Memorandum

18 May 2022

To	Zack Sasnow, U.S. EPA		
Copy to	Dave Favero, RACER		
From	John-Eric Pardys/kf	**Tel**	519-340-4316
Subject	Mixing Zone	**Project no.**	11208041-MEM-5

On behalf of Revitalizing Auto Communities Environmental Response (RACER) Trust, GHD has prepared this re-evaluation of the Mixing Zone Determination Request (MZDR) for the RACER Saginaw Nodular Industrial Land (Site), located in Saginaw, Michigan in response to the recommendations in the Michigan Department of environment, Great Lakes, and Energy (EGLE) Materials Management Division (MMD) Remediation Advisory Team meeting with the U. S. Environmental Protection Agency (U.S. EPA) on January 26, 2022.

Background

The Site was part of a larger facility, owned by the former General Motors Corporation (GMC), called the General Motors Powertrain Saginaw Metal Casting Operations (SMCO or Facility); located in Saginaw, Michigan.

On June 1, 2009, GMC filed for Chapter 11 protection under U.S. Bankruptcy Code. On July 10, 2009 GMC was renamed Motors Liquidation Company (MLC). On the same day portions of the operating assets of MLC were sold to a newly formed company “General Motors Company”. General Motors Company changed its name to General Motors LLC (GM LLC) on October 16, 2009. Assets not sold to GM LLC remained the property of MLC, in its capacity as debtor in possession in the bankruptcy case. On March 31, 2011 certain environmental obligations for this Site were transferred from MLC to the RACER Trust. Ownership of the Site was transferred to RACER Properties LLC, a wholly owned subsidiary of RACER Trust. Figure 1 presents the approximate location of the RACER Site.

A MZDR was made to the Michigan Department of Environmental Quality (MDEQ) in 2009 by GMC (Attachment 1) to address venting of groundwater with elevated ammonia and pH outside the acceptable range from the larger GMC SMCO Facility to the Saginaw River. The portion of the MZDR associated with the Site is referred to as the Ammonia Part 2 venting area. Based upon relative flows and pH conditions, the MZDR did not propose any "recommendations…. to be necessary to protect against acute or chronic un-ionized ammonia toxicity" (i.e., the Ammonia Part 2 plume did not pose "a reasonable potential to discharge chemicals to cause or contribute to water quality standards (WQS) being exceeded.", unlike the findings for the Ammonia Part 1 plume for which a mixing-zone based value was identified). Attachment 2 presents a copy of MDEQ's 2009 determination. In its 2009 determination, MDEQ states that, beyond the mixing-zone values identified for the Ammonia Part 1 plume (not Site related and non-RACER):

> *"No ammonia recommendations for any other GM-SMCO groundwater venting should be necessary to protect against acute or chronic un-ionized ammonia toxicity based on data provided in the MZDR. Pollutants affecting dissolved oxygen in the receiving water are not expected to be present at problematic levels in the venting discharges." (MDEQ, December 11, 2009)*

GSI Criteria for Ammonia and Pathway Compliance Options per Section 20120e (and GSICO)

"Generic" GSI criteria for ammonia pursuant to NREPA (Part 201) are identified in Table 1 of administrative rules for the Michigan Department of Environment, Great Lakes, and Energy (EGLE) RRD "Cleanup Criteria Requirements for Response Activity" (specifically, Rule 44). The criterion identified for ammonia is stated as "CC" which is explained in the footnotes of the administrative rule to be dependent upon: a) whether the receiving water body is protected as a cold water or warm water resource, and b) the amount of ammonia which is present in the "unionized" form, which is dependent upon the temperature and pH of the receiving water.

The receiving waters (Saginaw River) are classified and protected as a warm water resource. Only a fraction of total ammonia (unionized ammonia) is considered toxic. Water quality standards which are the basis for GSI criteria are the "Rule 57" water quality values identified by EGLE for warm water resources as 53 micrograms per liter (µg/L) (for chronic exposures) and 420 µg/L (for acute exposures) of unionized ammonia. The footnote explaining the Part 201 GSI criterion for ammonia provides a table for interpreting the percentage of total ammonia concentrations which are in the unionized form under various temperature and pH conditions. Similarly, U.S. EPA guidance entitled, "Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater 2013" (U.S. EPA, April 2013) provides two tables for acute and chronic total ammonia based on various pH and temperatures.

The previous 2009 MDEQ determination for this Site (and also for a similar condition downstream from the Site at the Middleground Landfill located at Bay City which is also on the Saginaw River) indicates EGLE finds "mixing" of venting groundwater to be such that "chronic" impacts are not likely, and that venting in excess of concentrations protective of acute impacts (420 µg/L unionized ammonia) would be a condition requiring response activity to ensure adequate resource protection. However, as described above, the ammonia concentrations originating from the Site and venting (Ammonia Part 2 plume) was actually considered to be so limited as to not even pose a potential for exceeding either the acute or chronic water quality standards.

Ammonia Part 2 Results

As part of the Environmental Indicators (EI) groundwater monitoring program that began in 2004 and was terminated with U.S. EPA approval in 2020, first GMC and then RACER continued to monitor ammonia concentrations in groundwater. Initially, groundwater samples were analyzed and reported for total ammonia. However, on April 6, 2015, GHD (formerly CRA) submitted a memorandum that discussed ammonia in groundwater at the Site for U.S. EPA's review and it was subsequently forwarded to MDEQ for review on April 8, 2015. This memorandum incorporated the evaluation of the toxic fraction of ammonia (unionized ammonia) and concluded that no further activities to address ammonia above GSI criteria in monitoring wells next to the Saginaw River are necessary, but that continued monitoring would continue to be of value to ensure conditions remain as currently understood and characterized. From 2015 to 2020, the toxic fraction of total ammonia was calculated and both total and unionized ammonia were reported as parted of the EI groundwater monitoring program.

The calculations for unionized ammonia involve averaging pH and temperature of groundwater from a given monitoring well and of surface water from the Saginaw River in order to calculate the unionized fraction. Table 1 presents the total ammonia data, pH, and temperature from the most recent EI sampling event in October 2020 for the three GSI compliance monitoring wells (MW-04257, MW-04051, MW-03945). Temperature and pH readings were measured in the Saginaw River the day samples were collected. Concentrations of unionized ammonia in the three GSI monitoring wells are below the chronic and the acute criteria.

Figure 2 presents the results for total and unionized ammonia and pH since 2011 for the GSI compliance monitoring locations, monitoring locations near the apparent source area, and monitoring wells between the source and the river. The results in the three GSI compliance monitoring wells have been consistently

below the chronic and the acute criteria, with exception of one sampling event (November 2014) in which the calculated unionized ammonia (61.1 µg/L) was above the chronic criteria (53 µg/L).

Ammonia Part 1 and High pH Results

As part of the original 2009 MZDR, elevated concentrations of ammonia were identified at MW-04764 and MW-04765 (Ammonia Part 1), as well as elevated pH readings at MW-04764 (high pH). These monitoring locations are located adjacent to the City of Saginaw Publicly Owned Treatment Works (POTW) and therefore likely influenced by the POTW. As a result, in October 23, 2013, Conestoga-Rovers & Associates (CRA) (now GHD) submitted a memorandum which discussed North Ditch Characterization and select Groundwater Monitoring (Attachment 3) and one of the recommendations was to discontinue monitoring at MW-04765 and MW-04864 (which is located immediately adjacent to MW-04764 and was selected to be monitored as part of the EI groundwater monitoring program) since results from these locations would be influenced by the POTW. A Site meeting was conducted on November 6, 2013 to review the area and on November 29, 2013, U.S. EPA approved (via email provided in Attachment 3) the recommendation to discontinue monitoring at MW-04765 and MW-04684.

Regardless, Figure 2 presents the results for total and unionized ammonia and pH from 2011 until 2013 when monitoring was discontinued for MW-04765 and MW-04864. The unionized ammonia results at MW-04765 and MW-04684 were consistently below the chronic and the acute criteria. The most recent results for pH in 2012 and 2013 were within the acceptable range for pH (6.5 to 8.5).

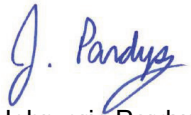
Conclusion

MDEQ's December 2009 MZDR did not have any recommendations to protect against acute or chronic un-ionized ammonia toxicity for the ammonia plume originating from the Site and venting to the Saginaw River (Ammonia Part 2 plume), and subsequent groundwater monitoring results have not shown any exceedances of the Part 201 Cleanup Criteria Requirements for Response Activity Groundwater Surface Water Interface (GSI) criteria for ammonia. Further evaluations/updates to the MZDR are not warranted for Ammonia Part 2 plume.

Ammonia Part 1 plume and high pH plume are located adjacent to and likely influenced by the POTW. The most recent readings from MW-04765 and MW-04864 have not shown exceedances of the Part 201 Cleanup Criteria Requirements for Response Activity Groundwater Surface Water Interface (GSI) criteria for ammonia or pH. Therefore, no further evaluations/updates to the MZDR by RACER are warranted.

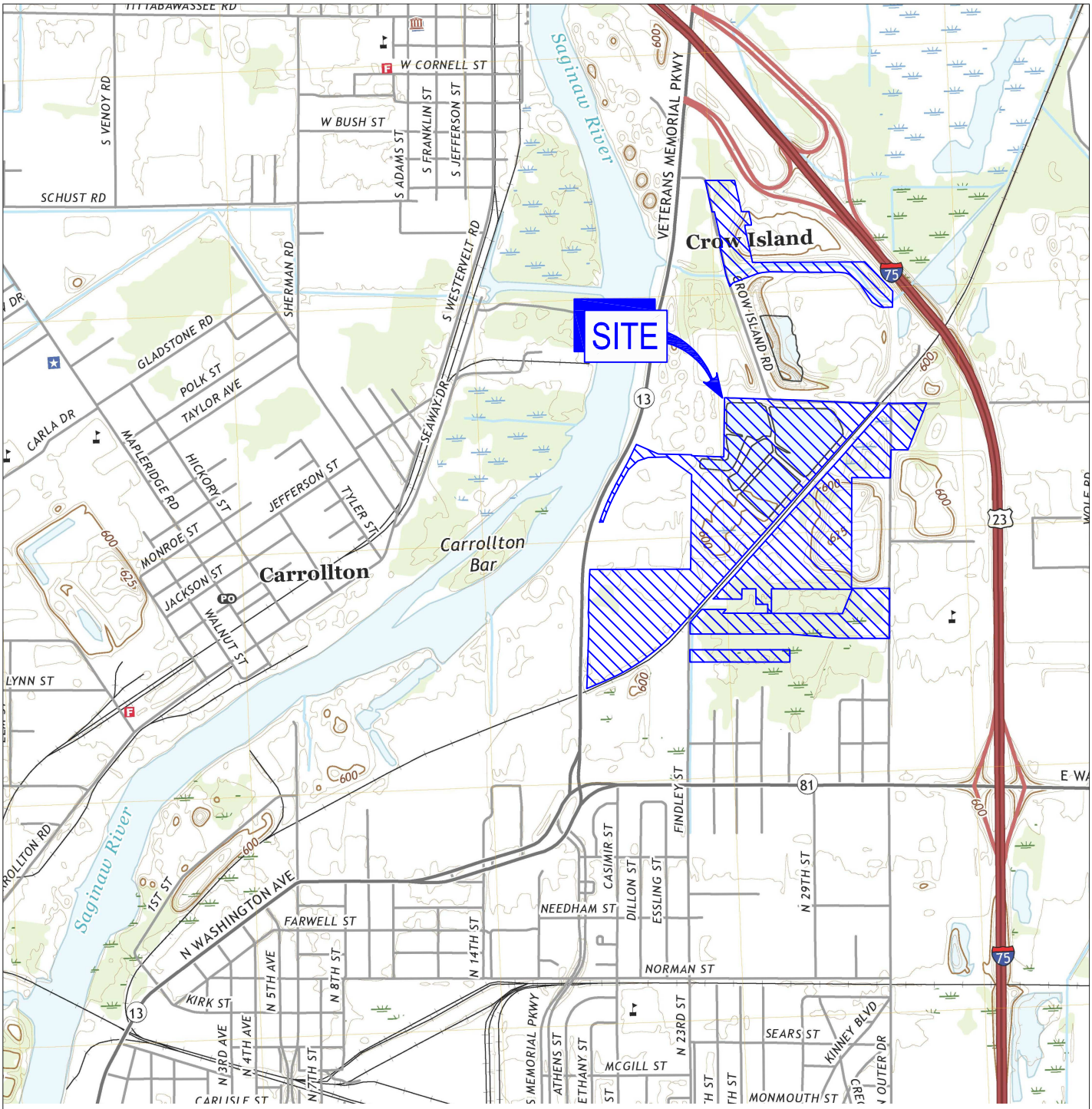
Figure 1	Site Location
Figure 2	Summary of Ammonia and pH results
Table 1	Groundwater Ammonia Compliance Worksheet
Attachment 1	2009 Mixing Zone Determination Request
Attachment 2	2009 and 2010 Mixing Zone Determination and Implementation Responses
Attachment 3	Correspondence Related to Discontinuing Monitoring at MW-04765 and MW-04864

Regards



John-eric Pardys

Figures



0 1000 2000 ft

N

GHD

RACER TRUST
SAGINAW, MICHIGAN

Project No. **11208041**
Date **March 2022**

SITE LOCATION

FIGURE 1

Filename: \\ghdnet\ghd\CA\Waterloo\Projects\662\11208041\Digital_Design\ACAD 2020\Figures\MEM005\11208041-GHD-00-00-MEM-EN-D102_WA-005.DWG
Plot Date: 15 March 2022 1:22 PM

Data Source: USGS QUADRANGLE MAP; SAGINAW, MI; 2019

MW-04757	11/07/2012	07/16/2013	11/12/2013	11/14/2014	11/03/2015	11/07/2016	05/18/2017	11/28/2018	11/11/2019	10/20/2020
Ammonia, Total	14000	1100 J1700 J	200 U	220	300	280	300	230	450	450
Ammonia, Unionized (Calculated)	285.3	40.6/62.7	0.0	3.7	10	5.5	10.7	3.7	6.03	15.5
pH, field	7.9	8.4	7.98	7.85	8.21	8.3	8.23	-	-	-
pH, lab	-	-	-	-	-	-	8.2 J	8.2 J	8.5 J	8.4 J

MW-04765	11/02/2011	11/08/2012	11/12/2013
Ammonia, Total	9800	4800	4100
Ammonia, Unionized (Calculated)	49.1	23.1	17.8
pH, field	7.09	7.07	7.08
pH, lab	6.8 J	6.92 J	7.01 J

MW-04864	11/01/2011	11/07/2012	11/12/2013
Ammonia, Total	1500	1400	3600
Ammonia, Unionized (Calculated)	58.5	8.4	19.3
pH, field	8.72	7.18	7.19
pH, lab	8.2 J	7.59 J	7.48 J

MW-04257	11/02/2011	11/08/2012	07/16/2013	11/12/2013	11/14/2014	11/03/2015	11/08/2016	05/18/2017	11/28/2018	11/13/2019	10/21/2020
Ammonia, Total	820	340	-	630	350	620	380	500	780	680	1100
Ammonia, Unionized (Calculated)	2.6	0.9	-	4.2	0.7	5	1.8	6.0	3.6	4.07	13.0
pH, field	6.88	6.79	7.22	7.35	6.71	-	7.06	7.32	-	-	-
pH, lab	7.0 J	6.97 J	-	7.30 J	7.32 J	6.96 J	-	7.3 J	7.3 J	7.5 J	7.5 J

MW-04250R	11/01/2011	11/08/2012	07/16/2013	11/12/2013	11/14/2014	11/03/2015	11/07/2016	05/17/2017	11/28/2018	11/11/2019	10/20/2020
Ammonia, Total	4400	4800/4800	-	5000/5200	2700 J1600 J	2200/2400	2700/2900	2000	4200	3700	5100
Ammonia, Unionized (Calculated)	197.5	221.1/313.2	-	207.3/215.6	103.4/61.3	122	60.3	99.8	89.3	50.48	212.1
pH, field	9.43	9.95	10.83	9.7	9.6/9.6	-	8.77	8.93	-	-	-
pH, lab	9.3 J	9.55 J/9.49 J	-	9.68 J/9.68 J	9.98 J/10.0 J	9.26 J/9.31 J	-	8.9 J	8.8 J	8.8 J	8.9 J

MW-04051	11/01/2011	11/08/2012	07/16/2013	11/12/2013	11/14/2014	11/03/2015	11/08/2016	05/18/2017	11/28/2018	11/13/2019	10/21/2020
Ammonia, Total	5700/5300	5800	-	4600	4400	5800	530	6300	7200	5900	10000
Ammonia, Unionized (Calculated)	9.5/8.9	18.7	-	15.2	10.1	19	1.3	28.6	12.5	15.65	36.4
pH, field	6.58	6.88	6.85	6.94	6.74	-	6.71	6.84	-	-	-
pH, lab	6.8 J/6.8 J	6.89 J	-	7.03 J	7.13 J	6.60 J	-	6.7 J	6.8 J	7.0 J	6.9 J

MW-03945	11/01/2011	11/08/2012	07/16/2013	11/12/2013	11/14/2014	11/03/2015	11/08/2016	05/18/2017	11/28/2018	11/11/2019	10/20/2020
Ammonia, Total	6700	8800	9100	5100	7300	7600	7400	8300	8000	9500/9500	10000
Ammonia, Unionized (Calculated)	11.0	16.4	21.8	9.0	17.8	20	11.3	27.4	9.5	21.64	33.0
pH, field	6.57	6.63	6.68	6.7	6.81	-	6.56	6.7	-	-	-
pH, lab	6.7 J	6.70 J	-	6.93 J	7.01 J	6.63 J	-	6.6 J	6.7 J	7.0 J/6.9 J	6.9 J

MW-04438R	11/27/2018	11/12/2019	10/27/2020
Ammonia, Total	2000	96 J	510
Ammonia, Unionized (Calculated)	50.1	0.71	19.4
pH, lab	11.5 J	7.8 J	9.1 J

MW-04438	05/17/2017
Ammonia, Total	1100
Ammonia, Unionized (Calculated)	60.4
pH, field	11.81
pH, lab	11.6 J

MW-04040	11/12/2014	11/03/2015	11/07/2016	05/17/2017	11/28/2018	11/12/2019	10/20/2020
Ammonia, Total	610	460	710	450	1100	860	950
Ammonia, Unionized (Calculated)	8.2	7	4.6	22.9	6.4	6.66	9.5
pH, field	7.73	7.66	7.47	9.62	-	-	-
pH, lab	-	-	-	7.9 J	7.5 J	7.8 J	7.5 J

MW-04836R	11/27/2018	11/11/2019	10/19/2020
Ammonia, Total	25000	17000	7550
Ammonia, Unionized (Calculated)	123.5	124.46	111.8
pH, lab	7.4 J	7.8 J	7.8 J/7.7 J

MW-04836	07/16/2013	11/13/2013	11/12/2014	11/03/2015	11/07/2016	05/17/2017
Ammonia, Total	11000	35000	33000	51000	18000	3400/3500
Ammonia, Unionized (Calculated)	188.0	309.7	276.0	161	47.8	107.2
pH, field	7.72	7.45	7.44	-	7.33	8.01/8.01
pH, lab	-	7.31 J	7.39 J	6.82 J	-	7.4 J/7.3 J

MW-05036	07/16/2013	11/13/2013	11/12/2014	11/03/2015	11/07/2016	05/17/2017
Ammonia, Total	-	4900	4900	12000	3600	1700
Ammonia, Unionized (Calculated)	-	202.3	195.1	647	82.0	94.1
pH, field	12.25	12.12	11.68	-	11.39	11.47
pH, lab	-	11.4 J	11.2 J	10.8 J	11.2 J	11.1 J

MW-04336	11/28/2018	11/12/2019	10/27/2020
Ammonia, Total	7900	7500	8100
Ammonia, Unionized (Calculated)	32.0	33.89	202.6
pH, lab	7.3 J	7.4 J	7.2 J

MW-04835	11/13/2013
Ammonia, Total	900
Ammonia, Unionized (Calculated)	5.2
pH, field	7.29
pH, lab	7.20 J

MW-05038	11/28/2018	11/12/2019	10/27/2020
Ammonia, Total	5000	5100	5100
Ammonia, Unionized (Calculated)	126.6	72.99	197.9
pH, lab	10.0 J	10.1 J	8.2 J

MW-05443	07/16/2013	11/27/2018	11/13/2019	10/20/2020
Ammonia, Total	7200	6700	6700	9600
Ammonia, Unionized (Calculated)	48.6	10.2	31.52	46.5
pH, field	7.21	6.78	-	-
pH, lab	-	-	7.4 J	7.1 J

MW-8	07/15/2013	11/13/2013	11/12/2014	11/03/2015	11/07/2016	05/17/2017
Ammonia, Total	17000	10000	10000	12000	11000	12000
Ammonia, Unionized (Calculated)	861.8	419.5	407.1	685	265.1	654.6
pH, field	11.35	10.7	10.57	-	10.74	11.01
pH, lab	-	10.7 J	10.3 J	9.81 J	10.6 J	10.6 J

MW-8R	11/27/2018	11/11/2019	10/19/2020
Ammonia, Total	21000	18000	9400
Ammonia, Unionized (Calculated)	534.7	262.12	421.0
pH, lab	9.7 J	9.7 J	10.6 J

MW-05036R	11/27/2018	11/11/2019	10/19/2020
Ammonia, Total	6800/8900	5800	3800
Ammonia, Unionized (Calculated)	224.9	83.36	160.8
pH, lab	11.2 J/11.2 J	11.4 J	11.4 J

Ammonia - Part 1
1646 feet long
9.1 feet thick
Max. Discharge: 1.73 ft³/s

pH - High
723 feet long
9.1 feet thick
Max. Discharge: 0.76 ft³/s

Ammonia - Part 2
769 feet long
9.1 feet thick
Max. Discharge: 0.81 ft³/s

MW-04765 (584.20)
MW-04864 (582.40)[4]
MW-04757 (584.36)
MW-04257 (581.57)
MW-15457 (585.25)
MW-04405 (582.16)
MW-03945 (582.22)
MW-04250R (NA)
MW-04250
MW-15450 (588.04)
MW-06951 (586.44)
MW-06445 (588.39)
MW-05443 (588.01)
MW-04040 (585.51)
MW-04438R
MW-04438
MW-05038
MW-8 (587.91)
MW-8R
MW-04836R
MW-04836 (587.54)
MW-05036R
MW-05036 (587.81)
MW-04336
MW-04835 (587.66)
MW-04434 (587.76)
MW-04831 (587.83)

PARKING
BUILDING
PARKING
BUILDING
RIVER
SAGINAW

584
583
582
585
586
587
588

LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- MW-8 — ABANDONED MONITORING WELL LOCATION
- MW-04765 — MONITORING WELL LOCATION
- (582.12) — GROUNDWATER ELEVATION - NOVEMBER 2015
- 586 — UPPER WATER BEARING ZONE GROUNDWATER CONTOUR - FT. AMSL (NAVD 88) - NOVEMBER 2015
- pH
- AMMONIA

MW-04864	11/01/2011	11/07/2012	11/12/2013
Ammonia, Total	1500	1400	3600
Ammonia, Unionized (Calculated)	58.5	8.4	19.3
pH, field	8.72	7.18	7.19
pH, lab	8.2 J	7.59 J	7.48 J

- SAMPLE LOCATION
- SAMPLE DATE
- RESULT (ug/L) EXCEPT pH WHICH IS IN s.u.
- PARAMETER
- EXCEEDS CRITERIA

MICHIGAN PART 201 CRITERIA

fraction	Parameter	Criteria (ug/L or s.u. for pH)	
WET	pH, field	6.5 - 8.5	A
WET	pH, lab	6.5 - 8.5	A
WET	Ammonia, Total		
WET	Ammonia Unionized (Calculated)	420	B

A: Non-Residential Drinking Water Criteria
B: GSI Criteria for Warmwater Acute Toxicity

NOTES:

1. SEE TABLE 1 FOR HOW UNIONIZED AMMONIA WAS CALCULATED.
2. GROUNDWATER ELEVATION NOT USED IN DETERMINATION OF GROUNDWATER CONTOURS.

0 100 200 400 ft

N

GHD

RACER
SAGINAW NODULAR INDUSTRIAL LAND
SAGINAW, MICHIGAN

SUMMARY OF CALCULATED UNIONIZED AMMONIA RESULTS (2011-2020)

Project No. 11208041
Date May 2022

FIGURE 2

Filename: N:\CA\Waterloo\Projects\662\11208041\Digital_Design\ACAD 2020\Figures\MEM005\11208041-GHD-00-00-MEM-EN-D103_WA-005.dwg
Plot Date: 18 May 2022 1:09 PM

Tables

Table 1

Groundwater Ammonia FAV Compliance Worksheet
GSI Compliance Sampling Event of October 2020
RACER Nodular Industrial Land
Saginaw, Michigan

GSI Compliance Point Number (Well ID)	Measured Total NH3 ($\mu g/L$)$_4$	Groundwater Temperature (^oC)$_4$	Groundwater pH$_4$	Saginaw River Temperature (^oC)[4]	Saginaw River pH [4]	Average Temperature (^oC)[1]	Average pH[2]	% Unionized NH_3[3]	Calculated Unionized NH3 ($\mu g/L$)
MW-04257	1100	16.90	7.50	10.3	8.03	13.60	7.69	1.18%	13.0
MW-04051	10000	17.10	6.90	10.3	8.03	13.70	7.17	0.36%	36.4
MW-03945	10000	14.50	6.90	10.3	8.03	12.40	7.17	0.33%	33.0

Notes:

1. Temperature is the average of the groundwater temperature and the Saginaw River temperature
2. pH value for average of groundwater and Saginaw River H^+ concentrations
3. Ammonia toxicity equations taken from Steven C. Chapra "Surface Water-Quality Modeling", McGraw-Hill Series in Water Resources and Environmental Engineering 1997
4. The NH3 and groundwater and Saginaw River temperature and pH were measured on October 21, 2020

Boxed Value indicates exceedance of FAV criterion of 420 µg/L

Attachments

Attachment 1

2009 Mixing Zone Determination Request

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Eric Alexander
Surface Water Quality Assessment Section
Water Bureau

FROM: Liane J. Shekter-Smith, P.E., Assistant Division Chief
Waste and Hazardous Materials Division

DATE: **October 1, 2009**

SUBJECT: **General Motors, SMCO**
Mixing Zone Determination Request, **Saginaw Bay** District

General Information

We are requesting a mixing zone determination for the above referenced facility, located in the **SW** 1/4 of the **SE** 1/4 of **Section 07**, **SE** 1/4 of the **SE** 1/4 of **Section 07**, **SW** 1/4 of the **SW** 1/4 of **Section 07**, **NW** 1/4 of the **NW** 1/4 of **Section 18**, **NE** 1/4 of the **NE** 1/4 of **Section 18**, **NE** 1/4 of the **NE** 1/4 of **Section 18**, **NW** 1/4 of the **NW** 1/4 of **Section 17**, **T12N**, **R 5E** in **Saginaw County.**

WHMD or U.S. Environmental Protection Agency Contact Person: **Ron Stone** Phone #: **517-373-7141**

District Supervisor/Unit Chief: **Virginia Himich**

Phone #: **517-373-7974** FAX #: **517-373-4797**

Priority: (to be filled out by the Assistant Division Chief)

[X] four week response **[ ] eight week response**

Facility Information

1. Please advise of the name of the receiving water body and the location of the venting groundwater contaminant plume; the map is attached. Please indicate if the discharge is to a public recreational area, a Great Lake, an inland lake or a wetland.

   Saginaw River

   a. This is a ☐ new, ☐ increased, or ☒ existing discharge. If new or increased discharge, see Attachment 3.

b. This is a discharge to a ☐ Great Lake, ☐ Inland Lake or ☐ wetland, ☒ not applicable.

c. Is human body contact expected in the receiving water? ☐ yes ☒ no

2. General information regarding the origin of the pollutants. This includes the location, nature, and chemical characteristics of the source of the groundwater contamination plume(s):

   Saginaw Metal Casting Operations (SMCO) Facility or the former Nodular Iron Foundry. Ammonia and pH have been reported above GSI criteria in groundwater samples from monitoring wells located next to the Saginaw River.

Technical Information

3. The name; Chemical Abstract Service (CAS) Number; worst case maximum concentration of contaminants reaching, or predicted to reach; the GSI. Generally, the highest concentration of the contaminant found in the groundwater would be appropriate to represent the worst case maximum. If source contaminants have not yet reached the groundwater but are expected to do so, source concentrations should be identified and noted as such.

Chemical or General Chemistry Parameter	CAS #	Worst Case Maximum GSI Discharge Concentration	Average Surface Water Conc. Upstream (if available)
pH	NA	5.39 (low)	NA
pH	NA	10.89 (high)	
Ammonia	7664-41-7	9.45 mg/L	NA

4. The maximum discharge rate of the venting groundwater contaminant plume in cubic feet per second. The maximum discharge rate must be recorded in the Request Form to ensure protection from acute effects to aquatic life. More than just the rate should be included here; all calculations need to be shown.

Please see Table 1 for a breakdown of the discharge rate calculations of the venting groundwater plume. Figures 1 and 2 attached show the approximate reaches of

groundwater venting for ammonia and pH, including their longitudinal distances as well as approximate saturated zone thicknesses.

The hydraulic conductivity of the fill material and the hydraulic gradient used in these calculations was 2.2×10^{-1} cm/s (0.0072 ft/s) and 0.016 (ft/ft) respectively and the hydraulic gradient represents the gradient directly adjacent to the Saginaw River (CRA, 2007).

Based on the calculations shown in Table 1, the maximum discharge rate for ammonia is calculated to be 2.53 ft^3/s. For high pH the maximum discharge rate is 0.76 ft^3/s and for low pH the maximum discharge rate is 2.05 ft^3s.

5. The location of other contaminant plumes entering the receiving surface water body, their constituents and concentrations, if available:

Attachments
cc:

TABLE 1
GM SMCO - RESPONSE TO ITEM NO. 4
CALCULATIONS
MAXIMUM DISCHARGE RATE OF VENTING CONTAMINANT PLUME

Equation Used:

Darcy's Law: $Q = Ki\,A$

Where: Q = discharge [ft^3/s]
K = hydraulic conductivity [ft/second]
i = hydraulic gradient [ft/ft]
A = cross sectional area of saturated fill [ft^2]

Darcy's Law Parameters:

1.) Hydraulic Gradient, *i*

a) Calculated *i* at river location (close to MW-03746, using Figure 3.7)
change in total head: 585 feet - 581 feet = 4 feet
length over this head interval: (0.8 cm x (500'/1.3 cm)) = 307.7 feet

i = (4'/307.7') = 0.013

b) Calculated *i* immediately adjacent to Saginaw River = 0.016

Source:
CRA. 2007. Resource Conservation and Recovery Act - Facility Investigation - Phase 1C Report - Revised. March. (page 30).

The hydraulic gradient used for calculations was 0.016, as it is a more conservative estimate.

2.) Hydraulic Conductivity, K

a) Calculated K in the fill material = 2.2×10^{-1} cm/s = 0.0072 ft/s

Source:
CRA. 2007. Resource Conservation and Recovery Act - Facility Investigation - Phase 1C Report - Revised. March. (page 30).

3.) Height (average) of saturated fill material (used in cross sectional area calculation)

a) Based on elevation values taken from Figures 3.5 and 3.7

Figure 3.7: Water Level (feet)	Figure 3.5: Top of Native Clay (feet)	Thickness of Saturated Layer (feet)
584	578	6
581	572	9
582.45	565.46	16.99
580.54	571.94	8.6
585	580	5
	Average Thickness:	**9.1**

** Please note that this value of 9.1 feet is used for all calculations except for pH-low. The closest saturated thickness data for this area yields 16.9 feet, so a thickness of 17 feet was used as average in that case.

TABLE 1
GM SMCO - RESPONSE TO ITEM NO. 4
CALCULATIONS
MAXIMUM DISCHARGE RATE OF VENTING CONTAMINANT PLUME

Parameter:

Ammonia

Part 1 - *See Figure 2*

Length of discharge zone:	(10.7 cm x (200 ft/1.3 cm)) = 1646 ft
Average thickness of zone:	9.1 ft
Hydraulic conductivity, K:	0.0072 ft/s
Hydraulic Gradient, *i:*	0.016

Max. Discharge Rate, Q = 1646 ft x 9.1 ft x 0.0072 ft/s x 0.016 = 1.73 ft^3/s

Part 2 - *See Figure 2*

Length of discharge zone:	(5.0 cm x (200 ft/1.3 cm)) =	769 ft
Average thickness of zone:	9.1 ft	
Hydraulic conductivity, K:	0.0072 ft/s	
Hydraulic Gradient, *i:*	0.016	

Max. Discharge Rate, Q = 769 ft x 9.1 ft x 0.0072 ft/s x 0.016 = 0.81 ft^3/s

Total Max. Discharge Rate: 2.53 ft^3/s

pH - High

See Figure 2

Length of discharge zone:	(4.7 cm x (200 ft/1.3 cm)) =	723 ft
Average thickness of zone:	9.1 ft	
Hydraulic conductivity, K:	0.0072 ft/s	
Hydraulic Gradient, *i:*	0.016	

Total Max. Discharge Rate, Q = 723 ft x 9.1 ft x 0.0072 ft/s x 0.016 = **0.76 ft^3/s**

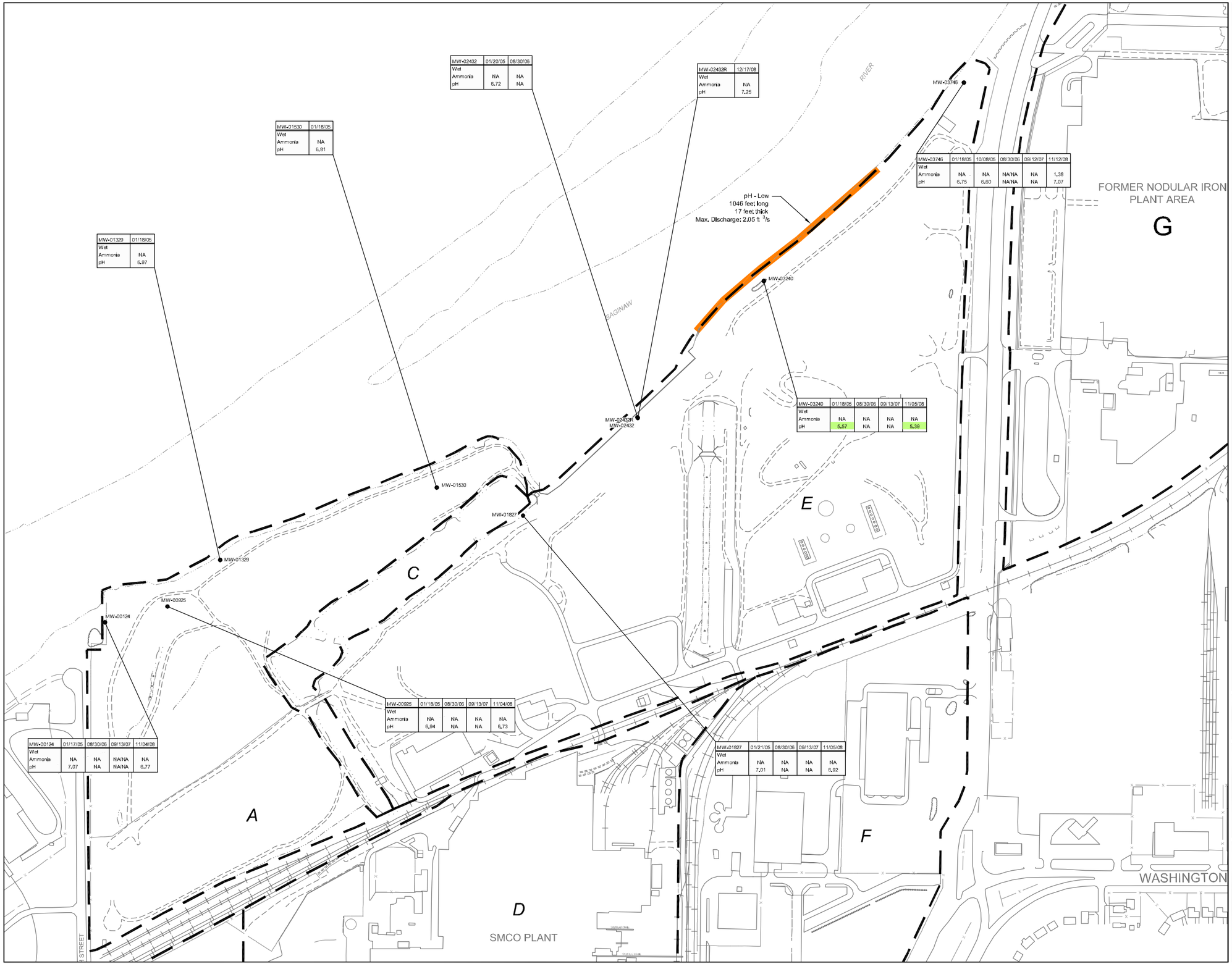
pH - Low

See Figure 1

Length of discharge zone:	(6.8 cm x (200 ft/1.3 cm)) =	1046 ft
Average thickness of zone:	17 ft	
Hydraulic conductivity, K:	0.0072 ft/s	
Hydraulic Gradient, *i:*	0.016	

**Note average thickness of zone in this location is 17 ft, not 9.1 ft

Total Max. Discharge Rate, Q = 1046 ft x 17 ft x 0.0072 ft/s x 0.016 = **2.05 ft^3/s**



NOTE:

1. NOTE THAT THE UNIONIZED FRACTION OF AMMONIA IS A FUNCTION OF THE WATER BODY CLASSIFICATION (WARM WATER OR COLD WATER), PH AND TEMPERATURE OF THE RECEIVING WATER AND IS ESTIMATED AS A PERCENT OF THE TOTAL AMMONIA. THE SAGINAW RIVER HAS BEEN CLASSIFIED AS WARM WATER. THE GENERIC GSI CRITERION (CHRONIC) FOR UNIONIZED AMMONIA IS 33 ug/L FOR WARM WATER SURFACE WATER. (SEE FOOTNOTE CC OF THE PART 201 CLEANUP CRITERIA PART 213 RISK-BASED SCREENING LEVELS RRD OPERATION, MEMORANDUM NO. 1 DATED DECEMBER 10, 2004). THE GENERIC ACUTE TOXICITY CRITERION FOR UNIONIZED AMMONIA IS 420 ug/L (PROVIDED TO CRA BY MDEQ ON MARCH 2, 2007 REGARDING A NEARBY FACILITY).

   BASED ON DATA AVAILABLE FOR THE SAGINAW RIVER FROM USGS, THE AVERAGE (1997-2005) TEMPERATURE AND PH FOR THE SAGINAW RIVER DURING THE FALL MONTHS (SEPT-NOV) ARE 12.5 DEGREES CELSIUS AND 8.0 S.U. UNITS, RESPECTIVELY. (USGS GAUGE 04157000 SOURCE: HTTP://NWIS.WATERDATA.USGS.GOV/MI/NWIS/QW). THEREFORE, FOR A PH OF 8 AND A TEMPERATURE OF 12.5 DEGREES CELSIUS, APPROXIMATELY 2.5 PERCENT OF THE TOTAL AMMONIA WILL BE PRESENT IN THE UNIONIZED FORM RESULTING IN A TOTAL AMMONIA GENERIC GSI CRITERION (CHRONIC) OF 2,120 ug/L (33 ug/L / 0.025).

   THEREFORE, FOR A PH OF 8 AND A TEMPERATURE OF 12.5 DEGREES CELSIUS, APPROXIMATELY 2.5 PERCENT OF THE TOTAL AMMONIA WILL BE PRESENT IN THE UNIONIZED FORM OR A MAXIMUM OF 230 ug/L (9.59 ug/L X 5228) FOR THE NOVEMBER 2008 EVENT.

2. NOTE THAT THE GSI CRITERIA DEVELOPED FOR TOTAL CHROMIUM WAS DEVELOPED FROM THE FINAL CHRONIC VALUE CALCULATION FOR TRIVALENT CHROMIUM, AS SPECIFIED IN THE MDEQ GUIDANCE. TOTAL CHROMIUM RESULTS WERE COMPARED TO TRIVALENT CHROMIUM CRITERIA SINCE EXTENSIVE SITE DATA SUPPORTS THAT THE MAJORITY OF THE TOTAL CHROMIUM IS TRIVALENT CHROMIUM. HEXAVALENT CHROMIUM IS STILL SAMPLED AT NUMEROUS LOCATIONS AND IS COMPARED TO HEXAVALENT CHROMIUM CRITERIA.

DRAFT
PREPARED AT THE REQUEST OF COUNSEL

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

GENERAL MOTORS COMPANY
SAGINAW METAL CASTING OPERATIONS

SAGINAW, MICHIGAN

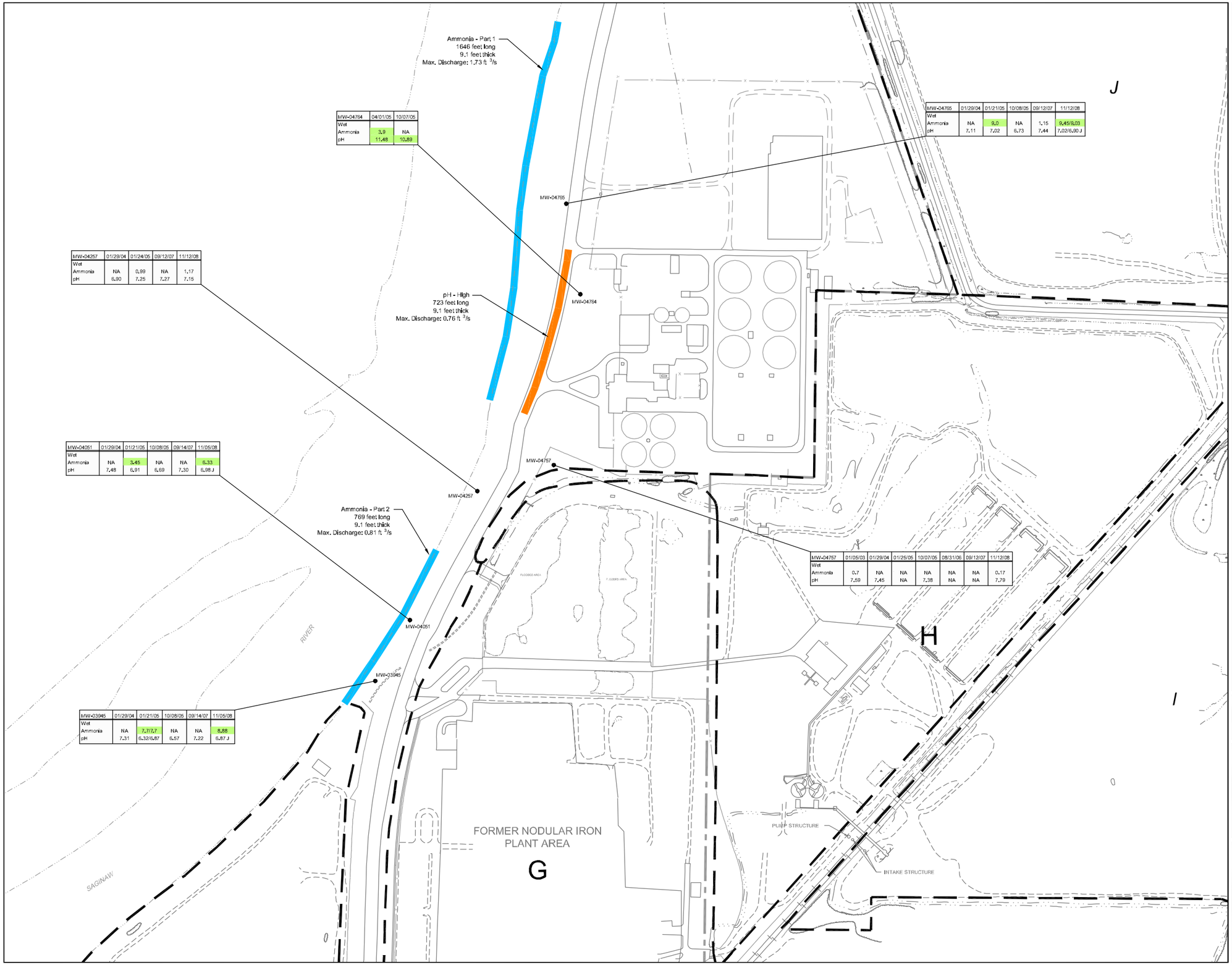
SUMMARY OF GSI LOCATIONS WEST OF VETERANS MEMORIAL HIGHWAY AND EXCEEDANCE SUMMARY 2003 TO PRESENT

CONESTOGA-ROVERS & ASSOCIATES

Source References:

Project Manager:	Reviewed By:	Date:	
M.T.	I.R.	OCTOBER 2009	
Scale: 1"=200'	Project N°: 17075-12	Report N°: MEMO023	Drawing N°: figure 1

17075-12(MEMO023)GN-WA004 OCT 02/2009



N

0 100 200ft

LEGEND

A — — INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER

MW-04765 ● INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER

pH

AMMONIA

MW-04764	04/01/05	10/07/05	
Wet			
Ammonia	3.9	NA	RESULT (mg/L) EXCEPT pH WHICH IS s.u.
pH	11.48	10.89	

SAMPLE LOCATION

SAMPLE DATE

PARAMETER

EXCEEDS CRITERIA

NA NOT ANALYZED

Chemical Name	GSI Criteria	Criteria unit
Wet		
Ammonia	2.12	mg/L
pH	6.5 - 9.0	s.u.

NOTE:

1. NOTE THAT THE UNIONIZED FRACTION OF AMMONIA IS A FUNCTION OF THE WATER BODY CLASSIFICATION (WARM WATER OR COLD WATER), PH AND TEMPERATURE OF THE RECEIVING WATER AND IS ESTIMATED AS A PERCENT OF THE TOTAL AMMONIA. THE SAGINAW RIVER HAS BEEN CLASSIFIED AS WARM WATER. THE GENERIC GSI CRITERION (CHRONIC) FOR UNIONIZED AMMONIA IS 59 ug/L FOR WARM WATER SURFACE WATER (SEE FOOTNOTE CC OF THE PART 201 CLEANUP CRITERIA PART 213 RISK-BASED SCREENING LEVELS RRD OPERATIONAL MEMORANDUM NO. 1 DATED DECEMBER 15, 2004). THE GENERIC ACUTE TOXICITY CRITERION FOR UNIONIZED AMMONIA IS 420 ug/L (PROVIDED TO CRA BY MDEQ ON MARCH 2, 2007 REGARDING A NEARBY FACILITY).

   BASED ON DATA AVAILABLE FOR THE SAGINAW RIVER FROM USGS, THE AVERAGE (1991-2005) TEMPERATURE AND PH FOR THE SAGINAW RIVER DURING THE FALL MONTHS (SEPT-NOV) ARE 12.5 DEGREES CELSIUS AND 8 S.I. UNITS, RESPECTIVELY (USGS GAUGE 04157005 SOURCE: HTTP://NWIS.WATERDATA.USGS.GOV/MI/NWIS/QW). THEREFORE, FOR A PH OF 8 AND A TEMPERATURE OF 12.5 DEGREES CELSIUS, APPROXIMATELY 2.5 PERCENT OF THE TOTAL AMMONIA WILL BE PRESENT IN THE UNIONIZED FORM RESULTING IN A TOTAL AMMONIA GENERIC GSI CRITERION (CHRONIC) OF 2,120 ug/L (59 ug/L / 0.025).

   THEREFORE, FOR A PH OF 8 AND A TEMPERATURE OF 12.5 DEGREES CELSIUS, APPROXIMATELY 2.5 PERCENT OF THE TOTAL AMMONIA WILL BE PRESENT IN THE UNIONIZED FORM OR A MAXIMUM OF 238 ug/L [9,450 ug/L X 0.025] FOR THE NOVEMBER 2008 EVENT.

2. NOTE THAT THE GSI CRITERIA DEVELOPED FOR TOTAL CHROMIUM WAS DEVELOPED FROM THE FINAL CHRONIC VALUE CALCULATION FOR TRIVALENT CHROMIUM, AS SPECIFIED IN THE MDEQ GUIDANCE. TOTAL CHROMIUM RESULTS WERE COMPARED TO TRIVALENT CHROMIUM CRITERIA SINCE EXTENSIVE SITE DATA SUPPORTS THAT THE MAJORITY OF THE TOTAL CHROMIUM IS TRIVALENT CHROMIUM. HEXAVALENT CHROMIUM IS STILL SAMPLED AT NUMEROUS LOCATIONS AND IS COMPARED TO HEXAVALENT CHROMIUM CRITERIA.

DRAFT
PREPARED AT THE REQUEST OF COUNSEL

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

GENERAL MOTORS COMPANY
SAGINAW METAL CASTING OPERATIONS

SAGINAW, MICHIGAN

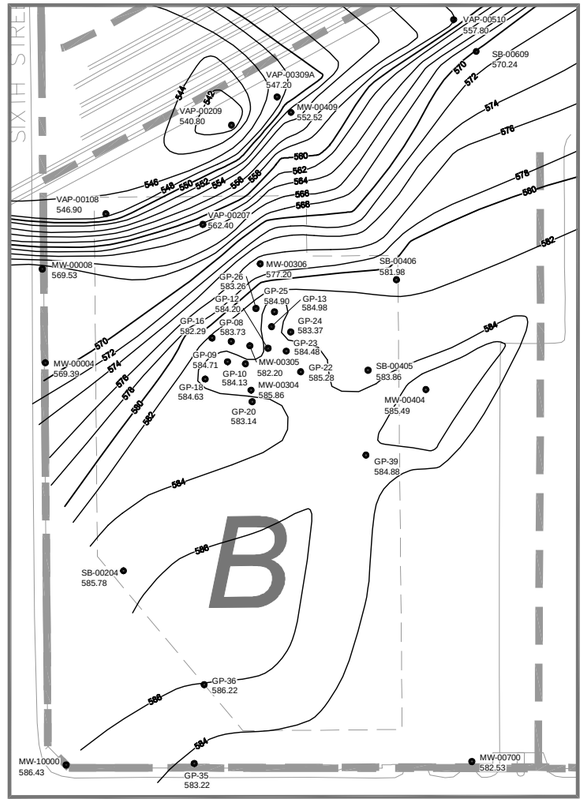
SUMMARY OF GSI LOCATIONS EAST OF VETERANS MEMORIAL HIGHWAY AND EXCEEDANCE SUMMARY 2003 TO PRESENT

CONESTOGA-ROVERS & ASSOCIATES

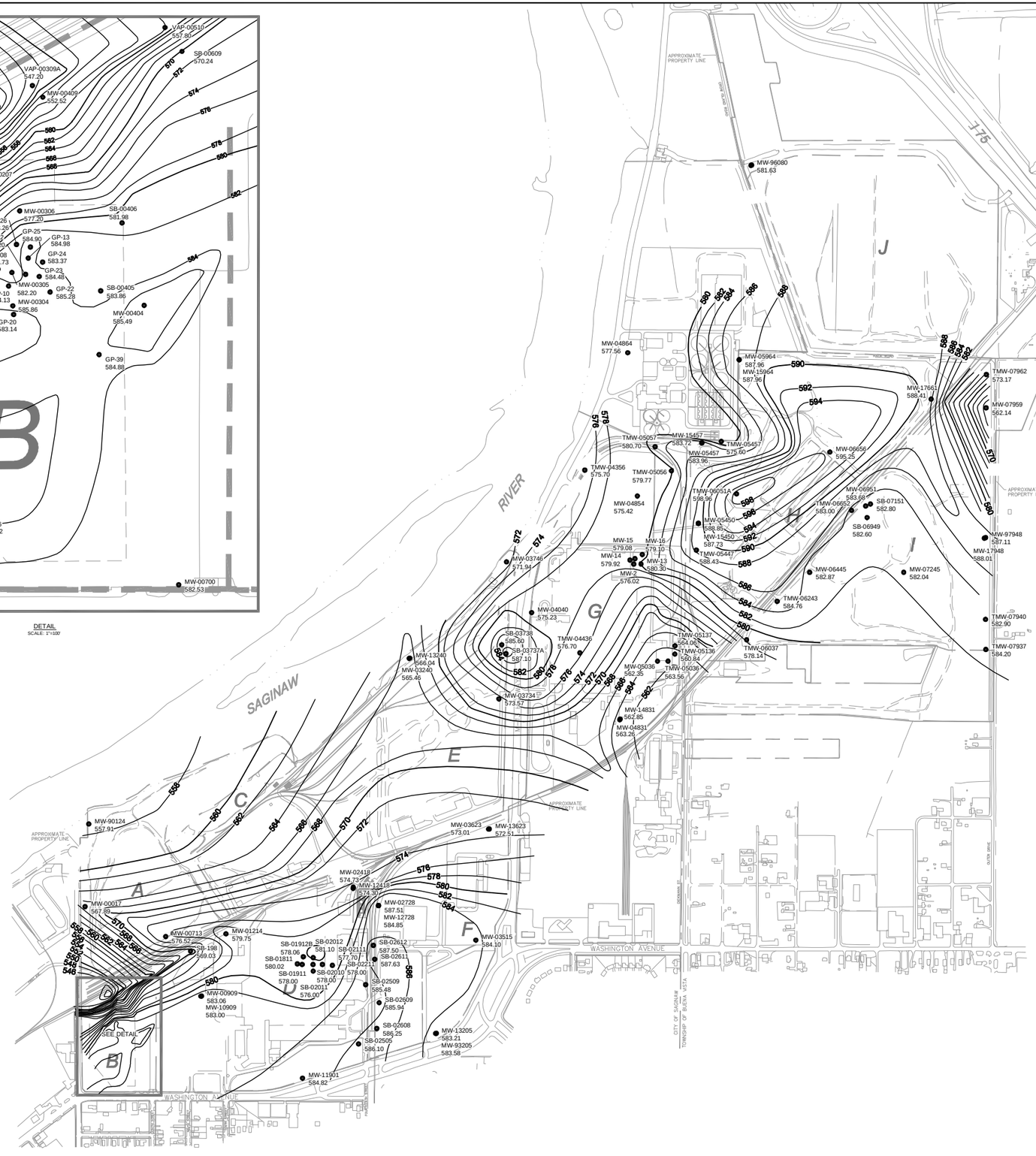
Source References:

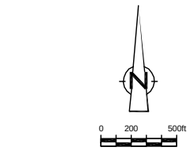
Project Manager:	Reviewed By:	Date:	
M.T.	I.R.	OCTOBER 2009	
Scale: 1"=200'	Project N°: 17075-12	Report N°: MEMO023	Drawing N°: figure 2

17075-12(MEMO023)GN-WA005 OCT 02/2009



DETAIL
SCALE: 1"=100'





LEGEND

580 TOP OF CLAY CONTOUR (ft.AMSL-NAVD 88)

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

GENERAL MOTORS CORPORATION
SAGINAW METAL CASTING OPERATIONS

SAGINAW, MICHIGAN

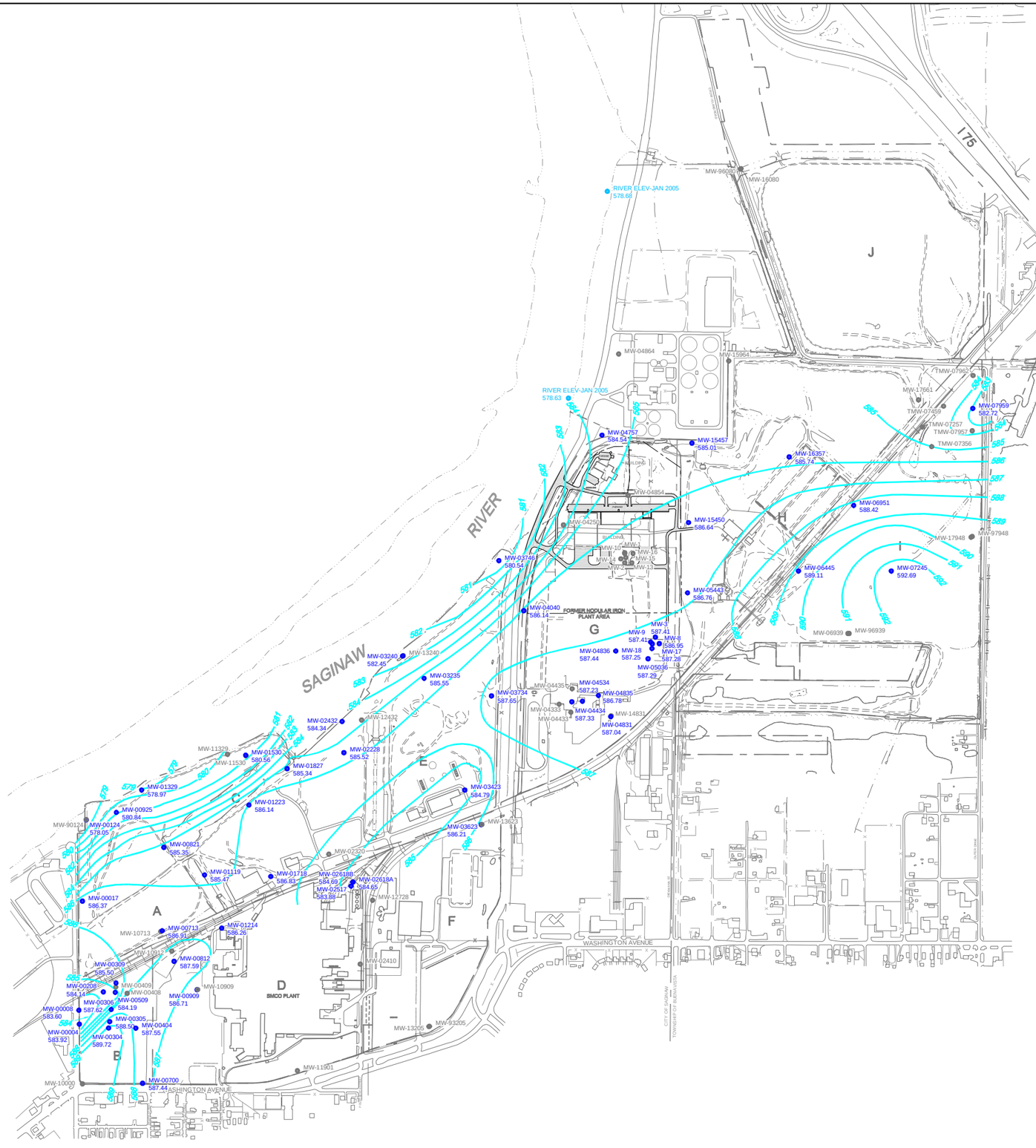
TOP OF NATIVE CLAY
CONTOURS

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:
MICHIGAN STATE PLANE SOUTH, NAD 83 USING INTERNATIONAL FEET, NGVD 88

Project Manager:	Reviewed By:	Date:	
I.R.	M.T.	FEBRUARY 2007	
Scale: 1" = 500'	Project №: 17075-16	Report №: 027	Drawing №: figure 3.5

17075-16(027)GN-WA039 FEB 05/2007



0 200 500ft

LEGEND

586	GROUNDWATER ELEVATION FT. AMSL (NAVD 88)
MW-07245 (592.68)	EXISTING MONITORING WELL WITH GROUNDWATER ELEVATION (JANUARY 2005)
MW-17661	EXISTING MONITORING WELL

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

GENERAL MOTORS CORPORATION
SAGINAW METAL CASTING OPERATIONS

SAGINAW, MICHIGAN

UPPER WATER BEARING ZONE
GROUNDWATER CONTOUR MAP

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
I.R.	M.T.	FEBRUARY 2007	
Scale: 1" = 500'	Project N°: 17075-16	Report N°: 027	Drawing N°: figure 3.7

17075-16(027)GN-WA004 FEB 05/2007

Attachment 2

2009 and 2010 Mixing Zone Determination and Implementation Responses

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Liane Shekter Smith, Assistant Division Chief
Waste and Hazardous Materials Division

FROM: Erik Sunday, Surface Water Assessment Section, Water Bureau

DATE: December 11, 2009

SUBJECT: General Motors Corp-Saginaw Metal Casting Operations (GM-SMCO)
Groundwater venting discharge

The Surface Water Assessment Section has evaluated Water Quality-Based Effluent Limits (WQBELs) for the GM-SMCO groundwater venting discharge. The existing GM-SMCO facility is continuously venting groundwater to the Saginaw River from four groundwater-surface water interfaces (GSIs) as described in the November 12, 2009, Mixing Zone Determination Request (MZDR) forwarded to SWAS by Waste and Hazardous Materials Division (WHMD):

Ammonia Part 1 – 1.73 cubic feet per second (cfs) (1.12 million gallons per day (MGD))
Ammonia Part 2 – 0.81 cfs (0.52 MGD)
pH-High – 0.76 cfs (0.49 MGD)
pH-Low – 2.05 cfs (1.33 MGD)

The above venting flow rates are maximum flows. The vents are located in Sections 7, 17, and 18 of T12N, R5E of Saginaw County. The pH-High groundwater venting flows to the Saginaw River through the Ammonia Part 1 venting area. Therefore, these two vents have been treated as a single vent with a maximum flow rate of 2.49 cfs (1.73 cfs + 0.76 cfs) in developing WQBELs. The combined Ammonia Part 1 and pH-High vent discharges to the Saginaw River downstream of the Carrolton Bar, while the Ammonia Part 2 and pH-Low vents discharge to a channel of the Saginaw River southeast of the Carrolton Bar.

The monthly exceedance flows (in cfs) for the Saginaw River below the Carrolton Bar at the point of discharge of the combined Ammonia Part 1 and pH-High vents are as follows:

	JAN.	FEB.	MAR.	APR.	MAY	JUNE
50%	2200	2510	6950	6830	3640	1880
95%	750	800	1560	2220	1180	740

	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
50%	1150	980	1000	1250	2010	2380
95%	550	500	510	600	750	780

The monthly exceedance flows (in cfs) for the channel of the Saginaw River southeast of the Carrolton Bar at the point of discharge of the Ammonia Part 2 and pH-Low vents are as follows:

	JAN.	FEB.	MAR.	APR.	MAY	JUNE
50%	1630	1860	5140	5050	2700	1390
95%	560	590	1160	1640	870	550

	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
50%	850	730	740	930	1490	1760
95%	410	370	380	440	560	580

The Saginaw River is protected for warmwater fish, other indigenous aquatic life and wildlife, agriculture, navigation, industrial water supply, public water supply at the point of intake, partial body contact recreation, total body contact recreation from May 1 to October 31, and fish consumption.

Ammonia concentrations and pH are the primary concerns for this facility's venting groundwater. Average values of groundwater pH in the four venting areas were computed from data contained in the MZDR:

Ammonia Part 1 – 7.06 S.U.
Ammonia Part 2 – 6.86
pH-High – 11.19
pH-Low – 5.48

SWAS recommends a pH range of 6.5 to 9.0 S.U. for all venting groundwater discharges to the Saginaw River year-round. Table 1 contains total ammonia recommendations based on meeting the 0.420 mg/l warmwater un-ionized ammonia acute toxicity criterion in the combined Ammonia Part 1 and pH-High venting. No ammonia recommendations for any other GM-SMCO groundwater venting should be necessary to protect against acute or chronic un-ionized ammonia toxicity based on data provided in the MZDR. Pollutants affecting dissolved oxygen in the receiving water are not expected to be present at problematic levels in the venting discharges.

The fraction of total ammonia existing as un-ionized ammonia is calculated, in part, from the pH of the venting groundwater. For the combined Ammonia Part 1 and pH-High venting, the upper value of the WQBEL pH range, 9.0 S.U., was used in the calculation of WQBELs based on un-ionized ammonia toxicity. The recommendations in Table 1 apply for groundwater pH's of 9.0 S.U. or lower. If the groundwater venting is permitted to discharge at a pH greater than 9.0 S.U., WQBELs for the combined Ammonia Part 1 and pH-High venting will need to be recalculated. For evaluation of the pH-Low and Ammonia Part 2 ventings, a pH of 7.1 S.U. was used based on the calculated average pH for the Ammonia Part 1 venting.

The attached effluent limit recommendations are based on water quality standards. We have not addressed treatment practicality or cost effectiveness. Our recommendations do not imply that other considerations should not be taken into account when deciding on permit limits.

Table 1. GM-SMCO pH and ammonia toxicity-based WQBEL recommendations
Combined Ammonia Part 1 and pH-High groundwater venting
WQBELs assume a pH of 9.0 S.U. or less in venting groundwater

Parameter	Months	Conc. (mg/l)	Load (lb/d)	Basis	Rationale
NH3-N	Year round	3.1	42	Daily Max.	Acute warmwater toxicity

Design Flow = 2.49 cfs (1.61 MGD)

cc: Jon Bloemker, Saginaw Bay District Supervisor, SWAS, WB
Eric Alexander/Groundwater Venting File, SWAS, WB

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Nate Nemani, Resource Conservation and Recovery Act of 1976 Corrective Action Project Manager, Land and Chemicals Division, Remediation and Reuse Branch, U.S. Environmental Protection Agency

FROM: Ronald Stone, Senior Geologist, Waste and Hazardous Materials Division, Michigan Department of Environmental Quality

DATE: January 12, 2010

SUBJECT: Implementation of a Mixing Zone Request; General Motors - Saginaw Metal Castings Operation (GM-SMCO); MID 041 793 340

The Michigan Department of Environmental Quality (MDEQ), Waste and Hazardous Materials Division (WHMD), has reviewed the request for a Mixing Zone Determination for venting groundwater to the Saginaw River from GM-SMCO in Saginaw County, Michigan and forwarded that request to the MDEQ, Water Bureau (WB). The attached response provided by the WB identifies the acceptable concentration limits for discharge of the various chemicals characterized in the mixing zone request to the Saginaw River.

Based on the information provided by the WB, it is determined that there is a reasonable potential for the discharge of some chemicals to cause or contribute to water quality standards (WQS) being exceeded.

Recommended mixing zone-based groundwater surface water interface (GSI) values are summarized in the table below:

Table 1: Plume Venting to the Saginaw River

Parameter	Final Acute Value	Final Chronic Value	Reported Worst Case Maximum Site Concentration
pH	6.5 - 9.0 S.U.		
Ammonia Nitrogen	3.1 mg/l		

General Comments

1. The final acute values listed above are the acute mixing zone-based GSI criteria. These limits are provided for chemicals determined to have a reasonable potential to exceed the acute mixing zone-based GSI criteria. These values (as well as the generic GSI criteria for other chemicals not specifically identified in the mixing zone request) must not be exceeded at the GSI compliance monitoring wells; if they are, further remedial action will be required. The facility has the following options in regards to parameters that exceed the acute mixing zone-based GSI criteria in site monitoring wells:

    a. If any existing exceedances are upgradient of the compliance monitoring wells, GM-SMCO must demonstrate that data from all of the compliance monitoring wells in the Mixing Zone Compliance Monitoring Plan are, and will be, in compliance with acute

mixing zone-based GSI criteria for those parameters. Averaging of groundwater data is not allowed for comparison to generic GSI or acute mixing zone-based GSI criteria, nor is it allowed for bioaccumulative contaminants of concern. Acute mixing zoned-based or generic GSI criteria may not be exceeded in any individual GSI compliance monitoring well.

b. Prevent the discharge of all parameters that exceed the acute mixing zone-based GSI criteria in the GSI compliance monitoring wells. This option would require the focus of subsequent site investigations to hydrogeologically define remediation designs for capturing the groundwater discharge, further plume characterization, and identification of sources for source control measures.

2. It has been determined that any other parameter on the mixing zone request form, not given a recommended mixing zone-based GSI criteria in the table above (if any) or in the attached memorandum, will not cause or contribute to WQS being exceeded at this time. This determination is based upon the reported maximum values in the mixing zone request, which was submitted to the WB by the WHMD.

In order to demonstrate the groundwater discharge long-term compliance with the mixing zone-based GSI criteria, GM-SMCO will need to submit a Mixing Zone Compliance Monitoring Plan for review and approval. The Mixing Zone Compliance Monitoring Plan should include a Sampling and Analysis Plan (to address both mixing zone chemicals and other chemicals reported in the mixing zone request), identification of the wells that GM-SMCO proposes to sample to show compliance with the mixing zone-based GSI criteria (along the GSI at the GSI point of compliance) and any sentinel wells within the appropriate portions of the plume, and provide an explanation of the monitoring schedule and reporting process.

Should you have any questions regarding this letter or the Mixing Zone Determination, please contact me via e-mail at stoner@michigan.gov or by telephone at 517-373-7141.

Attachment
cc/att: Ms. Cheryl Howe, WHMD
Ms. Rhonda Klann, Remediation and Redevelopment Division
Mr. David Slayton, WHMD
Corrective Action File

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Liane Shekter Smith, Assistant Division Chief
Waste and Hazardous Materials Division

FROM: Erik Sunday, Surface Water Assessment Section, Water Bureau

DATE: December 11, 2009

SUBJECT: General Motors Corp-Saginaw Metal Casting Operations (GM-SMCO)
Groundwater venting discharge

The Surface Water Assessment Section has evaluated Water Quality-Based Effluent Limits (WQBELs) for the GM-SMCO groundwater venting discharge. The existing GM-SMCO facility is continuously venting groundwater to the Saginaw River from four groundwater-surface water interfaces (GSIs) as described in the November 12, 2009, Mixing Zone Determination Request (MZDR) forwarded to SWAS by Waste and Hazardous Materials Division (WHMD):

Ammonia Part 1 – 1.73 cubic feet per second (cfs) (1.12 million gallons per day (MGD))
Ammonia Part 2 – 0.81 cfs (0.52 MGD)
pH-High – 0.76 cfs (0.49 MGD)
pH-Low – 2.05 cfs (1.33 MGD)

The above venting flow rates are maximum flows. The vents are located in Sections 7, 17, and 18 of T12N, R5E of Saginaw County. The pH-High groundwater venting flows to the Saginaw River through the Ammonia Part 1 venting area. Therefore, these two vents have been treated as a single vent with a maximum flow rate of 2.49 cfs (1.73 cfs + 0.76 cfs) in developing WQBELs. The combined Ammonia Part 1 and pH-High vent discharges to the Saginaw River downstream of the Carrolton Bar, while the Ammonia Part 2 and pH-Low vents discharge to a channel of the Saginaw River southeast of the Carrolton Bar.

The monthly exceedance flows (in cfs) for the Saginaw River below the Carrolton Bar at the point of discharge of the combined Ammonia Part 1 and pH-High vents are as follows:

	JAN.	FEB.	MAR.	APR.	MAY	JUNE
50%	2200	2510	6950	6830	3640	1880
95%	750	800	1560	2220	1180	740

	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
50%	1150	980	1000	1250	2010	2380
95%	550	500	510	600	750	780

The monthly exceedance flows (in cfs) for the channel of the Saginaw River southeast of the Carrolton Bar at the point of discharge of the Ammonia Part 2 and pH-Low vents are as follows:

	JAN.	FEB.	MAR.	APR.	MAY	JUNE
50%	1630	1860	5140	5050	2700	1390
95%	560	590	1160	1640	870	550

	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
50%	850	730	740	930	1490	1760
95%	410	370	380	440	560	580

The Saginaw River is protected for warmwater fish, other indigenous aquatic life and wildlife, agriculture, navigation, industrial water supply, public water supply at the point of intake, partial body contact recreation, total body contact recreation from May 1 to October 31, and fish consumption.

Ammonia concentrations and pH are the primary concerns for this facility's venting groundwater. Average values of groundwater pH in the four venting areas were computed from data contained in the MZDR:

Ammonia Part 1 – 7.06 S.U.
Ammonia Part 2 – 6.86
pH-High – 11.19
pH-Low – 5.48

SWAS recommends a pH range of 6.5 to 9.0 S.U. for all venting groundwater discharges to the Saginaw River year-round. Table 1 contains total ammonia recommendations based on meeting the 0.420 mg/l warmwater un-ionized ammonia acute toxicity criterion in the combined Ammonia Part 1 and pH-High venting. No ammonia recommendations for any other GM-SMCO groundwater venting should be necessary to protect against acute or chronic un-ionized ammonia toxicity based on data provided in the MZDR. Pollutants affecting dissolved oxygen in the receiving water are not expected to be present at problematic levels in the venting discharges.

The fraction of total ammonia existing as un-ionized ammonia is calculated, in part, from the pH of the venting groundwater. For the combined Ammonia Part 1 and pH-High venting, the upper value of the WQBEL pH range, 9.0 S.U., was used in the calculation of WQBELs based on un-ionized ammonia toxicity. The recommendations in Table 1 apply for groundwater pH's of 9.0 S.U. or lower. If the groundwater venting is permitted to discharge at a pH greater than 9.0 S.U., WQBELs for the combined Ammonia Part 1 and pH-High venting will need to be recalculated. For evaluation of the pH-Low and Ammonia Part 2 ventings, a pH of 7.1 S.U. was used based on the calculated average pH for the Ammonia Part 1 venting.

The attached effluent limit recommendations are based on water quality standards. We have not addressed treatment practicality or cost effectiveness. Our recommendations do not imply that other considerations should not be taken into account when deciding on permit limits.

Table 1. GM-SMCO pH and ammonia toxicity-based WQBEL recommendations
Combined Ammonia Part 1 and pH-High groundwater venting
WQBELs assume a pH of 9.0 S.U. or less in venting groundwater

Parameter	Months	Conc. (mg/l)	Load (lb/d)	Basis	Rationale
NH3-N	Year round	3.1	42	Daily Max.	Acute warmwater toxicity

Design Flow = 2.49 cfs (1.61 MGD)

cc: Jon Bloemker, Saginaw Bay District Supervisor, SWAS, WB
Eric Alexander/Groundwater Venting File, SWAS, WB

Attachment 3

Correspondence Related to Discontinuing Monitoring at MW-04765 and MW-04864

From:	Tomka, Mike
To:	"Nemani, Nate"
Cc:	Dave Favero (dfavero@racertrust.org); Hoevemeyer, Steven; Pardys, John-Eric; Project Email Filing
Subject:	RE: Follow-up From Site Visit on 11/6/13, Nodular ~COR-058502~
Date:	Friday, November 29, 2013 4:42:06 PM

Thank you Nate.
Mike

From: Nemani, Nate [mailto:nemani.nate@epa.gov]
Sent: Friday, November 29, 2013 4:37 PM
To: Tomka, Mike
Cc: Dave Favero (dfavero@racertrust.org); Hoevemeyer, Steven; Pardys, John-Eric; Project Email Filing
Subject: RE: Follow-up From Site Visit on 11/6/13, Nodular ~COR-058502~

Just in case I did not respond, you may implement the recommendations for the North Ditch as detailed below.

NATE NEMANI, P.E.
RCRA CORRECTIVE ACTION PROJECT MANAGER
LAND AND CHEMICALS DIVISION
REMEDIATION AND REUSE BRANCH,
U. S.EPA, REGION 5 ,
77 W JACKSON Blvd, CHICAGO,ILLINOIS,60604, Mail Code: LU-9J
(312) 886-3224 (PHONE)
(312) 692-2176 (FAX)
nemani.nate@epa.gov (e-mail address)

From: Tomka, Mike [mailto:mtomka@craworld.com]
Sent: Thursday, November 07, 2013 7:10 AM
To: Nemani, Nate
Cc: Dave Favero (dfavero@racertrust.org); Hoevemeyer, Steven; Pardys, John-Eric; Project Email Filing
Subject: Follow-up From Site Visit on 11/6/13, Nodular ~COR-058502~

Nate, thank you for your time yesterday. I think it was good for us all to visit the Nodular Site and see the areas we're working on.

Just to memorialize our discussion on the upcoming EI groundwater monitoring, the following presents a summary of our discussion:
- sampling will be conducted next week
- we'll proceed with the recommendations in the attached 3/11/13 EI submittal and the 10/23/13 North Ditch memo, with the exception that we will continue to monitor MW-04257 for ammonia, contrary to the 3/11/13 recommendation.

Take care.
Mike

Michael R. Tomka, P.Eng., P.E.
Conestoga-Rovers & Associates
Mailing Address: 651 Colby Drive, Waterloo, ON, Canada N2V 1C2

Office Address: 40 Bathurst Drive, Waterloo, ON
Voice: 519-884-0510 x3464 Fax: 519-725-1394
Mobile: 519-241-0007
mtomka@craworld.com www.craworld.com

This communication and any accompanying document(s) are confidential and are intended for the sole use of the addressee. If you are not the intended recipient, please notify me at the telephone number shown above or by return e-mail and delete this e-mail and any copies. You are advised that any disclosure, copying, distribution, or the taking of any action in reliance upon the communication without consent is strictly prohibited. Thank you.

CONESTOGA-ROVERS & ASSOCIATES

651 Colby Drive, Waterloo, Ontario, Canada N2V 1C2
Telephone: (519884-0510 Fax: (519) 884-0525
www.CRAworld.com)

DRAFT MEMORANDUM

TO:	Nate Nemani	REF. NO.:	058502
FROM:	Michael Tomka/kf/8	DATE:	October 23, 2013
CC:	Dave Favero (RACER), Grant Trigger (RACER)		
RE:	**North Ditch Characterization and Select Groundwater Monitoring Saginaw Nodular Industrial Land**		

Introduction

The following memorandum summarizes the North Ditch characterization and select groundwater sampling completed at the RACER Trust Saginaw Nodular Industrial Land (Site) in Saginaw, Michigan. The work was completed in accordance with Conestoga-Rovers and Associates (CRA), Additional Investigation Sampling and Analysis Plan (SAP), dated April 2013 (Work Plan), which was approved via email by the United States Environment Protection Agency (U.S. EPA) on July 8, 2013 via email.

Summary of Investigation

The following presents a brief summary of the results:

North Ditch Characterization

The following investigation of surface water, sediment, and soil on the bank was conducted to characterize impacts in the Former Stormwater Discharge Ditch (North Ditch) to assist in assessing alternatives to address the North Ditch.

Surface Water

- Six water samples were collected from three locations at two depths (surface and mid-depth) from the North Ditch.
- The samples were analyzed for: target analyte list (TAL) metals, polychlorinated biphenyls (PCBs), ammonia, biochemical oxygen demand (BOD), chemical oxygen demand (COD), cyanide (total and amenable), hardness, nitrate, oil and grease, pH, phenols, and total organic carbon (TOC).
- The results were screened against the Michigan Department of Environmental Quality (MDEQ) Groundwater Surface Water Interface (GSI) criteria and the DEQ Rule 57 Water Quality Values for surface water. All sample results were below criteria.

Figure 1 presents the surface water (SW) and mid-depth (MD) sample locations in the North Ditch and Figure 2 presents the depth of water and sediment at each sample location. Table 1 presents a summary of the surface water sample results.

REGISTERED COMPANY FOR ISO 9001 ENGINEERING DESIGN

Sediment/Native Material

- Seven sediment samples were collected from six locations in the North Ditch. In addition, five soil samples were collected from the native material (soil) underlying the sediment.
- The seven sediment and five soil samples were analyzed for: TAL metals, PCBs, ammonia, cyanide (total), nitrate, pH, sulfide, and TOC. The seven sediment samples were also analyzed for acid volatile sulfide/simultaneously extracted metals (AVS/SEM).
- The results were first screened against the Michigan Statewide Default Background Levels then compared to the MDEQ GSI protection criteria. All the soil and sediment sample results exceeded GSI protection criteria for at least one of four metals (arsenic, chromium, cobalt, and selenium) or total cyanide.

AVS/SEM analyses consider the bioavailability of divalent metals and potential toxicity to benthic invertebrates. For the AVS/SEM data, EPA guidance (EPA 2005[1]) indicates that values of carbon normalized excess (CNE) - SEM less than 130 umol/gram organic carbon (OC) are not toxic to benthic invertebrates. Values above 130 umol/gram OC but below 3,000 umol/gram OC are potentially toxic to benthic invertebrates, and values above 3,000 umol/gram OC are more likely to be toxic than nontoxic. The CNE-SEM values for all seven samples were calculated. Five of the seven sediment samples had CNE-SEM concentrations less than 130 umol/gram OC, indicating no reasonable potential for toxicity. The remaining two samples were above 130 umol/gram OC at 296 and 248 umol/gram OC. These two sediment samples were well below 3,000 umol/gram OC, above which sediments are predominantly toxic. Based on information provided in EPA (2005), these two samples have a low probability, about 10 percent, of being toxic to benthic invertebrates from divalent metals.

Figure 1 presents the sediment (SD) and native material (SO) sample locations in the North Ditch and Figure 2 presents the depth of water and sediment at each sample location. Table 2 presents a summary of the sediment and native soil sample results.

Soil

- Eighteen soil samples were collected from nine locations at two depths (0-5 inches and 5-12 inches) on the banks of the North Ditch.
- The nine shallow samples were analyzed on a one week turn for: TAL metals, PCBs, ammonia, cyanide (total), Nitrate, pH and total organic carbon. The nine deeper samples were placed on hold pending the analysis of the shallow samples.
- The results of the shallow samples were first screened against the Michigan Statewide Default Background Levels then compared to the MDEQ GSI protection criteria and MDEQ Direct Contact Criteria. The sample results exceeded GSI protection criteria for three metals (arsenic, chromium, and selenium) as well as total cyanide but did not exceed Direct Contact criteria. The PCB results of the shallow samples were well below the TSCA high occupancy criteria of 1,000 micrograms per kilogram (µg/kg). The highest detection of PCBs in the bank soil was 0.35 µg/kg. Due to the low detected concentrations of PCBs as well as no North Ditch water sample results exceeding GSI criteria for those compounds that exceeded GSI protection criteria in soil, analysis of the deeper soil samples was not completed.

Figure 1 presents the bank soil (SO) sample locations in the North Ditch. Table 3 presents a summary of the bank soil sample results.

---

[1] USEPA. 2005. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Metal Mixtures (Cadmium, Copper, Lead, Nickel, Silver and Zinc). EPA/600/R-02/011.

Select Groundwater Investigation

The following investigation of groundwater was conducted to re-assess potential unacceptable risk to construction workers as identified in the Human Health Risk Assessment (CRA, March 2007) from exposures to shallow groundwater for elevated pH and ammonia. The data that formed the basis for the risk determination was collected between 2000 and 2005.

- Groundwater samples were collected from fourteen monitoring wells and analyzed for ammonia. pH was measured in samples from fifteen monitoring wells.
- Samples were either submitted to the laboratory (11 samples for ammonia) for analysis and/or field tested (six samples for ammonia and 15 samples for pH).
- The laboratory or field analyzed ammonia, along with the average pH of the groundwater and receiving water (Saginaw River) and the average temperature of the groundwater and receiving water (Saginaw River) were used to calculate the un-ionized ammonia concentration using the equations developed by Steven C. Chapra "Surface Water-Quality Modeling", McGraw-Hill Series in Water Resources and Environmental Engineering 1997. The un-ionized ammonia was then screened against the warmwater un-ionized ammonia acute toxicity criterion (0.42 mg/L) consistent with the Mixing Zone Determination (MDEQ, January 12, 2010) provided in Attachment 1 as there are no established criteria for assessing direct contact exposures to ammonia. The Mixing Zone Determination was submitted on October 2, 2009 for ammonia and pH that were reported above GSI criteria in groundwater samples from monitoring wells located next to the Saginaw River.
- The pH results were screened against MDEQ GSI criteria as there are no established criteria for assessing direct contact exposures to pH, however, for pH the RCRA pH range for determining if a waste is characteristically hazardous due to corrosivity is; less than or equal to 2 s.u. or greater than or equal to 12.5 s.u.
- Ammonia did not exceed the warmwater un-ionized ammonia acute toxicity criterion at monitoring wells next to the Saginaw River.
- pH did not exceed MDEQ GSI criteria at monitoring wells next to the Saginaw River.

Figure 3 presents a summary of results of ammonia and pH in monitoring wells sampled as part of the SAP and sampled as part of the annual Environmental Indicator (EI) monitoring. Table 4 presents the analytical results summary of the monitoring wells sampled and analyzed for ammonia and pH as part of the SAP and compared to the warmwater un-ionized ammonia acute toxicity criterion and MDEQ GSI criterion, respectively.

Conclusions and Proposed Next Steps

The results of the North Ditch surface water investigation identified no exceedances of MDEQ GSI criteria or Rule 57 Water Quality Values. The results of the North Ditch soil and sediment investigation identified exceedances of MDEQ GSI protection criteria. The soil or sediment sample results exceeded GSI protection criteria for four metals (arsenic, chromium, cobalt, and selenium) as well as total cyanide. However, since the surface water sample results did not exceed GSI criteria for these constituents, this indicates that the parameters exceeding criteria did not leach significantly into the surface water. The soil and sediment have been in place for many years, therefore, we expect that leaching, if any, is in equilibrium. Therefore, soil and sediment exceedances of GSI protection criteria do not warrant further consideration with the exception of the potential for re-suspension of solids.

The results of the AVS/SEM analyses identified that five of the seven samples would not be toxic to benthic invertebrates from divalent metals, while the remaining two samples have a low potential of being toxic (EPA 2005). Hence, the sediments of the North Ditch, on overall average, have no significant toxicity to benthic invertebrates.

Notwithstanding the negligible potential toxicity to benthic invertebrates in the North Ditch, it is proposed that options to address the sediment be identified and evaluated.

The results of the groundwater monitoring sampling for ammonia indicate that the calculated un-ionized fraction of ammonia meets the warmwater un-ionized ammonia acute toxicity criterion at the river, however, there continues to be elevated un-ionized ammonia concentrations above criteria in the area where there has been historically high concentrations . The warmwater un-ionized ammonia acute toxicity criterion is intended to protect against significant exposures to aquatic life through contact with surface water. In addition, the site-specific Ecological Risk Assessment (CRA, March 2007) evaluated the migration of contaminants from groundwater to surface water. The evaluation concluded that groundwater discharging to surface water is not a significant exposure pathway for ecological receptors in the Saginaw River. Therefore, since the un-ionized ammonia results are below the warmwater un-ionized ammonia acute toxicity criterion next to the river and are consistent and/or decreasing when compared to historical results, groundwater discharge to surface water is not a significant exposure pathway.

Because potential unacceptable risk to construction workers from exposures to shallow groundwater impacted by ammonia was identified in the Human Health Risk Assessment (CRA, March 2007), groundwater samples were collected from select monitoring wells in order to provide current ammonia concentrations. The results were compared to the historical ammonia concentrations at MW-8 which were initially above the noncancer hazard quotient (HQ) of 1 at a concentration 55.7 mg/L and more recently were below the noncancer HQ of 1 at concentrations of 33 mg/L and 30.3 mg/L) as described in the HHRA (CRA, March 2007). All concentrations of ammonia for this monitoring event were less than 30.3 mg/L, therefore, ammonia does not exceed the noncancer HQ of 1. In addition monitoring wells with historically high ammonia concentrations (MW-8, MW-17, and MW-18) have had a decrease in ammonia over time. Those monitoring wells down gradient of these wells report generally stable or lower concentrations of ammonia.

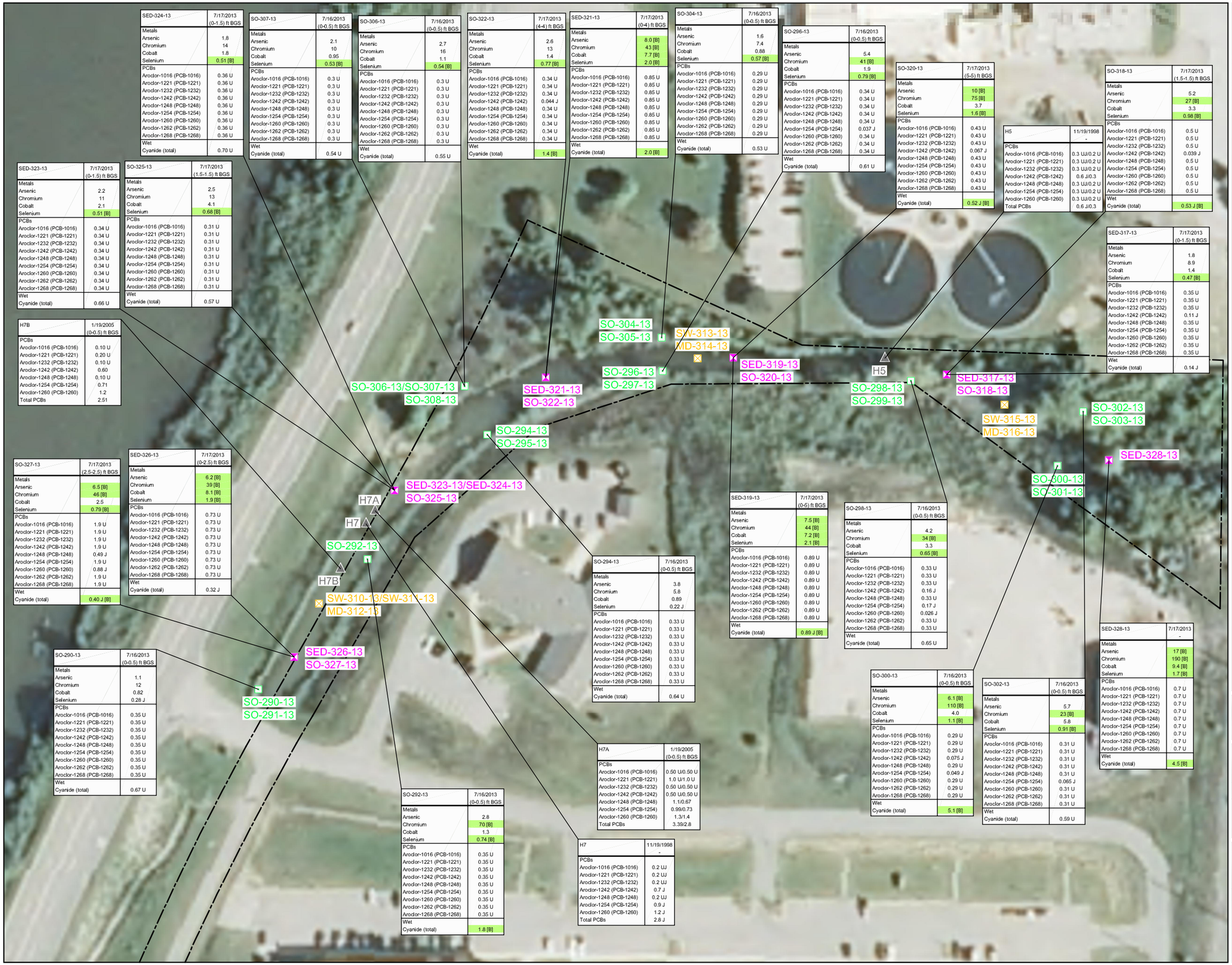
The pH results for this monitoring event indicate that there continues to be elevated pH when compared to the GSI criterion, however, results for monitoring wells next to the river meet the GSI criteria.

Since the shallow groundwater flow direction is generally towards the river, it is proposed that monitoring of the elevated ammonia and pH area and downgradient of this area be conducted to confirm stable conditions. Monitoring of ammonia and pH is currently conducted as part the annual EI monitoring event. The following adjustments to the EI program are recommended to confirm stable conditions of pH and ammonia:

- Add monitoring well locations MW-04836, MW-05036, and MW-8 in the area where there was historically high concentrations of pH and ammonia
- Add monitoring well location MW-04835 to provide delineation to the south
- Discontinue monitoring wells MW-04765 and MW-04864 since results from these locations would be influenced by the City of Saginaw Waste Water Treatment Plant

If acceptable to U.S. EPA, the above adjustments to the EI monitoring program will be included as part of the 2013 EI sampling event which is scheduled to be completed in November 2013. Further recommendations to revise the EI monitoring program maybe included with the submittal of 2013 EI results.

Should you have any questions, please do not hesitate to call.



SED-324-13	7/17/2013 (0-1.5) ft BGS
Metals	
Arsenic	1.8
Chromium	14
Cobalt	1.8
Selenium	0.51 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.36 U
Aroclor-1221 (PCB-1221)	0.36 U
Aroclor-1232 (PCB-1232)	0.36 U
Aroclor-1242 (PCB-1242)	0.36 U
Aroclor-1248 (PCB-1248)	0.36 U
Aroclor-1254 (PCB-1254)	0.36 U
Aroclor-1260 (PCB-1260)	0.36 U
Aroclor-1262 (PCB-1262)	0.36 U
Aroclor-1268 (PCB-1268)	0.36 U
Wet	
Cyanide (total)	0.70 U

SO-307-13	7/16/2013 (0-0.5) ft BGS
Metals	
Arsenic	2.1
Chromium	10
Cobalt	0.95
Selenium	0.53 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.3 U
Aroclor-1221 (PCB-1221)	0.3 U
Aroclor-1232 (PCB-1232)	0.3 U
Aroclor-1242 (PCB-1242)	0.3 U
Aroclor-1248 (PCB-1248)	0.3 U
Aroclor-1254 (PCB-1254)	0.3 U
Aroclor-1260 (PCB-1260)	0.3 U
Aroclor-1262 (PCB-1262)	0.3 U
Aroclor-1268 (PCB-1268)	0.3 U
Wet	
Cyanide (total)	0.54 U

SO-306-13	7/16/2013 (0-0.5) ft BGS
Metals	
Arsenic	2.7
Chromium	16
Cobalt	1.1
Selenium	0.54 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.3 U
Aroclor-1221 (PCB-1221)	0.3 U
Aroclor-1232 (PCB-1232)	0.3 U
Aroclor-1242 (PCB-1242)	0.3 U
Aroclor-1248 (PCB-1248)	0.3 U
Aroclor-1254 (PCB-1254)	0.3 U
Aroclor-1260 (PCB-1260)	0.3 U
Aroclor-1262 (PCB-1262)	0.3 U
Aroclor-1268 (PCB-1268)	0.3 U
Wet	
Cyanide (total)	0.55 U

SO-322-13	7/17/2013 (4-4) ft BGS
Metals	
Arsenic	2.6
Chromium	13
Cobalt	1.4
Selenium	0.77 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.34 U
Aroclor-1221 (PCB-1221)	0.34 U
Aroclor-1232 (PCB-1232)	0.34 U
Aroclor-1242 (PCB-1242)	0.044 J
Aroclor-1248 (PCB-1248)	0.34 U
Aroclor-1254 (PCB-1254)	0.34 U
Aroclor-1260 (PCB-1260)	0.34 U
Aroclor-1262 (PCB-1262)	0.34 U
Aroclor-1268 (PCB-1268)	0.34 U
Wet	
Cyanide (total)	1.4 [B]

SED-321-13	7/17/2013 (0-4) ft BGS
Metals	
Arsenic	8.0 [B]
Chromium	43 [B]
Cobalt	7.7 [B]
Selenium	2.0 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.85 U
Aroclor-1221 (PCB-1221)	0.85 U
Aroclor-1232 (PCB-1232)	0.85 U
Aroclor-1242 (PCB-1242)	0.85 U
Aroclor-1248 (PCB-1248)	0.85 U
Aroclor-1254 (PCB-1254)	0.85 U
Aroclor-1260 (PCB-1260)	0.85 U
Aroclor-1262 (PCB-1262)	0.85 U
Aroclor-1268 (PCB-1268)	0.85 U
Wet	
Cyanide (total)	2.0 [B]

SO-304-13	7/16/2013 (0-0.5) ft BGS
Metals	
Arsenic	1.6
Chromium	7.4
Cobalt	0.88
Selenium	0.57 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.29 U
Aroclor-1221 (PCB-1221)	0.29 U
Aroclor-1232 (PCB-1232)	0.29 U
Aroclor-1242 (PCB-1242)	0.29 U
Aroclor-1248 (PCB-1248)	0.29 U
Aroclor-1254 (PCB-1254)	0.29 U
Aroclor-1260 (PCB-1260)	0.29 U
Aroclor-1262 (PCB-1262)	0.29 U
Aroclor-1268 (PCB-1268)	0.29 U
Wet	
Cyanide (total)	0.53 U

SO-296-13	7/16/2013 (0-0.5) ft BGS
Metals	
Arsenic	5.4
Chromium	41 [B]
Cobalt	1.9
Selenium	0.79 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.34 U
Aroclor-1221 (PCB-1221)	0.34 U
Aroclor-1232 (PCB-1232)	0.34 U
Aroclor-1242 (PCB-1242)	0.34 U
Aroclor-1248 (PCB-1248)	0.34 U
Aroclor-1254 (PCB-1254)	0.037 J
Aroclor-1260 (PCB-1260)	0.34 U
Aroclor-1262 (PCB-1262)	0.34 U
Aroclor-1268 (PCB-1268)	0.34 U
Wet	
Cyanide (total)	0.61 U

SO-320-13	7/17/2013 (5-5) ft BGS
Metals	
Arsenic	10 [B]
Chromium	75 [B]
Cobalt	3.7
Selenium	1.6 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.43 U
Aroclor-1221 (PCB-1221)	0.43 U
Aroclor-1232 (PCB-1232)	0.43 U
Aroclor-1242 (PCB-1242)	0.067 J
Aroclor-1248 (PCB-1248)	0.43 U
Aroclor-1254 (PCB-1254)	0.43 U
Aroclor-1260 (PCB-1260)	0.43 U
Aroclor-1262 (PCB-1262)	0.43 U
Aroclor-1268 (PCB-1268)	0.43 U
Wet	
Cyanide (total)	0.52 J [B]

H5	11/19/1998
PCBs	-
Aroclor-1016 (PCB-1016)	0.3 UJ/0.2 U
Aroclor-1221 (PCB-1221)	0.3 UJ/0.2 U
Aroclor-1232 (PCB-1232)	0.3 UJ/0.2 U
Aroclor-1242 (PCB-1242)	0.6 J/0.3
Aroclor-1248 (PCB-1248)	0.3 UJ/0.2 U
Aroclor-1254 (PCB-1254)	0.3 UJ/0.2 U
Aroclor-1260 (PCB-1260)	0.3 UJ/0.2 U
Total PCBs	0.6 J/0.3

SO-318-13	7/17/2013 (1.5-1.5) ft BGS
Metals	
Arsenic	5.2
Chromium	27 [B]
Cobalt	3.3
Selenium	0.98 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.5 U
Aroclor-1221 (PCB-1221)	0.5 U
Aroclor-1232 (PCB-1232)	0.5 U
Aroclor-1242 (PCB-1242)	0.039 J
Aroclor-1248 (PCB-1248)	0.5 U
Aroclor-1254 (PCB-1254)	0.5 U
Aroclor-1260 (PCB-1260)	0.5 U
Aroclor-1262 (PCB-1262)	0.5 U
Aroclor-1268 (PCB-1268)	0.5 U
Wet	
Cyanide (total)	0.53 J [B]

SED-323-13	7/17/2013 (0-1.5) ft BGS
Metals	
Arsenic	2.2
Chromium	11
Cobalt	2.1
Selenium	0.51 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.34 U
Aroclor-1221 (PCB-1221)	0.34 U
Aroclor-1232 (PCB-1232)	0.34 U
Aroclor-1242 (PCB-1242)	0.34 U
Aroclor-1248 (PCB-1248)	0.34 U
Aroclor-1254 (PCB-1254)	0.34 U
Aroclor-1260 (PCB-1260)	0.34 U
Aroclor-1262 (PCB-1262)	0.34 U
Aroclor-1268 (PCB-1268)	0.34 U
Wet	
Cyanide (total)	0.66 U

SO-325-13	7/17/2013 (1.5-1.5) ft BGS
Metals	
Arsenic	2.5
Chromium	13
Cobalt	4.1
Selenium	0.68 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.31 U
Aroclor-1221 (PCB-1221)	0.31 U
Aroclor-1232 (PCB-1232)	0.31 U
Aroclor-1242 (PCB-1242)	0.31 U
Aroclor-1248 (PCB-1248)	0.31 U
Aroclor-1254 (PCB-1254)	0.31 U
Aroclor-1260 (PCB-1260)	0.31 U
Aroclor-1262 (PCB-1262)	0.31 U
Aroclor-1268 (PCB-1268)	0.31 U
Wet	
Cyanide (total)	0.57 U

H7B	1/19/2005 (0-0.5) ft BGS
PCBs	
Aroclor-1016 (PCB-1016)	0.10 U
Aroclor-1221 (PCB-1221)	0.20 U
Aroclor-1232 (PCB-1232)	0.10 U
Aroclor-1242 (PCB-1242)	0.60
Aroclor-1248 (PCB-1248)	0.10 U
Aroclor-1254 (PCB-1254)	0.71
Aroclor-1260 (PCB-1260)	1.2
Total PCBs	2.51

SED-317-13	7/17/2013 (0-1.5) ft BGS
Metals	
Arsenic	1.8
Chromium	8.9
Cobalt	1.4
Selenium	0.47 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.35 U
Aroclor-1221 (PCB-1221)	0.35 U
Aroclor-1232 (PCB-1232)	0.35 U
Aroclor-1242 (PCB-1242)	0.11 J
Aroclor-1248 (PCB-1248)	0.35 U
Aroclor-1254 (PCB-1254)	0.35 U
Aroclor-1260 (PCB-1260)	0.35 U
Aroclor-1262 (PCB-1262)	0.35 U
Aroclor-1268 (PCB-1268)	0.35 U
Wet	
Cyanide (total)	0.14 J

SO-327-13	7/17/2013 (2.5-2.5) ft BGS
Metals	
Arsenic	6.5 [B]
Chromium	46 [B]
Cobalt	2.5
Selenium	0.79 [B]
PCBs	
Aroclor-1016 (PCB-1016)	1.9 U
Aroclor-1221 (PCB-1221)	1.9 U
Aroclor-1232 (PCB-1232)	1.9 U
Aroclor-1242 (PCB-1242)	1.9 U
Aroclor-1248 (PCB-1248)	0.49 J
Aroclor-1254 (PCB-1254)	1.9 U
Aroclor-1260 (PCB-1260)	0.88 J
Aroclor-1262 (PCB-1262)	1.9 U
Aroclor-1268 (PCB-1268)	1.9 U
Wet	
Cyanide (total)	0.40 J [B]

SED-326-13	7/17/2013 (0-2.5) ft BGS
Metals	
Arsenic	6.2 [B]
Chromium	39 [B]
Cobalt	8.1 [B]
Selenium	1.9 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.73 U
Aroclor-1221 (PCB-1221)	0.73 U
Aroclor-1232 (PCB-1232)	0.73 U
Aroclor-1242 (PCB-1242)	0.73 U
Aroclor-1248 (PCB-1248)	0.73 U
Aroclor-1254 (PCB-1254)	0.73 U
Aroclor-1260 (PCB-1260)	0.73 U
Aroclor-1262 (PCB-1262)	0.73 U
Aroclor-1268 (PCB-1268)	0.73 U
Wet	
Cyanide (total)	0.32 J

SED-319-13	7/17/2013 (0-0.5) ft BGS
Metals	
Arsenic	7.5 [B]
Chromium	44 [B]
Cobalt	7.2 [B]
Selenium	2.1 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.89 U
Aroclor-1221 (PCB-1221)	0.89 U
Aroclor-1232 (PCB-1232)	0.89 U
Aroclor-1242 (PCB-1242)	0.89 U
Aroclor-1248 (PCB-1248)	0.89 U
Aroclor-1254 (PCB-1254)	0.89 U
Aroclor-1260 (PCB-1260)	0.89 U
Aroclor-1262 (PCB-1262)	0.89 U
Aroclor-1268 (PCB-1268)	0.89 U
Wet	
Cyanide (total)	0.89 J [B]

SO-298-13	7/16/2013 (0-0.5) ft BGS
Metals	
Arsenic	4.2
Chromium	34 [B]
Cobalt	3.3
Selenium	0.65 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.33 U
Aroclor-1221 (PCB-1221)	0.33 U
Aroclor-1232 (PCB-1232)	0.33 U
Aroclor-1242 (PCB-1242)	0.16 J
Aroclor-1248 (PCB-1248)	0.33 U
Aroclor-1254 (PCB-1254)	0.17 J
Aroclor-1260 (PCB-1260)	0.026 J
Aroclor-1262 (PCB-1262)	0.33 U
Aroclor-1268 (PCB-1268)	0.33 U
Wet	
Cyanide (total)	0.65 U

SO-290-13	7/16/2013 (0-0.5) ft BGS
Metals	
Arsenic	1.1
Chromium	12
Cobalt	0.82
Selenium	0.28 J
PCBs	
Aroclor-1016 (PCB-1016)	0.35 U
Aroclor-1221 (PCB-1221)	0.35 U
Aroclor-1232 (PCB-1232)	0.35 U
Aroclor-1242 (PCB-1242)	0.35 U
Aroclor-1248 (PCB-1248)	0.35 U
Aroclor-1254 (PCB-1254)	0.35 U
Aroclor-1260 (PCB-1260)	0.35 U
Aroclor-1262 (PCB-1262)	0.35 U
Aroclor-1268 (PCB-1268)	0.35 U
Wet	
Cyanide (total)	0.67 U

SO-294-13	7/16/2013 (0-0.5) ft BGS
Metals	
Arsenic	3.8
Chromium	5.8
Cobalt	0.89
Selenium	0.22 J
PCBs	
Aroclor-1016 (PCB-1016)	0.33 U
Aroclor-1221 (PCB-1221)	0.33 U
Aroclor-1232 (PCB-1232)	0.33 U
Aroclor-1242 (PCB-1242)	0.33 U
Aroclor-1248 (PCB-1248)	0.33 U
Aroclor-1254 (PCB-1254)	0.33 U
Aroclor-1260 (PCB-1260)	0.33 U
Aroclor-1262 (PCB-1262)	0.33 U
Aroclor-1268 (PCB-1268)	0.33 U
Wet	
Cyanide (total)	0.64 U

H7A	1/19/2005 (0-0.5) ft BGS
PCBs	
Aroclor-1016 (PCB-1016)	0.50 UJ/0.50 U
Aroclor-1221 (PCB-1221)	1.0 UJ/1.0 U
Aroclor-1232 (PCB-1232)	0.50 UJ/0.50 U
Aroclor-1242 (PCB-1242)	0.50 UJ/0.50 U
Aroclor-1248 (PCB-1248)	1.1/0.67
Aroclor-1254 (PCB-1254)	0.99/0.73
Aroclor-1260 (PCB-1260)	1.3/1.4
Total PCBs	3.39/2.8

SO-292-13	7/16/2013 (0-0.5) ft BGS
Metals	
Arsenic	2.8
Chromium	70 [B]
Cobalt	1.3
Selenium	0.74 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.35 U
Aroclor-1221 (PCB-1221)	0.35 U
Aroclor-1232 (PCB-1232)	0.35 U
Aroclor-1242 (PCB-1242)	0.35 U
Aroclor-1248 (PCB-1248)	0.35 U
Aroclor-1254 (PCB-1254)	0.35 U
Aroclor-1260 (PCB-1260)	0.35 U
Aroclor-1262 (PCB-1262)	0.35 U
Aroclor-1268 (PCB-1268)	0.35 U
Wet	
Cyanide (total)	1.8 [B]

H7	11/19/1998
PCBs	-
Aroclor-1016 (PCB-1016)	0.2 UJ
Aroclor-1221 (PCB-1221)	0.2 UJ
Aroclor-1232 (PCB-1232)	0.2 UJ
Aroclor-1242 (PCB-1242)	0.7 J
Aroclor-1248 (PCB-1248)	0.2 UJ
Aroclor-1254 (PCB-1254)	0.9 J
Aroclor-1260 (PCB-1260)	1.2 J
Total PCBs	2.8 J

SO-300-13	7/16/2013 (0-0.5) ft BGS
Metals	
Arsenic	6.1 [B]
Chromium	110 [B]
Cobalt	4.0
Selenium	1.1 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.29 U
Aroclor-1221 (PCB-1221)	0.29 U
Aroclor-1232 (PCB-1232)	0.29 U
Aroclor-1242 (PCB-1242)	0.075 J
Aroclor-1248 (PCB-1248)	0.29 U
Aroclor-1254 (PCB-1254)	0.049 J
Aroclor-1260 (PCB-1260)	0.29 U
Aroclor-1262 (PCB-1262)	0.29 U
Aroclor-1268 (PCB-1268)	0.29 U
Wet	
Cyanide (total)	5.1 [B]

SO-302-13	7/16/2013 (0-0.5) ft BGS
Metals	
Arsenic	5.7
Chromium	23 [B]
Cobalt	5.8
Selenium	0.91 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.31 U
Aroclor-1221 (PCB-1221)	0.31 U
Aroclor-1232 (PCB-1232)	0.31 U
Aroclor-1242 (PCB-1242)	0.31 U
Aroclor-1248 (PCB-1248)	0.31 U
Aroclor-1254 (PCB-1254)	0.065 J
Aroclor-1260 (PCB-1260)	0.31 U
Aroclor-1262 (PCB-1262)	0.31 U
Aroclor-1268 (PCB-1268)	0.31 U
Wet	
Cyanide (total)	0.59 U

SED-328-13	7/17/2013 -
Metals	
Arsenic	17 [B]
Chromium	190 [B]
Cobalt	9.4 [B]
Selenium	1.7 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.7 U
Aroclor-1221 (PCB-1221)	0.7 U
Aroclor-1232 (PCB-1232)	0.7 U
Aroclor-1242 (PCB-1242)	0.7 U
Aroclor-1248 (PCB-1248)	0.7 U
Aroclor-1254 (PCB-1254)	0.7 U
Aroclor-1260 (PCB-1260)	0.7 U
Aroclor-1262 (PCB-1262)	0.7 U
Aroclor-1268 (PCB-1268)	0.7 U
Wet	
Cyanide (total)	4.5 [B]

0 20 50ft

LEGEND

- SURVEYED PROPERTY BOUNDARY
- HISTORICAL SEDIMENT SAMPLE LOCATION
- SEDIMENT SAMPLE LOCATION
- SOIL SAMPLE LOCATION
- SURFACE WATER SAMPLE LOCATION

NOTES:
SO = SOIL
SED = SEDIMENT
SW = SURFACE WATER
MD = DEPTH OF WATER COLUMN

SED-317-13	7/17/2013 (0-1.5) ft BGS
Metals	
Selenium	0.47 [B]
PCBs	
Aroclor-1016 (PCB-1016)	0.35 U
Aroclor-1221 (PCB-1221)	0.35 U
Aroclor-1232 (PCB-1232)	0.35 U
Aroclor-1242 (PCB-1242)	0.11 J
Aroclor-1248 (PCB-1248)	0.35 U
Aroclor-1254 (PCB-1254)	0.35 U
Aroclor-1260 (PCB-1260)	0.35 U
Aroclor-1262 (PCB-1262)	0.35 U
Aroclor-1268 (PCB-1268)	0.35 U

SAMPLE LOCATION
SAMPLE DATE
SAMPLE DEPTH
RESULT (mg/kg)
PARAMETER
EXCEEDS CRITERIA

Chemical Name	A	B	C	Unit
Arsenic	5.8	4.6	37	mg/kg
Chromium	18	3.3	9200	mg/kg
Cobalt	6.8	2	9000	mg/kg
Selenium	0.41	0.4	9600	mg/kg
Aroclor-1016 (PCB-1016)	-	-	16	mg/kg
Aroclor-1221 (PCB-1221)	-	-	16	mg/kg
Aroclor-1232 (PCB-1232)	-	-	16	mg/kg
Aroclor-1242 (PCB-1242)	-	-	16	mg/kg
Aroclor-1248 (PCB-1248)	-	-	16	mg/kg
Aroclor-1254 (PCB-1254)	-	-	16	mg/kg
Aroclor-1260 (PCB-1260)	-	-	16	mg/kg
Aroclor-1262 (PCB-1262)	-	-	16	mg/kg
Aroclor-1268 (PCB-1268)	-	-	16	mg/kg
Total PCBs	-	-	16	mg/kg
Cyanide (total)	0.39	0.1	250	mg/kg

A: statewide Default background levels
B: GSI Criteria
C: Non_RES/Direct Contact

SOURCE: 2009 NAIP

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

RACER TRUST
SAGINAW NODULAR INDUSTRIAL LAND

SAGINAW, MICHIGAN

NORTH DITCH SEDIMENT AND SOIL SUMMARY OF EXCEEDANCES

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:
MICHIGAN STATE PLANE SOUTH, NAD 83 USING INTERNATIONAL FEET, NGVD 88
AERIAL: NAIP, 2009.

Project Manager:	Reviewed By:	Date:
M.T.	B.P.	OCTOBER 2013
Scale: 1" = 50'	Project N°: 58502-T02	Report N°: MEMO008
		Drawing N°: figure 1

58502-T02(MEMO008)GN-WA001 OCT 22/2013

0 20 50ft

LEGEND

- SURVEYED PROPERTY BOUNDARY
- HISTORICAL SEDIMENT SAMPLE LOCATION
- SEDIMENT SAMPLE LOCATION
- SOIL SAMPLE LOCATION
- SURFACE WATER SAMPLE LOCATION
- 4' WATER DEPTH
- 1.5' SEDIMENT THICKNESS

SOURCE: 2009 NAIP

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

RACER TRUST
SAGINAW NODULAR INDUSTRIAL LAND

SAGINAW, MICHIGAN

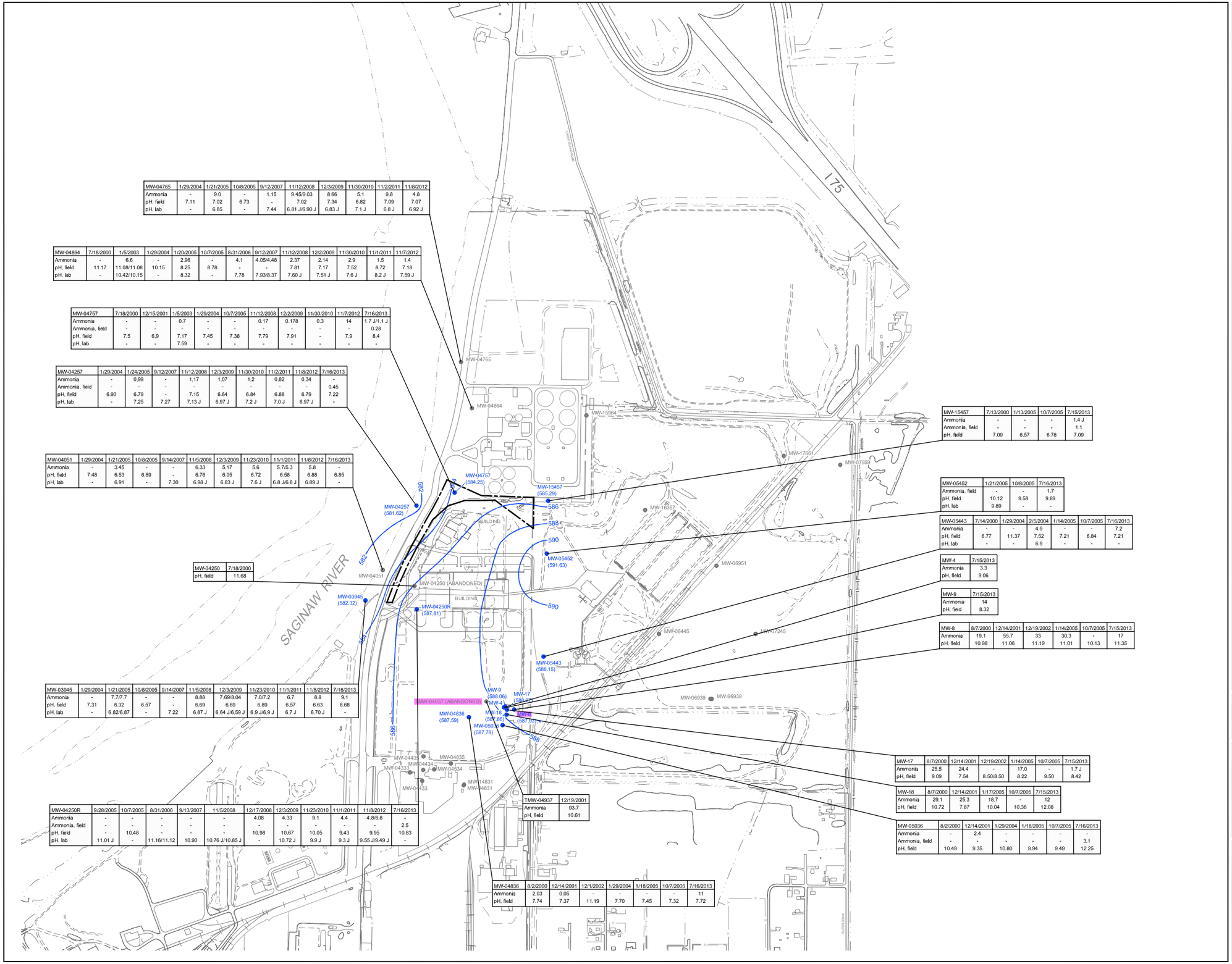
NORTH DITCH WATER DEPTH AND SEDIMENT THICKNESS

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:
MICHIGAN STATE PLANE SOUTH, NAD 83 USING INTERNATIONAL FEET, NGVD 88
AERIAL: NAIP, 2009.

Project Manager:	Reviewed By:	Date:	
M.T.	B.P.	OCTOBER 2013	
Scale: 1" = 50'	Project N#: 58502-T02	Report N#: MEMO008	Drawing N#: figure 2

58502-T02(MEMO008)GN-WA002 OCT 22/2013



MW-04765	1/29/2004	1/21/2005	10/8/2005	9/12/2007	11/12/2008	12/3/2009	11/30/2010	11/2/2011	11/8/2012
Ammonia	-	9.0	-	1.15	9.45/9.03	8.66	5.1	9.8	4.8
pH, field	7.11	7.02	6.73	-	7.02	7.34	6.82	7.09	7.07
pH, lab	-	6.85	-	7.44	6.81 J/6.90 J	6.83 J	7.1 J	6.8 J	6.92 J

MW-04864	7/18/2000	1/5/2003	1/29/2004	1/20/2005	10/7/2005	8/31/2006	9/12/2007	11/12/2008	12/2/2009	11/30/2010	11/1/2011	11/7/2012
Ammonia	-	6.6	-	2.96	-	4.1	4.05/4.48	2.37	2.14	2.9	1.5	1.4
pH, field	11.17	11.08/11.08	10.15	8.25	8.78	-	-	7.81	7.17	7.52	8.72	7.18
pH, lab	-	10.42/10.15	-	8.32	-	7.78	7.93/8.37	7.60 J	7.51 J	7.6 J	8.2 J	7.59 J

MW-04757	7/18/2000	12/15/2001	1/5/2003	1/29/2004	10/7/2005	11/12/2008	12/2/2009	11/30/2010	11/7/2012	7/16/2013
Ammonia	-	-	0.7	-	-	0.17	0.178	0.3	14	1.7 J/1.1 J
Ammonia, field	-	-	-	-	-	-	-	-	-	0.28
pH, field	7.5	6.9	7.17	7.45	7.38	7.79	7.91	-	7.9	8.4
pH, lab	-	-	7.59	-	-	-	-	-	-	-

MW-04257	1/29/2004	1/24/2005	9/12/2007	11/12/2008	12/3/2009	11/30/2010	11/2/2011	11/8/2012	7/16/2013
Ammonia	-	0.99	-	1.17	1.07	1.2	0.82	0.34	-
Ammonia, field	-	-	-	-	-	-	-	-	0.45
pH, field	6.90	6.79	-	7.15	6.64	6.84	6.88	6.79	7.22
pH, lab	-	7.25	7.27	7.13 J	6.97 J	7.2 J	7.0 J	6.97 J	-

MW-04051	1/29/2004	1/21/2005	10/8/2005	9/14/2007	11/5/2008	12/3/2009	11/23/2010	11/1/2011	11/8/2012	7/16/2013
Ammonia	-	3.45	-	-	6.33	5.17	5.6	5.7/5.3	5.8	-
pH, field	7.48	6.53	6.69	-	6.76	6.05	6.72	6.58	6.88	6.85
pH, lab	-	6.91	-	7.30	6.98 J	6.83 J	7.6 J	6.8 J/6.8 J	6.89 J	-

MW-04250	7/18/2000
pH, field	11.68

MW-03945	1/29/2004	1/21/2005	10/8/2005	9/14/2007	11/5/2008	12/3/2009	11/23/2010	11/1/2011	11/8/2012	7/16/2013
Ammonia	-	7.7/7.7	-	-	8.88	7.69/8.04	7.0/7.2	6.7	8.8	9.1
pH, field	7.31	6.32	6.57	-	6.69	6.69	6.89	6.57	6.63	6.68
pH, lab	-	6.82/6.87	-	7.22	6.87 J	6.64 J/6.59 J	6.9 J/6.9 J	6.7 J	6.70 J	-

MW-04250R	9/28/2005	10/7/2005	8/31/2006	9/13/2007	11/5/2008	12/17/2008	12/3/2009	11/23/2010	11/1/2011	11/8/2012	7/16/2013
Ammonia	-	-	-	-	-	4.08	4.33	9.1	4.4	4.8/6.8	-
Ammonia, field	-	-	-	-	-	-	-	-	-	-	2.5
pH, field	-	10.48	-	-	-	10.98	10.67	10.05	9.43	9.95	10.83
pH, lab	11.01 J	-	11.16/11.12	10.90	10.76 J/10.85 J	-	10.72 J	9.9 J	9.3 J	9.55 J/9.49 J	-

TMW-04937	12/19/2001
Ammonia	93.7
pH, field	10.61

MW-04836	8/2/2000	12/14/2001	12/1/2002	1/29/2004	1/18/2005	10/7/2005	7/16/2013
Ammonia	2.03	0.05	-	-	-	-	11
pH, field	7.74	7.37	11.19	7.70	7.45	7.32	7.72

MW-15457	7/13/2000	1/13/2005	10/7/2005	7/15/2013
Ammonia	-	-	-	1.4 J
Ammonia, field	-	-	-	1.1
pH, field	7.09	6.57	6.78	7.09

MW-05452	1/21/2005	10/8/2005	7/16/2013
Ammonia, field	-	-	1.7
pH, field	10.12	9.58	9.89
pH, lab	9.89	-	-

MW-05443	7/14/2000	1/29/2004	2/5/2004	1/14/2005	10/7/2005	7/16/2013
Ammonia	-	-	4.9	-	-	7.2
pH, field	6.77	11.37	7.52	7.21	6.84	7.21
pH, lab	-	-	6.9	-	-	-

MW-4	7/15/2013
Ammonia	3.3
pH, field	9.06

MW-9	7/15/2013
Ammonia	14
pH, field	8.32

MW-8	8/7/2000	12/14/2001	12/19/2002	1/14/2005	10/7/2005	7/15/2013
Ammonia	19.1	55.7	33	30.3	-	17
pH, field	10.98	11.06	11.19	11.01	10.13	11.35

MW-17	8/7/2000	12/14/2001	12/19/2002	1/14/2005	10/7/2005	7/15/2013
Ammonia	25.5	24.4	-	17.0	-	1.7 J
pH, field	9.09	7.54	8.50/8.50	8.22	9.50	8.42

MW-18	8/7/2000	12/14/2001	1/17/2005	10/7/2005	7/15/2013
Ammonia	29.1	25.3	18.7	-	12
pH, field	10.72	7.87	10.04	10.36	12.08

MW-05036	8/2/2000	12/14/2001	1/29/2004	1/18/2005	10/7/2005	7/16/2013
Ammonia	-	2.4	-	-	-	-
Ammonia, field	-	-	-	-	-	3.1
pH, field	10.49	9.35	10.80	9.94	9.49	12.25

0 200 500ft

LEGEND

- SURVEYED PROPERTY BOUNDARY
- MONITORING WELL LOCATION SAMPLED AND ANALYZED FOR AMMONIA
- OTHER MONITORING WELL LOCATION
- HISTORICAL LOCATION OF ELEVATED AMMONIA LEVELS
- (591.63) GROUNDWATER ELEVATION
- 590 GROUNDWATER ELEVATION CONTOUR
- * WATER ELEVATION NOT USED IN GROUNDWATER CONTOURING

MW-15457	7/15/2013
Ammonia	1.4 J
Ammonia, field	1.1

SAMPLE LOCATION
SAMPLE DATE
RESULT (mg/L)
PARAMETER

NOTE: TOPO - SANBORN, 1996

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

RACER
SAGINAW NODULAR INDUSTRIAL LAND

SAGINAW, MICHIGAN

GROUNDWATER ANALYTICAL RESULTS

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:
MICHIGAN STATE PLANE SOUTH, NAD 83 USING INTERNATIONAL FEET, NGVD 88

Project Manager:	Reviewed By:	Date:	
I.R.	M.T.	OCTOBER 2013	
Scale: 1" = 500'	Project N#: 58502-T02	Report N#: MEMO008	Drawing N#: figure 3

58502-T02(MEMO008)GN-WA003 OCT 22/2013

TABLE 1

ANALYTICAL RESULTS SUMMARY - SURFACE WATER DATA
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI

Sample Location:				***MD-312-13***	***MD-314-13***	***MD-316-13***	***SW-310-13***
Sample ID:				***W-58502-071713-SSH-312***	***W-58502-071713-SSH-314***	***W-58502-071713-SSH-316***	***W-58502-071713-SSH-310***
Sample Date:				***7/17/2013***	***7/17/2013***	***7/17/2013***	***7/17/2013***
Sample Depth:				***(2.5-2.5) ft BWS***	***(2.5-2.5) ft BWS***	***(2-2) ft BWS***	***(0-0) ft BWS***
matrix_code				***WS***	***WS***	***WS***	***WS***
Parameters:	***Units***	Res/Non_Res/GW SW Interface	DEQ Rule 57 - Surface Water Quality Values				
Metals							
Antimony	mg/L	0.13	0.0017	0.00038 J	0.00045 J	0.00029 J	0.0005 J
Arsenic	mg/L	0.01	0.01	0.005 U	0.005 U	0.005 U	0.005 U
Barium	mg/L	-	1.9	0.036 J	0.033 J	0.033 J	0.037 J
Beryllium	mg/L	-	0.16	0.001 U	0.00013 J	0.000056 J	0.00025 J
Cadmium	mg/L	-	0.0025	0.00003 J	0.00012 J	0.001 U	0.00014 J
Chromium	mg/L	0.011	0.12	0.005 U	0.005 U	0.005 U	0.005 U
Cobalt	mg/L	0.1	0.1	0.00018 J	0.0002 J	0.000093 J	0.00029 J
Copper	mg/L	-	0.47	0.002 U	0.002 U	0.002 U	0.002 U
Lead	mg/L	-	0.014	0.0014 J	0.001 J	0.00053 J	0.002 J
Manganese	mg/L	-	1.3	0.16	0.14	0.14	0.17
Mercury	mg/L	0.0000013	0.0000013	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Nickel	mg/L	-	2.6	0.02 U	0.02 U	0.02 U	0.02 U
Selenium	mg/L	0.005	0.005	0.00067 J	0.00056 J	0.00035 J	0.00083 J
Silver	mg/L	0.0002	0.00006	0.000019 J	0.000018 J	0.00001 J	0.000039 J
Thallium	mg/L	0.0037	0.0012	0.001 U	0.001 U	0.001 U	0.001 U
Vanadium	mg/L	0.012	0.027	0.004 U	0.004 U	0.004 U	0.004 U
Zinc	mg/L	-	3.3	0.02 U	0.02 U	0.02 U	0.02 U
Polychlorinated Biphenyls							
Aroclor-1016 (PCB-1016)	mg/L	0.0002	0.000000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1221 (PCB-1221)	mg/L	0.0002	0.000000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1232 (PCB-1232)	mg/L	0.0002	0.000000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1242 (PCB-1242)	mg/L	0.0002	0.000000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1248 (PCB-1248)	mg/L	0.0002	0.000000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1254 (PCB-1254)	mg/L	0.0002	0.000000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1260 (PCB-1260)	mg/L	0.0002	0.000000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1262 (PCB-1262)	mg/L	0.0002	0.000000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1268 (PCB-1268)	mg/L	0.0002	0.000000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
General Chemistry							
Ammonia	mg/L	-	-	1.4 J	2.0 U	2.0 U	2.0 U
Ammonia (unionized)	mg/L	0.053	0.053	0.01	-	-	-
Biochemical oxygen demand (BOD)	mg/L	-	-	2.0 U	2.0 U	2.0 U	2.0 U
Chemical oxygen demand (COD)	mg/L	-	-	20	20	22	22
Cyanide (amenable)	mg/L	-	-	0.010 U	0.010 U	0.010 U	0.010 U
Cyanide (total)	mg/L	0.0052	0.0052	0.010 U	0.010 U	0.010 U	0.010 U
Hardness, carbonate	mg/L	-	-	130	130	120	180
Hardness, magnesium	mg/L	-	-	44	45	46	45
Nitrate (as N)	mg/L	-	10	0.10 U	0.10 U	0.10 U	0.10 U
Oil and grease (HEM), polar	mg/L	-	-	4.7 U	4.8 UJ	4.8 U	4.9 U
pH, lab	s.u.	-	-	7.45 J	7.52 J	7.42 J	7.43 J
Phenolics (total)	mg/L	-	-	0.040 U	0.040 U	0.040 U	0.040 U
Total organic carbon (TOC)	mg/L	-	-	5.9	6.2	6.1	6.0

Notes:

J - Estimated concentration.
U - Not present at or above the associated value.
UJ - Estimated reporting limit.
BWS - Below Water surface
(1) The generic GSI criteria are based on the toxicity of unionized ammonia (NH_3); the criteria is 53 µg/L warm water surface water
(2) Temperature of the water was assumed to be approximately 65 degrees F at the criteria is 53 µg/L warm water surface water

TABLE 1

ANALYTICAL RESULTS SUMMARY - SURFACE WATER DATA
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI

Sample Location:				***SW-311-13***	***SW-313-13***	***SW-315-13***
Sample ID:				***W-58502-071713-SSH-311***	***W-58502-071713-SSH-313***	***W-58502-071713-SSH-315***
Sample Date:				***7/17/2013***	***7/17/2013***	***7/17/2013***
Sample Depth:				***(0-0) ft BWS***	***(0-0) ft BWS***	***(0-0) ft BWS***
matrix_code				***WS***	***WS***	***WS***
Parameters:	***Units***	Res/Non_Res/GW SW Interface	DEQ Rule 57 - Surface Water Quality Values			
Metals						
Antimony	mg/L	0.13	0.0017	0.00036 J	0.00032 J	0.00036 J
Arsenic	mg/L	0.01	0.01	0.005 U	0.005 U	0.005 U
Barium	mg/L	-	1.9	0.036 J	0.033 J	0.033 J
Beryllium	mg/L	-	0.16	0.00015 J	0.00004 J	0.000096 J
Cadmium	mg/L	-	0.0025	0.000029 J	0.001 U	0.001 U
Chromium	mg/L	0.011	0.12	0.005 U	0.005 U	0.005 U
Cobalt	mg/L	0.1	0.1	0.00018 J	0.000083 J	0.00014 J
Copper	mg/L	-	0.47	0.002 U	0.002 U	0.002 U
Lead	mg/L	-	0.014	0.0015 J	0.00062 J	0.001 J
Manganese	mg/L	-	1.3	0.15	0.11	0.18
Mercury	mg/L	0.0000013	0.0000013	0.0002 U	0.0002 U	0.0002 U
Nickel	mg/L	-	2.6	0.02 U	0.02 U	0.02 U
Selenium	mg/L	0.005	0.005	0.00052 J	0.00055 J	0.00049 J
Silver	mg/L	0.0002	0.00006	0.000022 J	0.000017 J	0.000012 J
Thallium	mg/L	0.0037	0.0012	0.001 U	0.001 U	0.001 U
Vanadium	mg/L	0.012	0.027	0.004 U	0.004 U	0.004 U
Zinc	mg/L	-	3.3	0.02 U	0.02 U	0.02 U
Polychlorinated Biphenyls						
Aroclor-1016 (PCB-1016)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1221 (PCB-1221)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1232 (PCB-1232)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1242 (PCB-1242)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1248 (PCB-1248)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1254 (PCB-1254)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1260 (PCB-1260)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1262 (PCB-1262)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1268 (PCB-1268)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
General Chemistry						
Ammonia	mg/L	-	-	1.1 J	1.1 J	2.0 U
Ammonia (unionized)	mg/L	0.053	0.053	0.01	0.01	-
Biochemical oxygen demand (BOD)	mg/L	-	-	2.0 U	2.0 U	2.0 U
Chemical oxygen demand (COD)	mg/L	-	-	25	17 J	30
Cyanide (amenable)	mg/L	-	-	0.010 U	0.010 U	0.010 U
Cyanide (total)	mg/L	0.0052	0.0052	0.010 U	0.010 U	0.010 U
Hardness, carbonate	mg/L	-	-	180	170	170
Hardness, magnesium	mg/L	-	-	44	45	44
Nitrate (as N)	mg/L	-	10	0.10 U	0.10 U	0.10 U
Oil and grease (HEM), polar	mg/L	-	-	4.9 U	4.8 U	4.9 U
pH, lab	s.u.	-	-	7.44 J	7.44 J	7.41 J
Phenolics (total)	mg/L	-	-	0.040 U	0.040 U	0.040 U
Total organic carbon (TOC)	mg/L	-	-	6.1	6.0	6.4

Notes:

J - Estimated concentration.
U - Not present at or above the associated value.
UJ - Estimated reporting limit.
BWS - Below Water surface
(1) The generic GSI criteria are based on the toxicity of unionized ammonia (NH3); the criteria is 53 µg/L warm water surface water
(2) Temperature of the water was assumed to be approximately 65 degrees F at the criteria is 53 µg/L warm water surface water

TABLE 2

ANALYTICAL RESULTS SUMMARY - SEDIMENT/MATERIAL BENEATH SEDIMENT
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI

Sample Location:				H5	***H5***	***H7***	***H7A***	***H7A***	***H7B***
Sample ID:				S00016	***S00017***	***S00020***	***B-7-0531***	***B-7-0532Q***	***B-7-0530***
Sample Date:				11/19/1998	***11/19/1998***	***11/19/1998***	***1/19/2005***	***1/19/2005***	***1/19/2005***
Sample Depth:					***DUP***		***(0-0.5) ft BGS***	***DUP (0-0.5) ft BGS***	***(0-0.5) ft BGS***
matrix_code				***SE***	***SE***	***SE***	***SE***	***SE***	***SE***
Parameters:	***Units***	***Statewide Default Background Levels***	Res/Non_Res/GW Prot_GW SW Interface Prot						
Metals									
Aluminum	mg/kg		-						
Antimony	mg/kg		94						
Arsenic	mg/kg	5.8	4.6						
Barium	mg/kg		-						
Beryllium	mg/kg		-						
Cadmium	mg/kg		-						
Calcium	mg/kg		-						
Chromium	mg/kg	18	3.3						
Cobalt	mg/kg	6.8	2						
Copper	mg/kg		-						
Iron	mg/kg		-						
Lead	mg/kg		-						
Magnesium	mg/kg		-						
Manganese	mg/kg		-						
Mercury	mg/kg	0.13	0.05						
Nickel	mg/kg		-						
Potassium	mg/kg		-						
Selenium	mg/kg	0.41	0.4						
Silver	mg/kg	1.0	0.1						
Sodium	mg/kg		-						
Thallium	mg/kg		4.2						
Vanadium	mg/kg		190						
Zinc	mg/kg		-						
Metals - SEM									
Cadmium	mg/kg		-						
Copper	mg/kg		-						
Lead	mg/kg		-						
Mercury	mg/kg		0.05						
Nickel	mg/kg		-						
Zinc	mg/kg		-						
SEM/AVS	none		-						
Polychlorinated Biphenyls									
Aroclor-1016 (PCB-1016)	ug/kg		-	0.3 UJ	0.2 U	0.2 UJ	0.50 U	0.50 U	0.10 U
Aroclor-1221 (PCB-1221)	ug/kg		-	0.3 UJ	0.2 U	0.2 UJ	1.0 U	1.0 U	0.20 U
Aroclor-1232 (PCB-1232)	ug/kg		-	0.3 UJ	0.2 U	0.2 UJ	0.50 U	0.50 U	0.10 U
Aroclor-1242 (PCB-1242)	ug/kg		-	0.6 J	0.3	0.7 J	0.50 U	0.50 U	0.60
Aroclor-1248 (PCB-1248)	ug/kg		-	0.3 UJ	0.2 U	0.2 UJ	1.1	0.67	0.10 U
Aroclor-1254 (PCB-1254)	ug/kg		-	0.3 UJ	0.2 U	0.9 J	0.99	0.73	0.71
Aroclor-1260 (PCB-1260)	ug/kg		-	0.3 UJ	0.2 U	1.2 J	1.3	1.4	1.2
Aroclor-1262 (PCB-1262)	ug/kg		-						
Aroclor-1268 (PCB-1268)	ug/kg		-						
Total PCBs (ND = 0)	ug/kg			0.6 J	0.3	2.8 J	3.39	2.8	2.51
Total PCBs At 1% OC	ug/kg								
General Chemistry									
Ammonia	mg/kg		-						
Cyanide (total)	mg/kg		0.1						
Nitrate (as N)	mg/kg		-						
pH, lab	s.u.		-						
Sulfide	mg/kg		-						
Total organic carbon (TOC)	mg/kg		-						
Total organic carbon (TOC)	%								
Selenium									
Aluminum									

AVS/SEM Expressed in umol/g

		Molecular Weight
cadmiium	umol/gram	112.40
copper	umol/gram	63.54
lead	umol/gram	207.20
mercury	umol/gram	200.59
nickel	umol/gram	58.70
zinc	umol/gram	65.37
total SEM	umol/gram	
Sulfide	umol/gram	33.48
		Estimated from AVS/SEM ratio
		Carbon normalized SEM criteria is 130
		Conclusion

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

TABLE 2

ANALYTICAL RESULTS SUMMARY - SEDIMENT/MATERIAL BENEATH SEDIMENT
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI

Sample Location:				*SED-317-13*	*SO-318-13*	*SED-319-13*	*SO-320-13*
Sample ID:				*S-58502-071713-SSH-317*	*S-58502-071713-SSH-318*	*S-58502-071713-SSH-319*	*S-58502-071713-SSH-320*
Sample Date:				*7/17/2013*	*7/17/2013*	*7/17/2013*	*7/17/2013*
Sample Depth:				*(0-1.5) ft BGS*	*(1.5-1.5) ft BGS*	*(0-5) ft BGS*	*(5-5) ft BGS*
matrix_code				*SE*	*SO*	*SE*	*SO*
Parameters:	***Units***	***Statewide Default Background Levels***	Res/Non_Res/GW Prot_GW SW Interface Prot				
Metals							
Aluminum	mg/kg		-	2400	6100	13000	7600
Antimony	mg/kg		94	0.12 J	0.41 J	0.71 J	1.0 J
Arsenic	mg/kg	5.8	4.6	1.8	5.2	**7.5**	**10**
Barium	mg/kg		-	14	44	75	55
Beryllium	mg/kg		-	0.13 J	0.31	0.76	0.61
Cadmium	mg/kg		-	0.046 J	0.43	1.2	1.2
Calcium	mg/kg		-	14000 J	29000 J	51000 J	24000 J
Chromium	mg/kg	18	3.3	8.9	**27**	**44**	**75**
Cobalt	mg/kg	6.8	2	1.4	3.3	**7.2**	3.7
Copper	mg/kg		-	7.8	26	51	44
Iron	mg/kg		-	6500	16000	35000	36000
Lead	mg/kg		-	6.4 J	52 J	130 J	230 J
Magnesium	mg/kg		-	3800	7300	14000	3800
Manganese	mg/kg		-	110	380	1200	1600
Mercury	mg/kg	0.13	0.05	0.056 U	0.042 J	0.10 J	0.046 J
Nickel	mg/kg		-	6.5	17	29	22
Potassium	mg/kg		-	310 J	820	1700	500 J
Selenium	mg/kg	0.41	0.4	**0.47**	**0.98**	**2.1**	**1.6**
Silver	mg/kg	1.0	0.1	0.021 J	0.10 J	0.32 J	0.43
Sodium	mg/kg		-	88 J	200	430	260
Thallium	mg/kg		4.2	0.057 J	0.10 J	0.20 J	0.18 J
Vanadium	mg/kg		190	6.4	13	22	11
Zinc	mg/kg		-	60	730	1800	5000
Metals - SEM							
Cadmium	mg/kg		-	0.075 J		1.3	
Copper	mg/kg		-	7.3		49	
Lead	mg/kg		-	6.8		160	
Mercury	mg/kg		0.05	0.017 U		0.040 U	
Nickel	mg/kg		-	5.0		21	
Zinc	mg/kg		-	75		2600	
SEM/AVS	none		-	0.87		1.4	
Polychlorinated Biphenyls							
Aroclor-1016 (PCB-1016)	ug/kg		-	0.35 U	0.5 U	0.89 U	0.43 U
Aroclor-1221 (PCB-1221)	ug/kg		-	0.35 U	0.5 U	0.89 U	0.43 U
Aroclor-1232 (PCB-1232)	ug/kg		-	0.35 U	0.5 U	0.89 U	0.43 U
Aroclor-1242 (PCB-1242)	ug/kg		-	0.11 J	0.039 J	0.89 U	0.067 J
Aroclor-1248 (PCB-1248)	ug/kg		-	0.35 U	0.5 U	0.89 U	0.43 U
Aroclor-1254 (PCB-1254)	ug/kg		-	0.35 U	0.5 U	0.89 U	0.43 U
Aroclor-1260 (PCB-1260)	ug/kg		-	0.35 U	0.5 U	0.89 U	0.43 U
Aroclor-1262 (PCB-1262)	ug/kg		-	0.35 U	0.5 U	0.89 U	0.43 U
Aroclor-1268 (PCB-1268)	ug/kg		-	0.35 U	0.5 U	0.89 U	0.43 U
Total PCBs (ND = 0)	ug/kg			0.11	0.039	0	0.067
Total PCBs At 1% OC	ug/kg			0.04	0.02	0.00	0.01
General Chemistry							
Ammonia	mg/kg		-	26 J	120	270	190
Cyanide (total)	mg/kg		0.1	**0.14 J**	**0.53 J**	**0.89 J**	**0.52 J**
Nitrate (as N)	mg/kg		-	340 U	480 U	860 U	410 U
pH, lab	s.u.		-	7.29 J	7.23 J	7.01 J	7.16 J
Sulfide	mg/kg		-	51	-	920	-
Total organic carbon (TOC)	mg/kg		-	28000	26000	120000	57000
Total organic carbon (TOC)	%			0.03	0.03	0.12	0.06
Selenium				0.47	0.98	2.1	1.6
Aluminum				2400	6100	13000	7600
AVS/SEM Expressed in umol/g							
			Molecular Weight				
cadmiium	umol/gram		112.40	0.00		0.01	
copper	umol/gram		63.54	0.11		0.77	
lead	umol/gram		207.20	0.03		0.77	
mercury	umol/gram		200.59	0.00		0.00	
nickel	umol/gram		58.70	0.09		0.36	
zinc	umol/gram		65.37	1.15		39.77	
total SEM	umol/gram			1.38		41.69	
Sulfide	umol/gram		33.48	1.52		27.48	
			Estimated from AVS/SEM ratio	1.59		29.78	
			Carbon normalized SEM criteria is 130	-5.09		118.39	
			Conclusion	Not Toxic		Not Toxic	

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

TABLE 2

ANALYTICAL RESULTS SUMMARY - SEDIMENT/MATERIAL BENEATH SEDIMENT
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI

Sample Location:				*SED-321-13*	*SO-322-13*	*SED-323-13*	*SED-324-13*	*SO-325-13*
Sample ID:				*S-58502-071713-SSH-321*	*S-58502-071713-SSH-322*	*S-58502-071713-SSH-323*	*S-58502-071713-SSH-324*	*S-58502-071713-SSH-325*
Sample Date:				*7/17/2013*	*7/17/2013*	*7/17/2013*	*7/17/2013*	*7/17/2013*
Sample Depth:				*(0-4) ft BGS*	*(4-4) ft BGS*	*(0-1.5) ft BGS*	*DUP (0-1.5) ft BGS*	*(1.5-1.5) ft BGS*
matrix_code				*SE*	*SO*	*SE*	*SE*	*SO*
Parameters:	***Units***	***Statewide Default Background Levels***	Res/Non_Res/GW Prot_GW SW Interface Prot					
Metals								
Aluminum	mg/kg		-	14000	2800	3200	2900	4900
Antimony	mg/kg		94	0.78 J	0.59 J	0.12 J	0.065 J	0.040 J
Arsenic	mg/kg	5.8	4.6	**8.0**	2.6	2.2	1.8	2.5
Barium	mg/kg		-	79	17	17	16	34
Beryllium	mg/kg		-	0.74	0.25	0.16 J	0.15 J	0.22
Cadmium	mg/kg		-	1.4	0.61	0.18	0.14	0.087
Calcium	mg/kg		-	61000 J	7100 J	43000 J	41000 J	65000 J
Chromium	mg/kg	18	3.3	**43**	13	11	14	13
Cobalt	mg/kg	6.8	2	**7.7**	1.4	2.1	1.8	4.1
Copper	mg/kg		-	52	18	9.2	6.5	9.3
Iron	mg/kg		-	35000	8300	7500	6300	8300
Lead	mg/kg		-	150 J	100 J	16 J	9.5 J	4.5 J
Magnesium	mg/kg		-	16000	1700	14000	13000	20000
Manganese	mg/kg		-	1400	450	300	310	250
Mercury	mg/kg	0.13	0.05	0.092 J	0.053	0.018 J	0.052 U	0.041 U
Nickel	mg/kg		-	28	6.8	6.6	5.7	12
Potassium	mg/kg		-	2100	210 J	610	520	1100
Selenium	mg/kg	0.41	0.4	**2.0**	**0.77**	**0.51**	**0.51**	**0.68**
Silver	mg/kg	1.0	0.1	0.40 J	0.24	0.042 J	0.031 J	0.025 J
Sodium	mg/kg		-	400	130	130	130	150
Thallium	mg/kg		4.2	0.23 J	0.11 J	0.090 J	0.050 J	0.094 J
Vanadium	mg/kg		190	24	4.8	8.0	7.8	12
Zinc	mg/kg		-	2900	3300	150	140	49
Metals - SEM								
Cadmium	mg/kg		-	1.3		0.078 J	0.10 J	
Copper	mg/kg		-	47		4.8	6.1	
Lead	mg/kg		-	130		7.3	8.9	
Mercury	mg/kg		0.05	0.0047 J		0.016 U	0.017 U	
Nickel	mg/kg		-	20		3.4	4.0	
Zinc	mg/kg		-	2400		110	130	
SEM/AVS	none		-	2.5		1.2	1.6	
Polychlorinated Biphenyls								
Aroclor-1016 (PCB-1016)	ug/kg		-	0.85 U	0.34 U	0.34 U	0.36 U	0.31 U
Aroclor-1221 (PCB-1221)	ug/kg		-	0.85 U	0.34 U	0.34 U	0.36 U	0.31 U
Aroclor-1232 (PCB-1232)	ug/kg		-	0.85 U	0.34 U	0.34 U	0.36 U	0.31 U
Aroclor-1242 (PCB-1242)	ug/kg		-	0.85 U	0.044 J	0.34 U	0.36 U	0.31 U
Aroclor-1248 (PCB-1248)	ug/kg		-	0.85 U	0.34 U	0.34 U	0.36 U	0.31 U
Aroclor-1254 (PCB-1254)	ug/kg		-	0.85 U	0.34 U	0.34 U	0.36 U	0.31 U
Aroclor-1260 (PCB-1260)	ug/kg		-	0.85 U	0.34 U	0.34 U	0.36 U	0.31 U
Aroclor-1262 (PCB-1262)	ug/kg		-	0.85 U	0.34 U	0.34 U	0.36 U	0.31 U
Aroclor-1268 (PCB-1268)	ug/kg		-	0.85 U	0.34 U	0.34 U	0.36 U	0.31 U
Total PCBs (ND = 0)	ug/kg			0	0.044	0	0	0
Total PCBs At 1% OC	ug/kg			0.00	0.02	0.00	0.00	0.00
General Chemistry								
Ammonia	mg/kg		-	94	81	40 J	66	40 J
Cyanide (total)	mg/kg		0.1	**2.0**	**1.4**	0.66 U	0.70 U	0.57 U
Nitrate (as N)	mg/kg		-	790 U	320 U	330 U	340 U	300 U
pH, lab	s.u.		-	7.03 J	8.12 J	7.17 J	7.20 J	7.91 J
Sulfide	mg/kg		-	490	-	50	46	-
Total organic carbon (TOC)	mg/kg		-	96000	27000	28000	17000	23000
Total organic carbon (TOC)	%			0.10	0.03	0.03	0.02	0.02
Selenium				2	0.77	0.51	0.51	0.68
Aluminum				14000	2800	3200	2900	4900
AVS/SEM Expressed in umol/g								
			Molecular Weight					
cadmiium	umol/gram		112.40	0.01		0.00	0.00	
copper	umol/gram		63.54	0.74		0.08	0.10	
lead	umol/gram		207.20	0.63		0.04	0.04	
mercury	umol/gram		200.59	0.00		0.00	0.00	
nickel	umol/gram		58.70	0.34		0.06	0.07	
zinc	umol/gram		65.37	36.71		1.68	1.99	
total SEM	umol/gram			38.43		1.85	2.20	
Sulfide	umol/gram		33.48	14.64		1.49	1.37	
			Estimated from AVS/SEM ratio	15.37		1.54	1.37	
			Carbon normalized SEM criteria is 130	247.89		12.81	48.40	
			Conclusion	Uncertain, probably not toxic		Not Toxic	Not Toxic	

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

TABLE 2

ANALYTICAL RESULTS SUMMARY - SEDIMENT/MATERIAL BENEATH SEDIMENT
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI

Sample Location:				***SED-326-13***	***SO-327-13***	***SED328-13***
Sample ID:				***S-58502-071713-SSH-326***	***S-58502-071713-SSH-327***	***S-58502-071713-SSH-328***
Sample Date:				***7/17/2013***	***7/17/2013***	***7/17/2013***
Sample Depth:				***(0-2.5) ft BGS***	***(2.5-2.5) ft BGS***	***-***
matrix_code				***SE***	***SO***	***SE***
Parameters:	***Units***	***Statewide Default Background Levels***	Res/Non_Res/GW Prot_GW SW Interface Prot			
Metals						
Aluminum	mg/kg		-	14000	5300	8600
Antimony	mg/kg		94	0.48 J	0.54 J	1.3 J
Arsenic	mg/kg	5.8	4.6	**6.2**	**6.5**	**17**
Barium	mg/kg		-	83	55	110
Beryllium	mg/kg		-	0.74	0.40	0.90
Cadmium	mg/kg		-	1.1	1.2	0.83 U
Calcium	mg/kg		-	74000 J	23000 J	38000 J
Chromium	mg/kg	18	3.3	**39**	**46**	**190**
Cobalt	mg/kg	6.8	2	**8.1**	2.5	**9.4**
Copper	mg/kg		-	43	63	120
Iron	mg/kg		-	27000	23000	180000
Lead	mg/kg		-	94 J	71 J	65 J
Magnesium	mg/kg		-	22000	4600	5300
Manganese	mg/kg		-	1100	630	3500
Mercury	mg/kg	0.13	0.05	0.12	0.13	0.10 U
Nickel	mg/kg		-	27	15	100
Potassium	mg/kg		-	2400	390 J	480 J
Selenium	mg/kg	0.41	0.4	**1.9**	**0.79**	**1.7**
Silver	mg/kg	1.0	0.1	0.39 J	0.47	0.14 J
Sodium	mg/kg		-	360	160	300
Thallium	mg/kg		4.2	0.23 J	0.079 J	0.067 J
Vanadium	mg/kg		190	26	8.7	11
Zinc	mg/kg		-	1700	1300	1100
Metals - SEM						
Cadmium	mg/kg		-	1.0		2.6 U
Copper	mg/kg		-	37		140
Lead	mg/kg		-	82		33
Mercury	mg/kg		0.05	0.0096 J		0.026 U
Nickel	mg/kg		-	19		76
Zinc	mg/kg		-	1700		740
SEM/AVS	none		-	2.4		0.86
Polychlorinated Biphenyls						
Aroclor-1016 (PCB-1016)	ug/kg		-	0.73 U	1.9 U	0.7 U
Aroclor-1221 (PCB-1221)	ug/kg		-	0.73 U	1.9 U	0.7 U
Aroclor-1232 (PCB-1232)	ug/kg		-	0.73 U	1.9 U	0.7 U
Aroclor-1242 (PCB-1242)	ug/kg		-	0.73 U	1.9 U	0.7 U
Aroclor-1248 (PCB-1248)	ug/kg		-	0.73 U	0.49 J	0.7 U
Aroclor-1254 (PCB-1254)	ug/kg		-	0.73 U	1.9 U	0.7 U
Aroclor-1260 (PCB-1260)	ug/kg		-	0.73 U	0.88 J	0.7 U
Aroclor-1262 (PCB-1262)	ug/kg		-	0.73 U	1.9 U	0.7 U
Aroclor-1268 (PCB-1268)	ug/kg		-	0.73 U	1.9 U	0.7 U
Total PCBs (ND = 0)	ug/kg			0	1.37	0
Total PCBs At 1% OC	ug/kg			0.00	0.15	0.00
General Chemistry						
Ammonia	mg/kg		-	54	69	120
Cyanide (total)	mg/kg		0.1	**0.32 J**	**0.40 J**	**4.5**
Nitrate (as N)	mg/kg		-	690 U	360 U	660 U
pH, lab	s.u.		-	7.14 J	7.20 J	7.53 J
Sulfide	mg/kg		-	350	-	550
Total organic carbon (TOC)	mg/kg		-	57000	91000	91000
Total organic carbon (TOC)	%			0.06	0.09	0.09
Selenium				1.9	0.79	1.7
Aluminum				14000	5300	8600
AVS/SEM Expressed in umol/g						
			Molecular Weight			
cadmiium	umol/gram		112.40	0.01		0.01
copper	umol/gram		63.54	0.58		2.20
lead	umol/gram		207.20	0.40		0.16
mercury	umol/gram		200.59	0.00		0.00
nickel	umol/gram		58.70	0.32		1.29
zinc	umol/gram		65.37	26.01		11.32
total SEM	umol/gram			27.32		14.99
Sulfide	umol/gram		33.48	10.45		16.43
			Estimated from AVS/SEM ratio	11.38		17.43
			Carbon normalized SEM criteria is 130	295.83		-15.81
			Conclusion	Uncertain, probably not toxic		Not Toxic

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

TABLE 3

ANALYTICAL RESULTS SUMMARY - BANK SOIL
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI

Sample Location:					*SO-290-13*	*SO-292-13*	*SO-294-13*
Sample ID:					*S-58502-071613-SSH-290*	*S-58502-071613-SSH-292*	*S-58502-071613-SSH-294*
Sample Date:					*7/16/2013*	*7/16/2013*	*7/16/2013*
Sample Depth:					*(0-0.5) ft BGS*	*(0-0.5) ft BGS*	*(0-0.5) ft BGS*
matrix_code					*SO*	*SO*	*SO*
Parameters:	*Units*	*Statewide Default Background Levels*	*Direct Contact Criteria & RBSLs (a)*	*Res/Non_Res/GW Prot_GW SW Interface Prot (b)*			
Metals							
Aluminum	mg/kg		370000	-	2200	4100	890
Antimony	mg/kg		670	94	0.13 J	0.14 J	0.094 J
Arsenic	mg/kg	5.8	37	4.6	1.1	2.8	3.8
Barium	mg/kg		130000	-	14	65	6.0
Beryllium	mg/kg		1600	-	0.10 J	0.42	0.066 J
Cadmium	mg/kg		2100	-	0.11	0.065 J	0.096
Calcium	mg/kg			-	3600	17000	1600
Chromium	mg/kg	18		3.3	12	**70 (b)**	5.8
Cobalt	mg/kg	6.8	9000	2	0.82	1.3	0.89
Copper	mg/kg		73000	-	7.5	18	3.6
Iron	mg/kg			-	5300	16000	6100
Lead	mg/kg		900	-	15	11	15
Magnesium	mg/kg		1000000	-	1300	1800	640
Manganese	mg/kg		90000	-	61	940	100
Mercury	mg/kg	0.13	580	0.05	0.055 U	0.058 U	0.050 U
Nickel	mg/kg		150000	-	4.9	13	2.5
Potassium	mg/kg			-	180 J	290 J	450 U
Selenium	mg/kg	0.41	9600	0.4	0.28 J	**0.74 (b)**	0.22 J
Silver	mg/kg	1.0	9000	0.1	0.013 J	0.081 J	0.019 J
Sodium	mg/kg		1000000	-	100 U	84 U	91 U
Thallium	mg/kg		130	4.2	0.14 J	0.17	0.18 U
Vanadium	mg/kg		5500	190	5.1	6.4	6.7
Zinc	mg/kg		630000	-	99	270	73
Polychlorinated Biphenyls							
Aroclor-1016 (PCB-1016) [1]	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1221 (PCB-1221) [1]	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1232 (PCB-1232) [1]	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1242 (PCB-1242) [1]	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1248 (PCB-1248) [1]	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1254 (PCB-1254) [1]	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1260 (PCB-1260) [1]	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1262 (PCB-1262) [1]	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1268 (PCB-1268) [1]	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
General Chemistry							
Ammonia	mg/kg			-	48 U	49 U	50 U
Cyanide (total)	mg/kg		250	0.1	0.67 U	**1.8 (b)**	0.64 U
Nitrate (as N)	mg/kg			-	330 U	330 U	310 U
pH, lab	s.u.			-	7.46 J	7.07 J	8.36 J
Total organic carbon (TOC)	mg/kg			-	12000	12000	8200

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

[1] MDEQ guidance references TSCA regulations. 1000ppb PCBs is the criteria for unrestricted use

TABLE 3

ANALYTICAL RESULTS SUMMARY - BANK SOIL
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI

Sample Location:					*SO-296-13*	*SO-298-13*	*SO-300-13*
Sample ID:					*S-58502-071613-SSH-296*	*S-58502-071613-SSH-298*	*S-58502-071613-SSH-300*
Sample Date:					*7/16/2013*	*7/16/2013*	*7/16/2013*
Sample Depth:					*(0-0.5) ft BGS*	*(0-0.5) ft BGS*	*(0-0.5) ft BGS*
matrix_code					*SO*	*SO*	*SO*
Parameters:	*Units*	*Statewide Default Background Levels*	*Direct Contact Criteria & RBSLs (a)*	*Res/Non_Res/GW Prot_GW SW Interface Prot (b)*			
Metals							
Aluminum	mg/kg		370000	-	3200	5100	7900
Antimony	mg/kg		670	94	0.27 J	0.49 J	0.43 J
Arsenic	mg/kg	5.8	37	4.6	5.4	4.2	**6.1 (b)**
Barium	mg/kg		130000	-	27	38	79
Beryllium	mg/kg		1600	-	0.22	0.28	0.64
Cadmium	mg/kg		2100	-	0.19	0.081 J	0.19 J
Calcium	mg/kg			-	15000	9200	35000
Chromium	mg/kg	18		3.3	**41 (b)**	**34 (b)**	**110 (b)**
Cobalt	mg/kg	6.8	9000	2	1.9	3.3	4.0
Copper	mg/kg		73000	-	15	28	54
Iron	mg/kg			-	16000	32000	61000
Lead	mg/kg		900	-	29	20	33
Magnesium	mg/kg		1000000	-	3000	2700	5600
Manganese	mg/kg		90000	-	380	580	1400
Mercury	mg/kg	0.13	580	0.05	0.049 U	0.050 U	0.047 U
Nickel	mg/kg		150000	-	13	20	57
Potassium	mg/kg			-	320 J	410 J	610
Selenium	mg/kg	0.41	9600	0.4	**0.79 (b)**	**0.65 (b)**	**1.1 (b)**
Silver	mg/kg	1.0	9000	0.1	0.062 J	0.049 J	0.088 J
Sodium	mg/kg		1000000	-	100 U	92 U	78 U
Thallium	mg/kg		130	4.2	0.22	0.18 U	0.16 U
Vanadium	mg/kg		5500	190	6.9	7.5	9.9
Zinc	mg/kg		630000	-	98	86	370
Polychlorinated Biphenyls							
Aroclor-1016 (PCB-1016) [1]	µg/kg		1000	-	0.34 U	0.33 U	0.29 U
Aroclor-1221 (PCB-1221) [1]	µg/kg		1000	-	0.34 U	0.33 U	0.29 U
Aroclor-1232 (PCB-1232) [1]	µg/kg		1000	-	0.34 U	0.33 U	0.29 U
Aroclor-1242 (PCB-1242) [1]	µg/kg		1000	-	0.34 U	0.16 J	0.075 J
Aroclor-1248 (PCB-1248) [1]	µg/kg		1000	-	0.34 U	0.33 U	0.29 U
Aroclor-1254 (PCB-1254) [1]	µg/kg		1000	-	0.037 J	0.17 J	0.049 J
Aroclor-1260 (PCB-1260) [1]	µg/kg		1000	-	0.34 U	0.026 J	0.29 U
Aroclor-1262 (PCB-1262) [1]	µg/kg		1000	-	0.34 U	0.33 U	0.29 U
Aroclor-1268 (PCB-1268) [1]	µg/kg		1000	-	0.34 U	0.33 U	0.29 U
General Chemistry							
Ammonia	mg/kg			-	80	50 U	68
Cyanide (total)	mg/kg		250	0.1	0.61 U	0.65 U	**5.1 (b)**
Nitrate (as N)	mg/kg			-	310 U	310 U	270 U
pH, lab	s.u.			-	8.18 J	7.97 J	8.13 J
Total organic carbon (TOC)	mg/kg			-	23000	18000	44000

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

[1] MDEQ guidance references TSCA regulations. 1000ppb PCBs is the criteria for unrestricted use

TABLE 3

ANALYTICAL RESULTS SUMMARY - BANK SOIL
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI

Sample Location:					*SO-302-13*	*SO-304-13*	*SO-306-13*
Sample ID:					*S-58502-071613-SSH-302*	*S-58502-071613-SSH-304*	*S-58502-071613-SSH-306*
Sample Date:					*7/16/2013*	*7/16/2013*	*7/16/2013*
Sample Depth:					*(0-0.5) ft BGS*	*(0-0.5) ft BGS*	*(0-0.5) ft BGS*
matrix_code					*SO*	*SO*	*SO*
Parameters:	*Units*	*Statewide Default Background Levels*	*Direct Contact Criteria & RBSLs (a)*	*Res/Non_Res/GW Prot_GW SW Interface Prot (b)*			
Metals							
Aluminum	mg/kg		370000	-	9300	4100	2900
Antimony	mg/kg		670	94	0.15 J	0.11 J	0.16 J
Arsenic	mg/kg	5.8	37	4.6	**5.7 (b)**	1.6	2.7
Barium	mg/kg		130000	-	59	34	19
Beryllium	mg/kg		1600	-	0.47	0.22	0.20
Cadmium	mg/kg		2100	-	0.24	0.097	0.045 J
Calcium	mg/kg			-	36000	7300	3300
Chromium	mg/kg	18		3.3	**23 (b)**	7.4	16
Cobalt	mg/kg	6.8	9000	2	5.8	0.88	1.1
Copper	mg/kg		73000	-	19	4.5	6.7
Iron	mg/kg			-	15000	4700	9500
Lead	mg/kg		900	-	23	8.4	12
Magnesium	mg/kg		1000000	-	13000	1600	810
Manganese	mg/kg		90000	-	530	170	240
Mercury	mg/kg	0.13	580	0.05	0.035 J	0.050 U	0.043 U
Nickel	mg/kg		150000	-	18	3.1	5.2
Potassium	mg/kg			-	1700	260 J	280 J
Selenium	mg/kg	0.41	9600	0.4	**0.91 (b)**	**0.57 (b)**	**0.54 (b)**
Silver	mg/kg	1.0	9000	0.1	0.053 J	0.019 J	0.023 J
Sodium	mg/kg		1000000	-	87	80 U	86 U
Thallium	mg/kg		130	4.2	0.17 U	0.16 U	0.17 U
Vanadium	mg/kg		5500	190	20	4.3	4.5
Zinc	mg/kg		630000	-	110	29	35
Polychlorinated Biphenyls							
Aroclor-1016 (PCB-1016) [1]	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1221 (PCB-1221) [1]	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1232 (PCB-1232) [1]	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1242 (PCB-1242) [1]	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1248 (PCB-1248) [1]	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1254 (PCB-1254) [1]	µg/kg		1000	-	0.065 J	0.29 U	0.3 U
Aroclor-1260 (PCB-1260) [1]	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1262 (PCB-1262) [1]	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1268 (PCB-1268) [1]	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
General Chemistry							
Ammonia	mg/kg			-	68	50 U	81
Cyanide (total)	mg/kg		250	0.1	0.59 U	0.53 U	0.55 U
Nitrate (as N)	mg/kg			-	290 U	280 U	280 U
pH, lab	s.u.			-	8.14 J	8.04 J	7.60 J
Total organic carbon (TOC)	mg/kg			-	27000	18000	24000

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

[1] MDEQ guidance references TSCA regulations. 1000ppb PCBs is the criteria for unrestricted use

TABLE 3

ANALYTICAL RESULTS SUMMARY - BANK SOIL
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI

Sample Location:					*SO-307-13*
Sample ID:					*S-58502-071613-SSH-307*
Sample Date:					*7/16/2013*
Sample Depth:					*(0-0.5) ft BGS*
matrix_code					*SO*
					(Duplicate)
Parameters:	***Units***	***Statewide Default Background Levels***	***Direct Contact Criteria & RBSLs (a)***	***Res/Non_Res/GW Prot_GW SW Interface Prot (b)***	
Metals					
Aluminum	mg/kg		370000	-	2900
Antimony	mg/kg		670	94	0.072 J
Arsenic	mg/kg	5.8	37	4.6	2.1
Barium	mg/kg		130000	-	18
Beryllium	mg/kg		1600	-	0.18
Cadmium	mg/kg		2100	-	0.038 J
Calcium	mg/kg			-	2600
Chromium	mg/kg	18		3.3	10
Cobalt	mg/kg	6.8	9000	2	0.95
Copper	mg/kg		73000	-	5.0
Iron	mg/kg			-	7200
Lead	mg/kg		900	-	11
Magnesium	mg/kg		1000000	-	870
Manganese	mg/kg		90000	-	160
Mercury	mg/kg	0.13	580	0.05	0.043 U
Nickel	mg/kg		150000	-	3.3
Potassium	mg/kg			-	260 J
Selenium	mg/kg	0.41	9600	0.4	**0.53 (b)**
Silver	mg/kg	1.0	9000	0.1	0.027 J
Sodium	mg/kg		1000000	-	82 U
Thallium	mg/kg		130	4.2	0.16 U
Vanadium	mg/kg		5500	190	4.3
Zinc	mg/kg		630000	-	34
Polychlorinated Biphenyls					
Aroclor-1016 (PCB-1016) [1]	µg/kg		1000	-	0.3 U
Aroclor-1221 (PCB-1221) [1]	µg/kg		1000	-	0.3 U
Aroclor-1232 (PCB-1232) [1]	µg/kg		1000	-	0.3 U
Aroclor-1242 (PCB-1242) [1]	µg/kg		1000	-	0.3 U
Aroclor-1248 (PCB-1248) [1]	µg/kg		1000	-	0.3 U
Aroclor-1254 (PCB-1254) [1]	µg/kg		1000	-	0.3 U
Aroclor-1260 (PCB-1260) [1]	µg/kg		1000	-	0.3 U
Aroclor-1262 (PCB-1262) [1]	µg/kg		1000	-	0.3 U
Aroclor-1268 (PCB-1268) [1]	µg/kg		1000	-	0.3 U
General Chemistry					
Ammonia	mg/kg			-	49 U
Cyanide (total)	mg/kg		250	0.1	0.54 U
Nitrate (as N)	mg/kg			-	280 U
pH, lab	s.u.			-	7.53 J
Total organic carbon (TOC)	mg/kg			-	21000

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

[1] MDEQ guidance references TSCA regulations. 1000ppb PCBs is the criteria for unrestricted use

TABLE 4

GROUNDWATER AMMONIA AND pH RESULTS SUMMARY
ADDITIONAL GROUNDWATER MONITORING
SAGINAW NODULAR INDUSTRIAL LAND
SAGINAW, MICHIGAN

Monitoring Well	*Approximate distance from the River (ft)*	*Measured Total NH_3 (mg/L)*	*Groundwater Temperature (^oC)*	*Groundwater pH*	*Saginaw River Temperature (^oC)* [4]	*Saginaw River pH*	*Average Temperature (^oC)* [1]	*Average pH* [2]	*% Unionized NH_3* [3]	*Calculated Unionized NH_3 (mg/L)*
MW-04757	400	1.7	17.92	8.40	24.90	8.30	21.4	8.35	8.89%	0.15
MW-04257	100	0.45	22.02	7.22	24.90	8.30	23.5	7.49	1.53%	0.01
MW-03945	50	9.1	18.63	6.68	24.90	8.30	21.8	6.97	0.42%	0.04
MW-04051	50	NA	17.95	6.85	24.90	8.30	21.4	7.14	0.60%	NA
MW-04250R	600	2.5	18.74	10.83	24.90	8.30	21.8	8.60	15.24%	0.38
MW-04836	1,500	11	17.07	7.72	24.90	8.30	21.0	7.92	3.41%	0.38
MW-05036	2,000	3.1	15.38	12.25	24.90	8.30	20.1	8.60	13.76%	0.43
MW-05443	2,000	7.2	16.49	7.21	24.90	8.30	20.7	7.48	1.23%	0.09
MW-05452	1,500	1.7	16.51	9.89	24.90	8.30	20.7	8.59	13.95%	0.24
MW-15457	1,750	1.4	14.75	7.09	24.90	8.30	19.8	7.37	0.90%	0.01
MW-4	1,700	3.3	17.72	9.06	24.90	8.30	21.3	8.53	12.89%	0.43
MW-8	2,000	17	17.33	11.35	24.90	8.30	21.1	8.60	14.61%	2.48
MW-9	1,800	14	17.38	8.32	24.90	8.30	21.1	8.31	8.07%	1.13
MW-17	2,000	1.7	19.64	8.42	24.90	8.30	22.3	8.36	9.58%	0.16
MW-18	2,000	12	19.94	12.08	24.90	8.30	22.4	8.60	15.84%	1.90

Notes:

[1] Temperature is the average of the groundwater temperature and the Saginaw river temperature

[2] pH value for average of groundwater and Saginaw River H^+ concentrations

[3] Ammonia toxicity equations taken from Steven C. Chapra "Surface Water-Quality Modeling", McGraw-Hill Series in Water Resources and Environmental Engineering 1997

Boxed Value indicates exceedance of Final Acute Value criteria of 0.42 mg/L for ammonia and less than 6.5 or greater than 9.0 for pH

ATTACHMENT 1

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Nate Nemani, Resource Conservation and Recovery Act of 1976 Corrective Action Project Manager, Land and Chemicals Division, Remediation and Reuse Branch, U.S. Environmental Protection Agency

FROM: Ronald Stone, Senior Geologist, Waste and Hazardous Materials Division, Michigan Department of Environmental Quality

DATE: January 12, 2010

SUBJECT: Implementation of a Mixing Zone Request; General Motors - Saginaw Metal Castings Operation (GM-SMCO); MID 041 793 340

The Michigan Department of Environmental Quality (MDEQ), Waste and Hazardous Materials Division (WHMD), has reviewed the request for a Mixing Zone Determination for venting groundwater to the Saginaw River from GM-SMCO in Saginaw County, Michigan and forwarded that request to the MDEQ, Water Bureau (WB). The attached response provided by the WB identifies the acceptable concentration limits for discharge of the various chemicals characterized in the mixing zone request to the Saginaw River.

Based on the information provided by the WB, it is determined that there is a reasonable potential for the discharge of some chemicals to cause or contribute to water quality standards (WQS) being exceeded.

Recommended mixing zone-based groundwater surface water interface (GSI) values are summarized in the table below:

Table 1: Plume Venting to the Saginaw River

Parameter	Final Acute Value	Final Chronic Value	Reported Worst Case Maximum Site Concentration
pH	6.5 - 9.0 S.U.		
Ammonia Nitrogen	3.1 mg/l		

General Comments

1. The final acute values listed above are the acute mixing zone-based GSI criteria. These limits are provided for chemicals determined to have a reasonable potential to exceed the acute mixing zone-based GSI criteria. These values (as well as the generic GSI criteria for other chemicals not specifically identified in the mixing zone request) must not be exceeded at the GSI compliance monitoring wells; if they are, further remedial action will be required. The facility has the following options in regards to parameters that exceed the acute mixing zone-based GSI criteria in site monitoring wells:

   a. If any existing exceedances are upgradient of the compliance monitoring wells, GM-SMCO must demonstrate that data from all of the compliance monitoring wells in the Mixing Zone Compliance Monitoring Plan are, and will be, in compliance with acute

mixing zone-based GSI criteria for those parameters. Averaging of groundwater data is not allowed for comparison to generic GSI or acute mixing zone-based GSI criteria, nor is it allowed for bioaccumulative contaminants of concern. Acute mixing zoned-based or generic GSI criteria may not be exceeded in any individual GSI compliance monitoring well.

b. Prevent the discharge of all parameters that exceed the acute mixing zone-based GSI criteria in the GSI compliance monitoring wells. This option would require the focus of subsequent site investigations to hydrogeologically define remediation designs for capturing the groundwater discharge, further plume characterization, and identification of sources for source control measures.

2. It has been determined that any other parameter on the mixing zone request form, not given a recommended mixing zone-based GSI criteria in the table above (if any) or in the attached memorandum, will not cause or contribute to WQS being exceeded at this time. This determination is based upon the reported maximum values in the mixing zone request, which was submitted to the WB by the WHMD.

In order to demonstrate the groundwater discharge long-term compliance with the mixing zone-based GSI criteria, GM-SMCO will need to submit a Mixing Zone Compliance Monitoring Plan for review and approval. The Mixing Zone Compliance Monitoring Plan should include a Sampling and Analysis Plan (to address both mixing zone chemicals and other chemicals reported in the mixing zone request), identification of the wells that GM-SMCO proposes to sample to show compliance with the mixing zone-based GSI criteria (along the GSI at the GSI point of compliance) and any sentinel wells within the appropriate portions of the plume, and provide an explanation of the monitoring schedule and reporting process.

Should you have any questions regarding this letter or the Mixing Zone Determination, please contact me via e-mail at stoner@michigan.gov or by telephone at 517-373-7141.

Attachment
cc/att: Ms. Cheryl Howe, WHMD
Ms. Rhonda Klann, Remediation and Redevelopment Division
Mr. David Slayton, WHMD
Corrective Action File

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Liane Shekter Smith, Assistant Division Chief
Waste and Hazardous Materials Division

FROM: Erik Sunday, Surface Water Assessment Section, Water Bureau

DATE: December 11, 2009 ES

SUBJECT: General Motors Corp-Saginaw Metal Casting Operations (GM-SMCO)
Groundwater venting discharge

The Surface Water Assessment Section has evaluated Water Quality-Based Effluent Limits (WQBELs) for the GM-SMCO groundwater venting discharge. The existing GM-SMCO facility is continuously venting groundwater to the Saginaw River from four groundwater-surface water interfaces (GSIs) as described in the November 12, 2009, Mixing Zone Determination Request (MZDR) forwarded to SWAS by Waste and Hazardous Materials Division (WHMD):

Ammonia Part 1 – 1.73 cubic feet per second (cfs) (1.12 million gallons per day (MGD))
Ammonia Part 2 – 0.81 cfs (0.52 MGD)
pH-High – 0.76 cfs (0.49 MGD)
pH-Low – 2.05 cfs (1.33 MGD)

The above venting flow rates are maximum flows. The vents are located in Sections 7, 17, and 18 of T12N, R5E of Saginaw County. The pH-High groundwater venting flows to the Saginaw River through the Ammonia Part 1 venting area. Therefore, these two vents have been treated as a single vent with a maximum flow rate of 2.49 cfs (1.73 cfs + 0.76 cfs) in developing WQBELs. The combined Ammonia Part 1 and pH-High vent discharges to the Saginaw River downstream of the Carrolton Bar, while the Ammonia Part 2 and pH-Low vents discharge to a channel of the Saginaw River southeast of the Carrolton Bar.

The monthly exceedance flows (in cfs) for the Saginaw River below the Carrolton Bar at the point of discharge of the combined Ammonia Part 1 and pH-High vents are as follows:

	JAN.	FEB.	MAR.	APR.	MAY	JUNE
50%	2200	2510	6950	6830	3640	1880
95%	750	800	1560	2220	1180	740

	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
50%	1150	980	1000	1250	2010	2380
95%	550	500	510	600	750	780

The monthly exceedance flows (in cfs) for the channel of the Saginaw River southeast of the Carrolton Bar at the point of discharge of the Ammonia Part 2 and pH-Low vents are as follows:

	JAN.	FEB.	MAR.	APR.	MAY	JUNE
50%	1630	1860	5140	5050	2700	1390
95%	560	590	1160	1640	870	550

	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
50%	850	730	740	930	1490	1760
95%	410	370	380	440	560	580

The Saginaw River is protected for warmwater fish, other indigenous aquatic life and wildlife, agriculture, navigation, industrial water supply, public water supply at the point of intake, partial body contact recreation, total body contact recreation from May 1 to October 31, and fish consumption.

Ammonia concentrations and pH are the primary concerns for this facility's venting groundwater. Average values of groundwater pH in the four venting areas were computed from data contained in the MZDR:

Ammonia Part 1 – 7.06 S.U.
Ammonia Part 2 – 6.86
pH-High – 11.19
pH-Low – 5.48

SWAS recommends a pH range of 6.5 to 9.0 S.U. for all venting groundwater discharges to the Saginaw River year-round. Table 1 contains total ammonia recommendations based on meeting the 0.420 mg/l warmwater un-ionized ammonia acute toxicity criterion in the combined Ammonia Part 1 and pH-High venting. No ammonia recommendations for any other GM-SMCO groundwater venting should be necessary to protect against acute or chronic un-ionized ammonia toxicity based on data provided in the MZDR. Pollutants affecting dissolved oxygen in the receiving water are not expected to be present at problematic levels in the venting discharges.

The fraction of total ammonia existing as un-ionized ammonia is calculated, in part, from the pH of the venting groundwater. For the combined Ammonia Part 1 and pH-High venting, the upper value of the WQBEL pH range, 9.0 S.U., was used in the calculation of WQBELs based on un-ionized ammonia toxicity. The recommendations in Table 1 apply for groundwater pH's of 9.0 S.U. or lower. If the groundwater venting is permitted to discharge at a pH greater than 9.0 S.U., WQBELs for the combined Ammonia Part 1 and pH-High venting will need to be recalculated. For evaluation of the pH-Low and Ammonia Part 2 ventings, a pH of 7.1 S.U. was used based on the calculated average pH for the Ammonia Part 1 venting.

The attached effluent limit recommendations are based on water quality standards. We have not addressed treatment practicality or cost effectiveness. Our recommendations do not imply that other considerations should not be taken into account when deciding on permit limits.

Table 1. GM-SMCO pH and ammonia toxicity-based WQBEL recommendations
Combined Ammonia Part 1 and pH-High groundwater venting
WQBELs assume a pH of 9.0 S.U. or less in venting groundwater

Parameter	Months	Conc. (mg/l)	Load (lb/d)	Basis	Rationale
NH3-N	Year round	3.1	42	Daily Max.	Acute warmwater toxicity

Design Flow = 2.49 cfs (1.61 MGD)

cc: Jon Bloemker, Saginaw Bay District Supervisor, SWAS, WB
Eric Alexander/Groundwater Venting File, SWAS, WB