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From:

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Date:

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Arcadis Project No.:

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Subject:

RACER Saginaw Malleable Industrial Land Mixing Zone Five Year Review

On behalf of Revitalizing Auto Communities Environmental Response (RACER), Arcadis has prepared this review of the groundwater-surface water interface (GSI) mixing zone arsenic criteria determined for the Saginaw Malleable Iron (SMI) Plant Property and the adjacent Green Point Landfill (GPL), located in Saginaw, Michigan. The original mixing zone approved by the Michigan Department of Environmental Quality (MDEQ) in 2009, and provided a mixing zone limit for arsenic of 680 micrograms per liter ($\mu\text{g/L}$). Arcadis reviewed the GSI data collected since the mixing zone was granted, as well as the current site hydrogeology, in order to understand if the mixing zone requires any updates. There are three key findings for the mixing zone summarized in this technical memorandum:

- The site has stayed in compliance with the mixing zone criteria for arsenic. Since the mixing zone was established, concentrations at the GSI compliance wells have always been less than 50% of the mixing zone criteria. Arsenic trends are not increasing and no activities at the site are contributing increased arsenic to the groundwater.
- The groundwater discharge rate from the site to the Saginaw River is lower than at the time of the original mixing zone in 2009.
- The mixing zone does not require re-calculation, because the reduced groundwater discharge from the site would lead to an increased mixing zone criteria for arsenic, and the mixing zone criteria is already at the maximum allowable concentration for arsenic (the Final Acute Value of 680 $\mu\text{g/L}$).

Arsenic Trends: 2009-2016

No manufacturing or other operations have taken place on the SMI or GPL property since the mixing zone was granted in 2009. Plant operations ceased in 2007, the SMI Plant was demolished in 2010, and GPL was capped and closed in 2000. Therefore, no changes have occurred that would contribute to additional arsenic impacts.

Groundwater samples were collected for arsenic beginning in 2010 along the Saginaw River from the following wells that are located within 100 feet of the Saginaw River:

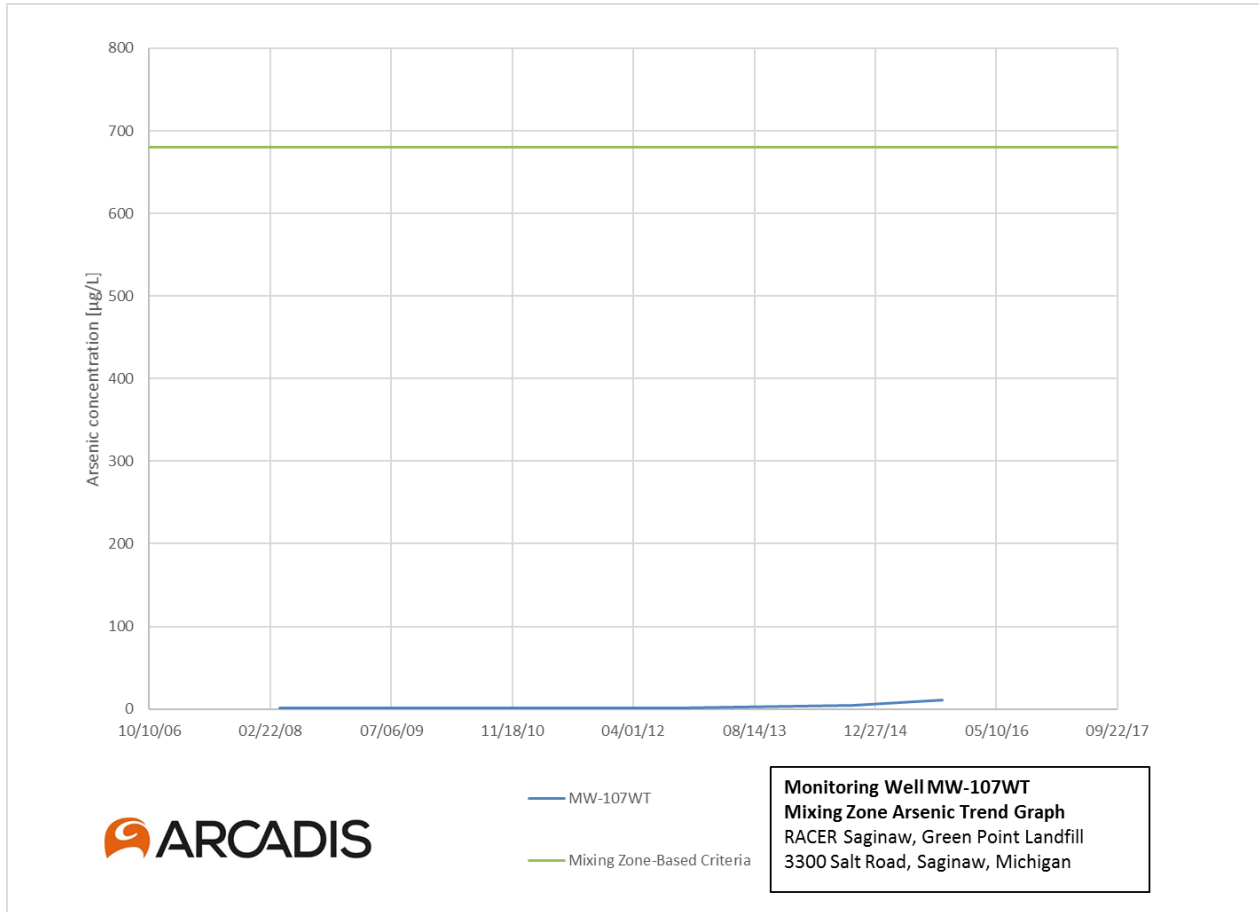
- SMI: MW-149WT, MW-114WT, MW-107WT
- GPL: X-4D, X-9D, X-4CAUGR, X-9AR, X-9BR, X-9CAUG, MW-183WT

The locations of the wells above are provided on **Figure 1** and analytical results for arsenic are summarized in **Table 1**. Exceedances of the MDEQ GSI cleanup criteria of 10 µg/L are currently observed in two wells:

- MW-107WT: 11 µg/L sampled on 10/1/2015
- MW-149WT: Concentrations since 2010 have ranged from 60 to 190 µg/L.

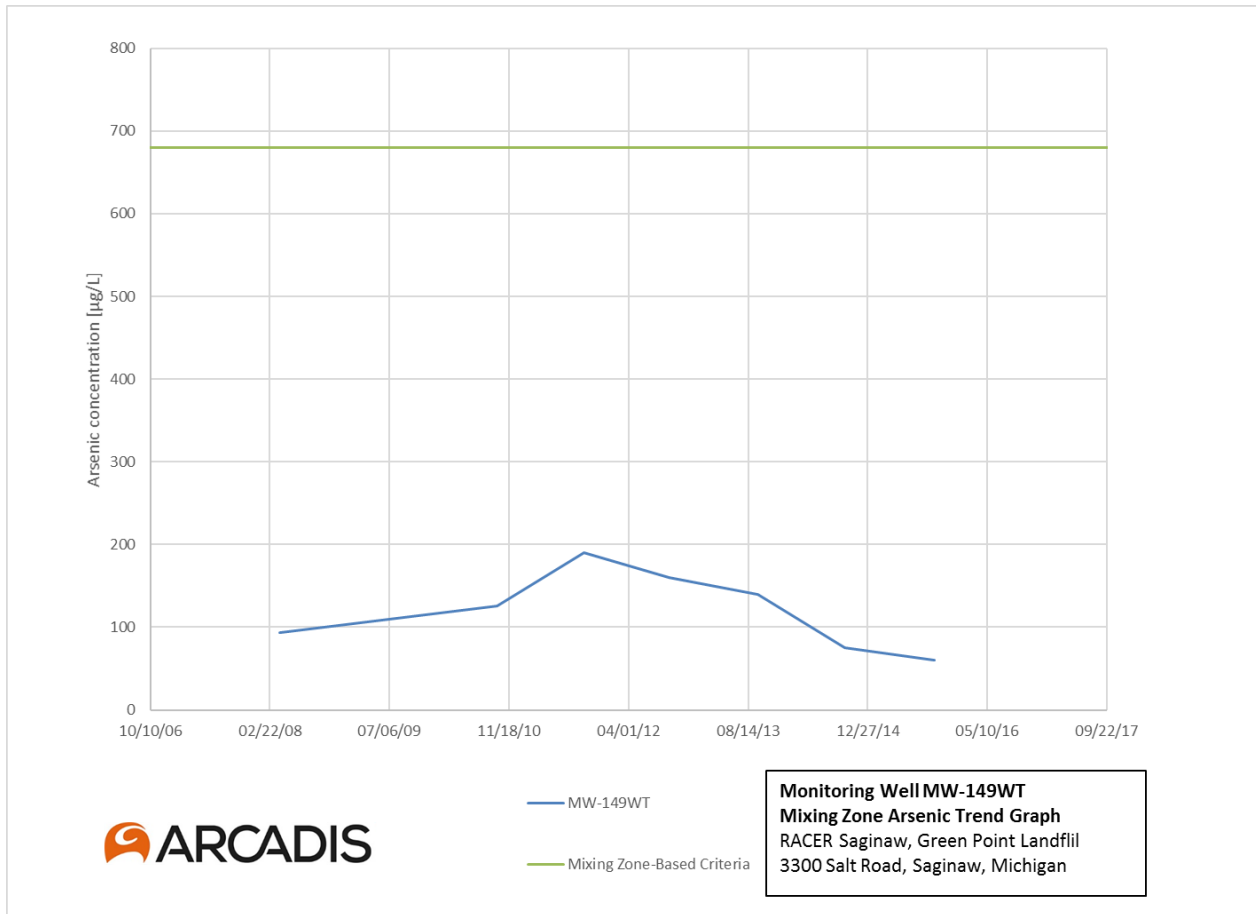
The maximum arsenic concentration observed in the wells sampled for arsenic since the submittal of the 2009 RAP is 190 µg/L in MW-149WT. Arsenic trends since 2009 for the two wells in the area of the mixing zone are presented below.

MW-107WT



As shown on the graph above, arsenic concentrations at monitoring well MW-107WT have remained low with a maximum concentration of 11 µg/L.

MW-149WT



As shown on the graph above, arsenic concentrations at monitoring well MW-149WT are higher than MW-107WT; however, concentrations are still well below the mixing zone level of 680 µg/L.

Comparison of Current and Historical Hydrogeology

The groundwater discharge rate was updated using the same approach as the original mixing zone application: a calculation based on hydraulic conductivity (K), hydraulic gradient, and the cross-sectional area of groundwater flow. The updated groundwater discharge calculation used the same two wells as the original mixing zone application (MW-107WT and MW-149WT).

- *Hydraulic conductivity* values were not revised from those reported in 2008. The geometric mean of the K values for the fill, silt, and upper sand units yielded a value of 4.18 feet per day (see Appendix I of the RAP).
- *Hydraulic gradient* was updated based on the current water elevations. Hydraulic gradients in the area of the arsenic mixing zone decreased from approximately 0.035 feet per foot to approximately 0.013 feet per foot (see **Figure 2**).

- *Cross-sectional area* of the arsenic mixing zone area was also updated based on the current water elevations. The area was based on the product of the saturated thickness (from the top of the water table to base of the upper sand unit) and the horizontal distance to the nearest monitoring well with concentrations below GSI criteria. The horizontal extent of the arsenic mixing zone area remained the same compared to 2008, but the saturated thickness increased to account for slightly higher groundwater elevations at MW-107WT and MW-149WT (see **Table 1**).

The changes in the mixing zone parameters are provided below.

Calculation Period	Cross-Sectional Area (ft ²)	Hydraulic Gradient (ft/ft)	Hydraulic Conductivity (ft/day)	Approximate Groundwater Flow Rate (ft ³ /d)
Original mixing zone	3,185	0.035	4.18	466
Current conditions	3,600	0.013	4.18	196

Summary

As presented in this technical memorandum, the following conclusions are made for the status of the arsenic mixing zone:

- The site has stayed in compliance with the mixing zone criteria for arsenic. Since the mixing zone was established, concentrations at the GSI compliance wells have always been less than 50% of the mixing zone criteria. Arsenic trends are not increasing and no activities at the site are contributing increased arsenic to the groundwater.
- Overall, groundwater discharge from the site to the Saginaw River has decreased.
- The mixing zone does not require re-calculation, because the reduced groundwater discharge from the site would lead to an increased mixing zone criteria for arsenic, and the mixing zone criteria is already at the maximum allowable concentration for arsenic (the Final Acute Value of 680 µg/L).

Annual monitoring will continue for arsenic in accordance with the operation and maintenance plan set forth in the RAP until the MDEQ approves discontinuing sampling.

Attachments:

Table 1 – Arsenic Groundwater Analytical Data

Figure 1 – Site Map

Figure 2 – Water Table Elevation Contour Map – September 2015

Tables



Table 1
Arsenic Groundwater Analytical Data
RACER Trust, Green Point Landfill
3300 Salt Road
Saginaw, Michigan

Sample ID:	Sample Depth (feet):	Date Collected:	Arsenic
<i>MDEQ GSI Criteria</i>			680*
X-4D	40 - 45	01/09/08	5.0 U
X-4D	40 - 45	04/03/08	5.0 U
X-4D	40 - 45	09/28/10	5.0 U
X-4D	40 - 45	09/26/11	1.1
X-4D	40 - 45	09/14/12	1.1
X-4D	40 - 45	09/24/13	0.91 J, B
X-4D	40 - 45	09/23/14	0.49 J, B
X-4D	40 - 45	09/30/15	1.2 J
X-9D	42.5 - 47.5	01/08/08	5.0 U
X-9D	42.5 - 47.5	03/11/08	5.0 U
X-9D	42.5 - 47.5	09/28/10	5.0 U
X-9D	42.5 - 47.5	09/23/11	0.64
X-9D	42.5 - 47.5	09/12/12	0.67 J
X-9D	42.5 - 47.5	09/25/13	21
X-9D	42.5 - 47.5	09/22/14	15
X-9D	42.5 - 47.5	09/30/15	9.5
X-4CAUGR	14 - 19	01/09/08	5.0 U
X-4CAUGR	14 - 19	03/12/08	5.0 U
X-4CAUGR	14 - 19	09/28/10	5.0 U
X-4CAUGR	14 - 19	09/26/11	0.74
X-4CAUGR	14 - 19	09/14/12	0.42 J
X-4CAUGR	14 - 19	09/24/13	1.9 B
X-4CAUGR	14 - 19	09/23/14	2.3 B
X-4CAUGR	14 - 19	09/30/15	2
X-9AR	3 - 13	01/10/08	5.0 U
X-9AR	3 - 13	03/11/08	5.0 U
X-9AR	3 - 13	09/29/10	5.0 U
X-9AR	3 - 13	09/23/11	0.4
X-9AR	3 - 13	09/12/12	0.43 J
X-9AR	3 - 13	09/25/13	6.0
X-9AR	3 - 13	09/22/14	1.2 J
X-9AR	3 - 13	10/01/15	0.63 J
X-9BR	26 - 31	01/08/08	5.0 U
X-9BR	26 - 31	03/11/08	5.0 U
X-9BR	26 - 31	09/28/10	5.0 U
X-9BR	26 - 31	09/23/11	0.65
X-9BR	26 - 31	09/12/12	0.94 J
X-9BR	26 - 31	09/25/13	6.2
X-9BR	26 - 31	09/22/14	2.0
X-9BR	26 - 31	10/01/15	1.6 J

Table 1
Arsenic Groundwater Analytical Data
RACER Trust, Green Point Landfill
3300 Salt Road
Saginaw, Michigan

Sample ID:	Sample Depth (feet):	Date Collected:	Arsenic
<i>MDEQ GSI Criteria</i>			680*
X-9CAUG	20 - 25	01/08/08	5.0 U
X-9CAUG	20 - 25	03/11/08	5.0 U
X-9CAUG	20 - 25	09/28/10	5.0 U
X-9CAUG	20 - 25	09/23/11	1.5
X-9CAUG	20 - 25	09/12/12	1.9 J
X-9CAUG	20 - 25	09/25/13	1.8 J
X-9CAUG	20 - 25	09/22/14	1.1 J, B
X-9CAUG	20 - 25	09/30/15	1.3 J
MW-183WT	6 - 16	01/09/08	5.0 U
MW-183WT	6 - 16	03/12/08	5.0 U
MW-183WT	6 - 16	09/28/10	5.0 U
MW-183WT	6 - 16	09/28/11	1.9
MW-183WT	6 - 16	09/14/12	1.0
MW-183WT	6 - 16	09/24/13	3.9 B
MW-183WT	6 - 16	09/23/14	1.8 J, B
MW-183WT	6 - 16	10/01/15	1.5 J
MW-107WT	4 - 9	4/3/2008	0.95 J
MW-107WT	4 - 9	9/18/2012	1.1
MW-107WT	4 - 9	9/24/2014	4.2
MW-107WT	4 - 9	10/1/2015	11
MW-114WT	3.5 - 8.5	09/23/14	5.3
MW-149WT	7 - 17	04/03/08	93.6
MW-149WT	7 - 17	09/30/10	126
MW-149WT	7 - 17	09/28/11	190
MW-149WT	7 - 17	09/18/12	160
MW-149WT	7 - 17	09/25/13	140 B
MW-149WT	7 - 17	09/24/14	75 B
MW-149WT	7 - 17	10/01/15	60

Notes:

Gray shaded cells represent constituent concentrations that exceed Groundwater/Surface Water (GSI) Michigan Part 201 Criteria updated December 30, 2013.

U = The constituent was analyzed for but not detected. The associated value is the constituent quantitation limit.

J = The compound/constituent was positively identified; however, the associated numerical value is an estimated concentration only.

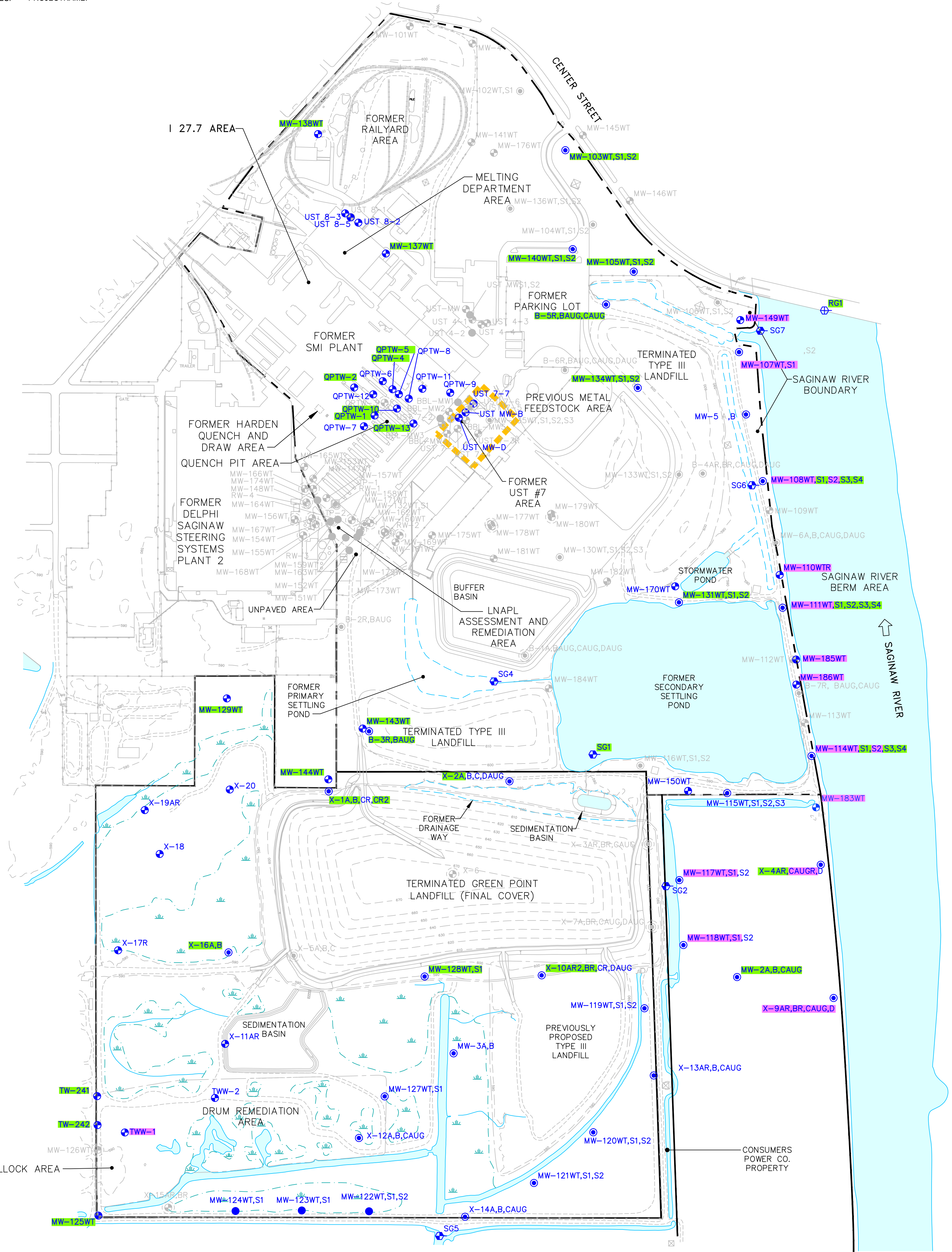
B = Inorganics: the detected analyte is an estimated value between the instrument detection limit (IDL) and the reporting limit (RL).

* Venting groundwater discharge concentrations were recommended by MDEQ in a letter dated November 26, 2008 followed by a Mixing Zone Determination Request.

Figures

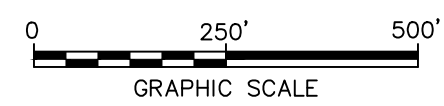


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 27608X01



STATE OF MICHIGAN PROPERTY
 (PREVIOUSLY RUBIN SCHULTZ PROPERTY)

- LEGEND:**
- SAGINAW MALLEABLE INDUSTRIAL LAND PROPERTY LINE (APPROX.)
 - PROPERTY LINE (APPROX.)
 - UNPAVED ROAD
 - GROUND SURFACE ELEVATION CONTOUR (10 FT INTERVAL)
 - FENCE LINE
 - SWAMPY AREA
 - MW-125WT MONITORING WELL
 - MW-2A,B,CAUG MONITORING WELL CLUSTER
 - SG5 STAFF GAUGE
 - TP-1 PIEZOMETER
 - RW-1 RECOVERY WELL
 - X-6 ABANDONED MONITORING WELL
 - X-5A,B,C ABANDONED MONITORING WELL CLUSTER
 - RG1 RIVER GAUGE
 - MW-152WT WELL NOT FOUND
 - SMW INVESTIGATION AREA



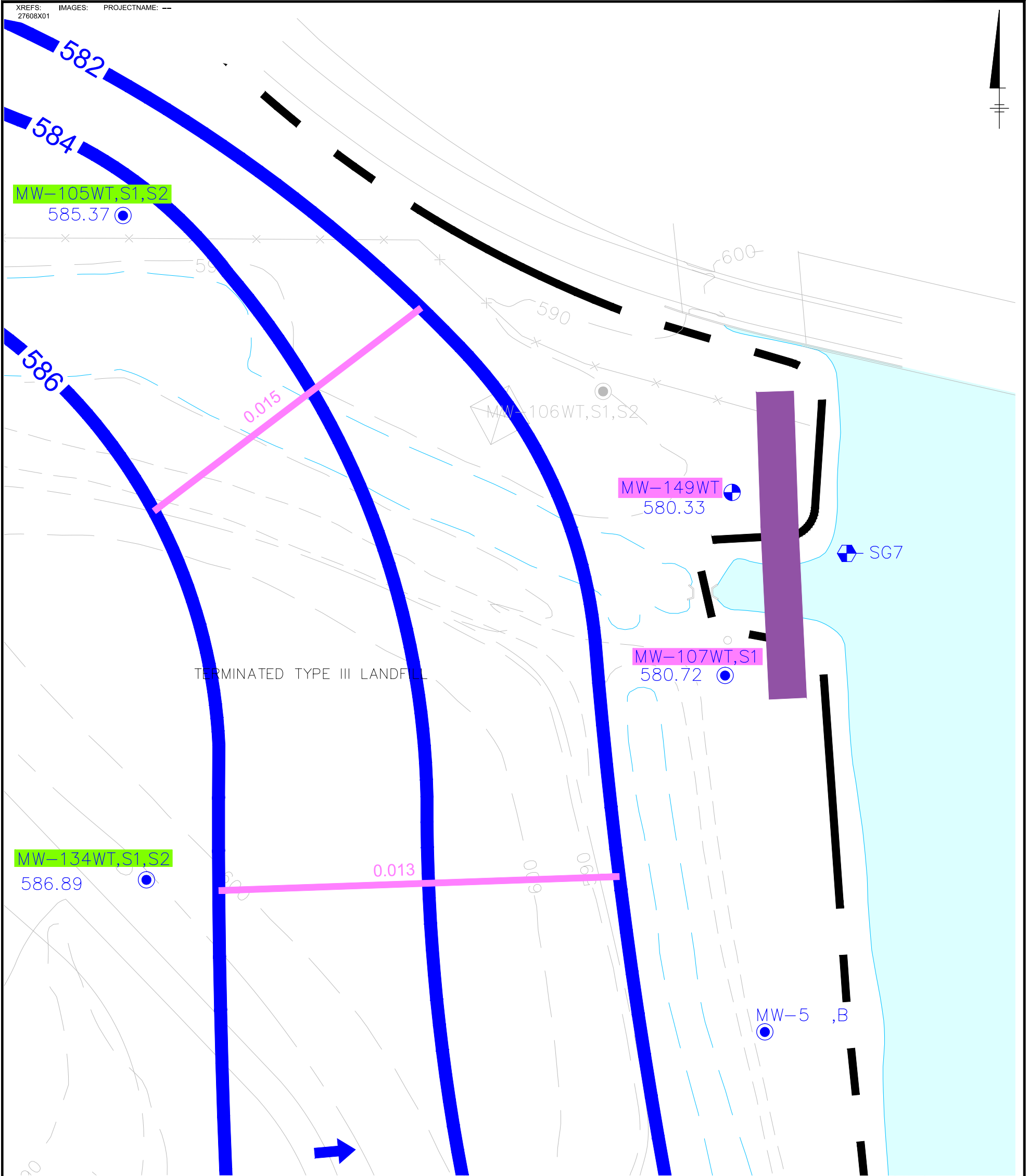
NOTES:

1. THIS PHOTOGRAMMETRIC BASE MAP FOR THE GM SAGINAW MALLEABLE IRON PLANT AND DELPHI SAGINAW STEERING SYSTEMS PLANT 2 PROPERTIES WAS PREPARED BY LOCKWOOD MAPPING, INC. OF ROCHESTER, NEW YORK. AERIAL PHOTOGRAPHY WAS CONDUCTED ON 11/11/94. ORIGINAL LOCKWOOD MAP WAS AT A SCALE OF 1"=100' AND WAS INTERPRETED FOR TWO-FOOT CONTOURS.
2. BASE MAP HAS BEEN MODIFIED TO INCORPORATE BUFFER BASIN, SEDIMENTATION BASINS, WETLANDS MITIGATION AREA, AND GREEN POINT LANDFILL (GPL) FINAL COVER FROM THE FINAL ENGINEERING DESIGN REPORT PREPARED BY BBL FOR THE GPL, DATED JANUARY 1998.
3. VERTICAL DATUM REFERENCED TO NGVD OF 1929, HORIZONTAL DATUM REFERENCED TO MICHIGAN SPC-NAD 1983.
4. PROPERTY BOUNDARY DIGITIZED FROM SPICER GROUP DRAWING NO. A-21854-1, DATED 3/27/98.
5. BASE MAP INFORMATION SOUTH OF MAIN REALM, INC. PROPERTY LINE FROM AIR-LAND SURVEYS, INC. PHOTO DATE 11/90, MAPPING DATE 10/91.

SAGINAW MALLEABLE INDUSTRIAL LAND
 GREEN POINT LANDFILL
 SAGINAW, MICHIGAN

SITE LAYOUT MAP

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NOTES:

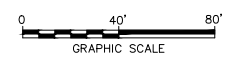
1. DEPTH TO WATER MEASUREMENTS WERE TAKEN IN SEPTEMBER 2015 AND WERE COLLECTED FROM TOP OF WELL CASING.
 2. ALL GROUNDWATER ELEVATIONS AND MEASUREMENTS ARE IN FEET ABOVE MEAN SEA LEVEL (AMSL).
 3. THIS PHOTGRAMMETRIC BASE MAP FOR THE GM SAGINAW MALLEABLE IRON PLANT AND DELPHI SAGINAW STEERING SYSTEMS PLANT 2 PROPERTIES WAS PREPARED BY LOCKWOOD MAPPING, INC. OF ROCHESTER, NEW YORK. AERIAL PHOTOGRAPHY WAS CONDUCTED ON 11/11/94. ORIGINAL LOCKWOOD MAP WAS AT A SCALE OF 1"=100' AND WAS INTERPRETED FOR TWO-FOOT CONTOURS.
 4. BASE MAP HAS BEEN MODIFIED TO INCORPORATE BUFFER BASIN, SEDIMENTATION BASINS, WETLANDS MITIGATION AREA, AND GREEN POINT LANDFILL (GPL) FINAL COVER FROM THE FINAL ENGINEERING DESIGN REPORT PREPARED BY BBL FOR THE GPL, DATED JANUARY 1998.
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 6. PROPERTY BOUNDARY DIGITIZED FROM SPICER GROUP DRAWING NO. A-21854-1, DATED 3/27/98.
 7. BASE MAP INFORMATION SOUTH OF MAIN REALM, INC. PROPERTY LINE FROM AIR-LAND SURVEYS, INC. PHOTO DATE 11/90, MAPPING DATE 10/91.
 8. CONTOURS HAVE BEEN INFERRED IN THE AREA OF THE LANDFILL BASED ON HISTORICAL DATA.
- * ELEVATIONS AT MW-143WT AND B-3R WERE NOT USED FOR CONTOURING.
 * MONITORING WELLS RW-1, RW-2 AND RW-3 NOT MEASURED BECAUSE THE VAULTS WERE FLOODED.

LEGEND:

- UNPAVED ROAD
- GROUND SURFACE ELEVATION CONTOUR (10 FT INTERVAL)
- FENCE LINE
- MW-125WT MONITORING WELL
- MW-2A,B,CAUG MONITORING WELL CLUSTER
- SG5 STAFF GAUGE
- TP-1 PIEZOMETER
- RW-1 RECOVERY WELL
- X-6 ABANDONED MONITORING WELL
- X-5A,B,C ABANDONED MONITORING WELL CLUSTER
- RG1 RIVER GAUGE
- MW-152WT WELL NOT FOUND
- 580.23 GROUNDWATER ELEVATION (FEET AMSL)
- 582 GROUNDWATER ELEVATION CONTOUR LINE (FEET AMSL), DASHED WHERE INFERRED
- GROUNDWATER FLOW DIRECTION
- 0.003 HORIZONTAL HYDRAULIC GRADIENT RESULT

RAP (7/31/08)
 MONITORING PROGRAM; REVISED 12/08

- SAMPLING AND GROUNDWATER ELEVATION MEASUREMENT LOCATION
- LNAPL AND/OR GROUNDWATER ELEVATION MEASUREMENT LOCATION
- ARSENIC MIXING ZONE



SAGINAW MALLEABLE INDUSTRIAL LAND
 GREEN POINT LANDFILL
 SAGINAW, MICHIGAN

**WATER TABLE ELEVATION
 CONTOUR MAP - SEPTEMBER 2015**