feasible. Recoverability analyses can aid in the decision making and have been demonstrated to be beneficial for determining how much NAPL may be removed and what remedial strategy may be most effective.

The factors outlined above are also important in achieving the goal of closure or no further action for a petroleum release. When the geographic location, chemical composition, and risk posed by the petroleum NAPL are well characterized and documented with a CSM, the resulting risk-based decision making is more protective, efficient, and cost effective.



## 1.0 INTRODUCTION

The non-aqueous phase liquid (NAPL) and management approaches referred to throughout this document are limited to only petroleum. Petroleum and petroleum compounds are commonly used in many industries and applications across the state. Given their widely-used nature, petroleum releases have occurred from a multitude of sources. Sources of petroleum releases include, but are not limited to, releases from oil and gas exploration and production, bulk storage, refining operations, retail sales (underground storage tanks), pipelines, home heating tanks, and industrial/manufacturing operations. Thousands of sites across the state of Michigan have documented releases of petroleum NAPL to the environment that will need to be addressed under statutory requirements, which includes the proper characterization, remediation, and/or management of the NAPL so that it does not pose an unacceptable risk to human health and the environment.

The scope of this document is to describe concepts for NAPL management. The document, in general terms, is broken into the following categories for NAPL management:

- *NAPL and Management Concepts*
- *NAPL Characterization*
- *Conceptual Site Model (CSM)*
- *Risk Assessment*
- *Recovery and Recoverability*
- *Site Closure*

It is not the intent of this document to provide a detailed discussion of every NAPL concept or strategy. A list of selected references, some of which provide a more thorough discussion of the concepts presented in this document, is presented in Appendix A.

In addition, a number of technical terms are used throughout this document when describing various aspects of NAPL assessment and management; this also includes terms used in certain statutes. A glossary of these and other commonly used terms and their definitions/applications are contained in Appendix B. Finally, the information contained in this document reflects basic concepts that are applicable to sites where only petroleum releases have occurred and reflect typical approaches to NAPL management. These approaches and concepts were reviewed by a number of external stakeholders and environmental professionals and where applicable, the comments were incorporated into this document. Appendix C is a list of external stakeholders whose review was sought for the development of this document.

## 2.0 NAPL and MANAGEMENT CONCEPTS

Basic NAPL concepts have been adapted from publications and training prepared by the Interstate Technology & Regulatory Council (ITRC) and ASTM International (ASTM). More detail on basic NAPL concepts is included in Appendix D.

The NAPL Management Strategy is based on three primary concepts:

1) The presence of NAPL should be assumed when there is a known release of petroleum **AND/OR** sustained subsurface petroleum contamination is detected (e.g. sustained vapor or groundwater plumes) **AND/OR** NAPL has been visually observed (e.g. accumulating in a well or excavation). In general, if NAPL was released at a site ("site" in this document is a general term), it is likely present as residual, mobile, and/or migrating NAPL.

2) There are two general stages in the development of the NAPL body after a release: i) the initial or expansion stage, which is generally relatively short in duration after the release has stopped, when the NAPL is actively migrating under a sufficient NAPL gradient; and ii) a stable stage, which is much longer in duration, when migration is minimal to nonexistent after the hydraulic forces driving lateral NAPL migration have declined relative to counteractive mechanisms (e.g. entry pressures, decreasing gradient, etc.) (MPCA, 2010).

3) The NAPL body may act as a long-term origin of chemicals of concern (COC) for the aqueous (dissolved) and vapor phases, referred to as compositional plumes. The NAPL body generally contains much more COC mass than is present in the dissolved and vapor phase, and contains a finite mass of COC. The dissolution or volatilization of the COC from the NAPL body into other phases is the primary mechanism by which most NAPL bodies create unacceptable risks over time. Dissolution, volatilization, and biodegradation, collectively known as natural source zone depletion (NSZD), of COCs from the NAPL body will also deplete the finite over time. The NAPL body may also occasionally release secondary contaminants under certain conditions (e.g. methane), which may result in unacceptable risks.

### 3.0 NAPL CHARACTERIZATION

The NAPL body and any associated compositional plumes (e.g. soil gas, groundwater) will need to be adequately delineated so that migration can be detected to determine plume stability and all risks, both saturational and compositional conditions can be evaluated (ASTM, 2007, Section 3; ITRC, 2009a, Section 3; ITRC, 2009b, Sections 3 and 4). The composition of the NAPL will need to be determined so appropriate investigative techniques, analytical methods, and risk assessments can be implemented (ASTM 2007, Section 6). NAPL characterization can be accomplished either by conventional means or more modern approaches. Conventional means of investigation include drilling accompanied by soil and groundwater sampling; a contemporary approach may include an ultraviolet optical screening tool/laser-induced fluorescence (LIF).

The risk assessment at a site generally requires conventional investigative means to compare concentrations of COCs to risk-based screening levels, and/or generic criteria. Other conventional means of characterization such as analysis of soil for total petroleum hydrocarbons (TPH), gasoline range organics (GRO), diesel range organics (DRO), and/or oil range organics (ORO), can be useful because they allow estimation of the degree of NAPL saturation at a specific, three-dimensional location. Refer to Table 1 below for GRO and DRO concentrations that may be used for screening purposes with soil samples or as a line of evidence. Screening concentrations have not been developed for ORO; however, site specific screening values can be developed using the individual soil and NAPL properties and possibly other lines of evidence. GRO and DRO concentrations greater than those in Table 1 are not automatic indicators of the presence of NAPL or the presence of an unacceptable risk. Additional lines of evidence may be used to determine the presence or absence and/or potential risks posed by the NAPL. These additional lines of evidence can be collected in conjunction with or in lieu of the TPH sampling. There is no prescriptive approach to site characterization because each site and release is unique. Previous site information, geologic and hydraulic information, and release information should guide the characterization phase.

**Table 1 – GRO and DRO Screening Levels**

| Material Released / NAPL | Use / Screening Purpose                               | GRO Concentration (mg/kg) | DRO Concentration (mg/kg) |
|--------------------------|-------------------------------------------------------|---------------------------|---------------------------|
| Gasoline                 | NAPL not present                                      | ≤ 250                     | N/A                       |
| Gasoline                 | Soil Volatilization to Indoor Air Criteria Applicable | ≤ 350                     | N/A                       |
| Gasoline                 | <0.5% Saturation for Direct Contact                   | ≤ 900                     | N/A                       |
| Diesel                   | NAPL not present                                      | N/A                       | ≤ 20                      |
| Diesel                   | Soil Volatilization to Indoor Air Criteria Applicable | N/A                       | ≤ 500                     |
| Diesel                   | <0.5% Saturation for Direct Contact                   | N/A                       | ≤ 1,050                   |

Regardless of the characterization methods used at a particular site, once characterization is complete, it should be evident where the NAPL is located (including below the water table) and its state (residual, mobile, and/or migrating). The presence or absence of NAPL is best determined by multiple lines of evidence. However, one line of evidence is not necessarily superior to another. The weight given to a particular line of evidence would be based on the type of NAPL released and the unique site conditions. Upon completion of the investigation, the location, nature, and extent of the compositional plumes would be well understood.

#### 4.0 NAPL CONCEPTUAL SITE MODEL

It is imperative in risk-based decision making that an adequate CSM is developed and utilized. The *ASTM Standard Guide for Development of Conceptual Site Models and Remediation Strategies for Light Non-aqueous Phase Liquids Released to the Subsurface* (ASTM 2531) was created to guide the development of a CSM for NAPL. As outlined in ASTM 2531, the CSM is developed using site data for the purpose of assessing risks at a site. Some examples of items to include in a CSM are depth to groundwater, location of the NAPL body, locations of any and all receptors, dissolved phase (groundwater) plume location, and vapor plume locations. For a detailed outline, list of elements commonly incorporated in a CSM, and discussion of the CSM development, refer to ASTM E2531-06 (Sections 6 and 7). The CSM is a dynamic document. As additional data is collected, the data is evaluated in the context of the CSM and appropriate modifications are made to the CSM as needed (ASTM, 2007, Sections 3.1.19.1 and 4.1). The CSM for each release and each site will be unique. The CSM could be developed using existing site data, or it may require new data collection to adequately characterize and understand the risks posed by the release. The land use and the potential risks posed by a site will determine the precision and amount of data necessary to complete the CSM. The CSM, at a minimum, can be made up of **tables** summarizing soil and groundwater contamination and groundwater elevations; **text** describing and summarizing the data and data collection; **boring logs** with lithology, field screening information (e.g. photoionization detector), and any relevant field observations; **hydrographs** showing the NAPL thickness in wells vs. corrected groundwater elevations (if mobile NAPL is observed at a site) and dissolved phase concentrations vs. groundwater elevations; **plan view maps** showing the NAPL body, contaminant distribution, groundwater elevation,



current/future buildings, property boundaries, and other potential receptors; and **cross-sectional maps** showing the NAPL body, groundwater elevations, lithology, contaminant distribution, and potential receptors. The CSM is also useful for identifying any data gaps and evaluating the potential effect they may have on site decision making.

The development and submission of a site-specific CSM improves the understanding of site conditions, potential receptors, and risks and serves as an excellent tool for communicating this information to all parties and stakeholders involved in site decisions. Graphical representations of the CSM are a very efficient way to depict the site and any associated risks. The use of three-dimensional data visualization software (e.g. fence diagrams) and/or volume/mass calculators (e.g. API's LNAPL Distribution and Recovery Model) may also be useful tools for the CSM.

## 5.0 NAPL RISK ASSESSMENT

Once the site is adequately characterized and a site-specific CSM is developed, the important steps of identifying and evaluating the saturational (e.g. presence of migrating NAPL) and compositional risks (e.g. soil gas or groundwater contaminant plumes) follows. This step is useful for identifying any unacceptable risks that would require some type of recovery, remediation, mitigation, exposure control, and/or other means necessary to abate risk(s).

Generic risk-based screening levels (RBSLs) and cleanup criteria have been developed to evaluate potential compositional risks for individual hazardous associated with various exposure pathways. Development of the generic RBSLs and cleanup criteria are based on assumptions regarding exposures, soil and site conditions, and the environmental fate-and-transport of contaminants. Generally, these assumptions do not account for the presence of NAPL in the soils at a site. However, the RBSLs and cleanup criteria may be used to assess risks at sites with NAPL present, but with certain pathways (direct contact and soil volatilization to indoor air) appropriate lines of evidence are necessary to determine applicability.

For exposure pathways that evaluate risk associated with the volatilization of hazardous substances from soil, the absence of NAPL was assumed in the calculations of the RBSLs and cleanup criteria. However, soil analytical data can be compared to the soil volatilization to indoor air inhalation criteria (SVIIC) if either NAPL is not present at that three dimensional location or there is a relatively minor amount of NAPL in the soil so that it can be assumed that aerobic degradation of the petroleum vapors in the soil can occur. Generic SVIIC RBSLs or cleanup criteria may be appropriate for use when GRO concentrations are less than 350 mg/kg for a gasoline release and when DRO concentrations are less than 500 mg/kg for a diesel release and mobile NAPL is not present at that location.

If the concentrations are less than SVIIC and they are applicable (consistent with all assumptions used to calculate the RBSLs or criteria), then no further investigative actions are needed even if residual NAPL is known to exist in the area proximal to the location of evaluation. If mobile NAPL is known to exist in the area proximal to the location of evaluation, then a site-specific risk evaluation would be necessary to evaluate the risk. For a risk assessment of indoor air when NAPL is known to exist, the use of direct measurements (e.g. soil gas) is better and more reliable to assure the protection of public health, especially when the generic assumptions used to calculate criteria are not representative of the site conditions. For the ambient air pathway, if the soil concentrations are lower than the criteria, the assessment is complete. The CSM can be utilized to evaluate the pathways, determine where generic criteria are applicable, and/or determine the need for additional data collection. Additional information regarding vapor intrusion assessment at NAPL sites is provided in Appendix E.



Soil direct contact RBSLs and cleanup criteria may not be appropriate for risk evaluation when mobile NAPL is present and when greater than 0.5% of the soil pore space contains residual NAPL (a degree of saturation that at or below can be reliably assumed to always be residual). Also, at or below this degree of NAPL saturation, this amount of NAPL in the soil is not expected to be significant enough to physically change the soil properties assumed in the direct contact algorithm (e.g. adhesion to skin and intestinal absorption). If the saturation of NAPL in the soil exceeds 0.5% in the pore space or mobile NAPL is present, then the assumption is that a direct contact risk is present at that location unless a site-specific evaluation demonstrates otherwise. The CSM can be utilized to evaluate the pathway, determine the need for additional data collection, and/or conduct a site-specific risk evaluation. Additional information regarding direct contact pathway evaluation at NAPL sites is provided in Appendix F.

## 6.0 NAPL RECOVERY AND RECOVERABILITY

The most cost-effective and efficient way to address new releases is to immediately recover as much NAPL as technically feasible when it is discovered. Generally, practical experience has demonstrated that this will provide the greatest amount of recovery, reduce risk, and save time and money for all parties involved. Once recovery of NAPL associated with a new release is complete, processes outlined in this document may be used to evaluate whether additional recovery is needed, what the threshold for recoverability may be for that release, and aid in the determination of the management practices for the remaining NAPL.

At sites where NAPL is present (which is the majority of sites where NAPL was released), conducting a recoverability analysis allows for better site decisions to be made. A recoverability analysis, which can be conducted for all NAPL, including residual, is a useful tool for determining the quantity of NAPL that may be recovered (hydraulic, excavation, etc.) as well as reviewing recoverability as a part of the overall site and risk assessment. For the recoverability analysis to be the most useful, it should take into account the feasibility of NAPL recovery, current and potential future risks posed by the NAPL, current and future land uses, and other pertinent site factors. Environmental factors, such as the potential seasonal changes in recoverability may make data from multiple events or during different seasons necessary to identify any seasonal affects and complete the analysis (e.g. NAPL could be recoverable during periods of low groundwater elevation and not recoverable during wet seasons with high groundwater elevations). Scientific studies, experience, and risk assessment have shown that in many cases all NAPL cannot be recovered and, in some instances, no recovery is necessary. Consistent with all risk-based corrective actions, if the NAPL (any states) and/or associated COC pose an unacceptable risk (e.g. expanding soil gas and groundwater plumes, threatened receptors, etc.), then the portion of the NAPL body or COCs creating the risk will have to be addressed via removal, destruction, toxicity reduction, and/or exposure elimination (e.g. institutional controls). For exposure elimination to be a feasible option, the NAPL body and all compositional plumes should be stable.

If mobile NAPL is present at a thickness greater than 0.2 feet in monitoring wells, transmissivity testing is a suitable tool to help determine recoverability. NAPL transmissivity is an indicator of the ability of the NAPL to flow in the subsurface and is a function of both the media and the NAPL properties. For more information on NAPL transmissivity, see ASTM E2856-11, *Standard Guide for Estimation of LNAPL Transmissivity*. In general, if the transmissivity of the NAPL is greater than 0.5 ft<sup>2</sup>/day, recovery is beneficial to reduce the saturation and the ability of the NAPL to flow and the NAPL can be recovered



in a cost effective and efficient manner. However, a demonstration may be made to show that recovery may not be necessary if the NAPL and risks can be appropriately managed.

Factors that comprise a recovery demonstration may include, but would not be limited to, composition of the NAPL, net benefit of NAPL recovery (e.g. environmental and/or societal), costs, distance to property boundaries, distance to nearest receptors, plume stability, and uncertainties. See ASTM 2531-06 Section 7.12 and ITRC 2009b Section 4 for descriptions of NAPL recovery metrics. The metric of transmissivity for NAPL recovery is a secondary metric and would be utilized after the risks are adequately abated, removed, and/or managed since the primary metric for remediation, exposure elimination, and recovery will be determined by the risks at a site. In some cases, the recovery of NAPL that results in transmissivity below  $0.5 \text{ ft}^2/\text{day}$  may not reduce the risks at a site; however, this will likely reduce the length of time it takes for a site to attenuate (reduce the legacy of the site). Both ASTM and ITRC guidance advocate for setting sound NAPL remedial objectives consistent with a CSM, using a systematic, science-based approach to select the most suitable NAPL remediation technology(ies), and implementing the technology(ies) to the fullest benefit (ASTM, 2007, Section 7.5; ITRC, 2009b, Section 1.5).

Federal law, 40 CFR 280.64, requires NAPL recovery to the “maximum extent practicable” (determined by the implementing agency) with a minimum standard of minimizing migration. The MDEQ interprets “maximum extent practicable” to mean the recovery of all NAPL that can be recovered in a cost-effective and efficient manner. Again, if the NAPL has a transmissivity greater than  $0.5 \text{ ft}^2/\text{day}$ , it is likely that the NAPL can be recovered in a cost-effective and efficient manner unless a demonstration is made to show otherwise. If migrating NAPL is present at a site, recovery and/or containment are necessary to stop or prevent migration.

## **7.0 NAPL AND NO FURTHER ACTION OR CLOSURE**

No further action or closure is achievable at sites where residual and/or mobile NAPL are present and risks are abated or managed. Demonstration that risks are appropriately abated or managed include the following: 1) recoverable NAPL has been recovered to the “maximum extent practicable;” 2) all unacceptable risks (e.g. expanding plumes, exposed or threatened receptors) have been abated; and 3) proper institutional controls are recorded on the deed, if necessary, to notify current and future property owners of the presence of NAPL and to ensure that land use changes do not alter site conditions without proper evaluation. Providing data for these demonstrations that clearly indicate all plumes and the NAPL body are stable or decreasing in size and mass will generally allow for a more efficient and expedited review of the documentation. The amount and timing of the data, as well as the length of time required for monitoring, is dependent upon the risks, the proximity to potential receptors, and the proximity to property boundaries.

Since the environment is dynamic, there may be some expected transient or seasonal expansions and contractions in plume sizes. Any transient expansions should be insignificant when compared to the distance to receptors and property boundaries. Risk-based assessments for sites with mobile NAPL may be more complex with additional data collected that is necessary to support the conclusions, account for potential uncertainties, and assure that the risks are properly managed. However, the data necessary to support risk abatement and management are based on site-specific conditions and are most effectively communicated in a clear, concise CSM.



## Appendix A.

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## Appendix B.

### Definitions/Terminology

The following terms are defined and if used for assessment, correspondence, and documentation of petroleum release sites regulated under NREPA will aid in clearer communications. When appropriate, a brief discussion of how these terms relate to light NAPL (LNAPL) or petroleum NAPL follows the definition (Note – The Part 213 statutory definitions are in all **CAPS** and **BOLD** text).

- **NAPL -- MEANS A NONAQUEOUS-PHASE LIQUID OR A NONAQUEOUS-PHASE LIQUID SOLUTION COMPOSED OF 1 OR MORE ORGANIC COMPOUNDS THAT ARE IMMISCIBLE OR SPARINGLY SOLUBLE IN WATER. NAPL INCLUDES BOTH DNAPL AND LNAPL.**
- **LNAPL -- MEANS A LIGHT NONAQUEOUS-PHASE LIQUID HAVING A SPECIFIC GRAVITY LESS THAN 1 AND COMPOSED OF 1 OR MORE ORGANIC COMPOUNDS THAT ARE IMMISCIBLE OR SPARINGLY SOLUBLE IN WATER, AND THE TERM ENCOMPASSES ALL POTENTIAL OCCURRENCES OF LNAPL.**
  - o This term addresses all states of LNAPL. It should only be used conceptually and generically in regards to LNAPL issues. Use of this term in lieu of the term free product should be avoided and instead the more descriptive terms residual LNAPL, mobile LNAPL, and migrating LNAPL should be applied.
- **'MIGRATING NAPL' – MEANS NAPL THAT IS OBSERVED TO SPREAD OR EXPAND Laterally or vertically or otherwise result in an increased volume of the NAPL extent, usually indicated by time-series data or observation. Migrating NAPL does not include NAPL that appears in a well within the historical extent of the NAPL due to a fluctuating water table.**
  - o Migrating petroleum NAPL occurs when the vertical and/or horizontal extent of this NAPL is expanding. It is only likely to be present shortly after a release occurs or if the release is ongoing. However, site-specific conditions or changes in site conditions may allow petroleum NAPL to migrate for extended periods of time. All migrating petroleum NAPL is also mobile NAPL.
- **MOBILE NAPL -- MEANS NAPL THAT EXCEEDS RESIDUAL SATURATION, AND INCLUDES MIGRATING NAPL, BUT NOT ALL MOBILE NAPL IS MIGRATING NAPL.**
  - o The term mobile NAPL can be used when petroleum NAPL is present and is at a high enough saturation to be hydraulically connected in the pore spaces so that it can flow. If a well is placed in a location with mobile petroleum NAPL present, this NAPL will accumulate in the well. Mobile petroleum NAPL has the potential to move or expand its footprint, but it is not spreading vertically or laterally. Mobile petroleum NAPL is potentially hydraulically recoverable, but recovery depends on several factors. Examples of mobile petroleum NAPL include: NAPL first observed to accumulate in a well or boring at a site prior to completion of a conceptual site model (CSM), or petroleum NAPL observed in a well due to a change of water levels.

- **RESIDUAL NAPL SATURATION -- MEANS THE RANGE OF NAPL SATURATIONS GREATER THAN ZERO NAPL SATURATION UP TO THE NAPL SATURATION AT WHICH NAPL CAPILLARY PRESSURE EQUALS PORE ENTRY PRESSURE AND INCLUDES THE MAXIMUM NAPL SATURATION, BELOW WHICH NAPL IS DISCONTINUOUS AND IMMOBILE UNDER THE APPLIED GRADIENT.**
  - o This defines the saturation below which petroleum NAPL become discontinuous and no longer has the ability to flow (residual NAPL). The petroleum NAPL is essentially trapped in the pores and under normal conditions and gradients, the NAPL will not move. The term residual NAPL is used to describe the state of NAPL below this saturation. This petroleum NAPL cannot be recovered by hydraulic means (e.g. pumping); however, with the use of technologies such as excavation, dual-phase extraction, or air sparge/soil vapor extraction, some fraction of the residual NAPL can be remediated or recovered.
  - o This term is used when petroleum NAPL has been released at a site, but other lines of evidence suggest mobile or migrating petroleum NAPL is not present. For example, if a boring log or other evidence (e.g. petroleum staining, high photoionization detector (PID) concentrations, laser-induced fluorescence (LIF), dye tests, etc.) indicates the presence of petroleum NAPL in the soil and/or aquifer material, but a properly developed well installed in the same location does not contain mobile NAPL, the NAPL is residual. If there is a sustained groundwater plume or vapor plume present at a site, but no observed mobile or migrating petroleum NAPL, residual NAPL is present. Residual petroleum NAPL could lead to the appearance of mobile NAPL with changes in site conditions, such as a drop in groundwater elevation.
  - o Residual petroleum NAPL can exist above and beneath the water table, and will have to be assessed in both the vadose zone and aquifer for the delineation of the petroleum NAPL body, mass calculations, and the development of the CSM. Residual petroleum NAPL can also be the source of compositional plumes (dissolved phase and/or vapor phase) from the NAPL body.

**NOTE:** Although ASTM 2531-06 has been incorporated by reference into the amended Part 213, some terms defined within the ASTM standard differ from the terms defined within the amended Part 213 (e.g. mobile NAPL has different meanings in each document – in Part 213 mobile NAPL has the ability to move but in ASTM 2531-06 mobile NAPL is moving). ASTM terms to become familiar with include:

- Free LNAPL – LNAPL that is hydraulically connected in the pore space and has the potential to be mobile in the environment. This is the same as mobile LNAPL as defined in amended Part 213.
- Residual LNAPL – LNAPL that is hydraulically discontinuous and immobile under prevailing conditions. Residual LNAPL cannot move through hydraulic mechanisms (unless prevailing conditions change), but can be a source for chemicals of concern (COC) dissolved in groundwater or in the vapor phase in soil gas.

**Appendix C.****Stakeholder List**

Below is the list of individuals outside of the Michigan Department of Environmental Quality (MDEQ) who received the Petroleum Non-Aqueous Phase Liquids (NAPL) Management Policy and Procedure. The list also shows external affiliations and if comments were provided.

| <b>Stakeholder Name</b>      | <b>Affiliation</b>                 | <b>Provided Comments (Yes/No)</b> |
|------------------------------|------------------------------------|-----------------------------------|
| Grant Trigger                | Racer Trust                        | No                                |
| Mark Adamski                 | BP America                         | Yes                               |
| Pete Bosanic / Stephen Zayko | PM Environmental                   | Yes                               |
| Abed Houssari                | DTE Energy                         | No                                |
| Cheryl Kehres-Dietrich       | Soil and Materials Engineers, Inc. | Yes                               |
| John Robbins                 | Shell Oil                          | Yes                               |
| Sanjay Garg                  | Shell Global Solutions             | Yes                               |
| Robert Steede                | Enbridge Energy                    | No                                |
| Keith Aragona                | Haley Aldrich                      | No                                |
| Curt Roebuck                 | DLZ Michigan                       | Yes                               |
| Steve Crider                 | NTH Consultants                    | No                                |
| Brad Koons                   | ARCADIS                            | Yes                               |
| John Rabideau                | AMEC E&I, Inc.                     | Yes                               |
| Erik Johnson                 | Blarney Castle Oil                 | No                                |
| Mike Wolfe                   | AECOM Environment                  | Yes                               |
| Joe Berlin                   | BLDI Inc.                          | No                                |
| Dana Bradt                   | ATC Associates                     | Yes                               |
| Greg Kernosek                | Envirosolutions, Inc.              | Yes                               |
| Tiffany Yusko-Kotimko        | Barr Engineering                   | Yes                               |
| Gary Dyke                    | CH2MHill                           | No                                |
| Donal Brady                  | Inland Seas Engineering            | Yes                               |
| Andrew Kirkman               | BP America                         | Yes                               |

## Appendix D.

### Basic Petroleum Non-Aqueous Phase Liquids Concepts

The migration of petroleum non-aqueous phase liquids (NAPL) requires that the NAPL displace air and water from the soil pores. It takes less force for NAPL to displace air than water; therefore, NAPL preferentially enters air-filled pores. It takes less pressure for NAPL to enter a larger pore; however, in an air-NAPL system (no water), the NAPL will also be in smaller pore spaces because it is the wetting fluid in that system. Geologic heterogeneity, pore geometry, and the presence and amount of water in the pores all strongly affect NAPL migration. NAPL can migrate below the surface of the groundwater; the depth of submerged NAPL will be determined by the degree of heterogeneity and the NAPL head. NAPL can also be present in perched and hydraulically-confined stratigraphic units in the presence of soil/lithology heterogeneity.

After a release, NAPL infiltrates into the pores and is driven downward by gravitational forces through the unsaturated (vadose) zone. As NAPL migrates through the vadose zone, some will remain immobile and trapped in the pores. This residual NAPL in the vadose zone is part of the NAPL body and can act as a source for compositional plumes. If a sufficient volume of NAPL is released to overcome the holding capacity of the vadose zone, the NAPL will reach the water table and, despite it generally having a lower density than water, can be driven into the saturated zone by the vertical NAPL head. For the NAPL to migrate in the saturated zone, it must first displace the water from the pore spaces. NAPL will continue to migrate downward into pores below the water table until vertical equilibrium is reached; this occurs when the NAPL head (downward force) is less than or equal to the sum of the buoyancy force (with LNAPL only) and the entry pressure of the aquifer pores (upward forces). Vertical equilibrium usually occurs before horizontal equilibrium, and the NAPL will continue to spread laterally until horizontal equilibrium is reached. The vertical and horizontal spread of NAPL is limited by buoyancy, capillary forces, NAPL conductivity, and the declining hydraulic force of the NAPL gradient. The NAPL will persist as a separate phase in the pores within both the vadose zone and saturated zone after the NAPL body is spatially stable. All of the NAPL in all of the states (residual, mobile, and migrating) within the saturated zone and the vadose zone make up the entire NAPL body.

NAPL body behavior can be characterized partly by the NAPL saturation, which is the percentage of total pore volume occupied by the NAPL. The remaining pore volume is occupied by air and water (soil moisture) in the vadose zone, and by water in the saturated zone. At vertical equilibrium in the saturated zone, the relative amount of NAPL in the pores varies with depth, and higher NAPL saturations are usually observed near the top of the saturated zone. Over time and as the groundwater elevation fluctuates, some of the NAPL may be vertically and locally redistributed. Some of the NAPL will eventually become hydraulically disconnected, leaving independent globules of NAPL in some pores. As the NAPL migrates and the degree of saturation of NAPL decreases, the NAPL will approach residual saturation. NAPL saturation at or below residual saturation is neither mobile nor hydraulically recoverable. NAPL saturation above residual saturation is mobile, potentially migrating, and potentially hydraulically recoverable. Even though residual NAPL is not mobile, it can still act as a significant source of contaminant mass for vapor and groundwater plumes. Conversely, in some instances, it is possible that the residual NAPL may not be in contact with groundwater, may not be leaching to groundwater, and may not be a vapor risk and can be left in place using institutional controls, if necessary.

The presence of mobile NAPL in a given well does not necessarily mean that the NAPL body is migrating; the NAPL just has the potential to migrate. In order for migration to occur at the edges of the

NAPL body (expansion), the NAPL head (e.g. potential energy or gradient) must be high enough to overcome the entry pressure of adjacent soil pores. As the NAPL body spreads, the degree of NAPL saturation decreases, which reduces the NAPL conductivity. Once the counteracting mechanisms (decreasing conductivity, decreasing gradient, and entry pressure combined with loss mechanisms of biodegradation, dissolution, and volatilization) are greater than the NAPL head, the NAPL body will eventually become spatially stable under prevailing conditions, even though mobile NAPL may remain in the core of the NAPL body.

The detection of visible or measurable NAPL in a well (analogous to a large soil pore) indicates that some of the NAPL in the immediate vicinity of the well exceeds residual saturation and is mobile. The lack of visible or measurable NAPL in a well does not necessarily mean that there is no NAPL in the vicinity of the well; there may be residual NAPL. Moreover, mobile NAPL may be trapped within the saturated zone due to the stronger force needed to displace water from the pores. That is why NAPL may appear or accumulate in greater volumes in a well after the elevation of the groundwater decreases. Thus, water table fluctuations must be accounted for when evaluating saturations, recovery, and the potential for migration of NAPL. Water table fluctuations also affect NAPL recharge rates and recovery trends.

NAPL will generally contain more mass of the constituents of concern (COC) than what is dissolved in groundwater, volatilized to soil gas, and adsorbed to soil particles; however, the mass contained in the NAPL is finite. Over time, as compounds dissolve, volatilize, biodegrade, and/or adsorb to soil, depletion of COC in the NAPL occurs, which is referred to as natural source zone depletion (NSZD). Determining the rate of NSZD may be useful in making risk-based, recovery, and remedial decisions.

The transmissivity of the NAPL, defined as the volume of NAPL traveling through a unit width of aquifer per time per unit drawdown, can be utilized as a metric for recoverability and aid in remedial decisions. Transmissivity can also be used as part of the conceptual site model (CSM) for delineating and depicting recovery trends; however, transmissivity does not necessarily provide information regarding the risk posed by the NAPL. The NAPL transmissivity is a function of both fluid (e.g. density, viscosity) and media (e.g. permeability, pore saturation) properties. Currently, the collection, assessment, and evaluation of NAPL transmissivity data is relatively new and may be subject to change as more data are collected. There are generally four means of data collection and analysis of NAPL transmissivity: 1) baildown/slug testing; 2) manual skimming; 3) recovery system data; and 4) tracer testing. For a more detailed discussion of the methods and analyses, see ASTM E2856 – 11, *Standard Guide for the Estimation of LNAPL Transmissivity*.



## Appendix E.

### Assessing Vapor Intrusion Risk at Sites with Petroleum Non-Aqueous Phase Liquids

The presence of petroleum non-aqueous phase liquids (NAPL) in soils can lead to difficulties evaluating the risk associated with the soil volatilization to indoor air pathway, commonly known as vapor intrusion (VI). This is partly attributed to the Michigan Department of Environmental Quality's (MDEQ) use of the Johnson and Ettinger VI model (J&E model) for assessing the risk of this exposure pathway, as well as the evaluation of individual contaminants rather than the multiple contaminants that can occur in NAPL. The United States Environmental Protection Agency (EPA) has identified a number of conditions under which the J&E model may not accurately predict VI risk, which includes the presence of NAPL. There are alternate versions of the J&E model as well as other models, such as the American Petroleum Institute's (API) BioVapor, that have been developed to help assess VI risk associated with NAPL. These alternate models can be utilized with multiple contaminants and also assume some biodegradation of petroleum vapors in the vadose zone; however, the source inputs for the models are groundwater or soil gas contaminant concentrations. As stated in the BioVapor model literature, with residual NAPL in the soil, the model(s) should not be used as a primary line of evidence for risk assessment and may require collection of soil gas data.

The MDEQ developed soil volatilization to indoor air inhalation criteria (SVIIC), assumed to be protective of indoor air. The SVIIC numbers will continue to be utilized to assess VI risk; however, with the inherent uncertainties with any model or calculation or soil gas data is a useful metric to make a direct assessment of the vapor risk. Absent soil gas data, soil analytical data can be compared to the SVIIC values for individual hazardous substances if the soil can be considered to contain a relatively minor amount of NAPL. The MDEQ will consider the SVIIC applicable if NAPL is not present or the concentration of TPH GRO is less than 350 mg/kg for gasoline or TPH DRO is less than 500 mg/kg for diesel. If the other assumptions in the algorithm are appropriate for the site, the soil contains no or relatively minor amount of NAPL and the soil analytical data is less than SVIIC, then no further risk assessment is required, even if residual NAPL is in the area proximal to the location of evaluation. If the soil concentrations exceed the SVIIC (when applicable), the soil is above 350 ppm GRO/500 ppm DRO, and/or mobile or migrating NAPL is present, then additional assessment (e.g. soil gas sampling) or presumptive remedies (e.g. soil vapor extraction or institutional controls) will need to be utilized to evaluate and/or address the pathway.

The collection of representative data is always the most appropriate way to evaluate sites. For various reasons, TPH may not always be collected. If soil TPH GRO data has not been collected, then it can be estimated using the soil benzene, toluene, ethylbenzene, and total xylene (BTEX) data. For a gasoline release, multiply the sum of the BTEX concentrations by 40 to estimate the GRO concentration. For a diesel release, estimating the DRO concentration is complex, and site-specific evaluations could be completed.

Soil TPH GRO estimate = Soil BTEX\*40

The following is intended to provide additional information and assistance on assessing VI risk and implementing corrective actions when addressing NAPL releases. One of the key assumptions is that the investigation results in an understanding of where the NAPL is located and where each state (residual, mobile, and migrating) of NAPL occurs. In addition, an adequate conceptual site model (CSM) will depict the location, nature, and extent of the NAPL body and compositional plumes in both plan and cross-sectional views, and properly identify potential receptors. The following options can be



utilized (alone or in combination) for evaluating and addressing the VI risk at NAPL sites using the CSM:

1. If the CSM demonstrates that there is no NAPL or only residual NAPL below the 350 ppm GRO or 500 ppm DRO, and the concentrations of the individual petroleum contaminants of concern (COC) in the soil are less than SVIIC then there will be no further risk assessment of the VI pathway required. Other assumptions in the SVIIC calculation will still need apply to the site. If GRO concentrations are unknown, the values can be estimated as outlined above. However, representative data provides the best information for assessing risks.
2. When NAPL is present, establish the chemical composition of the NAPL and utilize a scientifically defensible VI model that can estimate the rate of VI into buildings and identify the associated health risks. The model utilized will need to account for NAPL. Examples of appropriate NAPL models (in Excel<sup>®</sup> format), their assumptions and use restrictions, and their associated user's guides can be found at:

[http://www.epa.gov/oswer/riskassessment/airmodel/johnson\\_ettinger.htm](http://www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm)

OR

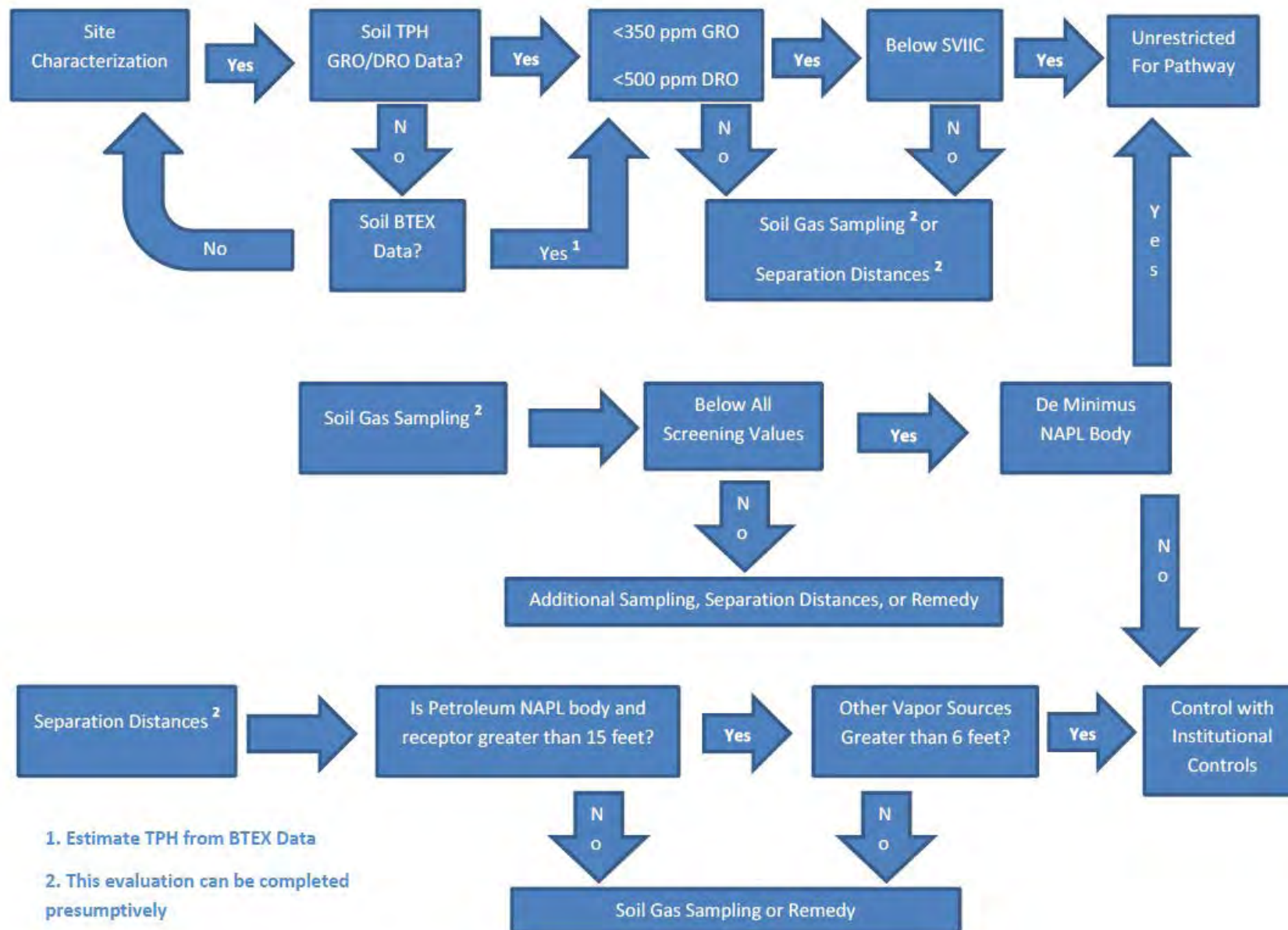
<http://www.api.org/environment-health-and-safety/clean-water/ground-water/vapor-intrusion/biovapor-form>

3. When mobile and/or migrating NAPL is present; **or** the SVIIC (when applicable) is exceeded; **or** the GRO/DRO (350/500 ppm) concentration exceeds the screening value; **or** a structure is less than five meters (15 feet) from a NAPL body (that exceeds screening values); **or** a structure is less than two meters (6 feet) from other vapor sources (that exceeds screening values), then soil gas or sub-slab samples may be collected and analyzed. The soil gas samples should be collected and analyzed in accordance with the sampling strategies identified in the MDEQ's *Guidance Document for the Vapor Intrusion Pathway* or in other scientifically defensible methods. Any detected values can be compared to the screening values published in that document to evaluate if the NAPL poses a risk.
4. If the CSM demonstrates that the NAPL body meets the separation distance of five meters (15 feet) and all other sources of vapor (e.g. impacted soil and dissolved groundwater) are at least two meters (6 feet) from any current, proposed, or planned structure, then the exposure risk is not present and no further risk assessment of the VI pathway is warranted.

NOTE: An institutional control would **NOT** be necessary if the evaluation was based on generic residential assumptions and comparison of soil analytical data to SVIIC (if applicable) or comparison of soil gas concentrations to screening levels to assess risk (if the soil gas samples were collected in or immediately adjacent to the NAPL body – “worst case”). Any time an evaluation other than one based on generic residential assumptions or “worst case” soil gas is implemented (e.g. dependence on separation distance), an institutional control or other remedial action will be necessary to prevent future exposures that could result from land use changes.

Further details on the investigation and risk assessment of soil vapors can be found in the MDEQ *Guidance Document for the Vapor Intrusion Pathway*.

### Evaluation of the Vapor Intrusion Pathway with Residual Petroleum NAPL





## Appendix F.

### Assessing Direct Contact Risk at Sites with Petroleum Non-Aqueous Phase Liquids

The presence of petroleum non-aqueous phase liquids (NAPL) complicates the evaluation of the soil direct contact (SDC) pathway. Soils containing NAPL can pose a direct contact risk to humans and risks to environmental receptors. The presence of petroleum-saturated soils was not accounted for in the development of the SDC risk-based screening levels (RBSLs)/cleanup criteria (CC) for individual hazardous substances, and may be inconsistent with the underlying assumptions of these criteria. Furthermore, while the Michigan Department of Environmental Quality (MDEQ) has established SDC RBSLs/CC for some of the individual hazardous substances that may be present in common petroleum mixtures, the variability of chemical compositions of petroleum mixtures and the site conditions under which they may exist prevents the development of generic petroleum-mixture RBSLs/CC for state-wide application. To minimize the uncertainties associated with applying the SDC RBSLs/CC when NAPL is present, the MDEQ considers the generic SDC RBSLs/CC appropriate for the evaluation of risk for the SDC exposure pathway when there is less than or equal to 0.5% of the pore space in the soil filled with residual NAPL and there is no evidence of mobile NAPL. At 0.5% saturation of NAPL, it can be reliably assumed that the NAPL is residual and there is not enough mass of NAPL in the soil to physically change the assumed soil properties in the algorithms.

If there is no evidence of mobile NAPL, initial comparisons of the soil concentrations may be made to the lower of the following: generic SDC RBSLs/CC or the individual single compound saturation limit ( $C_{sat}$  or soil in equilibrium with water at the solubility limit of an individual compound). When approximating the average compositions of petroleum, several of the individual  $C_{sat}$  concentrations may represent approximately 0.5% petroleum saturation in the soil pore space. If the lower of the generic SDC RBSLs/CC or  $C_{sat}$  is not exceeded, the MDEQ assumes that less than or equal to 0.5% of the pore spaces in the soil is filled with residual NAPL and no further activities would be required for this pathway.

If the lower of generic SDC RBSLs/CC or  $C_{sat}$  is exceeded, or there is evidence of mobile NAPL, a site-specific evaluation can be conducted to assess the SDC risk. The site-specific evaluation could include the determination of the degree of NAPL saturation and NAPL composition. The degree of NAPL saturation can be determined in the laboratory or estimated using total petroleum hydrocarbon (TPH) analysis and the following equation:

$$S_n = (\rho_b * TPH) / (\rho_n * n * 10^6)$$

Where:

$S_n$  – degree of saturation (unitless)

$\rho_b$  – dry bulk density of soil ( $\text{g}/\text{cm}^3$ ) – assumed to be 1.6

TPH – TPH analytical value ( $\text{mg}/\text{kg}$ )

$n$  – porosity – assumed to be 0.4 (unitless)

$\rho_n$  – NAPL density ( $\text{g}/\text{cm}^3$ ) – assumed to be 0.77 for gasoline and 0.85 for diesel fuel

Using the above assumptions, a TPH-gasoline range organics (GRO) concentration of 900  $\text{mg}/\text{kg}$  and a TPH-diesel range organics (DRO) concentration of 1,050  $\text{mg}/\text{kg}$  are approximately equal to 0.5% saturation of NAPL in the pore space of the soil. If the TPH concentration is less than or equal to these GRO and/or DRO concentrations or  $S_n$  is less than or equal to 0.5% NAPL saturation using site-



specific values, then the individual hazardous substance concentrations can be compared to the RBSLs/CC for the risk assessment of the SDC pathway.

If the NAPL saturation exceeds 0.5%, then it is assumed that there is a SDC risk associated with the soil, and corrective actions and/or exposure controls will be necessary. Site-specific risk evaluations may also be conducted to determine risks.

Example of an acceptable direct contact pathway risk evaluation:

1. The concentration of xylenes in a soil sample is 400,000 micrograms per kilogram ( $\mu\text{g/kg}$ ). Comparison to generic SDC RBSLs/CC indicates via footnote that it is necessary to determine if NAPL is present to use this value for comparison. The initial screening comparison then becomes comparison to  $C_{\text{sat}}$ .
2. This concentration exceeds the individual  $C_{\text{sat}}$  screening level of 150,000  $\mu\text{g/kg}$ . Further evaluation is required to determine if NAPL is present and if additional controls or protections from the NAPL are required.
3. The TPH-GRO concentration in this same soil sample is 750,000  $\mu\text{g/kg}$ . Using the above assumptions and saturation equation, the GRO value suggests that NAPL saturation is less than 0.5%. This implies that residual NAPL is present at a low enough saturation the SDC RBSL/CC for xylenes of 410,000,000  $\mu\text{g/kg}$  can be used for comparison.
4. Since the soil concentration of xylenes is less than the SDC RBSL/CC, there is no direct contact risk of total xylenes.

## **Appendix B**

### **RACER LNAPL Remedial/Management Decision-Making Process**

| LNAPL CONCEPTUAL SITE MODEL (LCSM) DEVELOPMENT – MENU OF OPTIONS |                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Potential Parameters/Considerations                              |                                                                                                                                                                                                                                                                                                                                                                                                                                         | Potential Evaluation Methods                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Discussion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| LNAPL Body Delineation/ Characterization                         | 1. LNAPL body geometry: horizontal/ vertical extents, position relative to water table<br>2. Relative intensity of impacts (hot spots)                                                                                                                                                                                                                                                                                                  | 1. Installation of wells/borings, laser-induced flourescence (LIF), resistivity<br>2. Soil sampling (TPH, LNAPL saturations), groundwater sampling, LIF, resistivity                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Geology/ Hydrogeology                                            | 1. General Stratigraphy<br>2. Impacted Soil Types<br>3. Hydraulic Gradients<br>4. LNAPL Gradient<br>5. Hydraulic Conductivity                                                                                                                                                                                                                                                                                                           | 1,2. Field screening of soil borings, laboratory grain size analysis<br>3,4. Well gauging<br>5. Slug tests, pumping tests, laboratory testing                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| LNAPL Physical/ Chemical Properties                              | 1. LNAPL viscosity<br>2. LNAPL specific gravity<br>3. LNAPL type/age<br>4. LNAPL chemical composition                                                                                                                                                                                                                                                                                                                                   | 1,2. Laboratory physical property testing<br>3. Laboratory forensic testing/fingerprinting<br>4. Laboratory chemical analytical testing                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Dissolved and Vapor Phase Impacts                                | 1. Groundwater concentrations of LNAPL constituents<br>2. Soil gas concentrations of LNAPL constituents<br>3. Soil gas explosivity                                                                                                                                                                                                                                                                                                      | 1. Groundwater sampling/laboratory testing<br>2. Soil gas sampling/laboratory testing<br>3. Field screening of well headspace and/or soil gas samples using handheld lower explosive limit (LEL) meter                                                                                                                                                                                                                                                                                                                                                                | 1. Focus on wells without LNAPL. The potential benefit of sampling groundwater under LNAPL should be weighed against the risk of obtaining LNAPL-contaminated samples (LNAPL presence may not be readily apparent in a groundwater sample).<br>2. The need for soil gas sampling and the potential parameter list can be screened based on the volatility of the LNAPL and/or specific constituents (e.g., test for constituents with Henry's law constant > 1e <sup>-5</sup> atm-m <sup>3</sup> /mol and vapor pressure > 0.05 Torr)                                                           |
| LNAPL Mobility                                                   | 1. Age of LNAPL body<br>2. Soil TPH concentrations<br>3. LNAPL saturations and residual saturations<br>4. LNAPL transmissivity<br>5. Recovery system performance<br>6. Dissolved phase trends<br><br>*Typically involves a weight of evidence approach where multiple lines of evidence are considered (due to the complexity of multi-phase flow in the subsurface and the technical limitations of the potential evaluation methods). | 2. Comparison against appropriate C <sub>res</sub> value or conversion of TPH concentrations to saturations and comparison to typical residual saturation values (see ASTM E2531-06)<br>3. Soil core sampling and laboratory petrophysical testing (e.g., pore fluid saturation testing, water drive testing)<br>4. Field LNAPL baildown testing, pumping tests, field dye tracer testing (see ASTM E2856-11)<br>5. LNAPL recovery system cumulative recovery/ recovery rate plots, decline curve analysis<br>6. Groundwater concentration trends of LNAPL parameters | 1. Older LNAPL is less likely to be mobile<br>2,3. LNAPL saturations exceeding residual levels provide a line of evidence of LNAPL mobility<br>4. LNAPL transmissivity > 0.8 ft <sup>2</sup> /day provides a line of evidence of LNAPL mobility (see ASTM E2856-11)<br>5. Poor recovery system performance may provide strong evidence that remaining LNAPL is at residual levels/immobile (if the system has been effectively implemented and operated)<br>6. Dissolved phase trends provide an indication of the state of the LNAPL body (e.g., stable dissolved phase trends = stable LNAPL) |
| LNAPL Migration                                                  | 1. LNAPL body expansion and migration<br><br>*LNAPL migration differs from the LNAPL mobility consideration above in that is only considers the potential for LNAPL mobility around the perimeter of an LNAPL body (i.e., its ability to migrate or expand into areas that are not already impacted).                                                                                                                                   | 1. One or more LNAPL mobility lines of evidence indicates potential mobility along LNAPL body perimeter<br>2. LNAPL observations in sentry wells installed in clean soil<br>3. Estimate critical LNAPL head (pore entry displacement pressure) at LNAPL periphery                                                                                                                                                                                                                                                                                                     | 3. Critical LNAPL head (pore entry displacement pressure) exceeded at LNAPL periphery represents a potential for LNAPL body expansion/ migration                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| LNAPL Recoverability                                             | 1. Potential LNAPL recovery rates<br>2. Fraction of LNAPL body that may be recoverable<br><br>*Most of the potential evaluation methods listed above for LNAPL mobility will also provide evidence relating to the potential recoverability of the LNAPL.                                                                                                                                                                               | 1. LNAPL recovery pilot results, LNAPL transmissivity estimation, full-scale LNAPL recovery system performance<br>2. Comparison of LNAPL saturations and residual saturations                                                                                                                                                                                                                                                                                                                                                                                         | 1. LNAPL recovery may be considered technically practicable where LNAPL recovery rates exceed a minimum level and/or where LNAPL transmissivity > 0.8 ft <sup>2</sup> /day<br>2. Regardless of the technical practicability of LNAPL recovery, any recovery activity will only have a significant effect on an LNAPL body where LNAPL saturations significantly exceed residual levels (i.e., significant recoverable fraction)                                                                                                                                                                 |
| Potential Remedial Drivers                                       | 1. Risk (compositional concerns)<br>2. LNAPL mobility/migration (saturation concerns)<br>3. Non-risk (non-technical) factors such as aesthetic (e.g., visual, olfactory), regulatory or other considerations (e.g., property transaction condition)                                                                                                                                                                                     | 1. Will vary from comparison of existing site data to generic criteria, to quantitative human health and ecological risk assessment (depending on complexity of site and magnitude of potential risks)<br>2. See LNAPL mobility and LNAPL migration lines of evidence and approaches above<br>3. Review applicable LNAPL regulations<br>3. Establish site goals                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

NOTES:

Draft document originally created for the RACER Trust through the collaborative efforts of RACER, Conestoga-Rovers & Associates, and Arcadis.

The “menu” provided above presents potential elements of an LCSM, potential evaluation methods and potential metrics (where applicable). The need to quantify specific items above should be based on a preliminary consideration of site-specific goals and site complexity. *It will not be necessary to quantify all items above at all sites.*

Table C-1 of ITRC’s Technical Regulatory Document entitled Evaluating LNAPL Remedial Technologies for Achieving Project Goals provides more detail on LCSM components and presents a three level tiered approach to LCSM development based on increasing levels of site complexity

Table X4.1 of ASTM Standard E2531-6 provides detailed information on LNAPL site data collection methods and their applicability

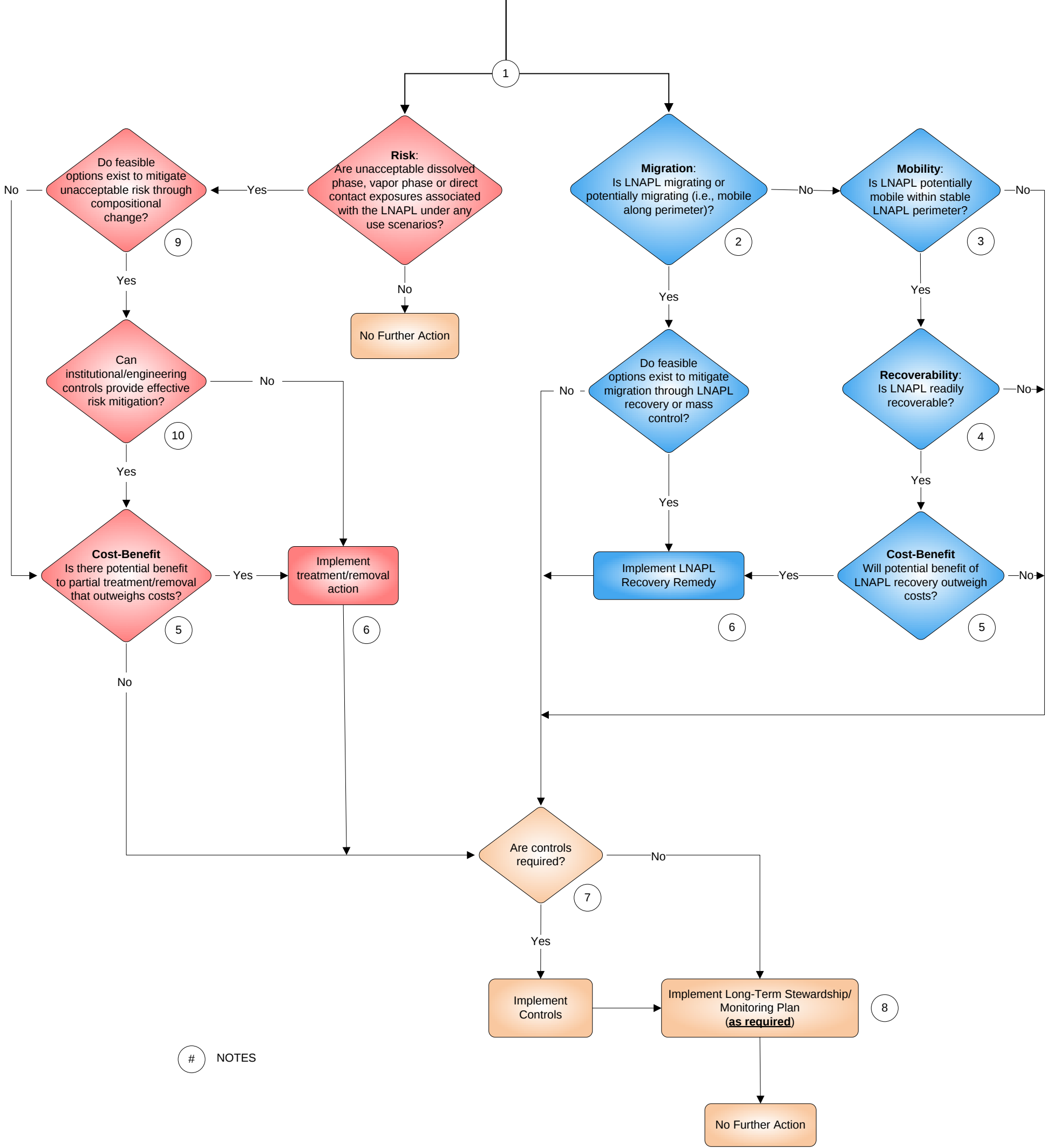
**LNAPL Compositional Concerns**  
**(potential exposure/risk issues):**

- Explosive hazards (vapor accumulation in confined spaces/ utilities, open excavations)
- Dissolved-phase concentrations (migration toward surface water bodies or groundwater supply wells)
- Vapor-phase concentrations (vapor intrusion/long-term exposure risk)
- Direct contact or ingestion

**EVALUATE LNAPL CONCERNS FROM LCSM**  
  
LNAPL Concerns = Remedial Drivers  
  
Compositional Concerns  
**Risk-based drivers such as unacceptable levels of dissolved or vapor-phase impacts**  
  
Saturation Concerns  
**Drivers relating to the mitigation of LNAPL migration and/or reduction of LNAPL mobility**

**LNAPL Saturation Concerns**  
**(mobility and migration issues)**

- Potential for LNAPL to spread and create new or increased risk (migration toward surface water, property boundary, underground utilities)
- Aesthetic/Nuisance issues



# NOTES

LNAPL Remedial Decision Tree  
WORKING DRAFT – 2/6/13

- 1 The LCSM may identify both risk and mobility/migration issues at a given site. Consequently, compositional change techniques (to mitigate risk) and saturation reduction techniques (to mitigate mobility/migration concerns) may represent concurrent considerations that may require independent remedies.
- 2 Migration is only likely to be occurring where releases are active or shortly after cessation where a LNAPL gradient/head is present. Due to the complexity of multi-phase flow in porous media and the limitations of available assessment methods, LNAPL migration potential should be evaluated using multiple lines of evidence (see LCSM Menu – Page 1)
- 3 LNAPL Mobility – Is LNAPL present at saturations exceeding residual values? Example lines of evidence listed in LCSM Menu – Page 1.
- 4 The presence of readily recoverable LNAPL as defined by transmissivity  $> 0.8 \text{ ft}^2/\text{day}$  does not necessarily indicate that a significant fraction of an LNAPL body would be beneficially affected through LNAPL recovery. An understanding of the fraction of the LNAPL body that may be recoverable is necessary in order to establish a realistic expectation of the actual benefit of any LNAPL recovery activity and a determination of whether the LNAPL body is “readily recoverable.”
- 5 The potential benefit of LNAPL remediation should be weighed against the potential costs in terms of the associated expenditure of financial and natural resources, the risks involved in implementation, and the contamination potentially resulting from the remedial action (i.e., sustainability considerations). For situations where LNAPL bodies are stable with no associated risk, the net environmental benefit of active engineered LNAPL remedial systems should be scrutinized. In these cases, it is highly unlikely that LNAPL recovery will effect enough of the LNAPL body to result in a significant level of risk reduction over natural source zone depletion (NSZD) alone.
- 6 Establish LNAPL recovery objectives and science-based achievable/measurable LNAPL recovery end-points prior to implementing LNAPL remediation (e.g., reduction of LNAPL transmissivity to less than  $0.8 \text{ ft}^2/\text{day}$  to meet a saturation objective).
- 7 Considering the significant technical limitations of LNAPL mass recovery or compositional change, engineering and/or institutional controls should be considered in conjunction with or in lieu of remedial action.
- 8 Perform any necessary monitoring to confirm LNAPL remedial goals are/were met.
- 9 LNAPL compositional change remediation is implemented to reduce the concentration or mole fraction of specific compounds in LNAPL that contribute to dissolved and or vapor phase concerns (i.e., air sparging and soil vapor extraction to reduce the mole fraction of benzene in LNAPL). Phase change technologies can be used to target immobile LNAPL, unlike conventional LNAPL mass recovery technologies such as LNAPL skimming. Examples of compositional change techniques may include air sparging, enhanced biodegradation, in situ thermal treatment, and in-situ chemical oxidation. Some phase change remedial technologies will accomplish both LNAPL mass recovery (saturation objective) and compositional change objectives simultaneously.
- 10 Examples of potentially effective removal actions include excavation with off-site disposal, excavation with ex-situ thermal treatment and in-situ thermal treatment (e.g., electrical resistance heating with high vacuum extraction).

## LNAPL Remedial Decision Tree Notes

WORKING DRAFT – 2/6/13

## **Appendix C**

### **Historical Well Gauging Data Plots**

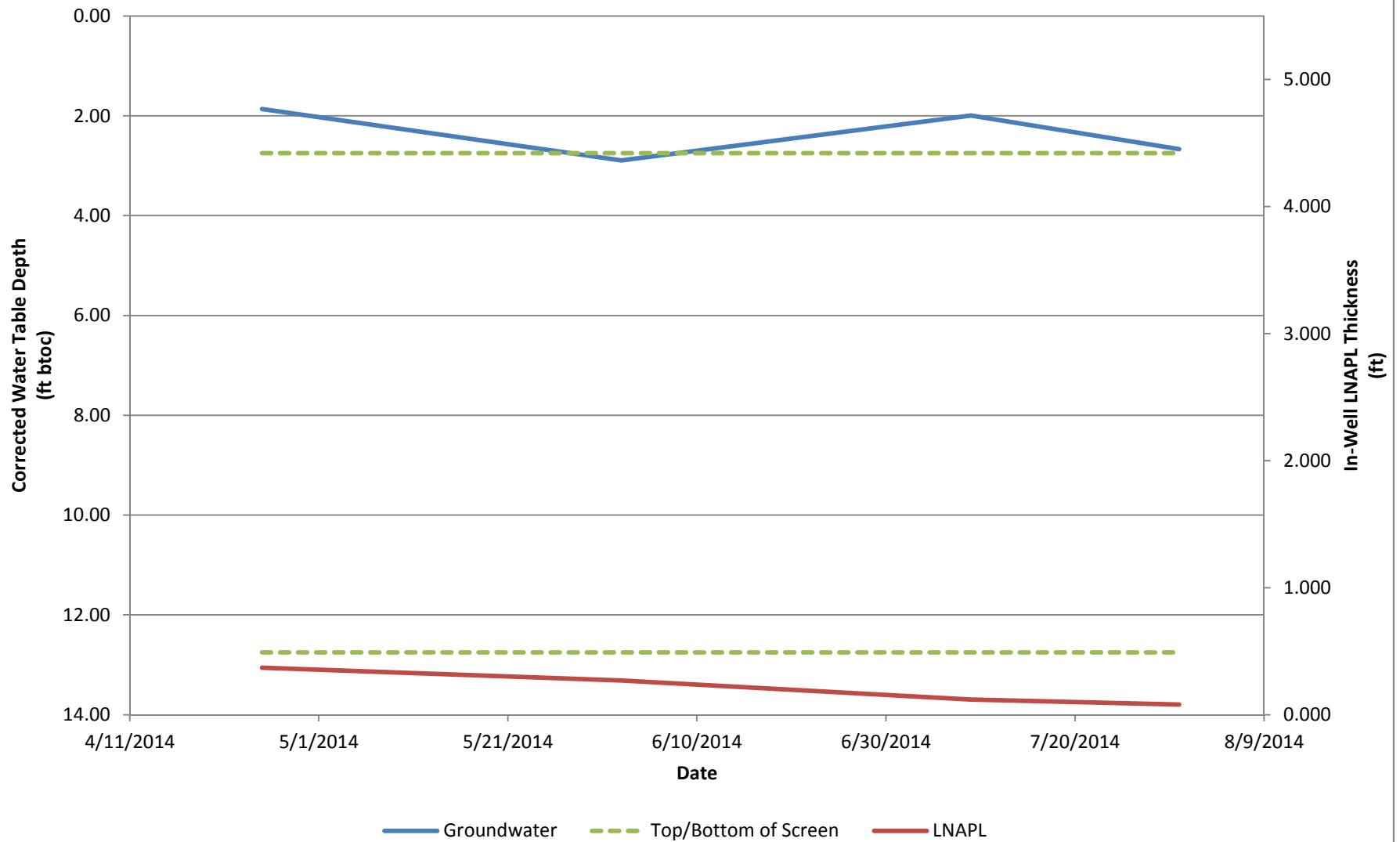
**Well Gauging Summary - QPTW-01**  
**Quench Pit LNAPL Area**  
**RACER Malleable Iron Industrial Land**  
**Saginaw, Michigan**



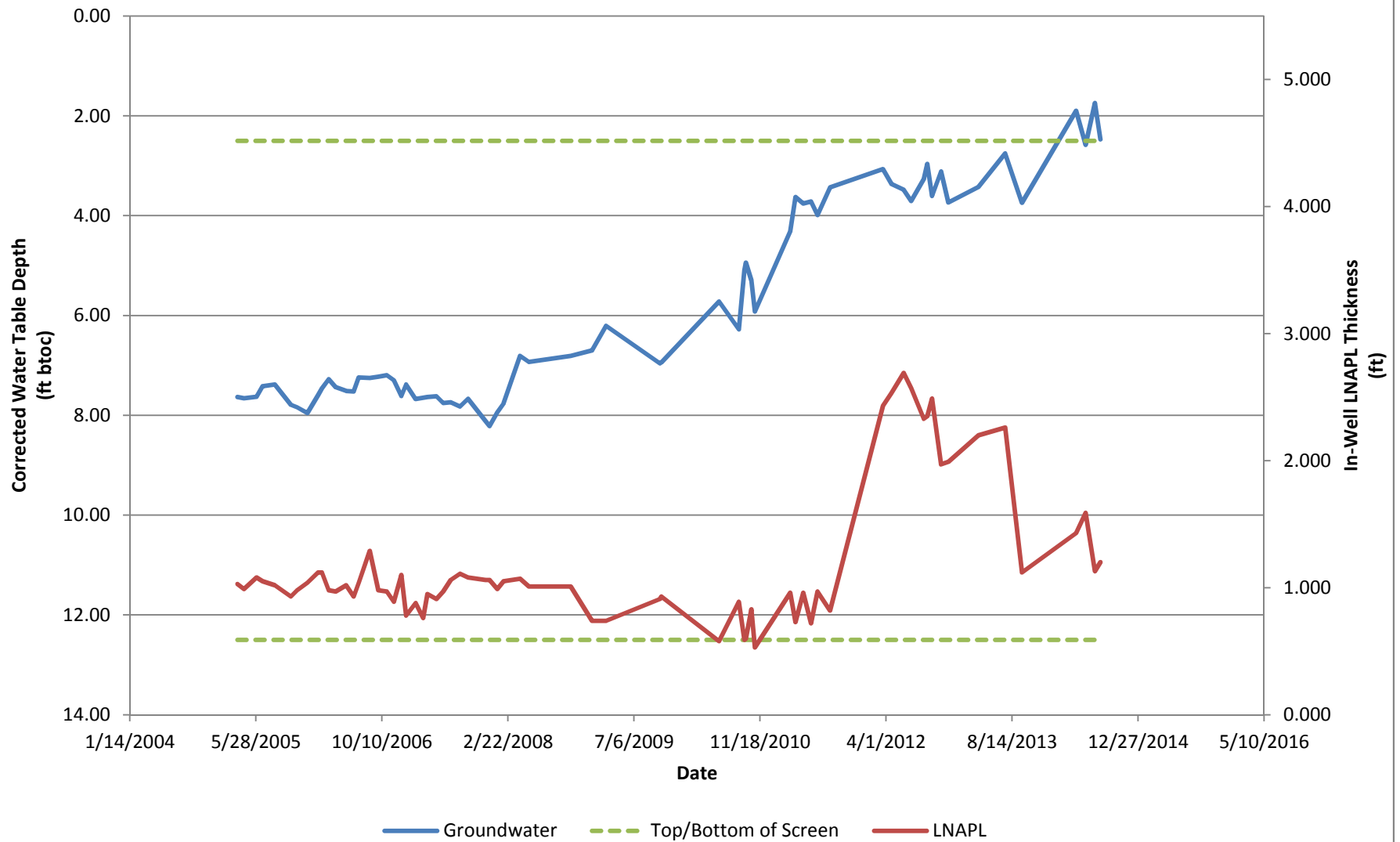
**Well Gauging Summary - QPTW-02**  
**Quench Pit LNAPL Area**  
**RACER Malleable Iron Industrial Land**  
**Saginaw, Michigan**



**Well Gauging Summary - QPTW-03R**  
**Quench Pit LNAPL Area**  
**RACER Malleable Iron Industrial Land**  
**Saginaw, Michigan**



**Well Gauging Summary - QPTW-04**  
**Quench Pit LNAPL Area**  
**RACER Malleable Iron Industrial Land**  
**Saginaw, Michigan**



**Well Gauging Summary - QPTW-05**  
**Quench Pit LNAPL Area**  
**RACER Malleable Iron Industrial Land**  
**Saginaw, Michigan**



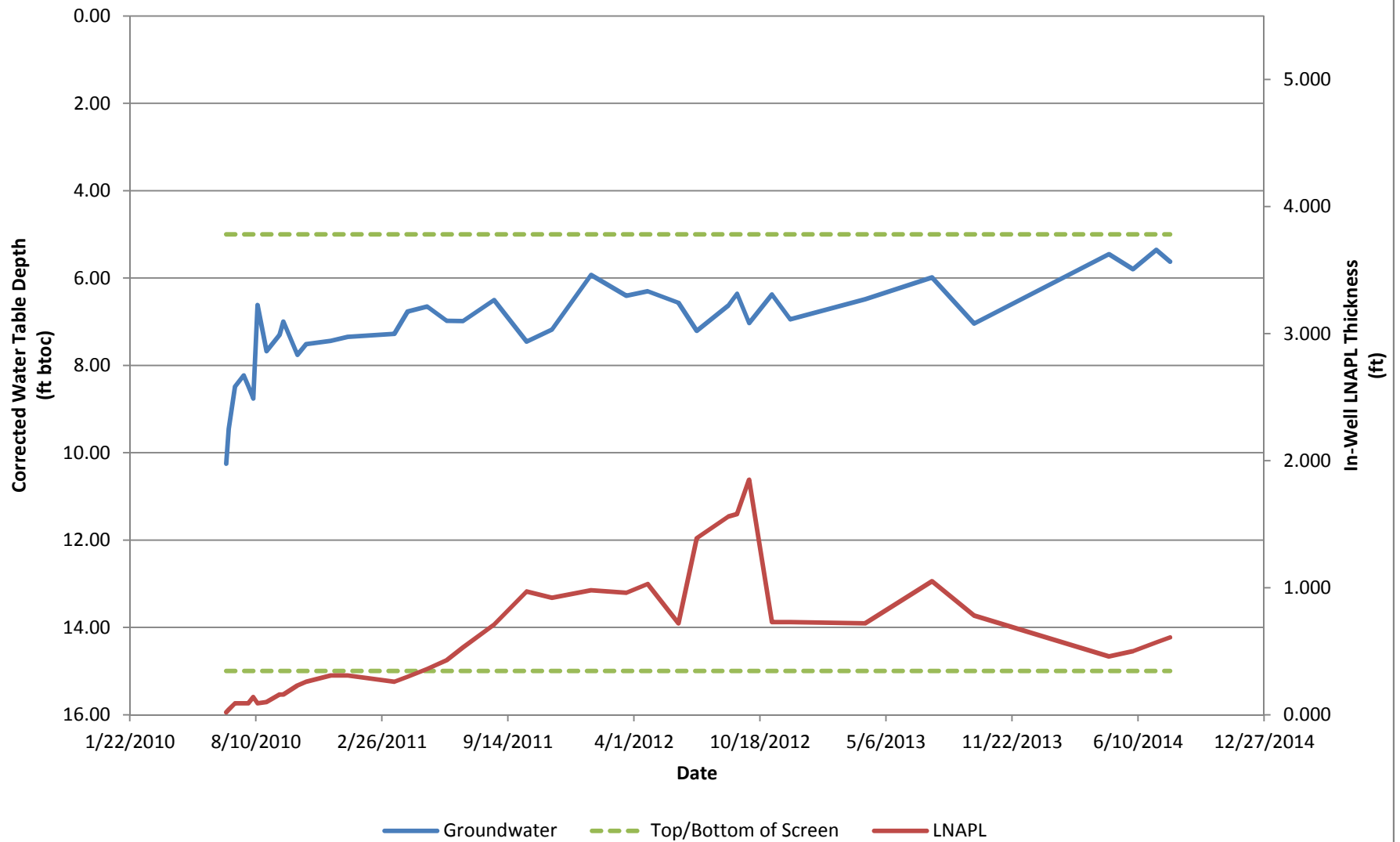
**Well Gauging Summary - QPTW-10**  
**Quench Pit LNAPL Area**  
**RACER Malleable Iron Industrial Land**  
**Saginaw, Michigan**



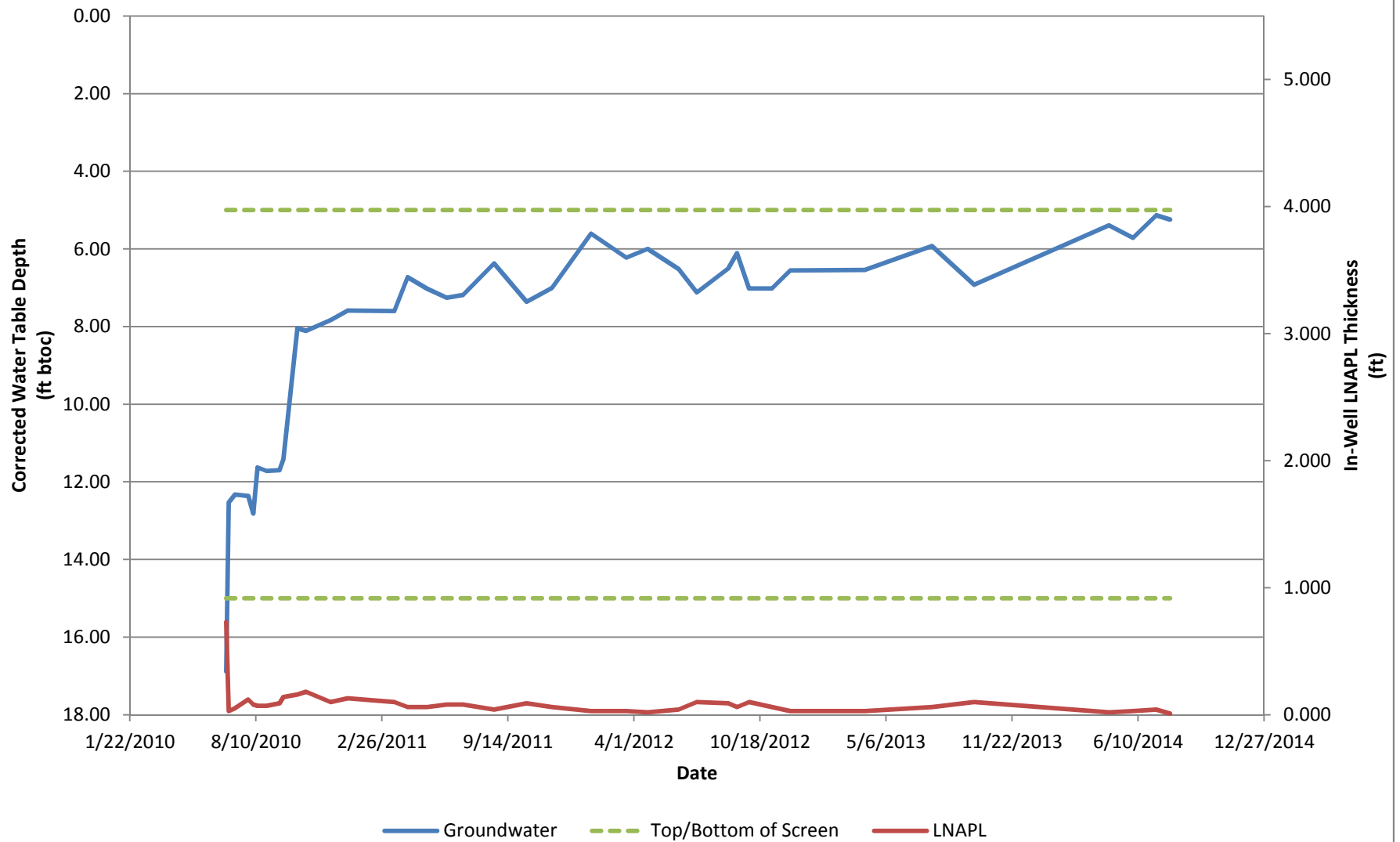
**Well Gauging Summary - QPTW-13**  
**Quench Pit LNAPL Area**  
**RACER Malleable Iron Industrial Land**  
**Saginaw, Michigan**



**Well Gauging Summary - QP-2**  
**Quench Pit LNAPL Area**  
**RACER Malleable Iron Industrial Land**  
**Saginaw, Michigan**



**Well Gauging Summary - QP-3**  
**Quench Pit LNAPL Area**  
**RACER Malleable Iron Industrial Land**  
**Saginaw, Michigan**



## **Appendix D**

### **LNAPL Analytical Laboratory Report**



## Analytical Laboratory Report

Report ID: S30993.01(01)  
Generated on 03/12/2007

### Report to

Attention: Ms. Renee Mietz  
GM Saginaw Malleable Iron  
77 W. Center  
MC: 486-577-008  
Saginaw, Michigan 48605

Phone: 989-757-0920 FAX: 989-757-0707

### Report produced by

Merit Laboratories  
2680 East Lansing Drive  
East Lansing, MI 48823

Phone: (517) 332-0167 FAX: (517) 332-6333

### Report Summary

Lab Sample ID(s): S30993.01-S30993.06  
Project: Annealing Assessment  
Collected Date: 03/01/2007  
Submitted Date/Time: 03/05/2007 11:45  
Sampled by: SH (CRA)  
P.O. #: GMS07301

### Report Notes

Results relate only to items tested as received by the laboratory.  
Methods may be modified for improved performance.  
Results reported on a dry weight basis where applicable.  
"Not detected" indicates that parameter was not found at a level equal to or greater than the RDL.  
Report shall not be reproduced except in full, without the written approval of Merit Laboratories.

A handwritten signature in cursive script that reads "Violetta F. Murshak".

Violetta F. Murshak  
Laboratory Director



## Analytical Laboratory Report

### Sample Summary (6 samples)

| Sample ID | Sample Tag | Matrix | Collected Date/Time |
|-----------|------------|--------|---------------------|
| S30993.01 | QPTW-1     | Oil    | 03/01/2007          |
| S30993.02 | QPTW-3     | Oil    | 03/01/2007          |
| S30993.03 | QPTW-4     | Oil    | 03/01/2007          |
| S30993.04 | QPTW-5     | Oil    | 03/01/2007          |
| S30993.05 | QPTW-10    | Oil    | 03/01/2007          |
| S30993.06 | QPTW-13    | Oil    | 03/01/2007          |



# Analytical Laboratory Report

Lab Sample ID: S30993.01  
Sample Tag: QPTW-1  
Collected Date/Time: 03/01/2007  
Matrix: Oil  
COC Reference: 036395

## Sample Containers

| # | Type       | Preservative(s) | Refrigerated? | Arrival Temp. (C) | Thermometer # |
|---|------------|-----------------|---------------|-------------------|---------------|
| 1 | 4oz. Glass | None            | Yes           | 4.7               | IR            |

| Analysis | Results | Units | RDL | Method | Run Date/Time | Analyst | Limits | Flags |
|----------|---------|-------|-----|--------|---------------|---------|--------|-------|
|----------|---------|-------|-----|--------|---------------|---------|--------|-------|

### Extraction / Prep.

|                   |           |  |  |       |                |     |  |  |
|-------------------|-----------|--|--|-------|----------------|-----|--|--|
| BNA Extraction    | Completed |  |  | 3550B | 03/05/07 20:20 | EMR |  |  |
| Extraction, PCB   | Completed |  |  | 3550B | 03/06/07 13:05 | TAS |  |  |
| Mercury Digestion | Completed |  |  | 7470A | 03/06/07 11:00 | JRT |  |  |
| Metal Digestion   | Completed |  |  | 3015A | 03/12/07 12:00 | SLS |  |  |

### TCLP Extraction

|                  |       |  |  |      |                |     |  |  |
|------------------|-------|--|--|------|----------------|-----|--|--|
| % Solids         | <0.5% |  |  | 1311 | 03/05/07 13:41 | LBR |  |  |
| Sample Used g    | <0.5% |  |  | 1311 | 03/05/07 13:41 | LBR |  |  |
| Final Volume mL  | <0.5% |  |  | 1311 | 03/05/07 13:41 | LBR |  |  |
| Final Extract pH | <0.5% |  |  | 1311 | 03/05/07 13:41 | LBR |  |  |

### Metals

|                |              |      |        |        |                |     |       |  |
|----------------|--------------|------|--------|--------|----------------|-----|-------|--|
| Arsenic, TCLP  | 0.09         | mg/L | 0.03   | 200.8  | 03/12/07 03:39 | SLS | 5.0   |  |
| Barium, TCLP   | 0.12         | mg/L | 0.05   | 200.8  | 03/12/07 03:39 | SLS | 100.0 |  |
| Cadmium, TCLP  | 0.009        | mg/L | 0.005  | 200.8  | 03/12/07 03:39 | SLS | 1.0   |  |
| Chromium, TCLP | Not detected | mg/L | 0.05   | 200.8  | 03/12/07 03:39 | SLS | 5.0   |  |
| Lead, TCLP     | Not detected | mg/L | 0.03   | 200.8  | 03/12/07 03:39 | SLS | 5.0   |  |
| Mercury, TCLP  | Not detected | mg/L | 0.0025 | 245.1M | 03/06/07 14:57 | JRT | 0.2   |  |
| Selenium, TCLP | 0.07         | mg/L | 0.05   | 200.8  | 03/12/07 03:39 | SLS | 1.0   |  |
| Silver, TCLP   | 0.007        | mg/L | 0.005  | 200.8  | 03/12/07 03:39 | SLS | 5.0   |  |

### Organics - PCBs/Pesticides

#### PCB List

|          |              |       |       |      |                |      |  |   |
|----------|--------------|-------|-------|------|----------------|------|--|---|
| PCB-1016 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:19 | JANB |  |   |
| PCB-1242 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:19 | JANB |  |   |
| PCB-1221 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:19 | JANB |  |   |
| PCB-1232 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:19 | JANB |  |   |
| PCB-1248 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:19 | JANB |  |   |
| PCB-1254 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:19 | JANB |  | J |
| PCB-1260 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:19 | JANB |  |   |

### Organics - Semi-Volatiles

#### Semi-Volatile Organics - MDEQ

|                      |              |       |         |       |                |     |  |    |
|----------------------|--------------|-------|---------|-------|----------------|-----|--|----|
| Acenaphthene         | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 19:35 | ARH |  | XT |
| Acenaphthylene       | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 19:35 | ARH |  | XT |
| Anthracene           | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 19:35 | ARH |  | XT |
| Benzo(a)anthracene   | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 19:35 | ARH |  | XT |
| Benzo(b)fluoranthene | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 19:35 | ARH |  | XT |
| Benzo(k)fluoranthene | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 19:35 | ARH |  | XT |
| Benzo(ghi)perylene   | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 19:35 | ARH |  | XT |
| Benzo(a)pyrene       | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 19:35 | ARH |  | XT |

J-Estimated value less than reporting limit, but greater than MDL

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.01 (continued)

Sample Tag: QPTW-1

| Analysis                                         | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|--------------------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Semi-Volatiles (continued)</b>     |              |       |         |        |                |         |        |       |
| <b>Semi-Volatile Organics - MDEQ (continued)</b> |              |       |         |        |                |         |        |       |
| bis(2-Chloroethoxy)methane                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| bis(2-Chloroethyl)ether                          | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| bis(2-Chloroisopropyl)ether                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| bis(2-Ethylhexyl)phthalate                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 4-Bromophenyl phenyl ether                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Butyl benzyl phthalate                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 4-Chloroaniline                                  | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 2-Chloronaphthalene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 4-Chloro-3-methylphenol                          | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 2-Chlorophenol                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 4-Chlorophenyl phenyl ether                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Chrysene                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| p,m-Cresol                                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| o-Cresol                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Dibenzo(ah)anthracene                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Dibenzofuran                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| di-n-Butyl phthalate                             | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 1,2-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 1,3-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 1,4-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 3,3'-Dichlorobenzidine                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 2,4-Dichlorophenol                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Diethyl phthalate                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 2,4-Dimethylphenol                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Dimethyl phthalate                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 4,6-Dinitro-2-methylphenol                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 2,4-Dinitrophenol                                | Not detected | ug/kg | 600,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 2,4-Dinitrotoluene                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 2,6-Dinitrotoluene                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 1,2-Diphenylhydrazine                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| di-n-Octyl phthalate                             | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Fluoranthene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Fluorene                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Hexachlorobenzene                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Hexachlorobutadiene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Hexachlorocyclopentadiene                        | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Hexachloroethane                                 | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Indeno(1,2,3-cd)pyrene                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Isophorone                                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 2-Methylnaphthalene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Naphthalene                                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 2-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 3-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 4-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Nitrobenzene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 2-Nitrophenol                                    | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 4-Nitrophenol                                    | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| N-Nitrosodiphenylamine                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.01 (continued)

Sample Tag: QPTW-1

| Analysis                                         | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|--------------------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Semi-Volatiles (continued)</b>     |              |       |         |        |                |         |        |       |
| <b>Semi-Volatile Organics - MDEQ (continued)</b> |              |       |         |        |                |         |        |       |
| N-Nitrosodi-n-propylamine                        | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Pentachlorophenol                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Phenanthrene                                     | 200,000      | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Phenol                                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| Pyrene                                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 1,2,4-Trichlorobenzene                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 2,4,5-Trichlorophenol                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| 2,4,6-Trichlorophenol                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 19:35 | ARH     |        | XT    |
| <b>Organics - Volatiles</b>                      |              |       |         |        |                |         |        |       |
| <b>Volatile Organics</b>                         |              |       |         |        |                |         |        |       |
| Benzene                                          | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Bromodichloromethane                             | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Bromoform                                        | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Bromomethane                                     | Not detected | ug/kg | 20,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| n-Butylbenzene                                   | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| sec-Butylbenzene                                 | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| tert-Butylbenzene                                | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Carbon tetrachloride                             | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Chlorobenzene                                    | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Chloroethane                                     | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Chloroform                                       | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Chloromethane                                    | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Dibromochloromethane                             | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,2-Dichlorobenzene                              | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,3-Dichlorobenzene                              | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,4-Dichlorobenzene                              | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,1-Dichloroethane                               | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,2-Dichloroethane                               | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,1-Dichloroethene                               | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| cis-1,2-Dichloroethene                           | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| trans-1,2-Dichloroethene                         | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,2-Dichloropropane                              | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| cis-1,3-Dichloropropene                          | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| trans-1,3-Dichloropropene                        | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Ethylbenzene                                     | 6,000        | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Isopropylbenzene                                 | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| p-Isopropyltoluene                               | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Methylene chloride                               | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Naphthalene                                      | 70,000       | ug/kg | 30,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| n-Propylbenzene                                  | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Styrene                                          | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,1,2,2-Tetrachloroethane                        | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Tetrachloroethene                                | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Toluene                                          | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,1,1-Trichloroethane                            | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,1,2-Trichloroethane                            | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |

X-Elevated reporting limit due to matrix interference T-No correction for total solids

Y-Elevated reporting limit due to high target concentration



# Analytical Laboratory Report

Lab Sample ID: S30993.01 (continued)

Sample Tag: QPTW-1

| Analysis                                | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|-----------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Volatiles (continued)</b> |              |       |         |        |                |         |        |       |
| <b>Volatile Organics (continued)</b>    |              |       |         |        |                |         |        |       |
| Trichloroethene                         | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,2,4-Trimethylbenzene                  | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,3,5-Trimethylbenzene                  | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Vinyl chloride                          | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| o-Xylene                                | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| p,m-Xylene                              | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Acetone                                 | Not detected | ug/kg | 100,000 | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 2-Butanone (MEK)                        | Not detected | ug/kg | 80,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Carbon disulfide                        | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 2-Hexanone                              | Not detected | ug/kg | 300,000 | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 4-Methyl-2-pentanone (MIBK)             | Not detected | ug/kg | 300,000 | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| tert-Methyl butyl ether (MTBE)          | Not detected | ug/kg | 20,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,1,1,2-Tetrachloroethane               | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,2,3-Trichlorobenzene                  | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,2,3-Trichloropropane                  | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,2,4-Trichlorobenzene                  | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,2-Dibromo-3-chloropropane             | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,2-Dibromoethane                       | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,4-Dichloro-2-butene                   | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 2-Methylnaphthalene                     | 40,000       | ug/kg | 30,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Acrylonitrile                           | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Bromobenzene                            | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Bromochloromethane                      | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Dibromomethane                          | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Dichlorodifluoromethane                 | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Diethyl ether                           | Not detected | ug/kg | 20,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Hexachloroethane                        | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Methyl iodide                           | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Tetrahydrofuran                         | Not detected | ug/kg | 100,000 | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| Trichlorofluoromethane                  | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |
| 1,2,3-Trimethylbenzene                  | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:01 | JGH     |        | Y     |

Y-Elevated reporting limit due to high target concentration



# Analytical Laboratory Report

Lab Sample ID: S30993.02  
Sample Tag: QPTW-3  
Collected Date/Time: 03/01/2007  
Matrix: Oil  
COC Reference: 036395

## Sample Containers

| # | Type       | Preservative(s) | Refrigerated? | Arrival Temp. (C) | Thermometer # |
|---|------------|-----------------|---------------|-------------------|---------------|
| 1 | 4oz. Glass | None            | Yes           | 4.7               | IR            |

| Analysis | Results | Units | RDL | Method | Run Date/Time | Analyst | Limits | Flags |
|----------|---------|-------|-----|--------|---------------|---------|--------|-------|
|----------|---------|-------|-----|--------|---------------|---------|--------|-------|

### Extraction / Prep.

|                   |           |  |  |       |                |     |  |  |
|-------------------|-----------|--|--|-------|----------------|-----|--|--|
| BNA Extraction    | Completed |  |  | 3550B | 03/05/07 20:20 | EMR |  |  |
| Extraction, PCB   | Completed |  |  | 3550B | 03/06/07 13:05 | TAS |  |  |
| Mercury Digestion | Completed |  |  | 7470A | 03/06/07 11:00 | JRT |  |  |
| Metal Digestion   | Completed |  |  | 3015A | 03/12/07 12:00 | SLS |  |  |

### TCLP Extraction

|                  |       |  |  |      |                |     |  |  |
|------------------|-------|--|--|------|----------------|-----|--|--|
| % Solids         | <0.5% |  |  | 1311 | 03/05/07 13:41 | LBR |  |  |
| Sample Used g    | <0.5% |  |  | 1311 | 03/05/07 13:41 | LBR |  |  |
| Final Volume mL  | <0.5% |  |  | 1311 | 03/05/07 13:41 | LBR |  |  |
| Final Extract pH | <0.5% |  |  | 1311 | 03/05/07 13:41 | LBR |  |  |

### Metals

|                |              |      |        |        |                |     |       |  |
|----------------|--------------|------|--------|--------|----------------|-----|-------|--|
| Arsenic, TCLP  | Not detected | mg/L | 0.03   | 200.8  | 03/12/07 03:42 | SLS | 5.0   |  |
| Barium, TCLP   | 0.05         | mg/L | 0.05   | 200.8  | 03/12/07 03:42 | SLS | 100.0 |  |
| Cadmium, TCLP  | Not detected | mg/L | 0.005  | 200.8  | 03/12/07 03:42 | SLS | 1.0   |  |
| Chromium, TCLP | Not detected | mg/L | 0.05   | 200.8  | 03/12/07 03:42 | SLS | 5.0   |  |
| Lead, TCLP     | 0.07         | mg/L | 0.03   | 200.8  | 03/12/07 03:42 | SLS | 5.0   |  |
| Mercury, TCLP  | Not detected | mg/L | 0.0025 | 245.1M | 03/06/07 14:59 | JRT | 0.2   |  |
| Selenium, TCLP | Not detected | mg/L | 0.05   | 200.8  | 03/12/07 03:42 | SLS | 1.0   |  |
| Silver, TCLP   | Not detected | mg/L | 0.005  | 200.8  | 03/12/07 03:42 | SLS | 5.0   |  |

### Organics - PCBs/Pesticides

#### PCB List

|          |              |       |       |      |                |      |  |  |
|----------|--------------|-------|-------|------|----------------|------|--|--|
| PCB-1016 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:30 | JANB |  |  |
| PCB-1242 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:30 | JANB |  |  |
| PCB-1221 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:30 | JANB |  |  |
| PCB-1232 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:30 | JANB |  |  |
| PCB-1248 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:30 | JANB |  |  |
| PCB-1254 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:30 | JANB |  |  |
| PCB-1260 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:30 | JANB |  |  |

### Organics - Semi-Volatiles

#### Semi-Volatile Organics - MDEQ

|                            |              |       |         |       |                |     |  |    |
|----------------------------|--------------|-------|---------|-------|----------------|-----|--|----|
| Acenaphthene               | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:11 | ARH |  | XT |
| Acenaphthylene             | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:11 | ARH |  | XT |
| Anthracene                 | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:11 | ARH |  | XT |
| Benzo(a)anthracene         | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:11 | ARH |  | XT |
| Benzo(b)fluoranthene       | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:11 | ARH |  | XT |
| Benzo(k)fluoranthene       | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:11 | ARH |  | XT |
| Benzo(ghi)perylene         | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:11 | ARH |  | XT |
| Benzo(a)pyrene             | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:11 | ARH |  | XT |
| bis(2-Chloroethoxy)methane | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:11 | ARH |  | XT |

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.02 (continued)

Sample Tag: QPTW-3

| Analysis                                         | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|--------------------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Semi-Volatiles (continued)</b>     |              |       |         |        |                |         |        |       |
| <b>Semi-Volatile Organics - MDEQ (continued)</b> |              |       |         |        |                |         |        |       |
| bis(2-Chloroethyl)ether                          | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| bis(2-Chloroisopropyl)ether                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| bis(2-Ethylhexyl)phthalate                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 4-Bromophenyl phenyl ether                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Butyl benzyl phthalate                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 4-Chloroaniline                                  | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 2-Chloronaphthalene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 4-Chloro-3-methylphenol                          | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 2-Chlorophenol                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 4-Chlorophenyl phenyl ether                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Chrysene                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| p,m-Cresol                                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| o-Cresol                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Dibenzo(ah)anthracene                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Dibenzofuran                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| di-n-Butyl phthalate                             | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 1,2-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 1,3-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 1,4-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 3,3'-Dichlorobenzidine                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 2,4-Dichlorophenol                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Diethyl phthalate                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 2,4-Dimethylphenol                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Dimethyl phthalate                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 4,6-Dinitro-2-methylphenol                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 2,4-Dinitrophenol                                | Not detected | ug/kg | 600,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 2,4-Dinitrotoluene                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 2,6-Dinitrotoluene                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 1,2-Diphenylhydrazine                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| di-n-Octyl phthalate                             | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Fluoranthene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Fluorene                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Hexachlorobenzene                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Hexachlorobutadiene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Hexachlorocyclopentadiene                        | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Hexachloroethane                                 | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Indeno(1,2,3-cd)pyrene                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Isophorone                                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 2-Methylnaphthalene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Naphthalene                                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 2-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 3-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 4-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Nitrobenzene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 2-Nitrophenol                                    | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 4-Nitrophenol                                    | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| N-Nitrosodiphenylamine                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| N-Nitrosodi-n-propylamine                        | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.02 (continued)

Sample Tag: QPTW-3

| Analysis                                         | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|--------------------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Semi-Volatiles (continued)</b>     |              |       |         |        |                |         |        |       |
| <b>Semi-Volatile Organics - MDEQ (continued)</b> |              |       |         |        |                |         |        |       |
| Pentachlorophenol                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Phenanthrene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Phenol                                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| Pyrene                                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 1,2,4-Trichlorobenzene                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 2,4,5-Trichlorophenol                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| 2,4,6-Trichlorophenol                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:11 | ARH     |        | XT    |
| <b>Organics - Volatiles</b>                      |              |       |         |        |                |         |        |       |
| <b>Volatile Organics</b>                         |              |       |         |        |                |         |        |       |
| Benzene                                          | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Bromodichloromethane                             | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Bromoform                                        | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Bromomethane                                     | Not detected | ug/kg | 20,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| n-Butylbenzene                                   | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| sec-Butylbenzene                                 | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| tert-Butylbenzene                                | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Carbon tetrachloride                             | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Chlorobenzene                                    | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Chloroethane                                     | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Chloroform                                       | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Chloromethane                                    | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Dibromochloromethane                             | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,2-Dichlorobenzene                              | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,3-Dichlorobenzene                              | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,4-Dichlorobenzene                              | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,1-Dichloroethane                               | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,2-Dichloroethane                               | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,1-Dichloroethene                               | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| cis-1,2-Dichloroethene                           | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| trans-1,2-Dichloroethene                         | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,2-Dichloropropane                              | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| cis-1,3-Dichloropropene                          | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| trans-1,3-Dichloropropene                        | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Ethylbenzene                                     | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Isopropylbenzene                                 | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| p-Isopropyltoluene                               | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Methylene chloride                               | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Naphthalene                                      | 40,000       | ug/kg | 30,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| n-Propylbenzene                                  | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Styrene                                          | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,1,2,2-Tetrachloroethane                        | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Tetrachloroethene                                | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Toluene                                          | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,1,1-Trichloroethane                            | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,1,2-Trichloroethane                            | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Trichloroethene                                  | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |

X-Elevated reporting limit due to matrix interference T-No correction for total solids

Y-Elevated reporting limit due to high target concentration



# Analytical Laboratory Report

Lab Sample ID: S30993.02 (continued)

Sample Tag: QPTW-3

| Analysis                                | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|-----------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Volatiles (continued)</b> |              |       |         |        |                |         |        |       |
| <b>Volatile Organics (continued)</b>    |              |       |         |        |                |         |        |       |
| 1,2,4-Trimethylbenzene                  | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,3,5-Trimethylbenzene                  | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Vinyl chloride                          | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| o-Xylene                                | Not detected | ug/kg | 5,000   | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| p,m-Xylene                              | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Acetone                                 | Not detected | ug/kg | 100,000 | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 2-Butanone (MEK)                        | Not detected | ug/kg | 80,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Carbon disulfide                        | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 2-Hexanone                              | Not detected | ug/kg | 300,000 | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 4-Methyl-2-pentanone (MIBK)             | Not detected | ug/kg | 300,000 | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| tert-Methyl butyl ether (MTBE)          | Not detected | ug/kg | 20,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,1,1,2-Tetrachloroethane               | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,2,3-Trichlorobenzene                  | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,2,3-Trichloropropane                  | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,2,4-Trichlorobenzene                  | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,2-Dibromo-3-chloropropane             | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,2-Dibromoethane                       | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,4-Dichloro-2-butene                   | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 2-Methylnaphthalene                     | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Acrylonitrile                           | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Bromobenzene                            | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Bromochloromethane                      | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Dibromomethane                          | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Dichlorodifluoromethane                 | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Diethyl ether                           | Not detected | ug/kg | 20,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Hexachloroethane                        | Not detected | ug/kg | 30,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Methyl iodide                           | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Tetrahydrofuran                         | Not detected | ug/kg | 100,000 | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| Trichlorofluoromethane                  | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |
| 1,2,3-Trimethylbenzene                  | Not detected | ug/kg | 10,000  | 8260B  | 03/06/07 18:20 | JGH     |        | Y     |

Y-Elevated reporting limit due to high target concentration



# Analytical Laboratory Report

Lab Sample ID: S30993.03  
Sample Tag: QPTW-4  
Collected Date/Time: 03/01/2007  
Matrix: Oil  
COC Reference: 036395

## Sample Containers

| # | Type       | Preservative(s) | Refrigerated? | Arrival Temp. (C) | Thermometer # |
|---|------------|-----------------|---------------|-------------------|---------------|
| 1 | 4oz. Glass | None            | Yes           | 4.7               | IR            |

| Analysis | Results | Units | RDL | Method | Run Date/Time | Analyst | Limits | Flags |
|----------|---------|-------|-----|--------|---------------|---------|--------|-------|
|----------|---------|-------|-----|--------|---------------|---------|--------|-------|

### Extraction / Prep.

|                   |           |  |  |       |                |     |  |  |
|-------------------|-----------|--|--|-------|----------------|-----|--|--|
| BNA Extraction    | Completed |  |  | 3550B | 03/05/07 20:20 | EMR |  |  |
| Extraction, PCB   | Completed |  |  | 3550B | 03/06/07 13:05 | TAS |  |  |
| Mercury Digestion | Completed |  |  | 7470A | 03/06/07 11:00 | JRT |  |  |
| Metal Digestion   | Completed |  |  | 3015A | 03/12/07 12:00 | SLS |  |  |

### TCLP Extraction

|                  |       |  |  |      |                |     |  |  |
|------------------|-------|--|--|------|----------------|-----|--|--|
| % Solids         | <0.5% |  |  | 1311 | 03/05/07 13:41 | LBR |  |  |
| Sample Used g    | <0.5% |  |  | 1311 | 03/05/07 13:41 | LBR |  |  |
| Final Volume mL  | <0.5% |  |  | 1311 | 03/05/07 13:41 | LBR |  |  |
| Final Extract pH | <0.5% |  |  | 1311 | 03/05/07 13:41 | LBR |  |  |

### Metals

|                |              |      |        |        |                |     |       |  |
|----------------|--------------|------|--------|--------|----------------|-----|-------|--|
| Arsenic, TCLP  | Not detected | mg/L | 0.03   | 200.8  | 03/12/07 03:45 | SLS | 5.0   |  |
| Barium, TCLP   | Not detected | mg/L | 0.05   | 200.8  | 03/12/07 03:45 | SLS | 100.0 |  |
| Cadmium, TCLP  | Not detected | mg/L | 0.005  | 200.8  | 03/12/07 03:45 | SLS | 1.0   |  |
| Chromium, TCLP | Not detected | mg/L | 0.05   | 200.8  | 03/12/07 03:45 | SLS | 5.0   |  |
| Lead, TCLP     | Not detected | mg/L | 0.03   | 200.8  | 03/12/07 03:45 | SLS | 5.0   |  |
| Mercury, TCLP  | Not detected | mg/L | 0.0025 | 245.1M | 03/06/07 15:00 | JRT | 0.2   |  |
| Selenium, TCLP | Not detected | mg/L | 0.05   | 200.8  | 03/12/07 03:45 | SLS | 1.0   |  |
| Silver, TCLP   | Not detected | mg/L | 0.005  | 200.8  | 03/12/07 03:45 | SLS | 5.0   |  |

### Organics - PCBs/Pesticides

#### PCB List

|          |              |       |       |      |                |      |  |  |
|----------|--------------|-------|-------|------|----------------|------|--|--|
| PCB-1016 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:42 | JANB |  |  |
| PCB-1242 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:42 | JANB |  |  |
| PCB-1221 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:42 | JANB |  |  |
| PCB-1232 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:42 | JANB |  |  |
| PCB-1248 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:42 | JANB |  |  |
| PCB-1254 | 2,700        | ug/kg | 1,000 | 8082 | 03/07/07 09:42 | JANB |  |  |
| PCB-1260 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:42 | JANB |  |  |

### Organics - Semi-Volatiles

#### Semi-Volatile Organics - MDEQ

|                            |              |       |         |       |                |     |  |    |
|----------------------------|--------------|-------|---------|-------|----------------|-----|--|----|
| Acenaphthene               | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:46 | ARH |  | XT |
| Acenaphthylene             | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:46 | ARH |  | XT |
| Anthracene                 | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:46 | ARH |  | XT |
| Benzo(a)anthracene         | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:46 | ARH |  | XT |
| Benzo(b)fluoranthene       | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:46 | ARH |  | XT |
| Benzo(k)fluoranthene       | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:46 | ARH |  | XT |
| Benzo(ghi)perylene         | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:46 | ARH |  | XT |
| Benzo(a)pyrene             | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:46 | ARH |  | XT |
| bis(2-Chloroethoxy)methane | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 20:46 | ARH |  | XT |

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.03 (continued)

Sample Tag: QPTW-4

| Analysis                                         | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|--------------------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Semi-Volatiles (continued)</b>     |              |       |         |        |                |         |        |       |
| <b>Semi-Volatile Organics - MDEQ (continued)</b> |              |       |         |        |                |         |        |       |
| bis(2-Chloroethyl)ether                          | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| bis(2-Chloroisopropyl)ether                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| bis(2-Ethylhexyl)phthalate                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 4-Bromophenyl phenyl ether                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Butyl benzyl phthalate                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 4-Chloroaniline                                  | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 2-Chloronaphthalene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 4-Chloro-3-methylphenol                          | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 2-Chlorophenol                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 4-Chlorophenyl phenyl ether                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Chrysene                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| p,m-Cresol                                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| o-Cresol                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Dibenzo(ah)anthracene                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Dibenzofuran                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| di-n-Butyl phthalate                             | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 1,2-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 1,3-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 1,4-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 3,3'-Dichlorobenzidine                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 2,4-Dichlorophenol                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Diethyl phthalate                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 2,4-Dimethylphenol                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Dimethyl phthalate                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 4,6-Dinitro-2-methylphenol                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 2,4-Dinitrophenol                                | Not detected | ug/kg | 600,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 2,4-Dinitrotoluene                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 2,6-Dinitrotoluene                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 1,2-Diphenylhydrazine                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| di-n-Octyl phthalate                             | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Fluoranthene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Fluorene                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Hexachlorobenzene                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Hexachlorobutadiene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Hexachlorocyclopentadiene                        | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Hexachloroethane                                 | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Indeno(1,2,3-cd)pyrene                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Isophorone                                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 2-Methylnaphthalene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Naphthalene                                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 2-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 3-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 4-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Nitrobenzene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 2-Nitrophenol                                    | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 4-Nitrophenol                                    | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| N-Nitrosodiphenylamine                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| N-Nitrosodi-n-propylamine                        | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.03 (continued)

Sample Tag: QPTW-4

| Analysis                                         | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|--------------------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Semi-Volatiles (continued)</b>     |              |       |         |        |                |         |        |       |
| <b>Semi-Volatile Organics - MDEQ (continued)</b> |              |       |         |        |                |         |        |       |
| Pentachlorophenol                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Phenanthrene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Phenol                                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| Pyrene                                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 1,2,4-Trichlorobenzene                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 2,4,5-Trichlorophenol                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| 2,4,6-Trichlorophenol                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 20:46 | ARH     |        | XT    |
| <b>Organics - Volatiles</b>                      |              |       |         |        |                |         |        |       |
| <b>Volatile Organics</b>                         |              |       |         |        |                |         |        |       |
| Benzene                                          | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Bromodichloromethane                             | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Bromoform                                        | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Bromomethane                                     | Not detected | ug/kg | 4,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| n-Butylbenzene                                   | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| sec-Butylbenzene                                 | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| tert-Butylbenzene                                | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Carbon tetrachloride                             | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Chlorobenzene                                    | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Chloroethane                                     | Not detected | ug/kg | 5,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Chloroform                                       | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Chloromethane                                    | Not detected | ug/kg | 5,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Dibromochloromethane                             | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,2-Dichlorobenzene                              | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,3-Dichlorobenzene                              | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,4-Dichlorobenzene                              | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,1-Dichloroethane                               | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,2-Dichloroethane                               | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,1-Dichloroethene                               | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| cis-1,2-Dichloroethene                           | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| trans-1,2-Dichloroethene                         | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,2-Dichloropropane                              | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| cis-1,3-Dichloropropene                          | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| trans-1,3-Dichloropropene                        | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Ethylbenzene                                     | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Isopropylbenzene                                 | Not detected | ug/kg | 5,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| p-Isopropyltoluene                               | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Methylene chloride                               | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Naphthalene                                      | 9,000        | ug/kg | 7,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| n-Propylbenzene                                  | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Styrene                                          | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,1,2,2-Tetrachloroethane                        | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Tetrachloroethene                                | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Toluene                                          | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,1,1-Trichloroethane                            | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,1,2-Trichloroethane                            | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Trichloroethene                                  | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |

X-Elevated reporting limit due to matrix interference T-No correction for total solids

Y-Elevated reporting limit due to high target concentration



# Analytical Laboratory Report

Lab Sample ID: S30993.03 (continued)

Sample Tag: QPTW-4

| Analysis                                | Results      | Units | RDL    | Method | Run Date/Time  | Analyst | Limits | Flags |
|-----------------------------------------|--------------|-------|--------|--------|----------------|---------|--------|-------|
| <b>Organics - Volatiles (continued)</b> |              |       |        |        |                |         |        |       |
| <b>Volatile Organics (continued)</b>    |              |       |        |        |                |         |        |       |
| 1,2,4-Trimethylbenzene                  | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,3,5-Trimethylbenzene                  | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Vinyl chloride                          | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| o-Xylene                                | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| p,m-Xylene                              | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Acetone                                 | Not detected | ug/kg | 20,000 | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 2-Butanone (MEK)                        | Not detected | ug/kg | 20,000 | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Carbon disulfide                        | Not detected | ug/kg | 5,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 2-Hexanone                              | Not detected | ug/kg | 50,000 | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 4-Methyl-2-pentanone (MIBK)             | Not detected | ug/kg | 50,000 | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| tert-Methyl butyl ether (MTBE)          | Not detected | ug/kg | 4,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,1,1,2-Tetrachloroethane               | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,2,3-Trichlorobenzene                  | Not detected | ug/kg | 7,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,2,3-Trichloropropane                  | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,2,4-Trichlorobenzene                  | Not detected | ug/kg | 7,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,2-Dibromo-3-chloropropane             | Not detected | ug/kg | 5,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,2-Dibromoethane                       | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,4-Dichloro-2-butene                   | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 2-Methylnaphthalene                     | Not detected | ug/kg | 7,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Acrylonitrile                           | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Bromobenzene                            | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Bromochloromethane                      | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Dibromomethane                          | Not detected | ug/kg | 5,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Dichlorodifluoromethane                 | Not detected | ug/kg | 5,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Diethyl ether                           | Not detected | ug/kg | 4,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Hexachloroethane                        | Not detected | ug/kg | 6,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Methyl iodide                           | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Tetrahydrofuran                         | Not detected | ug/kg | 20,000 | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| Trichlorofluoromethane                  | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |
| 1,2,3-Trimethylbenzene                  | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:38 | JGH     |        | Y     |

Y-Elevated reporting limit due to high target concentration



# Analytical Laboratory Report

Lab Sample ID: S30993.04  
Sample Tag: QPTW-5  
Collected Date/Time: 03/01/2007  
Matrix: Oil  
COC Reference: 036395

## Sample Containers

| # | Type       | Preservative(s) | Refrigerated? | Arrival Temp. (C) | Thermometer # |
|---|------------|-----------------|---------------|-------------------|---------------|
| 1 | 4oz. Glass | None            | Yes           | 4.7               | IR            |

| Analysis | Results | Units | RDL | Method | Run Date/Time | Analyst | Limits | Flags |
|----------|---------|-------|-----|--------|---------------|---------|--------|-------|
|----------|---------|-------|-----|--------|---------------|---------|--------|-------|

### Extraction / Prep.

|                   |           |  |  |       |                |     |  |  |
|-------------------|-----------|--|--|-------|----------------|-----|--|--|
| BNA Extraction    | Completed |  |  | 3550B | 03/05/07 20:20 | EMR |  |  |
| Extraction, PCB   | Completed |  |  | 3550B | 03/06/07 13:05 | TAS |  |  |
| Mercury Digestion | Completed |  |  | 7470A | 03/06/07 11:00 | JRT |  |  |
| Metal Digestion   | Completed |  |  | 3015A | 03/12/07 12:00 | SLS |  |  |

### TCLP Extraction

|                  |       |  |  |      |                |     |  |  |
|------------------|-------|--|--|------|----------------|-----|--|--|
| % Solids         | <0.5% |  |  | 1311 | 03/05/07 13:42 | LBR |  |  |
| Sample Used g    | <0.5% |  |  | 1311 | 03/05/07 13:42 | LBR |  |  |
| Final Volume mL  | <0.5% |  |  | 1311 | 03/05/07 13:42 | LBR |  |  |
| Final Extract pH | <0.5% |  |  | 1311 | 03/05/07 13:42 | LBR |  |  |

### Metals

|                |              |      |        |        |                |     |       |  |
|----------------|--------------|------|--------|--------|----------------|-----|-------|--|
| Arsenic, TCLP  | 0.04         | mg/L | 0.03   | 200.8  | 03/12/07 03:48 | SLS | 5.0   |  |
| Barium, TCLP   | Not detected | mg/L | 0.05   | 200.8  | 03/12/07 03:48 | SLS | 100.0 |  |
| Cadmium, TCLP  | Not detected | mg/L | 0.005  | 200.8  | 03/12/07 03:48 | SLS | 1.0   |  |
| Chromium, TCLP | Not detected | mg/L | 0.05   | 200.8  | 03/12/07 03:48 | SLS | 5.0   |  |
| Lead, TCLP     | Not detected | mg/L | 0.03   | 200.8  | 03/12/07 03:48 | SLS | 5.0   |  |
| Mercury, TCLP  | Not detected | mg/L | 0.0025 | 245.1M | 03/06/07 15:02 | JRT | 0.2   |  |
| Selenium, TCLP | Not detected | mg/L | 0.05   | 200.8  | 03/12/07 03:48 | SLS | 1.0   |  |
| Silver, TCLP   | Not detected | mg/L | 0.005  | 200.8  | 03/12/07 03:48 | SLS | 5.0   |  |

### Organics - PCBs/Pesticides

#### PCB List

|          |              |       |       |      |                |      |  |  |
|----------|--------------|-------|-------|------|----------------|------|--|--|
| PCB-1016 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:53 | JANB |  |  |
| PCB-1242 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:53 | JANB |  |  |
| PCB-1221 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:53 | JANB |  |  |
| PCB-1232 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:53 | JANB |  |  |
| PCB-1248 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:53 | JANB |  |  |
| PCB-1254 | 3,300        | ug/kg | 1,000 | 8082 | 03/07/07 09:53 | JANB |  |  |
| PCB-1260 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 09:53 | JANB |  |  |

### Organics - Semi-Volatiles

#### Semi-Volatile Organics - MDEQ

|                            |              |       |         |       |                |     |  |    |
|----------------------------|--------------|-------|---------|-------|----------------|-----|--|----|
| Acenaphthene               | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:21 | ARH |  | XT |
| Acenaphthylene             | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:21 | ARH |  | XT |
| Anthracene                 | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:21 | ARH |  | XT |
| Benzo(a)anthracene         | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:21 | ARH |  | XT |
| Benzo(b)fluoranthene       | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:21 | ARH |  | XT |
| Benzo(k)fluoranthene       | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:21 | ARH |  | XT |
| Benzo(ghi)perylene         | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:21 | ARH |  | XT |
| Benzo(a)pyrene             | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:21 | ARH |  | XT |
| bis(2-Chloroethoxy)methane | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:21 | ARH |  | XT |

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.04 (continued)

Sample Tag: QPTW-5

| Analysis                                         | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|--------------------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Semi-Volatiles (continued)</b>     |              |       |         |        |                |         |        |       |
| <b>Semi-Volatile Organics - MDEQ (continued)</b> |              |       |         |        |                |         |        |       |
| bis(2-Chloroethyl)ether                          | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| bis(2-Chloroisopropyl)ether                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| bis(2-Ethylhexyl)phthalate                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 4-Bromophenyl phenyl ether                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Butyl benzyl phthalate                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 4-Chloroaniline                                  | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 2-Chloronaphthalene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 4-Chloro-3-methylphenol                          | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 2-Chlorophenol                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 4-Chlorophenyl phenyl ether                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Chrysene                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| p,m-Cresol                                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| o-Cresol                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Dibenzo(ah)anthracene                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Dibenzofuran                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| di-n-Butyl phthalate                             | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 1,2-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 1,3-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 1,4-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 3,3'-Dichlorobenzidine                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 2,4-Dichlorophenol                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Diethyl phthalate                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 2,4-Dimethylphenol                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Dimethyl phthalate                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 4,6-Dinitro-2-methylphenol                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 2,4-Dinitrophenol                                | Not detected | ug/kg | 600,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 2,4-Dinitrotoluene                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 2,6-Dinitrotoluene                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 1,2-Diphenylhydrazine                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| di-n-Octyl phthalate                             | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Fluoranthene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Fluorene                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Hexachlorobenzene                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Hexachlorobutadiene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Hexachlorocyclopentadiene                        | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Hexachloroethane                                 | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Indeno(1,2,3-cd)pyrene                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Isophorone                                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 2-Methylnaphthalene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Naphthalene                                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 2-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 3-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 4-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Nitrobenzene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 2-Nitrophenol                                    | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 4-Nitrophenol                                    | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| N-Nitrosodiphenylamine                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| N-Nitrosodi-n-propylamine                        | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.04 (continued)

Sample Tag: QPTW-5

| Analysis                                         | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|--------------------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Semi-Volatiles (continued)</b>     |              |       |         |        |                |         |        |       |
| <b>Semi-Volatile Organics - MDEQ (continued)</b> |              |       |         |        |                |         |        |       |
| Pentachlorophenol                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Phenanthrene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Phenol                                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| Pyrene                                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 1,2,4-Trichlorobenzene                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 2,4,5-Trichlorophenol                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| 2,4,6-Trichlorophenol                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:21 | ARH     |        | XT    |
| <b>Organics - Volatiles</b>                      |              |       |         |        |                |         |        |       |
| <b>Volatile Organics</b>                         |              |       |         |        |                |         |        |       |
| Benzene                                          | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Bromodichloromethane                             | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Bromoform                                        | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Bromomethane                                     | Not detected | ug/kg | 4,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| n-Butylbenzene                                   | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:56 | JGH     |        | XY    |
| sec-Butylbenzene                                 | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| tert-Butylbenzene                                | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Carbon tetrachloride                             | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Chlorobenzene                                    | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Chloroethane                                     | Not detected | ug/kg | 5,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Chloroform                                       | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Chloromethane                                    | Not detected | ug/kg | 5,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Dibromochloromethane                             | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,2-Dichlorobenzene                              | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,3-Dichlorobenzene                              | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,4-Dichlorobenzene                              | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,1-Dichloroethane                               | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,2-Dichloroethane                               | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,1-Dichloroethene                               | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| cis-1,2-Dichloroethene                           | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| trans-1,2-Dichloroethene                         | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,2-Dichloropropane                              | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| cis-1,3-Dichloropropene                          | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| trans-1,3-Dichloropropene                        | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Ethylbenzene                                     | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Isopropylbenzene                                 | Not detected | ug/kg | 5,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| p-Isopropyltoluene                               | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Methylene chloride                               | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Naphthalene                                      | 22,000       | ug/kg | 7,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| n-Propylbenzene                                  | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Styrene                                          | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,1,2,2-Tetrachloroethane                        | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Tetrachloroethene                                | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Toluene                                          | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,1,1-Trichloroethane                            | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,1,2-Trichloroethane                            | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Trichloroethene                                  | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |

X-Elevated reporting limit due to matrix interference T-No correction for total solids

Y-Elevated reporting limit due to high target concentration



# Analytical Laboratory Report

Lab Sample ID: S30993.04 (continued)

Sample Tag: QPTW-5

| Analysis                                | Results      | Units | RDL    | Method | Run Date/Time  | Analyst | Limits | Flags |
|-----------------------------------------|--------------|-------|--------|--------|----------------|---------|--------|-------|
| <b>Organics - Volatiles (continued)</b> |              |       |        |        |                |         |        |       |
| <b>Volatile Organics (continued)</b>    |              |       |        |        |                |         |        |       |
| 1,2,4-Trimethylbenzene                  | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,3,5-Trimethylbenzene                  | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Vinyl chloride                          | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| o-Xylene                                | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| p,m-Xylene                              | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Acetone                                 | Not detected | ug/kg | 20,000 | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 2-Butanone (MEK)                        | Not detected | ug/kg | 20,000 | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Carbon disulfide                        | Not detected | ug/kg | 5,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 2-Hexanone                              | Not detected | ug/kg | 50,000 | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 4-Methyl-2-pentanone (MIBK)             | Not detected | ug/kg | 50,000 | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| tert-Methyl butyl ether (MTBE)          | Not detected | ug/kg | 4,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,1,1,2-Tetrachloroethane               | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,2,3-Trichlorobenzene                  | Not detected | ug/kg | 7,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,2,3-Trichloropropane                  | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,2,4-Trichlorobenzene                  | Not detected | ug/kg | 7,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,2-Dibromo-3-chloropropane             | Not detected | ug/kg | 5,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,2-Dibromoethane                       | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,4-Dichloro-2-butene                   | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 2-Methylnaphthalene                     | 11,000       | ug/kg | 7,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Acrylonitrile                           | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Bromobenzene                            | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Bromochloromethane                      | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Dibromomethane                          | Not detected | ug/kg | 5,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Dichlorodifluoromethane                 | Not detected | ug/kg | 5,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Diethyl ether                           | Not detected | ug/kg | 4,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Hexachloroethane                        | Not detected | ug/kg | 6,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Methyl iodide                           | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Tetrahydrofuran                         | Not detected | ug/kg | 20,000 | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| Trichlorofluoromethane                  | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |
| 1,2,3-Trimethylbenzene                  | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:56 | JGH     |        | Y     |

Y-Elevated reporting limit due to high target concentration



# Analytical Laboratory Report

Lab Sample ID: S30993.05  
Sample Tag: QPTW-10  
Collected Date/Time: 03/01/2007  
Matrix: Oil  
COC Reference: 036395

## Sample Containers

| # | Type       | Preservative(s) | Refrigerated? | Arrival Temp. (C) | Thermometer # |
|---|------------|-----------------|---------------|-------------------|---------------|
| 1 | 4oz. Glass | None            | Yes           | 4.7               | IR            |

| Analysis | Results | Units | RDL | Method | Run Date/Time | Analyst | Limits | Flags |
|----------|---------|-------|-----|--------|---------------|---------|--------|-------|
|----------|---------|-------|-----|--------|---------------|---------|--------|-------|

### Extraction / Prep.

|                   |           |  |  |       |                |     |  |  |
|-------------------|-----------|--|--|-------|----------------|-----|--|--|
| BNA Extraction    | Completed |  |  | 3550B | 03/05/07 20:20 | EMR |  |  |
| Extraction, PCB   | Completed |  |  | 3550B | 03/06/07 13:05 | TAS |  |  |
| Mercury Digestion | Completed |  |  | 7470A | 03/06/07 11:00 | JRT |  |  |
| Metal Digestion   | Completed |  |  | 3015A | 03/12/07 12:00 | SLS |  |  |

### TCLP Extraction

|                  |       |  |  |      |                |     |  |  |
|------------------|-------|--|--|------|----------------|-----|--|--|
| % Solids         | <0.5% |  |  | 1311 | 03/05/07 13:42 | LBR |  |  |
| Sample Used g    | <0.5% |  |  | 1311 | 03/05/07 13:42 | LBR |  |  |
| Final Volume mL  | <0.5% |  |  | 1311 | 03/05/07 13:42 | LBR |  |  |
| Final Extract pH | <0.5% |  |  | 1311 | 03/05/07 13:42 | LBR |  |  |

### Metals

|                |              |      |        |        |                |     |       |  |
|----------------|--------------|------|--------|--------|----------------|-----|-------|--|
| Arsenic, TCLP  | 0.06         | mg/L | 0.03   | 200.8  | 03/12/07 03:52 | SLS | 5.0   |  |
| Barium, TCLP   | Not detected | mg/L | 0.05   | 200.8  | 03/12/07 03:52 | SLS | 100.0 |  |
| Cadmium, TCLP  | Not detected | mg/L | 0.005  | 200.8  | 03/12/07 03:52 | SLS | 1.0   |  |
| Chromium, TCLP | Not detected | mg/L | 0.05   | 200.8  | 03/12/07 03:52 | SLS | 5.0   |  |
| Lead, TCLP     | 0.03         | mg/L | 0.03   | 200.8  | 03/12/07 03:52 | SLS | 5.0   |  |
| Mercury, TCLP  | Not detected | mg/L | 0.0025 | 245.1M | 03/06/07 15:04 | JRT | 0.2   |  |
| Selenium, TCLP | Not detected | mg/L | 0.05   | 200.8  | 03/12/07 03:52 | SLS | 1.0   |  |
| Silver, TCLP   | Not detected | mg/L | 0.005  | 200.8  | 03/12/07 03:52 | SLS | 5.0   |  |

### Organics - PCBs/Pesticides

#### PCB List

|          |              |       |       |      |                |      |  |  |
|----------|--------------|-------|-------|------|----------------|------|--|--|
| PCB-1016 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 10:29 | JANB |  |  |
| PCB-1242 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 10:29 | JANB |  |  |
| PCB-1221 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 10:29 | JANB |  |  |
| PCB-1232 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 10:29 | JANB |  |  |
| PCB-1248 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 10:29 | JANB |  |  |
| PCB-1254 | 6,000        | ug/kg | 1,000 | 8082 | 03/07/07 10:29 | JANB |  |  |
| PCB-1260 | Not detected | ug/kg | 1,000 | 8082 | 03/07/07 10:29 | JANB |  |  |

### Organics - Semi-Volatiles

#### Semi-Volatile Organics - MDEQ

|                            |              |       |         |       |                |     |  |    |
|----------------------------|--------------|-------|---------|-------|----------------|-----|--|----|
| Acenaphthene               | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:56 | ARH |  | XT |
| Acenaphthylene             | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:56 | ARH |  | XT |
| Anthracene                 | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:56 | ARH |  | XT |
| Benzo(a)anthracene         | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:56 | ARH |  | XT |
| Benzo(b)fluoranthene       | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:56 | ARH |  | XT |
| Benzo(k)fluoranthene       | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:56 | ARH |  | XT |
| Benzo(ghi)perylene         | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:56 | ARH |  | XT |
| Benzo(a)pyrene             | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:56 | ARH |  | XT |
| bis(2-Chloroethoxy)methane | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 21:56 | ARH |  | XT |

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.05 (continued)

Sample Tag: QPTW-10

| Analysis                                         | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|--------------------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Semi-Volatiles (continued)</b>     |              |       |         |        |                |         |        |       |
| <b>Semi-Volatile Organics - MDEQ (continued)</b> |              |       |         |        |                |         |        |       |
| bis(2-Chloroethyl)ether                          | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| bis(2-Chloroisopropyl)ether                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| bis(2-Ethylhexyl)phthalate                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 4-Bromophenyl phenyl ether                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Butyl benzyl phthalate                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 4-Chloroaniline                                  | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 2-Chloronaphthalene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 4-Chloro-3-methylphenol                          | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 2-Chlorophenol                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 4-Chlorophenyl phenyl ether                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Chrysene                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| p,m-Cresol                                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| o-Cresol                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Dibenzo(ah)anthracene                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Dibenzofuran                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| di-n-Butyl phthalate                             | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 1,2-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 1,3-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 1,4-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 3,3'-Dichlorobenzidine                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 2,4-Dichlorophenol                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Diethyl phthalate                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 2,4-Dimethylphenol                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Dimethyl phthalate                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 4,6-Dinitro-2-methylphenol                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 2,4-Dinitrophenol                                | Not detected | ug/kg | 700,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 2,4-Dinitrotoluene                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 2,6-Dinitrotoluene                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 1,2-Diphenylhydrazine                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| di-n-Octyl phthalate                             | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Fluoranthene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Fluorene                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Hexachlorobenzene                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Hexachlorobutadiene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Hexachlorocyclopentadiene                        | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Hexachloroethane                                 | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Indeno(1,2,3-cd)pyrene                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Isophorone                                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 2-Methylnaphthalene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Naphthalene                                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 2-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 3-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 4-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Nitrobenzene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 2-Nitrophenol                                    | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 4-Nitrophenol                                    | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| N-Nitrosodiphenylamine                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| N-Nitrosodi-n-propylamine                        | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.05 (continued)

Sample Tag: QPTW-10

| Analysis                                         | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|--------------------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Semi-Volatiles (continued)</b>     |              |       |         |        |                |         |        |       |
| <b>Semi-Volatile Organics - MDEQ (continued)</b> |              |       |         |        |                |         |        |       |
| Pentachlorophenol                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Phenanthrene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Phenol                                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| Pyrene                                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 1,2,4-Trichlorobenzene                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 2,4,5-Trichlorophenol                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| 2,4,6-Trichlorophenol                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 21:56 | ARH     |        | XT    |
| <b>Organics - Volatiles</b>                      |              |       |         |        |                |         |        |       |
| <b>Volatile Organics</b>                         |              |       |         |        |                |         |        |       |
| Benzene                                          | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Bromodichloromethane                             | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Bromoform                                        | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Bromomethane                                     | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| n-Butylbenzene                                   | 800          | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| sec-Butylbenzene                                 | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| tert-Butylbenzene                                | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Carbon tetrachloride                             | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Chlorobenzene                                    | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Chloroethane                                     | Not detected | ug/kg | 3,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Chloroform                                       | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Chloromethane                                    | Not detected | ug/kg | 3,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Dibromochloromethane                             | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,2-Dichlorobenzene                              | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,3-Dichlorobenzene                              | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,4-Dichlorobenzene                              | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,1-Dichloroethane                               | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,2-Dichloroethane                               | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,1-Dichloroethene                               | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| cis-1,2-Dichloroethene                           | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| trans-1,2-Dichloroethene                         | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,2-Dichloropropane                              | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| cis-1,3-Dichloropropene                          | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| trans-1,3-Dichloropropene                        | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Ethylbenzene                                     | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Isopropylbenzene                                 | Not detected | ug/kg | 3,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| p-Isopropyltoluene                               | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Methylene chloride                               | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Naphthalene                                      | Not detected | ug/kg | 3,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| n-Propylbenzene                                  | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Styrene                                          | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,1,2,2-Tetrachloroethane                        | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Tetrachloroethene                                | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Toluene                                          | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,1,1-Trichloroethane                            | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,1,2-Trichloroethane                            | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Trichloroethene                                  | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,2,4-Trimethylbenzene                           | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:00 | JGH     |        | X     |

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.05 (continued)

Sample Tag: QPTW-10

| Analysis                                | Results      | Units | RDL    | Method | Run Date/Time  | Analyst | Limits | Flags |
|-----------------------------------------|--------------|-------|--------|--------|----------------|---------|--------|-------|
| <b>Organics - Volatiles (continued)</b> |              |       |        |        |                |         |        |       |
| <b>Volatile Organics (continued)</b>    |              |       |        |        |                |         |        |       |
| 1,3,5-Trimethylbenzene                  | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Vinyl chloride                          | Not detected | ug/kg | 500    | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| o-Xylene                                | Not detected | ug/kg | 500    | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| p,m-Xylene                              | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Acetone                                 | Not detected | ug/kg | 10,000 | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 2-Butanone (MEK)                        | Not detected | ug/kg | 8,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Carbon disulfide                        | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 2-Hexanone                              | Not detected | ug/kg | 30,000 | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 4-Methyl-2-pentanone (MIBK)             | Not detected | ug/kg | 30,000 | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| tert-Methyl butyl ether (MTBE)          | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,1,1,2-Tetrachloroethane               | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,2,3-Trichlorobenzene                  | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,2,3-Trichloropropane                  | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,2,4-Trichlorobenzene                  | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,2-Dibromo-3-chloropropane             | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,2-Dibromoethane                       | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,4-Dichloro-2-butene                   | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 2-Methylnaphthalene                     | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Acrylonitrile                           | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Bromobenzene                            | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Bromochloromethane                      | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Dibromomethane                          | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Dichlorodifluoromethane                 | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Diethyl ether                           | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Hexachloroethane                        | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Methyl iodide                           | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Tetrahydrofuran                         | Not detected | ug/kg | 10,000 | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| Trichlorofluoromethane                  | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |
| 1,2,3-Trimethylbenzene                  | 1,000        | ug/kg | 1,000  | 8260B  | 03/07/07 16:00 | JGH     |        | X     |

X-Elevated reporting limit due to matrix interference



# Analytical Laboratory Report

Lab Sample ID: S30993.06  
Sample Tag: QPTW-13  
Collected Date/Time: 03/01/2007  
Matrix: Oil  
COC Reference: 036395

## Sample Containers

| # | Type       | Preservative(s) | Refrigerated? | Arrival Temp. (C) | Thermometer # |
|---|------------|-----------------|---------------|-------------------|---------------|
| 1 | 4oz. Glass | None            | Yes           | 4.7               | IR            |

| Analysis | Results | Units | RDL | Method | Run Date/Time | Analyst | Limits | Flags |
|----------|---------|-------|-----|--------|---------------|---------|--------|-------|
|----------|---------|-------|-----|--------|---------------|---------|--------|-------|

### Extraction / Prep.

|                   |           |  |  |       |                |     |  |  |
|-------------------|-----------|--|--|-------|----------------|-----|--|--|
| BNA Extraction    | Completed |  |  | 3550B | 03/05/07 20:20 | EMR |  |  |
| Extraction, PCB   | Completed |  |  | 3550B | 03/06/07 13:05 | TAS |  |  |
| Mercury Digestion | Completed |  |  | 7470A | 03/06/07 11:00 | JRT |  |  |
| Metal Digestion   | Completed |  |  | 3015A | 03/12/07 12:00 | SLS |  |  |

### TCLP Extraction

|                  |       |  |  |      |                |     |  |  |
|------------------|-------|--|--|------|----------------|-----|--|--|
| % Solids         | <0.5% |  |  | 1311 | 03/05/07 13:42 | LBR |  |  |
| Sample Used g    | <0.5% |  |  | 1311 | 03/05/07 13:42 | LBR |  |  |
| Final Volume mL  | <0.5% |  |  | 1311 | 03/05/07 13:42 | LBR |  |  |
| Final Extract pH | <0.5% |  |  | 1311 | 03/05/07 13:42 | LBR |  |  |

### Metals

|                |              |      |        |        |                |     |       |  |
|----------------|--------------|------|--------|--------|----------------|-----|-------|--|
| Arsenic, TCLP  | Not detected | mg/L | 0.03   | 200.8  | 03/12/07 03:55 | SLS | 5.0   |  |
| Barium, TCLP   | 0.10         | mg/L | 0.05   | 200.8  | 03/12/07 03:55 | SLS | 100.0 |  |
| Cadmium, TCLP  | 0.014        | mg/L | 0.005  | 200.8  | 03/12/07 03:55 | SLS | 1.0   |  |
| Chromium, TCLP | 0.05n        | mg/L | 0.05   | 200.8  | 03/12/07 03:55 | SLS | 5.0   |  |
| Lead, TCLP     | Not detected | mg/L | 0.03   | 200.8  | 03/12/07 03:55 | SLS | 5.0   |  |
| Mercury, TCLP  | Not detected | mg/L | 0.0025 | 245.1M | 03/06/07 15:06 | JRT | 0.2   |  |
| Selenium, TCLP | Not detected | mg/L | 0.05   | 200.8  | 03/12/07 03:55 | SLS | 1.0   |  |
| Silver, TCLP   | Not detected | mg/L | 0.005  | 200.8  | 03/12/07 03:55 | SLS | 5.0   |  |

### Organics - PCBs/Pesticides

#### PCB List

|          |              |       |       |      |                |      |  |  |
|----------|--------------|-------|-------|------|----------------|------|--|--|
| PCB-1016 | Not detected | ug/kg | 1,000 | 8082 | 03/08/07 11:28 | JANB |  |  |
| PCB-1242 | Not detected | ug/kg | 1,000 | 8082 | 03/08/07 11:28 | JANB |  |  |
| PCB-1221 | Not detected | ug/kg | 1,000 | 8082 | 03/08/07 11:28 | JANB |  |  |
| PCB-1232 | Not detected | ug/kg | 1,000 | 8082 | 03/08/07 11:28 | JANB |  |  |
| PCB-1248 | Not detected | ug/kg | 1,000 | 8082 | 03/08/07 11:28 | JANB |  |  |
| PCB-1254 | 4,000        | ug/kg | 1,000 | 8082 | 03/08/07 11:28 | JANB |  |  |
| PCB-1260 | Not detected | ug/kg | 1,000 | 8082 | 03/08/07 11:28 | JANB |  |  |

### Organics - Semi-Volatiles

#### Semi-Volatile Organics - MDEQ

|                            |              |       |         |       |                |     |  |    |
|----------------------------|--------------|-------|---------|-------|----------------|-----|--|----|
| Acenaphthene               | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 22:31 | ARH |  | XT |
| Acenaphthylene             | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 22:31 | ARH |  | XT |
| Anthracene                 | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 22:31 | ARH |  | XT |
| Benzo(a)anthracene         | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 22:31 | ARH |  | XT |
| Benzo(b)fluoranthene       | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 22:31 | ARH |  | XT |
| Benzo(k)fluoranthene       | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 22:31 | ARH |  | XT |
| Benzo(ghi)perylene         | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 22:31 | ARH |  | XT |
| Benzo(a)pyrene             | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 22:31 | ARH |  | XT |
| bis(2-Chloroethoxy)methane | Not detected | ug/kg | 200,000 | 8270C | 03/07/07 22:31 | ARH |  | XT |

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.06 (continued)

Sample Tag: QPTW-13

| Analysis                                         | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|--------------------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Semi-Volatiles (continued)</b>     |              |       |         |        |                |         |        |       |
| <b>Semi-Volatile Organics - MDEQ (continued)</b> |              |       |         |        |                |         |        |       |
| bis(2-Chloroethyl)ether                          | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| bis(2-Chloroisopropyl)ether                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| bis(2-Ethylhexyl)phthalate                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 4-Bromophenyl phenyl ether                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Butyl benzyl phthalate                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 4-Chloroaniline                                  | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 2-Chloronaphthalene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 4-Chloro-3-methylphenol                          | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 2-Chlorophenol                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 4-Chlorophenyl phenyl ether                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Chrysene                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| p,m-Cresol                                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| o-Cresol                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Dibenzo(ah)anthracene                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Dibenzofuran                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| di-n-Butyl phthalate                             | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 1,2-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 1,3-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 1,4-Dichlorobenzene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 3,3'-Dichlorobenzidine                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 2,4-Dichlorophenol                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Diethyl phthalate                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 2,4-Dimethylphenol                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Dimethyl phthalate                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 4,6-Dinitro-2-methylphenol                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 2,4-Dinitrophenol                                | Not detected | ug/kg | 800,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 2,4-Dinitrotoluene                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 2,6-Dinitrotoluene                               | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 1,2-Diphenylhydrazine                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| di-n-Octyl phthalate                             | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Fluoranthene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Fluorene                                         | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Hexachlorobenzene                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Hexachlorobutadiene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Hexachlorocyclopentadiene                        | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Hexachloroethane                                 | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Indeno(1,2,3-cd)pyrene                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Isophorone                                       | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 2-Methylnaphthalene                              | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Naphthalene                                      | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 2-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 3-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 4-Nitroaniline                                   | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Nitrobenzene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 2-Nitrophenol                                    | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 4-Nitrophenol                                    | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| N-Nitrosodiphenylamine                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| N-Nitrosodi-n-propylamine                        | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.06 (continued)

Sample Tag: QPTW-13

| Analysis                                         | Results      | Units | RDL     | Method | Run Date/Time  | Analyst | Limits | Flags |
|--------------------------------------------------|--------------|-------|---------|--------|----------------|---------|--------|-------|
| <b>Organics - Semi-Volatiles (continued)</b>     |              |       |         |        |                |         |        |       |
| <b>Semi-Volatile Organics - MDEQ (continued)</b> |              |       |         |        |                |         |        |       |
| Pentachlorophenol                                | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Phenanthrene                                     | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Phenol                                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| Pyrene                                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 1,2,4-Trichlorobenzene                           | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 2,4,5-Trichlorophenol                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| 2,4,6-Trichlorophenol                            | Not detected | ug/kg | 200,000 | 8270C  | 03/07/07 22:31 | ARH     |        | XT    |
| <b>Organics - Volatiles</b>                      |              |       |         |        |                |         |        |       |
| <b>Volatile Organics</b>                         |              |       |         |        |                |         |        |       |
| Benzene                                          | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Bromodichloromethane                             | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Bromoform                                        | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Bromomethane                                     | Not detected | ug/kg | 2,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| n-Butylbenzene                                   | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| sec-Butylbenzene                                 | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| tert-Butylbenzene                                | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Carbon tetrachloride                             | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Chlorobenzene                                    | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Chloroethane                                     | Not detected | ug/kg | 3,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Chloroform                                       | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Chloromethane                                    | Not detected | ug/kg | 3,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Dibromochloromethane                             | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,2-Dichlorobenzene                              | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,3-Dichlorobenzene                              | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,4-Dichlorobenzene                              | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,1-Dichloroethane                               | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,2-Dichloroethane                               | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,1-Dichloroethene                               | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| cis-1,2-Dichloroethene                           | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| trans-1,2-Dichloroethene                         | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,2-Dichloropropane                              | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| cis-1,3-Dichloropropene                          | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| trans-1,3-Dichloropropene                        | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Ethylbenzene                                     | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Isopropylbenzene                                 | Not detected | ug/kg | 3,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| p-Isopropyltoluene                               | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Methylene chloride                               | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Naphthalene                                      | Not detected | ug/kg | 3,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| n-Propylbenzene                                  | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Styrene                                          | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,1,2,2-Tetrachloroethane                        | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Tetrachloroethene                                | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Toluene                                          | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,1,1-Trichloroethane                            | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,1,2-Trichloroethane                            | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Trichloroethene                                  | Not detected | ug/kg | 500     | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,2,4-Trimethylbenzene                           | Not detected | ug/kg | 1,000   | 8260B  | 03/07/07 16:19 | JGH     |        | X     |

X-Elevated reporting limit due to matrix interference T-No correction for total solids



# Analytical Laboratory Report

Lab Sample ID: S30993.06 (continued)

Sample Tag: QPTW-13

| Analysis                                | Results      | Units | RDL    | Method | Run Date/Time  | Analyst | Limits | Flags |
|-----------------------------------------|--------------|-------|--------|--------|----------------|---------|--------|-------|
| <b>Organics - Volatiles (continued)</b> |              |       |        |        |                |         |        |       |
| <b>Volatile Organics (continued)</b>    |              |       |        |        |                |         |        |       |
| 1,3,5-Trimethylbenzene                  | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Vinyl chloride                          | Not detected | ug/kg | 500    | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| o-Xylene                                | Not detected | ug/kg | 500    | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| p,m-Xylene                              | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Acetone                                 | Not detected | ug/kg | 10,000 | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 2-Butanone (MEK)                        | Not detected | ug/kg | 8,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Carbon disulfide                        | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 2-Hexanone                              | Not detected | ug/kg | 30,000 | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 4-Methyl-2-pentanone (MIBK)             | Not detected | ug/kg | 30,000 | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| tert-Methyl butyl ether (MTBE)          | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,1,1,2-Tetrachloroethane               | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,2,3-Trichlorobenzene                  | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,2,3-Trichloropropane                  | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,2,4-Trichlorobenzene                  | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,2-Dibromo-3-chloropropane             | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,2-Dibromoethane                       | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,4-Dichloro-2-butene                   | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 2-Methylnaphthalene                     | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Acrylonitrile                           | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Bromobenzene                            | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Bromochloromethane                      | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Dibromomethane                          | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Dichlorodifluoromethane                 | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Diethyl ether                           | Not detected | ug/kg | 2,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Hexachloroethane                        | Not detected | ug/kg | 3,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Methyl iodide                           | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Tetrahydrofuran                         | Not detected | ug/kg | 10,000 | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| Trichlorofluoromethane                  | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |
| 1,2,3-Trimethylbenzene                  | Not detected | ug/kg | 1,000  | 8260B  | 03/07/07 16:19 | JGH     |        | X     |

X-Elevated reporting limit due to matrix interference

## REPORT TO

|                                   |  |                    |           |
|-----------------------------------|--|--------------------|-----------|
| CONTACT NAME<br><i>Renee Miel</i> |  |                    |           |
| COMPANY<br><i>SMT</i>             |  |                    |           |
| ADDRESS<br><i>77 W. Center</i>    |  |                    |           |
| CITY<br><i>Saginaw</i>            |  | STATE<br><i>MI</i> | ZIP CODE  |
| PHONE NO.                         |  | FAX NO.            | P.O. NO.  |
| E-MAIL ADDRESS                    |  |                    | QUOTE NO. |

## CHAIN OF CUSTODY RECORD

|              |         |                               |          |
|--------------|---------|-------------------------------|----------|
| CONTACT NAME |         | <input type="checkbox"/> SAME |          |
| COMPANY      |         |                               |          |
| ADDRESS      |         |                               |          |
| CITY         |         | STATE                         | ZIP CODE |
| PHONE NO.    | FAX NO. | P.O. NO.                      |          |

## INVOICE TO

|                                          |                                                   |
|------------------------------------------|---------------------------------------------------|
| PROJECT NO./NAME<br>Angelesina Asesano I | SAMPLER(S) - PLEASE PRINT/SIGN NAME<br>SH - (CRA) |
|------------------------------------------|---------------------------------------------------|

TURNAROUND TIME REQUIRED ☐ 24 HR ☐ 48 HR ☐ 72 HR ☐ STANDARD ☐ OTHER

DELIVERABLES REQUIRED ☐ STANDARD ☐ LEVEL II ☐ LEVEL III ☐ OTHER

|              |                             |                        |                 |                     |                    |
|--------------|-----------------------------|------------------------|-----------------|---------------------|--------------------|
| MATRIX CODE: | GW=GROUNDWATER<br>SL=SLUDGE | WW=WASTEWATER<br>O=OIL | S=SOIL<br>A=AIR | L=LIQUID<br>W=WASTE | SD=SOLID<br>M=MISC |
|--------------|-----------------------------|------------------------|-----------------|---------------------|--------------------|

# Containers &amp; Preservatives

| MERIT<br>LAB NO. | YEAR |      | SAMPLE TAG<br>IDENTIFICATION-DESCRIPTION | MATRIX | # OF<br>BOTTLES | NONE | HCL | HNO <sub>3</sub> | H <sub>2</sub> SO <sub>4</sub> | NaOH | NaOH | MACH | OTHER |
|------------------|------|------|------------------------------------------|--------|-----------------|------|-----|------------------|--------------------------------|------|------|------|-------|
|                  | DATE | TIME |                                          |        |                 |      |     |                  |                                |      |      |      |       |
| 3099301          | 1-07 |      | QPTW-1                                   | 0      | 1               | X    |     |                  |                                |      |      |      |       |
| .02              |      |      | " -3                                     | 0      | 1               | X    |     |                  |                                |      |      |      |       |
| .03              |      |      | " -4                                     | 0      | 1               | X    |     |                  |                                |      |      |      |       |
| .04              |      |      | " -5                                     | 0      | 1               | X    |     |                  |                                |      |      |      |       |
| .05              |      |      | " -10                                    | 0      | 1               | X    |     |                  |                                |      |      |      |       |
| .06              |      |      | " -13                                    | 0      | 1               | X    |     |                  |                                |      |      |      |       |

N/C on site  
AT

|                                            |                |      |
|--------------------------------------------|----------------|------|
| RELINQUISHED BY:<br>SIGNATURE/ORGANIZATION | DATE<br>5/5/07 | TIME |
|--------------------------------------------|----------------|------|

|                        |      |      |
|------------------------|------|------|
| RECEIVED BY:           | DATE | TIME |
| SIGNATURE/ORGANIZATION |      |      |

|                                            |      |      |
|--------------------------------------------|------|------|
| RELINQUISHED BY:<br>SIGNATURE/ORGANIZATION | DATE | TIME |
|--------------------------------------------|------|------|

|                                        |      |      |
|----------------------------------------|------|------|
| RECEIVED BY:<br>SIGNATURE/ORGANIZATION | DATE | TIME |
|----------------------------------------|------|------|

|                                            |      |      |
|--------------------------------------------|------|------|
| RELINQUISHED BY:<br>SIGNATURE/ORGANIZATION | DATE | TIME |
|--------------------------------------------|------|------|

|                                        |        |       |
|----------------------------------------|--------|-------|
| RECEIVED BY:<br>SIGNATURE/ORGANIZATION | DATE   | TIME  |
| <i>Barbara Richardson</i>              | 3-5-07 | 11:45 |

|          |                                                                         |          |       |                             |
|----------|-------------------------------------------------------------------------|----------|-------|-----------------------------|
| SEAL NO. | SEAL INTACT<br>YES <input type="checkbox"/> NO <input type="checkbox"/> | INITIALS | NOTES | TEMP. ON ARRIVAL <u>4.7</u> |
|----------|-------------------------------------------------------------------------|----------|-------|-----------------------------|

|          |                                                                         |          |
|----------|-------------------------------------------------------------------------|----------|
| SEAL NO. | SEAL INTACT<br>YES <input type="checkbox"/> NO <input type="checkbox"/> | INITIALS |
|----------|-------------------------------------------------------------------------|----------|

## Appendix E

### LNAPL Transmissivity Data

**007878 LNAPL TRANSMISSIVITY TESTING: QPTW-1  
RACER MALLEABLE IRON INDUSTRIAL LAND  
SAGINAW, MICHIGAN**

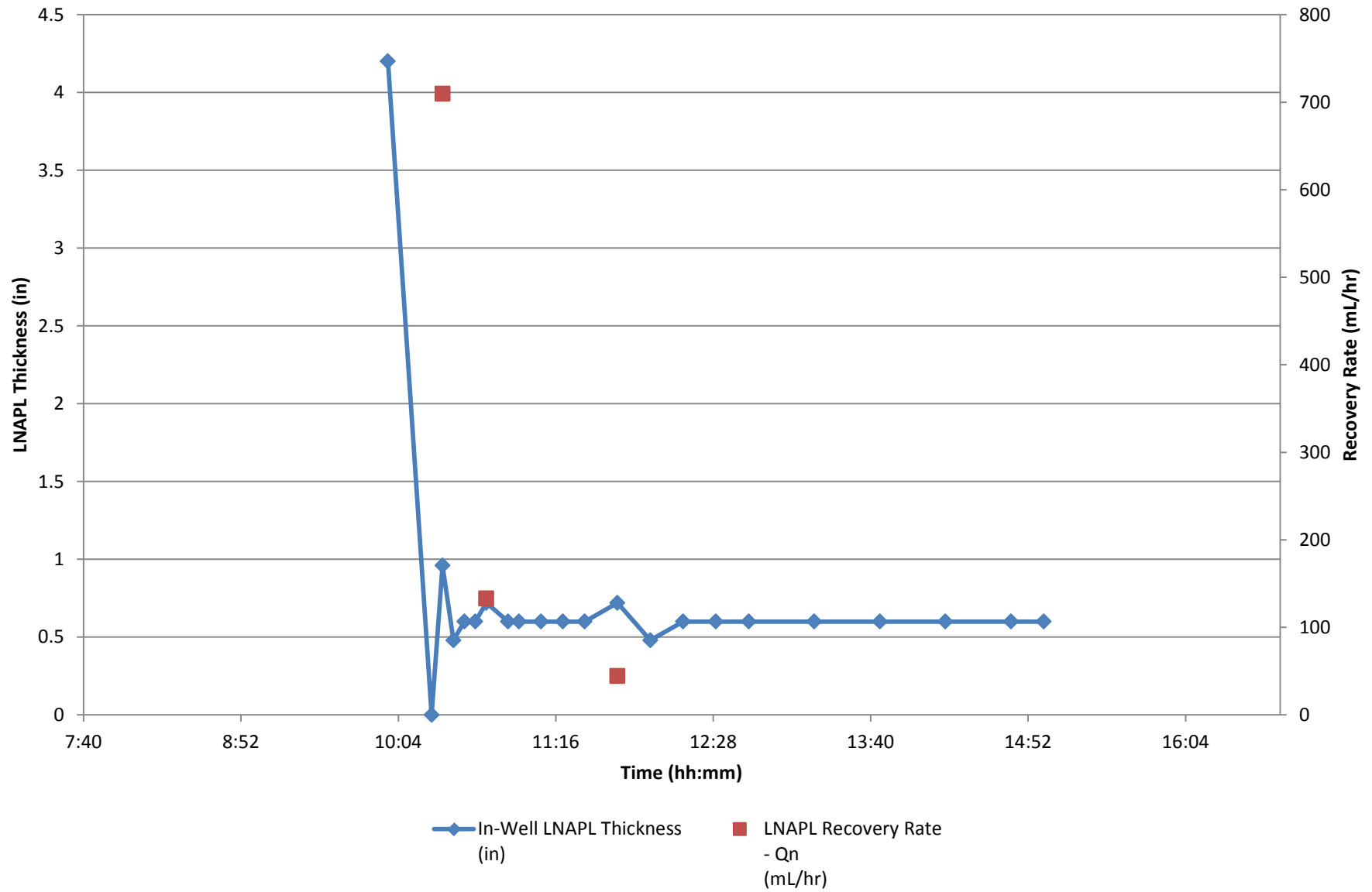
| Day       | Time  | Elapsed Time<br>(hours) | DTP<br>(ft btor) | DTW<br>(ft btor) | In-Well<br>LNAPL Thickness<br>(in) | Volume<br>Removed<br>(fl oz) | Volume<br>Removed<br>(mL) | LNAPL Recovery<br>Rate- $Q_n$<br>(mL/hr) | 25% of<br>Recovery Rate<br>(mL/hr) | Recovery<br>Rate Difference<br>(mL/hr) | LNAPL<br>Drawdown - $S_n$<br>(feet) | LNAPL<br>Recovery Rate - $Q_n$<br>(ft3/hr) | LNAPL<br>Recovery Rate - $Q_n$<br>(ft3/day) |
|-----------|-------|-------------------------|------------------|------------------|------------------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------|----------------------------------------|-------------------------------------|--------------------------------------------|---------------------------------------------|
| 4/28/2014 | 10:00 | 0:00                    | 2.77             | 3.12             | 4.20                               |                              |                           |                                          |                                    |                                        |                                     |                                            |                                             |
| 4/28/2014 | 10:20 | 0:00                    | --               | --               | --                                 | 8.0                          | 236.6                     |                                          |                                    |                                        |                                     |                                            |                                             |
| 4/28/2014 | 10:25 | 0:05                    | 3.18             | 3.26             | 0.96                               | 2.0                          | 59.1                      | 709.765                                  | 177.441                            |                                        | 0.41                                | 0.0251                                     | 0.601                                       |
| 4/28/2014 | 10:30 | 0:10                    | 3.29             | 3.33             | 0.48                               |                              |                           |                                          |                                    |                                        | 0.52                                |                                            |                                             |
| 4/28/2014 | 10:35 | 0:15                    | 3.13             | 3.18             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.36                                |                                            |                                             |
| 4/28/2014 | 10:40 | 0:20                    | 3.04             | 3.09             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.27                                |                                            |                                             |
| 4/28/2014 | 10:45 | 0:25                    | 2.99             | 3.05             | 0.72                               | 1.5                          | 44.4                      | 133.081                                  | 33.270                             | 576.684                                | 0.22                                | 0.0047                                     | 0.113                                       |
| 4/28/2014 | 10:55 | 0:35                    | 2.95             | 3.00             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.18                                |                                            |                                             |
| 4/28/2014 | 11:00 | 0:40                    | 2.92             | 2.97             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.15                                |                                            |                                             |
| 4/28/2014 | 11:10 | 0:50                    | 2.87             | 2.92             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.10                                |                                            |                                             |
| 4/28/2014 | 11:20 | 1:00                    | 2.85             | 2.90             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.08                                |                                            |                                             |
| 4/28/2014 | 11:30 | 1:10                    | 2.83             | 2.88             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.06                                |                                            |                                             |
| 4/28/2014 | 11:45 | 1:25                    | 2.81             | 2.87             | 0.72                               | 1.5                          | 44.4                      | 44.360                                   | 11.090                             | 88.721                                 | 0.04                                | 0.0016                                     | 0.038                                       |
| 4/28/2014 | 12:00 | 1:40                    | 2.83             | 2.87             | 0.48                               |                              |                           |                                          |                                    |                                        | 0.06                                |                                            |                                             |
| 4/28/2014 | 12:15 | 1:55                    | 2.80             | 2.85             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.03                                |                                            |                                             |
| 4/28/2014 | 12:30 | 2:10                    | 2.79             | 2.84             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.02                                |                                            |                                             |
| 4/28/2014 | 12:45 | 2:25                    | 2.79             | 2.84             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.02                                |                                            |                                             |
| 4/28/2014 | 13:15 | 2:55                    | 2.78             | 2.83             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.01                                |                                            |                                             |
| 4/28/2014 | 13:45 | 3:25                    | 2.77             | 2.82             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.00                                |                                            |                                             |
| 4/28/2014 | 14:15 | 3:55                    | 2.77             | 2.82             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.00                                |                                            |                                             |
| 4/28/2014 | 14:45 | 4:25                    | 2.77             | 2.82             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.00                                |                                            |                                             |
| 4/28/2014 | 15:00 | 4:40                    | 2.77             | 2.82             | 0.60                               |                              |                           |                                          |                                    |                                        | 0.00                                |                                            |                                             |

Inputs **0.09** **0.038**

LNAPL Transmissivity -  $T_n$  (ft<sup>2</sup>/day) **0.31**

(Note: final LNAPL recovery rate used in estimate)

007878 LNAPL Transmissivity Testing: QPTW-1 (4/28/14)  
RACER Malleable Iron Industrial Land  
Saginaw, Michigan



**007878 LNAPL TRANSMISSIVITY TESTING: QP-2  
RACER MALLEABLE IRON INDUSTRIAL LAND  
SAGINAW, MICHIGAN**

| Day       | Time  | ElapsedTime<br>(hours) | DTP<br>(ft btor) | DTW<br>(ft btor) | In-Well<br>LNAPL Thickness<br>(in) | Volume<br>Removed<br>(fl oz) | Volume<br>Removed<br>(mL) | LNAPL Recovery<br>Rate- $Q_n$<br>(mL/hr) | 25% of<br>Recovery Rate<br>(mL/hr) | Recovery<br>Rate Difference<br>(mL/hr) | LNAPL<br>Drawdown - $S_n$<br>(feet) | LNAPL<br>Recovery Rate - $Q_n$<br>(ft <sup>3</sup> /hr) | LNAPL<br>Recovery Rate - $Q_n$<br>(ft <sup>3</sup> /day) |
|-----------|-------|------------------------|------------------|------------------|------------------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------|----------------------------------------|-------------------------------------|---------------------------------------------------------|----------------------------------------------------------|
| 7/31/2014 | 8:00  | 0:00                   | 5.55             | 6.16             | 7.32                               | 48.0                         |                           |                                          |                                    |                                        |                                     |                                                         |                                                          |
| 7/31/2014 | 8:05  | 0:05                   | --               | --               | --                                 |                              |                           |                                          |                                    |                                        |                                     |                                                         |                                                          |
| 7/31/2014 | 8:15  | 0:15                   | 5.99             | 6.20             | 2.52                               | 16.0                         | 473.2                     | 2839.059                                 |                                    |                                        | 0.44                                | 0.1002                                                  | 2.406                                                    |
| 7/31/2014 | 8:25  | 0:25                   | 6.08             | 6.22             | 1.68                               | 12.0                         | 354.9                     | 2129.294                                 | 532.324                            |                                        | 0.53                                | 0.0752                                                  | 1.804                                                    |
| 7/31/2014 | 8:35  | 0:35                   | 5.98             | 6.09             | 1.32                               | 8.0                          | 236.6                     | 1419.529                                 | 354.882                            | 709.765                                | 0.43                                | 0.0501                                                  | 1.203                                                    |
| 7/31/2014 | 8:45  | 0:45                   | 5.91             | 6.00             | 1.08                               |                              |                           |                                          |                                    |                                        | 0.36                                |                                                         |                                                          |
| 7/31/2014 | 8:50  | 0:50                   | 5.83             | 5.92             | 1.08                               |                              |                           |                                          |                                    |                                        | 0.28                                |                                                         |                                                          |
| 7/31/2014 | 8:55  | 0:55                   | 5.79             | 5.89             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.24                                |                                                         |                                                          |
| 7/31/2014 | 9:00  | 1:00                   | 5.76             | 5.86             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.21                                |                                                         |                                                          |
| 7/31/2014 | 9:05  | 1:05                   | 5.73             | 5.84             | 1.32                               | 8.0                          | 236.6                     | 473.176                                  | 118.294                            | 946.353                                | 0.18                                | 0.0167                                                  | 0.401                                                    |
| 7/31/2014 | 9:15  | 1:15                   | 5.73             | 5.85             | 1.44                               |                              |                           |                                          |                                    |                                        | 0.18                                |                                                         |                                                          |
| 7/31/2014 | 9:30  | 1:30                   | 5.70             | 5.80             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.15                                |                                                         |                                                          |
| 7/31/2014 | 9:45  | 1:45                   | 5.68             | 5.78             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.13                                |                                                         |                                                          |
| 7/31/2014 | 10:00 | 2:00                   | 5.67             | 5.77             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.12                                |                                                         |                                                          |
| 7/31/2014 | 10:15 | 2:15                   | 5.66             | 5.76             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.11                                |                                                         |                                                          |
| 7/31/2014 | 10:30 | 2:30                   | 5.66             | 5.76             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.11                                |                                                         |                                                          |
| 7/31/2014 | 11:00 | 3:00                   | 5.66             | 5.76             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.11                                |                                                         |                                                          |
| 7/31/2014 | 11:30 | 3:30                   | 5.65             | 5.75             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.10                                |                                                         |                                                          |
| 7/31/2014 | 12:00 | 4:00                   | 5.65             | 5.75             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.10                                |                                                         |                                                          |
| 7/31/2014 | 12:30 | 4:30                   | 5.65             | 5.75             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.10                                |                                                         |                                                          |
| 7/31/2014 | 13:00 | 5:00                   | 5.65             | 5.75             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.10                                |                                                         |                                                          |
| 7/31/2014 | 13:30 | 5:30                   | 5.65             | 5.75             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.10                                |                                                         |                                                          |
| 7/31/2014 | 14:00 | 6:00                   | 5.65             | 5.75             | 1.20                               |                              |                           |                                          |                                    |                                        | 0.10                                |                                                         |                                                          |
| 7/31/2014 | 14:30 | 6:30                   | 5.65             | 5.75             | 1.20                               | 8.0                          | 236.6                     | 43.678                                   | 10.919                             | 43.678                                 | 0.10                                | 0.0015                                                  | 0.037                                                    |
| 7/31/2014 | 15:00 | 7:00                   | 5.72             | 5.80             | 0.96                               |                              |                           |                                          |                                    |                                        | 0.17                                |                                                         |                                                          |
| 7/31/2014 | 15:30 | 7:30                   | 5.68             | 5.77             | 1.08                               |                              |                           |                                          |                                    |                                        | 0.13                                |                                                         |                                                          |
| 7/31/2014 | 16:00 | 8:00                   | 5.67             | 5.76             | 1.08                               | 8.0                          | 236.6                     | 157.725                                  | 39.431                             | 157.725                                | 0.12                                | 0.0056                                                  | 0.134                                                    |
| 7/31/2014 | 16:30 | 8:30                   | 5.70             | 5.78             | 0.96                               |                              |                           |                                          |                                    |                                        | 0.15                                |                                                         |                                                          |
| 7/31/2014 | 17:00 | 9:00                   | 5.67             | 5.76             | 1.08                               |                              |                           |                                          |                                    |                                        | 0.12                                |                                                         |                                                          |

Inputs

0.16

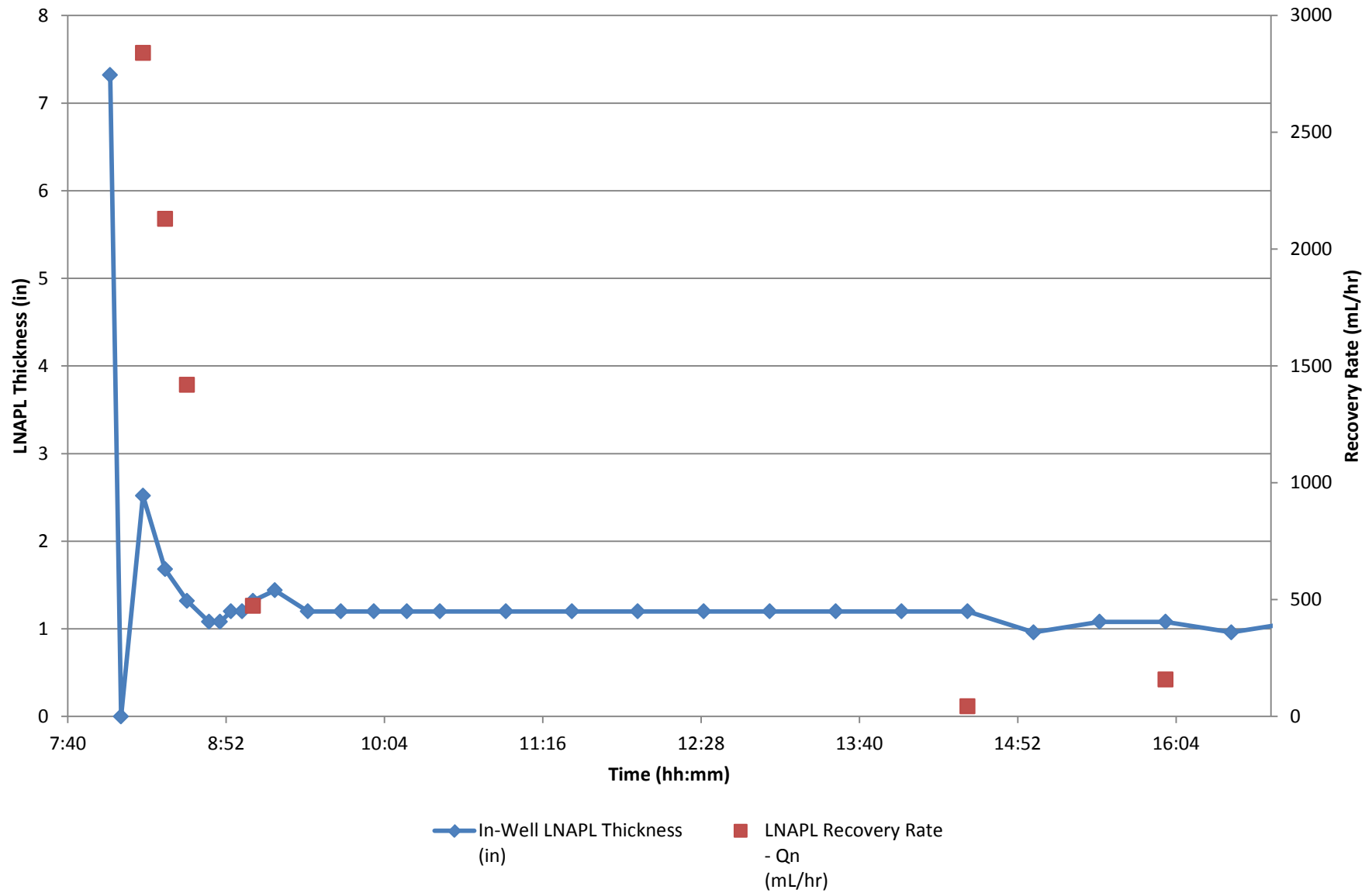
0.085

LNAPL Transmissivity -  $T_n$  (ft<sup>2</sup>/day)

0.39

(Note: Average of last two recovery rates used in estimate)

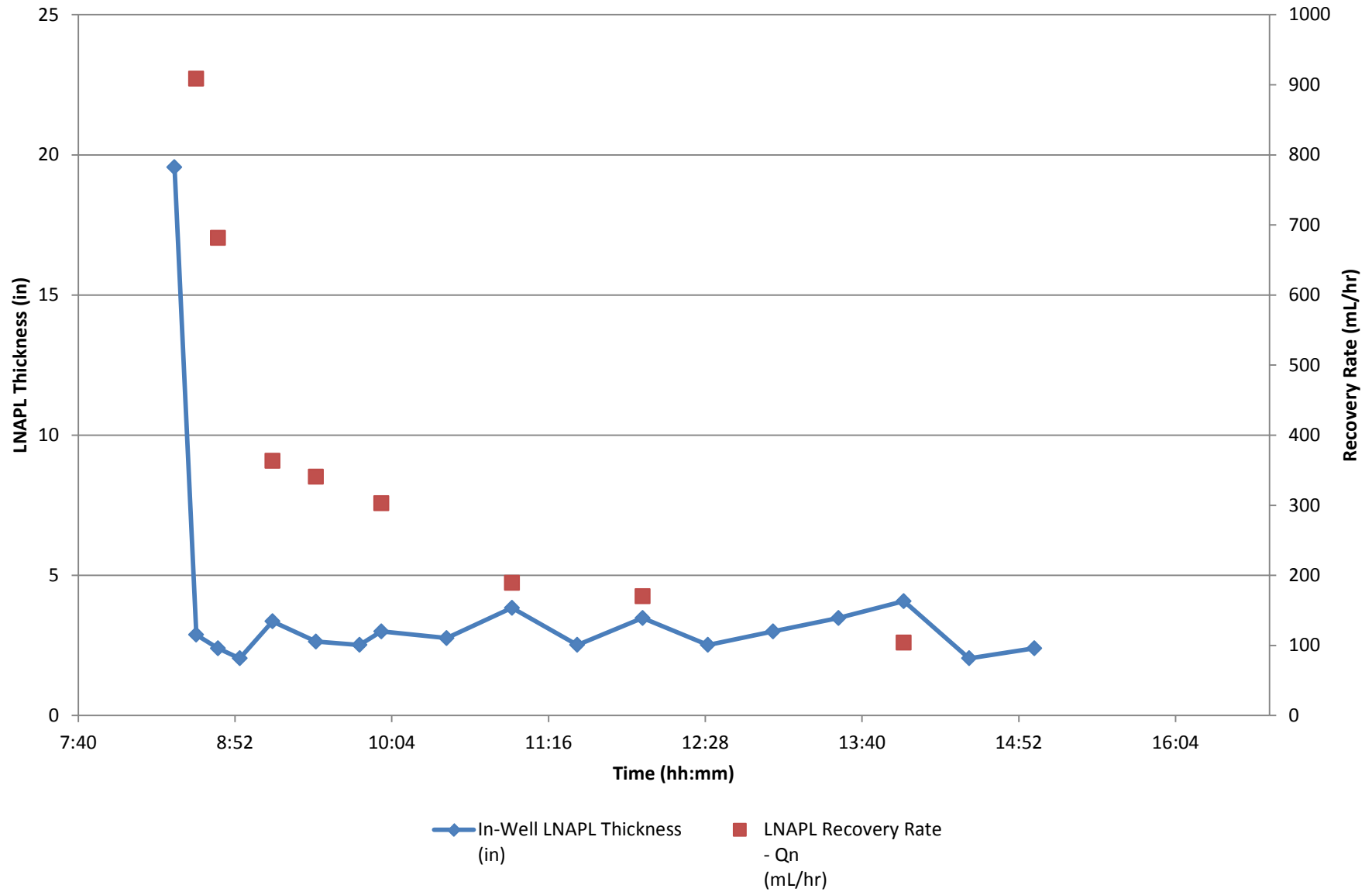
007878 LNAPL Transmissivity Testing: QP-2 (7/31/14)  
RACER Malleable Iron Industrial Land  
Saginaw, Michigan



**007878 LNAPL TRANSMISSIVITY TESTING: QPTW-4  
RACER MALLEABLE IRON INDUSTRIAL LAND  
SAGINAW, MICHIGAN**

| Day                                                 | Time  | Elapsed Time | DTP       | DTW       | In-Well<br>LNAPL Thickness | Volume<br>Removed | Volume<br>Removed | Volume<br>Removed | LNAPL Recovery<br>Rate- $Q_n$ | 25% of<br>Recovery Rate | Recovery<br>Rate Difference | LNAPL<br>Drawdown - $S_n$ | LNAPL Recovery<br>Rate - $Q_n$ |       |
|-----------------------------------------------------|-------|--------------|-----------|-----------|----------------------------|-------------------|-------------------|-------------------|-------------------------------|-------------------------|-----------------------------|---------------------------|--------------------------------|-------|
|                                                     |       | (hours)      | (ft btor) | (ft btor) | (in)                       | (gal)             | (fl oz)           | (mL)              | (mL/hr)                       | (mL/hr)                 | (mL/hr)                     | (feet)                    | (ft <sup>3</sup> /hr)          |       |
| 6/4/2014                                            | 8:25  | 0:00         | 2.44      | 4.07      | 19.56                      | 0.25              | 32.000            | 946.4             |                               |                         |                             |                           |                                |       |
| 6/4/2014                                            | 8:35  | 0:10         | 2.76      | 3.00      | 2.88                       | 0.04              | 5.120             | 151.4             | 908.499                       | 227.125                 |                             | 0.32                      | 0.0321                         | 0.770 |
| 6/4/2014                                            | 8:45  | 0:20         | 2.72      | 2.92      | 2.40                       | 0.03              | 3.840             | 113.6             | 681.374                       | 170.344                 | 227.125                     | 0.28                      | 0.0241                         | 0.577 |
| 6/4/2014                                            | 8:55  | 0:30         | 2.72      | 2.89      | 2.04                       |                   |                   |                   |                               |                         |                             | 0.28                      |                                |       |
| 6/4/2014                                            | 9:10  | 0:45         | 2.68      | 2.96      | 3.36                       | 0.04              | 5.120             | 151.4             | 363.400                       | 90.850                  | 317.975                     | 0.24                      | 0.0128                         | 0.308 |
| 6/4/2014                                            | 9:30  | 1:05         | 2.69      | 2.91      | 2.64                       | 0.03              | 3.840             | 113.6             | 340.687                       | 85.172                  | 22.712                      | 0.25                      | 0.0120                         | 0.289 |
| 6/4/2014                                            | 9:50  | 1:25         | 2.69      | 2.90      | 2.52                       |                   |                   |                   |                               |                         |                             | 0.25                      |                                |       |
| 6/4/2014                                            | 10:00 | 1:35         | 2.69      | 2.94      | 3.00                       | 0.04              | 5.120             | 151.4             | 302.833                       | 75.708                  | 37.854                      | 0.25                      | 0.0107                         | 0.257 |
| 6/4/2014                                            | 10:30 | 2:05         | 2.69      | 2.92      | 2.76                       |                   |                   |                   |                               |                         |                             | 0.25                      |                                |       |
| 6/4/2014                                            | 11:00 | 2:35         | 2.69      | 3.01      | 3.84                       | 0.05              | 6.400             | 189.3             | 189.271                       | 47.318                  | 113.562                     | 0.25                      | 0.0067                         | 0.160 |
| 6/4/2014                                            | 11:30 | 3:05         | 2.70      | 2.91      | 2.52                       |                   |                   |                   |                               |                         |                             | 0.26                      |                                |       |
| 6/4/2014                                            | 12:00 | 3:35         | 2.69      | 2.98      | 3.48                       | 0.05              | 5.760             | 170.3             | 170.344                       | 42.586                  | 18.927                      | 0.25                      | 0.0060                         | 0.144 |
| 6/4/2014                                            | 12:30 | 4:05         | 2.70      | 2.91      | 2.52                       |                   |                   |                   |                               |                         |                             | 0.26                      |                                |       |
| 6/4/2014                                            | 13:00 | 4:35         | 2.69      | 2.94      | 3.00                       |                   |                   |                   |                               |                         |                             | 0.25                      |                                |       |
| 6/4/2014                                            | 13:30 | 5:05         | 2.68      | 2.97      | 3.48                       |                   |                   |                   |                               |                         |                             | 0.24                      |                                |       |
| 6/4/2014                                            | 14:00 | 5:35         | 2.67      | 3.01      | 4.08                       | 0.06              | 7.040             | 208.2             | 104.099                       | 26.025                  | 66.245                      | 0.23                      | 0.0037                         | 0.088 |
| 6/4/2014                                            | 14:30 | 6:05         | 2.69      | 2.86      | 2.04                       |                   |                   |                   |                               |                         |                             | 0.25                      |                                |       |
| 6/4/2014                                            | 15:00 | 6:35         | 2.68      | 2.88      | 2.40                       |                   |                   |                   |                               |                         |                             | 0.24                      |                                |       |
| Inputs                                              |       |              |           |           |                            |                   |                   |                   |                               |                         |                             | 0.26                      | 0.088                          |       |
| LNAPL Transmissivity - $T_n$ (ft <sup>2</sup> /day) |       |              |           |           |                            |                   |                   |                   |                               |                         |                             |                           | 0.25                           |       |
| (Note: final LNAPL recovery rate used in estimate)  |       |              |           |           |                            |                   |                   |                   |                               |                         |                             |                           |                                |       |

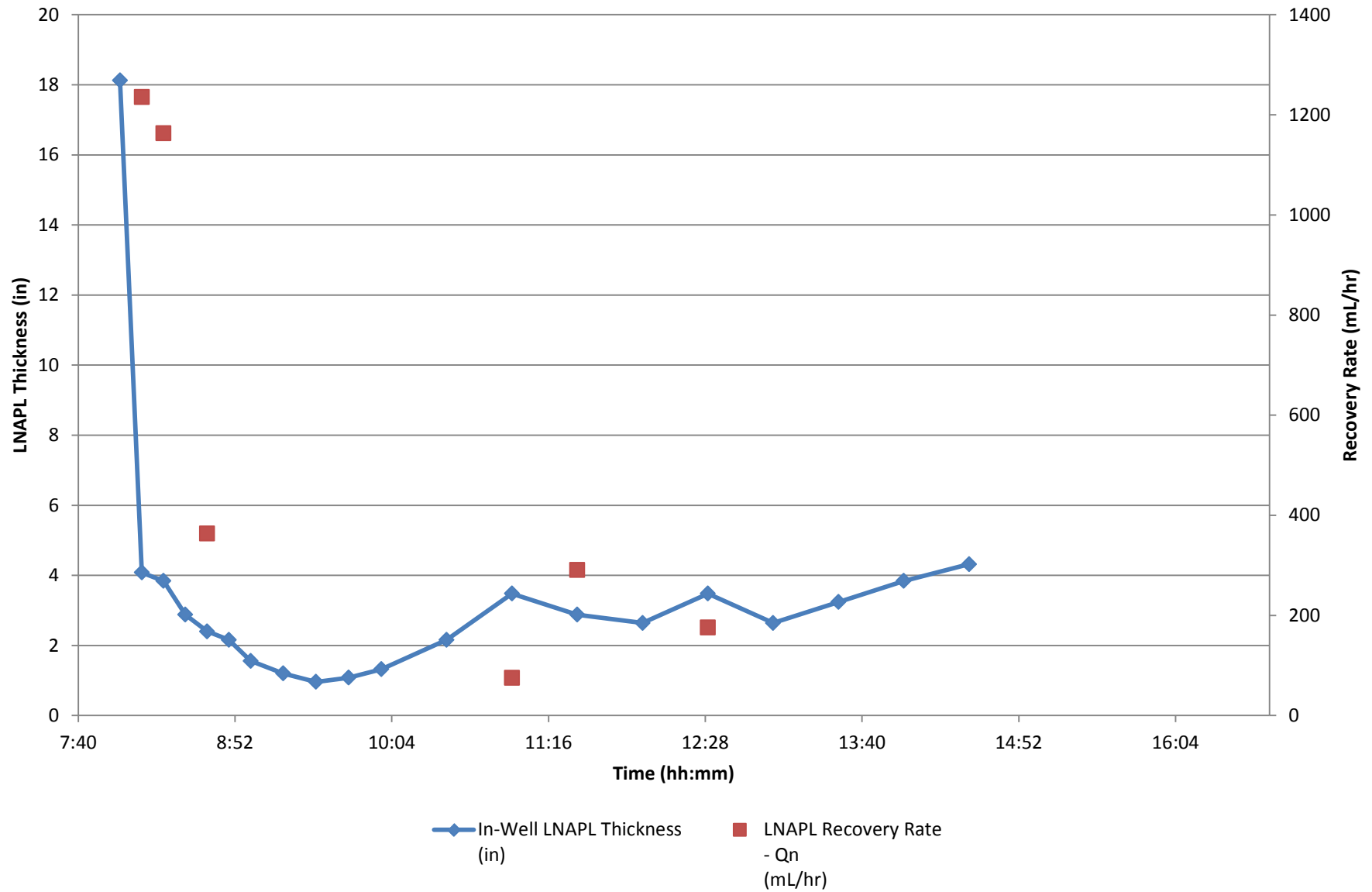
007878 LNAPL Transmissivity Testing: QPTW-4 (6/4/14)  
RACER Malleable Iron Industrial Land  
Saginaw, Michigan



**LNAPL TRANSMISSIVITY TESTING: QPTW-5  
RACER MALLEABLE IRON INDUSTRIAL LAND  
SAGINAW, MICHIGAN**

| Day                                                 | Time  | Elapsed Time<br>(hours) | DTP<br>(ft btor) | DTW<br>(ft btor) | In-Well<br>LNAPL Thickness<br>(in) | Volume<br>Removed<br>(gal) | Volume<br>Removed<br>(fl oz) | Volume<br>Removed<br>(mL) | LNAPL Recovery<br>Rate- $Q_n$<br>(mL/hr) | 25% of<br>Recovery Rate<br>(mL/hr) | Recovery Rate<br>Difference<br>(mL/hr) | LNAPL<br>Drawdown - $S_n$<br>(feet) | LNAPL Recovery<br>Rate - $Q_n$<br>(ft <sup>3</sup> /hr) |       |
|-----------------------------------------------------|-------|-------------------------|------------------|------------------|------------------------------------|----------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------|----------------------------------------|-------------------------------------|---------------------------------------------------------|-------|
| 6/19/2014                                           | 8:00  | 0:00                    | 3.37             | 4.88             | 18.12                              | 0.2500                     | 32.000                       | 946.4                     |                                          |                                    |                                        |                                     |                                                         |       |
| 6/19/2014                                           | 8:10  | 0:10                    | 4.02             | 4.36             | 4.08                               | 0.0544                     | 6.963                        | 205.9                     | 1235.558                                 | 308.890                            |                                        | 0.65                                | 0.0436                                                  | 1.047 |
| 6/19/2014                                           | 8:20  | 0:20                    | 3.88             | 4.20             | 3.84                               | 0.0512                     | 6.554                        | 193.8                     | 1162.878                                 | 290.720                            | 72.680                                 | 0.51                                | 0.0411                                                  | 0.985 |
| 6/19/2014                                           | 8:30  | 0:30                    | 3.80             | 4.04             | 2.88                               | 0.0384                     |                              |                           |                                          |                                    |                                        | 0.43                                |                                                         |       |
| 6/19/2014                                           | 8:40  | 0:40                    | 3.80             | 4.00             | 2.40                               | 0.0320                     | 4.096                        | 121.1                     | 363.400                                  | 90.850                             | 799.479                                | 0.43                                | 0.0128                                                  | 0.308 |
| 6/19/2014                                           | 8:50  | 0:50                    | 3.80             | 3.98             | 2.16                               |                            |                              |                           |                                          |                                    |                                        | 0.43                                |                                                         |       |
| 6/19/2014                                           | 9:00  | 1:00                    | 3.71             | 3.84             | 1.56                               |                            |                              |                           |                                          |                                    |                                        | 0.34                                |                                                         |       |
| 6/19/2014                                           | 9:15  | 1:15                    | 3.64             | 3.74             | 1.20                               |                            |                              |                           |                                          |                                    |                                        | 0.27                                |                                                         |       |
| 6/19/2014                                           | 9:30  | 1:30                    | 3.60             | 3.68             | 0.96                               |                            |                              |                           |                                          |                                    |                                        | 0.23                                |                                                         |       |
| 6/19/2014                                           | 9:45  | 1:45                    | 3.58             | 3.67             | 1.08                               |                            |                              |                           |                                          |                                    |                                        | 0.21                                |                                                         |       |
| 6/19/2014                                           | 10:00 | 2:00                    | 3.56             | 3.67             | 1.32                               |                            |                              |                           |                                          |                                    |                                        | 0.19                                |                                                         |       |
| 6/19/2014                                           | 10:30 | 2:30                    | 3.53             | 3.71             | 2.16                               |                            |                              |                           |                                          |                                    |                                        | 0.16                                |                                                         |       |
| 6/19/2014                                           | 11:00 | 3:00                    | 3.51             | 3.80             | 3.48                               | 0.0464                     | 5.939                        | 175.6                     | 75.276                                   | 18.819                             | 288.124                                | 0.14                                | 0.0027                                                  | 0.064 |
| 6/19/2014                                           | 11:30 | 3:30                    | 3.55             | 3.79             | 2.88                               | 0.0384                     | 4.915                        | 145.4                     | 290.720                                  | 72.680                             | 215.444                                | 0.18                                | 0.0103                                                  | 0.246 |
| 6/19/2014                                           | 12:00 | 4:00                    | 3.56             | 3.78             | 2.64                               |                            |                              |                           |                                          |                                    |                                        | 0.19                                |                                                         |       |
| 6/19/2014                                           | 12:30 | 4:30                    | 3.53             | 3.82             | 3.48                               | 0.0464                     | 5.939                        | 175.6                     | 175.643                                  | 43.911                             | 115.077                                | 0.16                                | 0.0062                                                  | 0.149 |
| 6/19/2014                                           | 13:00 | 5:00                    | 3.57             | 3.79             | 2.64                               |                            |                              |                           |                                          |                                    |                                        | 0.20                                |                                                         |       |
| 6/19/2014                                           | 13:30 | 5:30                    | 3.53             | 3.80             | 3.24                               |                            |                              |                           |                                          |                                    |                                        | 0.16                                |                                                         |       |
| 6/19/2014                                           | 14:00 | 6:00                    | 3.51             | 3.83             | 3.84                               |                            |                              |                           |                                          |                                    |                                        | 0.14                                |                                                         |       |
| 6/19/2014                                           | 14:30 | 6:30                    | 3.50             | 3.86             | 4.32                               |                            |                              |                           |                                          |                                    |                                        | 0.13                                |                                                         |       |
| Inputs                                              |       |                         |                  |                  |                                    |                            |                              |                           |                                          |                                    |                                        | 0.24                                | 0.149                                                   |       |
| LNAPL Transmissivity - $T_n$ (ft <sup>2</sup> /day) |       |                         |                  |                  |                                    |                            |                              |                           |                                          |                                    |                                        |                                     | 0.46                                                    |       |
| (Note: final LNAPL recovery rate used in estimate)  |       |                         |                  |                  |                                    |                            |                              |                           |                                          |                                    |                                        |                                     |                                                         |       |

007878 LNAPL Transmissivity Testing: QPTW-5 (6/19/14)  
RACER Malleable Iron Industrial Land  
Saginaw, Michigan



## **Appendix F**

### **Boring/Well Logs**

**Date Start-Finish:** 3/15/97 - 3/15/97  
**Drilling Company:** Carlo Environmental Tech.  
**Driller's Name:** Paul Libby  
**Drilling Method:** Hollow Stem Auger  
**Auger Size:** 4 1/4-in.  
**Rig Type:** Skid Mounted  
**Spoon Size:** 2-in.  
**Hammer Weight:** 140-lb  
**Height of Fall:** 30-in.

**Borehole Depth:** 13.0 ft.

**Geologist:** Gordon Hotchkiss

**Well No.** GPTW-01

**Client:**  
 General Motors Corporation

**Site:**  
 Malleable Iron Plant Property  
 Quench Pit Investigation

| DEPTH                  | ELEVATION | Sample Run Number | Sample/Int./Type | Blows/6 In.      | N  | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                                   | Well Construction                                      |
|------------------------|-----------|-------------------|------------------|------------------|----|----------------|---------------------|-------------------|-----------------|-------------------------------------------------------------|--------------------------------------------------------|
| gs elevation 592.3 ft. |           |                   |                  |                  |    |                |                     |                   |                 | GROUND SURFACE                                              | Flush mount casing with locking well cap.              |
|                        |           |                   |                  | NA               | NA | NA             | NA                  |                   |                 | Concrete.                                                   |                                                        |
| 590                    |           | 1                 |                  | 7<br>5<br>6<br>6 | 11 | 1.2            | 20                  | SP<br>Fill        |                 | Black medium SAND, poorly graded, dry.<br>Black silty CLAY. | Bentonite pellet seal 1.2' to 2.2' bgs.                |
| 5                      |           | 2                 |                  | 3<br>3<br>5<br>5 | 8  | 1.2            | 100                 | SP<br>Fill        |                 | Brown fine Silty SAND, dry.                                 | 2" diameter Sch. 40 PVC well casing 0.35' to 3.2' bgs. |
|                        |           | 3                 |                  | 1<br>1<br>1<br>1 | 2  | 1.5            | 100                 | SP<br>Fill        |                 | Black fine SAND, poorly graded, dry.                        |                                                        |
| 585                    |           | 4                 |                  | 2<br>3<br>3<br>5 | 6  | 1.8            | 90                  | SM                |                 | Gray fine SAND, trace to little Silt, saturated.            | 0.01" Sch. 40 PVC screen 3.2' to 13.2' bgs.            |
| 10                     |           | 5                 |                  | 3<br>3<br>4<br>2 | 7  | 1.5            | 80                  | SM                |                 | Trace shell fragments.                                      |                                                        |
| 580                    |           | 6                 |                  | 1<br>1<br>2<br>3 | 3  | 1.8            | 80                  | SM                |                 | Increased Silt and Clay content.                            | Grade #0 silica sand pack 2.1' to 13.25' bgs.          |
| 15                     |           |                   |                  |                  |    |                |                     |                   |                 | Total depth of boring 13.0' bgs.                            |                                                        |

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 engineers & scientists

**Remarks:**

NA - Not Applicable.

**Water Levels**

| Date / Time | Elevation | Depth |
|-------------|-----------|-------|
|             |           |       |
|             |           |       |
|             |           |       |

**Date Start-Finish:** 3/22/97 - 3/23/97  
**Drilling Company:** Carlo Environmental Tech.  
**Driller's Name:** Paul Libby  
**Drilling Method:** Hollow Stem Auger  
**Auger Size:** 4 1/4-in.  
**Rig Type:** Skid Mounted  
**Spoon Size:** 2-in.  
**Hammer Weight:** 140-lb  
**Height of Fall:** 30-in.

**Borehole Depth:** 21.0 ft.

**Geologist:** Gordon Hotchkiss

**Well No.** GPTW-02

**Client:**  
 General Motors Corporation

**Site:**  
 Malleable Iron Plant Property  
 Quench Pit Investigation

| DEPTH                  | ELEVATION | Sample Run Number | Sample/Int/Type | Blows/6 In.         | N  | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                                         | Well Construction                                       |
|------------------------|-----------|-------------------|-----------------|---------------------|----|----------------|---------------------|-------------------|-----------------|-------------------------------------------------------------------|---------------------------------------------------------|
| gs elevation 592.6 ft. |           |                   |                 |                     |    |                |                     |                   |                 | GROUND SURFACE                                                    | Flush mount casing with locking well cap.               |
|                        |           |                   |                 | NA                  | NA | NA             | NA                  |                   |                 | Concrete.                                                         |                                                         |
| 590                    |           | 1                 |                 | 2<br>2<br>2<br>3    | 4  | 0.5            | 10.0                | SP<br>Fill        |                 | Black fine to medium SAND, poorly graded, dry.                    | Bentonite pellet seal 1.05' to 2.05' bgs.               |
| 5                      |           | 2                 |                 | 3<br>2<br>3<br>2    | 5  | 0.5            | 3.0                 | SP<br>Fill        |                 |                                                                   | 2" diameter Sch. 40 PVC well casing 0.25' to 3.05' bgs. |
|                        |           | 3                 |                 | 1<br>4<br>4<br>4    | 8  | 1.0            | 1.0                 | SP/<br>SM         |                 | Gray fine silty SAND sand, dry.                                   | 0.01" Sch. 40 PVC screen 3.05' to 13.05' bgs.           |
| 585                    |           | 4                 |                 | 12<br>8<br>8<br>8   | 16 | 1.0            | 17.0                | SM/<br>CL         |                 | Saturated.<br>Brown silty CLAY, trace gravel, slightly fractured. |                                                         |
| 10                     |           | 5                 |                 | 8<br>12<br>14<br>26 | 26 | 1.5            | 9.0                 | CL                |                 |                                                                   | Grade #0 silica sand pack 1.3' to 13.1' bgs.            |
|                        |           | 6                 |                 | 4<br>10<br>19<br>23 | 29 | 1.8            | 60                  | CL                |                 | Very stiff to hard.                                               |                                                         |
| 580                    |           | 7                 |                 | 3<br>12<br>18<br>21 | 30 | 1.8            | 20                  | CL                |                 |                                                                   | Backfilled 12.8' to 21.0' bgs with bentonite chips.     |
| 15                     |           |                   |                 |                     |    |                |                     |                   |                 |                                                                   |                                                         |

**Remarks:**

NA - Not Applicable.

**Water Levels**

| Date / Time | Elevation | Depth |
|-------------|-----------|-------|
|             |           |       |
|             |           |       |
|             |           |       |
|             |           |       |

**Site:**

Malleable Iron Plant Property  
Quench Pit Investigation

Well No. GPTW-02

Total Depth = 21.0 ft.

**Client:**

General Motors Corporation

| DEPTH | ELEVATION | Sample Run Number | Sample/Int/Type | Blows/6 In.          | N  | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                       | Well Construction                                                                   |
|-------|-----------|-------------------|-----------------|----------------------|----|----------------|---------------------|-------------------|-----------------|-------------------------------------------------|-------------------------------------------------------------------------------------|
|       |           | 8                 |                 | 14<br>12<br>17<br>19 | 29 | 2.0            | 110                 | CL                |                 | Gray silt in fractures from 15.0' to 21.0' bgs. |  |
|       | 575       | 9                 |                 | 6<br>8<br>12<br>13   | 20 | 2.0            | 120                 | CL                |                 |                                                 |                                                                                     |
| 20    |           | 10                |                 | 7<br>8<br>10<br>11   | 18 | 1.5            | 140                 | CL                |                 |                                                 |                                                                                     |
|       |           |                   |                 |                      |    |                |                     |                   |                 | Total depth of boring 21.0' bgs.                |                                                                                     |
|       | 570       |                   |                 |                      |    |                |                     |                   |                 |                                                 |                                                                                     |
|       | 25        |                   |                 |                      |    |                |                     |                   |                 |                                                 |                                                                                     |
|       | 565       |                   |                 |                      |    |                |                     |                   |                 |                                                 |                                                                                     |
|       | 30        |                   |                 |                      |    |                |                     |                   |                 |                                                 |                                                                                     |
|       | 560       |                   |                 |                      |    |                |                     |                   |                 |                                                 |                                                                                     |
| 35    |           |                   |                 |                      |    |                |                     |                   |                 |                                                 |                                                                                     |



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engineers & scientists

**Remarks:**

| Water Levels |           |       |
|--------------|-----------|-------|
| Date / Time  | Elevation | Depth |
|              |           |       |
|              |           |       |
|              |           |       |

**Date Start-Finish:** 3/15/97 - 3/15/97  
**Drilling Company:** Carlo Environmental Tech.  
**Driller's Name:** Paul Libby  
**Drilling Method:** Hollow Stem Auger  
**Auger Size:** 4 1/4-in.  
**Rig Type:** Skid Mounted  
**Spoon Size:** 2-in.  
**Hammer Weight:** 140-lb  
**Height of Fall:** 30-in.

**Borehole Depth:** 13.0 ft.

**Geologist:** Gordon Hotchkiss

**Well No.** GPTW-03

**Client:**  
 General Motors Corporation

**Site:**  
 Malleable Iron Plant Property  
 Quench Pit Investigation

| DEPTH                  | ELEVATION | Sample Run Number | Sample/Int/Type | Blows/6 In. | N | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                                     | Well Construction                                       |
|------------------------|-----------|-------------------|-----------------|-------------|---|----------------|---------------------|-------------------|-----------------|---------------------------------------------------------------|---------------------------------------------------------|
| gs elevation 592.5 ft. |           |                   |                 |             |   |                |                     |                   |                 |                                                               |                                                         |
|                        |           |                   |                 |             |   |                |                     |                   |                 | GROUND SURFACE                                                | Flush mount casing with locking well cap.               |
|                        |           |                   |                 |             |   |                |                     |                   |                 | Concrete.                                                     |                                                         |
| 590                    |           |                   |                 |             |   |                |                     | SP Fill           |                 | Light brown fine to medium SAND, poorly graded, dry.          | Bentonite pellet seal 1.12' to 2.12' bgs.               |
| 5                      |           |                   |                 |             |   |                |                     | SP Fill           |                 |                                                               | 2" diameter Sch. 40 PVC well casing 0.37' to 3.12' bgs. |
| 585                    |           |                   |                 |             |   |                |                     | SP Fill           |                 | Dark brown fine to medium SAND, slight petroleum odor, moist. |                                                         |
|                        |           |                   |                 |             |   |                |                     | SP Fill           |                 | Saturated, strong petroleum odor.                             | 0.01" Sch. 40 PVC screen 3.12' to 13.12' bgs.           |
| 10                     |           |                   |                 |             |   |                |                     | SP Fill           |                 |                                                               |                                                         |
| 580                    |           |                   |                 |             |   |                |                     | SP Fill           |                 |                                                               | Grade #0 silica sand pack 2.12' to 13.17' bgs.          |
| 15                     |           |                   |                 |             |   |                |                     |                   |                 | Total depth of boring 13.0' bgs.                              |                                                         |

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**Remarks:**

NA - Not Applicable.  
 Could not mobilize/manuever rig to the selected location.  
 Therefore, a hand auger was used to extend the borehole.

| Water Levels |           |       |
|--------------|-----------|-------|
| Date / Time  | Elevation | Depth |
|              |           |       |
|              |           |       |
|              |           |       |

**Date Start-Finish:** 3/16/97 - 3/16/97  
**Drilling Company:** Carlo Environmental Tech.  
**Driller's Name:** Paul Libby  
**Drilling Method:** Hollow Stem Auger  
**Auger Size:** 4 1/4-in.  
**Rig Type:** Skid Mounted  
**Spoon Size:** 2-in.  
**Hammer Weight:** 140-lb  
**Height of Fall:** 30-in.

**Borehole Depth:** 13.0 ft.

**Geologist:** Gordon Hotchkiss

**Well No.** GPTW-04

**Client:**  
 General Motors Corporation

**Site:**  
 Malleable Iron Plant Property  
 Quench Pit Investigation

| DEPTH                  | ELEVATION | Sample Run Number | Sample/Int/Type  | Blows/6 In. | N   | Recovery (ft.) | P10 (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                                    | Well Construction                                       |
|------------------------|-----------|-------------------|------------------|-------------|-----|----------------|---------------------|-------------------|-----------------|--------------------------------------------------------------|---------------------------------------------------------|
| gs elevation 592.3 ft. |           |                   |                  |             |     |                |                     |                   |                 | GROUND SURFACE                                               | Flush mount casing with locking well cap.               |
|                        |           |                   |                  | NA          | NA  | NA             | NA                  |                   |                 | Concrete.                                                    |                                                         |
| 590                    |           |                   |                  | NA          | NA  | NA             | NA                  | SW Fill           |                 | Black medium SAND and slag, dry.                             | Bentonite pellet seal 1.07' to 2.07' bgs.               |
| 5                      |           | 1                 | 1<br>2<br>2      | 3           | 1.0 | 2.0            |                     | SW Fill           |                 |                                                              | 2" diameter Sch. 40 PVC well casing 0.57' to 3.07' bgs. |
|                        |           | 2                 | 2<br>3<br>4<br>4 | 7           | 2.0 | 7.0            |                     | SW Fill/SP        |                 | Black fine SAND, trace silt, poorly graded, dry.             |                                                         |
| 585                    |           | 3                 | 2<br>1<br>2<br>3 | 3           | 1.5 | 13.0           |                     | SP                |                 | Gray silty SAND, poorly graded, saturated, hydrocarbon odor. | 0.01" Sch. 40 PVC screen 3.07' to 13.07' bgs.           |
| 10                     |           | 4                 | 2<br>1<br>2<br>2 | 3           | 1.8 | 2.0            |                     | SM                |                 | Trace shell fragments.                                       |                                                         |
| 580                    |           | 5                 | 3<br>2<br>1<br>1 | 2           | 1.5 | 2.0            |                     | SM                |                 | Increasing clay content.                                     | Grade #0 silica sand pack 2.07' to 13.12' bgs.          |
| 15                     |           |                   |                  |             |     |                |                     |                   |                 | Total depth of boring 13.0' bgs.                             |                                                         |

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 engineers & scientists

**Remarks:**

NA - Not Applicable.

**Water Levels**

| Date / Time | Elevation | Depth |
|-------------|-----------|-------|
|             |           |       |
|             |           |       |
|             |           |       |
|             |           |       |

**Date Start-Finish:** 3/16/97 - 3/16/97  
**Drilling Company:** Carlo Environmental Tech.  
**Driller's Name:** Paul Libby  
**Drilling Method:** Hollow Stem Auger  
**Auger Size:** 4 1/4-in.  
**Rig Type:** Skid Mounted  
**Spoon Size:** 2-in.  
**Hammer Weight:** 140-lb  
**Height of Fall:** 30-in.

**Borehole Depth:** 13.0 ft.

**Geologist:** Gordon Hotchkiss

**Well No.** GPTW-05

**Client:**  
 General Motors Corporation

**Site:**  
 Malleable Iron Plant Property  
 Quench Pit Investigation

| DEPTH                  | ELEVATION | Sample Run Number | Sample/Int/Type | Blows/6 In.      | N  | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                                            | Well Construction                                       |
|------------------------|-----------|-------------------|-----------------|------------------|----|----------------|---------------------|-------------------|-----------------|----------------------------------------------------------------------|---------------------------------------------------------|
| GS elevation 592.4 ft. |           |                   |                 |                  |    |                |                     |                   |                 | GROUND SURFACE                                                       | Flush mount casing with locking well cap.               |
| 590                    |           | 1                 |                 | 1<br>3<br>4<br>5 | 7  | 1.5            | NA                  | SW<br>Fill        |                 | Concrete.                                                            |                                                         |
| 5                      |           | 2                 |                 | 3<br>3<br>3<br>3 | 6  | 1.8            | NA                  | SW<br>Fill        |                 | Black SAND, little Silt, Clay and slag, well graded, dry.            | Bentonite pellet seal 0.97' to 1.97' bgs.               |
|                        |           | 3                 |                 | NA               | NA | 1.8            | NA                  | SW<br>Fill/SP     |                 |                                                                      | 2" diameter Sch. 40 PVC well casing 0.27' to 2.97' bgs. |
| 585                    |           | 4                 |                 | 2<br>2<br>3<br>4 | 5  | 0.8            | NA                  | SP                |                 | Black fine SAND, poorly graded, dry.<br>Moist with hydrocarbon odor. | 0.01" Sch. 40 PVC screen 2.97' to 12.97' bgs.           |
| 10                     |           | 5                 |                 | 2<br>3<br>4<br>4 | 7  | 1.5            | NA                  | SM                |                 | Grey fine to medium SAND, trace to little Silt, and shell fragments. |                                                         |
| 580                    |           | 6                 |                 | 1<br>1<br>1<br>2 | 2  | 1.0            | NA                  | SM                |                 | 1-2" layers of silty Sand and sandy Silt.                            | Grade #0 silica sand pack 1.97' to 13.02' bgs.          |
| 15                     |           |                   |                 |                  |    |                |                     |                   |                 | Total depth of boring 13.0' bgs.                                     |                                                         |

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**Remarks:**

NA - Not Applicable.

| Water Levels |           |       |
|--------------|-----------|-------|
| Date / Time  | Elevation | Depth |
|              |           |       |
|              |           |       |
|              |           |       |
|              |           |       |

**Date Start-Finish:** 3/31/97 - 3/31/97  
**Drilling Company:** Carlo Environmental Tech.  
**Driller's Name:** Paul Libby  
**Drilling Method:** Hollow Stem Auger  
**Auger Size:** 4 1/4-in.  
**Rig Type:** Skid Mounted  
**Spoon Size:** 2-in.  
**Hammer Weight:** 140-lb  
**Height of Fall:** 30-in.

**Borehole Depth:** 21.0 ft.

**Geologist:** Gordon Hotchkiss

**Well No.** GPTW-06

**Client:**  
 General Motors Corporation

**Site:**  
 Malleable Iron Plant Property  
 Quench Pit Investigation

| DEPTH                  | ELEVATION | Sample Run Number | Sample/Int/Type | Blows/6 In.          | N   | Recovery (ft.) | P10 (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                                                | Well Construction                                       |
|------------------------|-----------|-------------------|-----------------|----------------------|-----|----------------|---------------------|-------------------|-----------------|--------------------------------------------------------------------------|---------------------------------------------------------|
| gs elevation 592.4 ft. |           |                   |                 |                      |     |                |                     |                   |                 | GROUND SURFACE                                                           | Flush mount casing with locking well cap.               |
|                        |           |                   |                 | NA                   | NA  | NA             | NA                  |                   |                 | Concrete.                                                                |                                                         |
| 590                    |           | 1                 |                 | 3<br>9<br>6<br>6     | 15  | 1.0            | 8                   | SP<br>Fill        |                 | Brown fine to medium SAND, dry, some metal shavings and brick fragments. | Bentonite pellet seal 0.97' to 1.97' bgs.               |
|                        |           | 2                 |                 | 2<br>4<br>4<br>6     | 8   | 1.0            | <1                  | SW<br>Fill        |                 |                                                                          | 2" diameter Sch. 40 PVC well casing 0.28' to 2.97' bgs. |
| 5                      |           | 3                 |                 | 5<br>3<br>2<br>4     | 5   | 0.5            | <1                  | SW<br>Fill        |                 | 2" piece of concrete.                                                    |                                                         |
| 585                    |           | 4                 |                 | 3<br>4<br>3<br>3     | 7   | 1.0            | <1                  | SM                |                 | Brown to gray silty SAND, little Clay, poorly graded, saturated.         | 0.01" Sch. 40 PVC screen 2.97' to 12.97' bgs.           |
|                        |           | 5                 |                 | 2<br>2<br>1<br>2     | 3   | 1.5            | 3                   | SP/<br>SC         |                 | Gray fine to medium SAND, trace Silt, saturated.                         |                                                         |
| 10                     |           |                   |                 |                      |     |                |                     |                   |                 | Dark gray clayey SAND.                                                   |                                                         |
|                        |           | 6                 |                 | 1<br>1<br>1<br>1     | 2   | 1.5            | 3                   | SC/<br>CL         |                 | Grades to gray.<br>Gray silty CLAY, moist, some shell fragments.         | Grade #0 silica sand pack 1.97' to 13.02' bgs.          |
| 580                    |           | 7                 |                 | 1/2<br>1/2<br>1<br>1 | 1.5 | 1.5            | <1                  | CL/<br>SC         |                 | Gray clayey SAND, saturated.                                             | Backfilled 13.02' to 21.0' bgs with bentonite chips.    |
| 15                     |           |                   |                 |                      |     |                |                     |                   |                 |                                                                          |                                                         |

**Remarks:**

NA - Not Applicable.

**Water Levels**

| Date / Time | Elevation | Depth |
|-------------|-----------|-------|
|             |           |       |
|             |           |       |
|             |           |       |
|             |           |       |

**Site:**

Malleable Iron Plant Property  
Quench Pit Investigation

Well No. GPTW-08

Total Depth = 21.0 ft.

**Client:**

General Motors Corporation

| DEPTH | ELEVATION | Sample Run Number | Sample/Int/Type | Blows/6 In.      | N  | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column                  | Stratigraphic Description                                                        | Well Construction                                    |
|-------|-----------|-------------------|-----------------|------------------|----|----------------|---------------------|-------------------|----------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------|
| 575   | 20        | 8                 |                 | 2<br>2<br>4<br>5 | 6  | 1.0            | 3                   | CL                |                                  | Gray silty CLAY, little Sand, trace wood and organics, dry to moist.<br><br>Dry. | Backfilled 13.02' to 21.0' bgs with bentonite chips. |
|       |           | 9                 |                 | 2<br>3<br>3<br>4 | 6  | 1.2            | 4                   | CL                |                                  |                                                                                  |                                                      |
|       |           | 10                |                 | 4<br>5<br>6<br>9 | 11 | 1.0            | 4                   | CL                |                                  |                                                                                  |                                                      |
| 570   |           |                   |                 |                  |    |                |                     |                   | Total depth of boring 21.0' bgs. |                                                                                  |                                                      |
| 565   |           |                   |                 |                  |    |                |                     |                   |                                  |                                                                                  |                                                      |
| 560   |           |                   |                 |                  |    |                |                     |                   |                                  |                                                                                  |                                                      |
| 35    |           |                   |                 |                  |    |                |                     |                   |                                  |                                                                                  |                                                      |



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engineers & scientists

**Remarks:**

| Water Levels |           |       |
|--------------|-----------|-------|
| Date / Time  | Elevation | Depth |
|              |           |       |
|              |           |       |
|              |           |       |

**Date Start-Finish:** 3/22/97 - 3/22/97  
**Drilling Company:** Carlo Environmental Tech.  
**Driller's Name:** Paul Libby  
**Drilling Method:** Hollow Stem Auger  
**Auger Size:** 4 1/4-in.  
**Rig Type:** Skid Mounted  
**Spoon Size:** 2-in.  
**Hammer Weight:** 140-lb  
**Height of Fall:** 30-in.

**Borehole Depth:** 21.0 ft.

**Geologist:** Gordon Hotchkiss

**Well No.** GPTW-07

**Client:**  
 General Motors Corporation

**Site:**  
 Malleable Iron Plant Property  
 Quench Pit Investigation

| DEPTH                  | ELEVATION | Sample Run Number | Sample/Int/Type | Blows/6 In.       | N  | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                                                                                           | Well Construction                                       |
|------------------------|-----------|-------------------|-----------------|-------------------|----|----------------|---------------------|-------------------|-----------------|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| gs elevation 592.3 ft. |           |                   |                 |                   |    |                |                     |                   |                 | GROUND SURFACE                                                                                                      | Flush mount casing with locking well cap.               |
|                        |           |                   |                 | NA                | NA | NA             | NA                  |                   |                 | Concrete.                                                                                                           |                                                         |
| 590                    |           | 1                 |                 | 3<br>4<br>4<br>4  | 8  | 1.5            | 4.0                 | SP<br>Fill        |                 | Black fine to medium SAND, dry, poorly sorted.<br>Black and gray glass and slag.                                    | Bentonite pellet seal 0.88' to 1.88' bgs.               |
|                        |           | 2                 |                 | 7<br>10<br>5<br>3 | 15 | 1.5            | 9.0                 | SP<br>Fill        |                 | Alternating horizons (3-4") of black to brown fine to medium SAND, dry.                                             | 2" diameter Sch. 40 PVC well casing 0.25' to 2.88' bgs. |
| 5                      |           | 3                 |                 | 2<br>3<br>3<br>2  | 6  | 2.0            | 17.0                | SP<br>Fill        |                 | Black fine clayey SAND, little Silt, moist.                                                                         |                                                         |
| 585                    |           | 4                 |                 | 3<br>2<br>3<br>4  | 5  | 1.8            | 8.0                 | SP/<br>SM         |                 | Black to brown fine to medium SAND, dry.<br>Light gray fine SAND, trace to little Silt, shell fragments, saturated. | 0.01" Sch. 40 PVC screen 2.88' to 12.88' bgs.           |
|                        |           | 5                 |                 | 2<br>2<br>3<br>2  | 5  | 1.5            | 8.0                 | SM                |                 | Light gray Silty SAND, saturated.                                                                                   |                                                         |
| 10                     |           | 6                 |                 | 0<br>0<br>1<br>1  | 1  | 1.8            | 11.0                | SM                |                 | Dark gray.                                                                                                          | Grade #0 silica sand pack 1.88' to 13.0' bgs.           |
| 580                    |           | 7                 |                 | 0<br>0<br>0<br>1  | 0  | 2.0            | 8.0                 | SM/<br>CL         |                 | Gray silty CLAY, high plasticity, trace shell fragments, dry to moist.                                              | Backfilled 13.0' to 21.0' bgs with bentonite chips.     |
| 15                     |           |                   |                 |                   |    |                |                     |                   |                 |                                                                                                                     |                                                         |

**BBL**  
 BLASLAND, BOUCK & LEE, INC.  
 engineers & scientists

**Remarks:**  
 NA - Not Applicable.

**Water Levels**

| Date / Time | Elevation | Depth |
|-------------|-----------|-------|
|             |           |       |
|             |           |       |
|             |           |       |

**Site:**

Malleable Iron Plant Property  
Quench Pit Investigation

Well No. QPTW-07

Total Depth = 21.0 ft.

**Client:**

General Motors Corporation

| DEPTH | ELEVATION | Sample Run Number | Sample/Int/Type | Blows/6 In.      | N | Recovery (ft.) | PTD (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description        | Well Construction |
|-------|-----------|-------------------|-----------------|------------------|---|----------------|---------------------|-------------------|-----------------|----------------------------------|-------------------|
| 575   |           | 8                 |                 | 0<br>0<br>1      | 1 | 2.0            | 3.0                 | CL                |                 |                                  |                   |
|       |           | 9                 |                 | 0<br>1<br>1      | 2 | 2.0            | 5.0                 | CL                |                 |                                  |                   |
| 20    |           | 10                |                 | 1<br>2<br>2<br>3 | 4 | 1.0            | < 1.0               | SC                |                 | Gray clayey SAND, saturated.     |                   |
| 570   |           |                   |                 |                  |   |                |                     |                   |                 | Total depth of boring 21.0' bgs. |                   |
| 25    |           |                   |                 |                  |   |                |                     |                   |                 |                                  |                   |
| 565   |           |                   |                 |                  |   |                |                     |                   |                 |                                  |                   |
| 30    |           |                   |                 |                  |   |                |                     |                   |                 |                                  |                   |
| 560   |           |                   |                 |                  |   |                |                     |                   |                 |                                  |                   |
| 35    |           |                   |                 |                  |   |                |                     |                   |                 |                                  |                   |

Backfilled 13.0' to 21.0' bgs with bentonite chips.

|                                                                                                                                                                          |                 |                     |           |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------|-----------|-------|
|  <p><b>BBL</b><br/>BLASLAND, BOUCK &amp; LEE, INC.<br/>engineers &amp; scientists</p> | <b>Remarks:</b> | <b>Water Levels</b> |           |       |
|                                                                                                                                                                          |                 | Date / Time         | Elevation | Depth |
|                                                                                                                                                                          |                 |                     |           |       |
|                                                                                                                                                                          |                 |                     |           |       |
|                                                                                                                                                                          |                 |                     |           |       |

Date Start-Finish: 3/23/97 - 3/23/97  
 Drilling Company: Carlo Environmental Tech.  
 Driller's Name: Paul Libby  
 Drilling Method: Hollow Stem Auger  
 Auger Size: 4 1/4-in.  
 Rig Type: Skid Mounted  
 Spoon Size: 2-in.  
 Hammer Weight: 140-lb  
 Height of Fall: 30-in.

Borehole Depth: 21 ft.

Geologist: Gordon Hotchkiss

Well No. GPTW-08

Client:  
General Motors Corporation

Site:  
Malleable Iron Plant Property  
Quench Pit Investigation

| DEPTH                  | ELEVATION | Sample Run Number | Sample/Int/Type | Blows/6 In.      | N  | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                                                                  | Well Construction                                       |
|------------------------|-----------|-------------------|-----------------|------------------|----|----------------|---------------------|-------------------|-----------------|--------------------------------------------------------------------------------------------|---------------------------------------------------------|
| gs elevation 592.5 ft. |           |                   |                 |                  |    |                |                     |                   |                 | GROUND SURFACE                                                                             | Flush mount casing with locking well cap.               |
|                        |           |                   |                 | NA               | NA | NA             | NA                  |                   |                 | Concrete.                                                                                  |                                                         |
| 590                    |           | 1                 |                 | NA               | NA | NA             | NA                  |                   |                 |                                                                                            | Bentonite pellet seal 0.53' to 1.53' bgs.               |
|                        |           | 2                 |                 | 1<br>2<br>2<br>2 | 4  | 1.2            | 60                  | CL                |                 | Black and brown sandy Clay, Gravel, and slag, dry.                                         | 2" diameter Sch. 40 PVC well casing 0.22' to 2.53' bgs. |
| 5                      |           | 3                 |                 | 2<br>3<br>4<br>7 | 7  | 1.8            | 130                 | CL                |                 |                                                                                            |                                                         |
| 585                    |           | 4                 |                 | 1<br>2<br>2<br>5 | 4  | 1.5            | 110                 | SP                |                 | Black fine to medium SAND, poorly graded, moist.<br>Gray, trace to little Silt, saturated. | 0.01" Sch. 40 PVC screen 3.02' to 13.02' bgs.           |
| 10                     |           | 5                 |                 | 2<br>5<br>5<br>9 | 10 | 1.2            | 100                 | SP                |                 | Trace shell fragments.                                                                     | Grade #0 silica sand pack 1.53' to 13.07' bgs.          |
| 580                    |           | 6                 |                 | NA               | NA | 1.5            | 5.0                 | SP                |                 |                                                                                            |                                                         |
| 15                     |           | 7                 |                 | 2<br>3<br>1<br>2 | 4  | 1.0            | 40.0                | SP                |                 |                                                                                            | Backfilled 13.07' to 21.0' bgs with native materials.   |

**BBL**  
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 engineers & scientists

Remarks:

NA - Not Applicable.

Water Levels

| Date / Time | Elevation | Depth |
|-------------|-----------|-------|
|             |           |       |
|             |           |       |
|             |           |       |

**Site:**

Malleable Iron Plant Property  
Quench Pit Investigation

**Well No. GPTW-08****Total Depth = 21 ft.****Client:**

General Motors Corporation

| DEPTH | ELEVATION | Sample Run Number | Sample/Int/Type | Blows/6 In. | N  | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description        | Well Construction |
|-------|-----------|-------------------|-----------------|-------------|----|----------------|---------------------|-------------------|-----------------|----------------------------------|-------------------|
|       |           | 8                 |                 | NA          | NA | 1.5            | 120.0               | SP                |                 |                                  |                   |
| 575   |           | 9                 |                 | NA          | NA | 1.0            | 80.0                | SP                |                 |                                  |                   |
| 20    |           | 10                |                 | NA          | NA | 1.0            | 40.0                | SP                |                 | 0.25" Silt seam.                 |                   |
|       |           |                   |                 |             |    |                |                     |                   |                 | Total depth of boring 21.0' bgs. |                   |
| 570   |           |                   |                 |             |    |                |                     |                   |                 |                                  |                   |
| 25    |           |                   |                 |             |    |                |                     |                   |                 |                                  |                   |
| 565   |           |                   |                 |             |    |                |                     |                   |                 |                                  |                   |
| 30    |           |                   |                 |             |    |                |                     |                   |                 |                                  |                   |
| 560   |           |                   |                 |             |    |                |                     |                   |                 |                                  |                   |
| 35    |           |                   |                 |             |    |                |                     |                   |                 |                                  |                   |

**BBL**  
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engineers & scientists

Remarks:

| Water Levels |           |       |
|--------------|-----------|-------|
| Date / Time  | Elevation | Depth |
|              |           |       |
|              |           |       |
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Backfilled 13.07' to 21.0' bgs with native materials.

|                                                                                                                                                                                                                                                                                                                                                   |                                                                           |                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Date Start-Finish:</b> 3/23/97 - 3/23/97<br><b>Drilling Company:</b> Carlo Environmental Tech.<br><b>Driller's Name:</b> Paul Libby<br><b>Drilling Method:</b> Hollow Stem Auger<br><b>Auger Size:</b> 4 1/4-in.<br><b>Rig Type:</b> Skid Mounted<br><b>Spoon Size:</b> 2-in.<br><b>Hammer Weight:</b> 140-lb<br><b>Height of Fall:</b> 30-in. | <b>Borehole Depth:</b> 13.0 ft.<br><br><b>Geologist:</b> Gordon Hotchkiss | <b>Well No.</b> GPTW-09<br><br><b>Client:</b><br>General Motors Corporation<br><br><b>Site:</b><br>Malleable Iron Plant Property<br>Quench Pit Investigation |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|

| DEPTH                  | ELEVATION | Sample Run Number | Sample/Int/Type  | Blows/6 In. | N   | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                                           | Well Construction                                       |
|------------------------|-----------|-------------------|------------------|-------------|-----|----------------|---------------------|-------------------|-----------------|---------------------------------------------------------------------|---------------------------------------------------------|
| gs elevation 592.7 ft. |           |                   |                  |             |     |                |                     |                   |                 | GROUND SURFACE                                                      | Flush mount casing with locking well cap.               |
|                        |           |                   |                  | NA          | NA  | NA             | NA                  |                   |                 | Concrete.                                                           |                                                         |
| 590                    |           |                   |                  | NA          | NA  | NA             | NA                  |                   |                 | Sand backfill.                                                      | Bentonite pellet seal 0.82' to 1.82' bgs.               |
| 5                      |           | 1                 | 2<br>2<br>3<br>5 | 5           | 1.8 | 13             | SW                  |                   |                 | Black fine to medium SAND, some Clay, dry.                          | 2" diameter Sch. 40 PVC well casing 0.24' to 2.82' bgs. |
| 585                    |           | 2                 | 4<br>6<br>2<br>8 | 13          | 1.0 | 6              | SP                  |                   |                 | Gray to black fine to medium SAND, poorly graded, hydrocarbon odor. | 0.01" Sch. 40 PVC screen 2.82' to 12.82' bgs.           |
| 10                     |           | 3                 | 3<br>3<br>3<br>3 | 6           | 1.8 | 3              | SP                  |                   |                 | 3" seam of black sandy Clay.                                        |                                                         |
|                        |           |                   |                  |             |     |                |                     |                   |                 | 3" seam of black sandy Clay.                                        |                                                         |
| 580                    |           | 4                 | 1<br>1<br>1<br>1 | 2           | 1.8 | 4              | SP/CL               |                   |                 | Dark gray silty Clay.                                               | Grade #0 silica sand pack 1.82' to 13.00' bgs.          |
| 15                     |           |                   |                  |             |     |                |                     |                   |                 | Total depth of boring 13.0' bgs.                                    |                                                         |

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 engineers & scientists

**Remarks:**  
 NA - Not Applicable.

| Water Levels |           |       |
|--------------|-----------|-------|
| Date / Time  | Elevation | Depth |
|              |           |       |
|              |           |       |
|              |           |       |

**Date Start-Finish:** 3/28/97 - 3/28/97  
**Drilling Company:** Carlo Environmental Tech.  
**Driller's Name:** Paul Libby  
**Drilling Method:** Hollow Stem Auger  
**Auger Size:** 4 1/4-in.  
**Rig Type:** Skid Mounted  
**Spoon Size:** 2-in.  
**Hammer Weight:** 140-lb  
**Height of Fall:** 30-in.

**Borehole Depth:** 15.0 ft.

**Geologist:** Gordon Hotchkiss

**Well No.** GPTW-10

**Client:**  
 General Motors Corporation

**Site:**  
 Malleable Iron Plant Property  
 Quench Pit Investigation

| DEPTH                 | ELEVATION | Sample Run Number | Sample/Int./Type         | Blows/6 In. | N   | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                                       | Well Construction                                       |
|-----------------------|-----------|-------------------|--------------------------|-------------|-----|----------------|---------------------|-------------------|-----------------|-----------------------------------------------------------------|---------------------------------------------------------|
| gs elevation 592.4 ft |           |                   |                          |             |     |                |                     |                   |                 | GROUND SURFACE                                                  | Flush mount casing with locking well cap.               |
|                       |           |                   |                          | NA          | NA  | NA             | NA                  |                   |                 | Concrete.                                                       |                                                         |
| 590                   |           | 1                 | 2<br>3<br>2<br>1         | 5           | 0.5 | 2.0            | SP Fill             |                   |                 | Black fine SAND, dry, poorly graded, trace Silt.                | Bentonite pellet seal 0.85' to 1.85' bgs.               |
|                       |           | 2                 | NA                       | NA          | 1.2 | 9.0            | CL                  |                   |                 | Brownish black silty CLAY, dry, non-plastic, thin laminations.  | 2" diameter Sch. 40 PVC well casing 0.25' to 2.85' bgs. |
| 5                     |           | 3                 | 1<br>1<br>2<br>1         | 3           | 1.0 | 10.0           | CL/SP               |                   |                 | Black fine SAND, trace Silt, petroleum staining.                |                                                         |
| 585                   |           | 4                 | 1<br>2<br>3<br>6         | 5           | 1.5 | 5.0            | SP                  |                   |                 | Gray fine to medium SAND, poorly graded, trace Silt, saturated. | 0.0" Sch. 40 PVC screen 2.85' to 12.85' bgs.            |
| 10                    |           | 5                 | 2<br>3<br>3<br>6         | 6           | 1.2 | 8.0            | SP                  |                   |                 |                                                                 |                                                         |
| 580                   |           | 6                 | 3<br>3<br>2<br>2         | 5           | 2.0 | 50.0           | SM                  |                   |                 | Increased Silt, Clay and shell fragments.                       | Grade #0 silica sand pack 1.85' to 13.0' bgs.           |
| 15                    |           | 7                 | 1/2<br>1/2<br>1/2<br>1/2 | 1           | 1.0 | 13.0           | SM                  |                   |                 |                                                                 | Backfilled 13.0' to 15.0' bgs with native materials     |

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 engineers & scientists

**Remarks:**

NA - Not Applicable.

**Water Levels**

| Date / Time | Elevation | Depth |
|-------------|-----------|-------|
|             |           |       |
|             |           |       |
|             |           |       |

Date Start-Finish: 04/05/97 - 04/05/97  
 Drilling Company: Carlo Environmental Tech.  
 Driller's Name: Paul Libby  
 Drilling Method: Hollow Stem Auger  
 Auger Size: 4 1/4-in.  
 Rig Type: Skid Mounted  
 Spoon Size: 2-in.  
 Hammer Weight: 140-lb  
 Height of Fall: 30-in.

Borehole Depth: 13.0 ft.

Geologist: Gordon Hotchkiss

Well No. GPTW-11

Client:  
General Motors Corporation

Site:  
Malleable Iron Plant Property  
Quench Pit Investigation

| DEPTH                  | ELEVATION | Sample Run Number | Sample/Int./Type | Blows/6 In.      | N  | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                             | Well Construction                                      |
|------------------------|-----------|-------------------|------------------|------------------|----|----------------|---------------------|-------------------|-----------------|-------------------------------------------------------|--------------------------------------------------------|
| gs elevation 582.8 ft. |           |                   |                  |                  |    |                |                     |                   |                 | GROUND SURFACE                                        | Flush mount casing with locking well cap.              |
|                        |           |                   |                  | NA               | NA | NA             | NA                  |                   |                 | Concrete.                                             |                                                        |
|                        | 590       | 1                 |                  | 2<br>3<br>2<br>2 | 5  | 1.0            | 50                  | CL                |                 | Black silty CLAY, non-plastic, dry, thin laminations. | Bentonite pellet seal 0.93' to 1.93' bgs.              |
|                        |           | 2                 |                  | 3<br>3<br>4<br>5 | 7  | 1.0            | 17                  | CL                |                 | Seam of brownish black medium Sand.                   | 2" diameter Sch. 40 PVC well casing 0.5' to 2.93' bgs. |
| 5                      |           | 3                 |                  | 2<br>2<br>3<br>4 | 5  | 1.3            | 7.0                 | CL                |                 | Thin Gravel layer.                                    |                                                        |
|                        | 585       | 4                 |                  | 4<br>3<br>3<br>2 | 6  | 1.3            | 30                  | CL/SP             |                 | Black medium Sand, moist, poorly graded.              | 0.01" Sch. 40 PVC screen 2.93' to 12.93' bgs           |
|                        |           | 5                 |                  | 2<br>3<br>4<br>5 | 7  | 1.0            | 20                  | SP                |                 | Dark gray fine to medium Sand, trace Silt, saturated. |                                                        |
| 10                     |           | 6                 |                  | 4<br>5<br>5<br>5 | 10 | 1.5            | 30                  | SM                |                 | Light gray fine silty Sand, poorly graded, saturated. | Grade #0 silica sand pack 1.93' to 13.0' bgs.          |
|                        | 580       |                   |                  |                  |    |                |                     |                   |                 | Total depth of boring 13.0' bgs.                      |                                                        |
| 15                     |           |                   |                  |                  |    |                |                     |                   |                 |                                                       |                                                        |

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 engineers & scientists

Remarks:

NA - Not Applicable.

Water Levels

| Date / Time | Elevation | Depth |
|-------------|-----------|-------|
|             |           |       |
|             |           |       |
|             |           |       |

**Date Start-Finish:** 04/05/97 - 04/05/97  
**Drilling Company:** Carlo Environmental Tech.  
**Driller's Name:** Paul Libby  
**Drilling Method:** Hollow Stem Auger  
**Auger Size:** 4 1/4-in.  
**Rig Type:** Skid Mounted  
**Spoon Size:** 2-in.  
**Hammer Weight:** 140-lb  
**Height of Fall:** 30-in.

**Borehole Depth:** 13.0 ft.

**Geologist:** Gordon Hotchkiss

**Well No.** GPTW-12

**Client:**  
 General Motors Corporation

**Site:**  
 Malleable Iron Plant Property  
 Quench Pit Investigation

| DEPTH                 | ELEVATION | Sample Run Number | Sample/Int/Type | Blows/6 In.      | N  | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                                             | Well Construction                                       |
|-----------------------|-----------|-------------------|-----------------|------------------|----|----------------|---------------------|-------------------|-----------------|-----------------------------------------------------------------------|---------------------------------------------------------|
| gs elevation 592.5 ft |           |                   |                 |                  |    |                |                     |                   |                 | GROUND SURFACE                                                        | Flush mount casing with locking well cap.               |
|                       |           |                   |                 | NA               |    | NA             | NA                  | NA                |                 | Concrete.                                                             |                                                         |
| 590                   |           | 1                 |                 | 5<br>6<br>3<br>3 | 9  | 1.2            | 7.0                 | SC<br>Fill        |                 | Brown to black fine Sand, Silt, and Clay, trace brick fragments, dry. | Bentonite pellet seal 0.93' to 1.93' bgs.               |
|                       |           | 2                 |                 | 3<br>3<br>3<br>2 | 6  | 1.2            | 3.0                 | CL                |                 | Black silty Clay, nonplastic, dry, thin laminations.                  | 2" diameter Sch. 40 PVC well casing 0.33' to 2.93' bgs. |
| 5                     |           | 3                 |                 | 3<br>2<br>3<br>3 | 5  | 0.0            | NA                  | NA                |                 | No recovery.                                                          |                                                         |
| 585                   |           | 4                 |                 | 4<br>5<br>5<br>4 | 10 | 1.0            | 20                  | SM                |                 | Dark gray fine Sand, trace to little Silt, poorly graded, saturated.  | 0.01" Sch. 40 PVC screen 2.93' to 12.93' bgs            |
|                       |           | 5                 |                 | 2<br>2<br>2<br>2 | 4  | 1.2            | 4.0                 | SM                |                 | Increasing Clay content.                                              | Grade #0 silica sand pack 1.93' to 13.0' bgs.           |
| 580                   |           | 6                 |                 | 2<br>2<br>1<br>1 | 3  | 1.5            | 1.0                 | SM/<br>CL         |                 | Dark gray silty Clay, highly plastic, moist.                          |                                                         |
|                       |           |                   |                 |                  |    |                |                     |                   |                 | Total depth of boring 13.0' bgs.                                      |                                                         |
| 15                    |           |                   |                 |                  |    |                |                     |                   |                 |                                                                       |                                                         |

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 engineers & scientists

**Remarks:**

NA - Not Applicable.

**Water Levels**

| Date / Time | Elevation | Depth |
|-------------|-----------|-------|
|             |           |       |
|             |           |       |
|             |           |       |

**Date Start-Finish:** 04/05/97 - 04/05/97  
**Drilling Company:** Carlo Environmental Tech.  
**Driller's Name:** Paul Libby  
**Drilling Method:** Hollow Stem Auger  
**Auger Size:** 4 1/4-in.  
**Rig Type:** Skid Mounted  
**Spoon Size:** 2-in.  
**Hammer Weight:** 140-lb  
**Height of Fall:** 30-in.

**Borehole Depth:** 13.0 ft.

**Geologist:** Gordon Hotchkiss

**Well No.** GPTW-13

**Client:**  
 General Motors Corporation

**Site:**  
 Malleable Iron Plant Property  
 Quench Pit Investigation

| DEPTH                  | ELEVATION | Sample Run Number | Sample/Int/Type | Blows/6 In. | N | Recovery (ft.) | PID (ppm) Headspace | Geotechnical Test | Geologic Column | Stratigraphic Description                                                  | Well Construction                                       |
|------------------------|-----------|-------------------|-----------------|-------------|---|----------------|---------------------|-------------------|-----------------|----------------------------------------------------------------------------|---------------------------------------------------------|
| gs elevation 592.7 ft. |           |                   |                 |             |   |                |                     |                   |                 | GROUND SURFACE                                                             | Flush mount casing with locking well cap.               |
|                        |           |                   |                 |             |   | NA             | NA                  |                   |                 | Concrete.                                                                  |                                                         |
| 590                    |           |                   |                 |             |   | NA             | NA                  |                   |                 |                                                                            | Bentonite pellet seal 1.1' to 2.1' bgs.                 |
|                        |           | 1                 |                 |             |   | 1.5            | 4.0                 | CL                |                 | Black silty CLAY, nonplastic, thin laminations, dry.                       | 2" diameter Sch. 40 PVC well casing 0.34' to 3.10' bgs. |
| 5                      |           | 2                 |                 |             |   | 2.0            | 17                  | CL                |                 | Interbedded with sandy CLAY.                                               |                                                         |
|                        |           | 3                 |                 |             |   | 1.5            | 7.0                 | SC                |                 | Increasing Sand and hydrocarbon odors and staining.                        |                                                         |
| 585                    |           | 4                 |                 |             |   | 1.5            | 13                  | SM                |                 | Light gray fine to medium Sand, trace Silt and shell fragments, saturated. | 0.01" Sch. 40 PVC screen 3.1' to 13.1' bgs              |
| 10                     |           | 5                 |                 |             |   | 2.0            | 12                  | SM                |                 | Light gray silty Sand, poorly graded, saturated.                           | Grade #0 silica sand pack 2.1' to 13.15' bgs.           |
| 580                    |           |                   |                 |             |   |                |                     |                   |                 | Total depth of boring 13.0' bgs.                                           |                                                         |
| 5                      |           |                   |                 |             |   |                |                     |                   |                 |                                                                            |                                                         |

**BBL**  
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 engineers & scientists

**Remarks:**

NA - Not Applicable.

**Water Levels**

| Date / Time | Elevation | Depth |
|-------------|-----------|-------|
|             |           |       |
|             |           |       |
|             |           |       |