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Ford Motor Company

COMPREHENSIVE PHASE II SITE INVESTIGATION REPORT

Twin Cities Assembly Plant
St. Paul, Minnesota

December 2015

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ACRONYMS AND ABBREVIATIONS

µg/L	microgram(s) per liter
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
1,2-DCA	1,2-dichloroethane
1,1,1-TCA	1,1,1-trichloroethane
Arcadis	Arcadis U.S., Inc.
BaP	benzo(a)pyrene
cis-1,2-DCE	*cis*-1,2-dichloroethene
DRO	diesel-range organics
ESA	environmental site assessment
Ford	Ford Motor Company
GRO	gasoline-range organics
GW_{ISV}	groundwater intrusion screening value
IDW	investigation-derived waste
MDH	Minnesota Department of Health
MPCA	Minnesota Pollution Control Agency
PAH	polynuclear aromatic hydrocarbon
PID	photoionization detector
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PPE	personal protective equipment
PRP	Petroleum Remediation Program
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
REC	recognized environmental condition
SIR	Site Investigation Report
SRV	soil reference value
SVOC	semivolatile organic compound
TAL	Target Analyte List

TCE	trichloroethene
TCLP	toxicity characteristic leaching procedure
trans-1,2-DCE	*trans*-1,2-dichloroethene
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
WE	Work Element
WI	Wisconsin
WQS	MPCA water quality standard(s) for surface water

EXECUTIVE SUMMARY

This Comprehensive Phase II Site Investigation Report was developed by Arcadis on behalf of Ford Motor Company (Ford) for the Twin Cities Assembly Plant (the Site). The objective of this report is to document the site investigation activities and results that have been completed to date under the guidance of the Minnesota Pollution Control Agency Voluntary Investigation and Cleanup Program and Petroleum Brownfields Program. Investigation activities related to Area C will be reported under separate cover.

The geology at the Site consists of a relatively thin layer (approximately 5 to 15 feet thick) of unconsolidated overburden that is primarily sands, silts and clays. The unconsolidated overburden is underlain by a discontinuous shale layer (Decorah), a limestone/dolostone layer (Platteville), a continuous shale layer (Glenwood) and a sandstone layer (St. Peter). Each shale layer serves as confining units to perched aquifers that are present in the overlying unconsolidated overburden and Platteville Limestone/Dolostone. The St. Peter Sandstone is a regional aquifer that flows west and ultimately discharges to the Mississippi River.

A Phase I Environmental Site Assessment was completed in 2007 which identified several recognized environmental conditions (RECs), historical RECs, and areas of interest. These areas were the focus of numerous Phase II investigations and delineation investigations completed between 2007 and 2015. In addition to the Phase II investigations, Ford also completed a General Site Wide Characterization in 2015 to investigation the portions of the Site that were not identified as RECs, HRECs, and AOIs during the Phase I. A seep and surface water investigation was completed in 2010 to evaluate the discharge of groundwater to surface water bodies. An initial receptor survey was completed in 2010 to identify potential groundwater, surface water and soil vapor receptors in the area.

Data collected during the Phase II investigation activities were compared to the following applicable screening values:

- Soil Reference Values (SRVs) were used for direct exposure to soil.
- Groundwater Intrusion Screening Values (GW_{ISV}s) were used to evaluate the potential for risk due to vapor intrusion if the Site were to be redeveloped.
- Surface Water Quality Standards were used to screen groundwater collected from the St. Peter Sandstone, which ultimately discharges to the Mississippi River.
- Minnesota Department of Health Health-Based Guidance was used if no other more applicable screening values were available.

A summary of the compounds that have been detected at least once in soil and/or groundwater at concentrations exceeding the screening values discussed above is shown in the table on the next page.

Compound	Soil	Groundwater		
	Unconsolidated Overburden	Perched Overburden	Perched Platteville Limestone/Dolostone	St. Peter Sandstone Aquifer
Chlorinated volatile organic compounds	No	Yes (trichloroethene only)	No	No
Non-chlorinated volatile organic compounds	Yes	Yes	No	No
Semivolatile organic compounds/polynuclear aromatic hydrocarbons	Yes	Yes (naphthalene only)	No	No
Metals	Yes	Yes (mercury only)	No	Yes
Gasoline-range organics	Yes	Yes	No	No
Diesel-range organics	Yes	Yes	Yes	Yes
Cyanide	No	No	No	Yes
Polychlorinated biphenyls	No	No	No	Yes

1 INTRODUCTION

This Comprehensive Phase II Site Investigation Report (SIR) was developed by Arcadis U.S., Inc. (Arcadis) on behalf of Ford Motor Company (Ford) for the Twin Cities Assembly Plant (the Site). As requested by Ford's Environmental Quality Office staff, this report documents information collected during investigation activities conducted at the Site. This SIR includes a technical overview of the investigation methodology, activities, results, and recommendations in accordance with the Minnesota Pollution Control Agency (MPCA) Voluntary Investigation and Cleanup (VIC) program and Petroleum Brownfields Program (PBP) reporting guidelines. Historical and ongoing investigation activities related to Area C are not included in this SIR and will be reported under separate cover.

2 SITE BACKGROUND

The Site is located at 966 South Mississippi River Boulevard in St. Paul, Ramsey County, Minnesota at approximate Latitude (north) 44° 54' 50.8" and Longitude (west) 93° 11' 31.9" (Figure 1). The Site is located in a mixed industrial, commercial and residential use area on the eastern shore of the Mississippi River, along the east side of South Mississippi River Boulevard, south of Ford Parkway, and west of South Cleveland Avenue (Figure 2).

Former operations at the Site consisted of the assembly and painting of light-duty trucks (Ford Ranger) using parts manufactured off site. Assembly processes included welding, metal cleaning, painting and curing, windshield and trim installation, and preparation of the vehicles for final delivery. Production buildings and several outbuildings comprised approximately 2,144,930 square feet within the property boundary. The primary production buildings consisted of the Main Assembly Building, which also included a Warehouse, and a Paint Building (Figure 2). In addition, a Wastewater Treatment Plant and Steam Plant west of Mississippi River Boulevard were associated with the former assembly operations Figure 2). Manufacturing operations at the Site ceased on December 16, 2011.

2.1 Site History

The Site was vacant undeveloped land prior to construction of the assembly plant. Construction of the original portion of the Main Assembly Building began in 1923, with several additions, which occurred mainly between 1960 and 1978; these added 300,000 square feet to the original building footprint. The Paint Building was constructed in 1985 and was connected to the Main Assembly Building via a 625-foot bridge. The Steam Plant was constructed in 1923 and is approximately 10,400 square feet. A former coal gasification plant was located near the southeast corner of the Steam Plant, but was demolished prior to 1974. The Wastewater Treatment Plant is located adjacent to the Steam Plant, and was constructed in 1984. Additional details on the history of the Site are available in the Phase I Environmental Site Assessment (ESA; Arcadis 2007a).

2.2 Site Geology and Hydrogeology

The general geology and hydrogeology of the Site, based on information identified during the Phase I ESA (Arcadis 2007a) and subsequent investigations, is described below. Data collected to date were also used to develop representative geologic cross sections traversing the Site. A site-wide map of cross section locations is provided on Figure 3.

2.2.1 Geology

At the surface of the Site, a mantle of unconsolidated sediments exists over bedrock terraces. Underlying the unconsolidated material are sedimentary bedrock units that were deposited during the middle of the Ordovician geologic period. The sedimentary units are, in descending order, Decorah Shale, Platteville Limestone/Dolostone, Glenwood Shale, and St. Peter Sandstone. The depth and thicknesses of the bedrock units, as interpreted from boring logs, are illustrated on the geologic cross sections (Figures 4 through 7).

The unconsolidated overburden consists predominately of sandy clay and clayey sand. Weathered shale cobbles are common and 2 to 5 feet of peat was observed east of the former oil fill area. The total thickness of the unconsolidated overburden is variable but generally is between 5 and 15 feet.

The Decorah Shale is the uppermost bedrock unit encountered at the Site. The upper portion of the Decorah Shale, at the contact with the unconsolidated overburden, is highly weathered, but transitions to be a more competent rock unit with depth. The thickness of the Decorah Shale is variable and it appears to be discontinuous across the Site. The Platteville Limestone/Dolostone lies on top of the Glenwood Shale formation and the contact appears to be gradational. The Glenwood Shale is composed of dark green to gray shale and sandy shale. The formation is thinly laminated and moderately fissile (cleavable) and is approximately 7 feet thick in the areas investigated. The St. Peter Sandstone outcrops along the bluffs of the Mississippi River and continues below the elevation of the riverbed. The sandstone is composed of medium-grained, well-sorted and well-rounded quartzite. It is white to buff in color and is medium to weakly indurated (hardened). The St. Peter formation is as much as 150 feet thick in the Twin Cities area.

2.2.2 Hydrogeology

Perched groundwater is found above both of the shale layers described above in both the unconsolidated overburden and the Platteville Limestone/Dolostone. The perched groundwater in the unconsolidated overburden is discontinuous across the Site and of variable thickness. Because of the discontinuous nature of this perched zone there is unlikely to be any meaningful lateral flow. The perched groundwater in the Platteville Limestone/Dolostone is consistently encountered. The total thickness of the saturated zone within the Platteville Limestone/Dolostone is approximately 12 to 23 feet. Groundwater flow direction is generally to the west towards the Mississippi River; however, any water migrating laterally through the Platteville Limestone/Dolostone discharges via seeps on the river bluff just west of Mississippi River Boulevard. Seeps can be intermittently observed on the face of the bluff west of Mississippi River Boulevard.

The uppermost groundwater aquifer is in the St. Peter Sandstone, which is a high-yielding aquifer. Perched groundwater is generally isolated from the bedrock groundwater by the Decorah and Glenwood Shale Formations. Groundwater flow direction is generally to the west towards the Mississippi River, which is the receptor for groundwater originating from the Site; however, based on site-wide monitoring well data, groundwater flow can be locally and seasonally variable particularly close to the river. A potentiometric surface map for the St. Peter Sandstone is included as Figure 8.

Additional information on the geology and hydrogeology of the Site can be found in the Phase I ESA (Arcadis 2007a) and the Initial Phase II – Exterior Investigation Report (Arcadis 2007b).

3 SUMMARY OF INVESTIGATION ACTIVITIES

On June 26, 1990 the MPCA issued a Request for Response Action due to the historical waste handling and disposal practices at the Site. In accordance with this request, a remedial investigation/feasibility study was completed in May 1992 by Conestoga-Rovers & Associates Inc., which included a Remedial Investigation/Alternatives Analysis of three areas adjacent to the Paint Building and Main Assembly Building (Area A, Area B and an underground storage tank [UST] site) designated by the MPCA (Conestoga-Rovers & Associates Inc.1992). The results of these investigations have not been included in this SIR.

Several phases of investigation have since been completed for the Site by Arcadis. The following is a brief summary of previous investigations. A timeline of investigations is included in Table 1. All analytical data from these investigations are included within the results discussion, tables, and figures of this SIR. Field notes from groundwater sampling and Phase II subsurface investigations are included in Appendix A.

3.1 2007 Phase I

Arcadis completed a Phase I ESA at the Site in the first half of 2007 (Arcadis 2007a). During the Phase I, several recognized environmental conditions (RECs), historical RECs, and areas of interest were identified interior and exterior to the building footprints. Based on the results from the Phase I ESA, several of the RECs, historical RECs, and areas of interest of the Site were identified as features for additional Phase II investigations. The results and conclusions of this SIR will not be discussed in the context of specific features, however, the location of these features is included on Figure 9, which can be used as a historical reference to provide landmarks for the investigation work described in the following sections.

3.2 2007 Baseball Fields Phase II

Arcadis conducted a soil investigation of Feature 139 – Baseball Fields in June and August 2007 to evaluate soil conditions. Feature 139 was identified as a potential battery waste disposal area during the Phase I ESA. The area is approximately 6 acres in size and presently includes three baseball fields, a concession building with restrooms, batting cages, and a practice pitching area. Investigative methods were developed based on MPCA program requirements, knowledge of the site geology, and potential environmental concerns.

Results of this investigation were initially reported in the Soil Investigation Report – Baseball Fields – Feature 139 (Arcadis 2007c). Based on the results of the initial soil investigation, an additional soil investigation and surface soil risk assessment was completed in 2007. Following this additional soil investigation, Ford completed response activities and submitted a Response Action Implementation Report – Baseball Fields – Feature 139 to the MPCA in March 2008 (Arcadis 2008). A total of 30 soil borings, 48 surficial sample locations, and two temporary wells were installed and sampled to evaluate soil and groundwater conditions. Discussion of the analytical results for these investigations are included in Section 6 below.

3.3 2007 Initial Exterior Phase II

Arcadis conducted the Initial Phase II – Exterior Investigation in June and July 2007. The Site has a total of 32 exterior features identified in the Phase I ESA Report. One feature was not investigated due to utility interferences (Feature 23 – Former Brake Fluid Aboveground Storage Tank). Features that were in close proximity to one another were grouped so that borings could be co-located. The co-located borings were placed in locations such that they could assess multiple features. A total of 54 soil borings, 16 hand auger borings, 12 permanent groundwater monitoring wells, and nine temporary groundwater monitoring wells were installed and sampled to evaluate soil and groundwater conditions at the Site. In addition, three existing monitoring wells already located on site were sampled as part of this investigation. Investigative methods were developed based on MPCA program requirements, knowledge of the site geology and potential environmental concerns.

Results of this investigation were initially reported in the Initial Phase II – Exterior Investigation Report (Arcadis 2007b) and are summarized in Section 6 below.

3.4 2010 Seep and Surface Water Investigation

In April 2010 a seep sample was collected from the face of the bluff at an outcropping of the Platteville Limestone/Dolostone above the Steam Plant and Wastewater Treatment Plant. The sample was analyzed for field parameters (specific conductivity, temperature, pH, dissolved oxygen, and oxidation/reduction potential, and samples were submitted for laboratory analysis of:

- Volatile organic compounds (VOCs) using United States Environmental Protection Agency (USEPA) Method 8260
- Semivolatile organic compounds (SVOCs) using USEPA Method 8270
- Total Resource Conservation and Recovery Act (RCRA) Metals using USEPA Method 6010
- Gasoline-range organics (GRO) using the Wisconsin (WI) Modified Method
- Diesel-range organics (DRO) using the WI Modified Method.

Analytical results were compared to MPCA Class 2B Water Quality Standards for surface water (WQS). All detectable results were below the Class 2B WQS.

In November 2010 two rounds of surface water samples were collected from the Mississippi River at upstream locations between the Wastewater Treatment Plant and Area C, downstream of Area C, and downstream of the plant. Additionally, one sample was collected of the water discharging to the Mississippi River at the Hidden Falls outfall. Samples were analysed for the same compounds as the seep sample discussed above. With the exception of the hardness concentration collected from the outfall sample, all analytical results were below applicable standards.

Methodology, locations, and analytical results were reported to the MPCA on February 22, 2011 in a document titled Technical Memorandum to Summarize the Seep and River Sampling Events (Arcadis 2011). Results of that investigation are not reproduced in this report.

3.5 Initial Receptor Survey

An initial receptor survey was completed in May of 2010. The receptor survey at the Twin Cities Assembly Plant was conducted in accordance with the requirements of the MPCA Guidance Document 4-02, Potential Receptor Surveys and Risk Evaluation Procedures at Petroleum Release Sites (MPCA 2008) and MPCA Guidance Document 4-18, Public Water Supply Risk Assessment at Petroleum Remediation Sites (MPCA 2005). The receptor survey was completed to assess the potential for groundwater, vapor, and surface-water receptors near the Site.

The receptor survey included a groundwater well survey within 500 feet of the perimeter of the Site, a vapor receptor survey within 500 feet of the Site, and a surface water receptor survey. Detailed results were presented in the Initial Receptor Survey memorandum (Arcadis 2010a) and are not included in this SIR.

3.6 2010 Interior Phase II

The Initial Phase II Interior Investigation began in August 2010 during a temporary production shutdown and focused on the evaluation of accessible interior features identified during the Phase I ESA as historical operations. Forty-two interior site features were identified in the Phase I ESA Report (Arcadis 2007a), which, due to active plant operations, were broken out into two phases (initial and auxiliary). Features that were in close proximity to one another were grouped so that borings could be co-located. The co-located borings were placed in locations such that they could assess multiple features. A total of 24 hand auger and direct-push borings and two temporary groundwater monitoring wells were completed to investigate 13 features within the Main Assembly Building for soil and groundwater impacts. One feature for the initial interior investigation was not completed due to refusal. Due to accessibility restrictions and shallow boring refusal, continuation of the work was postponed until plant closure, which occurred on December 16, 2011.

The results of this investigation have not previously been presented to the MPCA, but are discussed in Section 6 below.

3.7 2011 to 2012 Supplemental Exterior Phase II

Arcadis conducted a Supplemental Phase II Exterior Investigation from August to November 2011 and October 2012. This investigation included the installation of borings to provide delineation of impacts observed during the Initial Phase II Exterior investigation and to investigate features identified during the 2007 Phase I ESA that were not addressed during the initial mobilization. A total of 86 direct-push soil borings, 10 temporary groundwater monitoring wells, and 8 permanent groundwater monitoring wells were completed to investigate 27 features for soil and groundwater impacts. Three features (Nos. 23, 49, and 121) were not investigated due to utility interference or other obstructions.

Results of this investigation were initially reported in the Supplemental Phase II – Exterior Investigation Report (Revised) (Arcadis 2013a) but are also discussed in Section 6 below.

3.8 2012 Auxiliary and Supplemental Interior Phase II

In May and June 2012, Arcadis continued investigation of features attempted and additional features not addressed during the initial interior mobilization in August 2010. A total of 53 roto-sonic, direct-push and

hand auger soil borings, along with 11 temporary groundwater monitoring wells, were completed to investigate 20 features within the Main Assembly Building and Paint Building for soil and groundwater impacts.

The results of this investigation have not previously been presented to the MPCA, but are discussed in Section 6 below.

3.9 Work Element 1 – 2013 to 2014

Arcadis implemented the Work Element 1 (WE1) subsurface investigation activities to further evaluate impacts and eliminate data gaps identified during the completion of the Initial and Supplemental Phase II Exterior Investigations, as well as activities completed to date as part of the Initial Interior Investigation (Arcadis 2013bx). The WE1 subsurface investigation was conducted concurrently with site demolition activities, and was conducted during two mobilizations as various features became accessible. The first mobilization took place in October and November 2013 with the second mobilization occurring in January 2014.

A total of 103 soil borings were completed using direct-push or roto-sonic technology, and 18 temporary groundwater monitoring wells were completed.

Analytical results of these investigations were reported in the Subsurface Investigation Work Element 1 – 2013 Initial Mobilization Soil & Groundwater Quality Analytical Results (Arcadis 2014a) report and Work Element 1 – 2013 Second Mobilization Soil & Groundwater Quality Analytical Results (Arcadis 2014b) report and are summarized in Section 6 below.

3.10 Work Element 2 – 2014 to 2015

Arcadis implemented the Work Element 2 (WE2) subsurface investigation activities with the purpose of evaluating impacts identified during WE1 and to investigate proposed WE1 locations that were postponed due to access limitations. As with WE1, WE2 was completed in multiple mobilizations. The first mobilization took place in December 2014 and the second mobilization occurred in April 2015. A total of 133 soil borings were completed using direct-push and roto-sonic technology, and 29 temporary groundwater monitoring wells were completed.

Analytical data collected during the WE2 subsurface investigation activities have not previously been presented to the MPCA; these results are discussed in Section 6 below.

3.11 2015 General Site-wide Characterization

GHD (Formerly Conestoga Rovers and Associates) completed a General Site Wide Characterization in April and May 2015. The primary purpose of the investigation was to investigate metal concentrations across the Site and to fill in spatial gaps where no features were present and where no analytical or field screening data had been collected. A total of 719 direct-push soil borings were completed across the Site. Analytical data collected during the General Site Wide Investigation are included in the discussion in Section 6 below.

3.12 Work Element 3 – 2015

Arcadis implemented the Work Element 3 (WE3) subsurface investigation activities to evaluate impacts identified during the completion of WE2 and the General Site Wide Characterization. WE3 was completed in July 2015.

A total of 54 direct-push soil borings and 10 temporary groundwater monitoring wells were completed to delineate soil and groundwater impacts identified during previous investigations.

Analytical data collected during the WE3 subsurface investigation activities have not previously been presented to the MPCA; these results are discussed in Section 6 below.

4 GENERAL INVESTIGATION METHODOLOGY

This section provides a summary of the means and methods utilized during the subsurface investigations. Field logbook/documentation procedures and the field quality assurance program were implemented in accordance with the approved June 2007 Field Sampling Plan (Arcadis 2007d) and with MPCA-approved work plans. An addendum to Field Sampling Plan Section 3: Location and Sample Nomenclature was completed for the WE1/WE2/WE3 investigations, and is included in Appendix B. Standard operating procedures used to complete this field work are included in Appendix C, when applicable. This section will also reference approved work plans when possible.

4.1 Utility Clearance

A full utility clearance was performed prior to initiating any subsurface work at the Site. Activities included but were not limited to:

- Notification of Gopher One Call to mark all public utility lines servicing the Site
- Utilizing a private utility locator in the areas identified for subsurface work
- Surficial inspection referencing available utility and historical operational maps for each proposed boring location, if available.

After removing any surficial debris (i.e., asphalt or concrete), a hand auger or hydro-vacuum unit was used to 1) confirm the absence of utilities and 2) investigate the top 5 feet below ground surface if no utilities existed. Note that Arcadis was not able to collect soil samples for analytical testing if the hydro-vacuum unit was utilized.

4.2 Soil Borings and Temporary Groundwater Monitoring Wells

Soil borings were advanced using hand augers and direct-push, hollow-stem auger and roto-sonic drill rigs in areas of suspected impacts. Each boring was logged continuously by an Arcadis field geologist and screened using a photoionization detector (PID) with an 11.7 electron volt lamp. Soil boring logs were created in the field to identify material encountered for each borehole to total depth using the United Soil Classification System. Digitized soil boring logs are provided in Appendix D.

One to four soil samples were collected at each borehole. As stipulated in the initial interior and exterior work plans (Arcadis 2007b, Arcadis 2007d, Arcadis 2010b), the total number of borings to be advanced, the depth of exploration, and analytical sampling requirements were developed based on the dimensions, depth and use of each feature. Soil samples were collected from the interval with the highest field indication of PID and/or visual and/or incidental olfactory evidence of impacts. If impacts were identified in the interval below the highest impacts, samples were collected to delineate the extent of soil impacts. If PID and/or visual and/or incidental olfactory evidence of impacts were observed at multiple depth intervals that could provide useful assessment or delineation data, those intervals were sampled. If no PID, visual, or incidental olfactory evidence of impacts were observed, the 2-foot interval above the saturated zone or the lowermost interval of the soil boring (if the saturated zone was not encountered) was sampled. The depth of the feature was taken into consideration when selecting intervals for sampling. Borings were advanced until the target depth was reached or refusal due to bedrock was encountered. At delineation locations completed during WE1/WE2/WE3 investigations (Arcadis 2013b,

Arcadis 2014c) one soil sample was collected from the interval exhibiting the highest PID reading or evidence of potential impacts through visual or olfactory observations. If the highest PID reading did not correspond with exceedances observed at the original borehole location, a second soil sample was collected from the interval corresponding to the initially observed exceedances. A third soil sample was collected from the interval below the observed exceedance to provide vertical delineation.

Soil samples were collected in laboratory supplied containers and placed on ice pending shipment to the laboratory following standard chain-of-custody procedures. All samples were submitted to TestAmerica Laboratories in North Canton, Ohio for analysis of one or more of the following analytes:

- VOCs using USEPA Method 8260
- SVOCs using USEPA Method 8270
- Polynuclear aromatic hydrocarbons (PAHs) using USEPA Method 8270
- GRO using the WI Modified Method
- DRO using the WI Modified Method
- Cyanide using USEPA Method 335.4
- RCRA Metals using USEPA Method 6010
- Target Analyte List (TAL) Metals using USEPA Method 6010
- Polychlorinated biphenyls (PCBs) using USEPA Method 8082
- Lead using USEPA Method 6010
- Pesticides/Herbicides using USEPA Method 8081A
- pH using USEPA Method 150.1

Additional details regarding the number of samples, bottles, preservation, etc. for each analytical method is included in Table 2. Upon completion, bentonite chips were used to abandon each unregulated borehole. In some areas of the Site, perched groundwater is encountered above or at the interface of the unconsolidated sediments and the bedrock. If potential impacts appeared to extend to the perched groundwater in the unconsolidated overburden (based on visual observations, odors, or PID readings), temporary groundwater monitoring wells were installed and a grab sample was collected. As discussed in Section 2.2.2, perched groundwater was discontinuous during field investigations and finding locations with sufficient water for collection of a sample was difficult, therefore, temporary groundwater monitoring wells were also installed in boreholes that did not exhibit impacts to provide groundwater analytical in areas with potential data gaps and to delineate potentially impacted groundwater samples from impacted boreholes. Temporary groundwater monitoring wells were constructed of 1-inch diameter, 5-foot-long polyvinyl chloride (PVC) slotted well screens with PVC riser. Temporary wells, with sufficient yield, were purged of at least 1 gallon of groundwater using a peristaltic pump and disposable tubing prior to sampling to minimize turbidity. At least one sample was collected from the shallowest groundwater encountered at each location. Groundwater samples collected from temporary groundwater monitoring wells were analyzed for one or more of the following analytes:

- VOCs using USEPA Method 8260
- SVOCs using USEPA Method 8270
- PAHs using USEPA Method 8270
- GRO using the WI Modified Method
- DRO using the WI Modified Method
- Cyanide using USEPA Method 335.4
- Dissolved and Total TAL Metals using USEPA Method 6010
- Dissolved and Total RCRA Metals using USEPA Method 6010/7470
- PCBs using USEPA Method 8082
- Dissolved and Total Lead using USEPA Method 6010
- pH using USEPA Method 150.1.

Groundwater samples analyzed for dissolved metals were field filtered using a 0.45-micron disposable filter prior to sample collection. Groundwater sampling logs are included in Appendix E.

Upon completion, the borehole was sealed in accordance with Minnesota Department of Health (MDH) guidelines and a Borehole Sealing Record was prepared. Copies of borehole sealing records are in Appendix F. The surface disturbance of each borehole was repaired to match surrounding materials.

4.3 Permanent Groundwater Monitoring Wells

4.3.1 Permanent Groundwater Monitoring Well Installation

Twenty-five permanent groundwater monitoring wells were installed across the Site. The groundwater monitoring wells are screened within the perched unconsolidated overburden, the perched Platteville Limestone/Dolostone, or the St. Peter Sandstone aquifer. The groundwater monitoring wells were installed to evaluate groundwater quality within the site footprint and downgradient towards the Mississippi River (Figure 2).

Boreholes were drilled using either a nominal 4.25-inch inner diameter hollow-stem auger (overburden groundwater monitoring wells) or roto-sonic drilling rig (bedrock groundwater monitoring wells). A dual casing methodology was used during roto-sonic drilling, where the inner casing is drilled past the outer casing, minimizing the potential for vertical migration of constituents. Soil samples and rock coring samples were collected continuously for wells installed in 2007. Well construction and soil boring logs were prepared as described above, and each unconsolidated soil sample was screened in the field using a PID. Soil samples were not collected during the installation of overburden groundwater monitoring wells in 2011.

Groundwater monitoring wells installed in the overburden were constructed with 2-inch diameter, 5-footlong slotted Schedule 40 PVC screens, along with Schedule 40 PVC riser. Surface completions were either flush-mount or stickup, depending on the location. The Platteville Limestone/Dolostone and St. Peter Sandstone groundwater monitoring wells (bedrock monitoring wells) were constructed with 2-inch

diameter, 10-foot-long continuous stainless steel screens and black carbon steel riser. Surface completions were either flush-mount or stickup, depending on the location.

Each well had a filter sand pack extended to approximately 2 feet above the top of the screened interval. A 2-foot bentonite seal was placed over the sand pack and the remaining well annulus was sealed with cement grout to the surface. The wells were developed (bailing and surging techniques or air lifting) and permitted in accordance with MDH requirements. The well location, ground surface, and top–of-casing elevation for each well were surveyed to the Ramsey County coordinates and 1929 United States Geological Survey Vertical Datum.

Three existing groundwater monitoring wells located at the Site were observed during Phase I activities. The three existing wells (MW-4, MW-5 and MW-6) are located east, west, and southwest of the former hazardous waste storage building, respectively. These wells were installed to monitor groundwater present in the vicinity of the two former used solvent USTs situated west of the former hazardous waste storage building. A summary of the permanent groundwater monitoring well construction details is included in Table 3. Well construction logs are included in Appendix G.

4.3.2 Permanent Groundwater Monitoring Well Sampling Procedures

Each groundwater monitoring well was gauged prior to commencing sampling activities. During each gauging event, static water levels were collected as well as depth to bottom measurements to determine casing integrity and siltation of the well screens. Monitoring wells were surged to suspend fine particles for purging prior to sampling.

Groundwater monitoring wells were sampled using the low-flow sampling method in accordance with the USEPA Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures (USEPA 1996). Groundwater was purged using a peristaltic pump and dedicated tubing. If water levels exceeded approximately 25 feet below ground surface, monitoring wells were sampled using a dedicated bailer. Monitoring wells sampled with a dedicated bailer utilized the standard purge (three-well volume) technique rather than the low-flow method.

Water quality parameters (pH, temperature, specific conductivity, oxidation reduction potential, and dissolved oxygen) were collected during purging using a multi-parameter flow-through-cell and a separate turbidity meter. Once indicator parameters stabilized during low-flow groundwater sampling, or three well volumes were removed, samples were collected in laboratory-supplied containers and placed on ice pending shipment to the laboratory following standard chain-of-custody procedures. All samples were submitted to TestAmerica Laboratories in North Canton, Ohio of one or more of the following analytes:

- VOCs using USEPA Method 8260
- SVOCs using USEPA Method 8270
- GRO using the WI Modified Method
- DRO using the WI Modified Method
- Cyanide using USEPA Method 335.4
- Total and dissolved RCRA Metals using USEPA Method 6010/ Method 7470

- Dissolved TAL Metals using USEPA Method 6010
- Total and dissolved Lead using USEPA Method 6010
- PCBs using USEPA Method 8082.

All groundwater samples analysed for dissolved metals were field filtered using a 0.45-micron disposable filter prior to sample collection. Groundwater sampling logs are included in Appendix E.

4.4 Decontamination Procedures

Drilling and sampling equipment (e.g., drill rig, drill casings, rods, sample barrel, hand augers, stainless steel spatulas) and any piece of equipment that could have potentially come into contact (directly or indirectly) with impacts were decontaminated on-site. Decontamination protocols were followed per the Field Sampling Plan between boreholes and before leaving the site at the end of the project.

Drilling and sampling equipment were disassembled and immersed in a 2-percent solution of laboratory-grade detergent (e.g., Alconox) and city water. The equipment was then scrubbed to remove any adhering particles and rinsed with distilled water. The clean equipment was then handled with clean disposable gloves to avoid potential contamination. The 2 percent solution of laboratory-grade detergent and city water was changed daily, or more frequently after drilling at highly impacted locations.

Hand augers and stainless steel spatulas were rinsed with a solution of laboratory-grade detergent (e.g., Liquinox) and distilled water. The equipment was then scrubbed to remove any adhering particles and rinsed with distilled water. The clean equipment was then handled with clean disposable gloves to avoid potential contamination.

All decontamination water was containerized as investigation-derived waste (IDW) and disposed of as described in Section 4.5.2.

4.5 Investigation-derived Waste

IDW generated during the course of the subsurface investigations included soil cuttings, purge water, decontamination water, personal protective equipment (PPE) and disposable sampling equipment (i.e., filters, tubing, PVC).

4.5.1 Soil IDW

Soil cuttings generated during the subsurface investigations were either staged in a steel roll-off container or 55-gallon drums. Soil cuttings staged in 55-gallon drums were segregated in the field prior to disposal pursuant to field screening results using the following segregation parameters:

- Zero to <100 parts per million
- Greater than 100 parts per million.

One composite sample was collected for characterization from the steel roll-off. One composite sample was collected for laboratory analysis from the segregated staging areas for every five 55-gallon drums of soil cuttings generated. Laboratory analysis was utilized for offsite disposal. Laboratory analysis included one or more of the following:

- Toxicity characteristic leaching procedure (TCLP) VOCs using USEPA Method 1311/8260
- TCLP SVOCs using USEPA Method 1311/8270
- TCLP RCRA Metals using USEPA Method 1311/6010
- PCBs using USEPA Method 8082
- Corrosivity using USEPA Method 9045
- Flashpoint using USEPA Method 1010
- pH using USEPA Method 150.1.

In November 2011, two composite waste characterization samples were collected for the 2011 subsurface investigation activities. One sample consisted of a composite from the two 55-gallon drums and one sample consisted of a composite from the steel roll-off container. The off-site disposal of the soil IDW was organized and conducted by the on-site waste management company (Waste Management, Inc.).

In April 2014, waste characterization samples were collected from the 2013 to 2014-generated soil cuttings to develop a site-specific waste characterization profile for subsequent subsurface investigation soil cuttings IDW. The waste characterization samples consisted of composite samples collected from 12 of the 30 soil IDW 55-gallon drums. The site-specific waste characterization profile was used for off-site disposal of all non-hazardous soil cuttings generated between June 2014 and July 2015. The off-site disposal was facilitated through Waste Management Inc. and transported to the Spruce Ridge Facility in Glencoe, Minnesota.

4.5.2 Purge Water and Decontamination Water IDW

Purge water and decontamination water generated during investigation activities when the assembly plant was operational were temporarily staged on-site within poly tanks or 55-gallon drums. The purge water and decontamination water was then characterized by Waste Management, Inc. and discharged to the facilities wastewater treatment system.

Following plant shutdown in December 2011, purge water and decontamination water were drummed for off-site disposal. One composite sample was collected for characterization from the 55-gallon drums. Laboratory analysis was utilized for offsite disposal and included one or more of the following:

- TCLP VOCs using USEPA Method 1311/8260
- TCLP RCRA Metals using USEPA Method 1311/6010
- Corrosivity using USEPA Method 9045
- Flashpoint using USEPA Method 1010
- pH using USEPA Method 9040C.

A site-specific waste characterization profile was also generated for the purge and decontamination water IDW in 2014, and was used for off-site disposal between June 2014 and July 2015. The off-site disposal was facilitated through Waste Management Inc. and transported to the Spruce Ridge Facility.

4.5.3 PPE and Disposable Sampling Equipment

PPE and disposable sampling equipment were placed in the roll-off (2011) and in 55-gallon drums (2012 through 2015) and disposed of off-site after review of subsurface investigation results. A site-specific waste characterization profile was also generated for the PPE and disposable sampling equipment in 2014 based on analytical results for the soil and purge water and decontamination water IDW. The off-site disposal was facilitated through Waste Management Inc. and transported to the Spruce Ridge Facility.

4.6 Surveying

All soil borings and groundwater monitoring wells were surveyed for X, Y, and Z (ground surface and top of casing, if applicable) coordinates referencing the National Geodetic Vertical Datum of 1929 and North American Datum of 1983 by Sunde Land Surveying, LLC, a professional Minnesota-certified land surveyor, at the completion of each investigation event.

5 RISK-BASED SCREENING LEVELS

Results of the investigation activities described above were compared to risk-based screening values developed and propagated by the MDH and MPCA. These risk-based levels are only a preliminary screening tool and are not intended to indicate areas of the Site where remediation may be required. Final remediation action levels will be included as part of a Response Action Plan The risk-based values that will be included in the screening include:

- MPCA Soil Reference Values (SRVs) for direct contact with soil
- Site-specific values for naturally occurring metals (iron and arsenic) for direct contact with soil
- MPCA PRP Guidance Values for direct contact with petroleum impacted soil
- MDH Health-Based Guidance for ingestion of groundwater
- MPCA WQS for exposure to surface water
- MPCA Groundwater Intrusion Screening Values (GW_{ISVs}) for vapor intrusion

Each of these risk-based screening levels are discussed in more detail below.

5.1 Soil Reference Values

SRVs are a screening tool used to evaluate potential human health risks from direct soil exposure. SRVs were derived by the MPCA using the USEPA Superfund methodology. As stated above, SRVs are intended to be a screening tool to identify areas where additional investigation or remediation should be considered. SRVs have been developed for two soil land use categories, residential/recreational and commercial/industrial. Soil analytical data included in Section 6 will be compared against both soil land use categories because a final land use has yet to be determined for the Site.

5.2 Petroleum Remediation Program Guidance Values

The PRP has provided guidance values for preliminary screening of soil and groundwater impacted with GRO and DRO. The soil guidance value of 100 milligrams per kilogram for GRO and DRO is presented in the document titled Best Management Practices for the Off-Site Reuse of Unregulated Fill (MPCA 2012) and the guidance values for groundwater of 100 micrograms per liter (µg/L) for GRO and DRO was presented during personal communications with Petroleum Brownfields Program staff (Stacey Van Patten pers. com., October 30, 2015).

5.3 Minnesota Health-based Guidance Values

Guidance values for groundwater promulgated by the MDH and adopted by the MPCA include Health Risk Limits, Health Based Values and Risk Assessment Advice. This group of groundwater guidance values will collectively be referred to as MDH-derived values in the context of this report. MDH-derived values are relevant when considering direct exposure to groundwater through ingestion of drinking water. The perched groundwater present in the unconsolidated overburden and in the Platteville Limestone/Dolostone are not potable groundwater sources; therefore, direct exposure via drinking water is not a viable exposure pathway. The St. Peter Sandstone is a potential potable water supply aquifer; however, there are no water supply wells between the Site and eventual discharge of the St. Peter aquifer

into the Mississippi River, therefore, the direct exposure pathway is again incomplete. For those reasons, MDH-derived values are generally not the appropriate risk-based screening standards with which to compare the site groundwater analytical results; however, MDH-derived values are included in the groundwater analytical table for reference. Due to a lack of alternative standards for comparison, the groundwater samples collected from the perched zone within the Platteville Limestone/Dolostone will be screened against MDH-derived values. The appropriate risk-based screening standards for groundwater are discussed in more detail below.

5.4 Surface Water Quality Standards

WQSs are established by the MPCA for protection of beneficial uses of state water resources. WQSs vary based on the classification (e.g., drinking water, aquatic life, recreation) for each surface water body. The stretch of the Mississippi River adjacent to the Site is classified as a 2B, 3C, 4A, 5, and 6 water. Class 2B (Aquatic Life and Recreation beneficial uses) has the strictest surface water standards of those classes and are therefore utilized as the screening standards for groundwater samples collected from the St. Peter Sandstone, which, as discussed above, is the groundwater unit that discharges to the Mississippi River.

5.5 Groundwater Intrusion Screening Values

GW_{ISVs} are screening values developed by the MPCA as a tool for identifying areas where concentrations of volatile compounds in shallow or perched groundwater have the potential to create vapor intrusion concerns in overlying or nearby structures. There are currently no existing permanent structures on-site; however, in anticipation of site redevelopment, GW_{ISVs} will be used as the primary criteria for screening groundwater concentrations detected in the shallow overburden. Areas where groundwater concentrations exceed the GW_{ISVs} will be evaluated for additional soil gas investigation prior to or concurrent with any remediation and/or redevelopment activities.

6 INVESTIGATION RESULTS

A list of the compounds that exceed a screening value (as discussed in Section 5) for each contaminant class (discussed below) and media (soil and groundwater) is provided in Table 4. A complete list of soil analytical results is included in Table 5. Groundwater analytical results from temporary groundwater monitoring wells and permanent groundwater monitoring wells are included in Tables 6 and 7, respectively. Laboratory analytical reports are included in Appendix H.

6.1 Chlorinated VOCs

For the purposes of this report, the term “chlorinated VOCs” refers to the following compounds:

- 1,1-Dichloroethane (1,1-DCA)
- 1,1,2-Trichloroethane
- 1,1,1,2-Tetrachloroethane
- 1,1,1-Trichloroethane (1,1,1-TCA)
- 1,2-Dichloroethane (1,2-DCA)
- Chloroethane
- 1,1,2,2-Tetrachloroethane
- 1,1-Dichloroethene (1,1-DCE)
- *cis*-1,2-Dichloroethene (cis-1,2-DCE)
- Tetrachloroethene (PCE)
- *trans*-1,2-Dichloroethene (trans-1,2-DCE)
- Trichloroethene (TCE)
- Vinyl chloride.

6.1.1 Chlorinated VOCs in Soils

The following chlorinated VOCs were detected in site soils:

- 1,1,1-TCA
- 1,1-DCA
- 1,2-DCA
- cis-1,2-DCE
- PCE
- trans-1,2-DCE
- TCE
- Vinyl chloride.

A complete list of the chlorinated VOCs detected in soil samples collected from the Site is included in Table 5. A summary of chlorinated VOC results in soil is included on Figure 10. No chlorinated VOCs were detected above their respective residential SRVs in soils.

6.1.2 Chlorinated VOCs in Groundwater

The following chlorinated VOCs were detected in site groundwater:

- 1,1-DCA
- 1,1-DCE
- cis-1,2-DCE
- PCE
- trans-1,2-DCE
- TCE.

A complete list of the chlorinated VOC detections at the Site is included in Tables 6 and 7. A summary of chlorinated VOC results in groundwater is included on Figure 11.

The GW_{ISV} for TCE was exceeded in a sample collected from the unconsolidated overburden at ASB-0921, which is in the north half of the former Main Assembly Building. As noted in Section 5.5, an exceedance of a GW_{ISV} indicates there is the potential for a vapor intrusion issue in overlying or nearby structures. There are currently no existing permanent structures on-site; however, these exceedances will be considered when developing a Response Action Plan and a property redevelopment plan. No other chlorinated VOCs exceeded their respective GW_{ISVs} in the unconsolidated overburden.

PCE and TCE exceeded the MDH-derived values in the overburden unit. However, there is no regulatory driver associated with these exceedances as groundwater from the overburden unit is not utilized as drinking water.

No chlorinated VOCs were detected at concentrations above their respective MDH-derived values in the Platteville Limestone/Dolostone or above their respective WQSs in the St. Peter Sandstone.

6.2 Non-chlorinated VOCs

Non-chlorinated VOCs refers to all VOCs on the USEPA Method 8260 reporting list except those compounds that are explicitly listed in Section 6.1.

6.2.1 Non-chlorinated VOCs in Soil

A complete list of the non-chlorinated VOCs that have been detected in the soil is included in Table 5. A summary of non-chlorinated VOC results in soil is included on Figure 12. Soil concentrations exceeding their respective residential SRVs are generally clustered in the following areas:

- South of the Paint Building (Former UST Solvent Tank Area)
- Southeast of the Main Assembly Building (Former Disposal Areas A and B)
- East of the Main Assembly Building

- North of the Main Assembly Building (North Parking Area)

South of the Paint Building, in the vicinity of the Former UST Solvent Tank Area, m,p-xylene and o-xylene were detected above the residential SRVs.

In the vicinity of Former Disposal Areas A and B, the following constituents were detected above their respective residential SRVs: 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; m,p-xylene; naphthalene, n-butylbenzene; and o-xylene.

East of the Main Assembly Building, the following constituents were detected above their respective residential SRVs: 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; m,p-xylene; naphthalene; and n-butylbenzene.

North of the Main Assembly Building, in the North Parking Area, the following constituents were detected above their respective residential SRVs: 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; benzene; m,p-xylene; naphthalene; n-propylbenzene; o-xylene; toluene; and total xylenes.

Isolated soil samples containing concentrations exceeding their respective residential SRVs were also detected in the paved area near the northeast corner of the Site (1,2,4- and 1,3,5-trimethylbenzene at A090) and near the southern edge of the Main Assembly Building (naphthalene at ASB-219).

6.2.2 Non-chlorinated VOCs in Groundwater

A complete list of the non-chlorinated VOCs that have been detected in groundwater at the Site is included in Tables 6 and 7. A summary of non-chlorinated VOC results in groundwater is included on Figure 13. Groundwater concentrations exceeding their respective GW_{ISVs} are generally clustered in the following areas:

- East of the Main Assembly Building
- South of the Paint Building
- North of the Main Assembly Building (North Parking Area).

East of the Main Assembly Building the following constituents were detected in the perched overburden groundwater above the GW_{ISVs}: 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; benzene; ethylbenzene; CFC-12; m,p-xylene; and o-xylene. These constituents are similar to those identified in soil in the same areas.

South of the Paint Building, in the vicinity of the Former UST Solvent Tank Area, the following constituents were detected in the perched overburden groundwater above the GW_{ISVs}: ethylbenzene; m,p-xylene, and o-xylene. These constituents are similar to those identified in soil in the same area.

North of the Main Assembly Building in the North Parking Area, the following constituents were detected in the perched overburden groundwater above the GW_{ISVs}: 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; benzene; m,p-xylene, and o-xylene. These constituents are similar to those identified in soil in the same area.

As noted in Section 5.5, an exceedance of a GW_{ISV} indicates there is the potential for a vapor intrusion issue in overlying or nearby structures. There are currently no existing permanent structures on-site;

however, these exceedances will be considered when developing a Response Action Plan and a property redevelopment plan.

No non-chlorinated VOCs were detected at concentrations above their respective MDH-derived values in the Platteville Limestone/Dolostone or above their respective WQS in the St. Peter Sandstone.

6.3 SVOCs

6.3.1 SVOCs in Soil

A complete list of the SVOCs that have been detected in the soil is included in Table 5. A summary of SVOC results in soil is included on Figure 14. Soil concentrations exceeding the residential SRVs are generally clustered in the following areas:

- Southeast of the Main Assembly Building (Former Disposal Areas A and B)
- North of the Main Assembly Building (North Parking Area)
- Southeast of the Main Assembly Building (Packer Building)
- Southeast of the Steam Plant
- Warehouse.

Southeast of the Main Assembly Building, in the vicinity of Former Disposal Areas A and B, the following constituents were detected above their respective residential SRVs: benzo(a)pyrene (BaP), naphthalene, and BaP equivalents.

North of the Main Assembly Building, in the North Parking Area, BaP and BaP equivalents exceeded their respective residential SRVs at one location (ASB-121).

Southeast of the Main Assembly Building, in the vicinity of the Packer Building, BaP and BaP equivalents were detected above their respective residential SRVs. All BaP exceedances were located in the top 1 foot of soil.

Southeast of the Steam Plant, the following constituents were detected above their respective residential SRVs: BaP, naphthalene, and BaP equivalents.

In the warehouse, BaP and BaP equivalents exceeded their respective residential SRVs in isolated boring locations (ASB-0906 and ASB-0924).

6.3.2 SVOCs in Groundwater

A complete list of the SVOCs that have been detected at the Site is included in Tables 6 and 7. A summary of SVOC results in groundwater is included on Figure 15. The only constituent detected above its respective GW_{ISV} in the overburden unit was naphthalene. Naphthalene was detected in one groundwater sample collected from a temporary groundwater monitoring well set at ASB-001 located east of the Main Assembly Building; however, naphthalene was below the GW_{ISV} in the sample collected from a permanent groundwater monitoring well (AMW-14), which was installed in the same location. As noted in Section 5.5, an exceedance of a GW_{ISV} indicates there is the potential for a vapor intrusion issue in overlying or nearby structures. There are currently no existing permanent structures on-site; however,

these exceedances will be considered when developing a Response Action Plan and a property redevelopment plan.

Bis(2-ethylhexyl)phthalate was the only SVOC detected above the MDH-derived values in the Platteville Limestone/Dolostone from AMW-09 during the December 2007 event; however, samples collected from that well before (July 2007) and after (March and September 2008) were below detection limits. As discussed in Section 5.4, groundwater from the Platteville Limestone/Dolostone is not used as a potable water source, but was compared to the MDH-derived values in the absence of an alternative standard.

No SVOCs were detected above the WQS in the St. Peter Sandstone.

6.4 Metals

6.4.1 Metals in Soil

A complete list of the metals that have been detected at the Site is included in Table 5. A summary of metals results in soil is included on Figure 16. Iron results are not included on Figure 16 because iron detections above residential SRVs are ubiquitous across the Site including background samples, which indicates residential SRVs are not an appropriate screening tool. Site-specific remedial action values for naturally occurring metals that have been detected at the Site will be calculated as part of a Remedial Action Plan. Metal concentrations exceeding the residential SRVs are generally clustered in the following areas:

- Southeast of the Main Assembly Building (Former Disposal Areas A and B)
- North of the Main Assembly Building (North Parking Area)
- East of the Main Assembly Building
- West of the Main Assembly Building
- Southeast corner of the Site (Potential Battery Waste Disposal Area).

In addition to those areas where clusters of samples exceeding SRVs were noted, there were sporadic detections throughout much of the Site including within and around the Main Assembly Building and Warehouse, in the paved area north of the Paint Building, and near the Wastewater Treatment Plant.

Southeast of the Main Assembly Building, in the vicinity of Former Disposal Areas A and B, the following constituents were detected above their respective residential SRVs: antimony, arsenic, barium, cadmium, copper, iron, lead, mercury, and vanadium.

North of the Main Assembly Building (North Parking Area), vanadium and manganese were detected above their respective residential SRVs.

East of the Main Assembly Building, arsenic, mercury and vanadium were detected above their respective residential SRVs. These impacts are in the vicinity of the former railroad spurs.

West of the Main Assembly Building, the following constituents were detected above their respective residential SRVs: arsenic, barium, mercury and vanadium.

In the southeast corner of the site, arsenic and vanadium were detected above their respective residential SRVs.

6.4.2 Metals in Groundwater

Dissolved metals are the preferred analytical method when discussing metals concentrations in groundwater. A complete list of the total and dissolved metals that have been detected at the Site is included in Tables 6 and 7. A summary of dissolved metals results in groundwater is included on Figure 17.

Mercury is the only metal with an associated GW_{ISV}. Dissolved mercury did not exceed the GW_{ISV}. However, total mercury exceeded the GW_{ISV} east of the Main Assembly Building at ASB-036 and ASB-006. No dissolved metals sample was collected at this location. As noted in Section 5.5, an exceedance of a GW_{ISV} indicates there is the potential for a vapor intrusion issue in overlying or nearby structures. There are currently no existing permanent structures on-site; however, these exceedances will be considered when developing a Response Action Plan and a property redevelopment plan.

In absence of GW_{ISVs}, groundwater analytical results from the overburden unit were compared to the MDH-derived values. The following dissolved metals were detected above the MDH-derived values in the overburden unit: arsenic, manganese, thallium, and vanadium.

No dissolved metals exceeded MDH-derived values in the samples collected from the Platteville Limestone/Dolostone.

The following dissolved metals have been detected in the three monitoring wells (AMW-05, AMW-05B, and AMW-07) in the vicinity of the Wastewater Treatment Plant above their applicable WQSs in the St. Peter Sandstone: aluminum, cobalt, and selenium. Selenium was detected above the WQSs once in AMW-05 in July 2014 but was below detection limits during the two subsequent sampling events in August and September of the same year. Cobalt was detected above the WQSs once in AMW-05 in September 2014 but was below detection limits during the two previous sampling events in July and August of the same year. Those three sampling events were conducted at a time of high water level in the Mississippi River. AMW-05 is a dry well during normal water levels. Cobalt was also detected above the WQS once in AMW-05B in August 2014. Aluminum and cobalt were each detected at AMW-07 at concentrations above the WQS in samples collected in August and September 2014, but were below the WQSs in July 2014. .

6.5 PCBs

6.5.1 PCBs in Soil

A complete list of the PCBs that have been detected at the site soils is included in Table 5. A summary of PCB results in soil is included on Figure 18. No PCBs were detected at concentrations above the residential SRVs.

6.5.2 PCBs in Groundwater

A complete list of the PCBs that have been detected in groundwater is included in Tables 6 and 7. A summary of PCB results in groundwater is included on Figure 19. Analytical results from the overburden unit were compared to MDH-derived values in the absence of applicable GW_{ISVs}.

Aroclor 1254 and Aroclor 1260 were detected above the MDH-derived values in the overburden unit in one sample from each of the following temporary groundwater monitoring wells: ASB-095, ASB-212, and ASB-234. All three PCB exceedances were located to the east of the Main Assembly Building.

PCBs were not detected above the MDH-derived values in the Platteville Limestone/Dolostone.

PCBs have been detected at concentrations exceeding the WQSs at two locations on the parcel west of Mississippi River Boulevard (AMW-05B and AMW-07) in the St. Peter Sandstone. Aroclor 1254 was detected at AMW-05B and Aroclor 1260 was detected at AMW-07 in one sample event in September 2008. Three sampling events conducted in 2007, one sample event conducted earlier in 2008, and one subsequent sample event conducted in 2009 did not identify detectable concentrations of PCBs in either well. The WQS exceedance identified in September 2008 has not been duplicated in 5 other sample events from this well, indicating that the September 2008 detection is isolated in nature.

6.6 GRO/DRO

6.6.1 GRO/DRO in Soil

A complete list of the GRO and DRO detections in site soils is included in Table 5. A summary of GRO/DRO results in soil is included on Figure 20. Both GRO and DRO were detected above the PRP Guidance Value of 100 milligrams per kilogram. Soil concentrations exceeding the PRP Guidance Value were clustered in the following areas:

- East of the Main Assembly Building
- Southeast of the Main Assembly Building (Former Disposal Areas A and B)
- North of the Main Assembly Building (North Parking Area)
- North half of the Paint Building.

In addition to those areas where clusters of samples exceeding the PRP Guidance Value were noted, there were also isolated detections throughout much of the Site including within and around the Main Assembly Building, in the paved area north of the Paint Building, and in the south end of the Paint Building.

6.6.2 GRO/DRO in Groundwater

GRO and DRO were compared to MPCA-specified screening levels of 100 µg/L for both GRO and DRO (MPCA 2015). A complete list of GRO and DRO detections at the Site is included in Tables 6 and 7. A summary of GRO/DRO results in groundwater are included on Figure 21.

Perched Overburden Unit: Both GRO and DRO were detected at concentrations above the specified screening levels in the perched overburden unit in samples collected from both temporary and permanent wells. GRO and DRO detections above the specified screening levels were detected in the overburden unit across the Site. In general, DRO concentrations were relatively higher when compared to GRO. The areas with the highest concentrations (greater than two orders of magnitudes above the specified criteria) of GRO and DRO were north of the Main Assembly Building in the North Parking Lot (ASB-0203S, ASB-0207E, ASB-0208S, ASB-0215, and ASB-0216), east of the Main Assembly Building (ASB-001, ASB-003, ASB-037, ASB-0211N, ASB-0223, and ASB-0224) and southeast of the Main Assembly Building near

Former Fill Areas A and B (ASB-0416). GRO concentrations in the perched overburden range from non-detect to 66,000 µg/L and DRO concentrations range from non-detect to 64,000 µg/L.

Platteville Limestone/Dolostone Unit: Only DRO has been detected in the Platteville Limestone/Dolostone at concentrations exceeding the specified screening levels. Concentrations of DRO in this perched limestone aquifer have historically ranged from 380 µg/L to 2,300 µg/L which is lower than what is detected in the overlying perched overburden groundwater discussed above.

St. Peter Sandstone: DRO has been detected at one well (AMW-07) screened in the St. Peter Sandstone at concentrations exceeding the MPCA screening level (130 µg/L in March 2008 and 210 µg/L in September 2008). No other wells screened in the St. Peter Sandstone had detectable concentrations of DRO. No GRO was detected in the St. Peter Sandstone.

6.7 Pesticides/Herbicides

6.7.1 Pesticides/Herbicides in Soil

The soil sample collected from ASB-043 was analyzed for pesticides and herbicides. A complete list of the pesticides and herbicides that were analyzed is included in Table 5. A summary of the pesticide and herbicide results in soil is included on Figure 22. No pesticides or herbicides were detected in this sample.

6.8 Cyanide

6.8.1 Cyanide in Soil

A complete list of cyanide results in samples collected from the site soils is included in Table 5. A summary of cyanide results in soil is included in Figure 23. No cyanide was detected at concentrations above the residential SRVs.

6.8.2 Cyanide in Groundwater

A complete list of cyanide detections in site groundwater is included in Tables 6 and 7. A summary of cyanide results in groundwater is included on Figure 24. Analytical results from the overburden unit were compared to MDH-derived values in the absence of applicable GW_{ISVs}.

Cyanide was detected in one St. Peter Sandstone monitoring well at an estimated concentration of 5.9 µg/L in a sample collected from AMW-07 in March 2008. This concentration is above the applicable WQS for free cyanide and is located in the vicinity of the Wastewater Treatment Plant. Cyanide was not detected in AMW-07 from a subsequent sampling event completed in September 2008.

7 SUMMARY AND CONCLUSIONS

7.1 Summary of Screening Value Exceedances

A summary of the compounds that have been detected at least once in soil and/or groundwater at concentrations exceeding the screening values discussed above is shown in the table below:

Compound	Soil	Groundwater		
	Unconsolidated Overburden	Perched Overburden	Perched Platteville Limestone/Dolostone	St. Peter Sandstone Aquifer
Chlorinated VOCs	No	Yes (TCE only)	No	No
Non-chlorinated VOCs	Yes	Yes	No	No
SVOCs/PAHs	Yes	Yes (naphthalene only)	No	No
Metals	Yes	Yes (mercury only)	No	Yes
GRO	Yes	Yes	No	No
DRO	Yes	Yes	Yes	Yes
Cyanide	No	No	No	Yes
PCBs	No	No	No	Yes

7.2 Path Forward and Recommendations

The following investigation work will be completed to supplement the existing soil dataset at the Site:

- Additional overburden soil borings will be completed in the vicinity of the Wastewater Treatment Plant to more fully delineate the SVOC impacts that were identified in that area.
- Additional overburden soil borings will be completed in the northwest corner of the Site in the vicinity of ASB-0216 to investigate GRO/DRO impacts in that area.
- Trenches will be completed through the overburden around the suspected perimeter of Former Fill Areas A and B (southeast of the Main Assembly Building) to improve delineation of impacted soil and residual waste that may be remaining in place and that potentially extend to the south to the current adjacent Canadian Pacific property.

The following investigation work will be completed to supplement the existing groundwater dataset at the Site:

- Additional temporary wells will be installed in the northwest corner of the Site in the vicinity of ASB-0216 to more fully delineate the volatile organic compound and gasoline- and diesel range organics impacts in that area.
- Additional wells will be installed on the main parcel in the St. Peter Sandstone to expand on the existing well network and improve characterization of that aquifer.
- Soil gas samples will be collected from areas where GW_{ISVs} were exceeded in the perched aquifer in the unconsolidated overburden.

The additional investigation activities described above will be completed under the guidance of the MPCA PBP and VIC programs. Results of the additional investigation will be summarized and submitted concurrently with a Remedial Action Plan.

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