2019 Groundwater Monitoring Report

Halls Glen Landfill Site
(PC of A A341004)
Township of Douro-Dummer
County of Peterborough

GHD | 347 Pido Road Unit 29, Peterborough, Ontario, K9J 6X7 Canada

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Enclosures

1. Introduction

The following report presents the results of the 2019 groundwater monitoring program that was completed for the Halls Glen Landfill Site in the Township of Douro-Dummer (formerly Township of Dummer) of the County of Peterborough. The monitoring program was conducted in accordance with the scope of work as presented by our proposal dated October 24, 2013 as well as additional requirements outlined in various Ministry of the Environment, Conservation and Parks (MECP) Memorandums.

2. Background

The Halls Glen Landfill Site is situated along the south side of County Road No. 6, 10km north of the community of Warsaw. The Geologic Plan, Plate 1, illustrates the location of the landfill with respect to nearby roads and watercourses. The location of the property is described as part of Lot 25, Concession 4 in the Township of Douro-Dummer.

Details regarding the operation of the landfill are outlined in the Provisional Certificate of Approval (PC of A) No. A 341004 dated October 8, 1980. The site also operates as a transfer station according to PC of A No. A 341007 dated October 25, 1991, and the amended Certificate of Approval (C of A) dated February 1, 2006 (see Appendix A). Two Memorandums were issued by MECP personnel in 2014 in response to reviewing the 2013 Groundwater Monitoring Report (see Appendix A).

A Memorandum dated June 23, 2014 provides commentary on the groundwater aspects of the 2013 monitoring program. A Memorandum dated August 7, 2014 presented comments relating to surface water. The MOE recommendations were implemented in the monitoring program in 2016. In general, the background data consisted of the following documents:

1. Current PC's of A issued by the MECP (Appendix A);
2. Excerpts from a report prepared by Hydroterra Limited regarding details of the monitoring well construction and borehole records (Appendix B);
3. MECP well record for monitor MW-7 that was installed in March, 1997 (Appendix B), MECP well records for monitors MW-8, 9, 10, 11 and 12 that were installed in the Fall of 2001 (Appendix B), MECP well record for monitor MW-13 (TW1-02) that was installed in October, 2002 (Appendix B)
4. Monitoring program and sampling protocol established for the landfill site by the former Township of Dummer (Appendix C); and
5. Reports prepared by Geo-Logic Inc./ GHD dated 1994, 1996 to 2006, 2009 to 2019 and AECOM Canada Ltd. dated 2007-2008 presenting the results of previous monitoring programs.

3. Site Conditions

3.1 General Geology

The site is situated in an area within the physiographic region known as the Dummer Moraine (Chapman and Putnam, 1984). This region is characterized by relatively flat, stoney ground covered with shallow deposits of glacial drift (till). Based on previous investigations, this material is covered locally by a layer of glaciolacustrine sand. Bedrock underlying the site consists of limestone belonging to the Lindsay Formation. The bedrock is part of the Trenton-Black River Group and is of Middle Ordovician age. Based on previous subsurface data, bedrock underlies the site at an average depth of 3.25m below the ground surface.

3.2 Existing Groundwater Monitors

In total, thirteen (13) groundwater monitoring stations were included during both monitoring circuits (spring and fall). The location of the monitors with respect to the property limits is illustrated on the Site Plan, Plate 2. Monitors MW 1, 2, 3, 4, 5, 6 and 7 consist of a 38mm diameter standpipe and a 50mm diameter piezometer, which have been constructed within a common borehole. Monitors MW 8, 9, 10, 11 and 13 consist of two (2) 50mm diameter piezometers with MW 12 having three (3) 50mm diameter piezometers that have been constructed within a common borehole. The monitoring stations are protected by a 150mm diameter steel locked well casing. In general, each monitor consists of a bedrock monitor and an overburden monitor with the exception of MW12 which has one (1) overburden monitor and two (2) bedrock monitors at different depths. Details pertaining to the construction of the monitoring wells are presented in Appendix B. A description of the monitoring station locations is summarized in Table 3.1.

During the summer of 2003, the landfill refuse area was prepared for closure. The landfill area was mounded and capped. It is our understanding that further work was conducted in 2004 and the work continued in 2005. Monitors MW-2 and MW-6 casing were extended to allow for the mounding of the landfill. Elevation data for these two (2) monitors have been calculated using past measurements of well depth compared to the 2004 recorded values.

Table 3.1 Monitoring Well Locations and Installation Dates

Monitor	Descriptive Location
MW 1-91 MW 13-02	up-gradient to existing landfill area
MW 2-91	within the central area of the refuse landfill
MW 3-91 MW 4-91 MW 5-91 MW 6-91 MW 7-97 MW 8-01 MW 9-01 MW 10-01 MW 11-01 MW 12-01	down-gradient of existing landfill

Note: See Site Plan for precise location of monitoring stations.

3.3 Pattern of Groundwater Movement

Groundwater monitoring was conducted during two sampling circuits in 2019. The water level data was acquired on May 30th and October 29th, 2019. The measurements are presented on Plate 5 and summarized in Table 3.2. Elevation data was not available for the monitor installed in October 2002 (MW-13). The ground water elevations for MW-2 and MW-6 for the monitoring circuits were adjusted to compensate for the extended casings using field measurements.

As is past monitoring events, monitors MW1-II, MW 2-I and MW2-II were dry during both sampling circuits while MW 5-II was dry for the fall circuit. The overburden groundwater monitoring data for May 2019 is presented on the Site Plan, Plate 2. Based on the data, the pattern of overburden and the deeper groundwater movement appears to be in a southeasterly direction.

Table 3.2 2018 Water Level Summary

Monitor Number	Elevation Top of Casing	Water Level Elevation	
		May 30, 2019	Oct. 29 2019
Overburden Monitors			
MW 1-II	271.24	dry	dry
MW 2-II	282.49	dry	dry
MW 3-II	269.23	268.47	268.02
MW 4-II	268.28	266.73	266.39
MW 5-II	271.35	268.52	267.19
MW 6-II	271.01	268.46	267.37
MW 7-II	269.03	267.00	266.63
MW 8-II	270.74	266.46	264.93
MW 9-II	267.25	266.27	265.72
MW 10-II	267.97	265.96	265.76
MW 11-II	268.50	265.94	265.75
MW 12-I	268.00	266.40	266.24
MW 13-II	na	na	na
Bedrock Monitors			
MW 1-I	271.24	268.54	268.42
MW 2-I	282.53	dry	dry
MW 3-I	269.23	268.02	267.41
MW 4-I	268.28	266.36	266.21
MW 5-I	271.35	266.83	266.78
MW 6-I	271.01	266.49	266.31
MW 7-I	269.03	266.33	265.77
MW 8-I	270.74	266.35	265.69
MW 9-I	267.25	266.59	266.31
MW 10-I	267.97	266.09	265.77
MW 11-I	268.50	266.11	265.92
MW 12-II	268.00	266.48	266.30
MW 12-III	268.00	266.59	266.35
MW 13-I	na	na	na

Notes: All measurements are presented in metres. Monitor top of casing elevations provided by TSH.
(na) indicates information not available.

3.4 Horizontal Hydraulic Gradient

Horizontal hydraulic gradient is simply the slope of the water table or potentiometric surface. It is the change in hydraulic head over the change in distance between the two monitoring wells or dh/dl. In mathematical terms, horizontal gradient is rise over run.

dh/dl= difference in head / horizontal distance between wells. $(h_2 - h_1) / L$

All well locations were recorded using the Ministry of Natural Resources (MNR) Topographical mapping and plotted on the Site Plan, Plate 2. The distances between the wells were measured after plotting well locations on the MNR mapping for the site. Water level elevation was obtained from Table 3.2.

Overburden wells for the site are divided into shallow and deeper wells. Two gradients per monitoring period were calculated for each level of overburden wells for the spring monitoring period as most were dry during the fall. The average horizontal gradient for the shallow overburden wells was 9.7 m/km. The average horizontal gradient for the deeper overburden wells was 4.3 m/km. The results are summarized on Table 3.3.

Three gradients of bedrock wells were calculated for each monitoring period. The average horizontal gradient within the bedrock is calculated at 3.3 m/km. The results of the bedrock gradient analysis are summarized on Table 3.4.

Table 3.3 Hydraulic Gradient – Overburden Wells

Monitoring Wells	Shallow / Deep Spring / Fall 2019	Groundwater Elevation (m)	Distance Between Wells (km)	Hydraulic Gradient (m/km)
MW 3-II MW 4-II	Shallow / Spring	268.47 266.73	0.095	18.3
MW 3-II MW 7-II	Shallow / Spring	268.47 267.00	0.87	1.69
MW 6-II MW 11-II	Deep / Spring	268.46 265.94	0.28	9.0
MW 12-I MW 9-II	Deep / Spring	266.32 266.15	0.23	0.17
MW 3-II MW 4-II	Shallow / Fall	268.02 266.39	0.095	17.1
MW 3-II MW 7-II	Shallow / Fall	268.02 266.63	0.87	1.60
MW 6-II MW 11-II	Deep / Fall	267.37 265.75	0.28	5.79
MW 12-I MW 9-II	Deep / Fall	266.24 265.72	0.23	2.26
Average	Shallow		0.48	9.67
Average	Deep		0.26	4.31

Table 3.4 Hydraulic Gradient – Bedrock Wells

Monitoring Wells	Spring/Fall 2019	Groundwater Elevation (m)	Distance Between Wells (km)	Hydraulic Gradient (m/km)
MW 1-I MW 5-I	Spring	268.45 266.83	0.22	7.4
MW 7-I MW 8-I	Spring	266.33 266.35	0.38	0.1
MW 12-II MW 10-I	Spring	266.59 266.09	0.25	2.0
MW 1-I MW 5-I	Fall	268.48 266.78	0.22	7.7
MW 7-I MW 8-I	Fall	265.77 265.69	0.38	0.2
MW 12-II MW 10-I	Fall	266.35 265.77	0.25	2.3
Average	Spring		0.28	3.2
Average	Fall		0.28	3.4
Yearly Average				3.3

3.5 Hydraulic Conductivity

The hydraulic conductivity of a soil is described as a measure of the soil's ability to transmit water. Slug tests were performed in 2009 on two overburden and two bedrock wells in order to assess the permeability of the two layers present at the site. The results of the testing indicate that the overburden soils to be silty sand with a relatively high hydraulic conductivity. The bedrock results indicate this layer to be fractured limestone. Table 3.5 summarizes the results of slug tests performed at the site. The graphs of the hydraulic conductivity testing are presented in Appendix E.

Table 3.5 Hydraulic Gradient – Bedrock Wells

Location	Test Type	Hydraulic Conductivity (cm/s)	Geometric Mean K (cm/s)	Representative Aquifer
MW-3-1 MW-3-1	Falling Head Rising Head	6E-03 3E-03	10E-03	Fractured limestone Fractured limestone
MW-7-2 MW-7-2	Falling Head Rising Head	3E -02 2E-02	10E-02	Silty sand, clean sand Silty sand, clean sand
MW-8-2 MW-8-2	Falling Head Rising Head	2E-02 4E-02	10E-02	Silty sand Silty sand, clean sand
MW-8-1 MW-8-1	Falling Head Rising Head	4E-03 2E-03	10E-03	Fractured limestone Fractured limestone

4. Monitoring Program

GHD followed the established sampling and monitoring protocol for the Halls Glen landfill site during the 2019 season. Details of this protocol are summarized in Appendix C. An overview of the protocol is outlined below.

1. Field work to be carried out at all thirteen (13) monitoring stations during the spring and fall seasons.
2. Field work and sampling to be completed at four (4) residential wells during the spring and fall sampling period. Two (2) surface water stations to be sampled during both monitoring circuit.
3. Methane gas hydrogen sulphide generation was measured at each well using a portable multi-gas indicator.
4. Water levels were then recorded for each monitor prior to well purging.
5. Three to five measured casing volumes were then removed from each monitor in order to ensure that representative groundwater samples were obtained.
6. In-situ chemical testing was conducted during the purging operation in order to determine a stabilized water quality condition. The in-situ testing included parameters such as temperature, conductivity, pH, Orp and DO.
7. After the purging operation, representative samples of groundwater were collected in proper containers with appropriate preservatives where needed.
8. The water samples were delivered to SGS Laboratories in Lakefield. Sampling was carried out as per previous sampling circuits.
9. Reviewed slug testing on wells to determine hydraulic conductivity values as requested by MECP review (dated September 2, 2009) of the Halls Glen 2008 Monitoring Report prepared by AECOM Canada Ltd. Hydraulic Gradients were calculated using well locations and groundwater elevations.

5. Water Quality Data

5.1 General

Representative groundwater samples from each of the monitors were subjected to chemical testing for specified parameters. The parameters tested included those listed in Column 1 of Schedule 5 (Comprehensive List) in the spring and Column 2 (Indicator List) in the fall, of the Landfill Standards: A Guideline on Regulatory and Approval Requirements for New or Expanding Sites for the deeper wells. All metals were analyzed for the parameters listed in Schedule 5 Column 1 for all wells. In addition, selected samples were analyzed for volatile organic compounds (VOCs) to evaluate any trends that may develop. The surface water stations and shallow monitors that discharge to surface water were analyzed for the parameters listed in Column 3 of Schedule 5 of the Landfill Standards Guideline (Comprehensive List for Surface Water). The certificates of analysis are included in Appendix D.

5.2 Overburden Monitors

As in the past, monitor MW 1-II and MW 2-II were measured dry during the spring and fall 2019 sampling period. MW 5-II which usually has had insufficient water for sampling did generate enough water for sampling in the spring but not in the fall sampling circuit. Monitoring Well 3-II was also dry in the fall sampling period. In general, the groundwater levels in the monitors were found to be at normal elevation in the spring but lower in the fall. The chemical results from the shallow wells (where samples were obtained) have been summarized in Tables 5.1 and 5.2.

The data is presented with the Ontario Drinking Water Standards (ODWS) and Provincial Water Quality (PWQO) for comparison purposes. As in past reports, the monitors located closest to the former landfill area (MW-3, MW-5-II, MW- 6-II and MW-7-II) had the highest number of the parameters exceeding the PWQO and ODWS during both sampling circuits. Iron was elevated in down-gradient monitor MW 10-II during both sampling circuits. Although Iron has been historically elevated for the area and is interpreted to be naturally elevated this should be closely monitored for any upwards trends. Elevated levels of total dissolved solids (TDS) were reported in some wells during both sampling periods. MW-4-II that has in the past had exceedances for some parameters, met all analyzed parameters in 2019.

Although there were still exceedances of the ODWS and PWQO for some parameters there are no upward trends in the remaining monitors or in the parameters indicating exceedances. Future monitoring programs should continue to monitor these parameters to evaluate potential environmental concerns.

As in past reports, the monitoring data indicates that the monitoring stations located near the landfill area are being impacted by the landfill. The following overburden wells had parameters that exceeded the ODWS in 2019.

Spring Circuit Exceedances of ODWS

Alkalinity	MW 3-II, 5-II, 6-II
Iron	MW 5-II, 6-II 10-II, 11-II
TDS	MW-3-II, 5-II, 6-II
Manganese	MW 3-II, 5-II, 6-II, 7-II, 10-II

Fall Circuit Exceedances of ODWS

Alkalinity	MW 3-II, 6-II
Iron	MW 6-II, 10-II
TDS	MW 3-II, 6-II
Manganese	MW 6-II

The MECP in their 2014 memorandum indicated that all shallow wells that possibly discharge to the wetland located southeast of the landfill, be analyzed for the same parameters as surface water and must be compared to the PWQO standards. It was once again noted that the majority of exceedances were from monitoring wells MW 3-II, 5-II and 6-II that are located next to the landfill. These wells had the most exceedances while monitors further down gradient showed very few exceedances. The following overburden wells had parameters that exceeded the PWQO in 2019.

Spring Circuit Exceedances of PWQO

Iron	MW-5-II, 6-II, 10-II, 11-II
Boron	MW-3-II, 5-II, 6-II
Ammonia	MW-5-II, 6-II

Fall Circuit Exceedances of PWQO

Iron	MW 6-II, 10-II,
Ammonia	MW 6-II
Boron	MW 3-II, 6-II
Phenolics	MW 6-II
Copper	MW 6-II

In addition to the aforementioned parameters, monitors MW-3-II, MW-4-II, MW-5-II, MW-6-II, MW-7-II and MW-11-II were sampled for VOCs during the spring and fall sampling circuits. The monitors did not yield detectable levels of VOCs in either the spring or fall sampling circuits. As such all levels are within the ODWS and PWQO. The results of the chemical testing are presented in Appendix D.

Table 5.1 May 2019 Overburden Monitors

Parameters	Overburden Monitors											ODWS	PWQO
	MW 3-II	MW 4-II	MW 5-II	MW 6-II	MW 7-II	MW 8-II	MW 9-II	MW 10-II	MW 11-II	MW 12-1	MW 13-II		
May 30, 2019													
BOD	< 4	< 4	6	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	---	---
TSS	713	653	124	228	148	23	66	50	5	42	28	---	---
Alkalinity	536	218	806	792	191	235	241	243	224	284	230	**30-500**	---
pH	7.42	7.77	6.86	6.98	7.84	7.66	8.00	7.54	8.09	7.42	7.51	**6.5-8.5**	**6.5-8.5**
Conductivity	1110	320	1600	1640	331	429	653	599	465	675	569	---	---
TDS	677	186	934	1010	209	257	214	334	274	403	329	**500**	---
COD	11	< 8	47	70	< 8	< 8	< 8	< 8	< 8	< 8	10	---	---
Phosphorus	0.52	0.24	0.15	0.06	0.05	< 0.03	< 0.03	0.09	< 0.03	< 0.03	0.05	---	---
TKN	0.6	< 0.5	11.8	22.5	< 0.5	< 0.5	< 0.5	0.7	< 0.5	< 0.5	0.8	---	---
Ammonia	0.7	< 0.1	11.0	22.1	< 0.1	< 0.1	< 0.1	0.8	0.5	0.1	0.4	---	**3.3
Phenolics	< 0.001	< 0.001	0.005	0.006	< 0.001	0.002	0.003	< 0.001	< 0.001	< 0.001	0.002	---	**0.005**
Sulphate	70	< 2	9	170	11	7	16	8	6	22	18	**500**	--
Chloride	37	2	93	80	6	3	66	48	14	51	51	**250**	---
Nitrite	0.33	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.07	< 0.03	< 0.03	< 0.03	**1.0**	---
Nitrate	1.01	< 0.06	0.23	< 0.06	0.08	< 0.06	< 0.06	0.08	< 0.06	< 0.06	0.65	**10**	---
Mercury	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		
Arsenic	0.0002	<0.0002	0.0007	0.0016	< 0.0002	<0.0002	0.0003	0.0002	<0.0002	< 0.0002	<0.0002	**0.002**	**0.05**
Barium	0.175	0.0877	0.667	0.685	0.0876	0.0531	0.158	0.626	0.381	0.713	0.137	**200**	---
Boron	0.563	0.034	0.401	0.831	0.055	0.014	0.026	0.118	0.085	0.104	0.051	**1.0**	**0.2**
Calcium	246	92.9	281	372	72.1	103	105	117	96.6	126	139	---	---
Cadmium	0.000018	0.000003	0.000012	0.000012	0.000003	.000003	.000003	.000003	.000003	0.000003	0.000004	**0.005**	**0.0002**
Chromium	0.00019	0.00013	0.00072	0.00118	0.00017	0.00027	0.00015	0.00014	0.00059	0.00016	0.00015	**0.05**	---
Cooper	0.0011	0.0002	0.0016	0.0054	0.0007	0.0003	0.0008	0.0003	<0.0002	< 0.0002	0.0007	**1.0**	**0.005**
Iron	0.132	< 0.007	13.3	15.6	0.008	0.007	0.293	6.91	1.55	0.010	0.027	**0.3**	**0.3**
Potassium	16.9	0.729	24.4	40.3	1.33	0.472	2.16	2.42	1.99	3.28	3.48	---	---
Magnesium	22.0	2.20	27.8	48.0	3.71	2.82	3.89	11.2	7.40	11.5	4.42	---	---
Manganese	3.24	0.00041	6.61	8.40	0.00092	0.00074	0.0291	0.171	0.0245	0.00352	0.00144	**0.05**	---
Sodium	38.3	5.32	63.6	109	17.3	3.74	42.9	7.47	6.30	13.7	30.0	**200**	---
Lead	0.00002	<0.00001	0.00014	0.00020	0.00002	0.00002	0.00002	0.00012	0.00001	<0.00001	0.00003	**0.01**	**0.005**
Zinc	0.003	< 0.002	0.004	0.005	0.002	0.002	0.003	0.005	0.004	0.003	0.003	**5.0**	**0.03**

Notes: All results in mg/L with the exception of Conductivity (uS/cm) and pH, (---) indicates no data, (np) indicates not performed. Highlighted values exceed ODWS or PWQO.

Table 5.2 October 2019 Overburden Monitors

Parameters	Overburden Monitors										ODWS	PWQO
	MW 3-II	MW 4-II	MW 6-II	MW 7-II	MW 8-II	MW 9-II	MW 10-II	MW 11-II	MW 12-I	MW 13-II		
Oct. 29, 2019												
BOD	< 4	< 4	21	< 4	< 4	< 4	< 4	< 4	< 4	< 4	---	---
TSS	183	1130	110	178	37	2	55	6	38	69	---	---
Alkalinity	559	287	951	322	272	260	245	242	265	331	30-500	---
pH	7.58	7.93	7.60	7.92	8.12	8.11	8.03	8.10	7.92	7.82	6.5-8.5	6.5-8.5
Conductivity	1630	705	2010	691	748	737	621	584	649	833	---	---
TDS	1120	374	1240	451	434	414	354	320	403	474	500	---
COD	20	< 8	68	< 8	< 8	< 8	< 8	< 8	< 8	< 8	---	---
Phosphorus	0.11	0.39	0.06	0.06	0.03	< 0.03	0.06	0.04	< 0.03	0.10	---	---
TKN	< 0.5	< 0.5	25.4	< 0.5	< 0.5	< 0.5	1.1	1.0	< 0.5	< 0.5	---	---
Ammonia	0.1	< 0.1	23.3	< 0.1	< 0.1	< 0.1	1.1	0.9	< 0.1	< 0.1	---	**3.3
Phenolics	0.002	< 0.001	0.006	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	---	0.005
Sulphate	210	6	61	15	12	11	7	10	28	26	500	--
Chloride	100	34	110	35	69	73	48	33	44	58	250	---
Nitrite	0.03	< 0.03	0.04	< 0.03	< 0.03	< 0.03	0.04	< 0.03	< 0.03	< 0.03	1.0	---
Nitrate	5.39	0.45	3.72	1.36	0.66	0.93	0.08	0.18	< 0.06	2.36	10	---
Mercury	<0.01	< 0.01	0.02	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		
Arsenic	0.0003	< 0.0002	0.0012	0.0004	< 0.0002	< 0.0002	< 0.0002	0.0007	0.0008	0.0003	0.002	0.05
Barium	0.237	0.156	0.467	0.211	0.158	0.184	0.580	0.0408	0.230	0.155	200	---
Boron	0.827	0.036	0.753	0.138	0.050	0.065	0.145	0.176	0.099	0.046	1.0	0.2
Calcium	325	120	322	130	127	121	129	147	117	144	---	---
Cadmium	0.000030	0.000004	0.000016	0.000003	0.000005	0.000003	0.000003	0.000005	0.000003	0.000007	0.005	0.0002
Chromium	0.00030	0.00018	0.00080	0.00030	0.00025	0.00016	0.00012	0.00020	0.00013	0.00022	0.05	---
Cooper	0.0031	0.0014	0.0087	0.0031	0.0008	0.0014	< 0.0002	0.0011	0.0005	0.0020	1.0	0.005
Iron	0.020	< 0.007	3.86	< 0.007	0.010	0.038	4.03	0.124	0.019	0.019	0.3	0.3
Potassium	21.1	1.56	33.9	5.41	1.40	2.57	2.69	7.59	2.25	3.64	---	---
Magnesium	24.4	3.75	30.8	10.1	3.82	3.82	10.9	221	7.58	4.68	---	---
Sodium	43.3	24.4	101	29.8	36.8	46.5	5.54	76.7	12.0	36.5	200	---
Manganese	0.0520	0.00099	5.34	0.00029	0.00433	0.00464	0.0544	0.0147	0.0201	0.00227	0.05	---
Lead	0.00003	0.00002	0.00001	0.00003	0.00003	0.00002	0.00001	0.00002	0.00001	0.00004	0.01	0.005
Zinc	0.004	0.002	< 0.002	< 0.002	0.003	0.003	< 0.002	0.004	0.003	0.004	5.0	0.03

Notes: All results in mg/L with the exception of Conductivity (uS/cm) and pH, (---) indicates no data, (np) indicates not performed. Highlighted values exceed ODWS or PWQO

5.3 Bedrock Monitors

All of the bedrock monitors were sampled during the 2019 sampling circuits with the exception of MW 2-I, which was dry during both circuits. MW 2-I has been historically dry. The results of the testing are compared in Tables 5.3 and 5.4 against the ODWS. In general, the results are similar to past years with MW 5-I and MW 6-I yielding the most exceedances. MW 3-I and 4-I that yielded exceedances in the past had very few in 2019. All of these wells are directly adjacent to the landfill. As in past years, iron and manganese are elevated in other monitors. TDS that is generally elevated in other monitors was not this year. It is interpreted that these parameters are naturally elevated since the background monitors MW 1-I exceeded the criteria for TDS. Future monitoring programs should continue to monitor these parameters to evaluate potential environmental concerns. The results of the chemical testing are presented in Appendix D.

The following deeper bedrock wells had parameters that exceeded the ODWS in 2019.

Spring Circuit Exceedances of ODWS

Alkalinity	MW 5-I
TDS	MW 1-I (background) 5-I, 6-I
Iron	MW 5-I, 6-I
Manganese	MW 4-I, 5-I, 6-I, 9-I, 10-I, 11-I, 12-II

Fall Circuit Exceedances of ODWS

Alkalinity	MW 5-I
DOC	MW 5-I, 6-I
Iron	MW 5-I, 6-I
TDS	MW 1-I (background) 3-I, 4-I, 5-I, 6-I
Manganese	MW 4-I, 5-I, 6-I, 8-I, 9-I, 10-I 11-I, 12-II

In addition to the aforementioned parameters, monitors MW-3-I, MW-4-I, MW-5-I, MW-6-I, MW-7-I and MW-11-I were sampled for VOCs during the spring and fall sampling circuits. All other wells were sampled for the VOC parameters listed in Schedule 5 Column 1 during the spring circuit. The monitors yielded results below the detectable levels of VOCs in both the spring or fall sampling circuits with the exception of Benzene and Monochlorobenzene in Monitor MW 5-I in the fall sampling period which reported levels just above the detection limit. Generally monitors close to the landfill have yielded detectable VOC levels for a some parameters but only MW 5-I reported detectable levels this year. Duplicate sample 14-I (MW7-I) also indicated no detectable VOC's. The results of the chemical testing are presented in Appendix D.

Table 5.3 May 2019 Bedrock Monitors

Parameters	Bedrock Monitors													ODWS
	MW 1-I	MW 3-I	MW 4-I	MW 5-I	MW 6-I	MW 7-I	MW 8-I	MW 9-I	MW 10-I	MW 11-I	MW 12-II	MW 12-III	MW 13-I	
May 30, 2019														
Alkalinity	272	248	291	536	468	370	284	271	245	260	294	290	249	**30-500**
pH	7.53	7.34	8.08	7.44	7.21	7.92	7.53	7.41	7.74	7.78	7.62	8.06	8.10	**6.5-8.5**
Conductivity	1150	526	713	980	1260	808	795	605	616	643	740	711	628	**---**
TDS	711	294	434	574	749	474	489	391	400	400	463	443	394	**500**
COD	< 8	< 8	< 8	17	25	65	< 8	34	< 8	9	8	< 8	< 8	**---**
Phosphorus	0.04	< 0.03	< 0.03	0.04	0.14	0.04	< 0.03	< 0.03	< 0.03	< 0.03	0.03	< 0.03	< 0.03	**---**
TKN	< 0.5	< 0.5	1.1	6.2	6.6	< 0.5	< 0.5	0.5	< 0.5	0.5	< 0.5	< 0.5	< 0.5	**---**
Ammonia	< 0.1	< 0.1	1.2	5.8	6.6	< 0.1	< 0.1	0.7	0.2	0.7	0.3	< 0.1	< 0.1	**---**
Phenolics	0.006	< 0.001	0.002	0.002	0.006	0.002	0.001	< 0.001	0.002	< 0.001	0.001	0.001	0.003	**---**
Sulphate	79	9	22	12	44	34	18	41	25	37	72	26	10	**500**
Chloride	180	24	51	29	130	47	83	16	51	29	38	55	57	**250**
Nitrite	< 0.03	< 0.03	< 0.03	< 0.03	0.28	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	**1.0**
Nitrate	2.29	1.41	1.19	0.71	0.65	0.13	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	2.42	**10**
Mercury	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Arsenic	<0.0002	<0.0002	<0.0002	0.0011	0.0002	0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	**0.002**
Barium	0.282	0.0836	0.115	0.434	0.402	0.136	0.106	0.688	0.839	0.460	0.252	0.0399	0.118	**200**
Boron	0.093	0.025	0.069	0.213	0.246	0.516	0.114	0.590	0.260	0.362	0.609	0.090	0.021	**1.0**
Calcium	175	106	118	203	198	34.0	125	58.7	103	101	111	162	132	**---**
Cadmium	<0.000003	<0.000003	0.000006	<0.000003	<0.000003	0.000003	<0.000003	<0.000003	<0.000003	<0.000003	<0.000003	<0.000003	<0.000003	**0.005**
Chromium	0.00017	0.00018	0.00013	0.00033	0.00031	0.00013	0.00012	0.00015	0.00013	0.00018	0.00035	0.00026	0.00016	**0.05**
Cooper	0.0009	0.0004	0.0005	0.0003	0.0003	<0.0002	0.0009	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	**1.0**
Iron	< 0.007	< 0.007	0.012	11.1	0.684	0.007	0.016	< 0.007	0.085	0.042	0.143	0.054	< 0.007	**0.3**
Potassium	5.56	2.86	5.64	16.1	18.3	2.25	3.77	6.17	4.69	4.26	3.75	1.94	1.88	**---**
Magnesium	15.0	2.96	4.94	15.5	13.8	7.59	11.7	22.7	20.7	19.4	24.7	6.18	3.11	**---**
Manganese	0.00003	0.00024	0.168	1.17	1.53	0.00076	0.00523	0.0820	0.173	0.0629	0.139	0.0145	0.00015	**0.05**
Sodium	73.0	21.1	37.0	36.5	71.4	151	48.4	51.7	13.2	12.6	41.4	15.7	38.2	**200**
Lead	0.00001	0.00001	0.00001	0.00002	0.00020	0.00003	0.00001	0.00001	0.00001	0.00003	0.00046	0.00026	0.00004	**0.01**
Zinc	< 0.002	0.007	0.003	0.002	0.003	0.002	0.003	< 0.002	0.004	0.003	0.004	0.008	0.002	**5.0**

Notes: All results in mg/L with the exception of Conductivity (uS/cm) and pH, (---) indicates no data, (np) indicates not performed. Highlighted values exceed ODWS.

Table 5.4 October 2019 Bedrock Monitors

Parameters	Bedrock Monitors													ODWS
	MW 1-I	MW 3-I	MW 4-I	MW 5-I	MW 6-I	MW 7-I	MW 8-I	MW 9-I	MW 10-I	MW 11-I	MW 12-II	MW 12-III	MW 13-I	
Oct. 29, 2019														
Alkalinity	261	330	378	653	429	328	274	241	232	248	285	272	250	**30-500**
pH	7.98	7.90	7.57	7.21	7.94	8.12	7.94	8.23	8.16	8.22	7.95	7.75	7.89	**6.5-8.5**
Conductivity	1150	920	1050	1510	1210	844	801	561	608	598	730	694	534	**---**
TDS	666	534	597	874	671	469	454	323	334	334	417	391	286	**500**
COD	< 8	< 8	< 8	47	11	< 8	< 8	24	< 8	11	18	< 8	< 8	**---**
Ammonia	< 0.1	< 0.1	0.4	14.5	9.0	0.1	0.2	0.7	0.2	0.9	0.4	< 0.1	< 0.1	**---**
Sulphate	74	20	42	7	43	33	19	42	23	29	78	24	8	**500**
Chloride	170	56	90	120	120	45	78	18	49	35	37	51	21	**250**
Nitrate	2.40	2.51	2.14	0.24	0.50	0.25	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.26	**10**
DOC	< 1	2	3	14	6	2	< 1	< 1	< 1	< 1	< 1	1	1	**5**
Barium	0.278	0.118	0.193	0.664	0.337	0.128	0.106	0.570	0.803	0.446	0.204	0.0664	0.0824	**200**
Boron	0.105	0.050	0.079	0.340	0.227	0.445	0.102	0.491	0.273	0.396	0.548	0.143	0.019	**1.0**
Calcium	178	137	214	249	217	40.1	121	55.7	91.9	90.6	115	140	96.5	**---**
Iron	< 0.007	< 0.007	0.125	32.6	1.34	0.009	0.018	0.008	0.014	0.019	0.007	0.099	< 0.007	**0.3**
Magnesium	14.2	3.35	7.48	22.9	11.0	7.52	11.3	18.9	20.5	20.7	26.8	8.91	2.59	**---**
Sodium	69.4	43.0	49.2	80.2	60.9	152	45.9	42.6	13.0	12.3	45.7	18.8	28.4	**200**
Arsenic	<0.0002	<0.0002	0.0002	0.0035	0.0004	0.0008	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	**0.002**
Cadmium	0.000003	0.000012	0.000045	0.000003	0.000005	0.000016	0.000009	<0.000003	<0.000003	<0.000003	<0.000003	<0.000003	0.000003	**0.005**
Chromium	0.00017	0.00019	0.00013	0.00090	0.00029	0.00017	0.00016	0.00016	0.00014	0.00018	0.00023	0.00015	0.00023	**0.05**
Cooper	0.0014	0.0016	0.0009	0.0011	0.0014	0.0005	0.0009	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0005	**1.0**
Potassium	5.45	3.59	5.67	32.2	16.4	2.55	3.64	5.32	4.59	4.23	4.16	2.06	2.24	**---**
Manganese	0.00185	0.00620	0.0694	2.68	1.46	0.00831	0.0837	0.0700	0.136	0.0853	0.148	0.05023	0.00013	**0.05**
Sodium	69.4	43.0	49.2	80.2	60.9	152	45.9	42.6	13.0	12.3	45.7	18.8	28.4	**200**
Lead	0.00014	0.00005	0.00002	0.00005	0.00026	0.00003	0.00014	0.00001	0.00001	0.00008	0.00010	0.00003	0.00002	**0.01**
Zinc	< 0.002	0.004	< 0.002	0.002	0.004	< 0.002	0.003	< 0.002	< 0.002	< 0.002	0.003	< 0.002	0.003	**5.0**

Notes: All results in mg/L with the exception of Conductivity (uS/cm) and pH, (---) indicates no data, (np) indicates not performed. Highlighted values exceed ODWS.

5.4 Reasonable Use Concept

Reference is made to previous monitoring reports that presented estimated criteria for significant contaminant indicators. The Reasonable Use Concept evaluation was developed from MECP Guideline B-7 and Guideline B-7-1 Determination of Contaminant Limits and Attenuation Zones. The criterion is based on the following equation.

$$X = B + F(W - B)$$

Where:

X = maximum acceptable concentration at property boundary

B = background concentration of parameter

F = factor of 0.5 for aesthetic parameter and 0.25 for health related parameter

W = ODWS value for each particular parameter

The MECP (in their June 23, 2014 Memorandum) indicated that RUC should be applied to the parameters of Schedule 5 Column 2 indicator list for groundwater leachate for parameters that had ODWS. The RUC was applied to samples from both the overburden and bedrock monitors. Background water quality for the overburden monitors utilized the chemical results from monitor MW 13 while background water quality for the bedrock monitors utilized the chemical results from the bedrock monitor at stations MW 1 and MW 13. The results for the shallow monitors RUC are illustrated on Plates 6A and 6C. The results for the bedrock monitors RUC are illustrated on plates 6B and 6D with the RUC exceedances for the shallow wells summarized below.

Spring 2019 Overburden Monitors Exceedances of RUC

Alkalinity	MW 3-II, 5-II, 6-II
TDS	MW 3-II, 5-II, 6-II
Iron	MW 5-II, 6-II, 9-II, 10-II, 11-II
Manganese	MW-3-II, 5-II, 6-II, 7-II
Barium	MW-5-II **, 6-II **

Fall 2019 Overburden Monitors Exceedances of RUC

Alkalinity	MW 3-II, 6-II
TDS	MW 3-II, 6-II
Iron	MW 6-II, MW-9-II*, 10-II, 11-II
Manganese	MW 3-II, 6-II, 10-II

** indicates value within ODWS.

Exceedances for the bedrock monitors are listed below.

Spring 2019 Bedrock Monitors Exceedances of RUC

Alkalinity	MW-5-I, MW-6-I**
TDS	MW 4-1, MW-5-I, MW-7-I
Barium	MW 3-I, MW 9-I, MW 10-I
Iron	MW-5-I, MW-6-I, MW-8-1
Manganese	MW MW-4-I, 5-I, MW-6-I, MW-9-I, MW-10-I, MW-11-I, MW 12-II
Sodium	MW-7-I

Fall 2019 Bedrock Monitors Exceedances of RUC

Alkalinity	MW5-I, MW 6-I
TDS	MW 3-I, MW 4-I, MW-5-I, MW-6-I
DOC	MW 5-1 MW 6-I
Barium	MW 5-1
Iron	MW-5-I, MW-6-I, MW-8-I
Manganese	MW-4-I, 5-I, MW-6-I, MW-8-I, MW-9-I, MW-10-I, MW-11-I, MW 12-II, MW-12-III

**indicates value within ODWS.

A historical review of past monitoring programs indicates elevated levels of parameters within the monitors immediately down-gradient of the refuse area. The 2019 monitoring indicated less shallow monitors exceeded RUC MAC while similar monitors exceeded the RUC MAC's as historically in the fall. Based on the data off site significant impact has not been observed and it is anticipated that the potential for impact will decrease over time due to closure of the landfill site.

5.5 Historical Chemical Comparison

The MECP in their June 23, 2014 Memorandum indicated that a historical comparison be conducted for the chemical results for all parameters in the MECP Schedule 5 Column 2 Indicator List for Groundwater and Leachate for all monitors. For monitors MW-1 to MW-7 the data dates back to 1993 while in the newer monitors MW-8 to MW-12 well the data is from 2001 to present. Background Monitor MW-13 data ranges from installation in 2006 to 2019. No data is available for this well for 2007-2008 as TSH could not locate it for sampling.

The review of the historical chemical data indicates that monitors within the landfill or near the mound experience more elevated parameters compared to those down gradient. For the most part the values for each parameter in each well either remain constant or show seasonal fluctuations with the occasionally spike that generally returns to normal.

The exception to this appears to be at Monitoring Location 6, which is located within the south-eastern portion of the landfill. The shallow groundwater monitor MW-6-II and the deeper monitor 6-I are both showing an increasing trend for Ammonia.

Although there appears to be an upwards trend at monitoring location MW-6, the down-gradient monitors at locations MW-4 and MW-7, are not showing increasing trends for the Schedule 5 Column 2 parameters. Although there does appear to be a plume around MW-6 at this time it does not appear to be spreading to the south or east. The chemical comparison graphs are presented in Appendix F.

5.6 Residential Wells

Four (4) residential wells were sampled during the fall of 2019 but only three in the spring. Residential Well R-1 was observed during the spring circuit to be compromised to the point it was unable to be sampled. The well was abandoned in the summer of 2019 and a new monitoring well was established adjacent to the former well at a depth similar to the former dug well. The remaining three wells are deeper drilled wells (R2, R3 and R4). R1 and R2 are situated down-gradient of the landfill site and R3 and R4 are situated up-gradient. The wells were sampled and analyzed for the same parameters as the monitoring wells. The results of the 2019 residential well monitoring circuits are presented on Table 5.5 with the locations of the residential wells and the surface water stations presented on Plate 2.

As in past monitoring programs, the majority of the parameters tested are within the ODWS with respect to the residential wells. TDS (total dissolved solids) in R4 exceeded the criteria during the fall sampling circuit. TDS is considered an aesthetic objective under the ODWS and has been historically elevated in some of the residential wells. R1 and R3 exceeded for iron and manganese in the fall sample obtained. Iron levels in R-2 that have in the past exceeded the ODWS were within the criteria during both sampling circuits. The results of the sampling are presented in Appendix D. The 2019 sampling program did not yield any detectable concentrations of VOCs in the residential wells.

The results of the analyses indicate that the landfill appears to have had no impact on the surrounding residential wells. It should be noted that R-1 is located down-gradient of the landfill. This property is now part of the landfill property. Because of its location, it is our opinion that R-1 intercepts the shallow groundwater regime that represents the on-site conditions. In addition, the former well has been used for several years as a groundwater monitoring station that has resulted in a long history of chemical data. For these reasons, it is our opinion that R-1 should be used as a trigger point (RUC exceedance would trigger action) when evaluating the potential for off-site impacts from the former landfill operation. R3 showed no indication of contamination during the spring sampling but had iron and manganese levels that exceeded the ODWS in the fall sampling period. R1 could not be sampled in the spring. This should be closely monitored in the future monitoring events to see if a trend is developing. The results for the R-1 monitor are summarized on Table 5.5 while the RUC summary for this well is illustrated on Plate 5E.

Table 5.5 2019 Residential Well Water Quality Summary

Parameters	Residential Monitors								ODWS
	R-1 May / 19	R-1 Oct.. / 19	R-2 May / 19	R-2 Oct. / 19	R-3 May / 19	R-3 Oct. / 19	R-4 May / 19	R4 Oct. / 19	
Alkalinity	Unable to	273	272	291	243	257	288	336	30-500
pH	Sample	7.93	7.54	7.79	7.95	7.72	8.01	7.75	6.5-8.5
Conductivity		721	695	777	552	825	743	1290	---
TDS		423	403	454	343	480	411	726	500
COD		< 8	< 8	< 8	< 8	< 8	25	< 8	---
Phosphorus		0.074	< 0.03	< 0.003	< 0.03	0.005	< 0.03	0.023	---
TKN			< 0.5		< 0.5		< 0.5		---
Ammonia		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	---
Phenolics			< 0.002		< 0.002		< 0.002		---
Sulphate		18	17	11	< 2	19	13	17	500
Chloride		55	62	70	32	92	52	210	250
Nitrite			< 0.03		< 0.03		< 0.03		1
Nitrate (as N)		1.43	3.97	1.14	0.62	3.56	3.15	1.59	10
DOC		1	1	< 1	3	2	5	1	5.0
Mercury			< 0.01		< 0.01		< 0.01		
Arsenic		0.0005	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0003	< 0.0002	0.025
Barium		0.262	0.0953	0.0983	0.0377	0.0495	0.117	0.141	1.0
Boron		0.100	0.009	0.025	0.010	0.048	0.016	0.029	5.0
Calcium		111	126	125	56.2	56.9	128	120	---
Cadmium		0.000131	0.000008	0.000013	0.000006	0.000019	0.000004	0.000011	0.005
Chromium		0.00159	0.00023	0.00040	0.00033	0.00019	0.00025	0.00058	0.05
Copper		0.0044	0.154	2.29	0.210	0.0546	0.109	0.0862	5.0
Iron		0.664	< 0.007	0.010	< 0.007	0.591	< 0.007	0.014	0.3
Potassium		4.30	1.34	1.14	1.42	0.793	3.26	3.22	---
Magnesium		7.54	3.24	3.32	1.58	1.84	3.29	3.29	---
Manganese		3.27	0.00022	0.00032	0.00056	0.263	0.00010	0.00061	0.05
Sodium		31.0	21.3	38.3	70.4	123	34.6	153	200
Lead		0.00134	< 0.003	0.00128	0.00237	0.00132	0.009	0.00143	0.01
Zinc		0.010	0.00064	0.106	0.019	0.029	0.00229	0.037	5.0

Notes: All results in mg/L with the exception of Conductivity (uS/cm) and pH, (---) indicates no data, (np) indicates not performed. **Highlighted** values exceed ODWS.

5.7 Surface Water Monitoring

Two surface water sampling station were also utilized during the May and October 2019 sampling period. The surface water station (S-1) is located down-gradient from the landfill site and is adjacent to R1. Surface Water location S-2 is a background surface water monitor that was added in the fall of 2014. The samples obtained were analyzed for the parameters listed in Column 3 of Schedule 5 of the Landfill Standards Guideline (Comprehensive List for Surface Water). In-field measurements were taken at the surface water stations as presented in Table 5.6. The results of the analyses are summarized in Table 5.7. The results of the analysis are included in Appendix D. All of the parameters tested are within their respective current Provincial Water Quality Objective (PWQO), Canadian Water Quality Objective (CWQO) and Aquatic Protection Value (APV) with the exception of phenolics for PWQO in both fall and spring samples for both the background sample and the down-gradient sample and Nitrates and Nitrites in the background sample in the fall. It should be noted that the water samples obtained from S-1 and S-2 in the fall were stagnant with very little water for sampling. It is our opinion that this is not representative of the flowing conditions. It is recommended that should this condition arise in the future, an additional location be found in the general area of S-1.

Table 5.6 2019 Surface Water Field Measurements

Parameter	Field Measurement			
	S-1	S-2	S-1	S-2
	May, 2019	May, 2019	Oct. 2019	Oct. 2019
Temperature (°C)	13.8	14.9	12.2	13.9
pH	7.75	7.52	7.92	7.74
Conductivity (us/cm)	505	555	441	648
Dissolved Oxygen (mg/L)	5.90	7.30	5.71	5.06
ORP	---	---	180	190
Flow	Pond – Continuous Flow	Pond – Continuous Flow	Pond - Stagnant	Pond - Stagnant

Table 5.7 2019 Surface Water Data

Parameters	Sample Locations				APV	CWQG	PWQO
	S-1 May 2019	S-2 May 2019	S-1 Oct. 2019	S-2 Oct. 2019			
BOD	< 4	< 4	16	23			
TSS	5	< 2	2	28			
Alkalinity (mg/L)	240	235	245	168			
pH	8.09	7.70	7.85	7.72		6.0-9.0	6.5-8.5
Conductivity	603	638	587	675			
TDS	366	363	354	489			
COD	< 8	11	16	60			
TKN	< 0.5	< 0.5	< 0.5	1.1			
Ammonia	< 0.1	< 0.1	< 0.1	0.3			
Phenolics	0.004	0.003	0.010	0.011	0.04**	0.004	0.001
Sulphate	4	7	17	89			
Chloride (mg/L)	56	67	33	36	180	128	
Nitrite	< 0.03	< 0.03	< 0.03	1.16		0.06	
Nitrate	0.18	< 0.06	1.00	10.3		2.9	
Mercury	< 0.01	< 0.01	< 0.01	< 0.01			
Arsenic	< 0.0002	< 0.0002	0.0003	0.0005	0.150		
Barium	0.0764	0.0593	0.115	0.115	2.30		
Boron	0.017	0.013	0.025	0.030	3.55	1.50	0.2
Calcium	96.7	89.5	98.7	106			
Cadmium	0.000005	0.000003	0.000030	0.000071	0.00021	0.000017	0.0005
Chromium	0.00016	0.00012	0.00016	0.00032	0.064		
Copper	0.0007	0.0007	0.0039	0.0044	0.0069		0.005
Iron (mg/L)	0.010	0.020	0.042	0.025	1.00*		0.3
Potassium	1.51	1.07	2.29	6.10			
Magnesium	3.27	2.90	3.85	4.67			
Manganese	0.00306	0.0143	0.0299	0.0286			0.05
Sodium	35.3	42.8	22.2	20.3			
Phosphorus	0.006	0.008	0.048	0.404			3.3***
Lead	<0.00001	<0.00001	0.00029	0.00017	0.02		0.005
Zinc	0.003	0.003	0.012	0.009	0.089	0.03	0.02

Notes: Highlighted values exceed standard, ** USA EPA Criterion, ** Lowest observed effect criterion*
**** Based on 10º Celcius at 8pH, All results in mg/L with the exception of Conductivity (uS/cm) and pH,*
PWQO=Provincial Water Quality Objective, CWQO=Canadian Water Quality Objective, APV=Aquatic Protection Value

5.8 Groundwater Trigger Mechanism

Groundwater trigger mechanisms and contingency planning have been developed with respect to VOCs parameters due to detected levels in down gradient wells in past monitoring events. For the down-gradient wells (MW-8, MW-9, MW-10 and MW-11), parameters that have maximum acceptable concentrations (MACs) should consider a trigger of 0.5 of the MAC. The VOC parameters that have interim MACs (IMACs) should consider a trigger of 0.75 of the IMAC. If concentrations of parameters exceed the trigger values, then the contingency plan(s) should be implemented.

For example, consider benzene with an MAC in the ODWS of 5 µg/L. If a groundwater sample is greater than 2.5 µg/L, the contingency plan is triggered. The groundwater trigger mechanism was not exceeded for VOCs for any monitoring well during the 2019 monitoring period.

In addition, to address the MECP concern for a trigger mechanism for the RUC parameters prior to reaching the property boundary, R-1 was selected to be representative of the shallow groundwater on-site. At this location, the potential for off-site impact of the RUC parameters in the shallow groundwater was evaluated as an early warning sign (see Plate 6-E for 2018 results). R-1 was found to be unable to be sampled in the spring. A new shallow monitor was installed I the late fall to replace this well. This monitor was sampled in the fall. Exceedances of the RUC for iron and manganese were recorded for R-1 in the fall. The contingency plan indicates that if a second exceedance is recorded, then the down-gradient wells should be sampled. R-2 is the only well within two (2) kilometers down-gradient of R-1. The results of the iron and manganese testing for R-2 showed non-recordable levels of iron and negligible levels of manganese in both the spring and fall samples. Both were within the ODWS.

Contingency planning may be broken into the following steps when a trigger value is exceeded:

1. Immediately re-sample the well where an exceedance of the trigger value was observed;
2. If a second exceedance is reported, sample down-gradient wells to confirm that off-site migration has not occurred (re-sample if exceedance of trigger value at down-gradient wells);
3. If down-gradient wells at the Site boundary are impacted above trigger value, notify private well owners down-gradient of the Site and sample private wells on a monthly basis for parameter(s) of concern;
4. If private wells are impacted above the triggers values as outlined above, the Township of Douro-Dummer will need to provide an alternative water supply to the home owner (i.e. bottled water, temporary water supply, new well, etc.) until the exceedance of the trigger value subsides; and
5. If impacted, groundwater is migrating off-site (greater than Guideline B-7 values, MECP Table 2 Standards or exceeds ODWS), remediation will need to be implemented or greater attenuation areas established.

6. Conclusions and Recommendations

This report presents the results of the 2019 groundwater-monitoring program carried out at the Halls Glen Landfill Site in the Township of Douro-Dummer. It is our professional opinion that the groundwater level and chemical data do not indicate a significant anomaly from the results of the previous years.

The majority of the parameters are within their acceptable limits with a few exceedances in the shallow monitors located adjacent to the refuse area as determined by MECP Guideline B-7. The well trends should be monitored during future monitoring programs to evaluate if the exceedances are increasing.

Initiated during the 2002-monitoring program, monitors MW 3, MW 4, MW 5, MW 6 and MW 7, the bedrock monitor at MW 11 and the residential monitors have been sampled for VOCs annually during both sampling periods. Monitors MW5 and MW6, located within the former landfill, have historically detected low concentrations of some VOC parameters during all of the sampling periods. In 2019 only MW 5-I had recordable values for monochlorobenzene and benzene in the fall sample. The remainder of the monitors have indicated sporadic trace levels of VOCs with no trends or duplication of results. MW 11-I (bedrock), had been yielding relatively low levels of toluene, ethylbenzene and xylenes that were trending downwards towards non-detectable or trace levels of in past years. The 2016-2019 results have indicated non-detectable levels for all VOCs in MW-11-I and MW-11-II in both sampling events. Toluene levels (that meet ODWS) have been measured in MW 3-I and MW 4-I in the past but not for the last 8 monitoring periods. No VOC levels were recorded in any of the other monitoring wells or residential wells during either sampling period in 2019. Future monitoring programs should continue to evaluate the data collected to evaluate the VOC monitoring program. No VOC trigger mechanism values were met during the 2019 monitoring program.

Landfill gas was not detected during the 2019 sampling circuits. The water quality at the residential wells is not interpreted to be affected by the landfill.

Historical trends for BOD, TSS, Alkalinity, pH, Conductivity, COD, Ammonia, Sulphate, Chloride, Nitrate, Barium, Boron, Calcium, Iron, Magnesium, Sodium and Manganese have been tracked annually. All monitors have either been staying stable or decreasing for all parameters with very few exceptions. Monitor M 6-I and MW 6-II have been showing increases in Ammonia for the last few years although Monitors MW 4 and MW 12 that are immediately down gradient of MW 6 do not show increases for ammonia. Iron levels in monitor MW 5-1 has remained higher than other wells. Iron levels at 6-II (landfill shallow monitor) which appeared to be increasing in the past few years showed fluctuations this year but no longer appears to be increasing.

Alkalinity, TDS, Iron and Manganese levels generally exceed the ODWS and the RUC for shallow monitors MW 3-II, MW-5-II and MW 6-II. These wells are located within the landfill area. Shallow monitors immediately down gradient of these monitors (MW-4-II and MW-12-I) generally don't show exceedances of the ODWS or RUC indicating that the impacted shallow groundwater is not impacting the down-gradient shallow ground-water. In the deeper aquifer, landfill monitors MW-5 and OW-6 also have many exceedances of the ODWS and RUC.

Although there are occasional exceedances at down-gradient monitors MW-12-II and MW-12-III, there are rarely exceedances at the monitors further down gradient with the exception of manganese in MW-11-I. Manganese levels in MW-11-I should be monitored in future sampling events to see if the levels increase.

It is our professional opinion that even though the ground water within the landfill area may be impacted, it does not appear to impacting the down-gradient, shallow or deep groundwater. Surface water samples taken at the site do not show any impact related to the landfill. Down-gradient residential wells show no impact from the landfill.

Exceedance of the RUC for R-1 were noted for iron and manganese in the fall. Down-gradient well R-2 did not show any elevated levels for each parameter. R-1 was formerly a dug well that became unusable and has been replaced by a monitoring station. This monitored was sampled for the first time in the fall and should be closely watched to see if a trend is developing.

Future monitoring programs should consider the following recommendations.

1. At the recommendation of the MECP, the chemical parameter list for monitoring and residential wells should include the parameters in Column 1 (Groundwater) in the spring and Column 2 in the fall. Shallow wells that may discharge to surface water along with surface water samples should be analyzed for Column 3 of Schedule 5 in the Landfill Standards, A Guideline on Regulatory and Approval Requirements for New or Expanding Sites. The surface water monitoring should include the new background station (S-2) that was established in 2014.
2. Sampling should continue VOCs for wells that surround the landfill (MW 3-7) as well as the residential wells. Monitors MW-11-I and MW-11-II had shown detectable levels of VOC's in the past but have not for nine straight monitoring events. It is recommended that VOC monitoring be discontinued at these monitoring wells.
3. The monitoring program should continue to utilize the monitor installed in the fall of 2002 (MW-13) to evaluate the background water quality in the shallow overburden.
4. The use of S-1(surface Water) as a future predictor of potential RUC impacts offsite should continue for future monitoring periods. If S-1 is stagnant or dry it is recommended that a suitable surface water location be found in the general area of S-1.
5. The monitors should continue to be monitored for any trend increases.

6.1 Signatures

We trust that this report meets with your immediate requirements. Should you have any questions, please contact our office.

Sincerely,

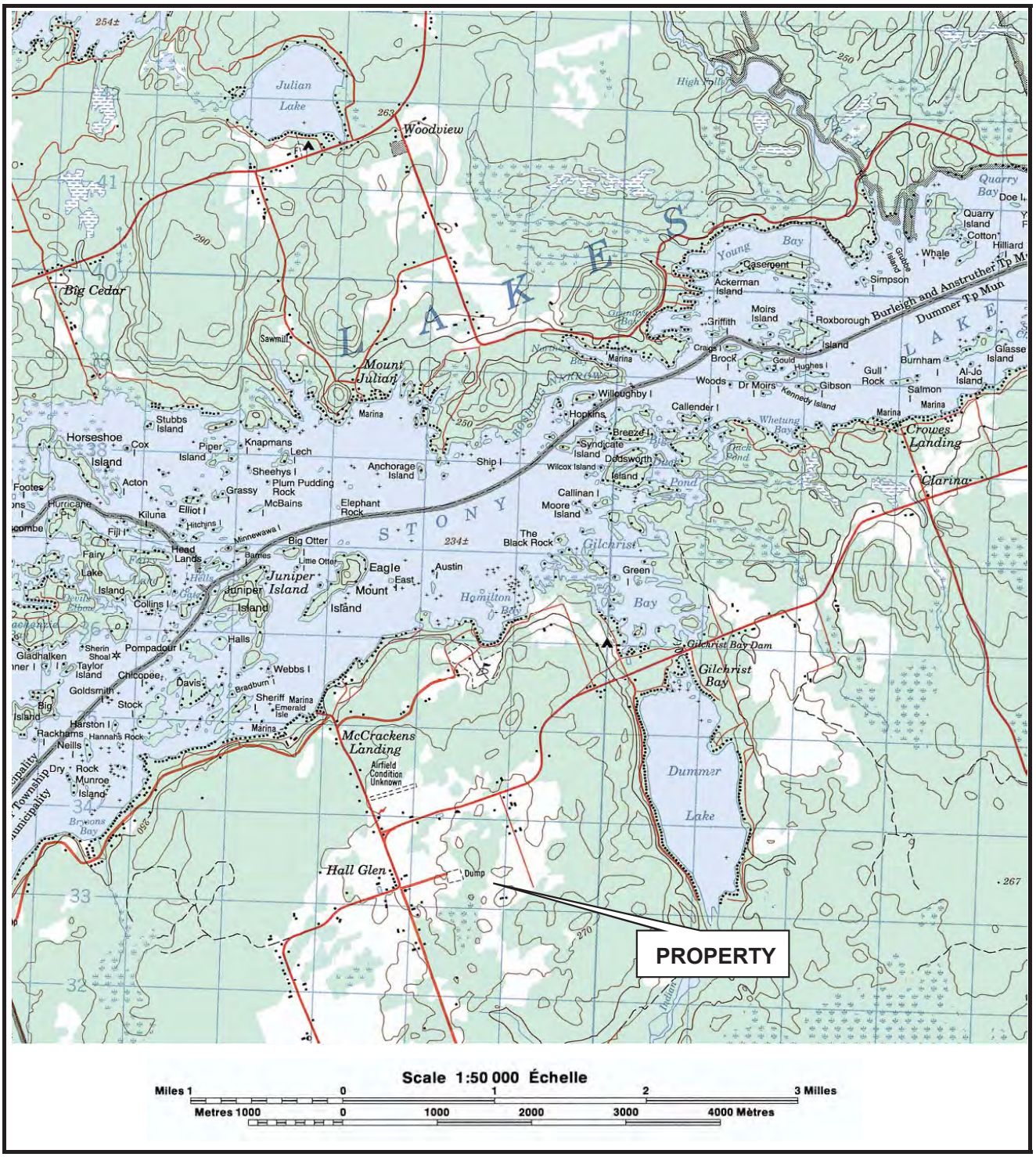
GHD

Steven Gagne, H.B.Sc.

Nyle McIlveen, P.Eng.

LICENSED PROFESSIONAL ENGINEER
N. C. McILVEEN
PROVINCE OF ONTARIO

Enclosures



Base map complied from Energy, Mines and Resources Canada Map 31 D/9 dated 1996. Air photography 1999.

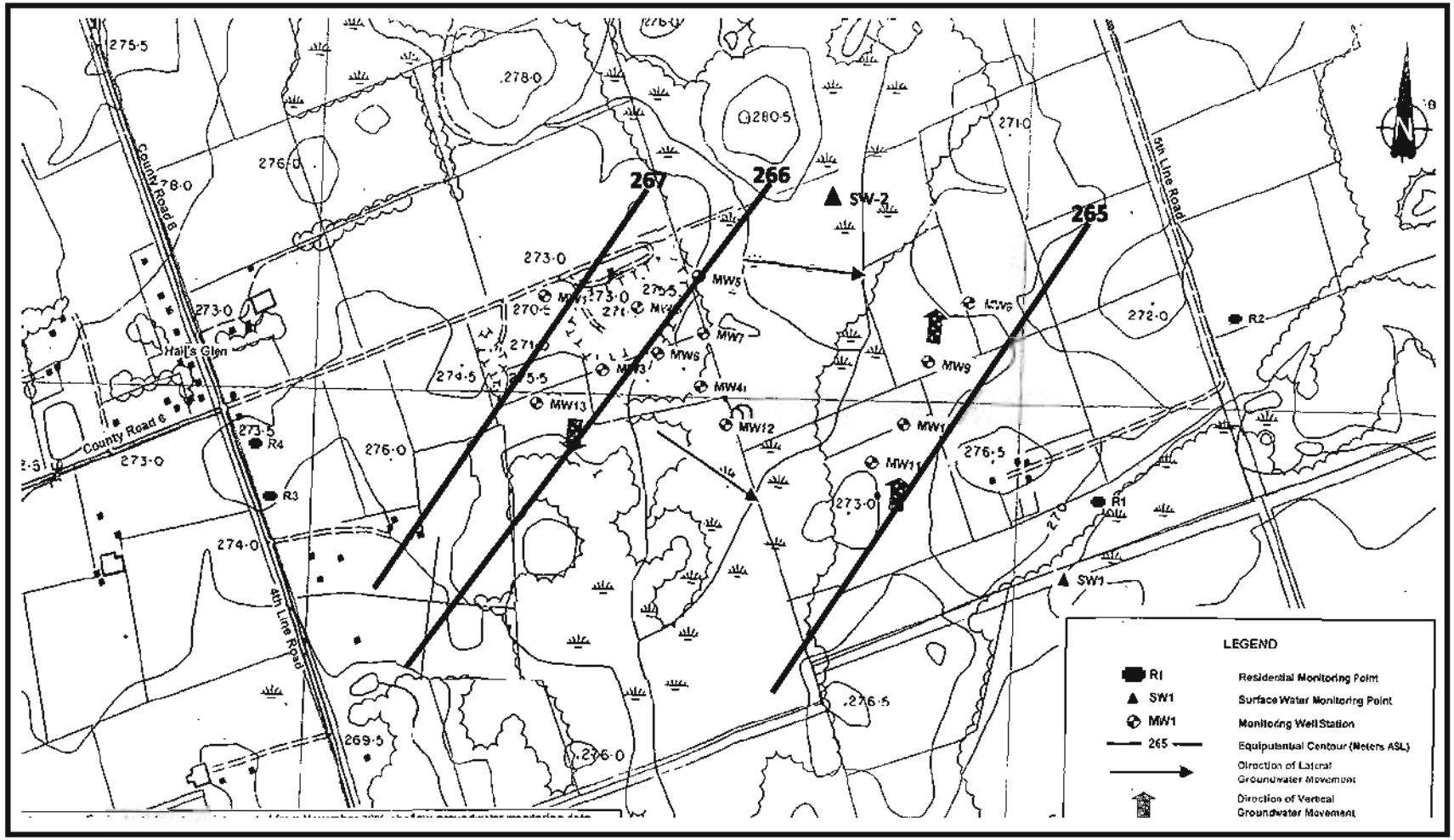
Scale:
1:50000
Coordinate System
NAD 1983 UTM

Halls Glenn Landfill
Douro-Dummer Township
Peterborough County

11193337-01
January, 2019

Vicinity Plan

Plate 1



Source: Ministry of Natural Resources Base Map Series10 17 7250 49300 dated 1990, Air Photo 1984

Scale: 1: 18000 Coordinate System: NAD 1983 UTM Zone 17	N	GHD	Halls Glenn Landfill Douro Dummer Township Peterborough County **Property Plan**
			11156057-01 January, 2019 **Plate 2**

Source: Ministry of Natural Resources Base Map Series10 17 7250 49320 dated 1990, Air Photo 1994

Scale: 1: 18000 Coordinate System: NAD 1983 UTM Zone 17	N	GHD	Halls Glenn Landfill Douro Dummer Township Peterborough County **Property Boundary Plan**	11156057-01 January, 2019 **Plate 3**

2018 FIELD DATA SUMMARY

Hall's Glen Landfill Site
Township of Douro-Dummer, County of Peterborough
Project No. 11156057-01

	June 6, 2018						*October 11, 2017*					
Monitoring Well	**TEMP (°C)**	**EC (uS/cm)**	**DO (ppm)**	**ORP mV**	**METHANE (% CH_4) / H^2S (ppm)**	**pH**	**TEMP (°C)**	**EC (uS/cm)**	**DO (ppm)**	**ORP mV**	**METHANE (% CH_4) / H^2S (ppm)**	**pH**
MW 1-I	8.9	767	6.4	164	0/0	7.7	10.8	9	6.6	75	0/0	6.5
MW 1-II					0/0						0/0	
MW 2-I					0/0						0/0	
MW 2-II					0/0						0/0	
MW 3-I	11.7	729	3.7	29	0/0	7.4	10.9	621	9.5	49	0/0	6.7
MW 3-II	11.3	490	3.7	86	0/0	7.0					0/0	
MW 4-I	8.5	477	4.1	-9	0/0	7.6	10.0	723	7.5	138	0/0	7.9
MW 4-II	10.3	295	8.6	-23	0/0	7.8	10.3	565	10.5	134	0/0	8.1
MW 5-I	10.2	958	7.2	-72	0/0	7.1	11.3	1124	9.0	44	0/0	6.1
MW 5-II	12.1	1236	9.6	101	0/0	7.0					0/0	
MW 6-I	11.2	918	4.2	-60	0/0	7.2	10.8	919	10.1		0/0	6.9
MW 6-II	11.7	1953	3.3	-88	0/0	6.9	10.9	832	11.8	55	0/0	6.7
MW 7-I	10.1	590	6.0	56	0/0	8.0	10.3	597	10.6	51	0/0	7.3
MW 7-II	11.3	370	9.8	63	0/0	7.7	11.1	1662	9.8	86	0/0	6.7
MW8-I	9.2	570	4.8	198	0/0	7.7	12.2	695	3.7	21	0/0	6.4
MW8-II	8.5	419	3.4	196	0/0	7.7	13.4	803	8.8	79	0/0	6.1
MW9-I	10.5	420	3.7	-195	0/0	7.9	13.2	533	2.8	-220	0/0	7.6
MW9-II	10.3	404	3.6	-125	0/0	7.7	14.1	655	4.1	-86	0/0	7.4
MW10-I	10.2	447	4.0	-70	0/0	7.8	13.2	556	3.6	-126	0/0	7.5
MW10-II	10.6	442	3.6	-109	0/0	7.6	13.8	518	4.0	-115	0/0	7.6
MW11-I	9.5	435	3.8	-95	0/0	7.8	12.9	589	4.4	-125	0/0	7.7
MW11-II	9.1	345	4.0	-93	0/0	7.8	12.5	528	5.7	-122	0/0	7.7
MW12-I	8.5	457	3.0	-92	0/0	7.6	9.9	477	5.9	-149	0/0	7.6
MW12-II	9.1	501	4.1	-55	0/0	7.7	9.2	576	6.5	-106	0/0	7.5
MW12-III	10.1	510	5.7	147	0/0	7.7	9.5	572	10.8	-51	0/0	7.7
MW 13-I	9.1	385	9.9	158	0/0	7.9	9.6	652	10.3	13	0/0	7.8
MW 13-II	8.9	292	7.1	129	0/0	7.9	10.8	502	8.7	10	0/0	7.6

Notes:
(---) indicates no data

2018 WATER LEVEL MONITORING SUMMARY

Hall's Glen Landfill Site
Township of Douro-Dummer, County of Peterborough
Project No. 11156057-01

		June 6, 2018		October 14, 2018	
MONITORING WELL	TOP OF CASING ELEVATION (M)	WATER LEVEL FROM TOP OF CASING (M)	WATER LEVEL ELEVATION (M)	WATER LEVEL FROM TOP OF CASING (M)	WATER LEVEL ELEVATION (M)
MW1-I	271.24	2.70	268.54	3.52	267.72
MW1-II	271.24	dry	---	dry	---
MW2-I	282.49	dry	---	dry	---
MW2-II	282.53	dry	---	dry	---
MW3-I	269.23	1.10	268.13	2.30	266.93
MW3-II	269.23	1.18	268.05	dry	---
MW4-I	268.28	2.05	266.23	2.50	265.78
MW4-II	268.28	1.86	266.42	2.31	---
MW5-I	271.35	4.92	266.43	5.13	266.22
MW5-II	271.35	3.30	268.05	dry	---
MW6-I	271.01	4.73	266.28	5.16	265.85
MW6-II	271.01	3.08	267.93	3.98	267.03
MW7-I	269.03	2.97	266.06	3.15	265.88
MW7-II	269.03	2.31	266.72	2.96	266.07
MW8-I	270.74	4.48	266.26	5.55	265.19
MW8-II	270.74	4.46	266.28	6.59	264.15
MW9-I	267.25	0.78	266.47	1.30	265.95
MW9-II	267.25	1.10	266.15	2.11	265.14
MW10-I	267.97	2.09	265.88	2.55	265.42
MW10-II	267.97	2.22	265.75	2.51	265.46
MW11-I	268.50	2.52	265.98	2.89	265.61
MW11-II	268.50	2.48	266.02	3.04	265.46
MW12-I	268.00	1.68	266.32	2.16	265.84
MW12-II	268.00	1.61	266.39	2.11	265.89
MW12-III	268.00	1.52	266.48	2.11	265.89
MW13-I	na	1.55	---	2.27	---
MW13-II	na	1.65	---	2.37	---

Notes:

All measurments presented in metres.

MP refers to measuring point (top of protective casing) above surrounding ground surface.

(na) - indicates not available

PLATE 5

EVALUATION OF REASONABLE USE CRITERIA - OVERBURDEN WELLS, JUNE 2018
Hall's Glen Landfill Site

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	OVERBURDEN MONITORS						BACKGROUND WELL
				MW 2-II	MW 3-II	MW 4-II	MW 5-II	MW 6-II	MW 7-II	MW 13-II
Alkalinity	500	221	360.50		**609**	305	**819**	**929**	**609**	221
pH	8.5	7.89	8.20		7.66	7.94	7.18	7.41	7.66	7.89
Conductivity		503			1300	356	1480	2060	1300	503
TDS	500	269	384.50		**794**	220	**969**	**1310**	**794**	269
COD		8			11	< 8	51	87	11	8
Ammonia		0.9			2.1	< 0.1	11.1	19.7	2.1	0.9
Sulphate	500	18	259.00		78	3	9	180	78	18
Chloride	250	44	147.00		26	4	91	99	26	44
Nitrate	10	0.7	5.36		**7.6**	0.07	1.02	< 0.06	7.6	0.71
Barium	1	0.16	0.58		0.173	0.0955	**0.689**	**0.701**	0.173	0.16
Boron	5	0.074	2.54		0.435	0.045	0.362	0.817	0.435	0.074
Calcium		130			231	107	273	438	231	130
Iron	0.3	0.02	0.16		**1.4**	< 0.007	**29.9**	**21.4**	**1.4**	0.024
Manganese	0.05	0.00378	0.03		**3.15**	0.0678	**6.76**	**11.7**	**3.15**	0.00378
Sodium	200	29.3	114.65		58.5	11.4	64	121	58.5	29.3

All results are represented in mg/L unless otherwise stated

ODWS - Ontario Drinking Water Standards, 2000

RUP - Reasonable Use Policy (Policy B-7) Bolded values exceed RUP.

Background Well MW1-I was reported at less than detection limit for Nitrate (<0.05).

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	OVERBURDEN MONITORS						BACKGROUND WELL
				MW 8-II	MW 9-II	MW 10-II	MW 11-II	MW 12-I		MW 13-II
Alkalinity	500	221	360.50	235	247	251	238	267		221
pH	8.5	7.89	8.20	7.82	7.99	7.82	8.04	7.93		7.89
Conductivity		503		639	616	610	509	690		503
TDS	500	269	384.50	349	317	380	294	**414**		269
COD		8		11	8	< 8	< 8	< 8		8
Ammonia		0.9		< 0.1	< 0.1	0.6	0.6	0.2		0.9
Sulphate	500	18	259.00	8	10	11	10	24		18
Chloride	250	44	147.00	72	44	52	13	51		44
Nitrate	10	0.7	5.36	0.2	< 0.06	0.4	< 0.06	< 0.06		0.71
Barium	1	0.16	0.58	0.107	0.16	0.566	0.361	**0.62**		0.16
Boron	5	0.074	2.54	0.043	0.039	0.128	0.164	0.117		0.074
Calcium		130		106	106	128	99.9	135		130
Iron	0.3	0.02	0.16	0.016	**0.372**	**4.28**	**1.52**	< 0.007		0.024
Manganese	0.05	0.00378	0.03	0.0052	0.0159	**0.0931**	0.0268	0.00515		0.00378
Sodium	200	29.3	114.65	37.4	34.6	6.56	8.7	13.9		29.3

PLATE 6A

EVALUATION OF REASONABLE USE CRITERIA - BEDROCK WELLS, JUNE 2018
Hall's Glen Landfill Site

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	BEDROCK MONITORS						BACKGROUND WELL	
				MW2-I	MW3-I	MW4-I	MW5-I	MW6-I	MW7-I	MW1-I	MW13-I
Alkalinity	500	259	379.50		272	310	**640**	**469**	301	291	227
pH	8.5	8.09	8.30		8.01	8.01	7.52	7.84	7.76	8.07	8.11
Conductivity		880			643	743	1340	1270	435	1170	590
TDS	500	544	522.00		354	397	**774**	**686**	254	774	314
COD		10.5			< 8	< 8	38	25	10	8	13
Ammonia		0.1			0.1	0.4	10.2	6.2	< 0.1	0.1	0.1
Sulphate	500	45.5	272.75		61	350	15	43	12	76	15
Chloride	250	130	190.00		40	65	130	110	14	160	100
Nitrate	10	1.2			1.41	0.88	2.74	0.61	< 0.06	1.48	0.94
DOC	5	2	3.50		**4**	**5**	**20**	**9**	3	2	2
Barium	1	0.15415	0.58		0.0998	0.115	0.484	0.313	0.123	0.238	0.0703
Boron	5	0.0665	2.53		0.065	0.092	0.295	0.241	0.539	0.111	0.022
Calcium		135.2			135	135	259	194	35.7	174	96.4
Iron	0.3	0.01	0.15		< 0.007	< 0.007	**21.8**	**1.24**	< 0.007	0.007	0.007
Manganese	0.05	0.0001	0.03		0.00437	**0.234**	**2.03**	**1.42**	0.00052	0.00012	0.00008
Sodium	200	48.7	124.35		17.8	27.7	54.6	64.1	143	65.8	31.6

All results are represented in mg/L unless otherwise stated

ODWS - Ontario Drinking Water Standards, 2000

RUP - Reasonable Use Policy (Policy B-7)

Bolded values exceed RUP.

Background Well MW1-I was reported at less than detection limit for Nitrate (<0.05).

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	BEDROCK MONITORS						BACKGROUND WELL	
				MW8-I	MW9-I	MW10-I	MW11-I	MW12-II	MW12-III	MW1-I	MW13-I
Alkalinity	500	259	379.50	291	275	241	265	284	281	291	227
pH	8.5	8.09	8.30	7.89	8.15	8.03	8.11	8.11	8.01	8.07	8.11
Conductivity		880		816	633	638	669	767	747	1170	590
TDS	500	544	522.00	457	386	389	391	429	463	774	314
COD		10.5		< 8	19	9	< 8	< 8	< 8	8	13
Ammonia		0.1		< 0.1	0.6	< 0.1	0.8	0.2	< 0.1	0.1	0.1
Sulphate	500	45.5	272.75	16	68	28	53	71	25	76	15
Chloride	250	130	190.00	82	15	51	32	39	60	160	100
Nitrate	10	1.2	5.61	< 0.06	0.14	0.27	< 0.06	< 0.06	< 0.06	1.48	0.94
DOC	5	2	3.50	1	1	3	2	2	< 1	2	2
Barium	1	0.15415	0.58	0.096	0.416	**0.702**	0.377	0.18	0.0735	0.238	0.0703
Boron	5	0.0665	2.53	0.108	0.385	0.242	0.492	0.533	0.115	0.111	0.022
Calcium		135.2		125	77.2	112	118	119	153	174	96.4
Iron	0.3	0.01	0.15	0.031	0.096	**0.481**	0.028	0.033	0.04	0.007	0.007
Manganese	0.05	0.0001	0.03	0.00156	**0.0526**	**0.191**	**0.0814**	**0.156**	0.0161	0.00012	0.00008
Sodium	200	48.7	124.35	47.1	41.8	12	14.8	38.5	14.5	65.8	31.6

PLATE 6B

EVALUATION OF REASONABLE USE CRITERIA - OVERBURDEN WELLS, NOVEMBER 2018
Hall's Glen Landfill Site

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	OVERBURDEN MONITORS						BACKGROUND WELL
				MW 2-II	MW 3-II	MW 4-II	MW 5-II	MW 6-II	MW 7-II	MW 13-II
Alkalinity	500	282	391.00			315		**505**	**1080**	282
pH	8.5	7.91	8.21			7.87		7.74	7.58	7.91
Conductivity		610				701		1080	2200	610
TDS	500	371	435.50			417		**686**	**1470**	371
COD		< 8				< 8		17	95	< 8
Ammonia		< 0.1				< 0.1		< 0.1	23.2	< 0.1
Sulphate	500	15	257.50			11		43	60	15
Chloride	250	30	140.00			50		65	140	30
Nitrate	10	1.4	5.69			0.77		4.76	0.12	1.37
Barium	1	0.106	0.55			0.143		0.304	0.432	0.106
Boron	5	0.027	2.51			0.044		0.269	0.673	0.027
Calcium		109				116		145	308	109
Iron	0.3	0.01	0.16			0.017		0.111	**0.178**	0.013
Manganese	0.05	0.0096	0.03			0.00114		0.00925	**7.44**	0.0096
Sodium	200	31.8	115.90			20.6		55.6	**128**	31.8

All results are represented in mg/L unless otherwise stated

ODWS - Ontario Drinking Water Standards, 2000

RUP - Reasonable Use Policy (Policy B-7) *Bolded values exceed RUP.*

Background Well MW1-I was reported at less than detection limit for Nitrate (<0.05).

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	OVERBURDEN MONITORS						BACKGROUND WELL
				MW 8-II	MW 9-II	MW 10-II	MW 11-II	MW 12-I		MW 13-II
Alkalinity	500	282	391.00	272	272	244	247	251		282
pH	8.5	7.91	8.21	8.15	8.14	7.9	7.65	7.95		7.91
Conductivity		610		984	801	619	603	593		610
TDS	500	371	435.50	**583**	423	360	354	346		371
COD		< 8		9	8	10	9	13		< 8
Ammonia		< 0.1		0.1	0.2	0.6	0.9	0.1		< 0.1
Sulphate	500	15	257.50	14	16	7	13	22		15
Chloride	250	30	140.00	120	85	47	29	45		30
Nitrate	10	1.4	5.69	0.94	0.62	0.23	< 0.06	< 0.06		1.37
Barium	1	0.106	0.55	0.19	0.203	0.472	0.477	**0.667**		0.106
Boron	5	0.027	2.51	0.023	0.091	0.113	0.129	0.12		0.027
Calcium		109		139	97.6	90.8	102	96.7		109
Iron	0.3	0.01	0.15	1.32	**0.526**	**9.96**	**3.35**	< 0.007		0.013
Manganese	0.05	0.0096	0.03	0.0389	0.0211	**0.0751**	**0.0313**	0.00269		0.0096
Sodium	200	31.8	115.90	46	48.3	8.17	5.56	10.4		31.8

PLATE 6C

EVALUATION OF REASONABLE USE CRITERIA - BEDROCK WELLS, NOVEMBER 2018
Hall's Glen Landfill Site

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	BEDROCK MONITORS						BACKGROUND WELL	
				MW2-I	MW3-I	MW4-I	MW5-I	MW6-I	MW7-I	MW1-I	MW13-I
Alkalinity	500	282.5	391		354	376	**677**	**469**	342	292	273
pH	8.5	7.975	8.2		7.82	7.76	7.56	7.75	**8.26**	7.96	7.99
Conductivity		966			815	904	1520	1190	787	1110	822
TDS	500	564	532.00		471	**537**	**877**	**703**	454	671	457
COD		8			< 8	8	41	15	< 8	8	8
Ammonia		0.1			< 0.1	0.2	13.3	6.5	< 0.1	0.1	0.1
Sulphate	500	43	271.50		16	27	10	42	30	73	13
Chloride	250	126.5	188.25		52	67	120	100	45	160	93
Nitrate	10	2.0	5.98		2.26	1.58	0.54	0.14	0.25	2.7	1.21
DOC	5	2.5	3.75		2	3	**14**	6	1	2	3
Barium	1	0.1537	0.58		0.112	0.151	**0.587**	0.285	0.131	0.229	0.0784
Boron	5	0.062	2.53		0.045	0.11	0.45	0.213	0.54	0.104	0.02
Calcium		114.4			129	155	230	163	40.6	157	71.8
Iron	0.3	0.01	0.15		0.013	0.061	**28.4**	**2.24**	< 0.007	0.008	0.007
Manganese	0.05	0.003585	0.03		**0.102**	**0.0535**	**2.12**	**1.37**	0.00568	0.00682	0.00035
Sodium	200	70.55	135.28		30.7	34.2	81.9	63.7	**148**	70.5	70.6

All results are represented in mg/L unless otherwise stated

ODWS - Ontario Drinking Water Standards, 2000

RUP - Reasonable Use Policy (Policy B-7), *Bolded values exceed RUP.*

Background Well MW1-I was reported at less than detection limit for Nitrate (<0.05).

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	BEDROCK MONITORS						BACKGROUND WELL	
				MW8-I	MW9-I	MW10-I	MW11-I	MW12-II	MW12-III	MW1-I	MW13-I
Alkalinity	500	282.5	391	292	279	240	256	287	294	292	273
pH	8.5	7.975	8.24	7.85	8.41	8.26	8.19	8	7.83	7.96	7.99
Conductivity		966		818	606	649	647	732	708	1110	822
TDS	500	564	532.00	434	280	374	380	449	426	671	457
COD		8		12	37	< 8	15	15	< 8	8	8
Ammonia		0.1		< 0.1	0.6	0.2	0.7	0.2	< 0.1	0.1	0.1
Sulphate	500	43	271.50	17	31	23	52	66	23	73	13
Chloride	250	126.5	188.25	81	18	50	30	43	56	160	93
Nitrate	10	2.0	5.98	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.08	2.7	1.21
DOC	5	2.5	3.75	< 1	1	< 1	2	2	1	2	3
Barium	1	0.1132	0.56	0.102	0.769	0.747	0.37	0.168	0.0347	0.148	0.0784
Boron	5	0.0495	2.52	0.104	0.612	0.253	0.478	0.501	0.08	0.079	0.02
Calcium		112.4		117	59	98.5	103	97.7	136	153	71.8
Iron	0.3	0.01	0.15	**0.031**	< 0.007	0.043	0.148	0.024	0.2	0.008	0.007
Manganese	0.05	0.003585	0.03	**0.0452**	**0.0706**	**0.133**	**0.0835**	**0.149**	**0.0493**	0.00682	0.00035
Sodium	200	70.55	135.28	49.7	52.4	14.7	15.7	40.4	15.2	70.5	70.6

PLATE 6D

EVALUATION OF REASONABLE USE CRITERIA - OVERBURDEN WELLS, 2018
Hall's Glen Landfill Site

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	OVERBURDEN MONITORS		BACKGROUND WELL	
				R-1 Spring	R-1 Fall	MW 13-II Spring	MW 13-II Fall
Alkalinity	500	251.5	375.75	228	267	221	282
pH	8.5	7.9	8.20	7.98	7.93	7.89	7.91
Conductivity		556.5		623	667	503	610
TDS	500	320	410.00	320	357	269	371
COD		8		8	11	8	8
Ammonia		0.5		0.1	0.3	0.9	0.1
Sulphate	500	16.5	258.25	4	10	18	15
Chloride	250	37	143.50	56	51	44	30
Nitrate	10	1.0	5.52	0.12	0.24	0.71	1.37
Barium	1	0.133	0.57	0.0663	0.0946	0.16	0.106
Boron	5	0.0505	2.53	0.037	0.017	0.074	0.027
Calcium		119.5		101	111	130	109
Iron	0.3	0.02	0.16	**0.3**	**0.371**	0.024	0.013
Manganese	0.05	0.01	0.03	0.00241	**0.308**	0.00378	0.0096
Sodium	200	30.55	115.28	38.8	33.5	29.3	31.8

All results are represented in mg/L unless otherwise stated

ODWS - Ontario Drinking Water Standards, 2000

RUP - Reasoneble Use Policy (Policy B-7)

Bolded values exceed RUP.

Background Well MW1-I was reported at less than detection limit for Nitrate (<0.05).

PLATE 6E

Appendix A
MOECC C of A and Correspondence

Ministry of the Environment and Climate Change

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M E M O R A N D U M

September 8, 2016

TO: C. Johnston
Senior Environmental Officer
Peterborough District Office
Eastern Region

FROM: B. W. Metcalfe
Senior Environmental Officer
Water Resources Unit – Surface Water Group
Technical Support Section
Eastern Region

RE: 2015 Groundwater Monitoring Report – Hall's Glen Landfill Site
Lot 25, Concession 4, Geographic Township of Dummer
Township of Douro-Dummer, County of Peterborough
Environmental Compliance Approval (ECA) No. 341007

I have reviewed the noted report dated March 2016, prepared by GHD, for the Township of Douro-Dummer, the landfill site Owner. The following comments are offered relative to surface water impact concerns:

Background Information

The Hall's Glen landfill Site is situated along the south side of County Road no. 6 approximately 10 km north of the community of Warsaw. The site operates per the provisional Certificate of Approval No. 341004 dated October 8, 1980. The site also operates as a transfer site according to ECA No. A341007. It was reported that during the summer of 2003 the landfill site was prepared for closure. The landfill area has been mounded and capped and it was understood that that further work was conducted in 2004 and 2005. The landfill operates as a natural attenuating site.

Surface Water Regime

The landfill site is situated within the Trent River Basin. The major surface water features in the landfill site area include Stony Lake located north of the Site and Dummer Lake located to the east of the Site.

Based on overburden groundwater monitoring data GEO-LOGIC determined that the pattern of overburden groundwater movement within the Site area appears to be in a southeasterly direction. There is possible groundwater discharge from the Site area to the wetland located southeast of the landfill.

2015 Surface Water Sampling Program

Surface water samples were collected on two occasions during May and November of 2015. Surface water sample station S-1 is located downgradient from the landfill site and sample station S-2 is the background surface water monitor that was added in 2014. The collected samples were analyzed for the parameters listed in Column 3 of Schedule 5 of the Landfill Standards Guidelines (Comprehensive List for Surface Water). In-field measurements of water temperature, pH, conductivity and dissolved oxygen were taken for each sampling event.

2015 Surface Water Sampling Results

Upstream Background (S-2):

Surface water sample station, newly established in 2014, is located north, upgradient of the landfill site. Sampling was conducted on two occasions in 2015 during May (spring) and November (fall).

The water quality general chemistry was characterized having BOD (<4 mg/L), COD (9 – 18 mg/L), field Dissolved Oxygen (8.18 mg/L, Nov. 19/15), field Conductivity (109 µS/cm, Nov. 19/15), field pH (7.82, Nov. 19/15), Alkalinity (251 - 269 mg/L), Chlorides (34 - 84 mg/L), Total Ammonia (<0.1 mg/L), Un-ionized Ammonia (n.a.), Nitrate (<0.06 – 0.13 mg/L), Total Phosphorus (0.021 - <0.03 mg/L), Total Suspended Solids (< 2 – 3 mg/L) and Phenols (0.001 – 0.002 mg/L).

- Provincial Water Quality Objectives (PWQO) exceedance was observed only for Phenols (0.002 mg/L slightly exceeded 0.001 mg/l, Nov. 91/15).

Downstream Impact (S-1):

Surface water sample station is located approximately 0.75 km southeast downgradient of the landfill site waste mound. Sampling was conducted on two occasions during May and November 2015.

The water quality general chemistry was characterized having BOD (< 4 mg/L), COD (9 - 10 mg/L), field Dissolved Oxygen (6.05 mg/L, Nov. 4/15), field Conductivity (546 µS/cm, Nov. 4/15), field pH (7.2, Nov. 4/15), Alkalinity (253 - 273 mg/L), Chlorides (59 – 84 mg/L), Total Ammonia (<0.1 mg/L), Un-ionized Ammonia (n.a.), Nitrate (<0.03 mg/L), Total Phosphorus (0.012 – <0.03 mg/L), Total Suspended Solids (< 2 – 4 mg/L) and Phenols (<0.001 – 0.001 mg/L).

- There were no PWQO exceedances observed for the relevant parameters analyzed for.

Surface Water Quality Impact Assessment

- The reviewer is in agreement with the landfill site Owner's assessment that all of the water quality parameters tested for are within their respective current PWQO, the Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines, and APV concentrations with the exception of a minor exceedance for Phenols of the PWQO in the background 2015 November (fall) sample.

- The monitoring results for the 2015 sampling events indicated the landfill site was not having an adverse impact to the water quality of the down-gradient surface water monitored at sample location S-2.

- Relative to surface water impact concerns the reviewer is in agreement with the conclusions and recommendations presented in the 2015 Annual Monitoring Report for the Hall's Glen Landfill Site.

"Original Signed By"

Bruce Metcalfe
BWM/dv

ec: G. Faaren
P. Taylor
C. Redmond

c: S. Trimper
B. Metcalfe (Aba2016\aba4161.mem) 6151-AAFLMZ \ X-ref. 6700-AAFLBU
File SW PB DD C4 03 06, Hall's Glen Landfill Site, Township of Douro-Dummer
File SW 11 02 07 02, Unnamed Tributary, Stony Lake, Trent River Basin

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M E M O R A N D U M

07 August 2014

TO: C. Johnston
Senior Environmental Officer
Peterborough District Office
Eastern Region

FROM: B. W. Metcalfe
Senior Environmental Officer
Water Resources Unit, Surface Water Group
Technical Support Section
Eastern Region

RE: 2013 Annual Monitoring Report - Hall's Glen Landfill Site
Lot 25, Concession 4, Dummer Ward, Geographic Township of Dummer
Township of Duoro-Dummer, County of Peterborough
Environmental Compliance Approval (ECA) No. A341004

I have reviewed the document entitled, "2013 Groundwater Monitoring Report, Hall's Glen Landfill Site (C of A A341004)", dated March 2014, prepared by Geo-Logic Inc. (Geo-Logic) for the Township of Duoro- Dummer. The following comments are offered relative to surface water impact concerns.

Background Information

The Hall's Glen landfill Site is situated along the south side of County Road No. 6 approximately 10 km north of the community of Warsaw. The site operates per the provisional Certificate of Approval No. 341004 dated October 8, 1980. The site also operates as transfer site according to Provisional Certificate of Approval No. A341007. It was reported that during the summer of 2003 the landfill site was prepared for closure. The landfill area has been mounded and capped and it was understood that further work was conducted in 2004 and 2005. The landfill operates as a natural attenuating site.

Surface Water Regime

The landfill site is situated within the Trent River Basin. The major surface water features in the landfill site area include Stony Lake located north of the site and Dummer Lake located to the east of the site.

Based on overburden groundwater monitoring data Geo-Logic determined that the pattern of overburden groundwater movement appears to be in an easterly direction.

Surface Water Monitoring Program

The groundwater monitoring report includes a limited surface water sampling component for the site. The surface water monitoring program is limited to one surface water sampling station (identified as SW1 on the Site Plan) which is located southeast downgradient of the site. The surface water feature monitored was not identified, but appears to be a drainage ditch or ponded wetland. The landfill site Owner did not include a reference background upstream surface water quality sampling station.

Sample station SW1 was sampled on two occasions, June 10 and November 5, 2013. The collected surface water samples were analyzed for the limited parameter suite specified in Column 4 of Schedule 5 of the Landfill Standards Guideline (Indicator List for Surface Waters).

The analyses of the June 10 and November 5, 2013 collected surface water samples (referenced as sample station S-1) were presented in the SGS Certificate of Analysis Reports dated June 17 and November 13, 2013 respectively.

Surface Water Impact Assessment

SGS summarized the surface water quality data with the assessment that all of the parameters tested are within their respective current PWQO (the PWQO parameters analyzed for were limited only to pH, total phosphorus, phenols, and iron).

A review of the 2013 analytical results showed a total phosphorus concentration of 0.08 mg/L for the June 10/13 sample which exceeded the PWQO of 0.03 mg/L.

- The reviewer would note that there is no upstream background surface water sampling station incorporated in the surface water monitoring program for the landfill site.

Summary and Recommendations

Relative to surface water quality impact assessment purposes the reviewer considers the 2013 Annual Monitoring Report for the Hall's Glen Landfill Site provided by the landfill site Owner to be deficient.

The reviewer provided previous surface water technical comment on the 2012 Annual Monitoring Report for the Hall's Glen Landfill Site (Geo-Logic, 2012) which was presented in the memorandum dated January 20, 2014, from B. Metcalfe, Senior Environmental Officer, Water Resources Unit, Technical Support Section, Eastern Region to D. Johnston, Senior Environmental Officer, Peterborough District Office. The reviewer's recommendations presented in the noted January 20, 2014 memorandum and those provided in this memorandum remain essentially the same. Additional detail regarding the nature and degree of the surface water quality impact associated with the landfill site is required from the landfill site Owner. The reviewer recommends the following:

- In addition to the existing downstream surface water sampling station SW1 a reference upstream background surface water sampling station is required for the surface water monitoring program for the landfill site.

- The chemical parameter suite per Column 4 of Schedule 5 of the Landfill Standards Guideline (Indicator List for Surface Waters) is considered to be inadequate for the purposes of surface water quality impact assessment for this landfill site. The collected surface water samples should be analyzed for the Schedule 5 – Column 3 Comprehensive List for Surface Water (which includes the metals analyses suite) per the MOE Landfill Standards Guideline.

- A surface water quality impact assessment section is required to be provided by the landfill site Owner and this should be included in all future Annual Monitoring Reports for the Hall's Glen Landfill Site.

B.W. Metcalfe

Bruce Metcalfe
BWM/gl

c: G. Faaren
B. Metcalfe (Aba2014\aba414.mem) 2441-9KKLGX \ X-ref. 2387-9KHRP6
File SW PB DD C4 03 06, Hall's Glen Landfill Site, Township of Duoro-Dummer
File SW 11 02 07 02, Unnamed Tributary, Stony Lake, Trent River Basin

ec: G. Dagg-Foster
P. Taylor
J. Matherus

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M E M O R A N D U M

23 June 2014

TO: Chris Johnston
Senior Environmental Officer
Peterborough District Office
Eastern Region

FROM: Greg Faaren
Hydrogeologist
Technical Support Section
Eastern Region

RE: Hall's Glen Waste Disposal Site, 2013 Annual Monitoring Report
Lot 25, Concession IV, Geographic Region of Dummer
Township of Duoro-Dummer, County of Peterborough, A341004

Purpose

I have reviewed the hydrogeologically pertinent sections of the document entitled "2013 Groundwater Monitoring Report, Hall's Glen Landfill Site (A341004), Township of Douro-Dummer, County of Peterborough" dated March 2014 and prepared by GEO-LOGIC Inc. (GLI). This report was provided on behalf of Township of Douro-Dummer to fulfill the requirements of the Provisional Environmental Compliance Approval (ECA) for the site. I offer the following comments for your consideration.

Summary

- The primary pathway for leachate migration at the site is within the overburden and shallow bedrock to the southeast of the waste mound. Leachate impacted groundwater is present to the south and southeast of the waste mound.

- GLI completed a Guideline B-7 Reasonable Use (RU) assessment as part of the 2013 annual monitoring report. However, the RU assessment only included four (4) parameters (iron, chloride, sulphate and nitrate). The data provided by GLI shows RU exceedances for iron in several downgradient wells. GLI states that the iron concentrations observed in the downgradient wells at locations MW8, MW10 and MW11 may be naturally occurring. Continued monitoring is recommended. Future RU assessments must also include all leachate indicator parameters for the site.

- Leachate impacted groundwater flows to the south and southeast from the waste mound, and may discharge to the wetland in this portion of the site. It is recommended that any monitoring wells that are thought to intercept groundwater that discharges to surface water be analyzed for the same suite of parameters as the surface water samples. The samples should also be analyzed with detection limits commensurate with

the Provincial Water Quality Objectives (PWQO). The samples from these monitoring wells must be compared to the PWQO and the Ontario Drinking Water Quality Standards, Objectives and Guidelines (ODWSOG).

- The fall sample from residential well R2 exceeded the ODWSOG for iron. The spring and fall samples from well R4 also exceeded the ODWSOG for TDS. These impacts do not appear to be landfill related as well R4 is located upgradient of the waste disposal site and well R2 is located downgradient of the site across a wetland. Continued monitoring is recommended.

- Trend analysis information was provided for select monitoring wells at the site, but the supporting data (i.e. numerical data tables) was not provided. It is recommended that the historical sampling data as well as background water quality ranges be included as part of each annual report. The supporting data should be provided in both hard copy and electronic format (i.e. MS Excel) as well. Evaluation of trends in groundwater concentrations should continue to be completed for all leachate indicator parameters at all monitoring wells at the site.

- GLI has provided groundwater trigger mechanisms based on only health related volatile organic compound (VOC) parameters. These parameters alone do not comprise an appropriate trigger mechanism for the site. It is recommended that trigger mechanisms and contingency plans based Guideline B-7, Reasonable Use and surface water issues be developed for the site and provided in the next annual monitoring report. The trigger parameters should include all leachate indicator parameters.

- It is noted that the waste disposal site boundaries are not shown clearly on the figures attached in the report. This issue should be addressed.

- GLI recommends that groundwater samples be analyzed for the list of parameters in Column 2 of Schedule 5 of the Landfill Standards Guideline. The reporting frequency is to be every year. I recommend that the semi-annual groundwater monitoring sampling program continue at this site. The list of parameters should include those listed in Column 1 (spring) and Column 2 (fall) of Schedule 5 of the Landfill Standards Guideline (including manganese).

- As per the MOE's November 2010 Monitoring and Reporting for Waste Disposal Sites Technical Guidance Document, a Monitoring and Screening checklist is to be submitted with all annual monitoring reports, commencing in 2011. In reviewing the Hall's Glen waste disposal site report, it is noted that the checklist was not included. It is recommended that the 2014 report, and all subsequent future reports include a completed and signed checklist.

Environmental Compliance Approval (ECA)

The Hall's Glen waste disposal site previously operated under Provisional ECA A341004. The site stopped accepting waste in 2003 and began closure activities at that time. Final capping of the landfill was completed in 2005. The site is located in Lot 25, Concession IV, Geographic Region of Dummer, Township of Douro-Dummer. Originally, the licensed waste footprint was 1.0 hectare within a total property of 2.0 ha. However in 2005, additional buffer lands were

purchased by the Township to bring the site's total area to 48.5 ha. These additional lands were added in an amendment to the site's ECA issued on February 1, 2006. A groundwater monitoring program was implemented for the site as part of the post closure plan. It is noted that the waste disposal site boundaries are not shown clearly on the figures attached in the report.

According to MOE's November 2010 Monitoring and Reporting for Waste Disposal Sites Technical Guidance Document, and as communicated by the ministry (through webinars and information distributed in coordination with the Ontario Waste Management Association both last year and earlier this year), a Monitoring and Screening checklist is to be submitted with all annual monitoring reports, commencing in 2011. In reviewing the 2013 Hall's Glen waste disposal site report, it is noted that the checklist was not included.

Geology

The consultants previously described the geology of the site as:

- A glacial drift/till unit;
- A glaciolacustrine sand unit; and,
- A limestone bedrock unit (Lindsay Formation).

GLI reports that the typical overburden thickness at the site is approximately 3.25 m.

Hydrogeology

The consultants previously determined the physical hydrogeological characteristics of the site as:

- Groundwater flow within the overburden on-site is to the southeast towards an unnamed wetland. Groundwater flow within the bedrock is towards the south.
- The hydraulic conductivities at the site range from 10^{-2} to 10^{-3} cm/second.
- GLI reported that the average horizontal gradient for the shallow overburden wells was 1.6×10^{-2} m/m, deep overburden wells was 4.6×10^{-03} m/m and 3.8×10^{-03} m/m in bedrock. Vertical hydraulic gradients are variable with downward gradients observed in wells near the waste mound and upward gradients in wells near the wetland.

GLI reports that monitoring wells MW1-II, MW2-I, MW2-II and MW5-II were not able to be sampled in 2013.

Background Water Quality

GLI has used monitoring wells MW1-I, MW1-II, MW13-I and MW13-II to represent background water quality conditions for the site. These monitoring wells are located hydraulically upgradient to the existing landfill area. Water samples were unable to be collected from well MW1-II during the 2013 sampling program. The groundwater sampling results show that only dissolved organic carbon (DOC) and total dissolved solids (TDS) from well MW1-I exceeded the ODWSOG in analyzed background groundwater samples in 2013.

Leachate

Groundwater monitoring wells MW2-I and MW2-II are located within the waste area and are expected to be representative of leachate quality. However, monitoring wells MW2-I and MW2-II were not able to be sampled in 2013. It is noted that both the shallow and deep monitoring wells at locations MW3, MW5 and MW6 were sampled in 2013 and (as in previous years) the groundwater quality in these wells was notably impacted. Elevated concentrations of iron, alkalinity, DOC, sulphate and TDS were noted in these wells. These wells would appear to most represent leachate quality at the landfill.

Downgradient Water Quality

The primary pathway for leachate migration is inferred to be within the overburden and shallow bedrock in a south to southeasterly direction. Leachate impacts to groundwater as measured in the downgradient locations at this site are summarized as follows:

- The highest levels of leachate indicator parameters were seen in the overburden monitoring wells at locations MW3, MW5 and MW6. Levels of one (1) or more of iron, alkalinity, DOC and TDS exceeded the ODWSOG in each of these wells.

- It is noted that concentrations of most leachate indicator parameters were lower in the spring sampling event (June) than in the fall sampling event (November). GLI also notes that groundwater quality showed less impact in 2013 as compared to previous years. Further monitoring is required to study this trend.

- Exceedances of the ODWSOG for iron were noted in the furthest downgradient monitoring wells (i.e. MW10 and MW11).

GLI reports that the elevated concentrations of iron observed in wells MW8-I, MW10-II and MW11-II may be naturally occurring. The concentrations of iron observed in these monitoring wells are significantly higher than those observed in wells closer to the waste mound, particularly in the shallow zone wells. There may be other factors contributing to the elevated iron concentrations in these wells. However it is noted that elevated concentrations of landfill related iron are evident in some monitoring wells closer to the waste mound.

The results of the VOC analyses conducted showed no exceedances of the ODWSOG for VOC parameters.

It is noted that the groundwater samples from the Hall's Glen waste disposal site were not submitted for analysis of manganese. Manganese is a common leachate indicator parameter at waste disposal sites. The reason for not including manganese in the sampling suite was not provided.

Groundwater/Surface Water Interaction

The site plans provided by GLI indicate that there are wetlands located off-site to the southeast of the waste mound. GLI reports that vertical hydraulic gradients near the wetland are upward, indicating groundwater discharge conditions. Therefore there is the potential that shallow groundwater discharges to the surface water to the southeast of the site. GLI has not compared the results of the groundwater analyses conducted to the PWQO criteria.

Potable Groundwater Sampling

GLI reports that groundwater samples were collected from nearby potable water supply wells R1, R2, R3 and R4 in the spring and fall of 2013. Wells R1 and R2 are located downgradient of the landfill site and across a wetland. Wells R3 and R4 are located upgradient of the landfill near the intersection of 4th Line Road and County Road 6.

A review of the sampling results indicates that the spring and fall 2013 water samples from well R4 exceeded the ODWSOG for TDS. However, the samples from well R4 showed low levels of barium, calcium and magnesium, but elevated levels of chloride, sodium, TDS and conductivity. Well R4 is located hydraulically upgradient of the waste disposal site and therefore the impacts in this well are not likely related to the landfill. This well may be showing signs of road salt impacts.

The fall sample from well R2 exceeded the ODWSOG for iron. These impacts do not appear to be landfill related as well R2 is located significantly downgradient of the site across a wetland.

Guideline B-7 Reasonable Use

Guideline B-7 applies to operating waste disposal sites and to sites closed post 1986. GLI conducted a Guideline B-7 Reasonable Use for the site as part of the 2013 monitoring program report. However, GLI only used four (4) parameters as part of the Reasonable Use assessment, namely chloride, sulphate, nitrate and iron. Other leachate indicator parameters including TDS, alkalinity and DOC were not included.

GLI reports Reasonable Use (RU) exceedances for iron in several downgradient wells on at least one (1) occasion in 2013. GLI states that the iron concentrations observed in the downgradient wells may be naturally occurring. Iron is not elevated in any of the background groundwater monitoring wells and wells located closer to the waste mound show elevated concentrations of iron likely related to leachate impacts. However, iron concentrations observed in wells MW8-I, MW10-II and MW11-II are significantly higher than those observed in wells closer to the waste mound, particularly in the shallow zone wells. There may be other factors contributing to the elevated iron concentrations in these wells. It is noted that concentrations of leachate indicators in the downgradient wells has decreased from previous years.

The landfill site boundaries are not well illustrated on the site plan. Therefore it is difficult to ascertain where the Guideline B-7 conformance boundary is located.

Trigger Mechanisms/Contingency Plans

Information regarding trigger mechanisms or contingency plans was provided in the 2013 report. However, the trigger mechanisms specified were based only on health related parameters from the ODWSOG for VOCs. Trigger mechanisms based on non-health related groundwater parameters or surface water issues were not provided.

Groundwater Monitoring

GLI recommends that groundwater samples be analyzed for the list of parameters in Column 2 of Schedule 5 of the Landfill Standards Guideline. GLI also recommends that additional QA/QC samples be analyzed for VOCs during both sampling events in 2014. The reporting frequency is to be annual.

Greg Faaren, P.Geo.
GF/sh

ec: Peter Taylor
Gillian Dagg-Foster
David Bradley
Victor Castro

c: File GW PB DD C4 01 03 (A341004)
GF/IDS #2417-8VLL4E

FEB 0 8 2006

Ontario

Ministry of the Environment | Ministère de l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A341004

Issue Date: February 1, 2006

The Corporation of the Township of Douro-Dummer
PO Box 92
Warsaw, Ontario
K0L 3A0

Site Location: Hall's Glen Landfill Site
Lot 25, Concession 4, Dummer Ward
Douro-Dummer Township, County of Peterborough

You are hereby notified that I have amended Provisional Certificate of Approval No. A341004 issued on October 8, 1980 and amended on April 6, 2001, November 29, 2001, August 29, 2002, July 18, 2003, July 23, 2004 and June 23, 2005 for a Waste Disposal Site (Landfill/Transfer), as follows:

I. The total area of the closed Hall's Glen landfill site is hereby increased from 8 hectares to 48.5 hectares in accordance with the letter dated August 30, 2005 to James O' Mara, Director, Environmental Assessment and Approvals Branch, Ministry of the Environment. See Part IV for Registration on Title requirements.

II. The following definitions are hereby added:

(1) (g) "**Competent**" means knowledgeable, through instruction and practice, and able to carry out any necessary duties in the following:

(i) relevant waste management legislation, regulations and guidelines;
(ii) major environmental concerns pertaining to the waste to be handled;
(iii) emergency response procedures for the waste to be handled;
(iv) use and operation of the equipment to be used at the Site;
(v) emergency response procedure and alerting;
(vi) Site specific written procedures for the control of conditions that may cause an adverse effect; and
(vii) requirements of this Certificate.

III. <u>HOUSEHOLD HAZARDOUS WASTE ("HHW") DEPOT</u>

The Township is hereby approved to establish and operate a household hazardous waste depot at the site, in accordance with the following added conditions and with the items listed in Schedule "B" of this Certificate:

(34) (a) The HHW depot shall not receive more than 20 cubic metres of HHW per day; and

(b) The HHW depot shall not store in excess of 50 cubic metres of HHW on site.

(35) HHW shall not be stored at the Site for longer than one hundred eighty (180) days, unless the consent of the District Manager has been obtained, with the exception of waste oil which shall be stored on site in accordance with Condition 31(b).

(36) All household hazardous waste received and stored must be managed in accordance with Ontario Regulation 347, R.R.O. 1990, as amended, and with the Ministry of Environment document entitled "Household Hazardous Waste Collection and Facility Guidelines" dated May 1993.

(37) All storage of liquid wastes shall be in accordance with this Ministry's publication "Guidelines of Environmental Protection Measures at Chemical Storage Facilities", dated October 1978 as amended.

(38) All HHW shall be stored in secondary containment that is adequate to contain any spills or leaks. Segregated secondary containment shall be provided for incompatible types of waste.

(39) Incoming HHW shall be inspected by Competent personnel, prior to being accepted at the Site, to ensure that the Site is approved to accept that type of waste.

(40) All containers shall be clearly labeled indicating the type and nature of the hazardous waste stored as required by regulation. All points of access to the Site shall be posted to warn that the area contains hazardous materials.

(41) No radioactive wastes shall be accepted at this Site.

(42) Oil and oil-based paints which have been manufactured prior to 1972; or whose manufacturing date cannot be determined, may contain PCBs and shall be handled as follows:

(a) The oil and oil-based paints shall not be mixed (bulked) with other paints prior to testing. Paints which are lab-packed are not considered to be mixed under this Certificate;

(b) The oil and oil-based paints shall be tested by a certified laboratory for PCB content and shall be handled in the manner outlined in Condition 42(c) if found to contain PCBs;

(c) If the oil and oil-based paints are found to have PCBs at or above levels identified in Condition 42(d), it shall be forthwith reported to the District Manager and shall be managed in accordance with Regulation 362 and stored or removed from the Site to an approved PCB storage site, in accordance with written instructions from the District Manager; and

(d) The oil and oil-based paints shall not be distributed for reuse if they have any measurable PCB content. The oil and oil-based paint is considered to be a PCB waste, if measured levels are equal to or greater than 50 parts per million.

(43) Except for oil based paints that become classified as PCB Waste, paints may be offered for reuse to the public. Records shall be kept of the type, volume and recipient of paint returned to the public.

(44) The Township shall maintain, at the Site, a log book which records daily, the following information:

(a) date of record;
(b) types, quantities and source of HHW received;
(c) quantities of HHW stored at the Site;
(d) quantities and destination of HHW shipped from the Site; and
(e) quantities of waste returned to the public as noted in Condition (42).

IV. The following Conditions are hereby added:

CERTIFICATE OF REQUIREMENT

(45) The Owner shall:

(a) within sixty (60) calendar days of the date of this Certificate, submit to the Director, for Director's signature, two copies of a completed Certificate of Requirement containing a registerable description of the newly acquired property, in accordance with the attached form; and

(b) within twenty (20) calendar days of receiving the Certificate of Requirement signed by the Director, register the Certificate of Requirement in the appropriate Land Registry Office on title to the Property and submit to the Director the duplicate registered copy immediately following registration.

(46) Pursuant to Section 197 of the *EPA*, neither the *Owner* nor any person having an interest in the Property shall deal with the Property in any way without first giving a copy of this Certificate to each person acquiring an interest in the Property as a result of the dealing.

V. The following items are hereby added to Schedule "B":

(8) Application for a Provisional Certificate of Approval for a Waste Disposal Site dated September 1, 2005 and signed by Mr. David Clifford, CAO, The Corporation of the Township of Douro-Dummer including all attached supporting information and documentation.

(9) Document entitled "*County of Peterborough: Household Hazardous Waste (HHW) Facility Operations Manual*" dated August 10, 2005.

(10) Letter dated August 30, 2005 to Mr. James O'Mara, Director, Environmental Assessment and Approvals Branch, Ministry of Environment from Mr. Michael Cant, Manager, Solid Waste, Totten Sims Hubicki Associates. Re: Amendment for Certificate of Approval No. A341004 including all attachments.

(11) Letter dated October 11, 2005 to Mr. Matthew Chisholm, Application Processor, Ministry of Environment, from Mr. Michael Cant, Manager, Solid Waste, Totten Sims Hubicki Associates. Re: Application for Approval of a Waste Disposal Site, MOE Reference No. 2960-6FTPZG.

(12) Letter dated January 24, 2006 to Mr. David Lee, Waste Evaluator, Ministry of Environment, from Mr. Michael Cant, TSH Associates, Re: Draft Notice of Amendment for Certificate of Approval No. A341004.

The reasons for this amendment to the Certificate of Approval are as follows:

The reason for section I is to recognize the new total site area of the waste disposal site.

The reason for section II is to define the specific meaning of the term "competent" as used in this Notice of Amendment.

The reason for the conditions imposed in section III is to approve the establishment and operation of a household hazardous waste transfer station and to ensure that the wastes are managed in a manner that protects the environment and the health and safety of the public.

The reason for the conditions imposed in section IV is to ensure that any persons having an interest in the lands are aware that the land has been used for waste disposal operations.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A341004 dated October 8, 1980

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 39, *Environmental Protection Act*
Ministry of Environment and Energy.
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this 1st day of February, 2006

Greg Washuta, P.Eng.
Director
Section 39, *Environmental Protection Act*

DL/

c: District Manager, MOE Peterborough
Michael Cant, Totten Sims Hubicki Associates (1997) Limited

Appendix B
Monitoring Well Details and Borehole Data

TOWNSHIP OF DUMMER

HALL'S GLEN LANDFILL STUDY

BOREHOLE LOGS

June 27 - July 9, 1991

BOREHOLE	DEPTH INTERVAL (metres below ground)	DRILLER'S DESCRIPTION
1-91	0 - 0.61	Brown CLAY, GRAVEL, hard
	0.61 - 1.98	Grey GRAVEL, dry
	1.98 - 6.10	Grey LIMESTONE
	6.10 - 6.71	Brown SHALE
	Water-bearing zone reported at 6.10 metres	
2-91	0 - 1.22	Brown FILL
	1.22 - 3.05	REFUSE
	3.05 - 4.88	Brown SAND, COBBLES
	4.88 - 5.49	Grey GRAVEL
	5.49 - 6.71	Brown SHALE, wet
	6.71 - 8.53	Grey LIMESTONE
	8.53 - 9.14	Brown SHALE
	Water-bearing zone reported at 8.53 metres	
3-91	0 - 0.91	Brown SAND, CLAY
	0.91 - 1.52	Brown GRAVEL, COBBLES, CLAY, hard
	1.52 - 4.27	Grey LIMESTONE
	Water-bearing zone reported at 3.66 metres	
4-91	0 - 2.74	Grey GRAVEL, BOULDERS
	2.74 - 3.66	Grey LIMESTONE
	3.66 - 4.88	Brown SHALE
	Water-bearing zone reported at 3.66 metres	
5-91	0 - 1.83	Brown SAND, CLAY
	1.83 - 3.20	Brown SAND, GRAVEL
	3.20 - 3.66	Brown SAND, CLAY
	3.66 - 7.01	Grey LIMESTONE
	Water-bearing zone reported at 6.40 metres	

TOWNSHIP OF DUMMER

HALL'S GLEN LANDFILL STUDY

BOREHOLE LOGS

June 27 - July 9, 1991

BOREHOLE	DEPTH INTERVAL (metres below ground)	DRILLER'S DESCRIPTION
6-91	0 - 0.61	Brown SAND
	0.61 - 2.74	Brown SAND, GRAVEL
	2.74 - 5.18	Grey LIMESTONE
	5.18 - 5.79	Brown SHALE

Water-bearing zone reported at 5.18 metres

MONITOR DETAILS

BOREHOLE		MONITOR					SCREENED INTERVAL (mbgl)	SAND FILTER PACK (mbgl)	BENTONITE SEAL (mbgl)	STEEL CASING (mbgl)
NO	Diameter (mm)	NO	Type	Diameter (mm)	Stick-up (m)	Elevation (t.o.p.m.)				
1-91	150	I	P	50	0.98	271.27	6.71 - 5.18	6.71 - 5.33	5.33 - 4.72	0.91 - 10.88
1-91		II	S	38			1.98 - 0.46	1.98 - 0.46	0.46 - 0.00	
2-91	150	I	P	50	1.07	275.79	9.14 - 7.62	9.14 -6.70	6.70 - 5.79	0.91 - 11.07
2-91		II	S	38			5.49 - 3.96	5.49 - 0.61	0.61 - 0.00	
3-91	150	I	P	50	1.11	269.23	4.27 - 2.74	4.27 - 2.13	2.13 - 1.52	0.91 - 11.11
3-91		II	S	38			1.52 - 0.00	1.52 - 0.31	0.31 - 0.00	
4-91	150	I	P	50	1.04	268.28	4.88 - 3.35	4.88 - 3.66	3.66 - 3.05	0.91 - 11.04
4-91		II	S	38			3.05 - 1.52	3.05 - 0.61	0.61 - 0.00	
5-91	150	I	P	50	1.00	271.32	7.01 - 5.49	7.01 - 4.27	4.27 - 3.66	0.91 - 11.00
5-91		II	S	38			3.66 - 2.13	3.66 - 0.16	0.61 - 0.00	
6-91	150	I	P	50	1.02	269.83	5.79 - 4.26	5.79 - 3.35	3.35 - 2.74	0.91 - 11.02
6-91		II	S	38			2.74 - 1.22	2.74 - 0.61	0.61 - 0.00	

P = Piezometer mbgl = metres below

Geo-Logic Inc.
Plate B-3

Ministry of Environment and Energy
Ontario

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable

County or District	Township/Borough/City/Town/Village	Con.	Block	Tract	Survey	Lot
Peterborough	Dummer Twp., Hall Glen Landfill	Con.4				26
Owner's surname / Full name	Address	Date completed				
Township of Dummer	C/O Totten Sims Hubicki Assoc. 300 Water St., Whitby, Ont. L1N 9J2	16	03	97		

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	To
Black	Topsoil	stones	soft	0	1
Brown	Gravelly Clay	stones	soft-caving	1	9
Brown	Shale		soft	9	14
Gray	Limestone		hard	14	18
Brown	Limestone		very hard	18	22½
		* Finished depth @ 21 ft.			

WATER RECORD

Water found at - feet	Kind of water
9	☐ Fresh ☐ Salty ☐ Sulphur ☐ Mineral ☐ Gas
18	☐ Fresh ☐ Salty ☐ Sulphur ☐ Mineral ☐ Gas
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Mineral ☐ Gas
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Mineral ☐ Gas
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Mineral ☐ Gas

CASING & OPEN HOLE RECORD

Inside diam. inches	Material	Wall thickness inches	Depth - feet From	To
6½	☐ Steel ☐ Galv. steel ☐ Concrete ☐ Open hole ☐ Plastic	.188	+ 2	3
2	☐ Steel ☐ Galv. steel ☐ Concrete ☐ Open hole ☐ Plastic	Plexo	+ 2	16
2	☐ Steel ☐ Galv. steel ☐ Concrete ☐ Open hole ☐ Plastic	Plexo	+ 2	4

SCREEN

Screw or opening (Slot No.)	Diameter inches	Length feet
10	2	2ft 5
Material and type	Depth at top of screen	
PVC	4 &16	

PLUGGING & SEALING RECORD

☒ Annular space ☐ Abandonment

Depth set at - feet From	To	Material and type (Cement grout, bentonite, etc.)
0	3	Mud Slurry
3	4	Bentonite
4	11½	Gravel
11½	16	Bentonite
16	22½	Gravel
22½		Bentonite

PUMPING TEST

Pumping test method: ☐ Pump ☒ Bailer
Pumping rate: 10 GPM
Duration of pumping: ___ hours 30 minutes
Water level during: ☐ Pumping ☐ Recovery

Static level	Water level at end of pumping	15 minutes	30 minutes	45 minutes	60 minutes
6 feet	11 feet	11 feet	11 feet	11 feet	11 feet

If flowing give rate: GPM
Pump intake set at: feet
Water at end of test: ☐ Clear ☐ Cloudy
Recommended pump type: ☐ Shallow ☐ Deep
Recommended pump setting: feet
Recommended pump rate: GPM

FINAL STATUS OF WELL

☐ Water supply ☐ Observation well ☐ Test hole ☐ Recharge well
☐ Abandoned, insufficient supply ☐ Abandoned, poor quality ☐ Abandoned (Other)
☐ Unfinished ☐ Replacement well ☐ Dewatering

WATER USE

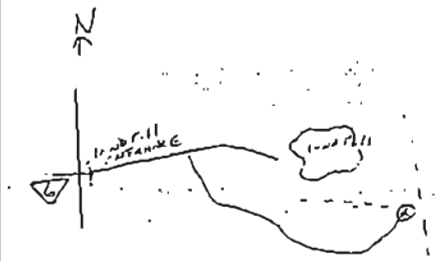
☐ Domestic ☐ Stock ☐ Irrigation ☐ Industrial
☐ Commercial ☐ Municipal ☐ Public supply ☐ Cooling & air conditioning
☐ Not used ☒ Other (Piezometer)

METHOD OF CONSTRUCTION

☒ Cable tool ☐ Rotary (conventional) ☐ Rotary (reverse) ☐ Rotary (air)
☐ Air percussion ☐ Boring ☐ Diamond ☐ Jetting
☐ Driving ☐ Digging ☐ Other

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



174284

Name of Well Contractor	Well Contractor's Licence No.
C.Hart & Sons Well Drilling Ltd.	2662
Address	
Box 850, Fenelon Falls, Ontario	
Name of Well Technician	Well Technician's Licence No.
Greg Bullock	T-2108
Signature of Technician/Contractor	Submission date

MINISTRY USE ONLY

3 - OWNER'S COPY

M.O.E. WATER WELL RECORD

MW-7

Geo-Logic Inc.

Plate B-4

Ontario Ministry of the Environment

WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

County or District	Township/Borough/City/Town/Village (BH-8)	Con. Lot. Tract survey, etc.	Lot
Peterborough	Dummer Twp., Halls Glen-Landfill	Con. 4	26
Owner's surname / Given name	Address c/o Totten Sims Hubicki Assoc.	Date completed	
Township of Dummer	300 Water St., Whitby, ON L1N 9J2	1 11 01 (day month year)	

Form ☐ Loading ☐ Numbering ☐

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other material	General description	Depth - feet From	To
Black	Topsoil			0	1
Brown	Gravel	sand		1	9
Brown	Gravel	stones		9	15
Brown	Rock		broken	15	17
Gray	Limestone			17	35

WATER RECORD

Water found at - feet	Kind of water
19	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral ☐ Gas
28	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral ☐ Gas
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral ☐ Gas
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral ☐ Gas
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral ☐ Gas

CASING & OPEN HOLE RECORD

Inside diam. inches	Material	Wall thickness inches	Depth - feet From	To
6¼	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	.188	+2½	17
2	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	Plexo	+2½	30
2	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	Plexo	+2½	17½

SCREEN

Make of Screen (Set No.)	Diameter	Length
10	2 inches	2 x 5 feet
Material and type	Depth set at - feet	
PVC	30, 17½	

PLUGGING & SEALING RECORD

☐ Annular space ☐ Abandonment

Depth set at - feet From	To	Material and type (Cement grout, bentonite, etc.)
0	17	Bentonite & Mudslurry

PUMPING TEST

☐ Pump ☐ Bailer — Pumping rate 8-10 GPM — Duration of pumping 30 hours

Water level before pumping 15 feet — Water level end of pumping — Water level during pumping: 10 minutes — 20 minutes — 40 minutes — 60 minutes

Recommended pump type ☐ Shallow ☐ Deep — Recommended pump setting — Recommended pump rate — Water at end of test ☐ Clear ☐ Cloudy

FINAL STATUS OF WELL

☐ Water supply ☐ Observation well ☐ Test hole ☐ Recharge well ☐ Abandoned, insufficient supply ☐ Abandoned, poor quality ☐ Abandoned (Other) ☐ Dewatering ☐ Unfinished ☐ Replacement well

WATER USE

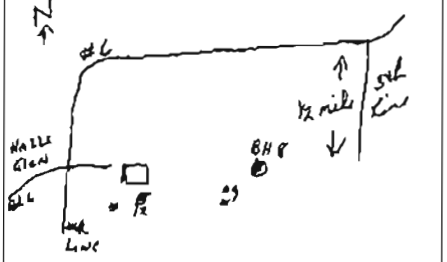
☐ Domestic ☐ Stock ☐ Irrigation ☐ Industrial ☐ Commercial ☐ Municipal ☐ Public supply ☐ Cooling & air conditioning ☐ Other

METHOD OF CONSTRUCTION

☐ Cable tool ☐ Rotary (conventional) ☐ Rotary (reverse) ☐ Rotary (air) ☐ Air percussion ☐ Boring ☐ Diamond ☐ Jetting ☐ Digging ☐ Driving ☐ Other

LOCATION OF WELL

In diagram below show distance of well from road and lot line. Indicate north by arrow.



236648

Name of Well Contractor	Well Contractor's Licence No.
C. Hart & Sons Well Drilling Ltd.	2662
Address	
Box 850, Fenelon Falls, Ontario	
Name of Well Technician	Well Technician's Licence No.
Jim Lean	T-0546
Signature of Technician/Contractor	Submission date (day mo yr)

MINISTRY USE ONLY

1 - CONTRACTOR'S COPY

M.O.E. WATER WELL RECORD

MW-8

Geo-Logic Inc.

PLATE B-5

Ontario Ministry of the Environment

The Ontario Water Resources Act

WATER WELL RECORD

Print only in spaces provided
Mark correct box with a checkmark, where applicable.

County or District	Township, Borough, City, Town, Village	Con	Block	Tract	Survey, etc	Lot
Peterborough	Dummer Twp., Halln Glen-Landfill (BH-9)	Con.4				26
Owner's surname / First Name: Township of Dummer	Address: c/o Totten Sims Hubicki Assoc. 300 Water St., Whitby, Ont. L1N 9J2	Date completed: 30 (day) 10 (month) 01 (year)				

Zone | Easting | Northing

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	To
Black	Topsoil			0	1
Brown	Gravel			1	10
Brown	Rock		broken	10	12
Gray	Limestone			12	30

WATER RECORD

Water found at - feet	Kind of water
12	Fresh / Salty / Sulphur / Mineral / Gas
26	Fresh / Salty / Sulphur / Mineral / Gas
	Fresh / Salty / Sulphur / Mineral / Gas
	Fresh / Salty / Sulphur / Mineral / Gas
	Fresh / Salty / Sulphur / Mineral / Gas

CASING & OPENHOLE RECORD

Inside diam.	Material	Wall thickness	Depth - feet From	To
6¼	Steel / Galvanized / Concrete / Open hole / Plastic	.188	+2½	12
2	Steel / Galvanized / Concrete / Open hole / Plastic	Plezo	+2½	25
2	Steel / Galvanized / Concrete / Open hole / Plastic	Plezo	+2½	13

SCREEN

Slot No.	Diameter	Length
10	2 inches	2 x 5 feet

Material and type: PVC — Depth to top of screen: 25.8-13 feet

PLUGGING & SEALING RECORD

Annular space / Abandonment

Depth set at - feet From	To	Material and type (Cement grout, bentonite, etc.)
0	12	Bentonite

PUMPING TEST

Pumping test method: Pump / Bailer — Pumping rate: 9-10 GPM — Duration of pumping: 60 hours

Static level: 8 feet — Water level end of pumping: feet

While pumping: Water levels during: Pumping / Recovery

5 minutes	10 minutes	15 minutes	20 minutes
feet	feet	feet	feet

Flowing: give rate — gpm — Pump intake set at: feet — Water after 1 and 2 hours: Clear / Cloudy

Recommended pump type: Submersible / Jet — Recommended pump depth: feet — Recommended pump rate: GPM

WELL STATUS OF WELL

Water supply / Observation well / Test hole / Recharge well — Abandoned, insufficient supply / Abandoned, poor quality / Abandoned (Other) / Dewatering — Unknown / Replacement well

WATER USE

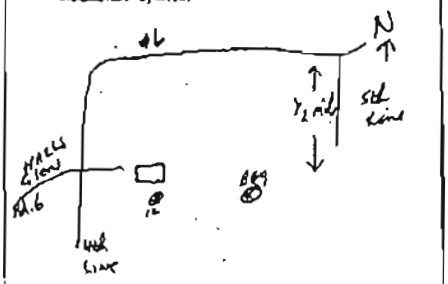
Domestic / Stock / Irrigation / Industrial — Commercial / Municipal / Water supply / Cooling & air conditioning — Not used / Other: Monit. Well

METHOD OF CONSTRUCTION

Cable tool / Rotary (conventional) / Rotary (reverse) / Rotary (air) — Air percussion / Boring / Diamond / Jetting — Driving / Digging / Other

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



236649

Name of Well Contractor	Well Contractor's Licence No.
G.Hart & Sons Well Drilling Ltd	2662
Address: Box 850, Fenelon Falls, Ontario	
Name of Well Technician: Jim Lean	Well Technician's Licence No. T-0546
Signature of Technician/Contractor	Submission date: day / month / year

MINISTRY USE ONLY

1 - CONTRACTOR'S COPY

M.O.E. WATER WELL RECORD

MW-9

Ontario Ministry of the Environment

The Ontario Water Resources Act

WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

County or District: Peterborough	Township/Borough/City/Town/Village (OR-TO): Dummer Twp., Halls Glen-Landfill	Con (each lot/tract survey, etc.): Con.4 — Lot: 26
Owner's surname: Township of Dummer — First Name:	Address: c/o Totten Sims Hubicki Assoc. 300 Water St., Whitby, ON L1N 9J2	Date completed: 2 (day) 11 (month) 01 (year)

Form ☐ Grading ☐ Plotting ☐

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth: Feet	Depth: To
Black	Topsoil			0	1
Brown	Gravel			1	9
Brown	Gravel	broken rock		9	15
Gray	Limestone			15	30

WATER RECORD

Water found at - Feet	Kind of water
13	☒ Fresh ☐ Salty ☐ Sulphur ☐ Mineral ☐ Gas ☐ Oil
26	☐ Fresh ☐ Salty ☐ Sulphur ☐ Mineral ☐ Gas ☐ Oil
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Mineral ☐ Gas ☐ Oil
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Mineral ☐ Gas ☐ Oil
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Mineral ☐ Gas ☐ Oil

CASING & OPEN HOLE RECORD

Inside diam. (inches)	Material	Wall thickness (inches)	Depth: Feet	Depth: To
6¼	☒ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	.188	+2½	13
2	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☒ Plastic	Pleso	+2½	25
2	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☒ Plastic	Pleso	+2½	14.3

SCREEN

Slot no. (Inches)	Diameter	Length
10	2 inches	2x 5 feet
Material and type: PVC	Depth at top of screen: 25.14.3 feet	

PLUGGING & SEALING RECORD

Depth: Feet	To	Material and type (Cement grout, bentonite, etc.)
0	13	Holeplug (outside 6")
13	20½	Sand
20½	22	Holeplug
22	30	Sand

PUMPING TEST

Pumping test method: ☐ Pump ☐ Bailer — Pumping rate: 5-6 GPM — Duration of pumping: ____ Hours 30 Mins

Static level: 8. Feet — Water level end of pumping: — Water levels during: ☐ Pumping ☐ Recovery

10 minutes: ____ Feet — 20 minutes: ____ Feet — 30 minutes: ____ Feet — 40 minutes: ____ Feet

If flowing give rate: ____ GPM — Pump intake set at: ____ Feet — Water at end of test: ☐ Clear ☐ Cloudy

Recommended pump type: ☐ Shallow ☐ Deep — Recommended pump setting: ____ Feet — Recommended pump rate: ____ GPM

FINAL STATUS OF WELL

☒ Water supply ☐ Observation well ☐ Test hole ☐ Recharge well ☐ Abandoned, insufficient supply ☐ Abandoned, poor quality ☐ Abandoned (Other) ☐ Dewatering ☐ Unfinished ☐ Replacement well

WATER USE

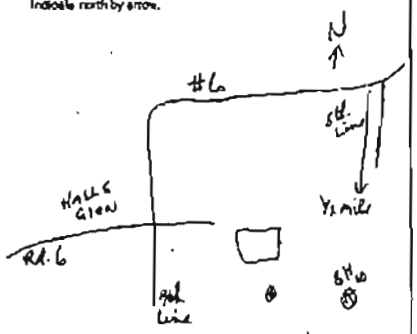
☐ Domestic ☐ Stock ☐ Irrigation ☐ Industrial ☐ Commercial ☐ Municipal ☐ Public supply ☐ Cooling & air conditioning ☐ Not used ☒ Other DOMESTIC

METHOD OF CONSTRUCTION

☒ Cable tool ☐ Rotary (conventional) ☐ Rotary (reverse) ☐ Jetting ☐ Air percussion ☐ Boring ☐ Diamond ☐ Jetting ☐ Driving ☐ Digging ☐ Other

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



236643

Name of Well Contractor: G.Hart & Sons Well Drilling Ltd	Well Contractor's Licence No.: 2662	
Address: Box 850, Fenelon Falls, ONtario		
Name of Well Technician: Jim Lean	Well Technician's Licence No.: T-0546	
Signature of Technician/Contractor:	Submission date:	

MINISTRY USE ONLY

1 - CONTRACTOR'S COPY

M.O.E. WATER WELL RECORD

MW-10

Geo-Logic Inc.

PLATE B-7

Ontario Ministry of the Environment

WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark where applicable

County or District	Township/Borough/City/Town/Village (BH-11)	Con. Block, Tract, Survey, etc.	Lot
Peterborough	Dummer Twp., Halls Glen-Landfill	Con. 4	26
Owner's surname / First name: Township of Dummer	Address: c/o Tutten Sims Hubicki Assoc. 300 Water St., Whitby, ON L1N 9J2	Date completed: 5 day, 11 month, 01 year	

Use | Kind | Factory

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	Depth - feet To
Black	Topsoil			0	1
Brown	Gravel			1	5
Brown	Gravel	Boulder		5	10
Brown	Broken Rock			10	12
Gray	Limestone			12	30

WATER RECORD

Water found at ft - feet	Kind of water
19	Fresh / Salty / Sulphur / Minerals / Gas
29	Fresh / Salty / Sulphur / Minerals / Gas
	Fresh / Salty / Sulphur / Minerals / Gas
	Fresh / Salty / Sulphur / Minerals / Gas
	Fresh / Salty / Sulphur / Minerals / Gas

CASING & OPENHOLE RECORD

Internal diameter	Material	Wall thickness	Depth - feet From	Depth - feet To
6¼	Steel / Galvanized / Concrete / Open hole / Plastic	.188	+2½	12
2	Steel / Galvanized / Concrete / Open hole / Plastic	Plast	+2½	25
2	Steel / Galvanized / Concrete / Open hole / Plastic	Plast	+2½	15

INCREASE

Size of opening (inches)	Diameter	Length
10	2 inches	2x 5 feet
Material and type: PVC	Depth at top of screen: 25.15 feet	

PLUGGING & SEALING RECORD

Annular space / Abandonment

Depth set at - feet From	To	Material and type (Cement grout, bentonite, etc.)
0	12	Holeplug (outside accel)
11	20	Sand
20	22	Holeplug
22	30	Sand

PUMPING TEST

Pumping test method: Pump / Bailer
Pumping rate: 2-3 GPM
Duration of pumping: ___ Hours 30 Min
Static level: 9 feet
Water level end of pumping: feet
Pumping level(s) during pumping: feet / feet / feet / feet
Recommended pump depth: feet
Recommended pump rate: GPM
Water at end of test: Clear / Cloudy
Recommended pump type: Shallow / Deep

FINAL STATUS OF WELL

Water supply / Observation well / Test hole / Recharge well / Abandoned, insufficient supply / Abandoned, poor quality / Abandoned (Other) / Dewatering / Unfinished / Replacement well

WATER USE

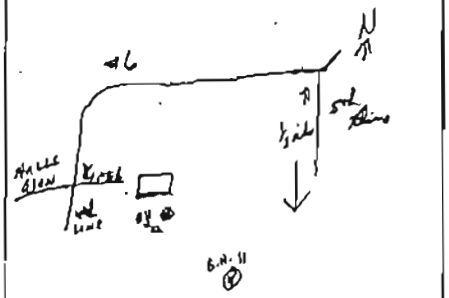
Domestic / Stock / Irrigation / Industrial / Commercial / Municipal / Public supply / Cooling (air conditioning) / Other: MONITOR

METHOD OF CONSTRUCTION

Cable tool / Rotary (conventional) / Rotary (reverse) / Rotary (air) / Air percussion / Boring / Diamond / Jetting / Driving / Digging / Other

LOCATION OF WELL

In diagram below show distance of well from road and lot line. Indicate north by arrow.



236642

Name of Well Contractor	Well Contractor's Licence No.
G.HART & Sons Well Drilling Ltd	2662
Address: Box 850, Fenelon Falls, Ontario	
Name of Well Technician: Jim Lean	Well Technician's Licence No. 7-0546
Signature of Technician/Contractor	Submission date: day, month, year

MINISTRY USE ONLY

1 - CONTRACTOR'S COPY

M.O.E. WATER WELL RECORD

MW-11

Geo-Logic Inc.

PLATE B-8

Ontario Ministry of the Environment

The Ontario Water Resources Act

WATER WELL RECORD

Print only in spaces provided
Mark correct box with a checkmark, where applicable.

County or District	Township/Borough/City/Town/Village (RW-12)	Con.	Lot
Peterborough	Dummer Twp., Halls Glen - Landfill	Con. 4	26
Owner's surname / First Name: Township of Dummer	Address: c/o Totten Sims Hubicki Assoc., 300 Water St., Whitby, ON L1N 9J2	Date completed: 7 day 11 month 01 year	

Zone | Easting | Northing

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	To
Black	Topsoil			0	1
Brown	Gravel			1	8
Brown	Gravel	broken rock		8	13
Gray	Limestone			13	29
Gray	Limestone		soft	29	30
Grey	Limestone			30	40

WATER RECORD

Water found ft - feet	Kind of water
13	Fresh, Salty, Sulphur, Mineral, Gas
29	Fresh, Salty, Sulphur, Mineral, Gas
	Fresh, Salty, Sulphur, Mineral, Gas
	Fresh, Salty, Sulphur, Mineral, Gas
	Fresh, Salty, Sulphur, Mineral, Gas

CASING & OPEN HOLE RECORD

Inside diam. inches	Material	Wall thickness inches	Depth - feet From	To
6¼	Steel, Galvanized, Concrete, Open hole, Plastic	.188	+3	13
2	Steel, Galvanized, Concrete, Open hole, Plastic	Plezo	+3	35
2	Steel, Galvanized, Concrete, Open hole, Plastic	Plezo	+3	25¼
2	Steel, Galvanized, Concrete, Open hole, Plastic	Plezo	+3	14¼

SCREEN

Kind of opening (slot no.)	Diameter	Length
10	2 inches	3x 5 feet
Material and type: PVC	Depth set at - feet: 35.5 to 14.5	

PLUGGING & SEALING RECORD

Annular space / Abandonment

Depth set at - feet From	To	Material and type (Cement grout, bentonite, etc.)
0	13	Bentonite (outside)
40	31	Sand (inside)
31	30	Holeplug, diameter 6 inches Cont'd

PUMPING TEST

Pumping test method: Pump / Bailer
Pumping rate: 10 - 15GPM
Duration of pumping: hours / minutes
Static level: feet
Water level end of pumping: feet
Water levels during: Pumping / Recovery
1/2 minutes: feet
5 minutes: feet
10 minutes: feet
15 minutes: feet
If flowing give rate: GPM
Pump intake set at: feet
Water at end of test: Flowing / Pumping
Recommended pump type: Shallow / Deep
Recommended pump setting: feet
Recommended pump rate: GPM

FINAL STATUS OF WELL

Water supply / Observation well / Test hole / Recharge well / Abandoned, insufficient supply / Abandoned, poor quality / Abandoned (Other) / Dewatering / Unfinished / Replacement well

WATER USE

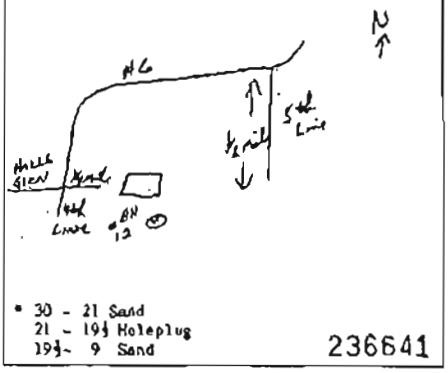
Domestic / Stock / Irrigation / Industrial / Commercial / Municipal / Public supply / Cooling & air conditioning / Not used / Other: Monitor

METHOD OF CONSTRUCTION

Cable tool / Rotary (conventional) / Rotary (reverse) / Rotary (air) / Air percussion / Boring / Diamond / Jetting / Driving / Digging / Other

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



- 30 - 21 Sand
- 21 - 19½ Holeplug
- 19½ - 9 Sand

236641

Name of Well Contractor	Well Contractor's Licence No.
C. Hart & Sons Well Drilling Ltd.	2662
Address: Box 850, Fenelon Falls, Ontario	
Name of Well Technician: Jim Lann	Well Technician's Licence No. T-0546
Signature of Technician/Contractor	Submission date: day / month / year

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M.O.E. WATER WELL RECORD

MW-12

705 749 3246 P.02/02

WATER WELL RECORD

Ministry of the Environment

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

County or District	Township/Borough/City/Town/Village	Con.	Lot
Peterborough	Dummer Twp. Halls Glen-landfill TW1-02	4	26
Owner's surname / First name	Address	Date completed	
Township of Dummer	c/o Totten Sims Hubicki Assoc. 300 Water St. Whitby ON L1N 9J2	29 day 10 month 02 year	

Zone | Easting | Northing

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth (m) From	To
Black	Topsoil			0	.5
Brown	Gravel	boulders		.5	9
Grey	Limestone			9	17

WATER RECORD

Water found at (m)	Kind of water					
15.5	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals ☐ Gas				
	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals ☐ Gas				
	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals ☐ Gas				
	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals ☐ Gas				
	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals ☐ Gas				

CASING & OPEN HOLE RECORD

Inside diam. (cm)	Material	Wall thickness (cm)	Depth (m) From	To
6¼	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Other	.188	+3	6
2	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Other	.180	+3	6
2	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Other	.180	+3	12

SCREEN

Make	Diameter	Length
	2 cm	3'65' m
Material and type: PVC	Depth at top of screen: 6, 12 m	

PLUGGING & SEALING RECORD

Depth set at (m) From	To	Material and type (Cement grout, bentonite, etc.)
17	11	sand
11	9	holeplug
9	5	sand backfilling

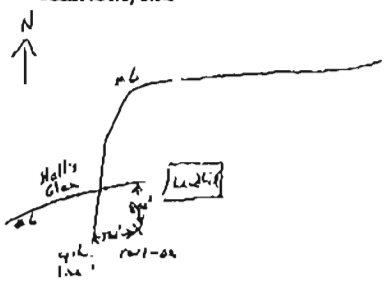
PUMPING TEST

Pumping test method: ☐ Pumping ☐ Bailer | Pumping rate (gpm) | Duration of pumping: ___ Hours ___ Minutes

Static level (m)	Water level end of pumping (m)	Pumping level (m)			
7		After ___ hours		After ___ hours	
		After ___ minutes		After ___ minutes	
If flowing give rate (gpm)		Pumping level (m)		Water at end of test: ☐ Clear ☐ Cloudy	
Recommended pump type: ☐ Shallow ☐ Deep		Recommended pump setting (m)		Recommended pump rate (gpm)	

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



252361

FINAL STATUS OF WELL

☐ Water supply ☐ Replacement well ☐ Test hole ☐ Recharging well
☐ Dewatering ☐ Observation, additional supply ☐ Abandoned, poor quality ☐ Abandoned (Other) ☐ Monitoring
☐ Unfinished ☐ Abandoned, insufficient supply

WATER USE

☐ Domestic ☐ Stock ☐ Irrigation ☐ Industrial
☐ Commercial ☐ Municipal ☐ Public supply ☐ Cooling & air conditioning
☐ Not used ☐ Other, specify

METHOD OF CONSTRUCTION

☐ Cable tool ☐ Rotary (conventional) ☐ Rotary (reverse) ☐ Rotary (air) ☐ Air percussion ☐ Boring ☐ Diamond ☐ Jetting ☐ Digging ☐ Other

Name of Well Contractor	Well Contractor's Licence No.
C. Hart & Sons Well Drilling Ltd.	2662
Address: Box 850, Fenelon Falls, ON K0M 1N0	
Name of Well Technician: Jim Lang	Well Technician's Licence No. 7-0546
Signature of Technician/Contractor: Clark Hart	Submission date: ___ M ___ D ___ Y

MINISTRY USE ONLY

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M.O.E. WELL RECORD

MW-13

Appendix C
Chemical Comparison Tables and Certificates of Analysis

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Schedule 5 Column 1 with VOC short list

29-June-2018

GHD
Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Date Rec. : 06 June 2018
LR Report: **CA14178-JUN18**
Reference: PO# 11156057-01

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW8-1	6: MW9-1	7: MW10-1	8: MW11-II	9: R-1	10: R-2	11: R-3	12: R-4
Sample Date & Time					06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18
Temperature Upon Receipt [°C]	---	---	--	---	13.0	13.0	13.0	13.0	---	---	---	---
Alkalinity [mg/L as CaCO3]	07-Jun-18	18:18	12-Jun-18	21:33	291	275	241	265	228	251	240	272
pH [no unit]	07-Jun-18	18:18	12-Jun-18	21:33	7.89	8.15	8.03	8.11	7.98	7.94	8.01	7.96
Conductivity [µS/cm]	07-Jun-18	18:18	12-Jun-18	21:33	816	633	638	669	623	667	559	743
Total Dissolved Solids [mg/L]	07-Jun-18	21:02	17-Jun-18	22:35	457	386	389	391	320	383	300	409
Chemical Oxygen Demand [mg/L]	08-Jun-18	07:26	14-Jun-18	19:39	< 8	19	9	< 8	8	< 8	27	< 8
Phosphorus (total) [mg/L]	08-Jun-18	18:00	21-Jun-18	16:03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.04
Total Kjeldahl Nitrogen [as N mg/L]	11-Jun-18	20:42	23-Jun-18	09:50	< 0.5	0.7	< 0.5	0.9	< 0.5	< 0.5	< 0.5	< 0.5
Ammonia+Ammonium (N) [mg/L]	08-Jun-18	20:14	21-Jun-18	14:31	< 0.1	0.6	< 0.1	0.8	< 0.1	< 0.1	< 0.1	0.1
4AAP-Phenolics [mg/L]	13-Jun-18	10:00	15-Jun-18	11:46	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.007	< 0.002
Sulphate [mg/L]	15-Jun-18	11:21	19-Jun-18	13:58	16	68	28	53	4	9	< 2	10
Chloride [mg/L]	15-Jun-18	11:27	19-Jun-18	13:58	82	15	51	32	56	58	35	71
Nitrite (as N) [mg/L]	13-Jun-18	12:58	13-Jun-18	17:44	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Nitrate (as N) [mg/L]	13-Jun-18	12:58	13-Jun-18	17:44	< 0.06	0.14	0.27	< 0.06	0.12	1.60	0.78	1.34
Dissolved Organic Carbon [mg/L]	08-Jun-18	06:00	13-Jun-18	10:53	1	1	3	2	6	< 1	1	2
Mercury (total) [ug/L]	08-Jun-18	11:00	11-Jun-18	10:28	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Arsenic (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.0018	0.0010	0.0007	0.0004	0.0005	0.0004	0.0003	0.0003
Barium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.0960	0.416	0.702	0.377	0.0663	0.0853	0.0663	0.105
Boron (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.108	0.385	0.242	0.492	0.037	0.021	0.018	0.024
Calcium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	125	77.2	112	118	101	127	102	125

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Schedule 5 Column 1 with VOC short list

LR Report : **CA14178-JUN18**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW8-1	6: MW9-1	7: MW10-1	8: MW11-II	9: R-1	10: R-2	11: R-3	12: R-4
Cadmium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.000005	< 0.000003	< 0.000003	< 0.000003	0.000053	0.000004	< 0.000003	0.000022
Chromium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.00014	0.00011	0.00013	0.00015	0.00019	0.00020	0.00026	0.00020
Copper (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.00116	0.00010	0.00011	0.00012	0.00123	0.394	0.163	0.288
Iron (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.031	0.096	0.481	0.028	0.030	< 0.007	< 0.007	< 0.007
Potassium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	3.97	4.51	4.40	5.11	0.890	0.952	0.856	6.01
Magnesium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	11.9	14.7	19.6	25.3	3.00	2.97	2.76	3.47
Manganese (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.00156	0.0526	0.191	0.0814	0.00241	0.00011	0.00016	0.00029
Sodium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	47.1	41.8	12.0	14.8	38.8	29.0	26.8	43.6
Lead (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.00002	< 0.00001	< 0.00001	< 0.00001	0.00139	0.00088	0.00095	0.00447
Zinc (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.003	0.002	< 0.002	< 0.002	0.008	0.037	0.008	0.127
Benzene [µg/L]	08-Jun-18	16:13	12-Jun-18	15:49	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,4-Dichlorobenzene [µg/L]	08-Jun-18	16:13	12-Jun-18	15:49	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Dichloromethane [µg/L]	08-Jun-18	16:13	12-Jun-18	15:49	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Toluene [µg/L]	08-Jun-18	16:13	12-Jun-18	15:49	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Vinyl Chloride [µg/L]	08-Jun-18	16:13	12-Jun-18	15:49	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Bromodichloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Bromoform [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Bromomethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carbon tetrachloride [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 5	< 5	< 5	< 5	< 5
Chloroform [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 5	< 5	< 5	< 5	< 5
Dibromochloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,3-Dichlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloropropane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
trans-1,2-Dichloroethene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
cis-1,2-Dichloroethene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
cis-1,3-Dichloropropene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
trans-1,3-Dichloropropene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ethylbenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ethylenedibromide [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Monochlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Styrene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5

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Schedule 5 Column 1 with VOC short list

LR Report : **CA14178-JUN18**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW8-1	6: MW9-1	7: MW10-1	8: MW11-II	9: R-1	10: R-2	11: R-3	12: R-4
1,1,2,2-Tetrachloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Tetrachloroethene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Trichloroethylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Trichlorofluoromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 5	< 5	< 5	< 5	< 5
1,1,1-Trichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Xylene (total) [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
o-xylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
m/p-xylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5

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Schedule 5 Column 3

29-June-2018

GHD
Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Date Rec. : 06 June 2018
LR Report: **CA14186-JUN18**
Reference: 11153057-01

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-2	6: MW-9-2	7: MW-10-2	8: MW-11-2	9: S-1	10: S-2
Sample Date & Time			06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18
Temperature Upon Receipt [°C]	--	---	13.0	13.0	13.0	13.0	13.0	13.0
Biochemical Oxygen Demand (BOD5) [mg/L]	14-Jun-18	10:09	< 4	< 4	10	< 4	< 4	< 4
Total Suspended Solids [mg/L]	14-Jun-18	15:35	19	2	34	11	8	5
Alkalinity [mg/L as CaCO3]	12-Jun-18	21:55	235	247	251	238	238	230
pH [no unit]	12-Jun-18	21:55	7.82	7.99	7.82	8.04	7.96	8.01
Conductivity [µS/cm]	12-Jun-18	21:55	639	616	610	509	588	652
Total Dissolved Solids [mg/L]	13-Jun-18	10:45	349	317	380	294	326	360
Chemical Oxygen Demand [mg/L]	19-Jun-18	11:58	11	8	< 8	< 8	10	22
Phosphorus (total) [mg/L]	12-Jun-18	13:22	< 0.03	< 0.03	0.04	< 0.03	< 0.03	< 0.03
Total Kjeldahl Nitrogen [as N mg/L]	13-Jun-18	14:59	< 0.5	< 0.5	0.7	0.7	< 0.5	< 0.5
Ammonia+Ammonium (N) [mg/L]	12-Jun-18	09:02	< 0.1	< 0.1	0.6	0.6	< 0.1	< 0.1
4AAP-Phenolics [mg/L]	14-Jun-18	11:38	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001
Sulphate [mg/L]	19-Jun-18	14:00	8	10	11	10	< 2	< 2
Chloride [mg/L]	19-Jun-18	14:00	72	44	52	13	48	73
Nitrite (as N) [mg/L]	17-Jun-18	12:20	< 0.03	< 0.03	0.19	0.05	< 0.03	< 0.03
Nitrate (as N) [mg/L]	17-Jun-18	12:20	0.20	< 0.06	0.40	< 0.06	0.23	< 0.06
Mercury (total) [ug/L]	11-Jun-18	10:29	< 0.01	0.02	< 0.01	< 0.01	< 0.01	0.02

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Schedule 5 Column 3

LR Report : **CA14186-JUN18**

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-2	6: MW-9-2	7: MW-10-2	8: MW-11-2	9: S-1	10: S-2
Arsenic (total) [mg/L]	11-Jun-18	14:46	< 0.0002	0.0004	< 0.0002	< 0.0002	< 0.0002	0.0003
Barium (total) [mg/L]	11-Jun-18	14:46	0.107	0.160	0.566	0.361	0.08721	0.06474
Boron (total) [mg/L]	11-Jun-18	14:46	0.043	0.039	0.128	0.164	0.020	0.015
Cadmium (total) [mg/L]	11-Jun-18	14:46	0.000006	< 0.000003	0.000003	0.000003	0.000007	0.000004
Calcium (total) [mg/L]	11-Jun-18	14:46	106	106	128	99.9	103	103
Chromium (total) [mg/L]	11-Jun-18	14:46	0.00013	0.00012	0.00011	0.00011	0.00394	0.00014
Copper (total) [mg/L]	11-Jun-18	14:46	0.00084	0.00098	0.00041	0.00042	0.00047	0.00035
Iron (total) [mg/L]	11-Jun-18	14:46	0.016	0.372	4.28	1.52	0.014	0.080
Potassium (total) [mg/L]	11-Jun-18	14:46	1.31	2.16	2.60	3.19	1.35	1.47
Magnesium (total) [mg/L]	11-Jun-18	14:46	3.64	3.67	11.1	10.3	2.97	2.82
Manganese (total) [mg/L]	11-Jun-18	14:46	0.0052	0.0159	0.0931	0.0268	0.0014	0.0409
Sodium (total) [mg/L]	11-Jun-18	14:46	37.4	34.6	6.56	8.70	28.1	43.9
Lead (total) [mg/L]	11-Jun-18	14:46	0.00004	0.00003	0.00002	0.00002	0.00004	0.00004
Zinc (total) [mg/L]	11-Jun-18	14:46	< 0.002	< 0.002	< 0.002	< 0.002	0.004	< 0.002
Benzene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,4-Dichlorobenzene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Dichloromethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Toluene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Vinyl Chloride [ug/L]	11-Jun-18	15:54	---	---	---	< 0.2	---	---
Bromodichloromethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Bromoform [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Bromomethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Carbon tetrachloride [ug/L]	11-Jun-18	15:54	---	---	---	< 0.2	---	---
Chloroethane [ug/L]	11-Jun-18	15:54	---	---	---	< 5	---	---
Chloroform [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Chloromethane [ug/L]	11-Jun-18	15:54	---	---	---	< 5	---	---
Dibromochloromethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,2-Dichlorobenzene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,3-Dichlorobenzene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,1-Dichloroethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,2-Dichloroethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,1-Dichloroethylene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---

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Schedule 5 Column 3

LR Report : **CA14186-JUN18**

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-2	6: MW-9-2	7: MW-10-2	8: MW-11-2	9: S-1	10: S-2
1,2-Dichloropropane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
trans-1,2-Dichloroethene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
cis-1,2-Dichloroethene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
cis-1,3-Dichloropropene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
trans-1,3-Dichloropropene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Ethylbenzene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Ethylenedibromide [ug/L]	11-Jun-18	15:54	---	---	---	< 0.2	---	---
Monochlorobenzene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Styrene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,1,2,2-Tetrachloroethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Tetrachloroethene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Trichloroethylene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Trichlorofluoromethane [ug/L]	11-Jun-18	15:54	---	---	---	< 5	---	---
1,1,1-Trichloroethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,1,2-Trichloroethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Xylene (total) [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
o-xylene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
m/p-xylene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---

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Schedule 5 Column 1 with full VOC scan

29-June-2018

GHD
Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
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Phone: 705-749-3317, Fax:

Date Rec. : 07 June 2018
LR Report: **CA14224-JUN18**
Reference: Project #: 11148416-01 PO# 73507633

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: MW-1-1	6: MW-3-1	7: MW-4-1	8: MW-5-1	9: MW-6-1	10: MW-7-1	11: MW-12-2	12: MW-12-3
Sample Date & Time					07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18
Temperature Upon Receipt [°C]					13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
Alkalinity [mg/L as CaCO3]	07-Jun-18	18:18	12-Jun-18	21:34	291	272	310	640	469	334	284	281
pH [no unit]	07-Jun-18	18:18	12-Jun-18	21:34	8.07	8.01	8.01	7.52	7.84	8.32	8.11	8.01
Conductivity [uS/cm]	07-Jun-18	18:18	12-Jun-18	21:34	1170	643	743	1340	1270	817	767	747
Total Dissolved Solids [mg/L]	08-Jun-18	15:23	17-Jun-18	22:35	774	354	397	774	686	474	429	463
Chemical Oxygen Demand [mg/L]	08-Jun-18	07:26	13-Jun-18	11:09	< 8	< 8	< 8	38	25	14	< 8	< 8
Phosphorus (total) [mg/L]	11-Jun-18	18:00	12-Jun-18	12:37	< 0.03	< 0.03	0.04	0.08	0.08	0.10	< 0.03	< 0.03
Total Kjeldahl Nitrogen [as N mg/L]	11-Jun-18	16:00	15-Jun-18	10:12	< 0.5	< 0.5	0.5	11.2	7.0	2.3	< 0.5	< 0.5
Ammonia+Ammonium (N) [mg/L]	11-Jun-18	18:00	14-Jun-18	09:06	< 0.1	0.1	0.4	10.2	6.2	< 0.1	0.2	< 0.1
4AAP-Phenolics [mg/L]	15-Jun-18	08:00	16-Jun-18	08:53	0.004	< 0.002	< 0.002	0.005	0.003	< 0.002	< 0.002	< 0.002
Sulphate [mg/L]	18-Jun-18	09:12	19-Jun-18	12:56	76	61	350	15	43	33	71	25
Chloride [mg/L]	18-Jun-18	09:03	19-Jun-18	12:56	160	40	65	130	110	46	39	60
Nitrite (as N) [mg/L]	14-Jun-18	11:53	19-Jun-18	16:46	0.03	0.05	< 0.03	0.05	0.14	< 0.03	< 0.03	< 0.03
Nitrate (as N) [mg/L]	14-Jun-18	11:53	19-Jun-18	16:46	1.48	1.41	0.88	2.74	0.61	< 0.06	< 0.06	< 0.06
Dissolved Organic Carbon [mg/L]	08-Jun-18	06:00	13-Jun-18	10:49	2	4	5	20	9	3	2	< 1
Mercury (total) [mg/L]	08-Jun-18	11:00	11-Jun-18	10:29	0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Arsenic (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	< 0.0002	< 0.0002	< 0.0002	0.0027	0.0004	0.0006	< 0.0002	< 0.0002
Barium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.238	0.0998	0.115	0.484	0.313	0.123	0.180	0.0735

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Schedule 5 Column 1 with full VOC scan

LR Report : **CA14224-JUN18**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: MW-1-1	6: MW-3-1	7: MW-4-1	8: MW-5-1	9: MW-6-1	10: MW-7-1	11: MW-12-2	12: MW-12-3
Boron (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.111	0.065	0.092	0.295	0.241	0.539	0.533	0.115
Calcium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	174	135	135	259	194	35.7	119	153
Cadmium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.000035	0.000006	0.000017	< 0.000003	0.000008	0.000006	< 0.000003	< 0.000003
Chromium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.00015	0.00015	0.00016	0.00059	0.00032	0.00016	0.00013	0.00013
Copper (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.00187	0.00061	0.00079	0.00033	0.00059	0.00035	0.00040	0.00030
Iron (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	< 0.007	< 0.007	< 0.007	21.8	1.24	< 0.007	0.033	0.040
Potassium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	4.97	4.14	5.31	19.1	15.3	2.05	3.40	1.66
Magnesium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	13.2	4.10	4.95	17.8	11.2	7.00	20.0	5.59
Manganese (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.00012	0.00437	0.234	2.03	1.42	0.00052	0.156	0.0161
Sodium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	65.8	17.8	27.7	54.6	64.1	143	38.5	14.5
Lead (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	< 0.00001	< 0.00001	< 0.00001	< 0.00001	0.00019	< 0.00001	< 0.00001	< 0.00001
Zinc (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.003	0.002	0.002	0.002	0.004	0.002	< 0.002	< 0.002
Benzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Bromodichloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Bromoform [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Bromomethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Carbon tetrachloride [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	---	---
Chloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 5	< 5	< 5	< 5	< 5	---	---
Chloroform [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Chloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 5	< 5	< 5	< 5	< 5	---	---
Dibromochloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,2-Dichlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,3-Dichlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,4-Dichlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1-Dichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,2-Dichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1-Dichloroethylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,2-Dichloropropane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
trans-1,2-Dichloroethene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
cis-1,2-Dichloroethene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
cis-1,3-Dichloropropene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
trans-1,3-Dichloropropene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Ethylbenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Ethylenedibromide [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	---	---
Dichloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Monochlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	0.6	< 0.5	< 0.5	---	---

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Schedule 5 Column 1 with full VOC scan

LR Report : **CA14224-JUN18**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: MW-1-1	6: MW-3-1	7: MW-4-1	8: MW-5-1	9: MW-6-1	10: MW-7-1	11: MW-12-2	12: MW-12-3
Styrene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1,2,2-Tetrachloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Tetrachloroethene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Toluene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Trichloroethylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Vinyl Chloride [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	---	---
Trichlorofluoromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 5	< 5	< 5	< 5	< 5	---	---
1,1,1-Trichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1,2-Trichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Xylene (total) [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
o-xylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
m/p-xylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1,1,2-Tetrachloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---

Analysis	13: MW-13-1
Sample Date & Time	07-Jun-18
Temperature Upon Receipt [°C]	13.0
Alkalinity [mg/L as CaCO3]	227
pH [no unit]	8.11
Conductivity [uS/cm]	590
Total Dissolved Solids [mg/L]	314
Chemical Oxygen Demand [mg/L]	13
Phosphorus (total) [mg/L]	0.04
Total Kjeldahl Nitrogen [as N mg/L]	< 0.5
Ammonia+Ammonium (N) [mg/L]	< 0.1
4AAP-Phenolics [mg/L]	< 0.002
Sulphate [mg/L]	15
Chloride [mg/L]	100
Nitrite (as N) [mg/L]	< 0.03
Nitrate (as N) [mg/L]	0.94
Dissolved Organic Carbon [mg/L]	2
Mercury (total) [mg/L]	0.00001
Arsenic (dissolved) [mg/L]	< 0.0002

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Schedule 5 Column 1 with full VOC scan

LR Report : **CA14224-JUN18**

Analysis	13: MW-13-1
Barium (dissolved) [mg/L]	0.0703
Boron (dissolved) [mg/L]	0.022
Calcium (dissolved) [mg/L]	96.4
Cadmium (dissolved) [mg/L]	0.000012
Chromium (dissolved) [mg/L]	0.00023
Copper (dissolved) [mg/L]	0.00068
Iron (dissolved) [mg/L]	< 0.007
Potassium (dissolved) [mg/L]	1.91
Magnesium (dissolved) [mg/L]	2.31
Manganese (dissolved) [mg/L]	0.00008
Sodium (dissolved) [mg/L]	31.6
Lead (dissolved) [mg/L]	0.00002
Zinc (dissolved) [mg/L]	0.013
Benzene [ug/L]	---
Bromodichloromethane [ug/L]	---
Bromoform [ug/L]	---
Bromomethane [ug/L]	---
Carbon tetrachloride [ug/L]	---
Chloroethane [ug/L]	---
Chloroform [ug/L]	---
Chloromethane [ug/L]	---
Dibromochloromethane [ug/L]	---
1,2-Dichlorobenzene [ug/L]	---
1,3-Dichlorobenzene [ug/L]	---
1,4-Dichlorobenzene [ug/L]	---
1,1-Dichloroethane [ug/L]	---
1,2-Dichloroethane [ug/L]	---
1,1-Dichloroethylene [ug/L]	---
1,2-Dichloropropane [ug/L]	---
trans-1,2-Dichloroethene [ug/L]	---
cis-1,2-Dichloroethene [ug/L]	---
cis-1,3-Dichloropropene [ug/L]	---
trans-1,3-Dichloropropene [ug/L]	---
Ethylbenzene [ug/L]	---
Ethylenedibromide [ug/L]	---
Dichloromethane [ug/L]	---

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Analysis	13: MW-13-1
Monochlorobenzene [ug/L]	---
Styrene [ug/L]	---
1,1,2,2-Tetrachloroethane [ug/L]	---
Tetrachloroethene [ug/L]	---
Toluene [ug/L]	---
Trichloroethylene [ug/L]	---
Vinyl Chloride [ug/L]	---
Trichlorofluoromethane [ug/L]	---
1,1,1-Trichloroethane [ug/L]	---
1,1,2-Trichloroethane [ug/L]	---
Xylene (total) [ug/L]	---
o-xylene [ug/L]	---
m/p-xylene [ug/L]	---
1,1,1,2-Tetrachloroethane [ug/L]	---

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Schedule 5 Column 3

29-June-2018

GHD
Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Date Rec. : 07 June 2018
LR Report: **CA14225-JUN18**
Reference: PO# 73510995 Project #: 111562057-1

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: MW-3-2	6: MW-4-2	7: MW-5-2	8: MW-6-II	9: MW-7-2	10: MW-12-1	11: MW-13-2
Sample Date & Time			07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18
Temperature Upon Receipt [°C]			13.0	13.0	13.0	13.0	13.0	13.0	13.0
Biochemical Oxygen Demand (BOD5) [mg/L]	14-Jun-18	15:23	7	< 4	< 4	< 4	< 4	< 4	< 4
Total Suspended Solids [mg/L]	13-Jun-18	14:36	392	1340	1610	188	259	19	46
Alkalinity [mg/L as CaCO3]	12-Jun-18	21:55	609	305	819	929	286	267	221
pH [no unit]	12-Jun-18	21:55	7.66	7.94	7.18	7.41	7.97	7.93	7.89
Conductivity [uS/cm]	12-Jun-18	21:55	1300	356	1480	2060	650	690	503
Total Dissolved Solids [mg/L]	13-Jun-18	11:20	794	220	969	1310	380	414	269
Chemical Oxygen Demand [mg/L]	13-Jun-18	11:09	11	< 8	51	87	< 8	< 8	< 8
Phosphorus (total) [mg/L]	12-Jun-18	12:37	0.13	0.23	0.18	0.05	0.06	< 0.03	0.04
Total Kjeldahl Nitrogen [as N mg/L]	15-Jun-18	10:12	2.6	< 0.5	14.3	23.4	< 0.5	< 0.5	1.7
Ammonia+Ammonium (N) [mg/L]	14-Jun-18	15:14	2.1	< 0.1	11.1	19.7	0.2	0.2	0.9
4AAP-Phenolics [mg/L]	15-Jun-18	11:46	0.001	< 0.001	0.006	0.010	< 0.001	< 0.001	< 0.001
Sulphate [mg/L]	21-Jun-18	15:55	78	3	9	180	16	24	18
Chloride [mg/L]	20-Jun-18	14:05	26	4	91	99	7	51	44
Nitrite (as N) [mg/L]	19-Jun-18	16:47	0.90	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.10
Nitrate (as N) [mg/L]	19-Jun-18	16:47	7.60	0.07	1.02	< 0.06	< 0.06	< 0.06	0.71
Mercury (total) [ug/L]	11-Jun-18	10:29	< 0.01	0.03	< 0.01	0.01	< 0.01	< 0.01	< 0.01
Arsenic (total) [mg/L]	12-Jun-18	09:31	0.0003	< 0.0002	0.0020	0.0028	< 0.0002	< 0.0002	< 0.0002

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0001426177

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Schedule 5 Column 3

LR Report : **CA14225-JUN18**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: MW-3-2	6: MW-4-2	7: MW-5-2	8: MW-6-II	9: MW-7-2	10: MW-12-1	11: MW-13-2
Barium (total) [mg/L]	12-Jun-18	09:31	0.173	0.0955	0.689	0.701	0.144	0.620	0.160
Boron (total) [mg/L]	12-Jun-18	09:31	0.435	0.045	0.362	0.817	0.076	0.117	0.074
Calcium (total) [mg/L]	12-Jun-18	09:31	231	107	273	438	110	135	130
Cadmium (total) [mg/L]	12-Jun-18	09:31	0.000012	0.000004	0.000006	0.000014	< 0.000003	0.000021	0.000004
Chromium (total) [mg/L]	12-Jun-18	09:31	0.00020	0.00015	0.00075	0.00163	0.00024	0.00011	0.00017
Copper (total) [mg/L]	12-Jun-18	09:31	0.00178	0.00057	0.00058	0.00430	0.00154	0.00017	0.00080
Iron (total) [mg/L]	12-Jun-18	09:31	1.40	< 0.007	29.9	21.4	< 0.007	< 0.007	0.024
Potassium (total) [mg/L]	12-Jun-18	09:31	18.1	1.81	23.3	44.0	1.87	3.40	4.47
Magnesium (total) [mg/L]	12-Jun-18	09:31	22.6	2.92	24.7	50.4	5.07	11.0	4.43
Manganese (total) [mg/L]	13-Jun-18	13:32	3.15	0.0678	6.76	11.7	0.00208	0.00515	0.00378
Sodium (total) [mg/L]	12-Jun-18	09:31	58.5	11.4	64.0	121	19.9	13.9	29.3
Lead (total) [mg/L]	12-Jun-18	09:31	0.00003	< 0.00001	0.00005	0.00005	0.00003	0.00002	0.00002
Zinc (total) [mg/L]	12-Jun-18	09:31	< 0.002	0.002	0.004	0.002	0.004	0.002	0.003
Benzene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Bromodichloromethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Bromoform [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Bromomethane [ug/L]	14-Jun-18	15:00	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Carbon tetrachloride [ug/L]	12-Jun-18	15:41	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	---	---
Chloroethane [ug/L]	12-Jun-18	15:41	< 5	< 5	< 5	< 5	< 5	---	---
Chloroform [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Chloromethane [ug/L]	12-Jun-18	15:41	< 5	< 5	< 5	< 5	< 5	---	---
Dibromochloromethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,2-Dichlorobenzene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,3-Dichlorobenzene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,4-Dichlorobenzene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1-Dichloroethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,2-Dichloroethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1-Dichloroethylene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,2-Dichloropropane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
trans-1,2-Dichloroethene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
cis-1,2-Dichloroethene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
cis-1,3-Dichloropropene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
trans-1,3-Dichloropropene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Ethylbenzene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Ethylenedibromide [ug/L]	12-Jun-18	15:41	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	---	---
Dichloromethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---

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Schedule 5 Column 3

LR Report : **CA14225-JUN18**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: MW-3-2	6: MW-4-2	7: MW-5-2	8: MW-6-II	9: MW-7-2	10: MW-12-1	11: MW-13-2
Monochlorobenzene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Styrene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1,2,2-Tetrachloroethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Tetrachloroethene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Toluene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Trichloroethylene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Vinyl Chloride [ug/L]	12-Jun-18	15:41	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	---	---
Trichlorofluoromethane [ug/L]	12-Jun-18	15:41	< 5	< 5	< 5	< 5	< 5	---	---
1,1,1-Trichloroethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1,2-Trichloroethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Xylene (total) [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
o-xylene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
m/p-xylene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1,1,2-Tetrachloroethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---

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0001426177

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Schedule 5 Column 2

21-October-2018

GHD
Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Date Rec. : 11 October 2018
LR Report: **CA14226-OCT18**
Reference: PO#73510995 11156055-01

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-1	6: MW-9-1	7: MW-10-1	8: MW-11-1
Sample Date & Time					11-Oct-18	11-Oct-18	11-Oct-18	11-Oct-18
Temp Upon Receipt [°C]	---	---	--	---	17.0	17.0	17.0	17.0
Alkalinity [mg/L as CaCO3]	11-Oct-18	13:13	14-Oct-18	21:26	292	279	240	256
pH [no unit]	11-Oct-18	13:13	14-Oct-18	21:26	7.85	8.41	8.26	8.19
Conductivity [uS/cm]	11-Oct-18	13:13	14-Oct-18	21:26	818	606	649	647
TDS [mg/L]	11-Oct-18	14:59	14-Oct-18	15:49	434	280	374	380
COD [mg/L]	12-Oct-18	08:16	14-Oct-18	22:16	12	37	< 8	15
NH3+NH4 [as N mg/L]	18-Oct-18	17:50	18-Oct-18	14:53	< 0.1	0.6	0.2	0.7
SO4 [mg/L]	16-Oct-18	15:48	18-Oct-18	15:31	17	31	23	52
Cl [mg/L]	16-Oct-18	15:53	18-Oct-18	15:31	81	18	50	30
NO3 [as N mg/L]	16-Oct-18	21:10	18-Oct-18	15:06	< 0.06	< 0.06	< 0.06	< 0.06
DOC [mg/L]	15-Oct-18	18:00	17-Oct-18	09:36	< 1	1	< 1	2
Ba (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	0.102	0.769	0.747	0.370
B (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	0.104	0.612	0.253	0.478
Ca (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	117	59.0	98.5	103
Fe (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	0.031	< 0.007	0.043	0.148

OnLine LIMS

0001549246

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

LR Report : CA14226-OCT18

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-1	6: MW-9-1	7: MW-10-1	8: MW-11-1
Mg (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	12.3	22.9	22.0	26.9
Na (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	49.7	52.4	14.7	15.7
As (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Cd (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	< 0.000003	< 0.000003	< 0.000003	< 0.000003
Cr (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:26	0.00014	0.00011	0.00011	0.00016
Cu (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:26	0.00143	0.00044	0.00013	0.00031
K (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:26	3.58	5.38	4.29	4.52
Mn (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:26	0.0452	0.0706	0.133	0.0835
Pb (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:26	0.00003	0.00001	0.00002	0.00001
Zn (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:26	0.003	0.004	0.005	0.004
Benzene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Bromodichloromethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Bromoform [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Bromomethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Carbon tetrachloride [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.2
Chloroethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 5
Chloroform [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Chloromethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 5
Dibromochloromethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,2-Dichlorobenzene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,3-Dichlorobenzene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,4-Dichlorobenzene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,1-Dichloroethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,2-Dichloroethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,1-Dichloroethylene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,2-Dichloropropane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
trans-1,2-Dichloroet [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
cis-1,2-Dichloroethe [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
cis-1,3-Dichloroprop [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5

SGS Canada Inc.
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Schedule 5 Column 2

LR Report : **CA14226-OCT18**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-1	6: MW-9-1	7: MW-10-1	8: MW-11-1
trans-1,3-Dichloropr [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Ethylbenzene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Ethylenedibromide [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.2
Dichloromethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Monochlorobenzene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Styrene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,1,2,2-Tetrachloroe [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Tetrachloroethene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Toluene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Trichloroethylene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Vinyl Chloride [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.2
Trichlorofluorometha [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 5
1,1,1-Trichloroethan [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,1,2-Trichloroethan [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Xylene (total) [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
o-xylene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
m-p-xylene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,1,1,2-Tetrachloroe [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Robert Irwin
CHEMIST

Rob Irwin B.Sc., C.Chem
Technical Manager, Inorganic Chemistry
Environmental, Analytical Services

OnLine LIMS

0001549246

SGS Canada Inc.
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Lakefield - Ontario - KOL 2HO
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Schedule 5 Column 3, Column 1 metals

Project : PO#735108995 11156057-01

13-November-2018

GHD
Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Date Rec. : 11 October 2018
LR Report: **CA14227-OCT18**
Reference: PO#735108995
11156057-01Gus Bolin

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-2	6: MW-9-2	7: MW-10-2	8: MW-11-2
Sample Date & Time			11-Oct-18	11-Oct-18	11-Oct-18	11-Oct-18
Temperature Upon Receipt [°C]	--	---	17.0	17.0	17.0	17.0
Biochemical Oxygen Demand (BOD5) [mg/L]	16-Oct-18	14:02	6	< 4	6	< 4
Total Suspended Solids [mg/L]	16-Oct-18	16:06	17	8	29	8
Alkalinity [mg/L as CaCO3]	14-Oct-18	21:27	272	272	244	247
pH [no unit]	14-Oct-18	21:27	8.15	8.14	7.90	7.65
Conductivity [uS/cm]	14-Oct-18	21:27	984	801	619	603
Total Dissolved Solids [mg/L]	14-Oct-18	15:49	583	423	360	354
Chemical Oxygen Demand [mg/L]	16-Oct-18	14:02	9	8	10	9
Phosphorus (total) [mg/L]	17-Oct-18	11:21	0.04	0.04	0.06	0.05
Total Kjeldahl Nitrogen [as N mg/L]	18-Oct-18	10:40	0.7	< 0.5	1.3	1.4
Ammonia+Ammonium (N) [as N mg/L]	16-Oct-18	12:27	0.1	0.2	0.6	0.9
4AAP-Phenolics [mg/L]	15-Oct-18	15:32	0.005	0.004	0.004	0.004
Sulphate [mg/L]	18-Oct-18	15:31	14	16	7	13
Chloride [mg/L]	18-Oct-18	15:31	120	85	47	29
Nitrite (as N) [mg/L]	18-Oct-18	15:06	< 0.03	< 0.03	0.18	< 0.03
Nitrate (as N) [mg/L]	18-Oct-18	15:06	0.94	0.62	0.23	< 0.06
Mercury (total) [ug/L]	16-Oct-18	14:18	0.03	0.02	0.01	< 0.01
Arsenic (dissolved) [mg/L]	19-Oct-18	14:54	0.0003	0.0004	0.0003	< 0.0002
Barium (dissolved) [mg/L]	19-Oct-18	14:58	0.190	0.203	0.472	0.477
Boron (dissolved) [mg/L]	19-Oct-18	14:58	0.023	0.091	0.113	0.129
Calcium (dissolved) [mg/L]	19-Oct-18	14:58	139	97.6	90.8	102
Cadmium (dissolved) [mg/L]	19-Oct-18	14:58	0.000010	0.000008	0.000008	0.000008
Chromium (dissolved) [mg/L]	19-Oct-18	14:58	0.00026	0.00070	0.00100	0.00016
Copper (dissolved) [mg/L]	19-Oct-18	14:58	0.00063	0.00189	0.00039	< 0.00002
Iron (dissolved) [mg/L]	19-Oct-18	14:58	1.32	0.526	9.96	3.35
Potassium (dissolved) [mg/L]	19-Oct-18	14:58	1.31	4.86	3.54	2.57
Magnesium (dissolved) [mg/L]	19-Oct-18	14:58	4.98	5.78	10.3	10.4
Manganese (dissolved) [mg/L]	19-Oct-18	14:58	0.0389	0.0211	0.0751	0.0313
Sodium (dissolved) [mg/L]	19-Oct-18	14:58	46.0	48.3	8.17	5.56

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Schedule 5 Column 3, Column 1 metals

Project : PO#735108995 11156057-01

LR Report : **CA14227-OCT18**

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-2	6: MW-9-2	7: MW-10-2	8: MW-11-2
Lead (dissolved) [mg/L]	19-Oct-18	14:58	0.00058	0.00031	0.00028	0.00013
Zinc (total) [mg/L]	19-Oct-18	14:58	< 0.002	0.005	< 0.002	< 0.002
Benzene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Bromodichloromethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Bromoform [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Bromomethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Carbon tetrachloride [ug/L]	17-Oct-18	13:58	---	---	---	< 0.2
Chloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 5
Chloroform [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Chloromethane [ug/L]	17-Oct-18	13:58	---	---	---	< 5
Dibromochloromethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,2-Dichlorobenzene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,3-Dichlorobenzene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,4-Dichlorobenzene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,1-Dichloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,2-Dichloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,1-Dichloroethylene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,2-Dichloropropane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
trans-1,2-Dichloroethene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
cis-1,2-Dichloroethene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
cis-1,3-Dichloropropene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
trans-1,3-Dichloropropene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Ethylbenzene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Ethylenedibromide [ug/L]	17-Oct-18	13:58	---	---	---	< 0.2
Dichloromethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Monochlorobenzene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Styrene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,1,2,2-Tetrachloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Tetrachloroethene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Toluene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Trichloroethylene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Vinyl Chloride [ug/L]	17-Oct-18	13:58	---	---	---	< 0.2
Trichlorofluoromethane [ug/L]	17-Oct-18	13:58	---	---	---	< 5
1,1,1-Trichloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,1,2-Trichloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Xylene (total) [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
o-xylene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
m/p-xylene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,1,1,2-Tetrachloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5

SGS Canada Inc.
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Schedule 5 Column 3, Column 1 metals

Project : PO#735108995 11156057-01

LR Report : **CA14227-OCT18**

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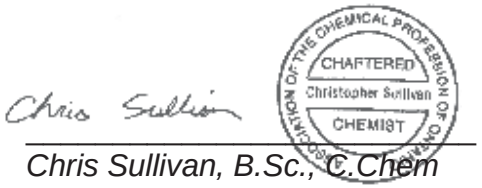

Chris Sullivan, B.Sc., C.Chem
Project Specialist
Environmental Services, Analytical

OnLine LIMS

0001574722

SGS Canada Inc.
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GHD
Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Schedule 5 Column 2

Project : 11156055-01

01-November-2018

Date Rec. : 13 October 2018
LR Report: **CA14289-OCT18**
Reference: PO#73510995 11156055-01 Gus Bolin

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-12-2	6: MW-12-3	7: MW-13-1	8: MW-7-1
Sample Date & Time					12-Oct-18	12-Oct-18	12-Oct-18	12-Oct-18
Temp Upon Receipt [°C]	---	---	--	---	10.0	10.0	10.0	10.0
Alkalinity [mg/L as CaCO3]	15-Oct-18	14:46	16-Oct-18	14:33	287	294	273	342
pH [no unit]	15-Oct-18	14:46	16-Oct-18	14:33	8.00	7.83	7.99	8.26
Conductivity [uS/cm]	15-Oct-18	14:46	16-Oct-18	14:33	732	708	822	787
TDS [mg/L]	15-Oct-18	14:21	17-Oct-18	13:06	449	426	457	454
COD [mg/L]	17-Oct-18	07:43	17-Oct-18	16:25	15	< 8	< 8	< 8
NH3+NH4 [as N mg/L]	18-Oct-18	17:50	18-Oct-18	14:54	0.2	< 0.1	< 0.1	< 0.1
SO4 [mg/L]	18-Oct-18	13:55	19-Oct-18	13:27	66	23	13	30
Cl [mg/L]	18-Oct-18	13:49	19-Oct-18	13:27	43	56	93	45
NO3 [as N mg/L]	16-Oct-18	23:21	18-Oct-18	15:58	< 0.06	0.08	1.21	0.25
DOC [mg/L]	23-Oct-18	14:00	30-Oct-18	13:41	2	1	3	1
Ba (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.168	0.0347	0.0784	0.131
B (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.501	0.080	0.020	0.540

OnLine LIMS

0001563205

SGS Canada Inc.
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Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Schedule 5 Column 2

Project : 11156055-01

LR Report : CA14289-OCT18

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-12-2	6: MW-12-3	7: MW-13-1	8: MW-7-1
Ca (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	97.7	136	71.8	40.6
Fe (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.024	0.200	< 0.007	< 0.007
Mg (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	22.2	5.99	2.31	8.26
Na (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	40.4	15.2	70.6	148
As (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	< 0.0002	< 0.0002	< 0.0002	0.0006
Cd (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	< 0.000003	< 0.000003	< 0.000003	0.000007
Cr (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.00012	0.00013	0.00015	0.00016
Cu (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.00024	0.00022	0.00077	0.00048
K (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	3.11	1.67	2.64	2.45
Mn (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.149	0.0493	0.00035	0.00568
Pb (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	< 0.00001	0.00002	0.00003	0.00002
Zn (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	< 0.002	0.002	< 0.002	< 0.002
Benzene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Bromodichloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Bromoform [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Bromomethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Carbon tetrachloride [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.2
Chloroethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 5
Chloroform [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Chloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 5
Dibromochloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,2-Dichlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,3-Dichlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,4-Dichlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,1-Dichloroethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,2-Dichloroethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,1-Dichloroethylene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5

SGS Canada Inc.
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Schedule 5 Column 2

Project : 11156055-01

LR Report : CA14289-OCT18

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-12-2	6: MW-12-3	7: MW-13-1	8: MW-7-1
1,2-Dichloropropane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
trans-1,2-Dichloroet [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
cis-1,2-Dichloroethe [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
cis-1,3-Dichloroprop [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
trans-1,3-Dichloropr [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Ethylbenzene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Ethylenedibromide [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.2
Dichloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Monochlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Styrene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,1,2,2-Tetrachloroe [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Tetrachloroethene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Toluene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Trichloroethylene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Vinyl Chloride [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.2
Trichlorofluorometha [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 5
1,1,1-Trichloroethan [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,1,2-Trichloroethan [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Xylene (total) [ug/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
o-xylene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
m-p-xylene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,1,1,2-Tetrachloroe [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5

SGS Canada Inc.
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Schedule 5 Column 2

Project : 11156055-01

LR Report : **CA14289-OCT18**

Rob Irwin B.Sc., C.Chem
Technical Manager, Inorganic Chemistry
Environmental, Analytical Services

OnLine LIMS

0001563205

SGS Canada Inc.
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Schedule 5 Column 2

01-November-2018

GHD
Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Date Rec. : 15 October 2018
LR Report: **CA14290-OCT18**
Reference: PO#73510995 11156055-01

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-1-1	6: MW-3-1	7: MW-4-1	8: MW-5-1	9: MW-6-1
Sample Date & Time					12-Oct-18	12-Oct-18	12-Oct-18	12-Oct-18	12-Oct-18
Temp Upon Receipt [°C]	---	---	--	---	8.0	8.0	8.0	8.0	8.0
Alkalinity [mg/L as CaCO3]	15-Oct-18	14:46	16-Oct-18	14:33	292	354	376	677	469
pH [no unit]	15-Oct-18	14:46	16-Oct-18	14:33	7.96	7.82	7.76	7.56	7.75
Conductivity [uS/cm]	15-Oct-18	14:46	16-Oct-18	14:33	1110	815	904	1520	1190
TDS [mg/L]	15-Oct-18	14:21	17-Oct-18	13:06	671	471	537	877	703
COD [mg/L]	17-Oct-18	07:43	17-Oct-18	16:25	< 8	< 8	8	41	15
Total P [mg/L]	18-Oct-18	19:10	22-Oct-18	10:48	0.04	< 0.03	< 0.03	< 0.03	0.06
NH3+NH4 [as N mg/L]	18-Oct-18	17:50	23-Oct-18	12:01	< 0.1	< 0.1	0.2	13.3	6.5
SO4 [mg/L]	18-Oct-18	13:55	19-Oct-18	13:27	73	16	27	10	42
Cl [mg/L]	18-Oct-18	13:49	19-Oct-18	15:23	160	52	67	120	100
NO3 [as N mg/L]	17-Oct-18	04:00	22-Oct-18	14:29	2.70	2.26	1.58	0.54	0.14
DOC [mg/L]	23-Oct-18	14:00	24-Oct-18	12:48	2	2	3	14	6
Ba (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.229	0.112	0.151	0.587	0.285
B (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.104	0.045	0.110	0.450	0.213
Ca (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	157	129	155	230	163

OnLine LIMS

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Schedule 5 Column 2

LR Report : **CA14290-OCT18**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-1-1	6: MW-3-1	7: MW-4-1	8: MW-5-1	9: MW-6-1
Fe (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.008	0.013	0.061	28.4	2.24
Mg (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	14.9	4.46	7.42	22.5	11.6
Na (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	70.5	30.7	34.2	81.9	63.7
As (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	< 0.0002	< 0.0002	< 0.0002	0.0026	0.0005
Cd (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.000007	0.000022	0.000014	< 0.000003	0.000003
Cr (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.00012	0.00011	0.00018	0.00077	0.00032
Cu (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.00330	0.00281	0.00177	0.00111	0.00086
K (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	4.84	3.69	4.46	25.1	13.3
Mn (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.00682	0.102	0.0535	2.12	1.37
Pb (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.00015	0.00016	0.00009	0.00007	0.00021
Zn (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.004	0.005	0.003	0.003	0.004
Benzene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Bromodichloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Bromoform [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Bromomethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Carbon tetrachloride [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.2	< 0.2	< 0.2	< 0.2
Chloroethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 5	< 5	< 5	< 5
Chloroform [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Chloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 5	< 5	< 5	< 5
Dibromochloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,3-Dichlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,4-Dichlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloroethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethylene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloropropane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
trans-1,2-Dichloroet [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
cis-1,2-Dichloroethe [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5

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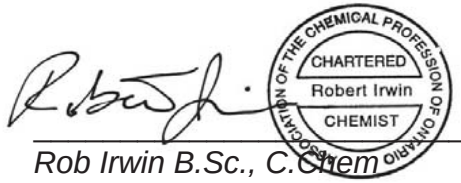
Schedule 5 Column 2

LR Report : **CA14290-OCT18**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-1-1	6: MW-3-1	7: MW-4-1	8: MW-5-1	9: MW-6-1
cis-1,3-Dichloroprop [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
trans-1,3-Dichloropr [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Ethylbenzene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Ethylenedibromide [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.2	< 0.2	< 0.2	< 0.2
Dichloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Monochlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Styrene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2,2-Tetrachloroe [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Tetrachloroethene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Toluene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Trichloroethylene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Vinyl Chloride [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.2	< 0.2	< 0.2	< 0.2
Trichlorofluorometha [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 5	< 5	< 5	< 5
1,1,1-Trichloroethan [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichloroethan [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Xylene (total) [ug/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
o-xylene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
m-p-xylene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,1,1,2-Tetrachloroe [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5



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OnLine LIMS

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13-November-2018

GHD
Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Date Rec. : 13 October 2018
LR Report: **CA14303-OCT18**
Reference: PO#735108995
11156057-01Gus Bolin

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-12-1	6: MW-13-2	7: MW-7-2	8: MW-14-1
Sample Date & Time			12-Oct-18	12-Oct-18	12-Oct-18	12-Oct-18
Temperature Upon Receipt [°C]	--	---	10.0	10.0	10.0	10.0
Biochemical Oxygen Demand (BOD5) [mg/L]	22-Oct-18	13:36	9	< 4	< 4	---
Total Suspended Solids [mg/L]	19-Oct-18	11:53	2	< 2	100	---
Alkalinity [mg/L as CaCO3]	16-Oct-18	14:33	251	282	1080	---
pH [no unit]	16-Oct-18	14:33	7.95	7.91	7.58	---
Conductivity [uS/cm]	16-Oct-18	14:33	593	610	2200	---
Total Dissolved Solids [mg/L]	17-Oct-18	13:22	346	371	1470	---
Chemical Oxygen Demand [mg/L]	22-Oct-18	13:36	13	< 8	95	---
Phosphorus (total) [mg/L]	17-Oct-18	13:50	< 0.03	0.06	< 0.03	---
Total Kjeldahl Nitrogen [as N mg/L]	06-Nov-18	12:51	< 0.5	< 0.5	31.9	---
Ammonia+Ammonium (N) [as N mg/L]	24-Oct-18	09:15	0.1	< 0.1	23.2	---
4AAP-Phenolics [mg/L]	25-Oct-18	09:04	< 0.001	< 0.001	0.003	---
Sulphate [mg/L]	19-Oct-18	13:27	22	15	60	---
Chloride [mg/L]	19-Oct-18	15:23	45	30	140	---
Nitrite (as N) [mg/L]	17-Oct-18	12:29	< 0.03	< 0.03	< 0.03	---
Nitrate (as N) [mg/L]	17-Oct-18	12:29	< 0.06	1.37	0.12	---
Mercury (total) [ug/L]	17-Oct-18	14:33	< 0.01	< 0.01	0.01	---
Mercury (dissolved) [mg/L]	17-Oct-18	14:33	< 0.00001	< 0.00001	0.00001	---
Arsenic (dissolved) [mg/L]	30-Oct-18	15:22	< 0.0002	< 0.0002	0.0009	---
Barium (dissolved) [mg/L]	30-Oct-18	15:22	0.667	0.106	0.432	---
Boron (dissolved) [mg/L]	30-Oct-18	15:22	0.120	0.027	0.673	---
Calcium (dissolved) [mg/L]	30-Oct-18	15:22	96.7	109	308	---
Cadmium (dissolved) [mg/L]	30-Oct-18	15:22	< 0.000003	0.000004	0.000008	---
Chromium (dissolved) [mg/L]	30-Oct-18	15:22	0.00003	0.00007	0.00093	---
Copper (dissolved) [mg/L]	30-Oct-18	15:22	0.00030	0.00071	0.00318	---
Iron (dissolved) [mg/L]	30-Oct-18	15:22	< 0.007	0.013	0.178	---
Potassium (dissolved) [mg/L]	30-Oct-18	15:22	3.30	3.17	39.4	---
Magnesium (dissolved) [mg/L]	30-Oct-18	15:22	12.1	2.82	37.6	---
Manganese (dissolved) [mg/L]	30-Oct-18	15:22	0.00269	0.00960	7.44	---

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LR Report : **CA14303-OCT18**

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-12-1	6: MW-13-2	7: MW-7-2	8: MW-14-1
Sodium (dissolved) [mg/L]	30-Oct-18	15:22	10.4	31.8	128	---
Lead (dissolved) [mg/L]	30-Oct-18	15:22	< 0.00001	< 0.00001	< 0.00001	---
Zinc (dissolved) [mg/L]	30-Oct-18	15:22	< 0.002	< 0.002	< 0.002	---
Benzene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Bromodichloromethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Bromoform [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Bromomethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Carbon tetrachloride [ug/L]	18-Oct-18	16:17	---	---	< 0.2	< 0.2
Chloroethane [ug/L]	18-Oct-18	16:17	---	---	< 5	< 5
Chloroform [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Chloromethane [ug/L]	18-Oct-18	16:17	---	---	< 5	< 5
Dibromochloromethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,2-Dichlorobenzene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,3-Dichlorobenzene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,4-Dichlorobenzene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,1-Dichloroethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,2-Dichloroethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,1-Dichloroethylene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,2-Dichloropropane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
trans-1,2-Dichloroethene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
cis-1,2-Dichloroethene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
cis-1,3-Dichloropropene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
trans-1,3-Dichloropropene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Ethylbenzene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Ethylenedibromide [ug/L]	18-Oct-18	16:17	---	---	< 0.2	< 0.2
Dichloromethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Monochlorobenzene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Styrene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,1,2,2-Tetrachloroethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Tetrachloroethene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Toluene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Trichloroethylene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Vinyl Chloride [ug/L]	18-Oct-18	16:17	---	---	< 0.2	< 0.2
Trichlorofluoromethane [ug/L]	18-Oct-18	16:17	---	---	< 5	< 5
1,1,1-Trichloroethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,1,2-Trichloroethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Xylene (total) [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
o-xylene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
m/p-xylene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,1,1,2-Tetrachloroethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5

SGS Canada Inc.
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LR Report : **CA14303-OCT18**

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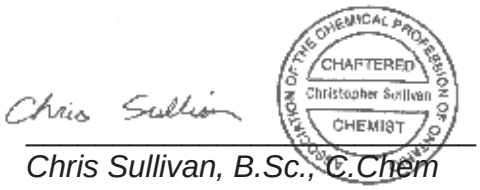

Chris Sullivan, B.Sc., C.Chem
Project Specialist
Environmental Services, Analytical

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
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Schedule 5 Column 3, Column 1 metals

Project : PO#735108995 11156057-01

13-November-2018

GHD
Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Date Rec. : 13 October 2018
LR Report: **CA14304-OCT18**
Reference: PO#735108995
11156057-01 Gus Bolin

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-4-2	6: MW-6-2
Sample Date & Time			12-Oct-18	12-Oct-18
Temperature Upon Receipt [°C]	--	---	8.0	8.0
Biochemical Oxygen Demand (BOD5) [mg/L]	22-Oct-18	13:35	< 4	< 4
Total Suspended Solids [mg/L]	18-Oct-18	13:47	2520	704
Alkalinity [mg/L as CaCO3]	16-Oct-18	14:33	315	505
pH [no unit]	16-Oct-18	14:33	7.87	7.74
Conductivity [uS/cm]	16-Oct-18	14:33	701	1080
Total Dissolved Solids [mg/L]	17-Oct-18	13:06	417	686
Chemical Oxygen Demand [mg/L]	17-Oct-18	16:26	< 8	17
Phosphorus (total) [mg/L]	17-Oct-18	13:50	< 0.03	0.05
Total Kjeldahl Nitrogen [as N mg/L]	18-Oct-18	09:49	< 0.5	< 0.5
Ammonia+Ammonium (N) [as N mg/L]	24-Oct-18	09:15	< 0.1	< 0.1
4AAP-Phenolics [mg/L]	25-Oct-18	09:04	< 0.001	0.002
Sulphate [mg/L]	19-Oct-18	13:27	11	43
Chloride [mg/L]	19-Oct-18	13:27	50	65
Nitrite (as N) [mg/L]	19-Oct-18	14:42	< 0.03	< 0.03
Nitrate (as N) [mg/L]	19-Oct-18	14:42	0.77	4.76
Mercury (total) [ug/L]	17-Oct-18	14:33	< 0.01	0.02
Mercury (dissolved) [mg/L]	03-Nov-18	07:09	0.00001	0.00001
Arsenic (dissolved) [mg/L]	30-Oct-18	15:25	< 0.0002	< 0.0002
Barium (dissolved) [mg/L]	30-Oct-18	15:25	0.143	0.304
Boron (dissolved) [mg/L]	30-Oct-18	15:25	0.044	0.269
Calcium (dissolved) [mg/L]	30-Oct-18	15:25	116	145
Cadmium (total) [mg/L]	30-Oct-18	15:25	0.000004	0.000005
Chromium (dissolved) [mg/L]	30-Oct-18	15:25	0.00014	0.00039
Copper (dissolved) [mg/L]	30-Oct-18	15:25	0.00071	0.00358
Iron (dissolved) [mg/L]	30-Oct-18	15:25	0.017	0.111
Potassium (dissolved) [mg/L]	30-Oct-18	15:25	1.80	9.57
Magnesium (dissolved) [mg/L]	30-Oct-18	15:25	3.82	16.5
Manganese (dissolved) [mg/L]	30-Oct-18	15:25	0.00114	0.00925

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Schedule 5 Column 3, Column 1 metals

Project : PO#735108995 11156057-01

LR Report : **CA14304-OCT18**

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-4-2	6: MW-6-2
Sodium (dissolved) [mg/L]	30-Oct-18	15:25	20.6	55.6
Lead (dissolved) [mg/L]	30-Oct-18	15:25	0.00004	0.00019
Zinc (dissolved) [mg/L]	30-Oct-18	15:25	< 0.002	< 0.002
Benzene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Bromodichloromethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Bromoform [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Bromomethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Carbon tetrachloride [ug/L]	18-Oct-18	16:16	< 0.2	< 0.2
Chloroethane [ug/L]	18-Oct-18	16:16	< 5	< 5
Chloroform [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Chloromethane [ug/L]	18-Oct-18	16:16	< 5	< 5
Dibromochloromethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,2-Dichlorobenzene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,3-Dichlorobenzene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,4-Dichlorobenzene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,1-Dichloroethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,2-Dichloroethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,1-Dichloroethylene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,2-Dichloropropane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
trans-1,2-Dichloroethene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
cis-1,2-Dichloroethene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
cis-1,3-Dichloropropene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
trans-1,3-Dichloropropene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Ethylbenzene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Ethylenedibromide [ug/L]	18-Oct-18	16:16	< 0.2	< 0.2
Dichloromethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Monochlorobenzene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Styrene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,1,2,2-Tetrachloroethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Tetrachloroethene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Toluene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Trichloroethylene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Vinyl Chloride [ug/L]	18-Oct-18	16:16	< 0.2	< 0.2
Trichlorofluoromethane [ug/L]	18-Oct-18	16:16	< 5	< 5
1,1,1-Trichloroethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,1,2-Trichloroethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Xylene (total) [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
o-xylene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
m/p-xylene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,1,1,2-Tetrachloroethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
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Schedule 5 Column 3, Column 1 metals

Project : PO#735108995 11156057-01

LR Report : **CA14304-OCT18**

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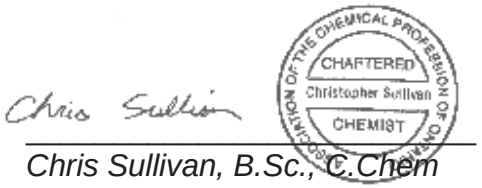

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Project Specialist
Environmental Services, Analytical

OnLine LIMS

0001574735

SGS Canada Inc.
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Schedule 5 Column 2

21-October-2018

GHD
Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Date Rec. : 11 October 2018
LR Report: **CA15200-OCT18**
Reference: PO#73510995 11156055-01

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: R-1	6: R-2	7: R-3	8: R-4
Sample Date & Time					11-Oct-18	11-Oct-18	11-Oct-18	11-Oct-18
Temp Upon Receipt [°C]	---	---	--	---	17.0	17.0	17.0	17.0
Alkalinity [mg/L as CaCO3]	11-Oct-18	13:13	14-Oct-18	21:27	267	286	255	374
pH [no unit]	11-Oct-18	13:13	14-Oct-18	21:27	7.93	8.12	8.28	8.17
Conductivity [uS/cm]	11-Oct-18	13:13	14-Oct-18	21:27	667	894	792	1610
TDS [mg/L]	11-Oct-18	14:59	14-Oct-18	20:54	357	509	434	843
COD [mg/L]	12-Oct-18	08:52	14-Oct-18	22:17	11	< 8	22	10
NH3+NH4 [as N mg/L]	18-Oct-18	17:50	18-Oct-18	15:00	0.3	< 0.1	< 0.1	< 0.1
SO4 [mg/L]	16-Oct-18	15:48	18-Oct-18	15:31	10	13	< 2	18
Cl [mg/L]	16-Oct-18	15:53	18-Oct-18	15:31	51	110	84	280
NO3 [as N mg/L]	16-Oct-18	21:10	18-Oct-18	15:06	0.24	0.59	1.78	2.49
DOC [mg/L]	15-Oct-18	18:00	17-Oct-18	09:39	3	2	3	5
Ba (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.0946	0.106	0.00061	0.145
B (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.017	0.023	0.033	0.037
Ca (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	111	138	0.32	137
Fe (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.371	< 0.007	< 0.007	< 0.007

OnLine LIMS

0001549239

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Schedule 5 Column 2

LR Report : **CA15200-OCT18**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: R-1	6: R-2	7: R-3	8: R-4
Mg (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	3.99	4.63	0.025	4.04
Na (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	33.5	49.0	193	154
As (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.0003	< 0.0002	< 0.0002	0.0002
Cd (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.000031	< 0.000003	< 0.000003	0.000004
Cr (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.00017	0.00017	0.00016	0.00029
Cu (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.00185	0.144	0.0600	0.0845
K (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	1.68	1.37	0.273	3.76
Mn (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.308	0.00025	0.00013	0.00029
Pb (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.00288	0.00057	0.00032	0.00217
Zn (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:09	0.013	0.009	0.009	0.036
Benzene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Bromodichloromethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Bromoform [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Bromomethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Carbon tetrachloride [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.2	< 0.2	< 0.2	< 0.2
Chloroethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 5	< 5	< 5	< 5
Chloroform [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Chloromethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 5	< 5	< 5	< 5
Dibromochloromethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichlorobenzene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,3-Dichlorobenzene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,4-Dichlorobenzene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloroethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethylene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloropropane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
trans-1,2-Dichloroet [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
cis-1,2-Dichloroethe [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
cis-1,3-Dichloroprop [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5

SGS Canada Inc.
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Schedule 5 Column 2

LR Report : **CA15200-OCT18**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: R-1	6: R-2	7: R-3	8: R-4
trans-1,3-Dichloropr [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Ethylbenzene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Ethylenedibromide [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.2	< 0.2	< 0.2	< 0.2
Dichloromethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Monochlorobenzene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Styrene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2,2-Tetrachloroe [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Tetrachloroethene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Toluene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Trichloroethylene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Vinyl Chloride [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.2	< 0.2	< 0.2	< 0.2
Trichlorofluorometha [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 5	< 5	< 5	< 5
1,1,1-Trichloroethan [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichloroethan [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Xylene (total) [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
o-xylene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
m-p-xylene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,1,1,2-Tetrachloroe [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5

CHARTERED CHEMIST — Robert Irwin — THE CHEMICAL PROFESSION OF ONTARIO

Rob Irwin B.Sc., C.Chem
Technical Manager, Inorganic Chemistry
Environmental, Analytical Services

OnLine LIMS

0001549239

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Schedule 5 Column 3, Column 1 metals

Project : PO#73510995 11156057-01

21-October-2018

GHD
Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Date Rec. : 11 October 2018
LR Report: **CA15199-OCT18**
Reference: PO#73510995
11156057-01

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: S-1
Sample Date & Time			11-Oct-18
Temperature Upon Receipt [°C]	--	---	17.0
Biochemical Oxygen Demand (BOD5) [mg/L]	16-Oct-18	14:02	18
Total Suspended Solids [mg/L]	16-Oct-18	16:06	27
Alkalinity [mg/L as CaCO3]	14-Oct-18	21:27	278
pH [no unit]	14-Oct-18	21:27	7.87
Conductivity [uS/cm]	14-Oct-18	21:27	613
Total Dissolved Solids [mg/L]	14-Oct-18	20:54	371
Chemical Oxygen Demand [mg/L]	16-Oct-18	14:02	58
Total Kjeldahl Nitrogen [as N mg/L]	18-Oct-18	10:41	1.1
Ammonia+Ammonium (N) [as N mg/L]	16-Oct-18	13:27	0.1
4AAP-Phenolics [mg/L]	15-Oct-18	15:32	0.032
Sulphate [mg/L]	18-Oct-18	15:31	25
Chloride [mg/L]	18-Oct-18	15:31	25
Nitrite (as N) [mg/L]	18-Oct-18	14:34	< 0.03
Nitrate (as N) [mg/L]	18-Oct-18	14:34	< 0.06
Mercury (total) [ug/L]	16-Oct-18	14:25	0.01
Arsenic (total) [mg/L]	16-Oct-18	11:35	0.0013
Barium (total) [mg/L]	16-Oct-18	11:35	0.145
Boron (total) [mg/L]	16-Oct-18	11:35	0.037
Calcium (total) [mg/L]	16-Oct-18	11:35	128
Cadmium (total) [mg/L]	16-Oct-18	11:35	0.000056
Chromium (total) [mg/L]	16-Oct-18	11:35	0.00093
Copper (total) [mg/L]	16-Oct-18	11:35	0.00172
Iron (total) [mg/L]	16-Oct-18	11:35	0.528
Potassium (total) [mg/L]	16-Oct-18	11:35	5.49
Magnesium (total) [mg/L]	16-Oct-18	11:35	4.48
Manganese (total) [mg/L]	16-Oct-18	11:35	0.197
Sodium (total) [mg/L]	16-Oct-18	11:35	18.9
Phosphorus (total) [mg/L]	16-Oct-18	11:35	0.342

OnLine LIMS

0001549242

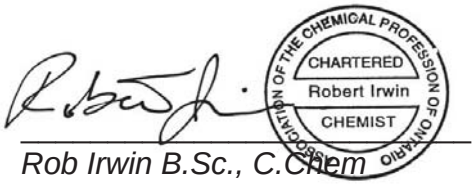
SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Schedule 5 Column 3, Column 1 metals

Project : PO#73510995 11156057-01

LR Report : **CA15199-OCT18**

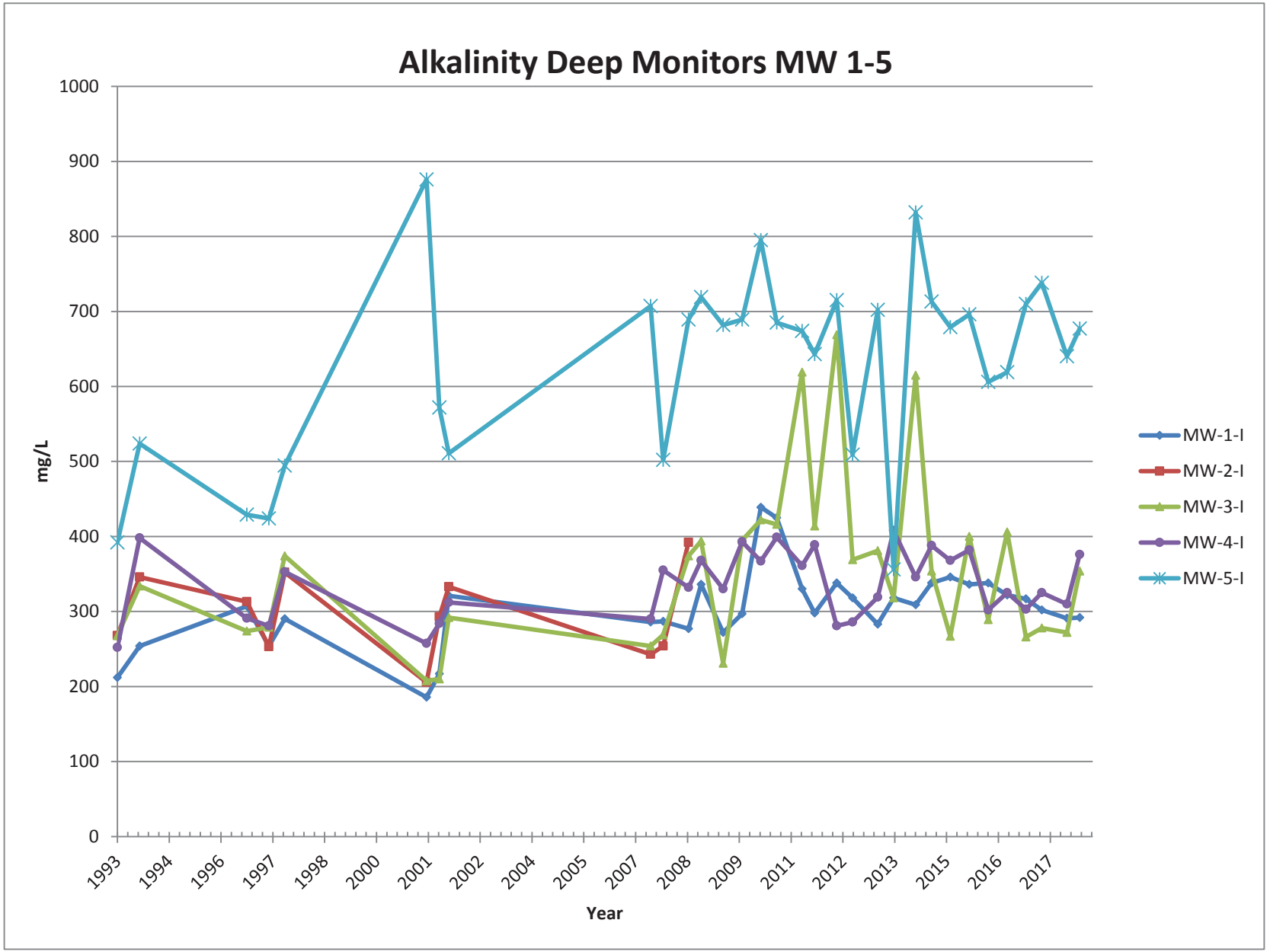
Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: S-1
Lead (total) [mg/L]	16-Oct-18	11:35	0.00033
Zinc (total) [mg/L]	16-Oct-18	11:35	0.006

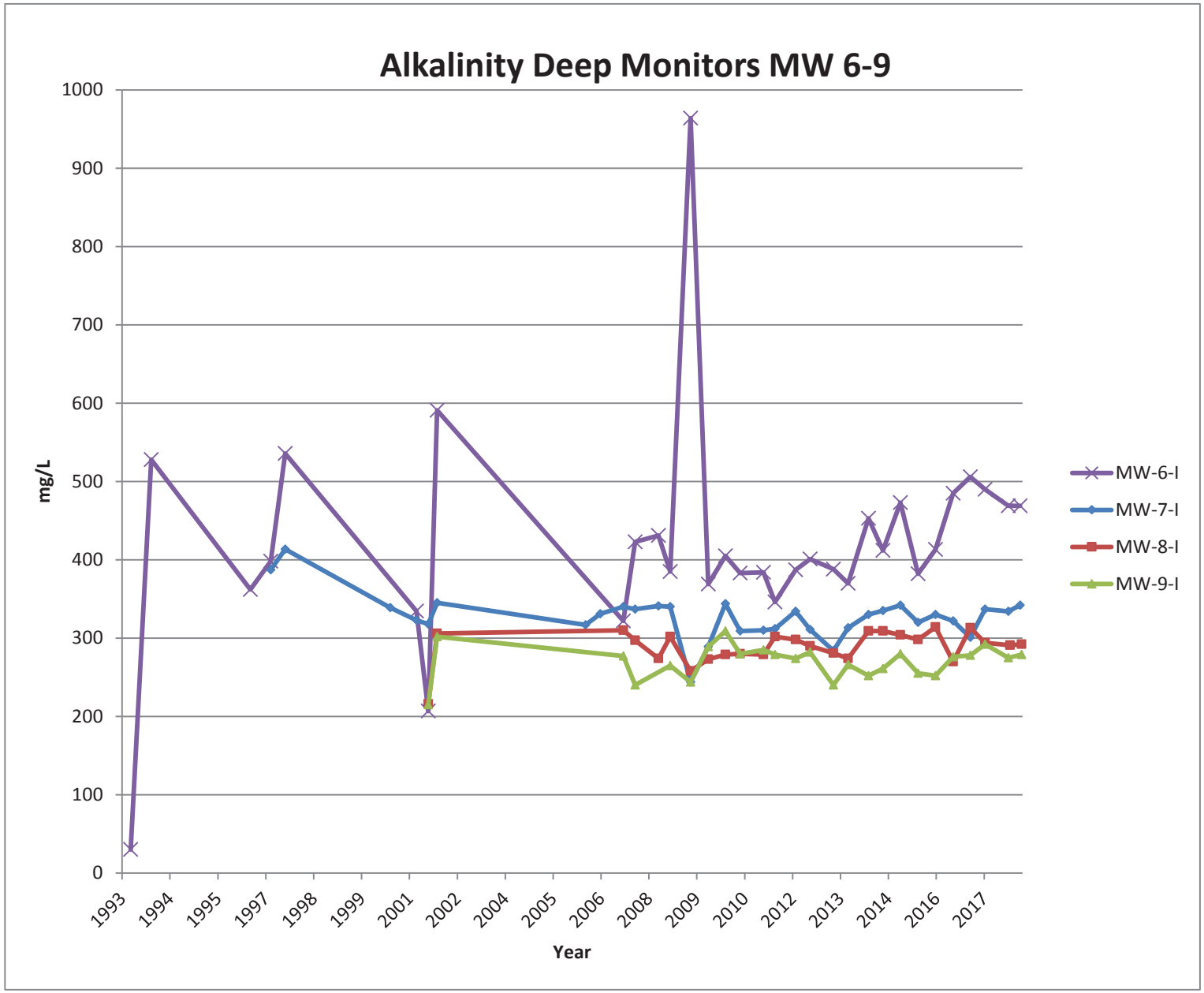


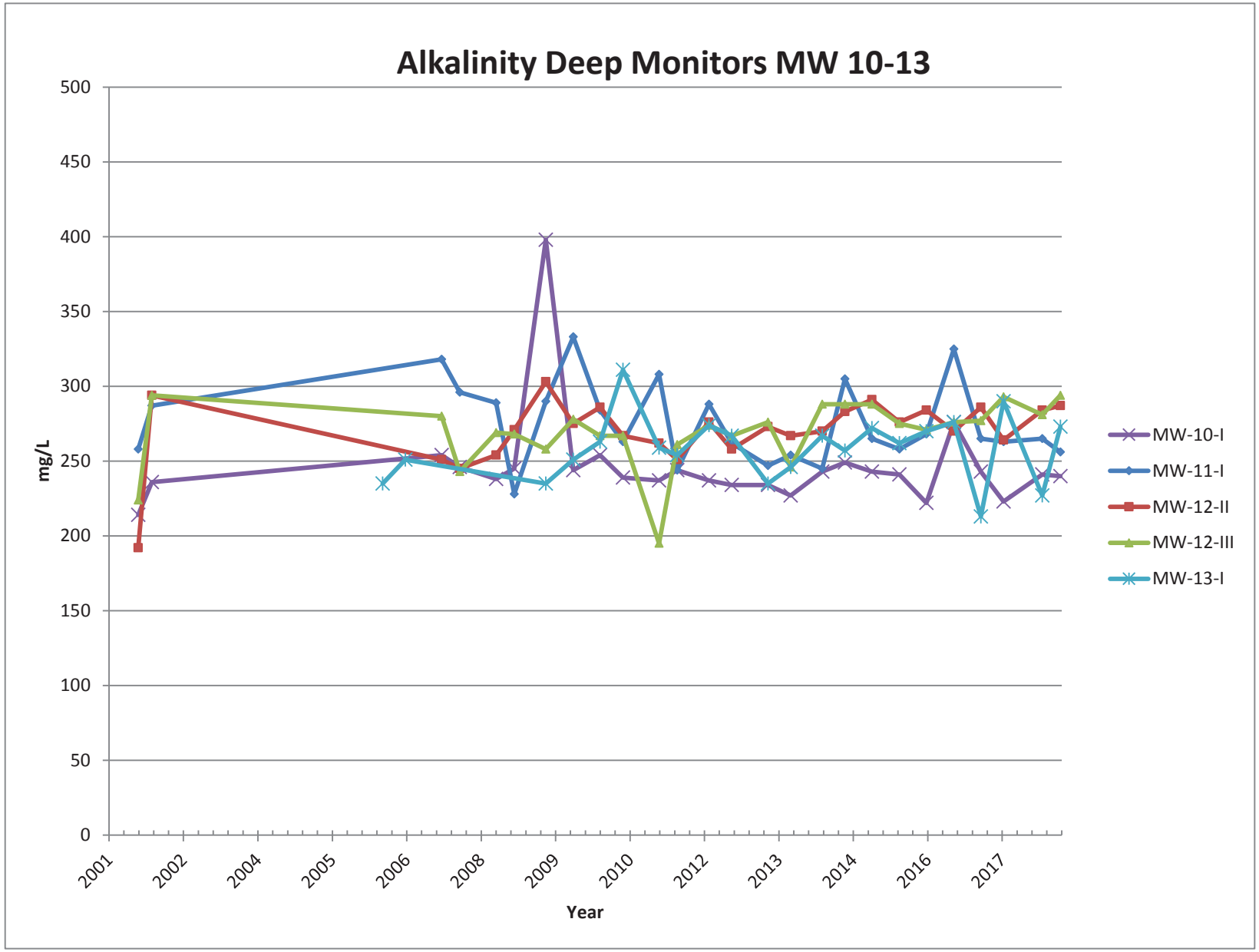
Rob Irwin B.Sc., C.Chem
Technical Manager, Inorganic Chemistry
Environmental, Analytical Services

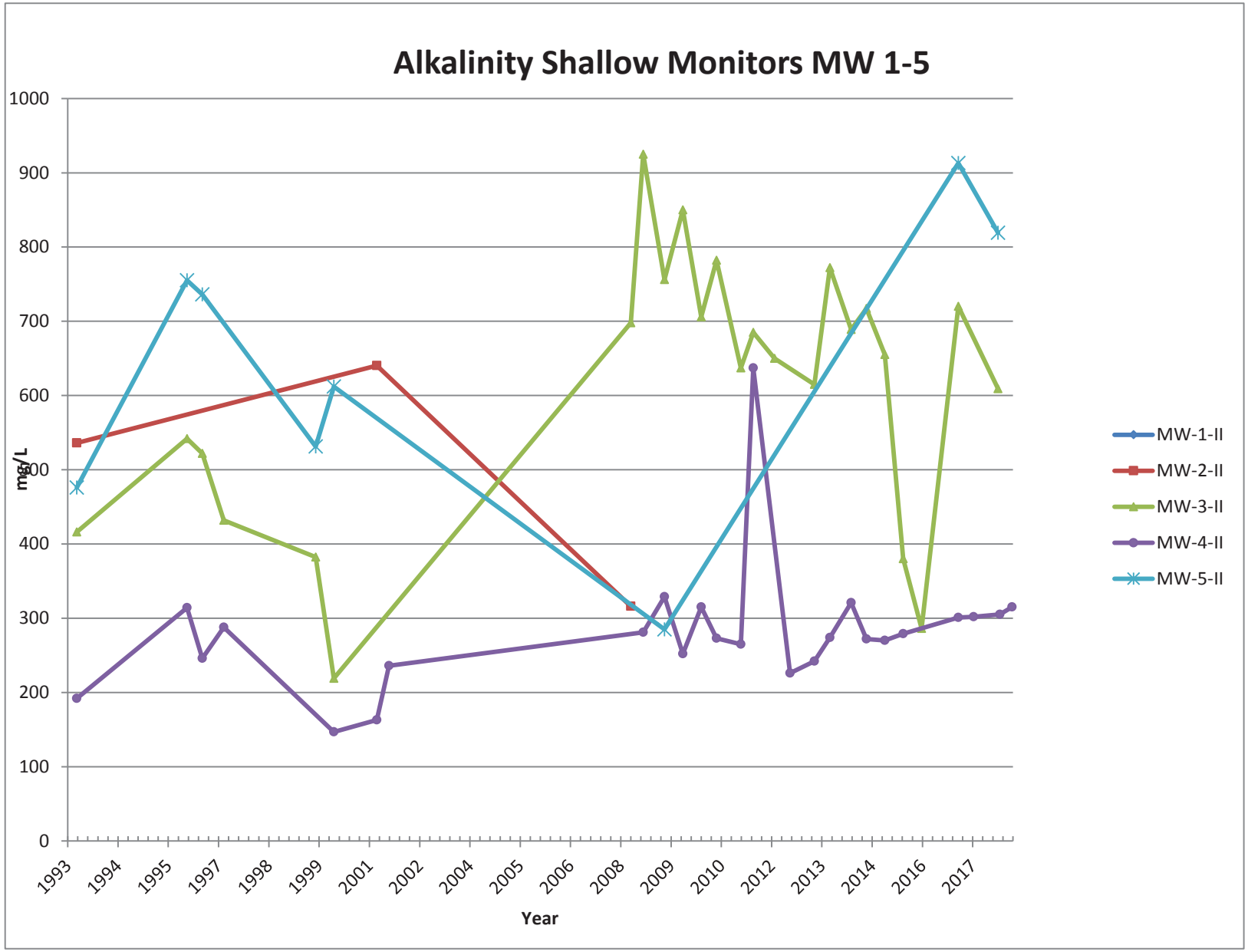
OnLine LIMS

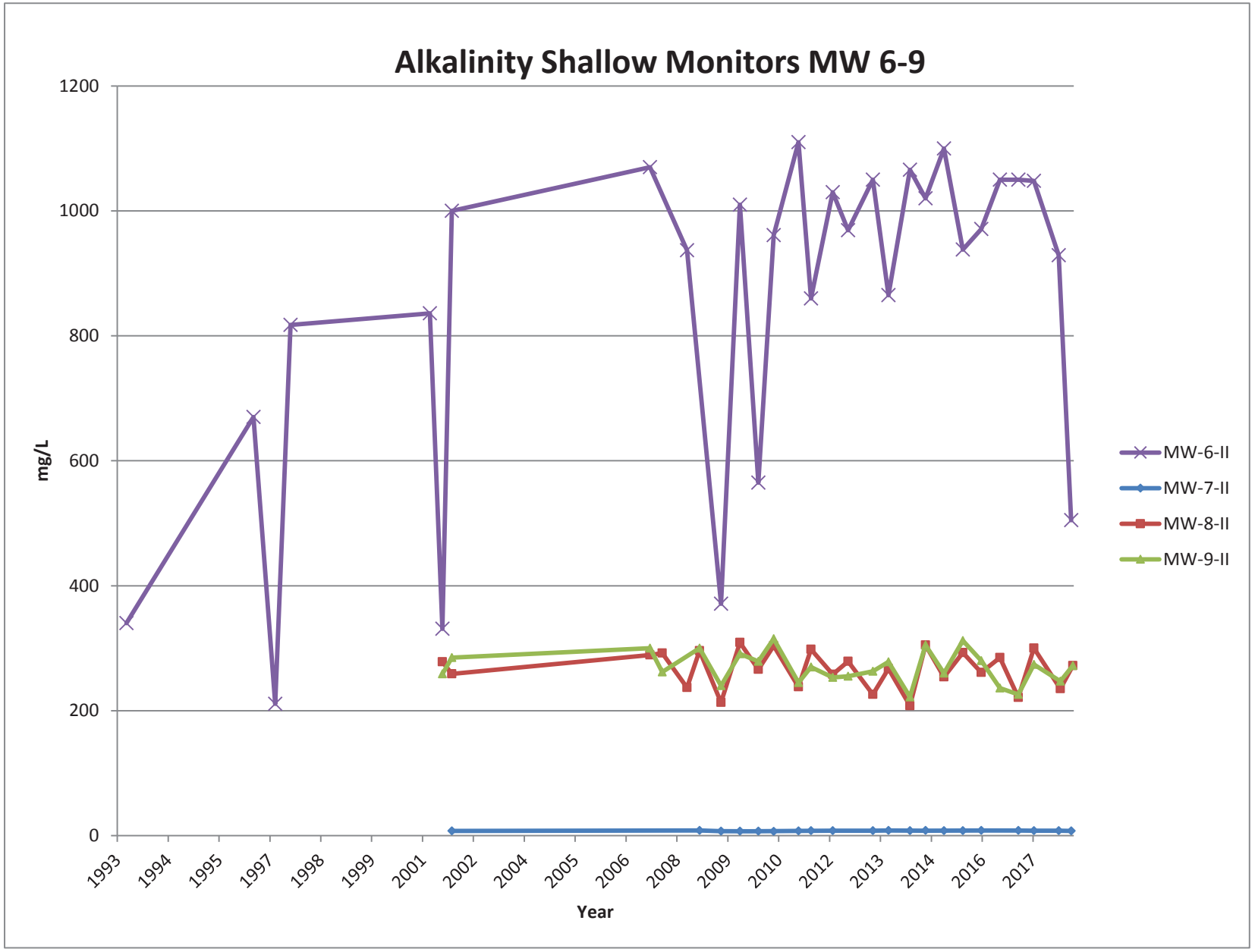
0001549242

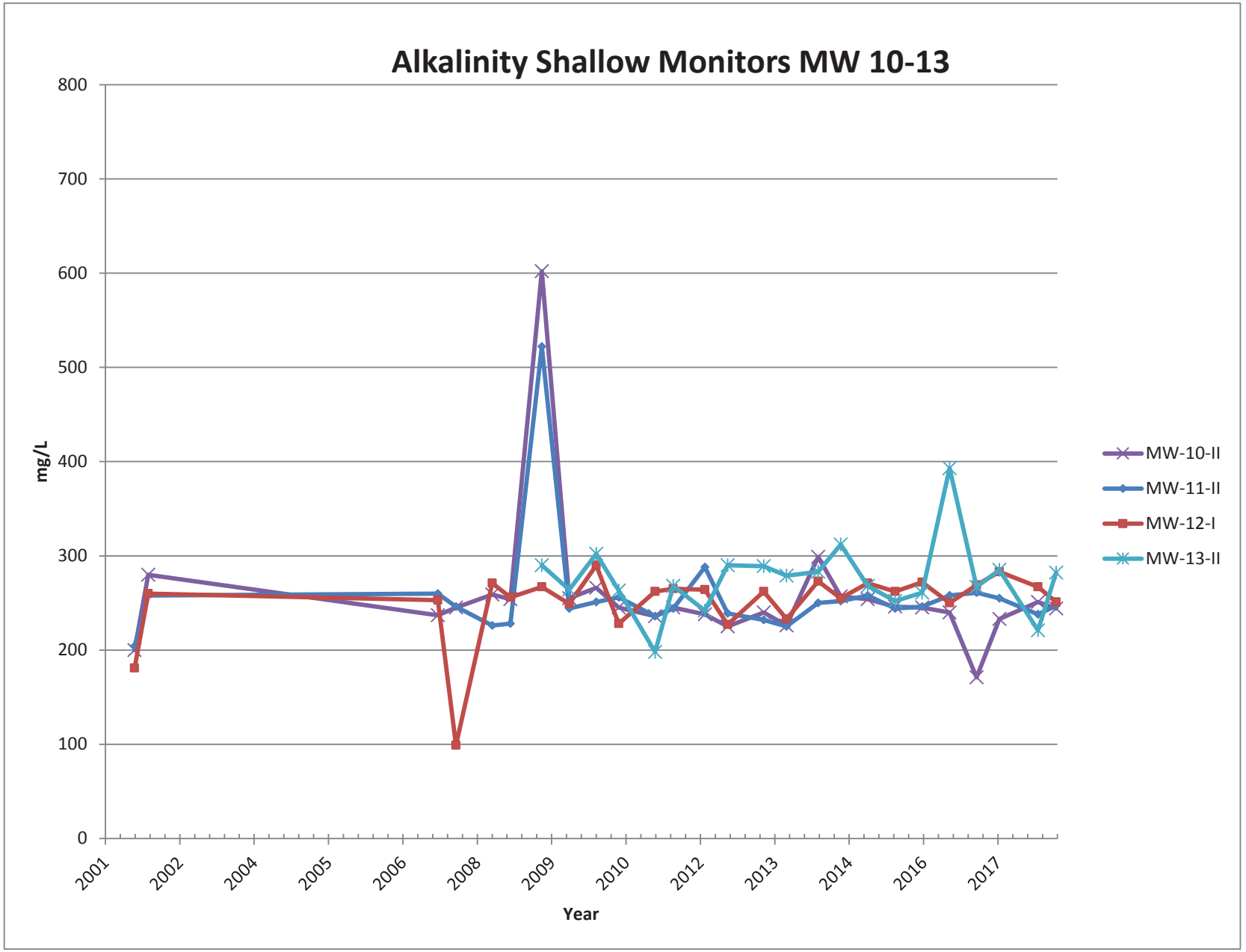

Alkalinity Deep Monitors MW 1-5
1000
900
800
700
600
500
400
300
200
100
0
mg/L
1993
1994
1996
1997
1998
2000
2001
2002
2004
2005
2007
2008
2009
2011
2012
2013
2015
2016
2017
Year
MW-1-I
MW-2-I
MW-3-I
MW-4-I
MW-5-I

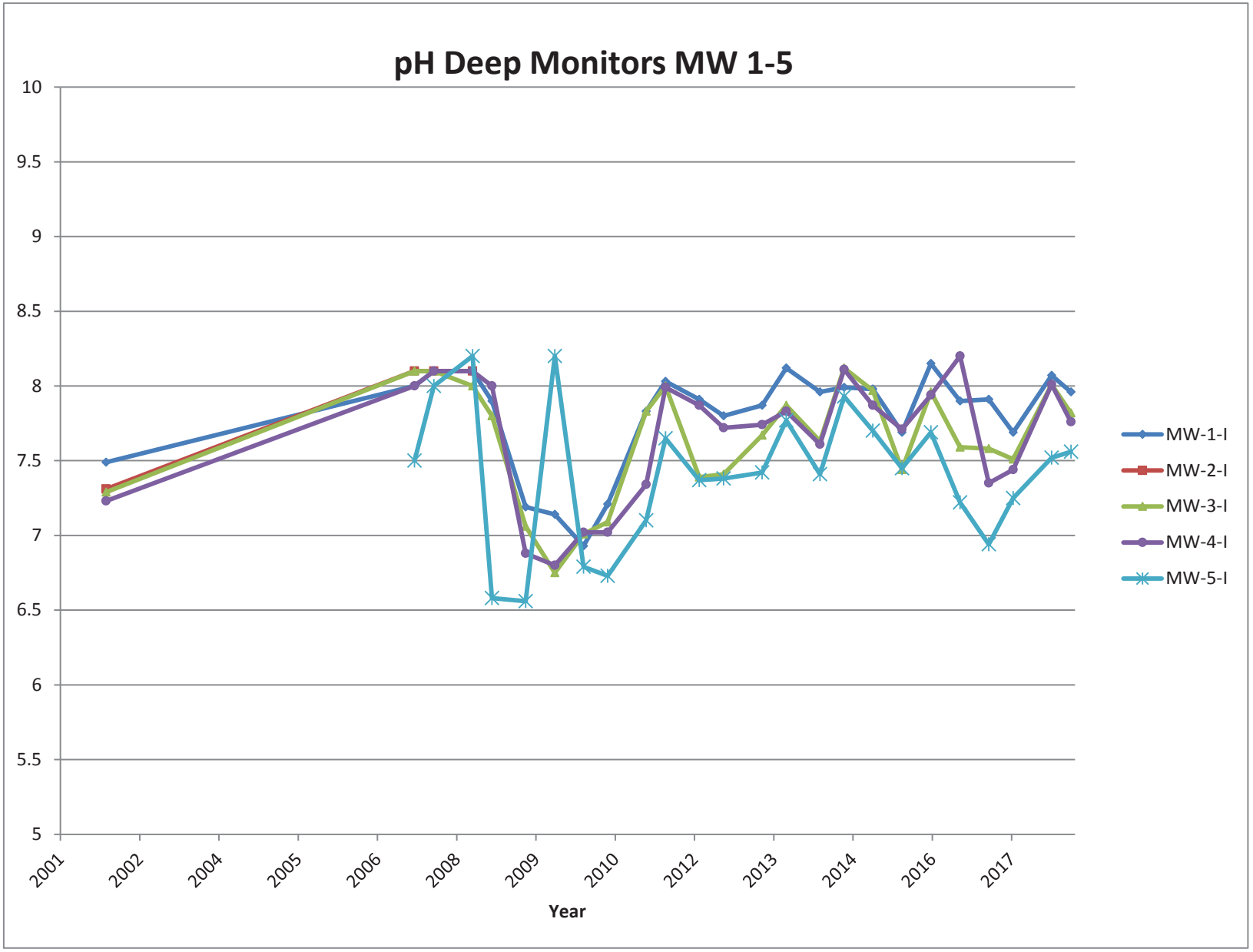

Alkalinity Deep Monitors MW 6-9
1000
900
800
700
600
500
400
300
200
100
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-6-I
MW-7-I
MW-8-I
MW-9-I


Alkalinity Deep Monitors MW 10-13
500
450
400
350
300
250
200
150
100
50
0
mg/L
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-10-I
MW-11-I
MW-12-II
MW-12-III
MW-13-I


Alkalinity Shallow Monitors MW 1-5
1000
900
800
700
600
500
400
300
200
100
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-1-II
MW-2-II
MW-3-II
MW-4-II
MW-5-II


Alkalinity Shallow Monitors MW 6-9
1200
1000
800
600
400
200
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-6-II
MW-7-II
MW-8-II
MW-9-II


Alkalinity Shallow Monitors MW 10-13
800
700
600
500
400
300
200
100
0
mg/L
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-10-II
MW-11-II
MW-12-I
MW-13-II


pH Deep Monitors MW 1-5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
2001
2002
2004
2005
2006
2008
2009
2010
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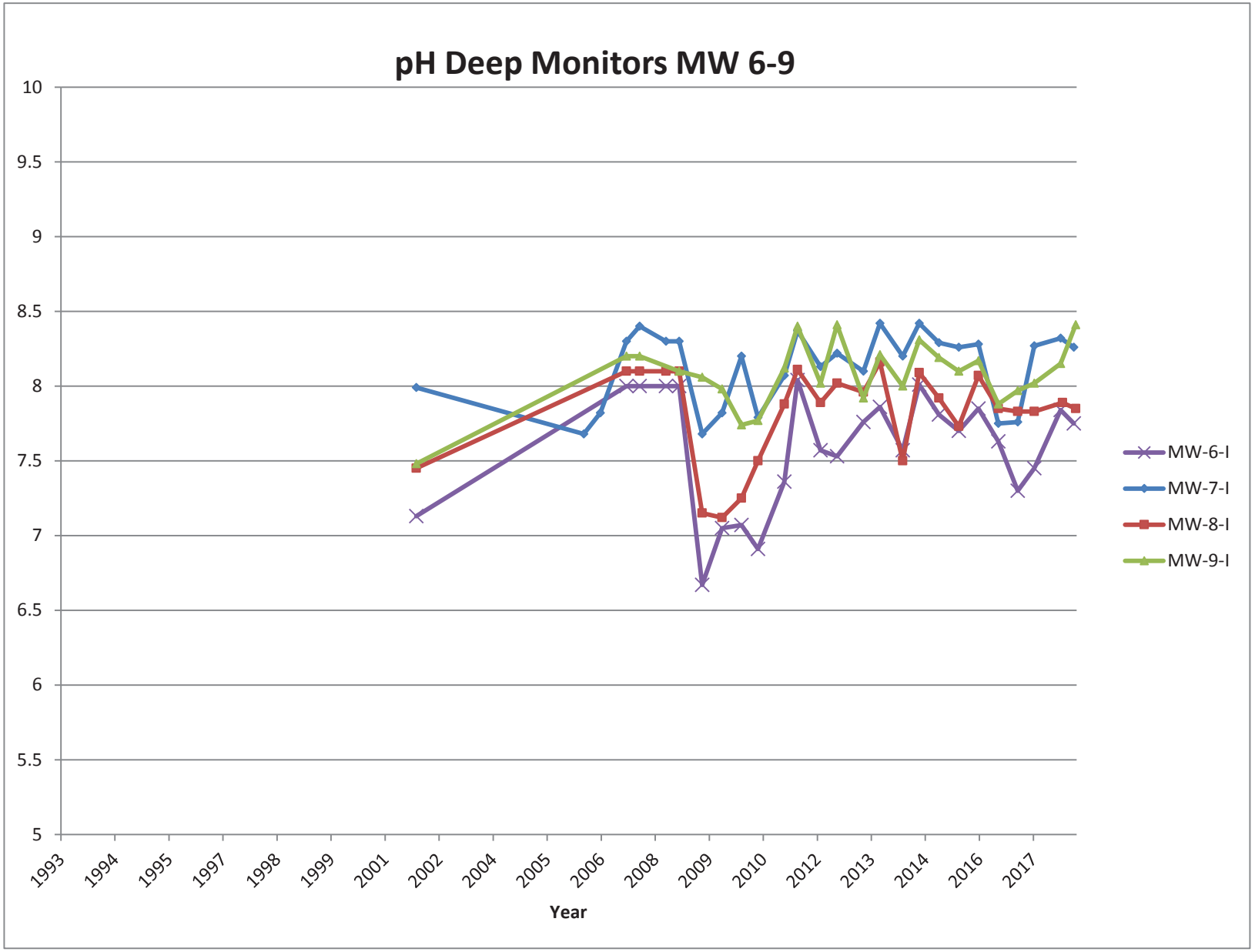
2013
2014
2016
2017
Year
MW-1-I
MW-2-I
MW-3-I
MW-4-I
MW-5-I


pH Deep Monitors MW 6-9
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
1993
1994
1995
1997
1998
1999
2001
2002
2004
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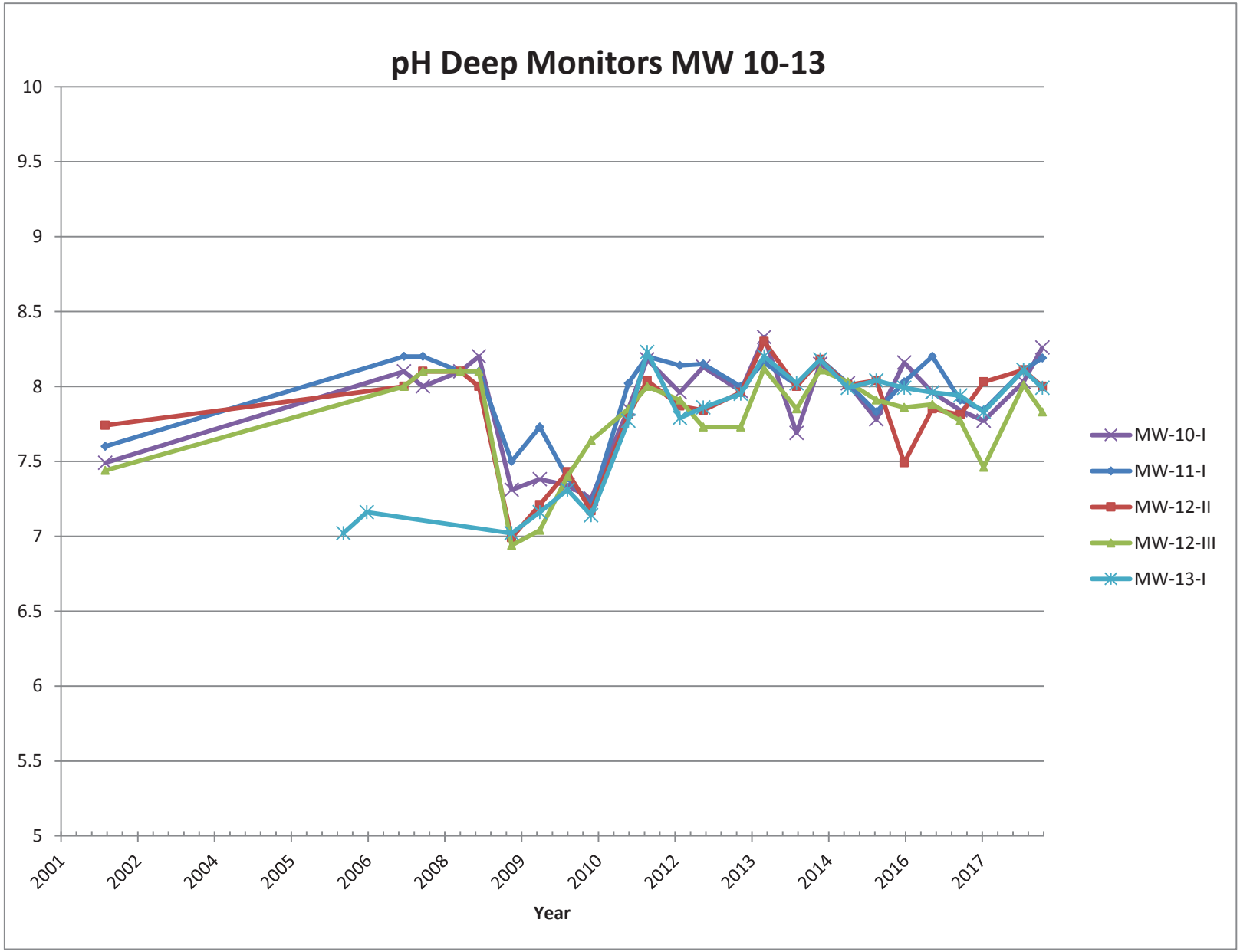
2014
2016
2017
Year
MW-6-I
MW-7-I
MW-8-I
MW-9-I


pH Deep Monitors MW 10-13
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
2001
2002
2004
2005
2006
2008
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2010
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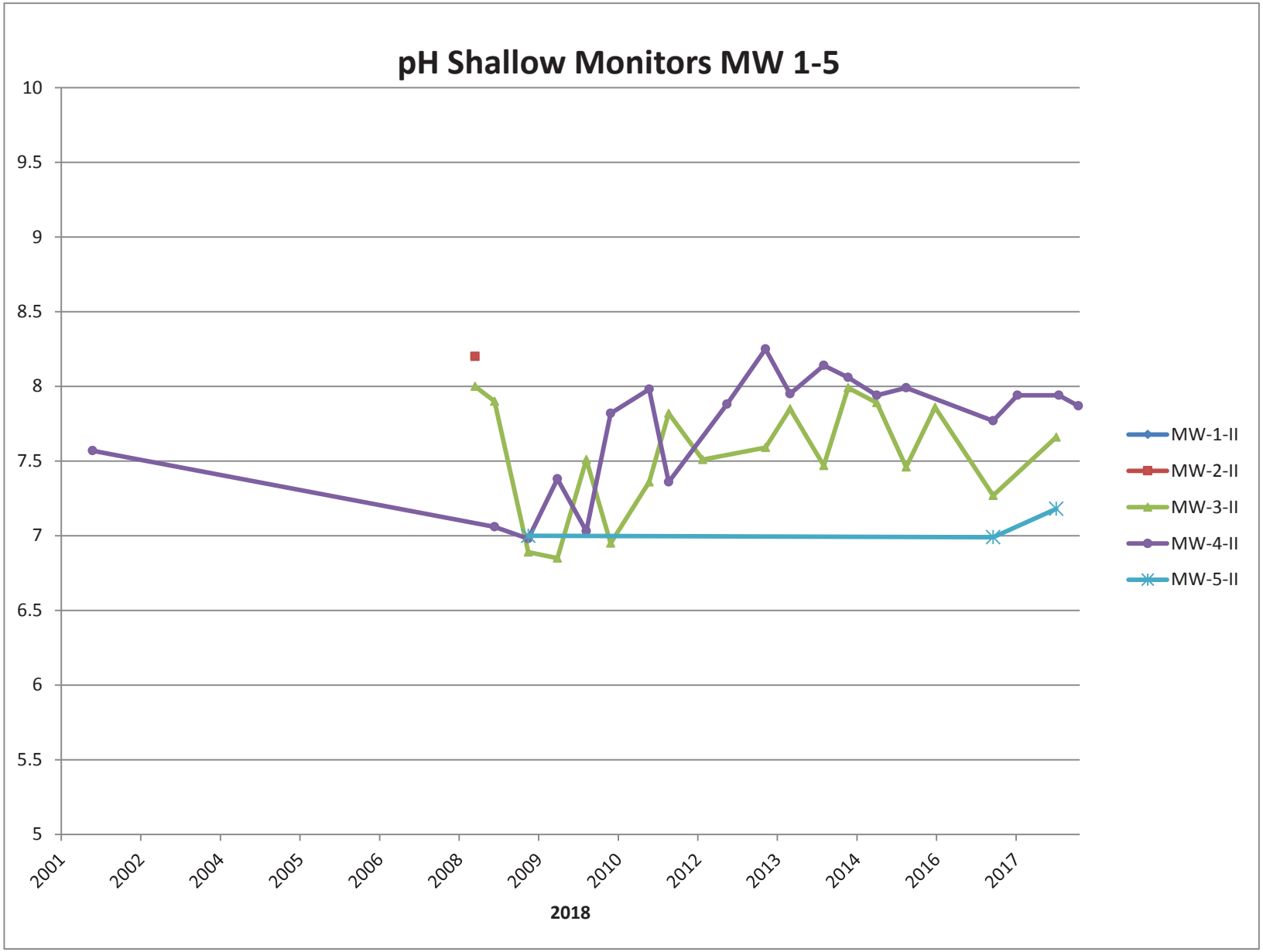
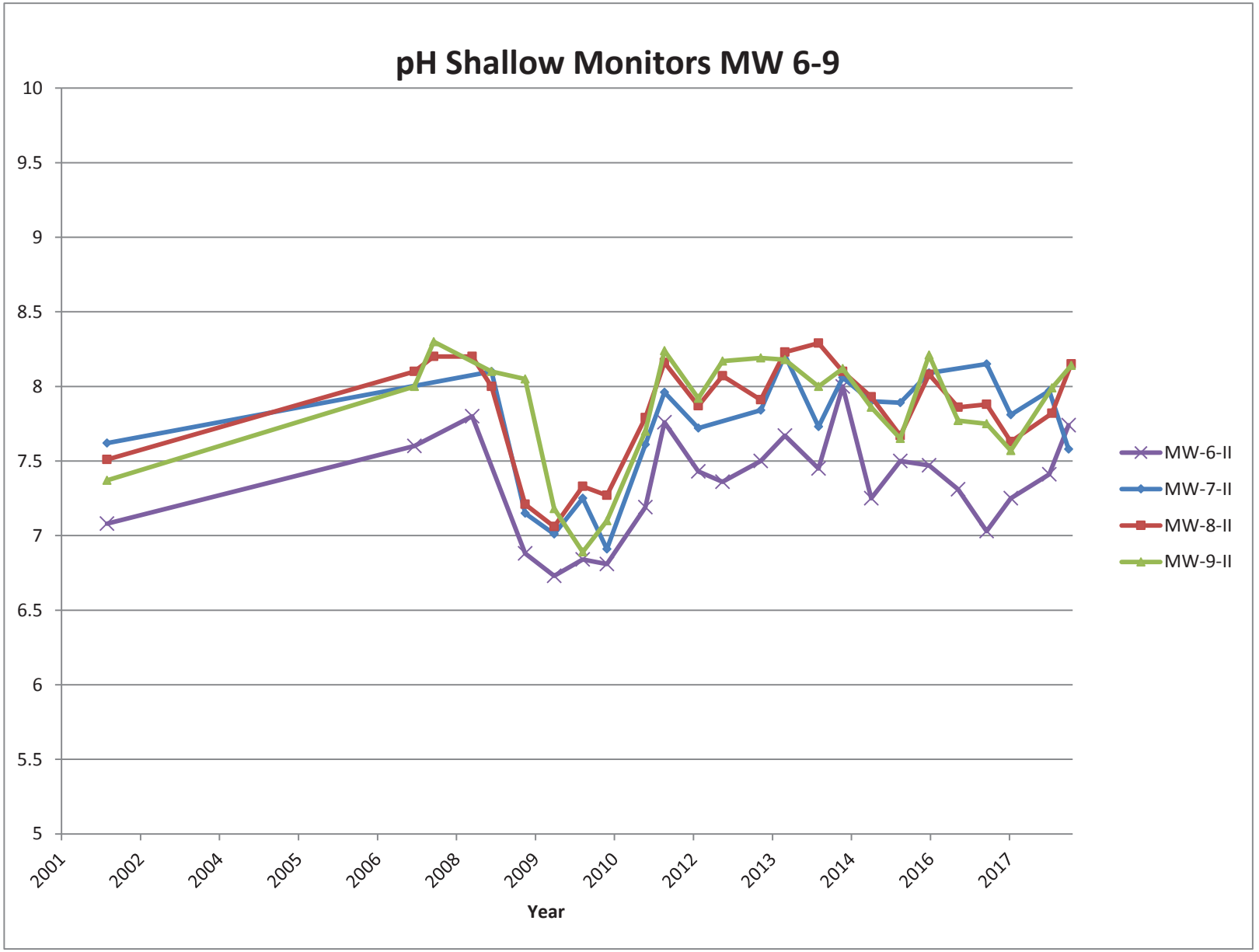
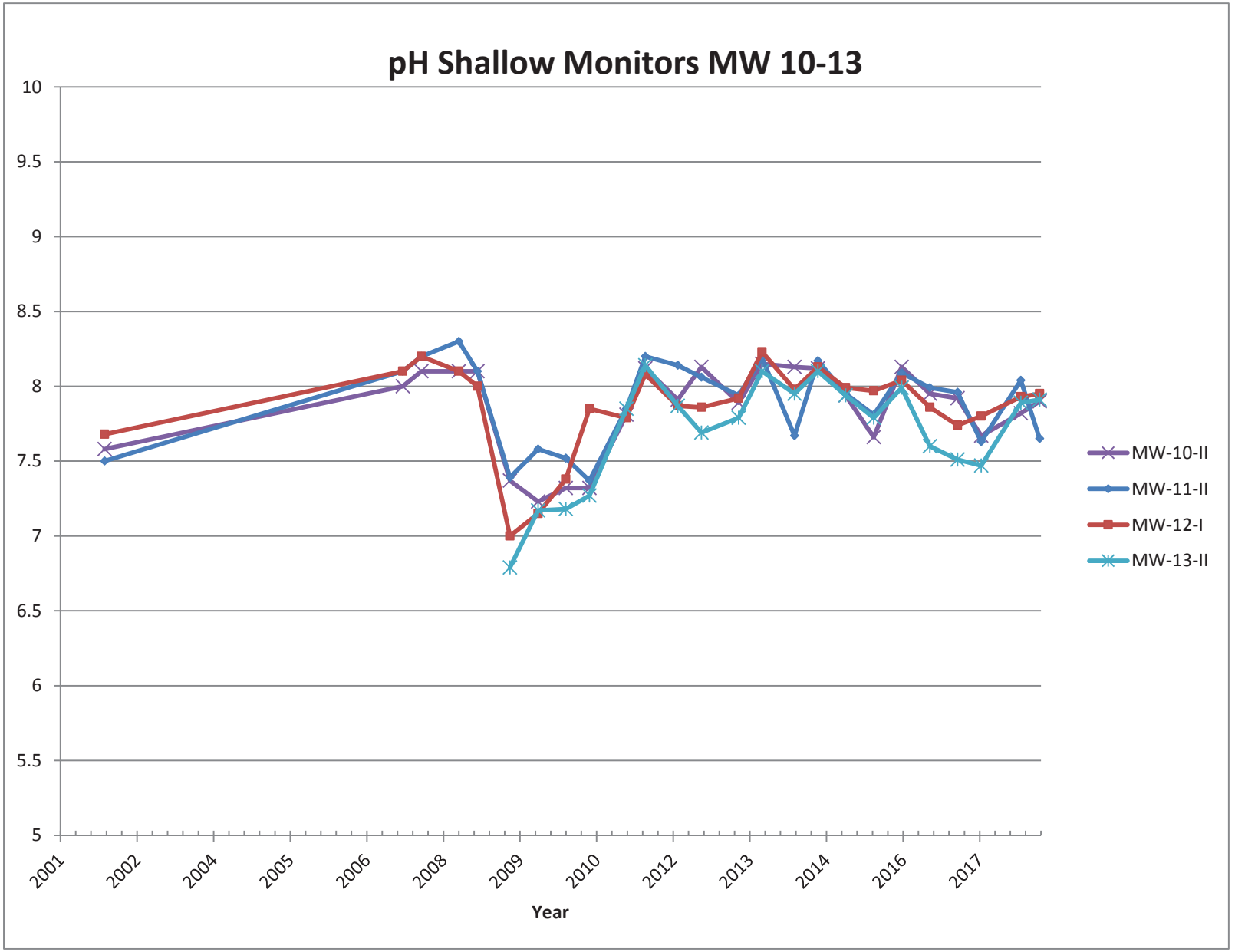
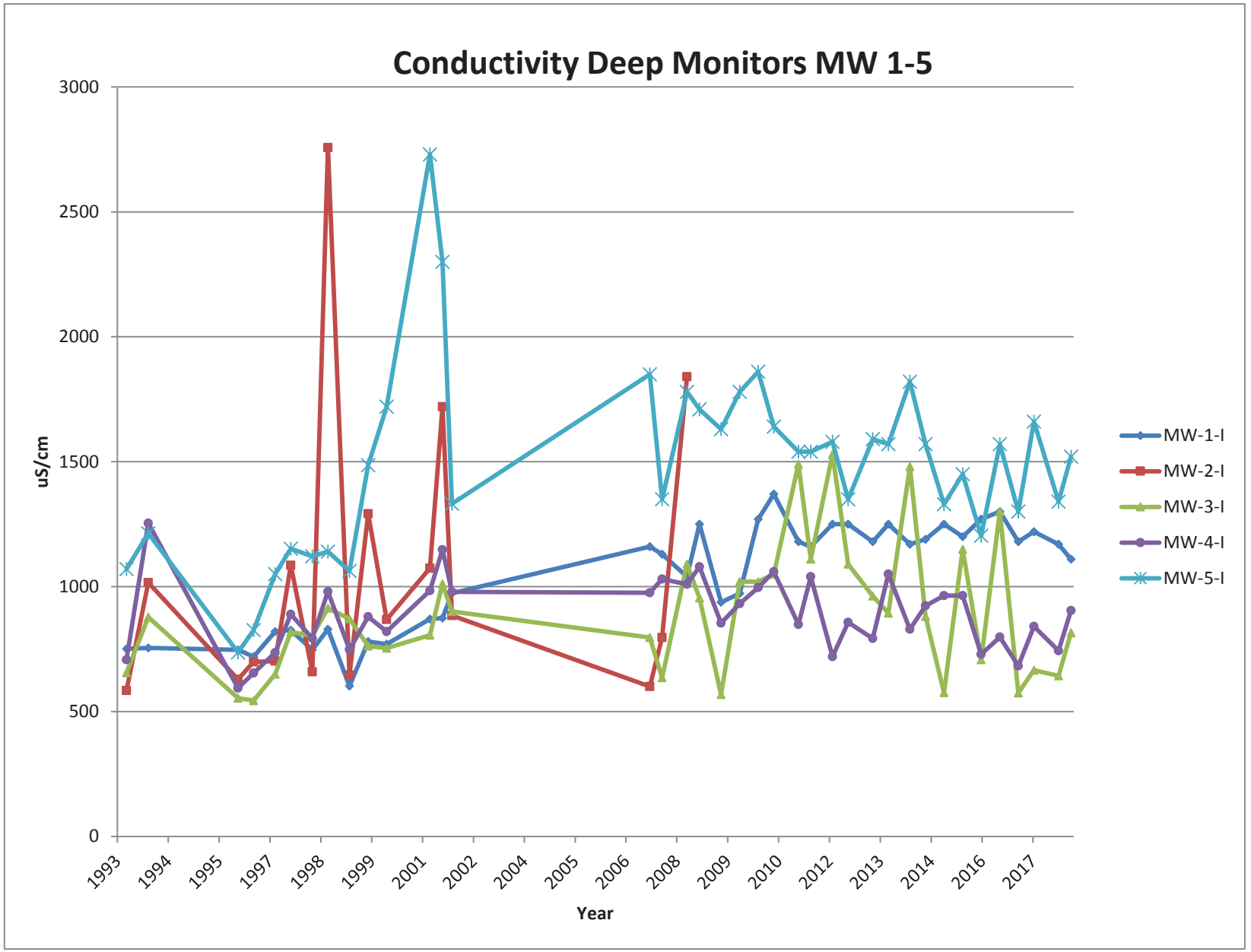
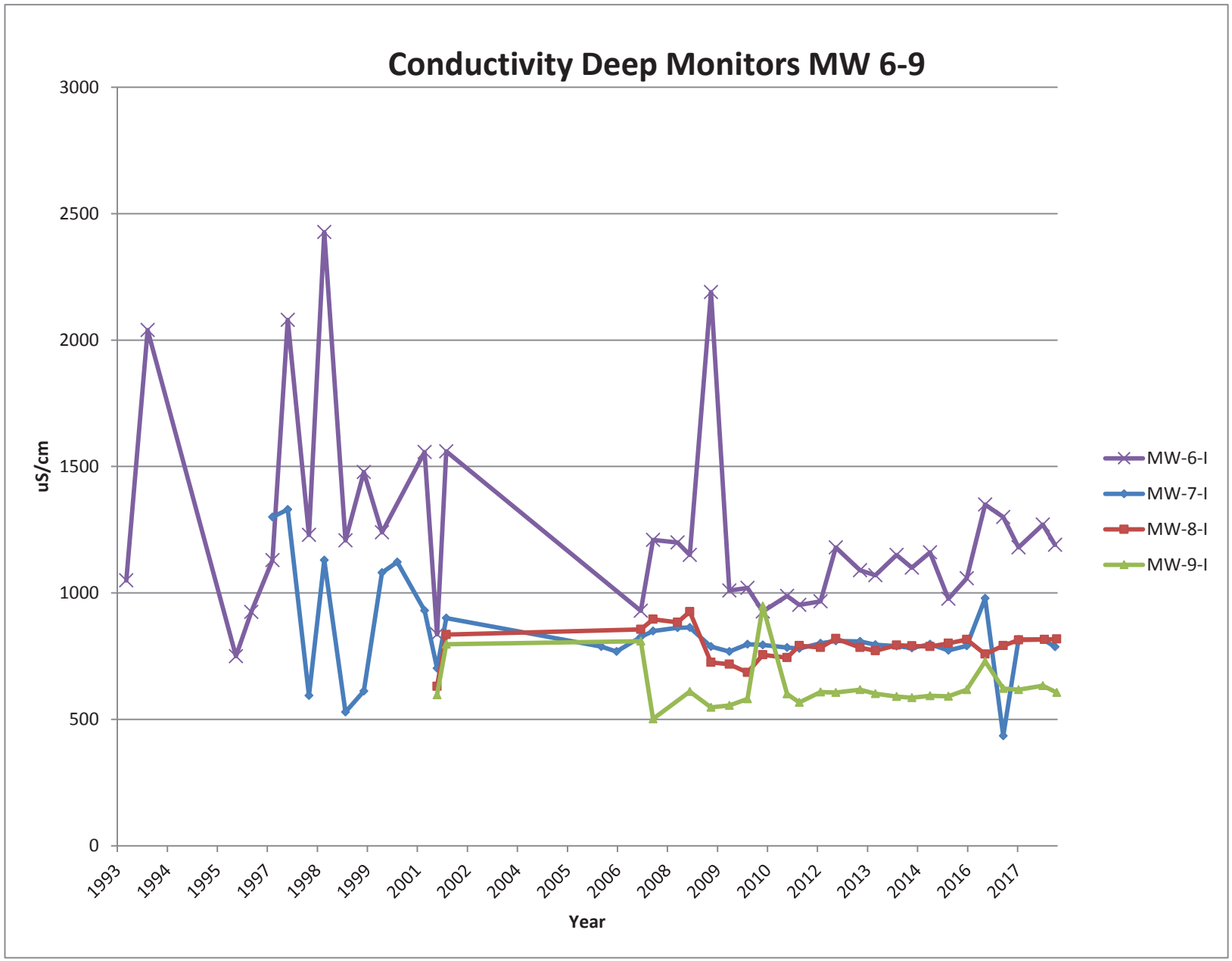
2016
2017
Year
MW-10-I
MW-11-I
MW-12-II
MW-12-III
MW-13-I

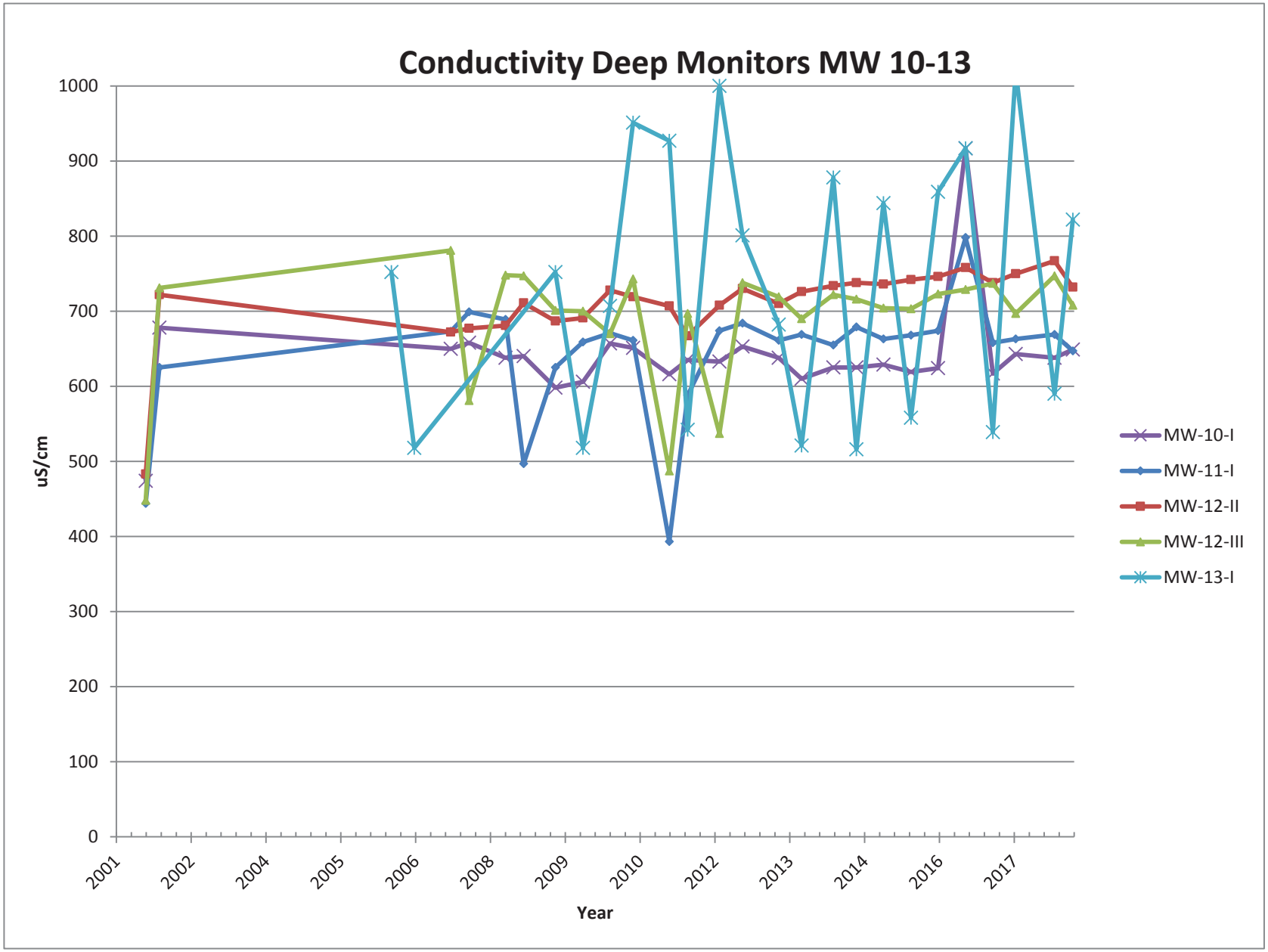

pH Shallow Monitors MW 1-5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
2018
MW-1-II
MW-2-II
MW-3-II
MW-4-II
MW-5-II

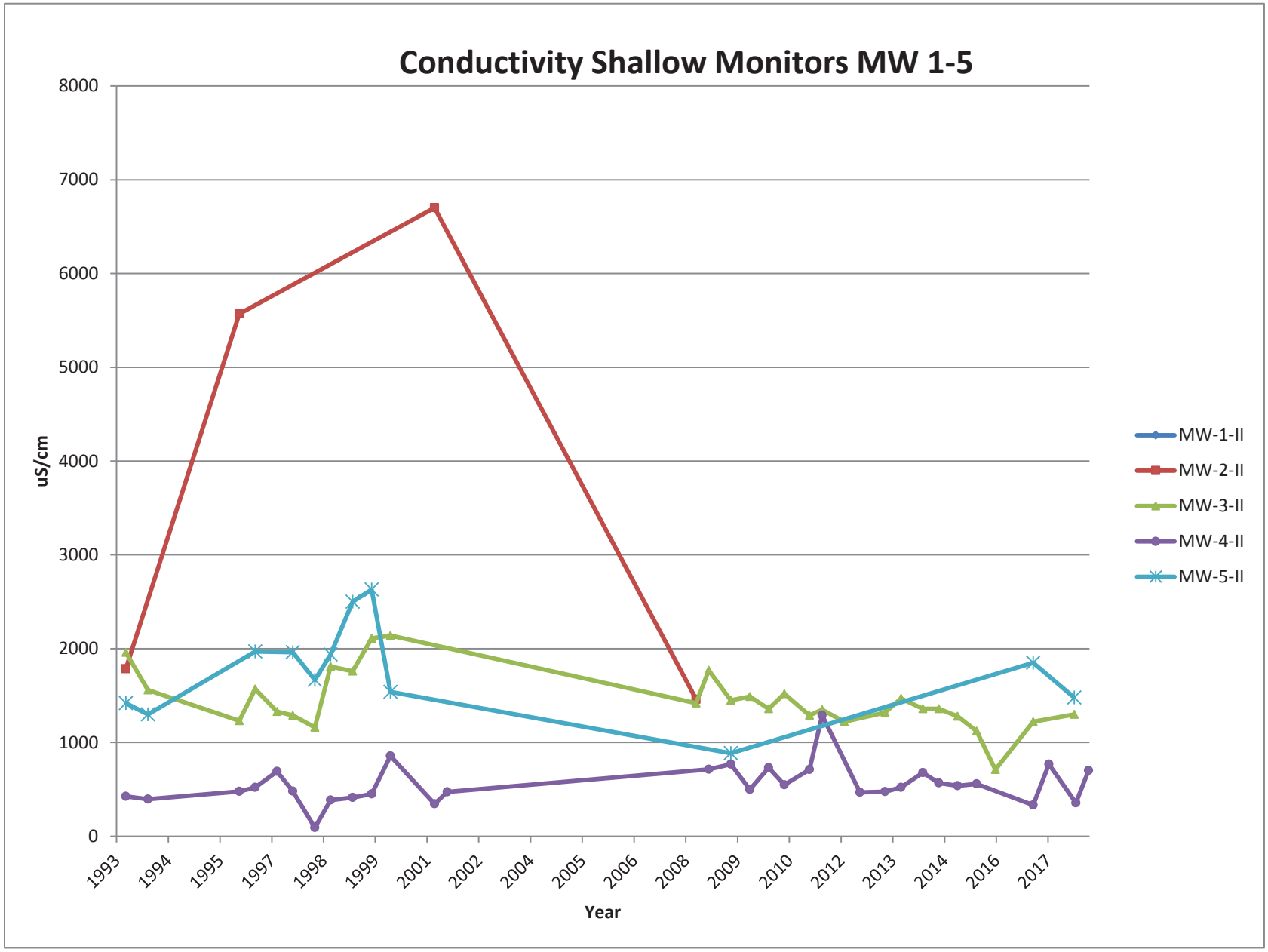

pH Shallow Monitors MW 6-9
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-6-II
MW-7-II
MW-8-II
MW-9-II

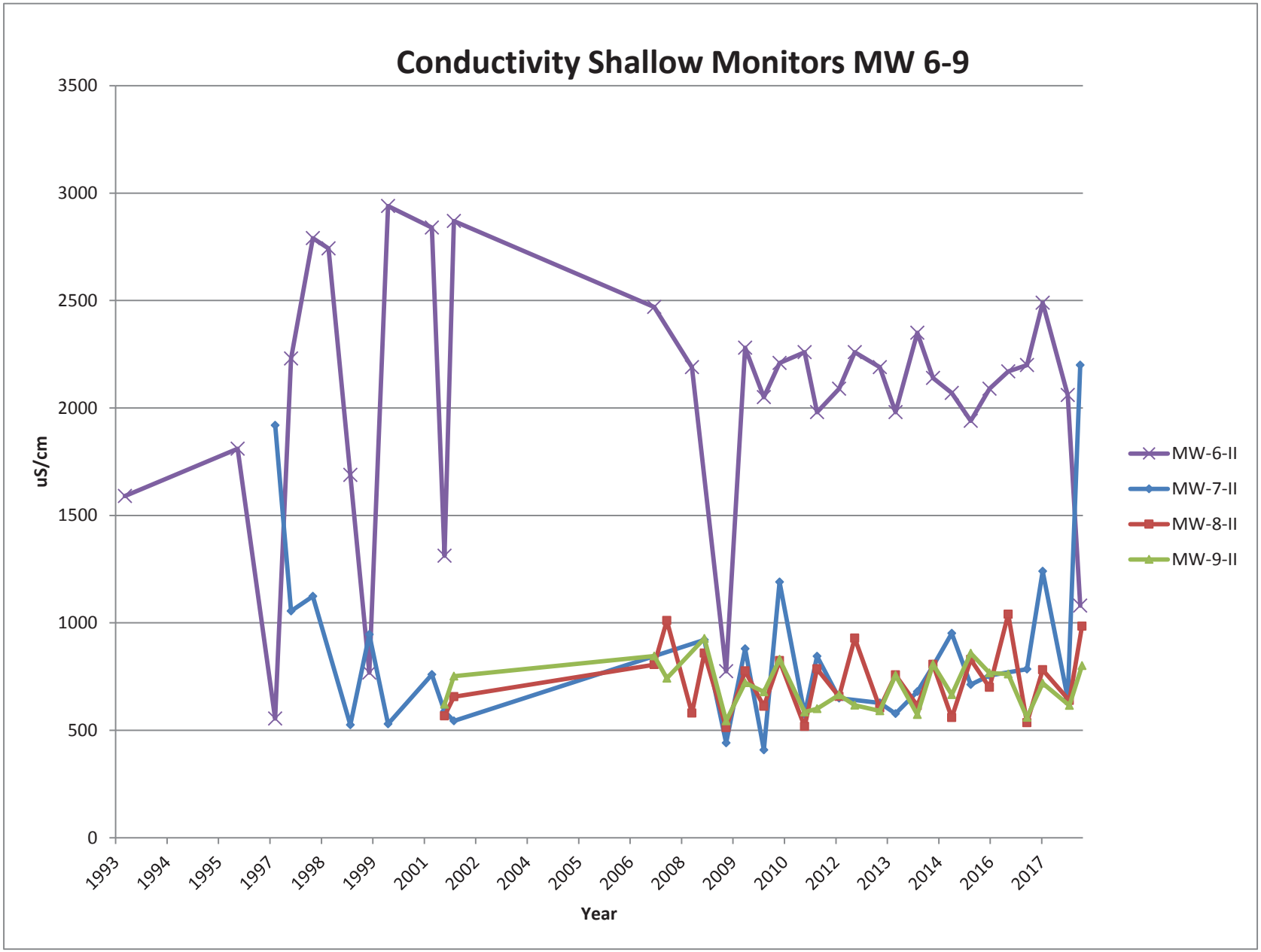

pH Shallow Monitors MW 10-13
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-10-II
MW-11-II
MW-12-I
MW-13-II

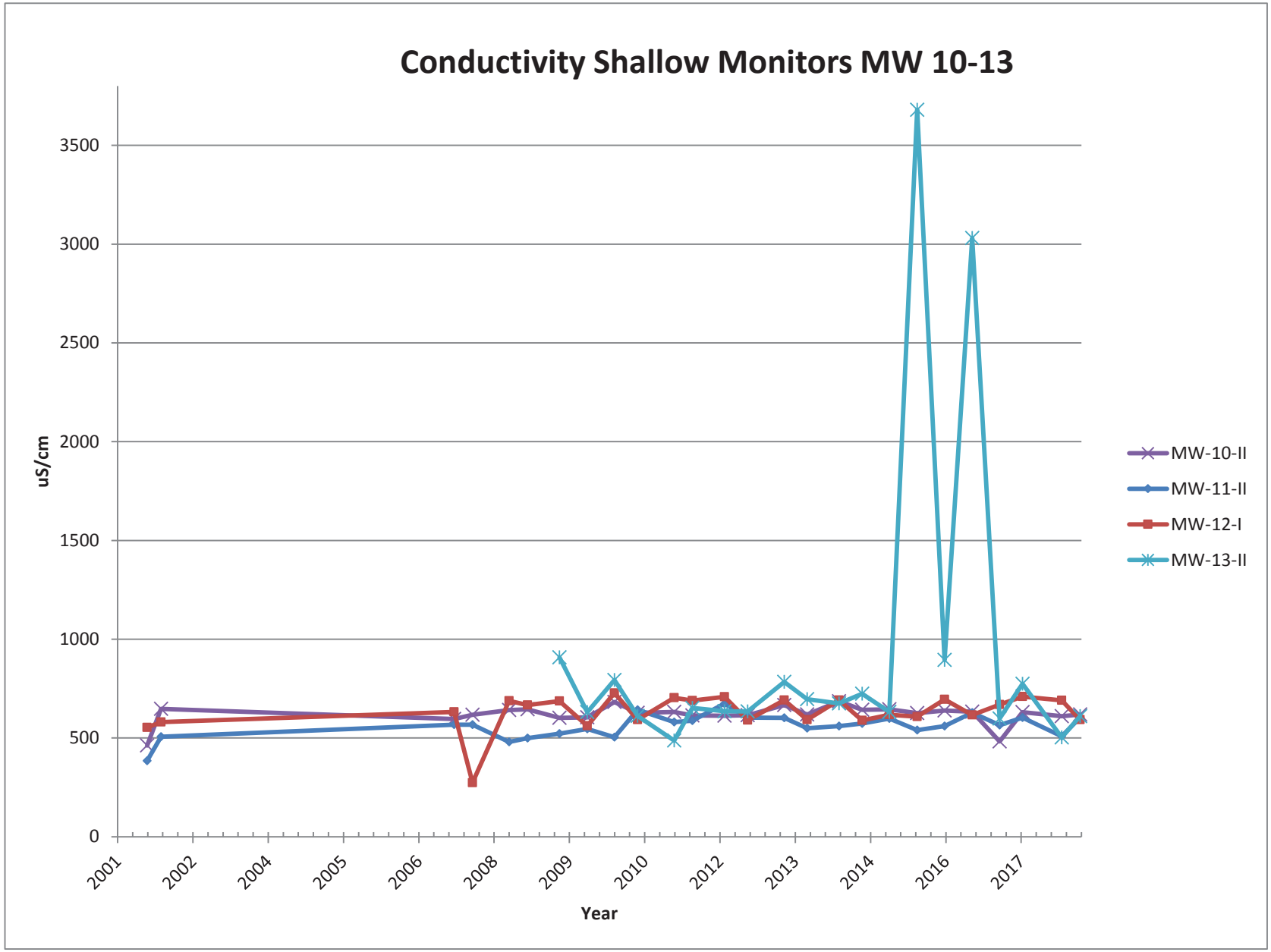

Conductivity Deep Monitors MW 1-5
3000
2500
2000
1500
1000
500
0
uS/cm
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-1-I
MW-2-I
MW-3-I
MW-4-I
MW-5-I

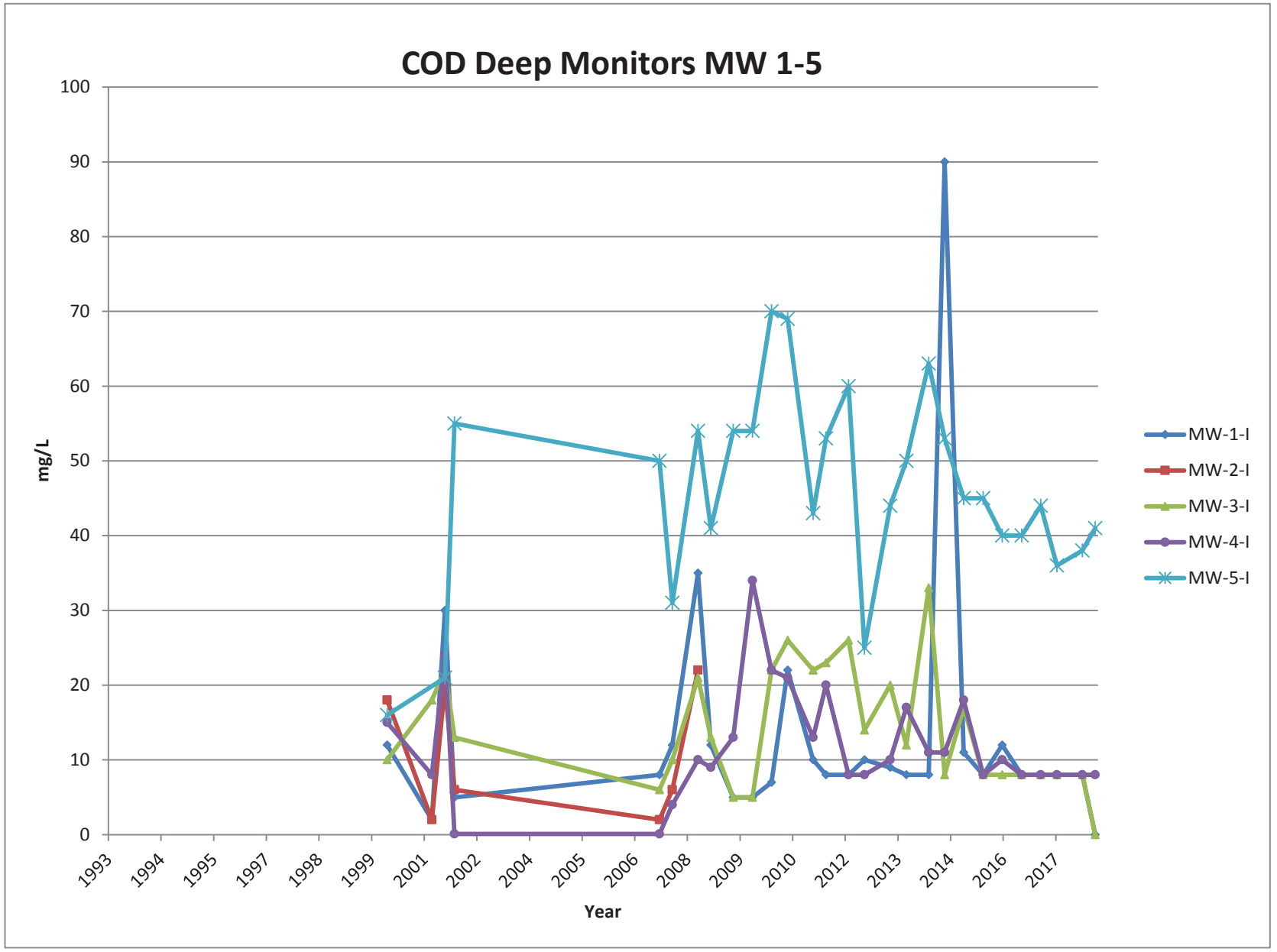

Conductivity Deep Monitors MW 6-9
3000
2500
2000
1500
1000
500
0
uS/cm
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-6-I
MW-7-I
MW-8-I
MW-9-I


Conductivity Deep Monitors MW 10-13
uS/cm
1000
900
800
700
600
500
400
300
200
100
0
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-10-I
MW-11-I
MW-12-II
MW-12-III
MW-13-I


Conductivity Shallow Monitors MW 1-5
8000
7000
6000
5000
4000
3000
2000
1000
0
uS/cm
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-1-II
MW-2-II
MW-3-II
MW-4-II
MW-5-II


Conductivity Shallow Monitors MW 6-9
uS/cm
3500
3000
2500
2000
1500
1000
500
0
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-6-II
MW-7-II
MW-8-II
MW-9-II


Conductivity Shallow Monitors MW 10-13
uS/cm
3500
3000
2500
2000
1500
1000
500
0
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-10-II
MW-11-II
MW-12-I
MW-13-II


COD Deep Monitors MW 1-5
mg/L
100
90
80
70
60
50
40
30
20
10
0
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
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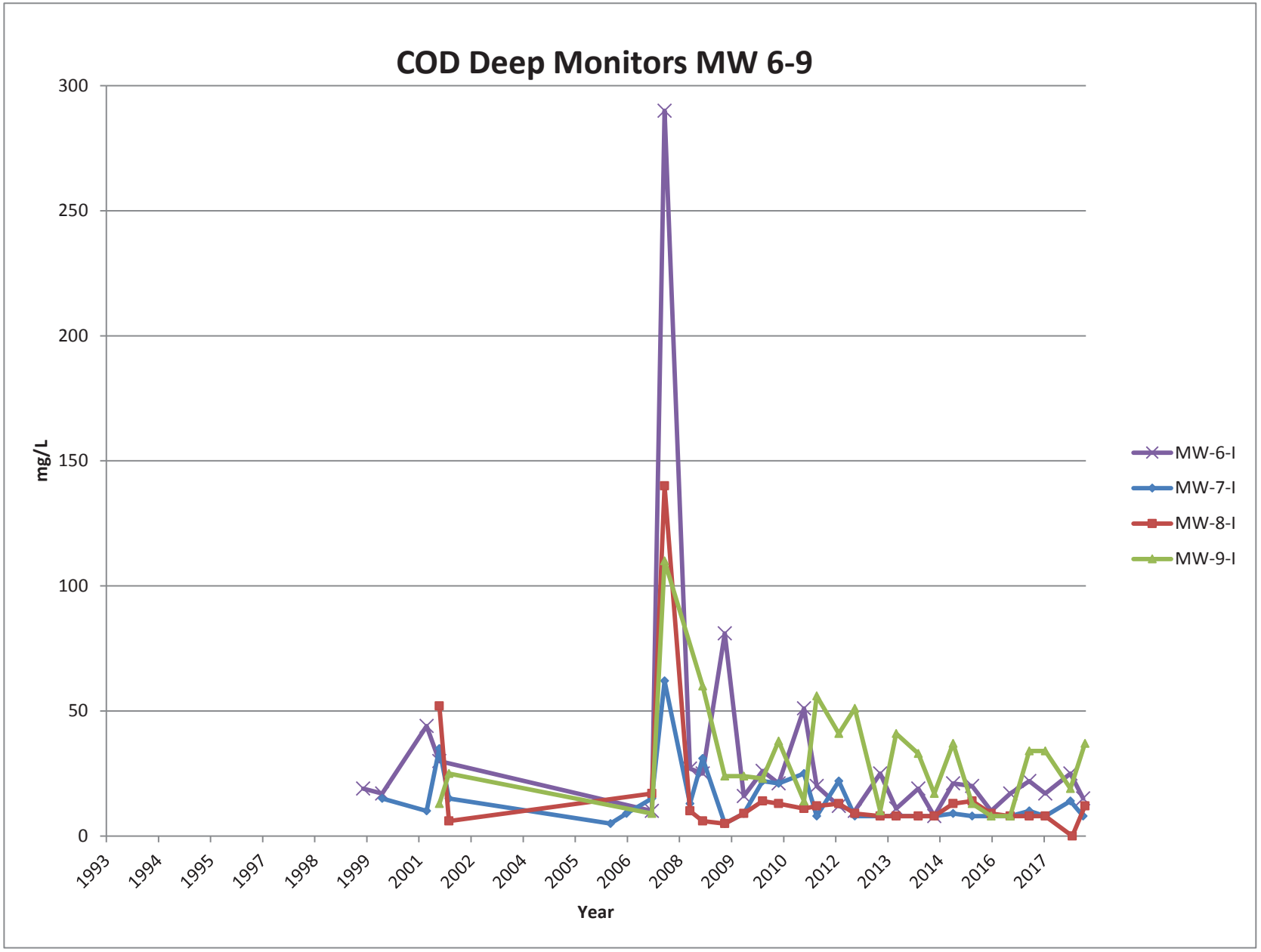
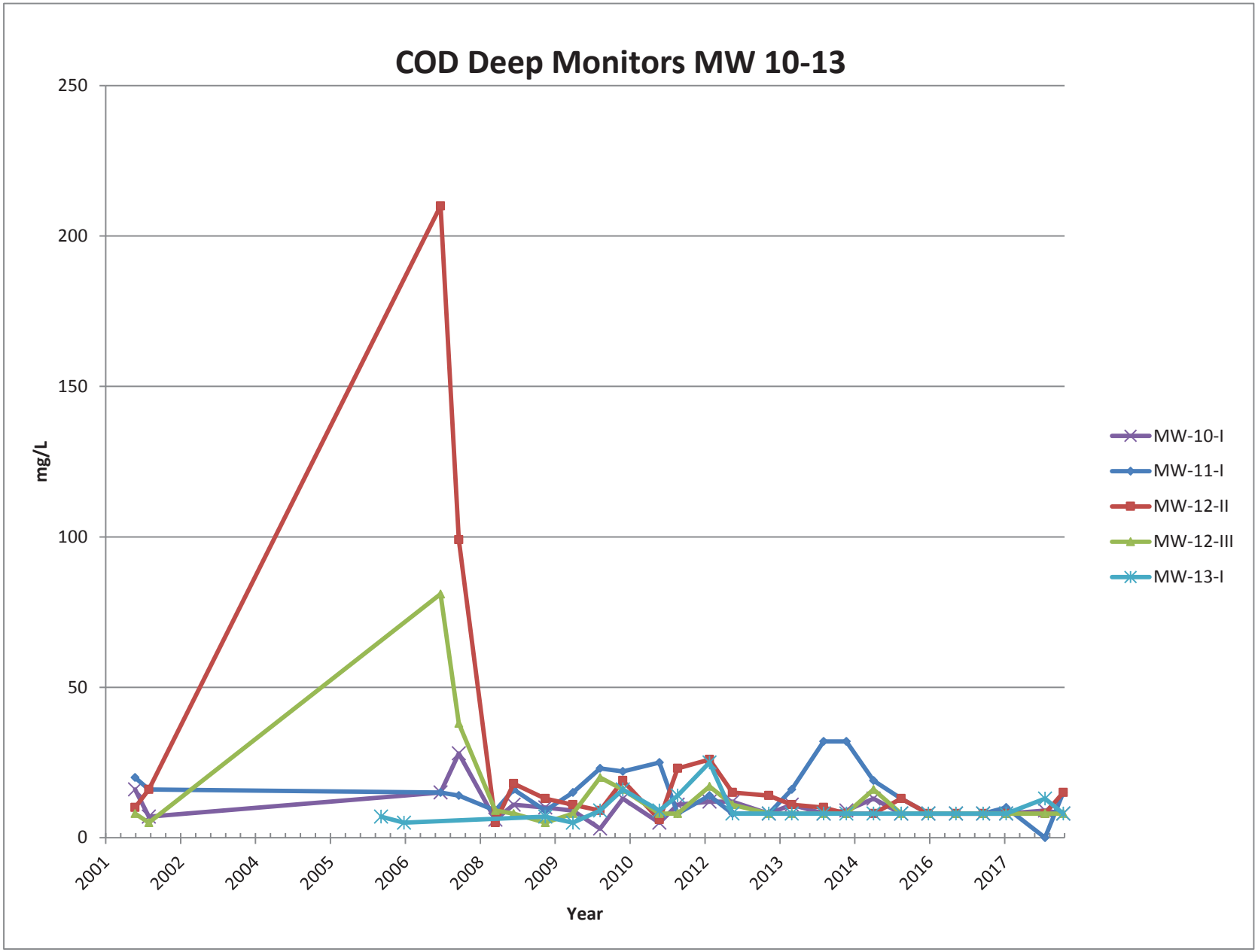
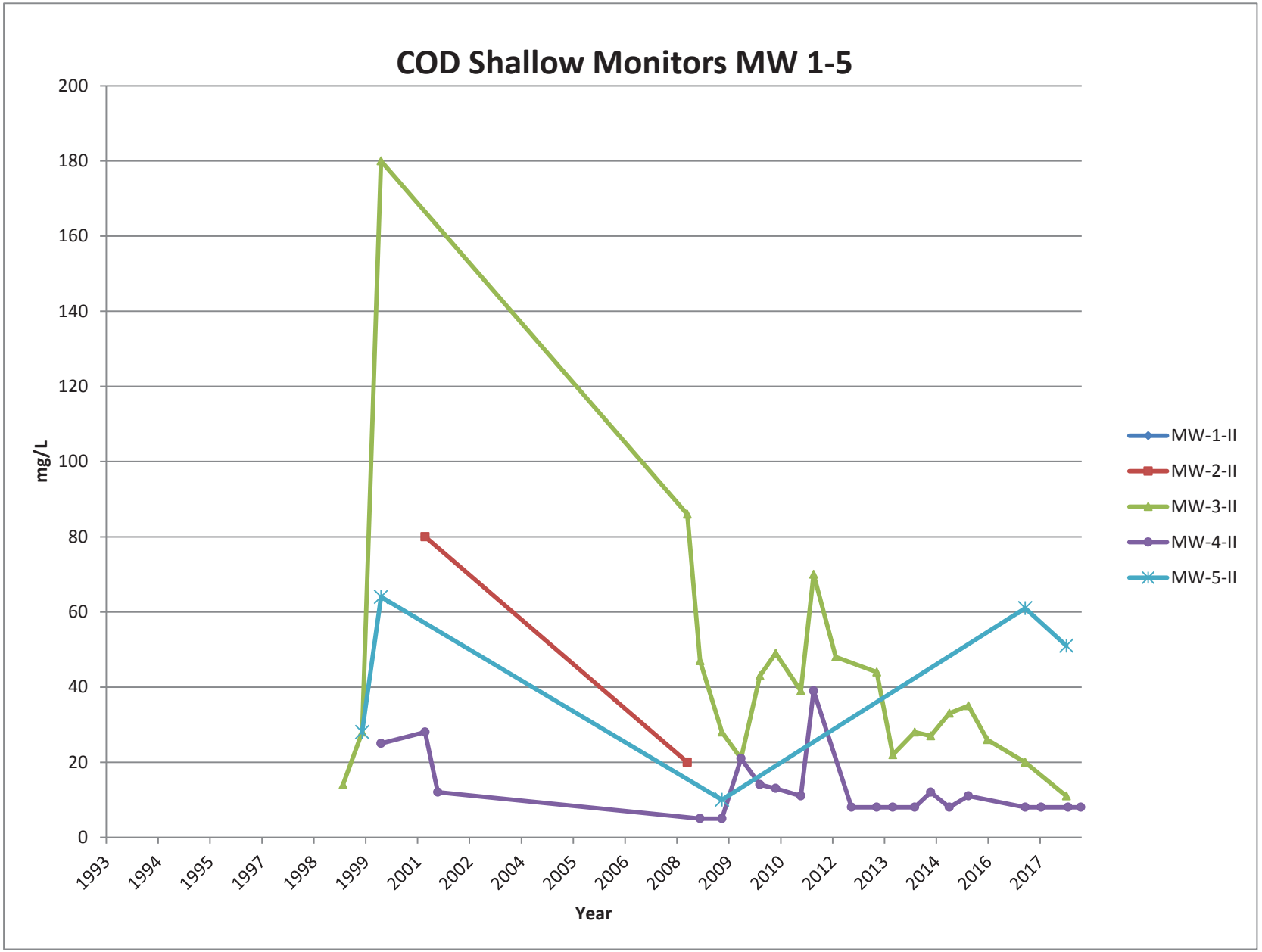
2016
2017
Year
MW-1-I
MW-2-I
MW-3-I
MW-4-I
MW-5-I


COD Deep Monitors MW 6-9
300
250
200
150
100
50
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-6-I
MW-7-I
MW-8-I
MW-9-I


COD Deep Monitors MW 10-13
250
200
150
100
50
0
mg/L
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-10-I
MW-11-I
MW-12-II
MW-12-III
MW-13-I


COD Shallow Monitors MW 1-5
mg/L
200
180
160
140
120
100
80
60
40
20
0
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
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2013
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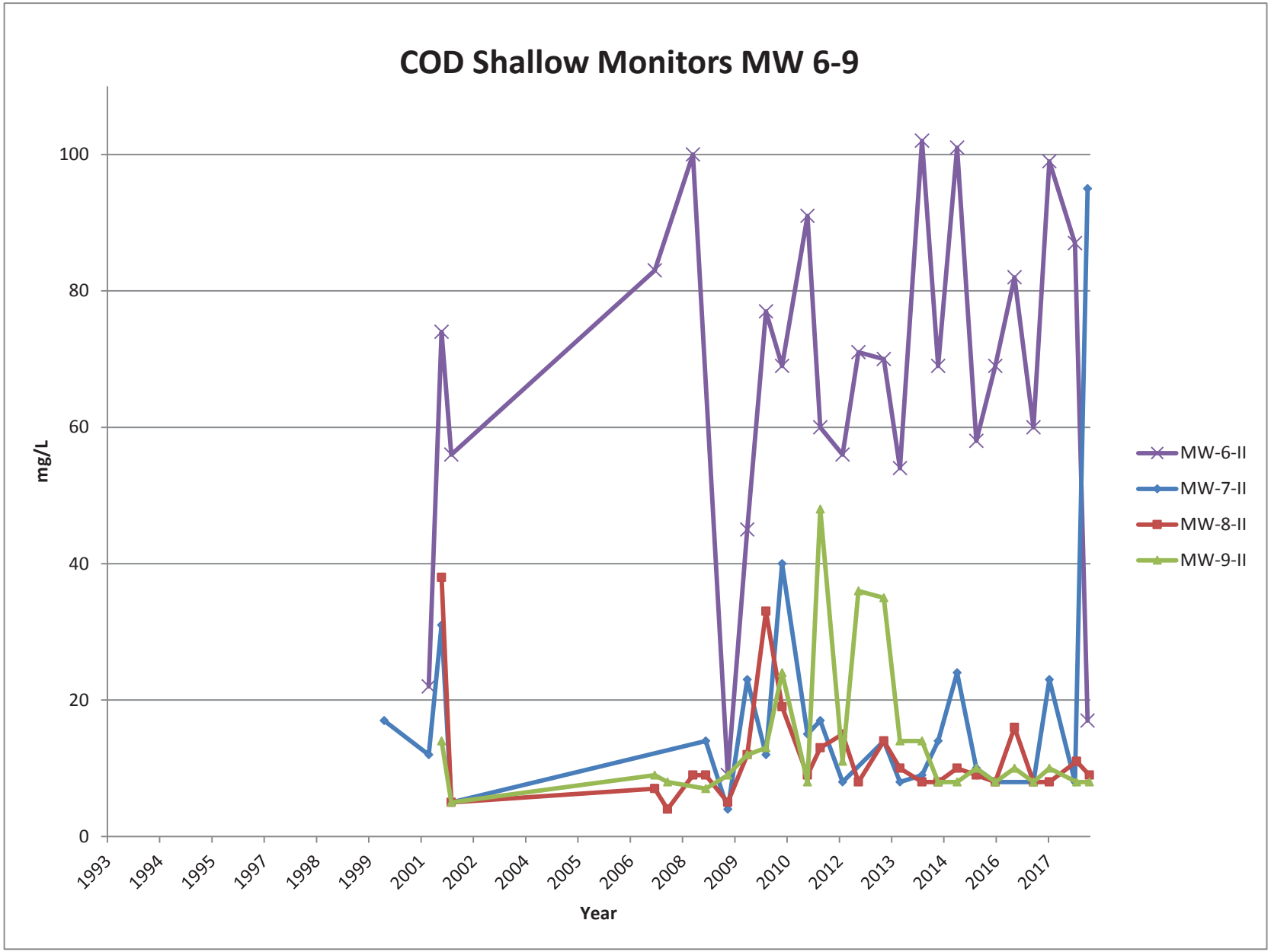
2016
2017
Year
MW-1-II
MW-2-II
MW-3-II
MW-4-II
MW-5-II


COD Shallow Monitors MW 6-9
mg/L
100
80
60
40
20
0
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
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2013
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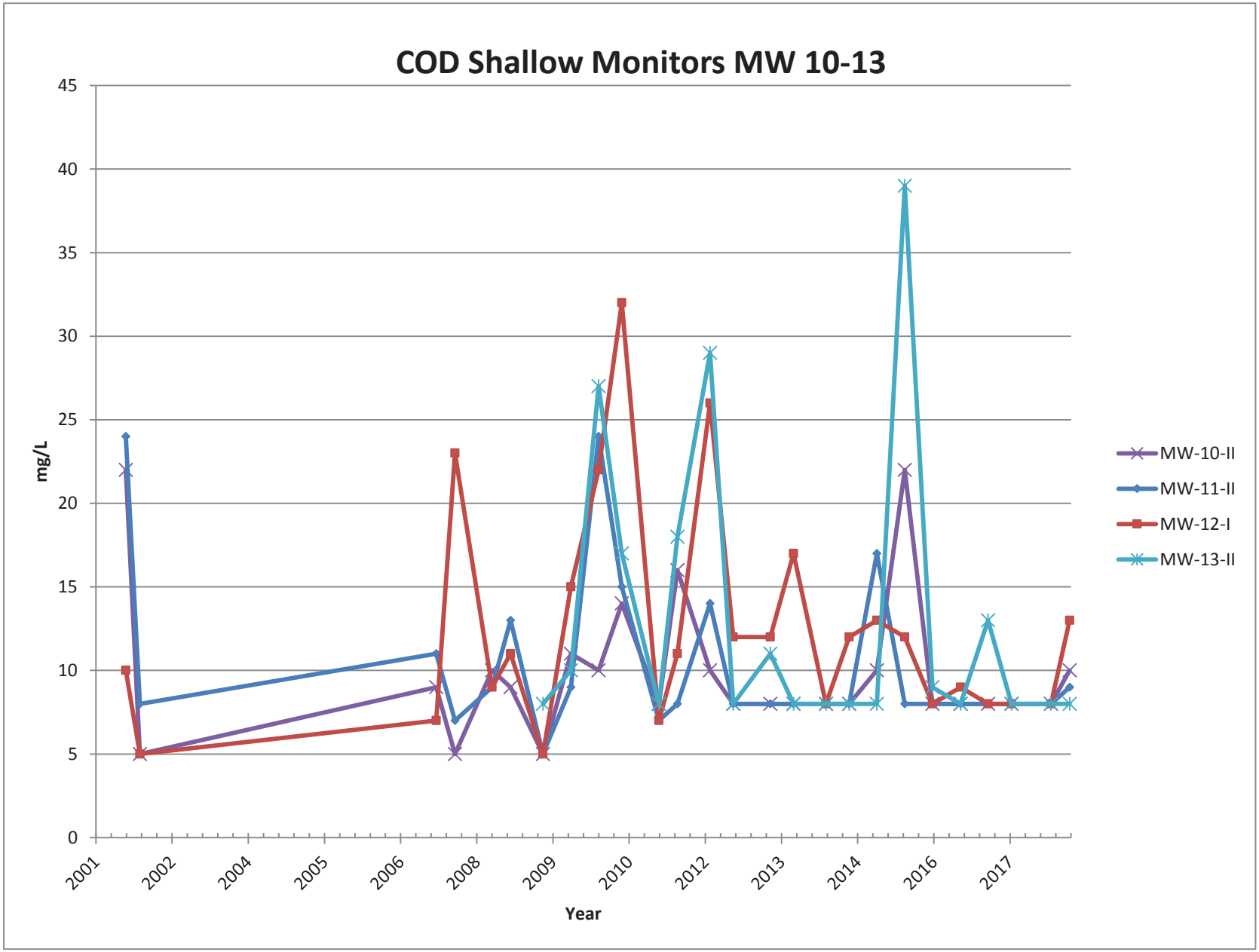
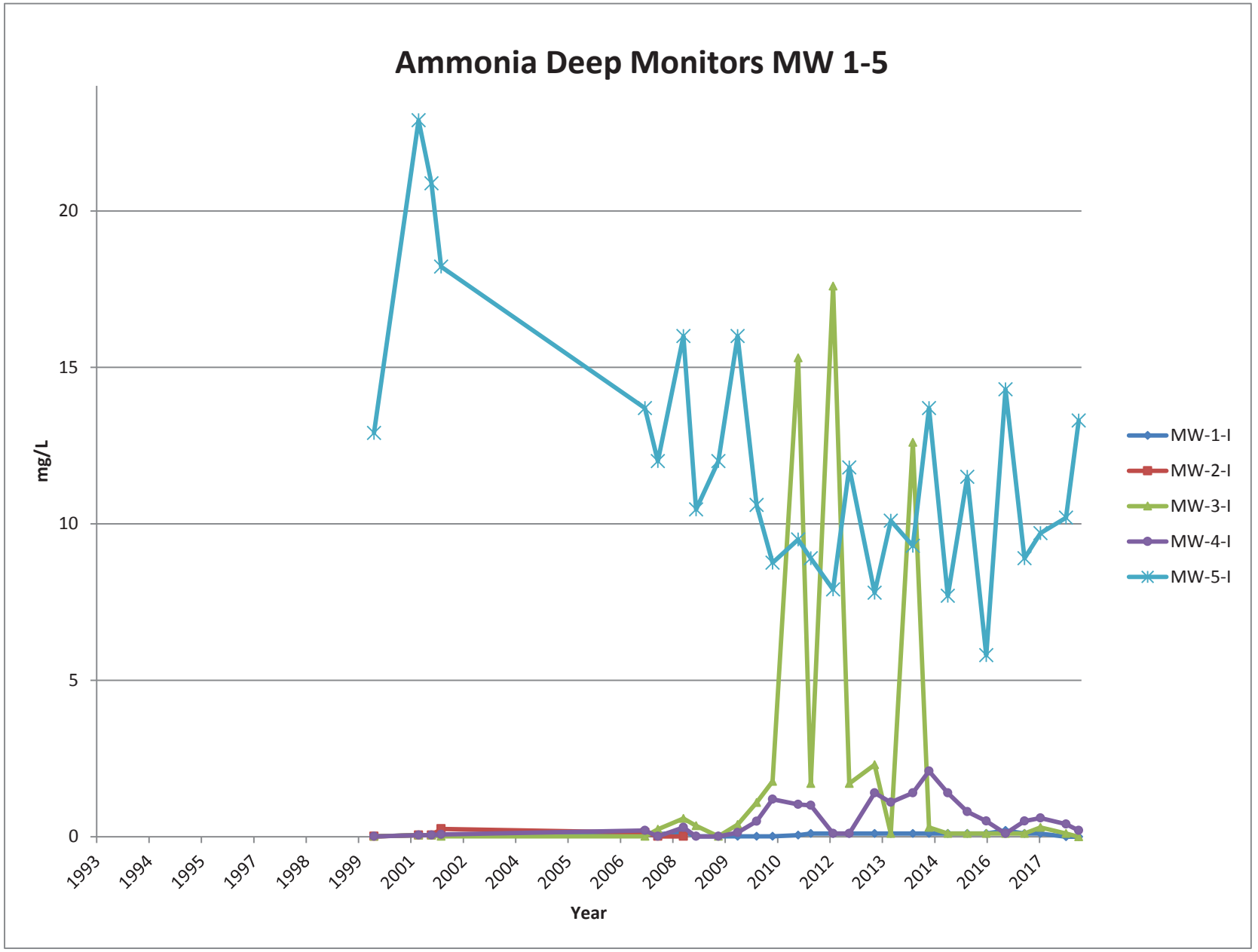
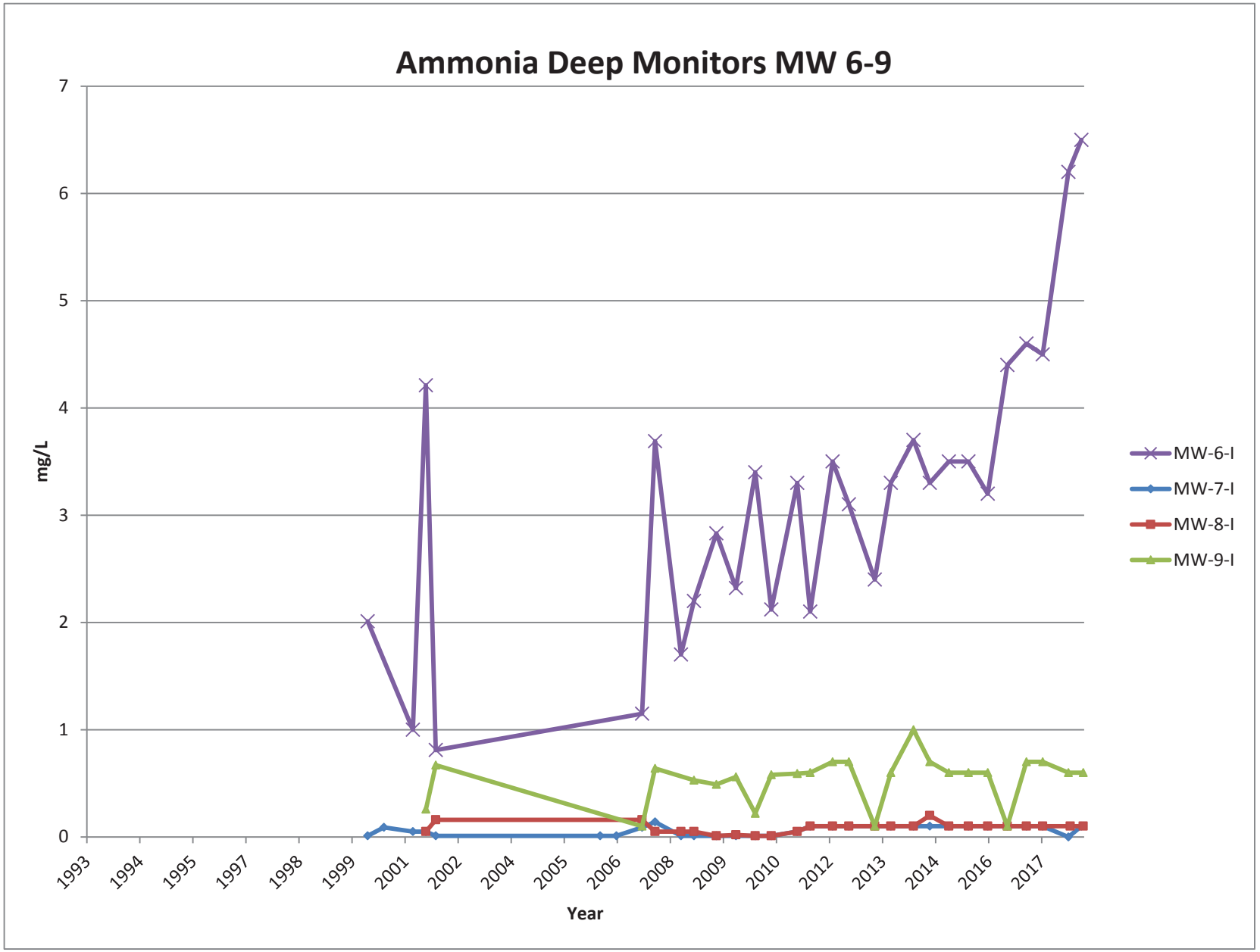
2016
2017
Year
MW-6-II
MW-7-II
MW-8-II
MW-9-II


COD Shallow Monitors MW 10-13
mg/L
45
40
35
30
25
20
15
10
5
0
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-10-II
MW-11-II
MW-12-I
MW-13-II


Ammonia Deep Monitors MW 1-5
mg/L
20
15
10
5
0
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-1-I
MW-2-I
MW-3-I
MW-4-I
MW-5-I


Ammonia Deep Monitors MW 6-9
mg/L
Year
MW-6-I
MW-7-I
MW-8-I
MW-9-I
0
1
2
3
4
5
6
7
1993
1994
1995
1997
1998
1999
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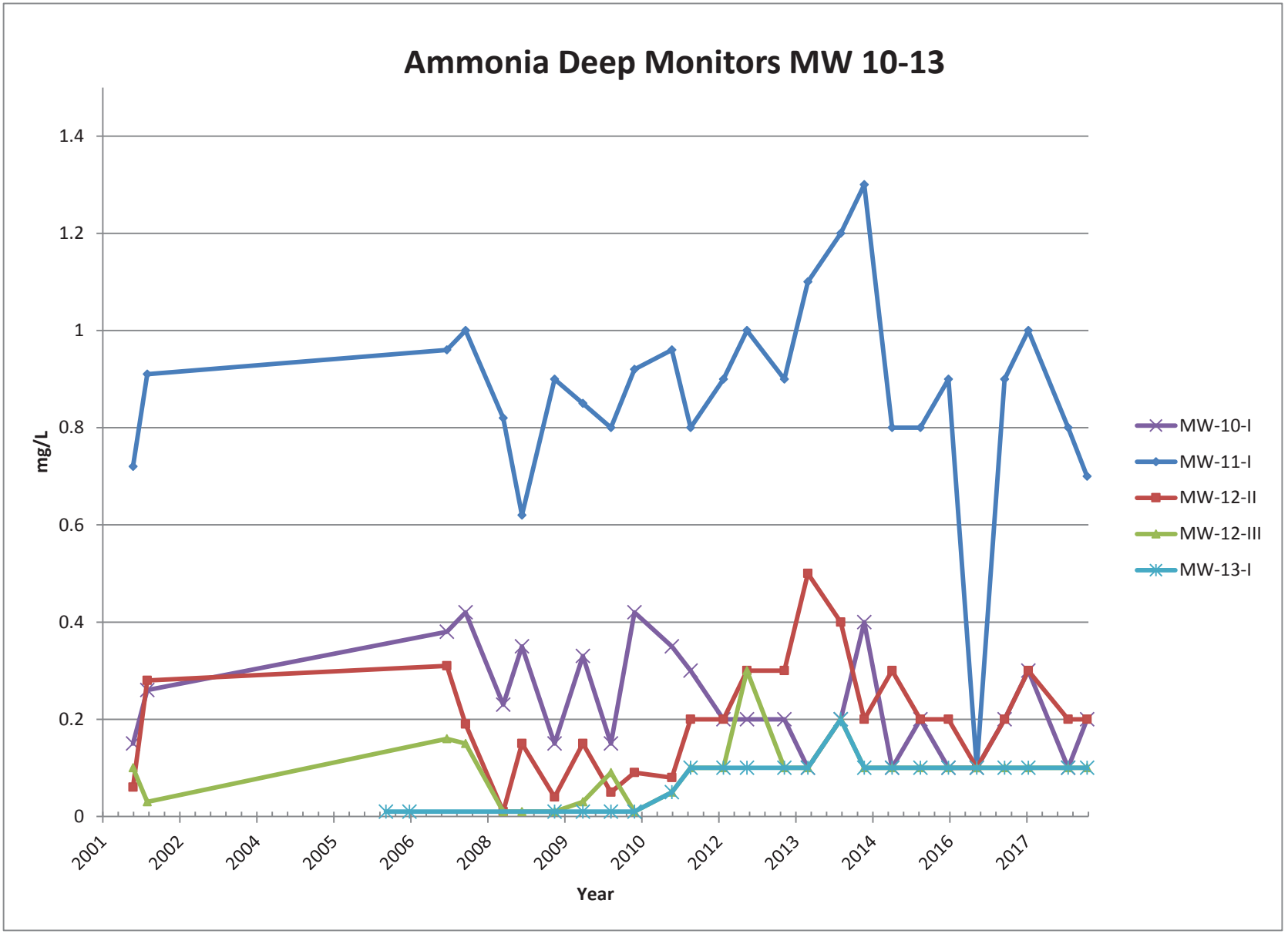
2008
2009
2010
2012
2013
2014
2016
2017


Ammonia Deep Monitors MW 10-13
1.4
1.2
1
0.8
0.6
0.4
0.2
0
mg/L
2001
2002
2004
2005
2006
2008
2009
2010
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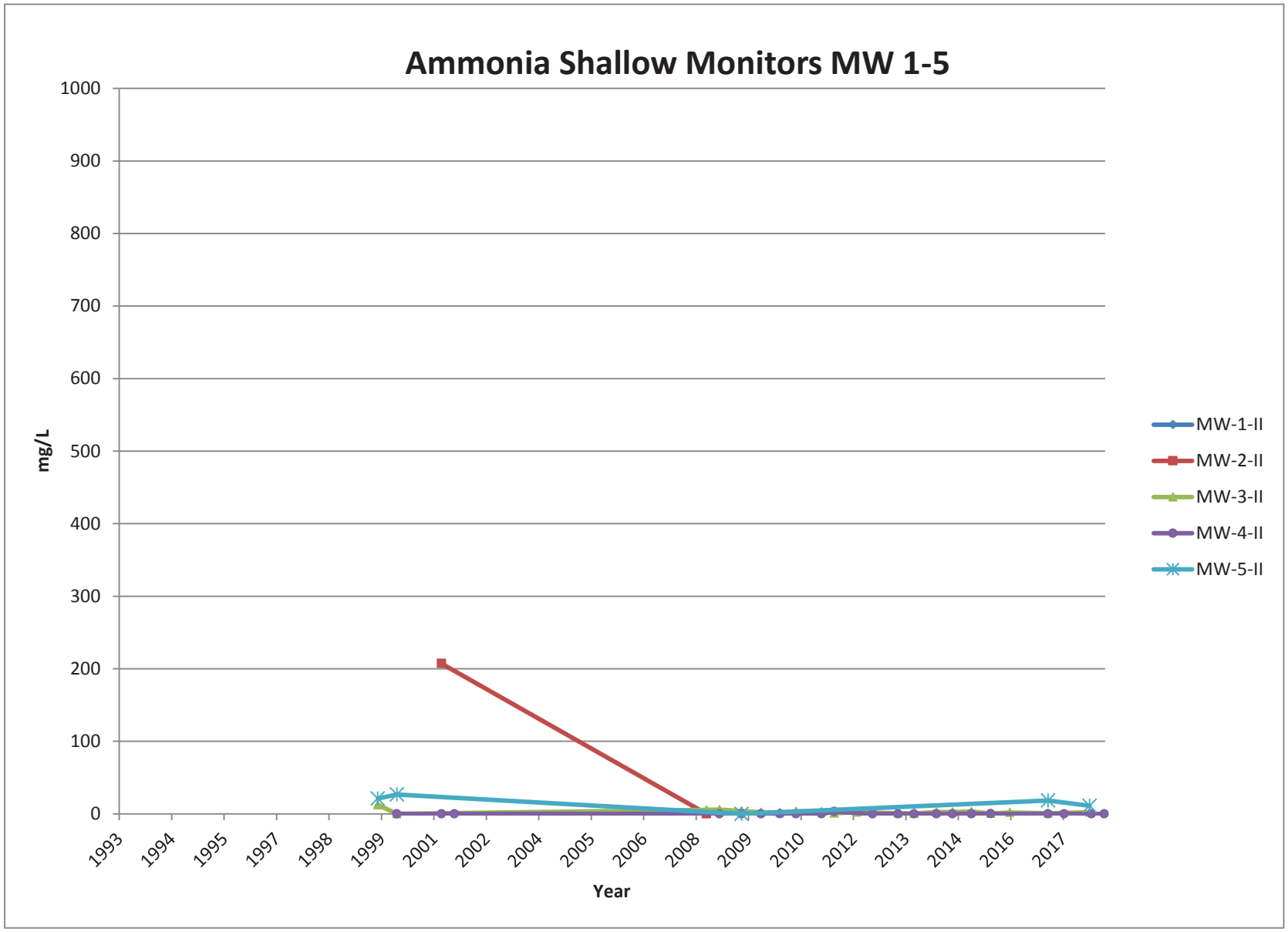
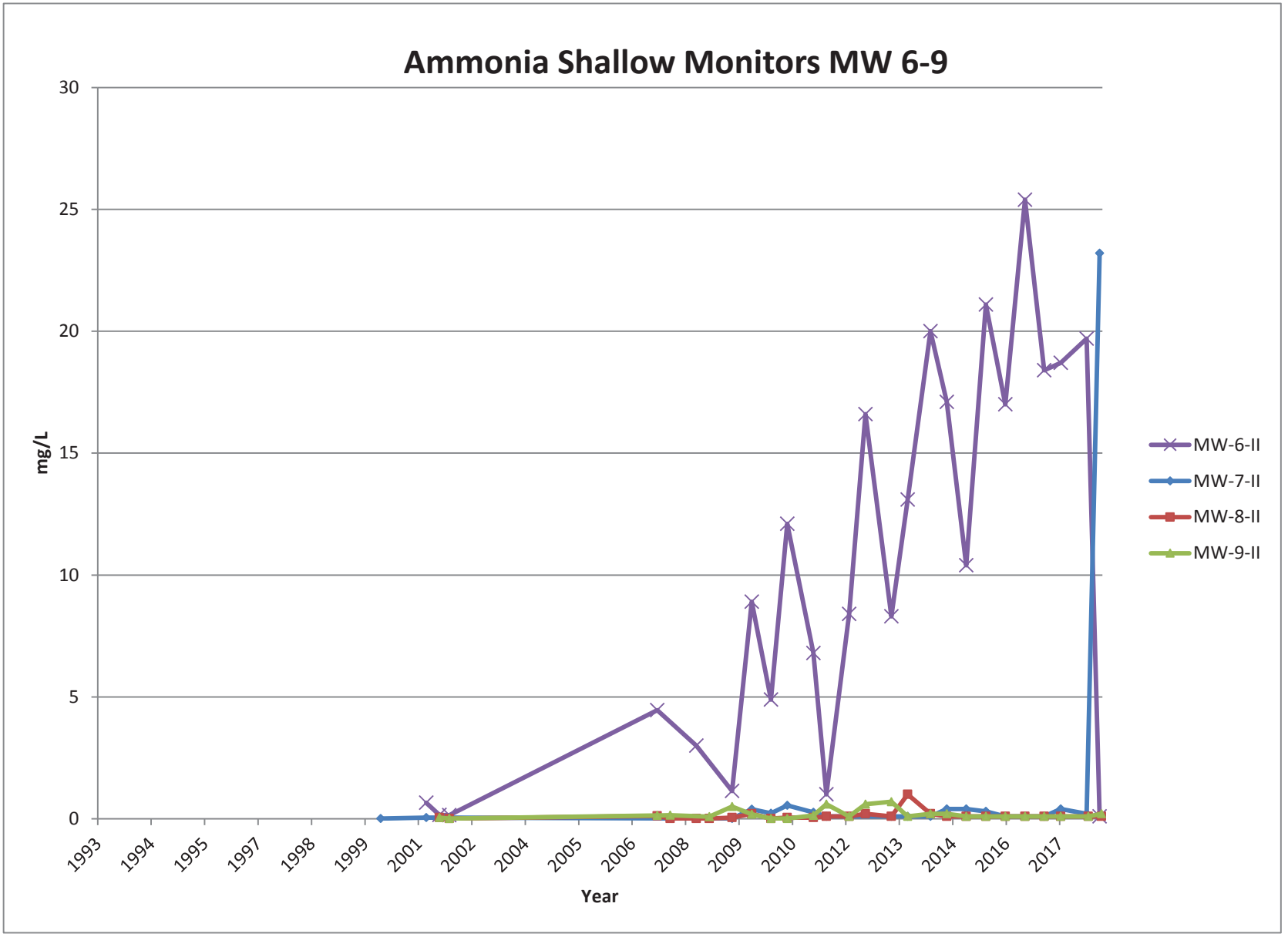
2013
2014
2016
2017
Year
MW-10-I
MW-11-I
MW-12-II
MW-12-III
MW-13-I


Ammonia Shallow Monitors MW 1-5
1000
900
800
700
600
500
400
300
200
100
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-1-II
MW-2-II
MW-3-II
MW-4-II
MW-5-II


Ammonia Shallow Monitors MW 6-9
30
25
20
15
10
5
0
mg/L
1993
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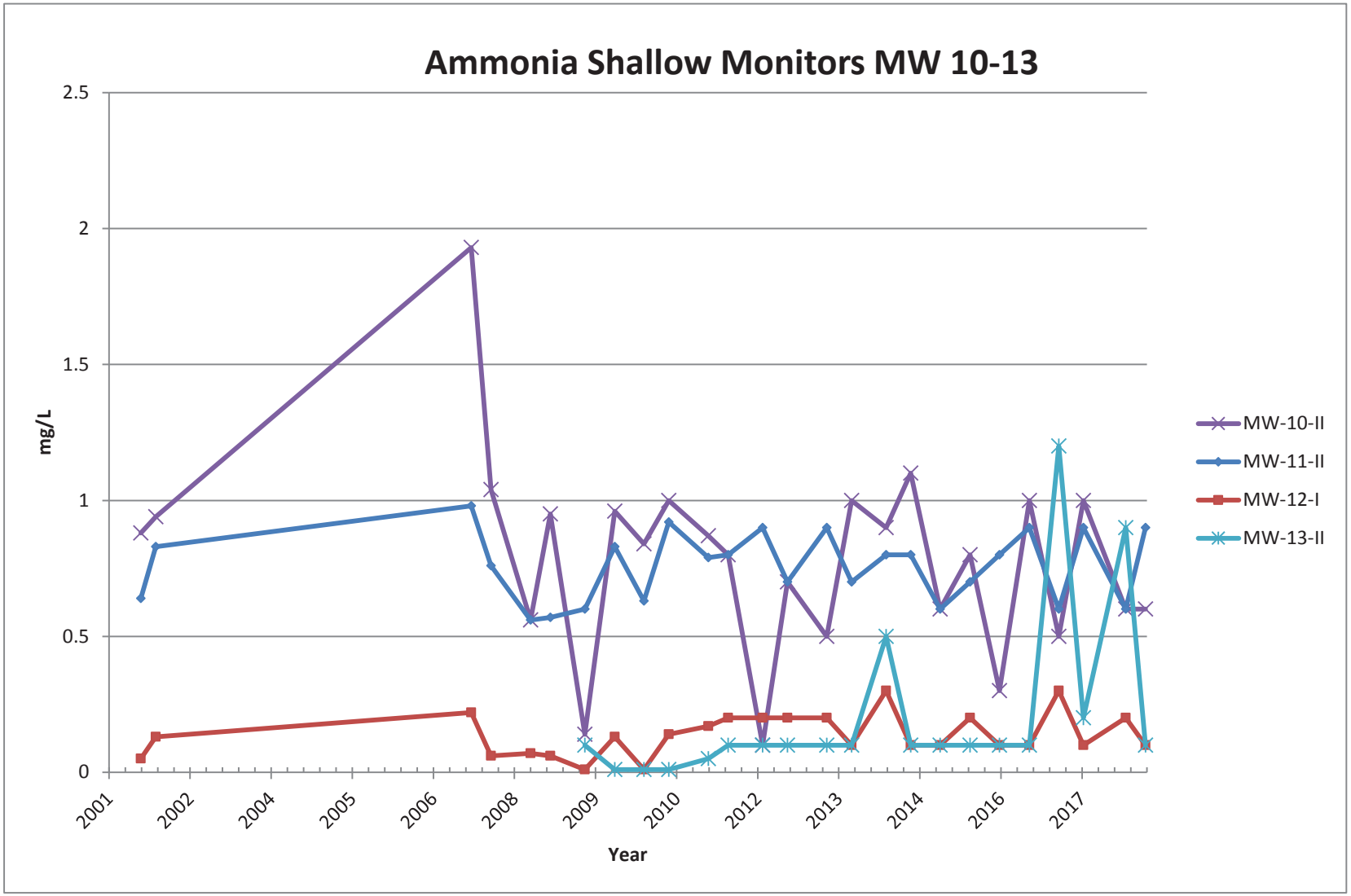
Ammonia Shallow Monitors MW 10-13
2.5
2
1.5
1
0.5
0
mg/L
2001
2002
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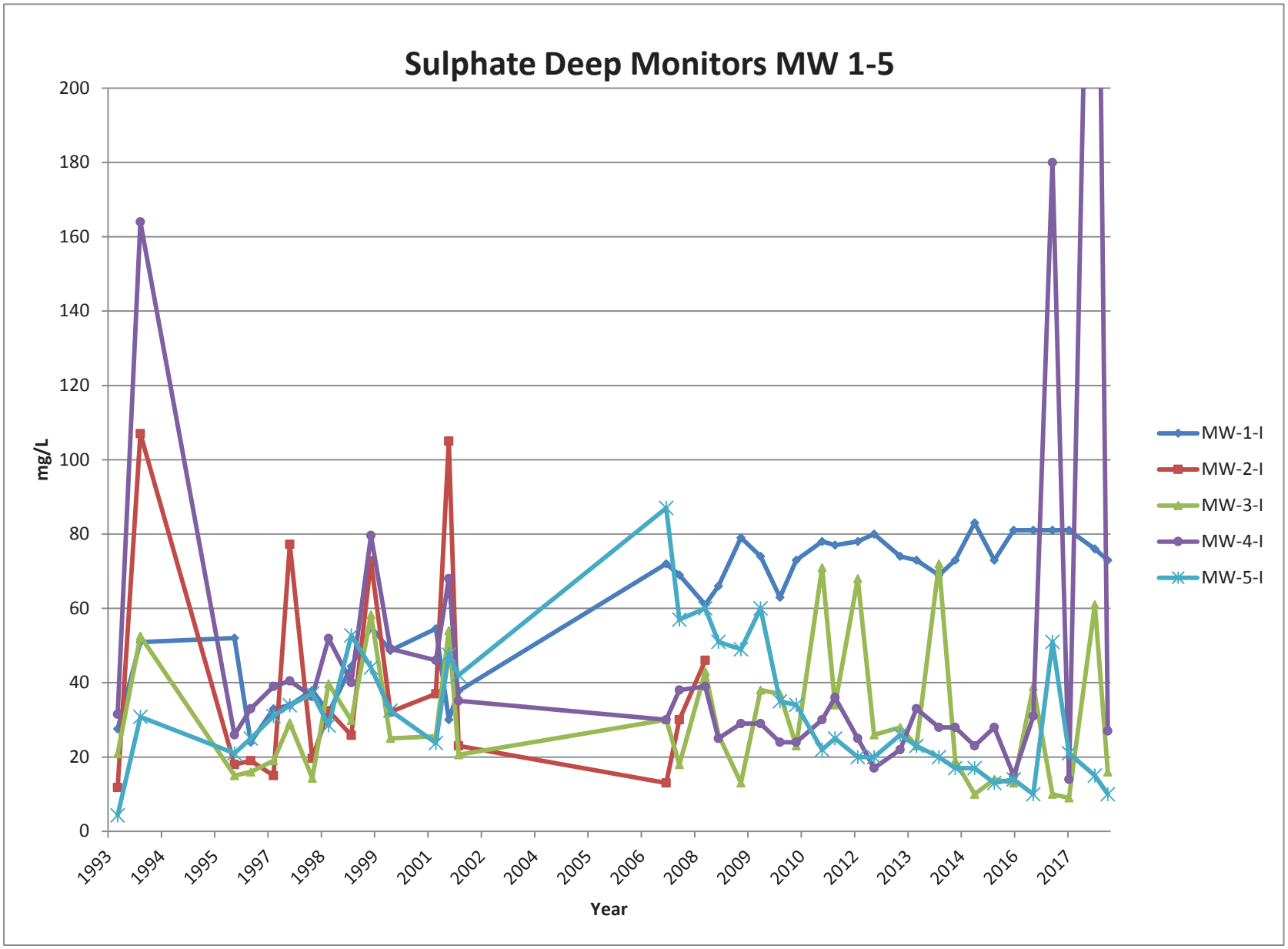
Sulphate Deep Monitors MW 1-5
mg/L
200
180
160
140
120
100
80
60
40
20
0
1993
1994
1995
1997
1998
1999
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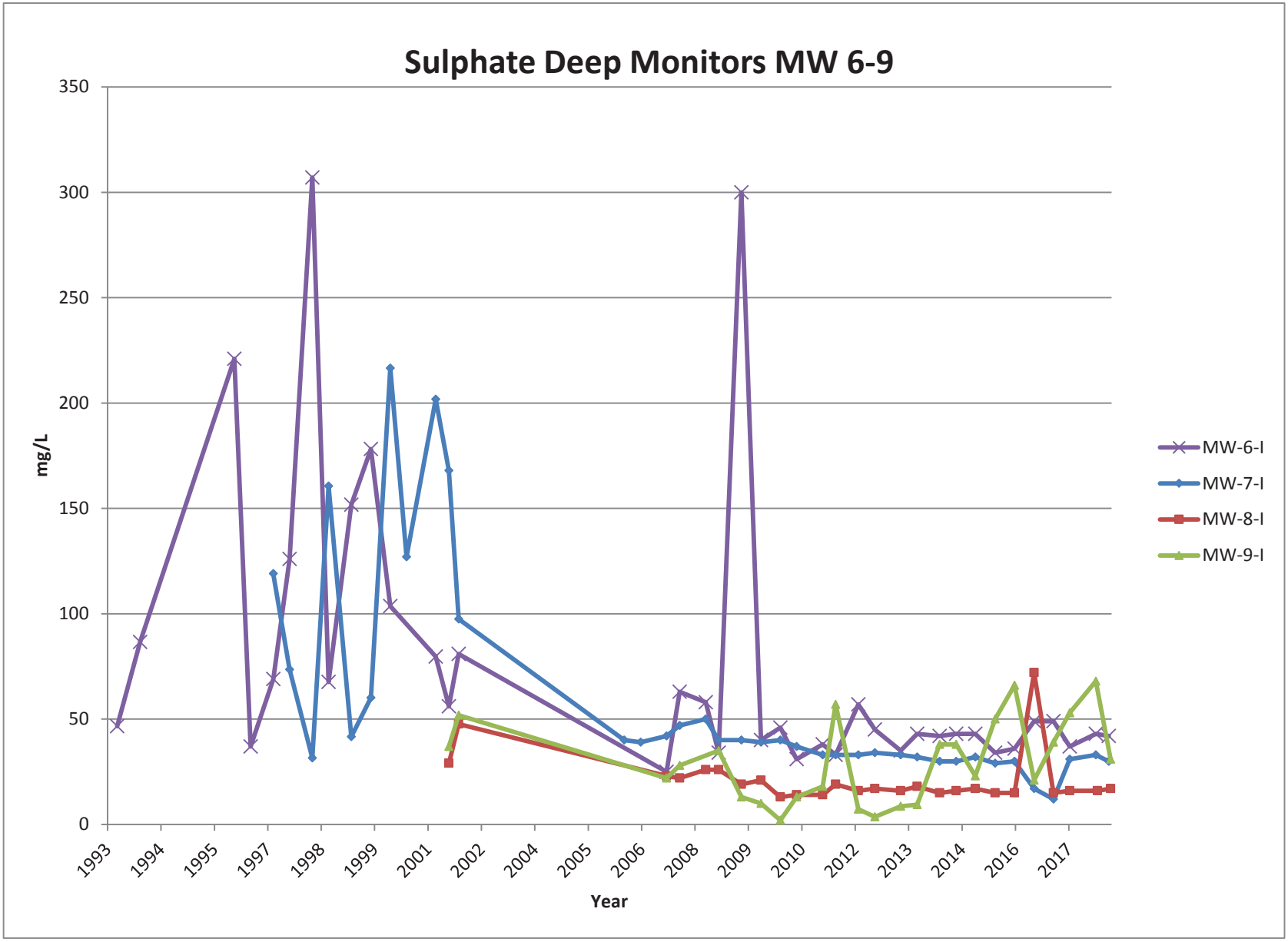
Sulphate Deep Monitors MW 6-9
350
300
250
200
150
100
50
0
mg/L
1993
1994
1995
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1999
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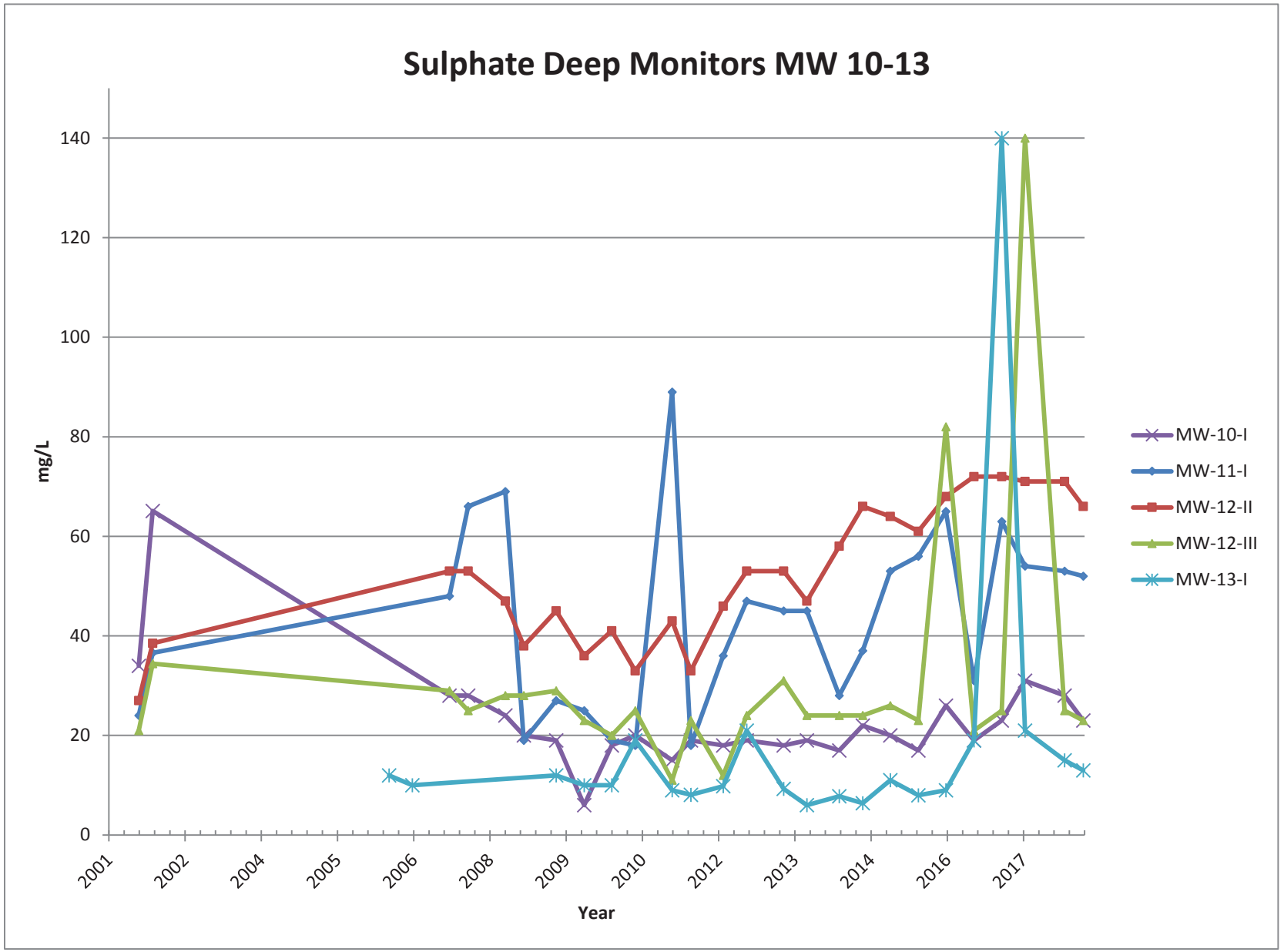
Sulphate Deep Monitors MW 10-13
mg/L
140
120
100
80
60
40
20
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2001
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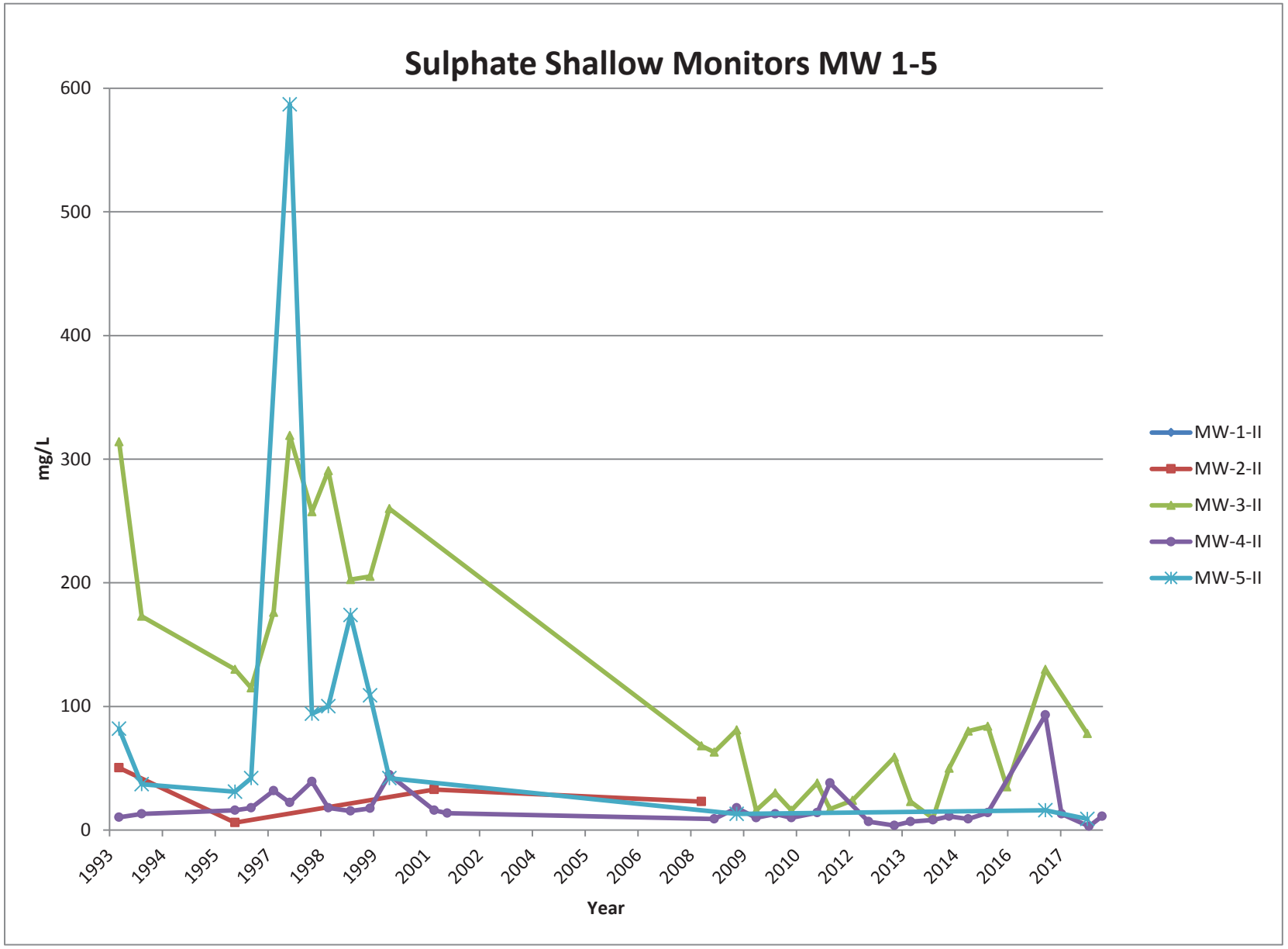
Sulphate Shallow Monitors MW 1-5
600
500
400
300
200
100
0
mg/L
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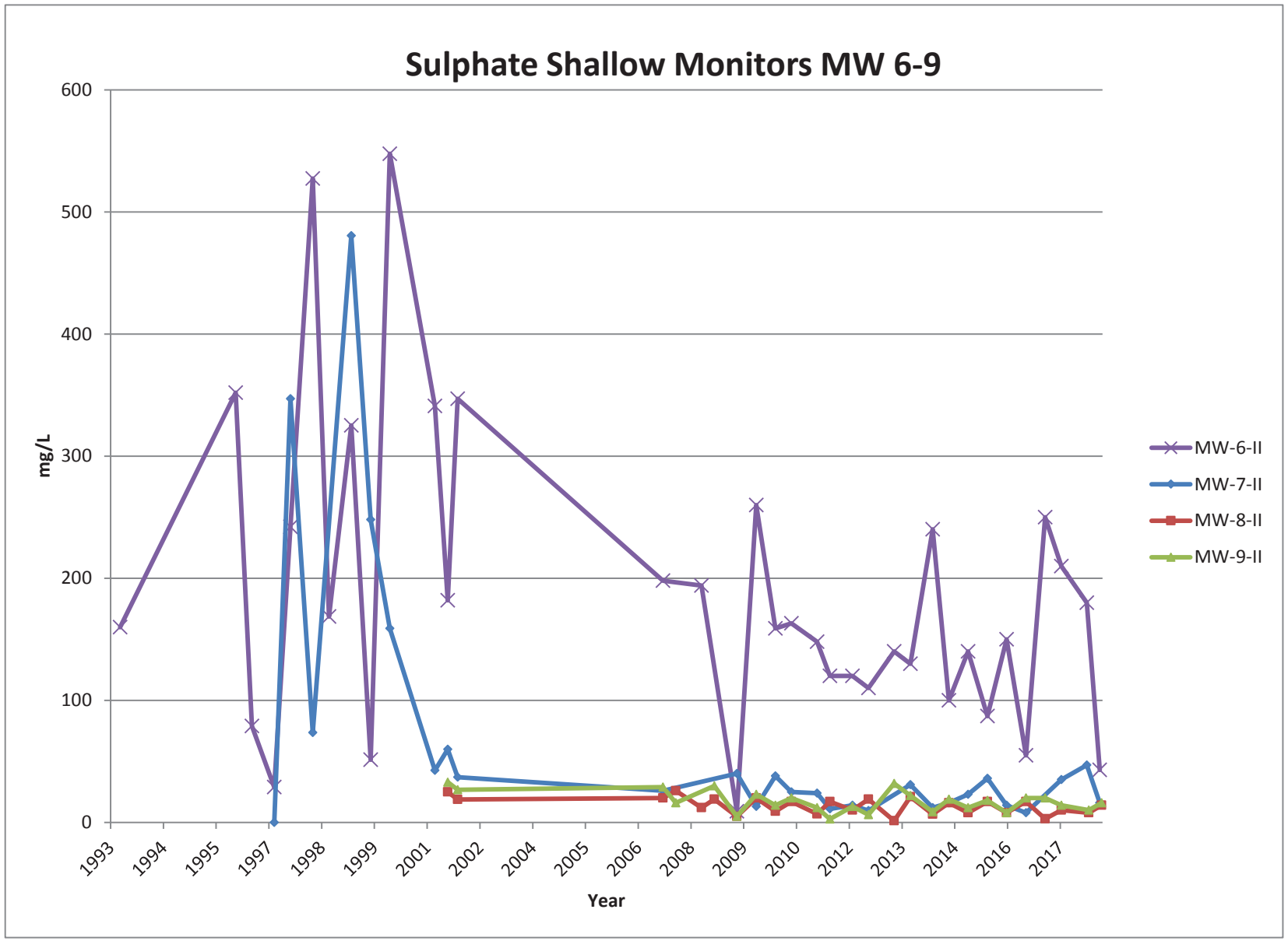
Sulphate Shallow Monitors MW 6-9
600
500
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300
200
100
0
mg/L
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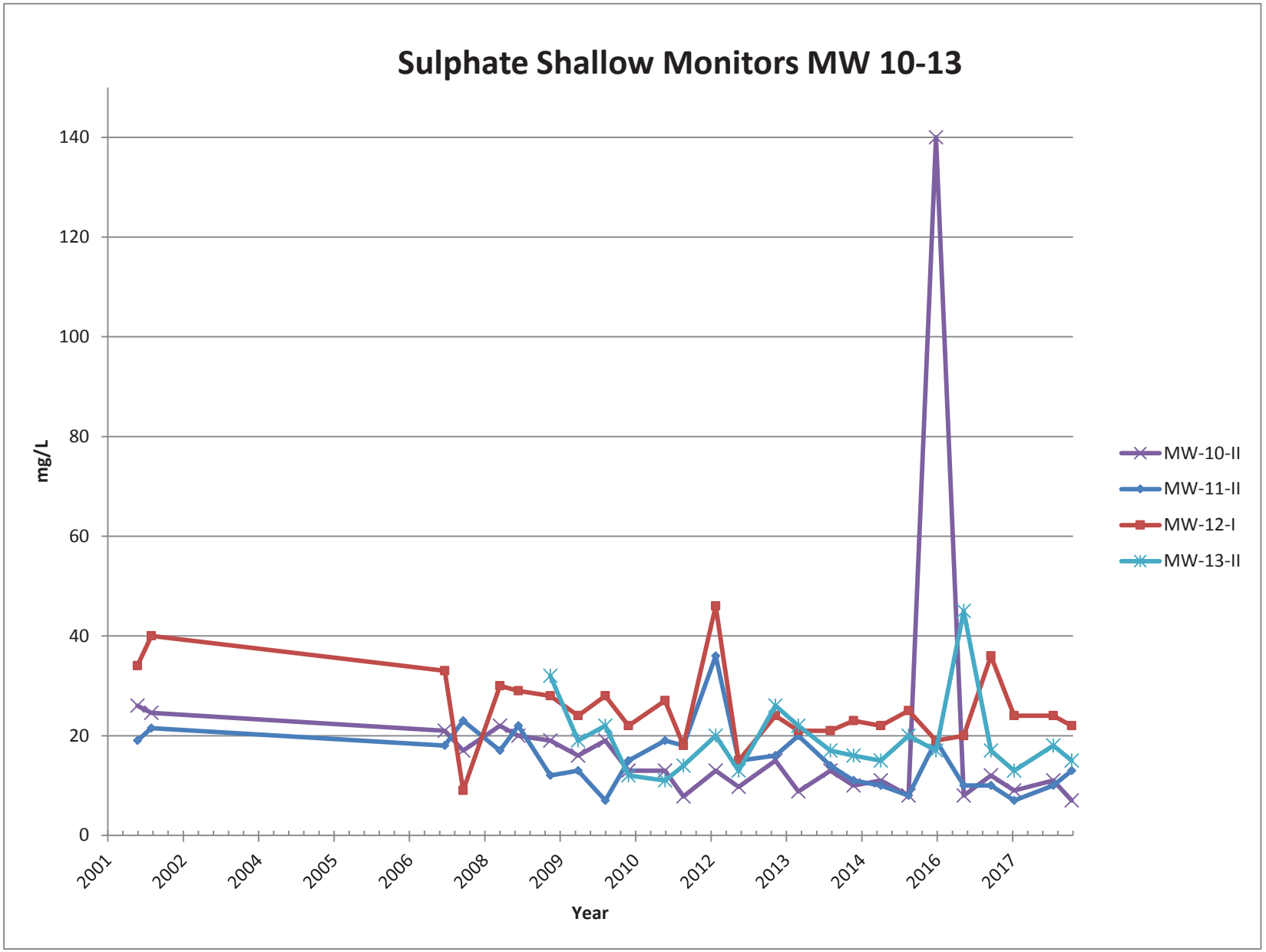
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mg/L
140
120
100
80
60
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2001
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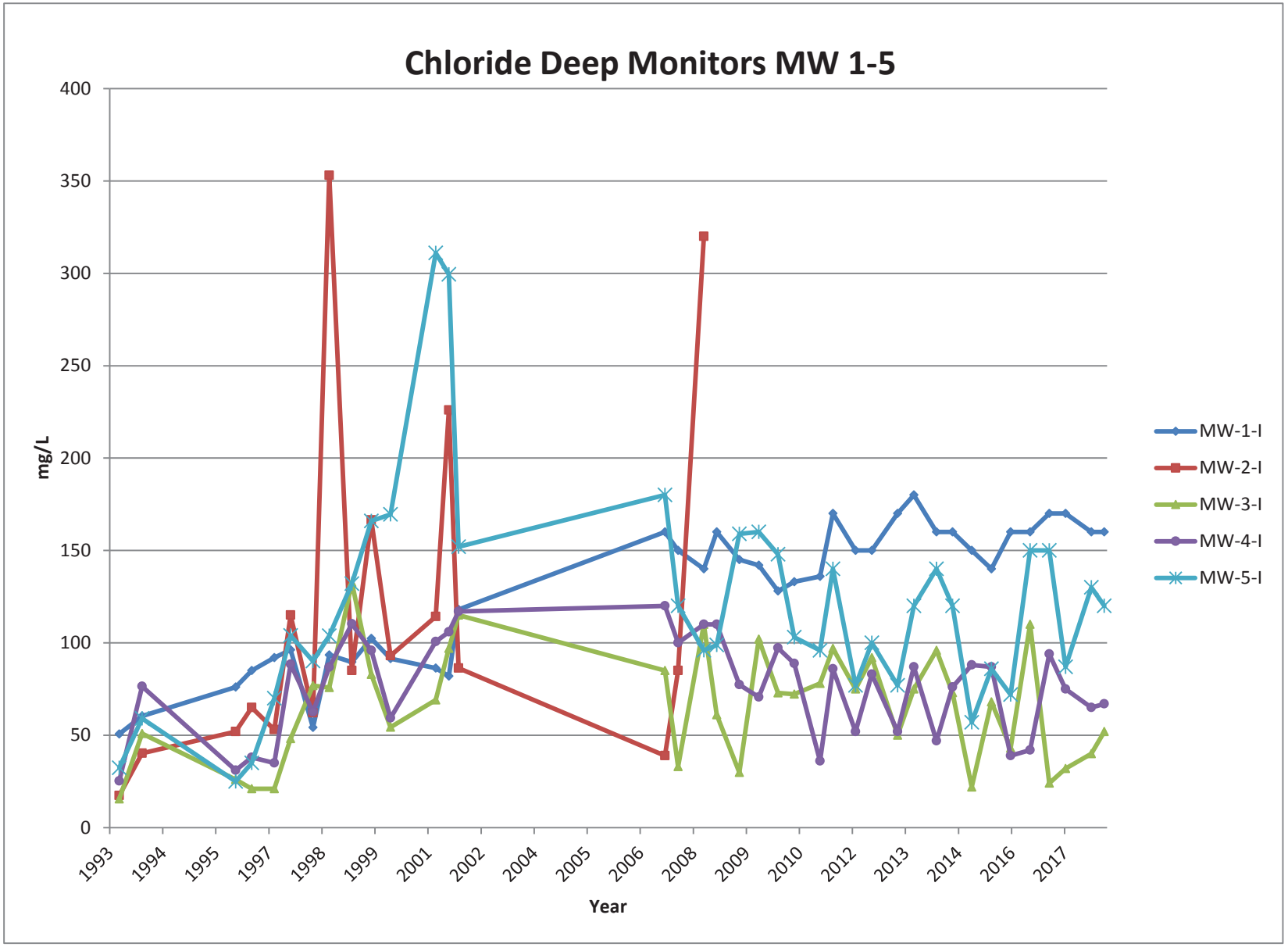
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400
350
300
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100
50
0
mg/L
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1994
1995
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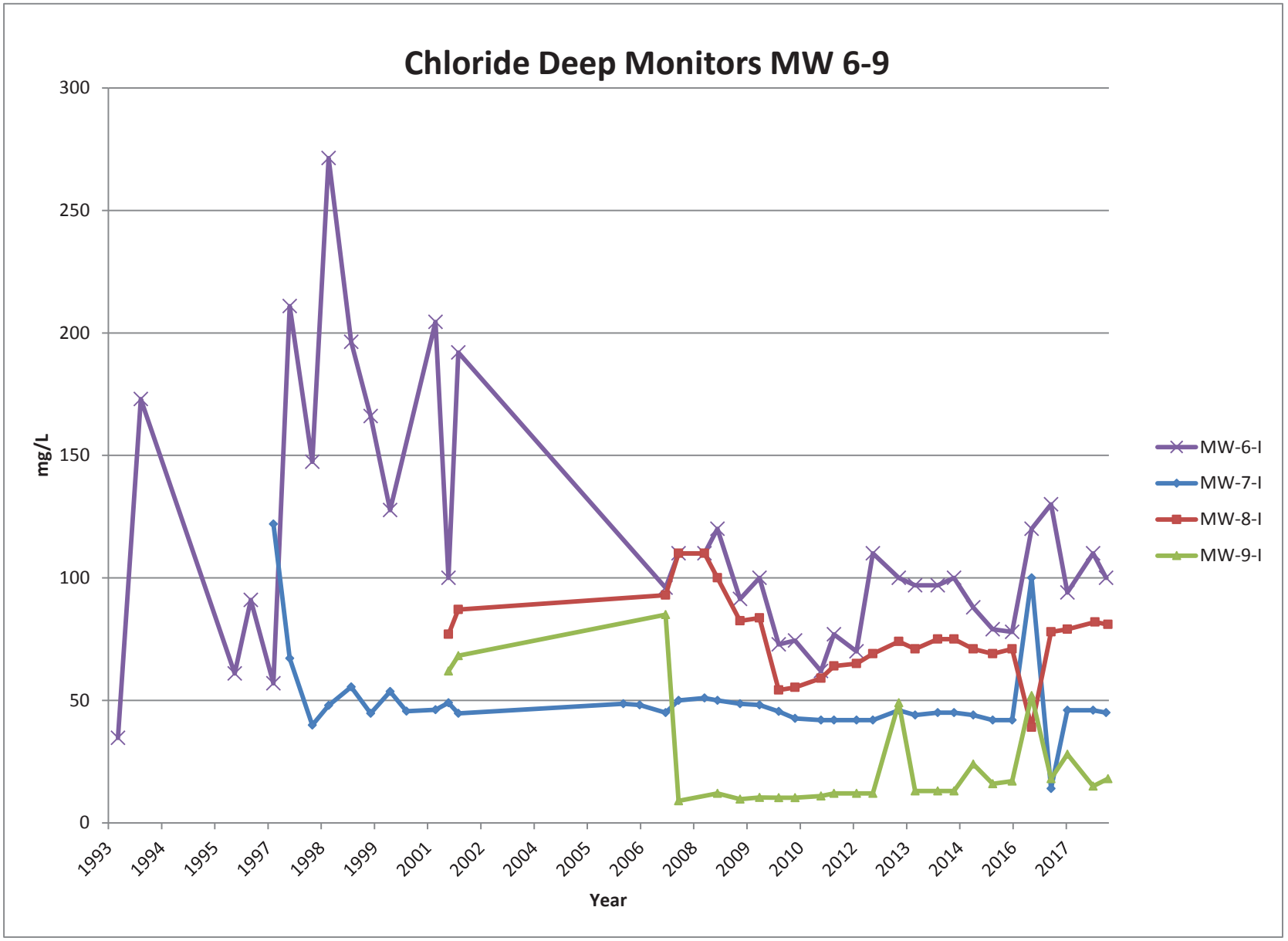
Chloride Deep Monitors MW 6-9
300
250
200
150
100
50
0
mg/L
1993
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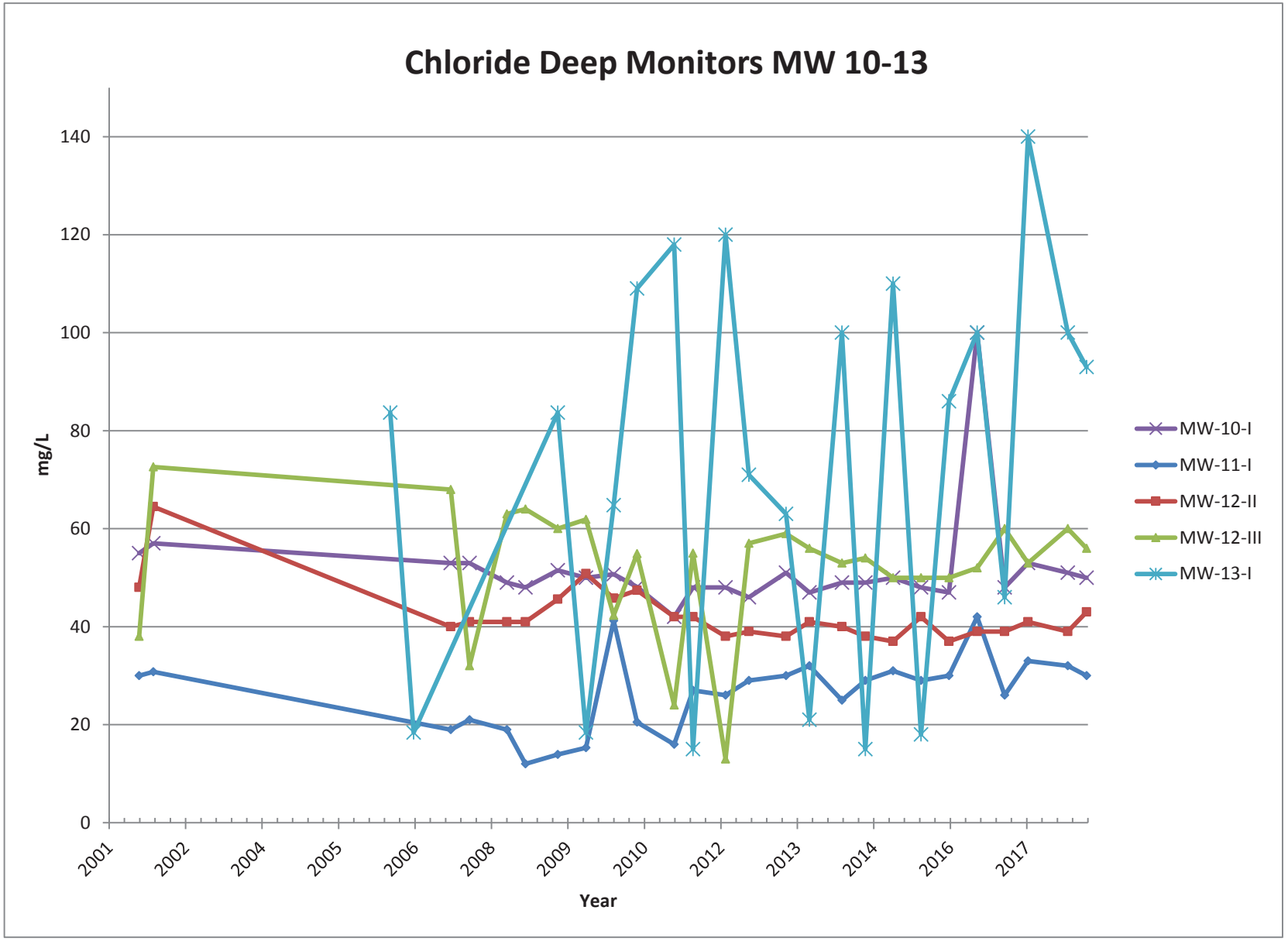
MW-9-I


Chloride Deep Monitors MW 10-13
mg/L
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120
100
80
60
40
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2001
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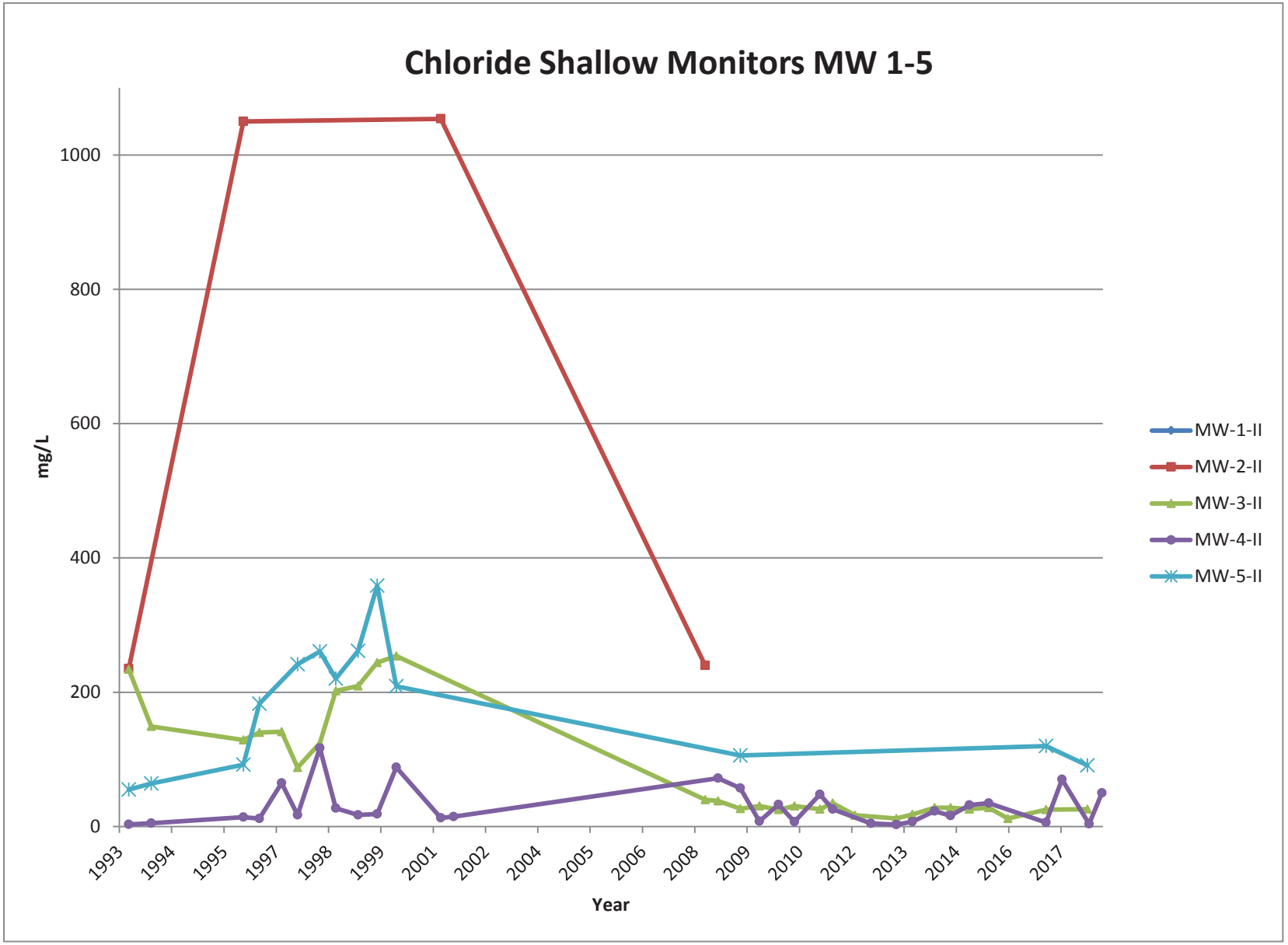
MW-13-I


Chloride Shallow Monitors MW 1-5
mg/L
1000
800
600
400
200
0
1993
1994
1995
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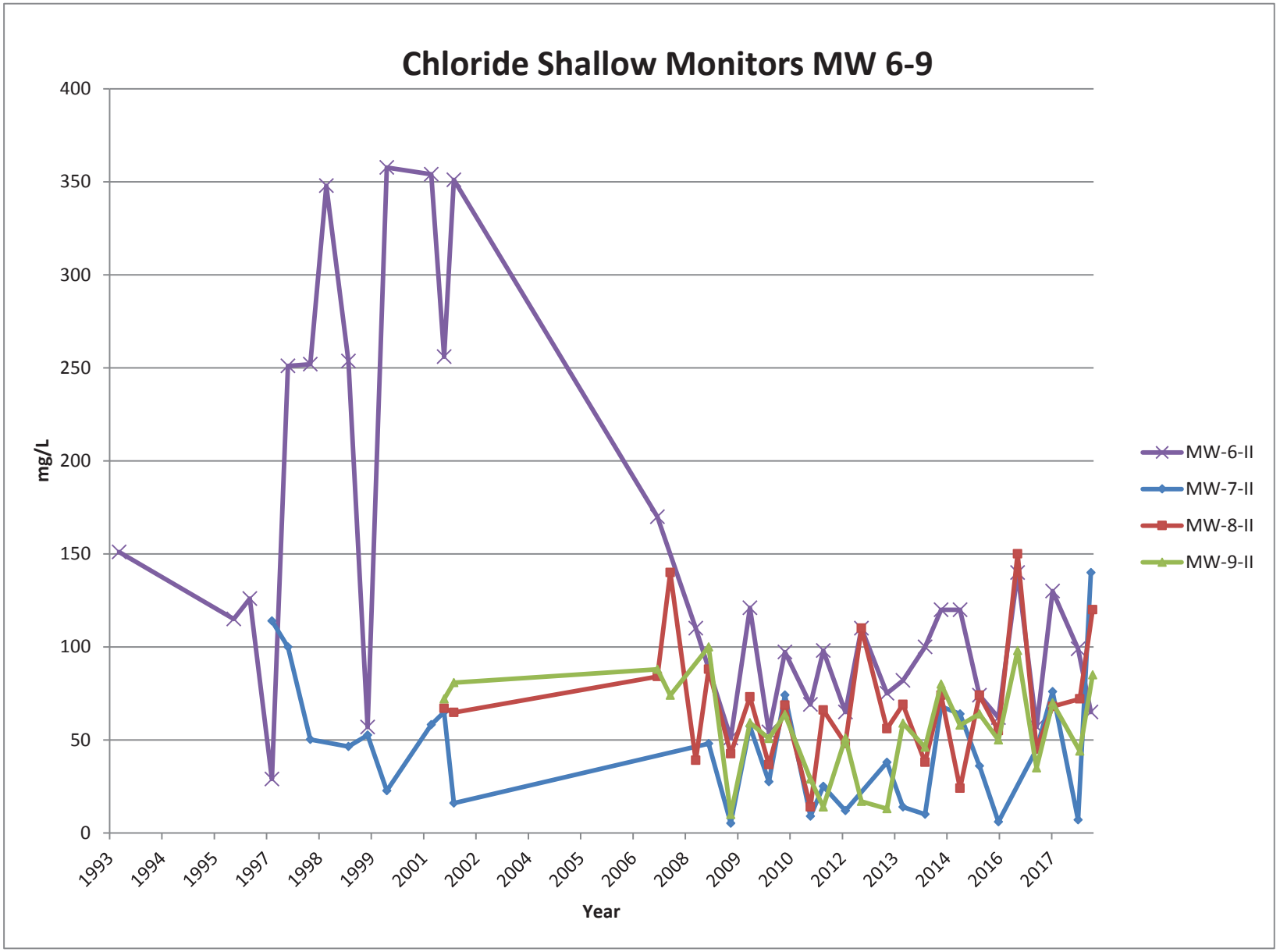
Chloride Shallow Monitors MW 6-9
400
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100
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0
mg/L
1993
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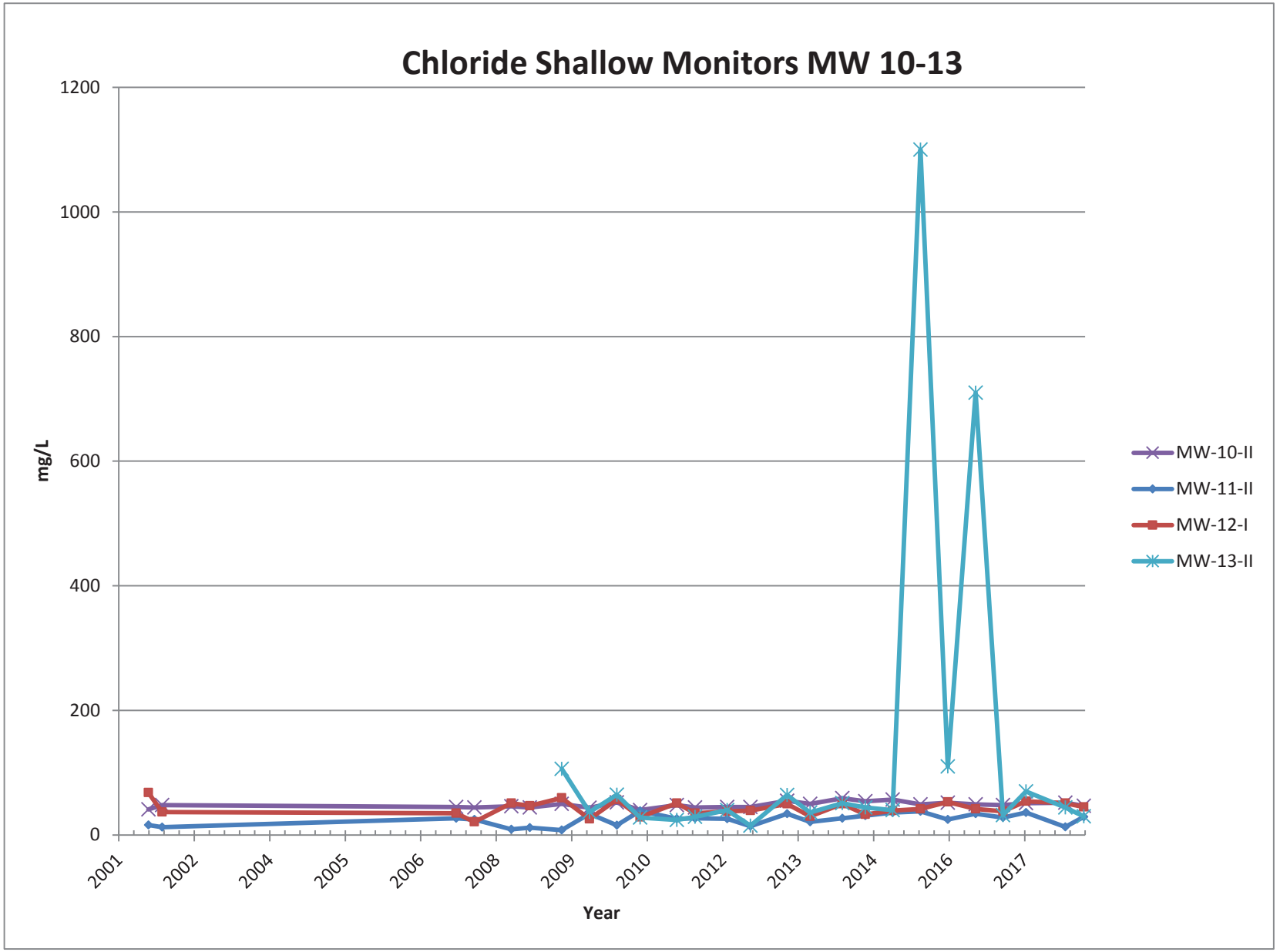
Chloride Shallow Monitors MW 10-13
1200
1000
800
600
400
200
0
mg/L
2001
2002
2004
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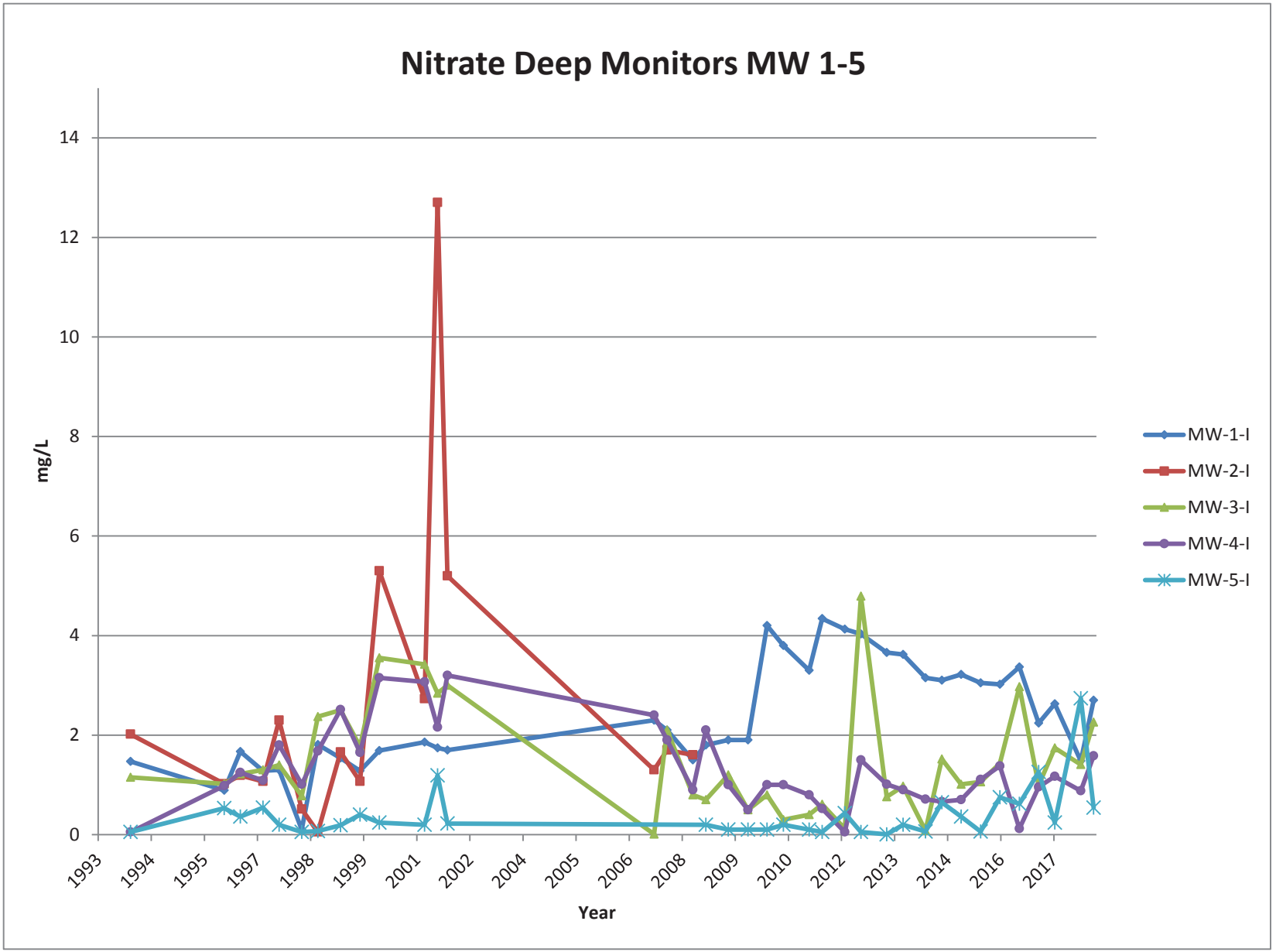
Nitrate Deep Monitors MW 1-5
14
12
10
8
6
4
2
0
mg/L
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1994
1995
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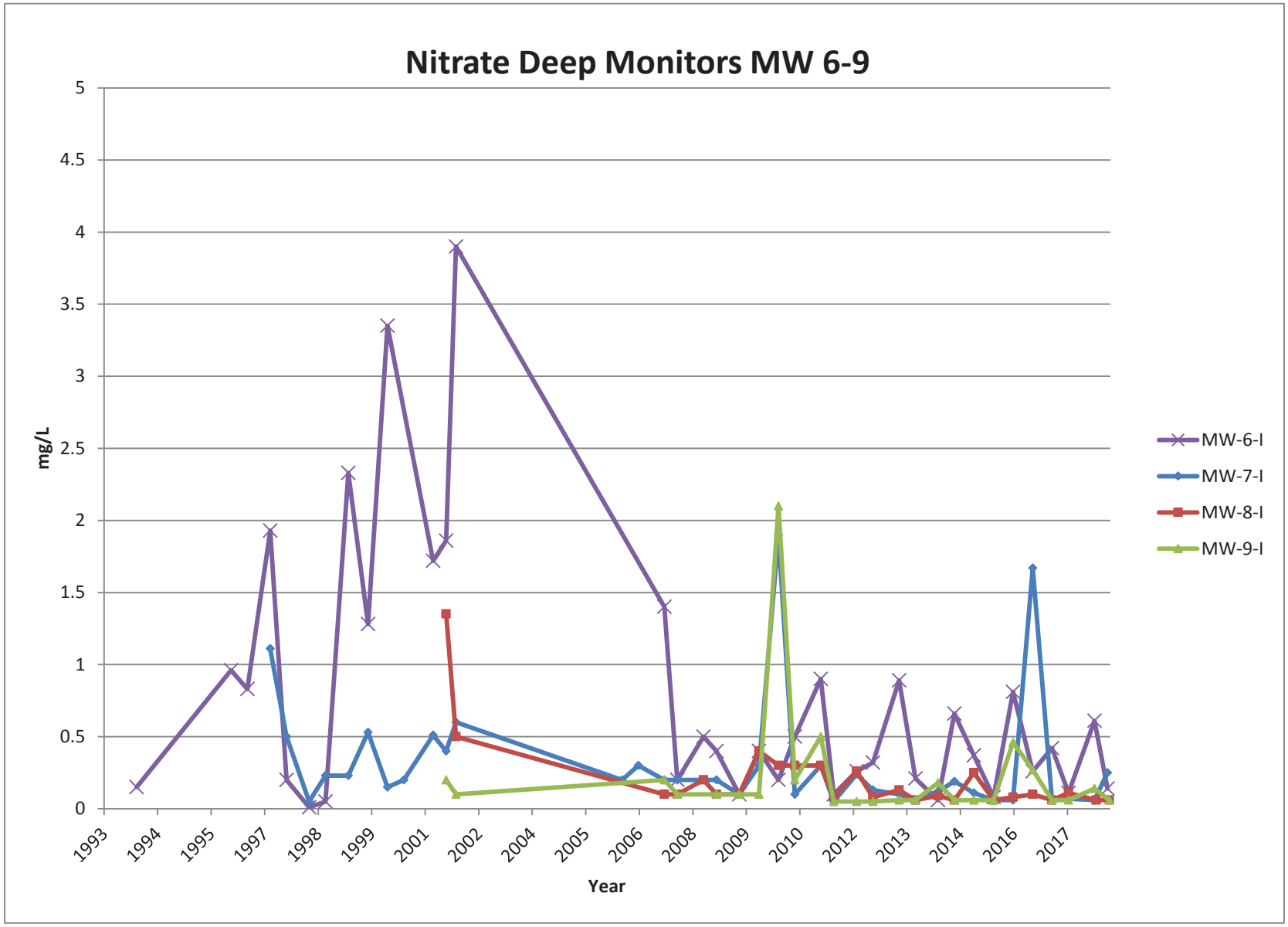
Nitrate Deep Monitors MW 6-9
mg/L
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4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1993
1994
1995
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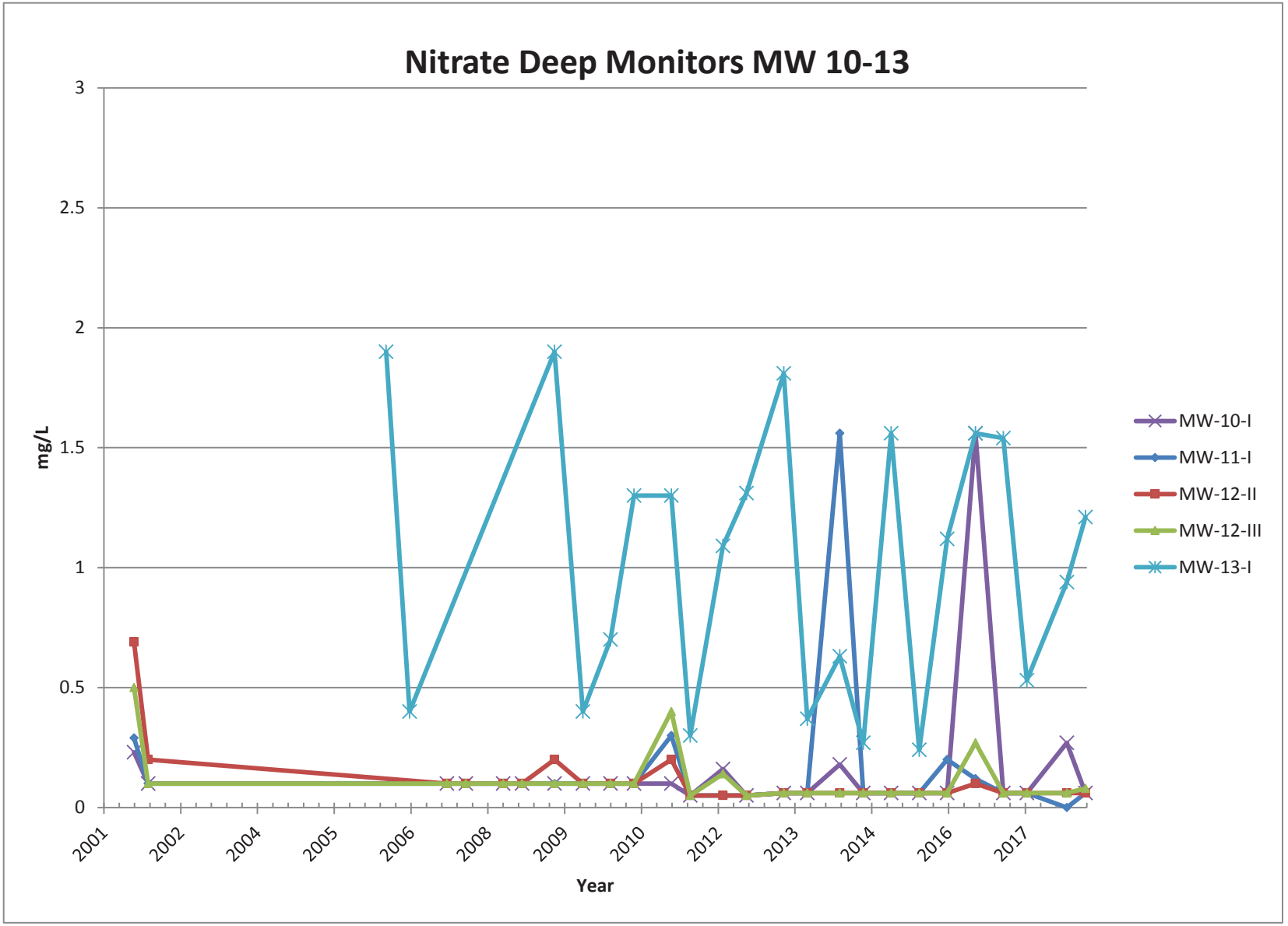
Nitrate Deep Monitors MW 10-13
mg/L
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2.5
2
1.5
1
0.5
0
2001
2002
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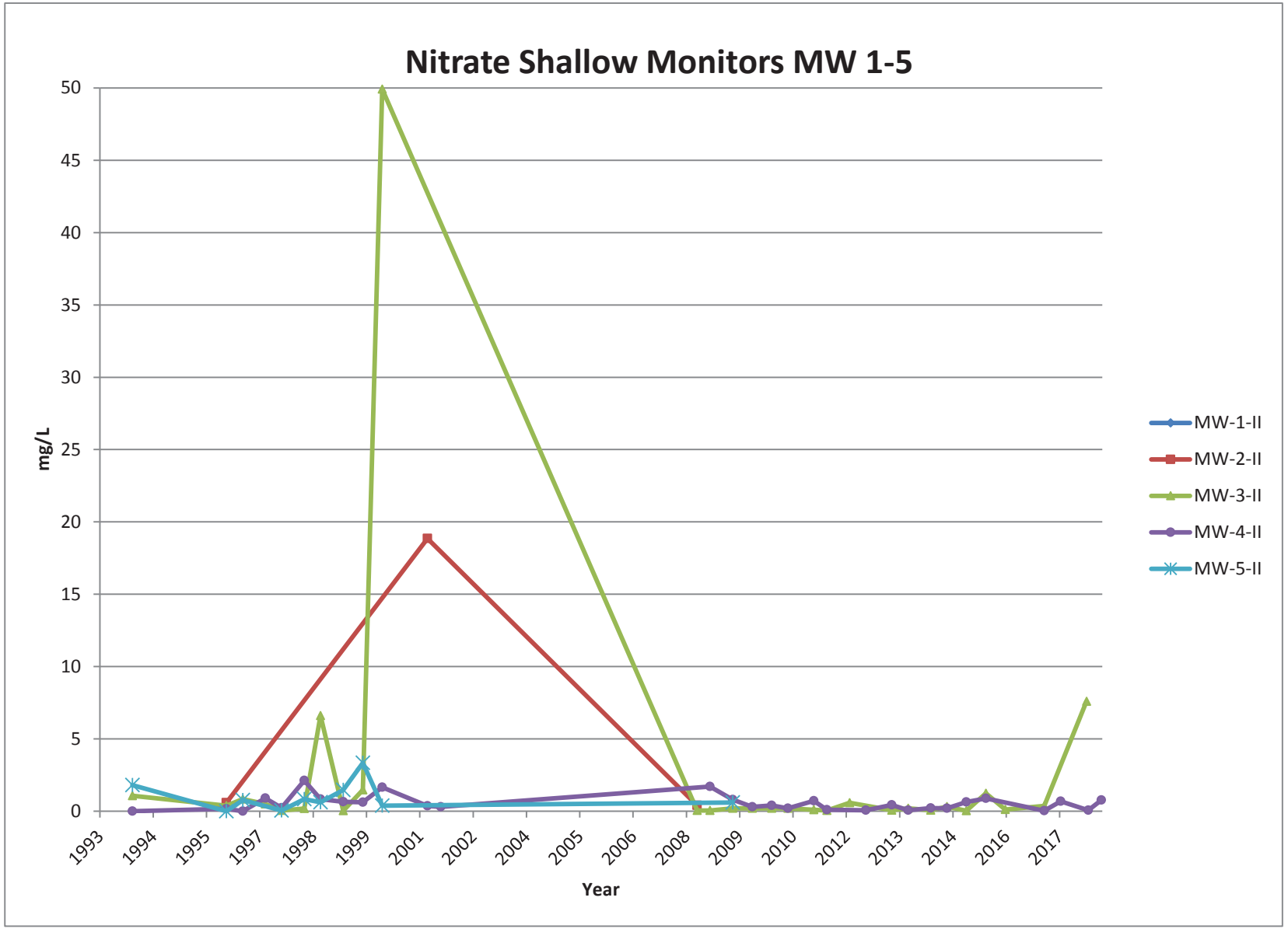
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mg/L
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45
40
35
30
25
20
15
10
5
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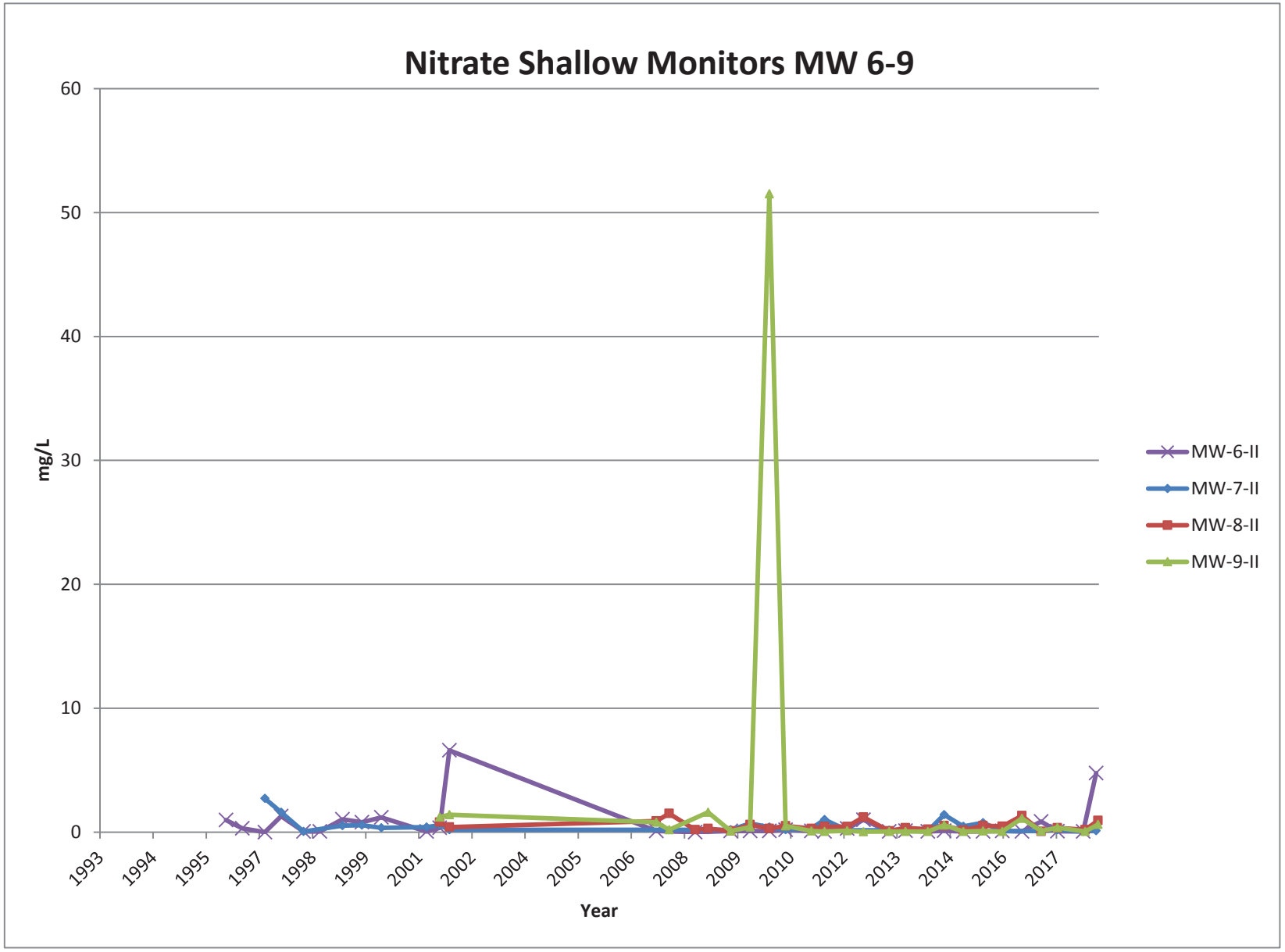
Nitrate Shallow Monitors MW 6-9
60
50
40
30
20
10
0
mg/L
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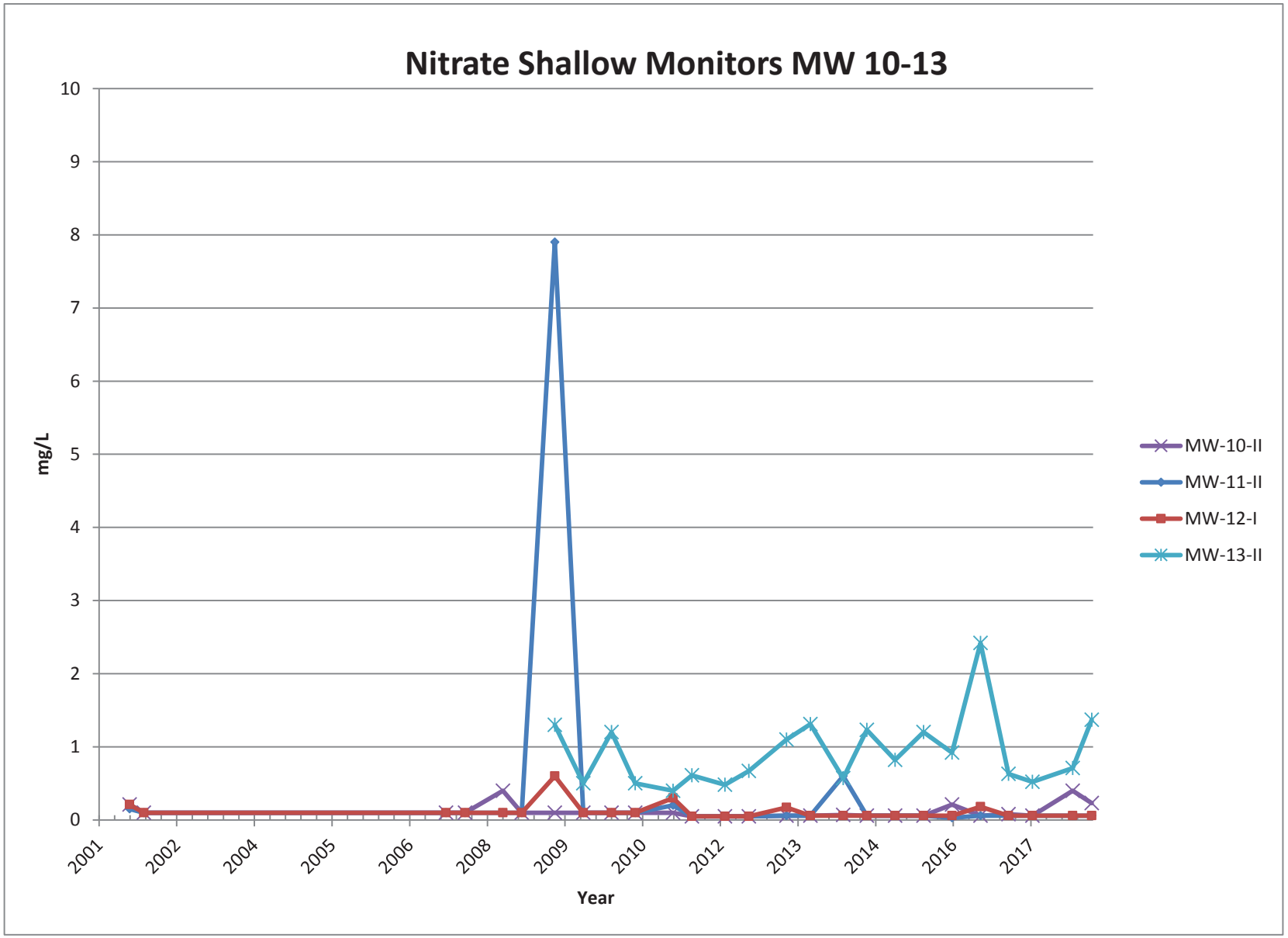
Nitrate Shallow Monitors MW 10-13
mg/L
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9
8
7
6
5
4
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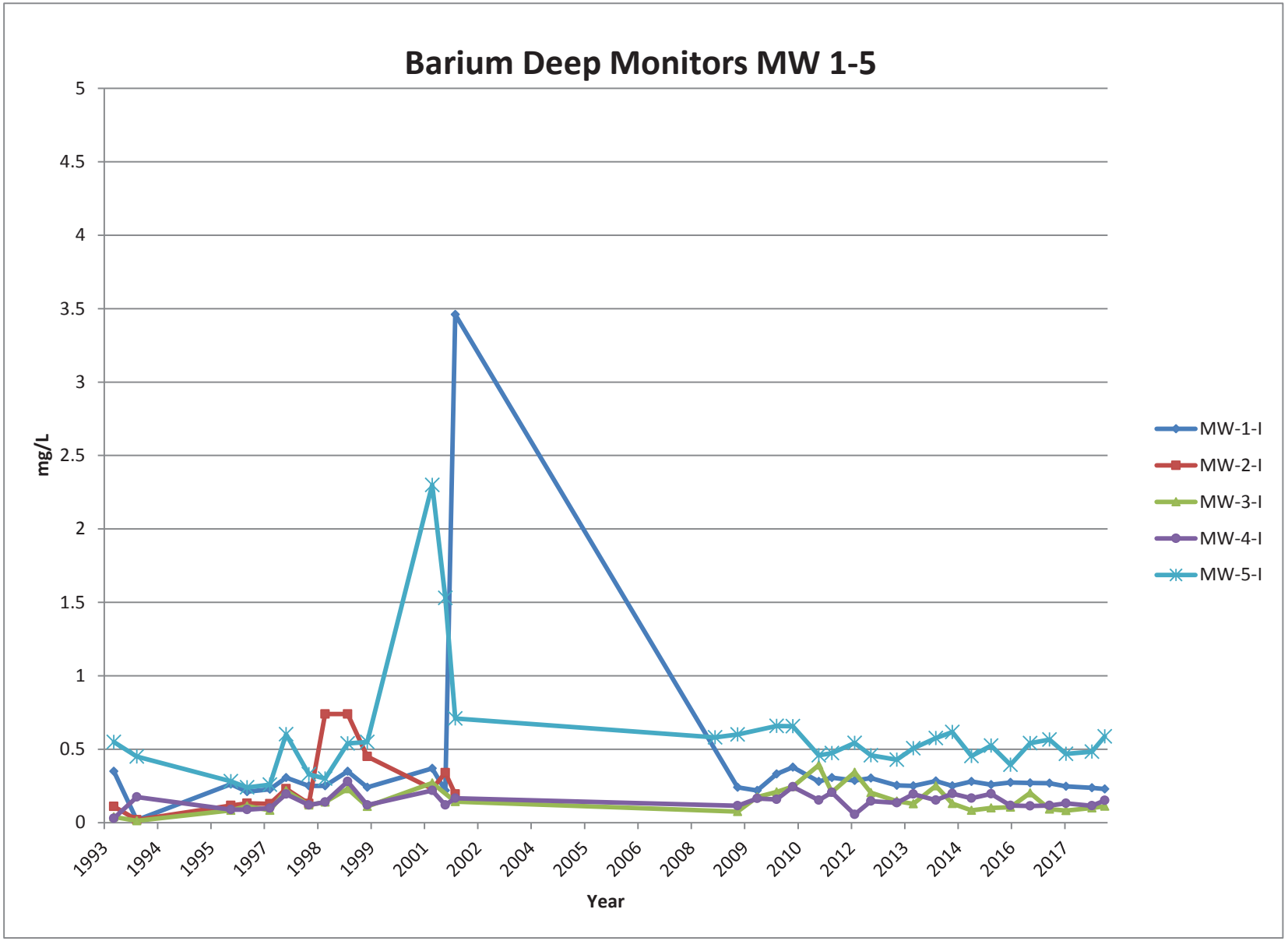
Barium Deep Monitors MW 1-5
mg/L
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4.5
4
3.5
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2.5
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1.5
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0.5
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1994
1995
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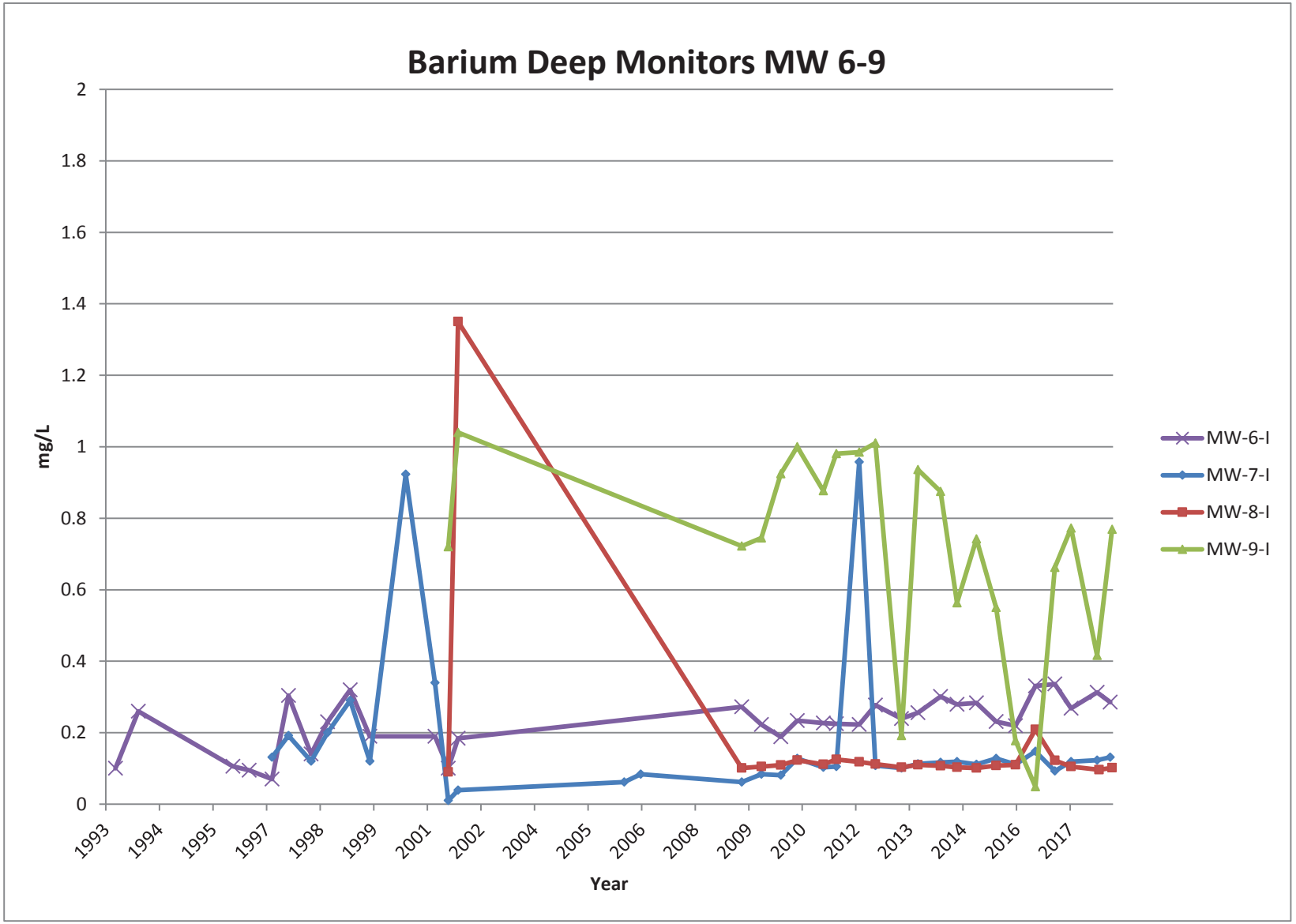
Barium Deep Monitors MW 6-9
mg/L
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1.6
1.4
1.2
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0.8
0.6
0.4
0.2
0
1993
1994
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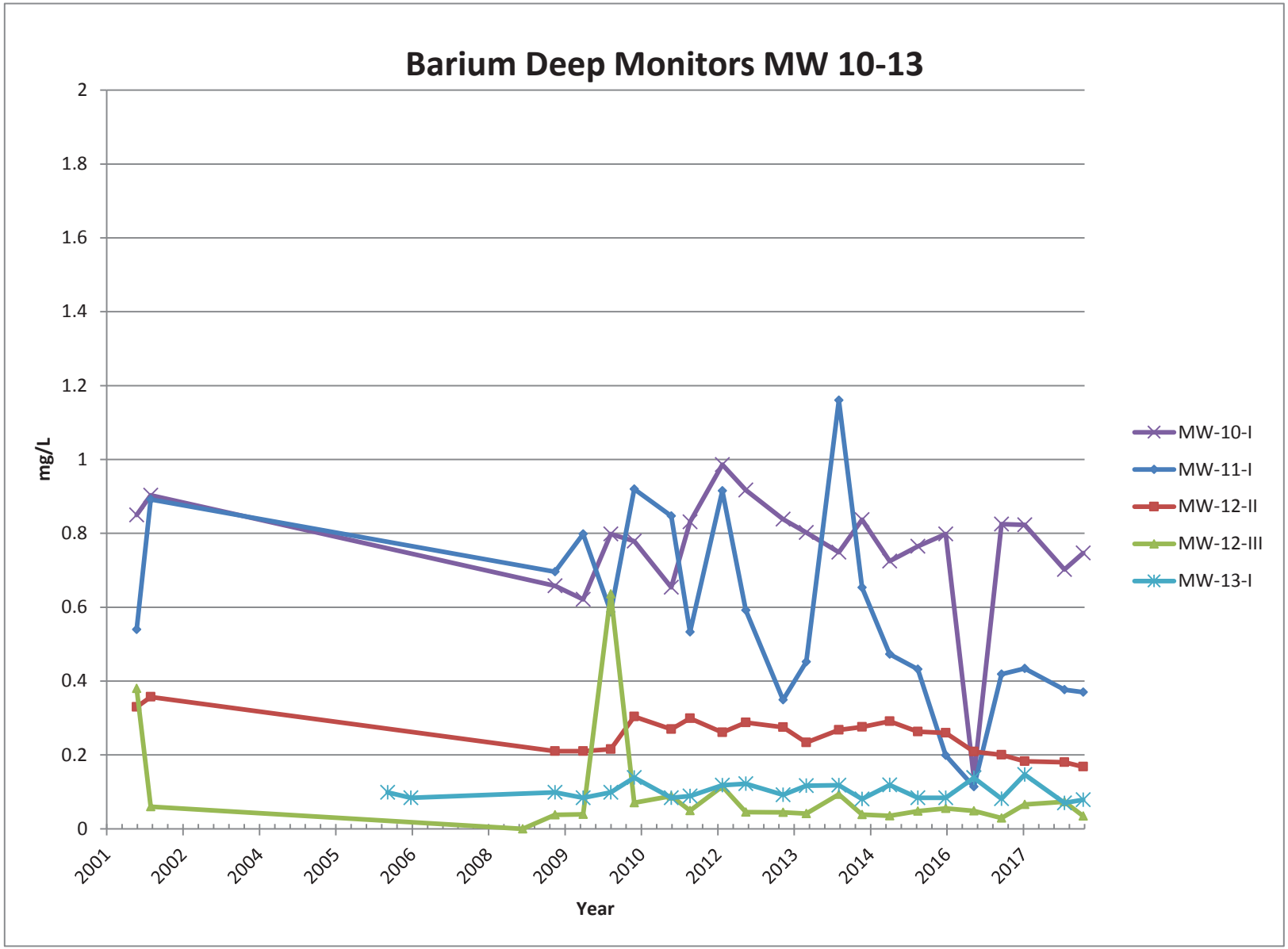
Barium Deep Monitors MW 10-13
mg/L
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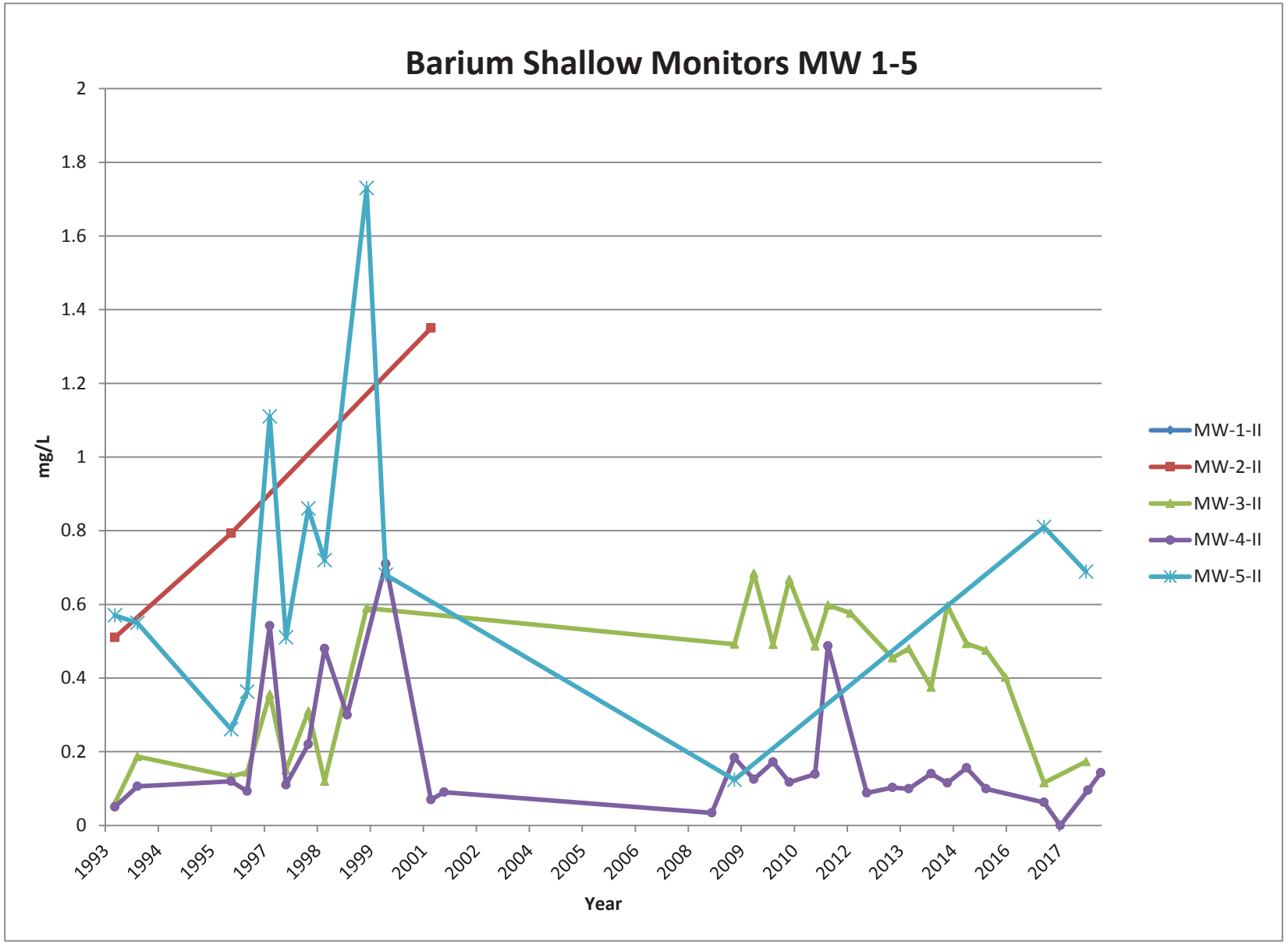
Barium Shallow Monitors MW 1-5
2
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0.8
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0.4
0.2
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mg/L
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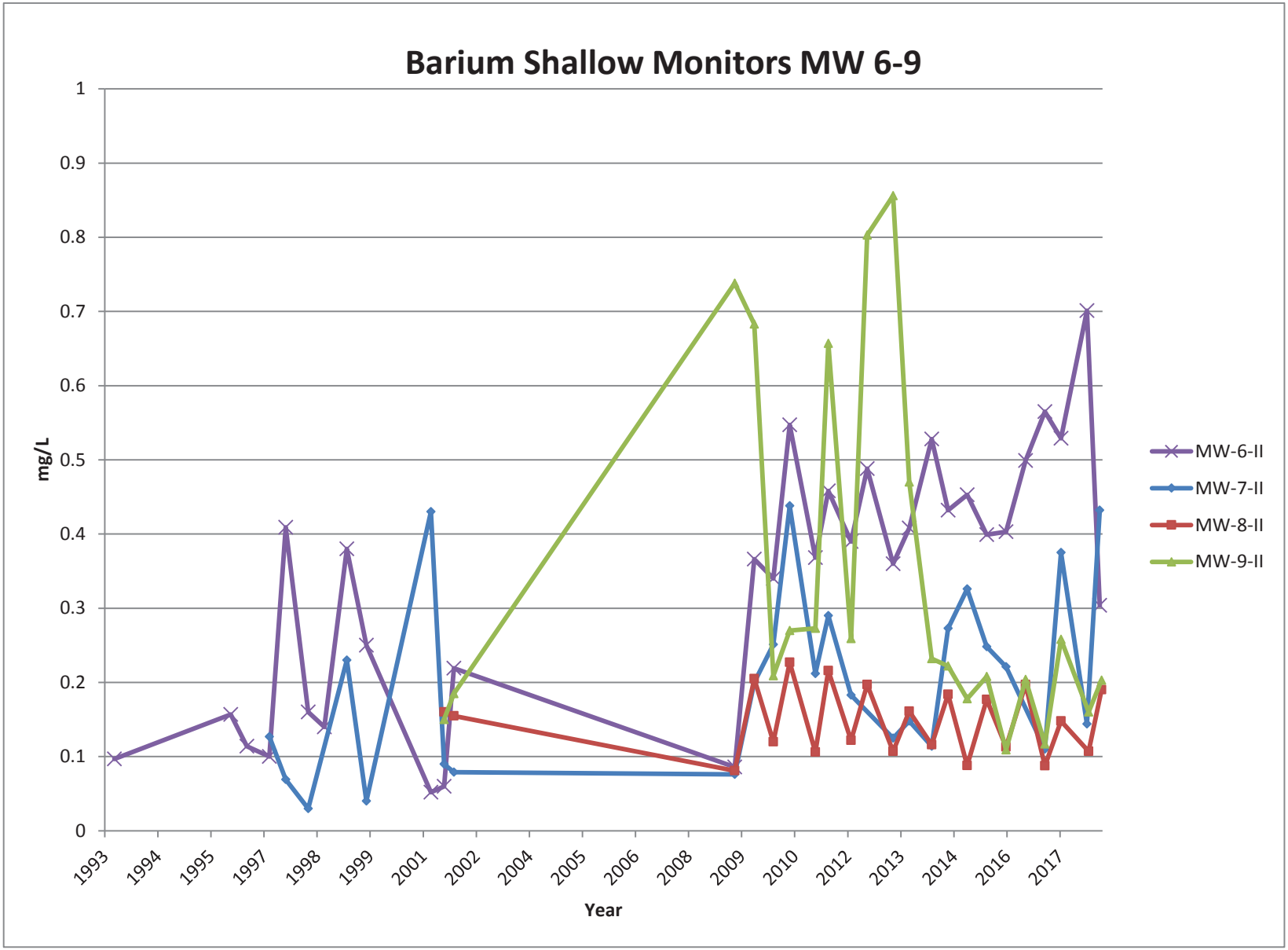
Barium Shallow Monitors MW 6-9
mg/L
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0.6
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0.4
0.3
0.2
0.1
0
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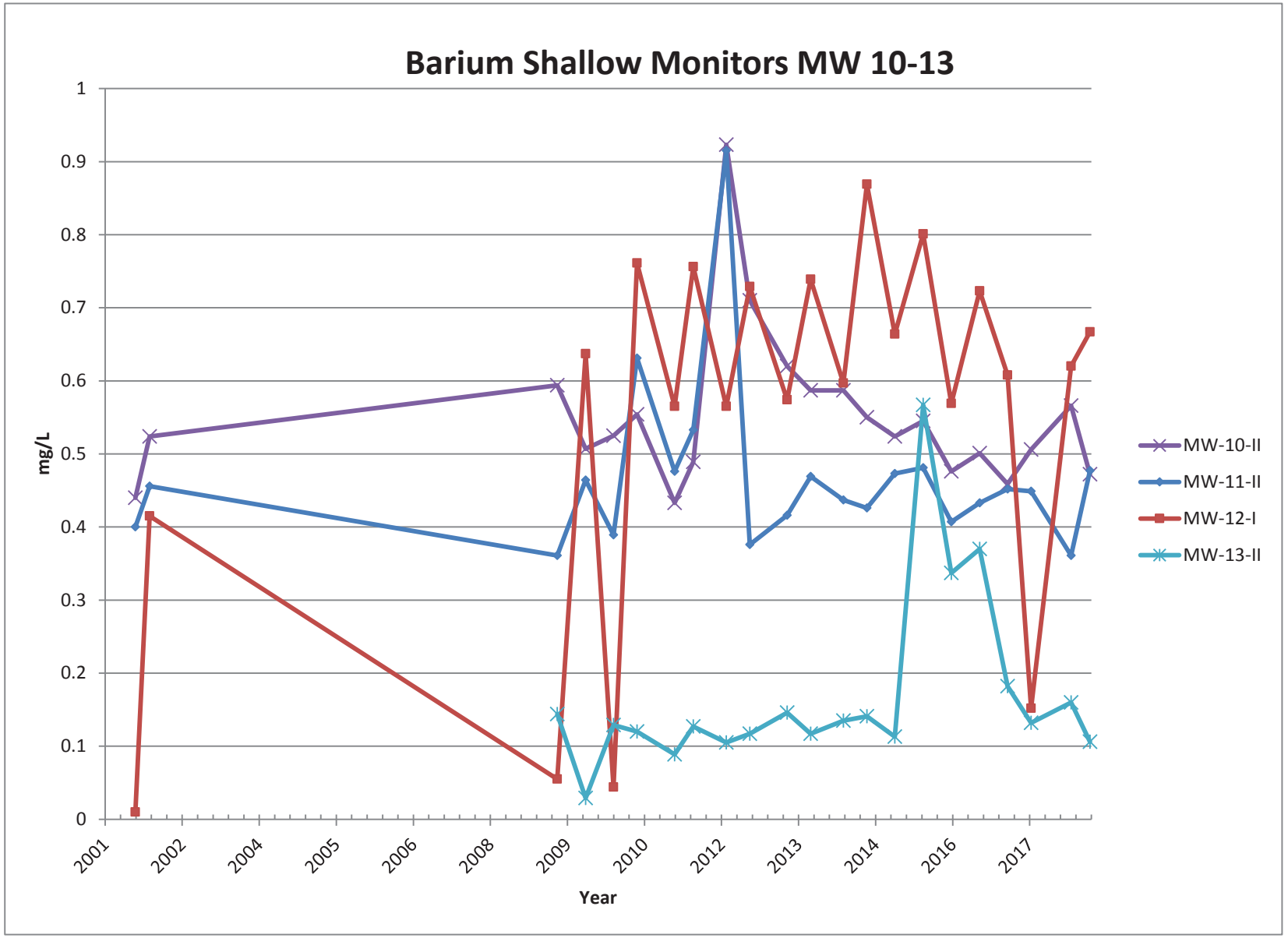
Barium Shallow Monitors MW 10-13
mg/L
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0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
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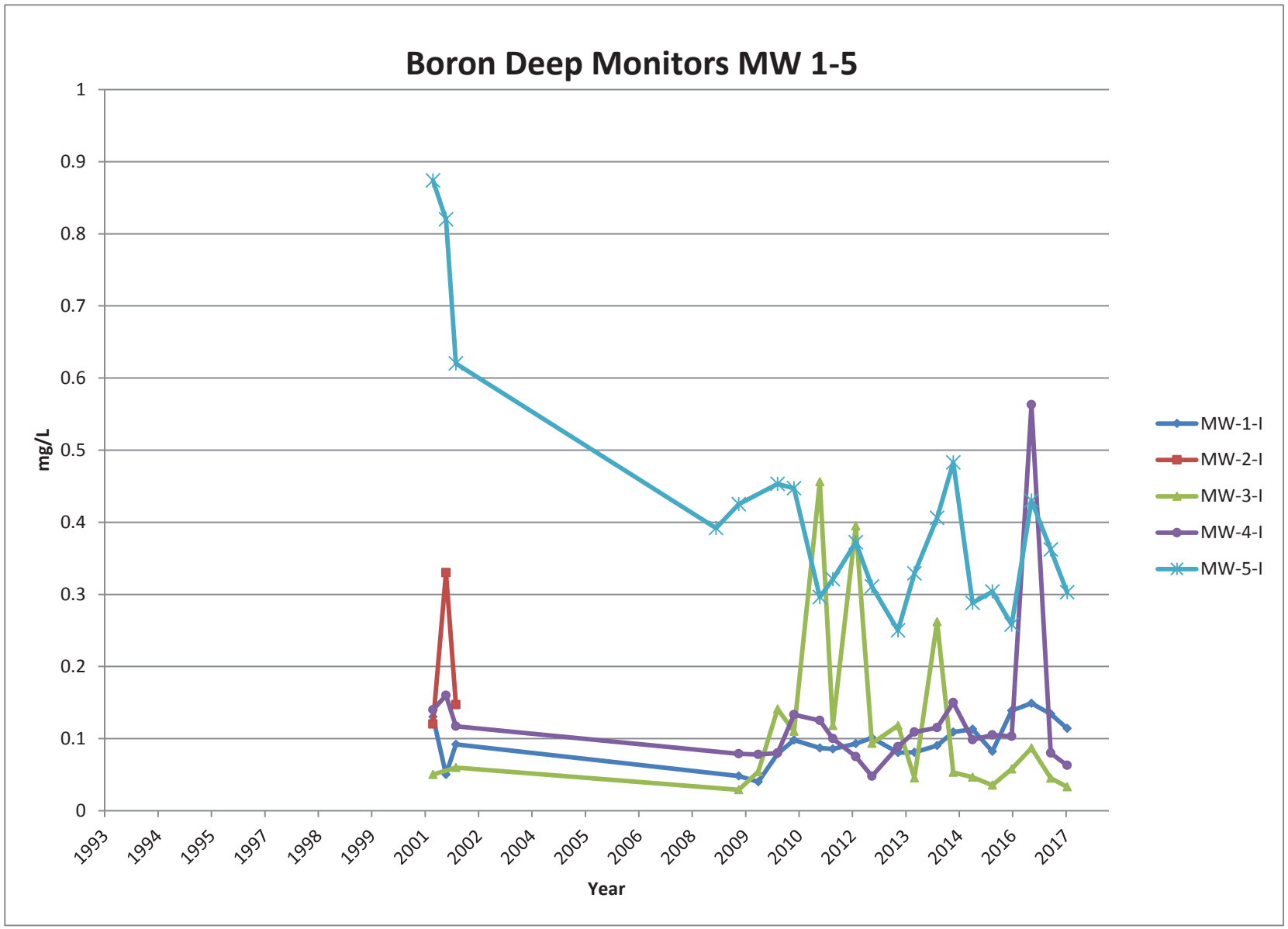
Boron Deep Monitors MW 1-5
mg/L
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0.8
0.7
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0.4
0.3
0.2
0.1
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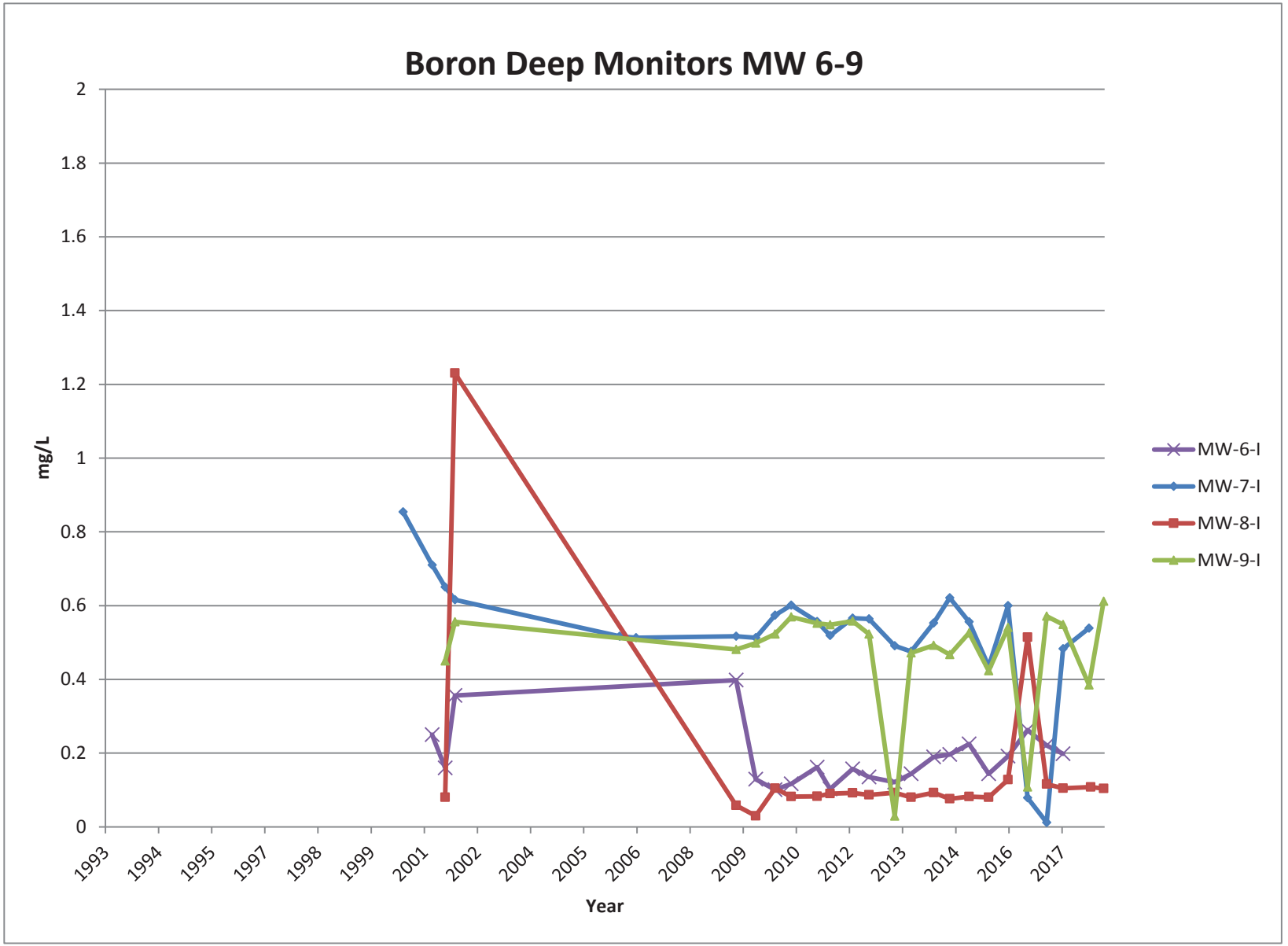
Boron Deep Monitors MW 6-9
mg/L
2
1.8
1.6
1.4
1.2
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0.2
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1993
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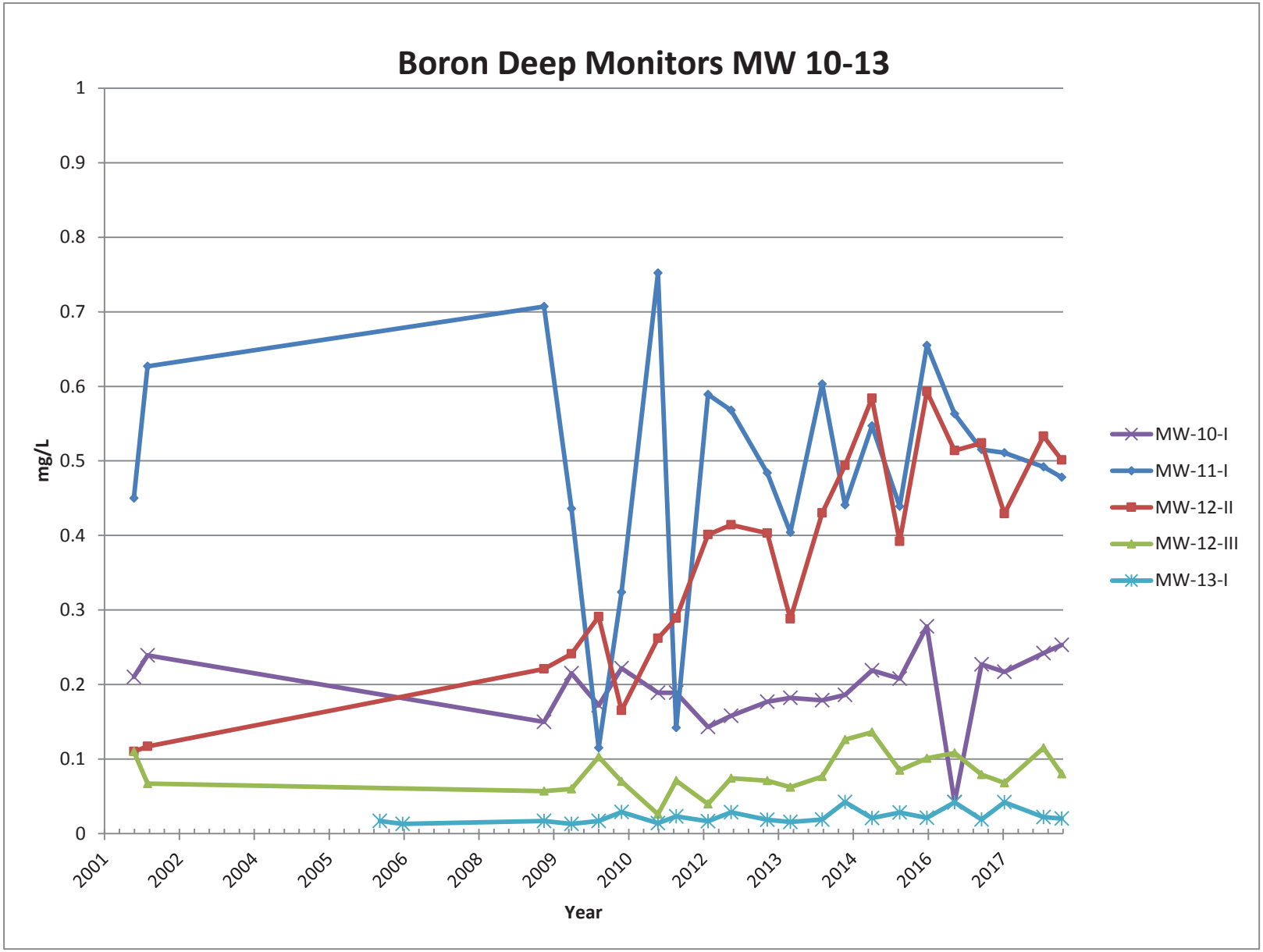
MW-9-I


Boron Deep Monitors MW 10-13
mg/L
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0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
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2001
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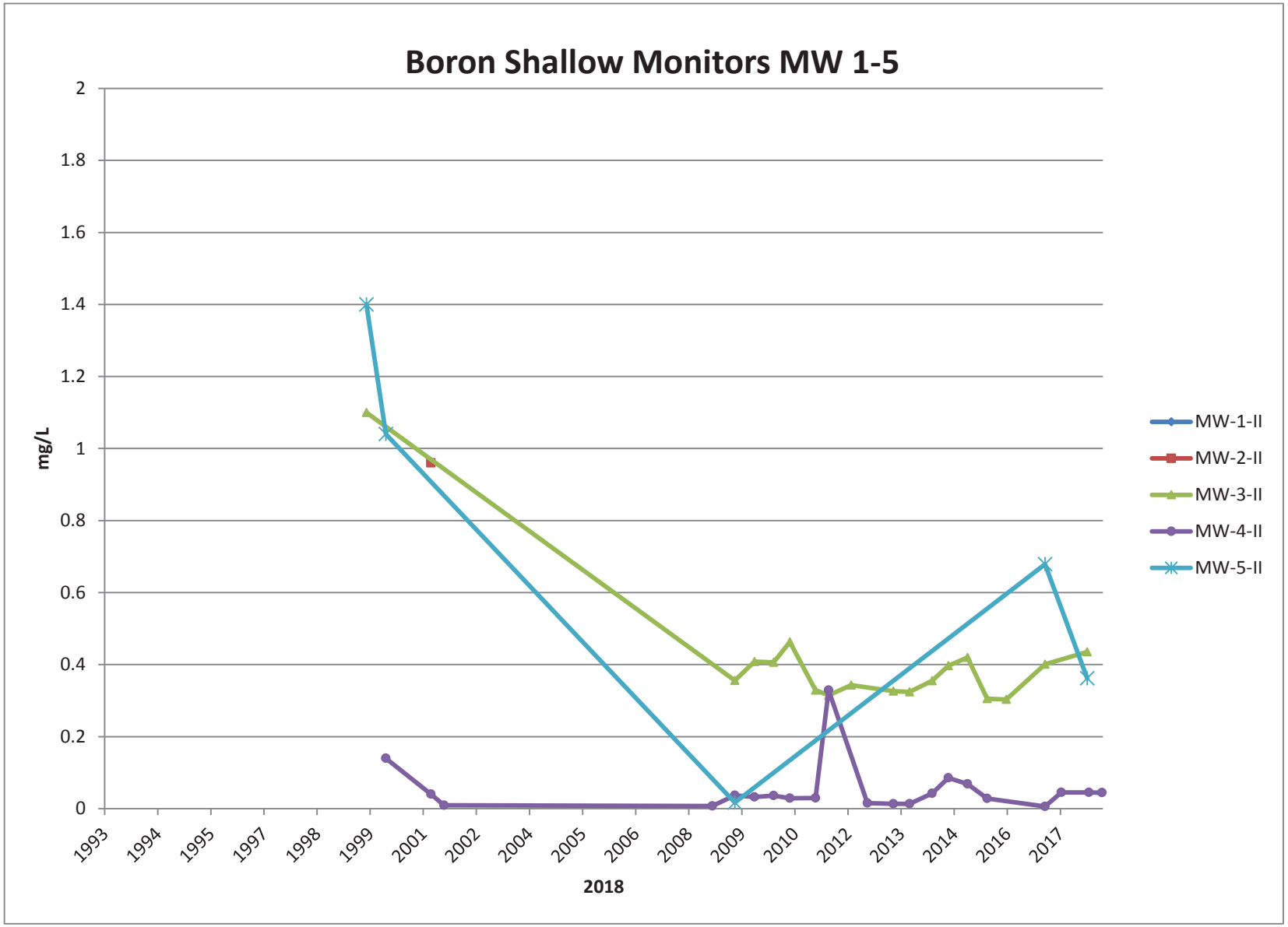
Boron Shallow Monitors MW 1-5
mg/L
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
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0
1993
1994
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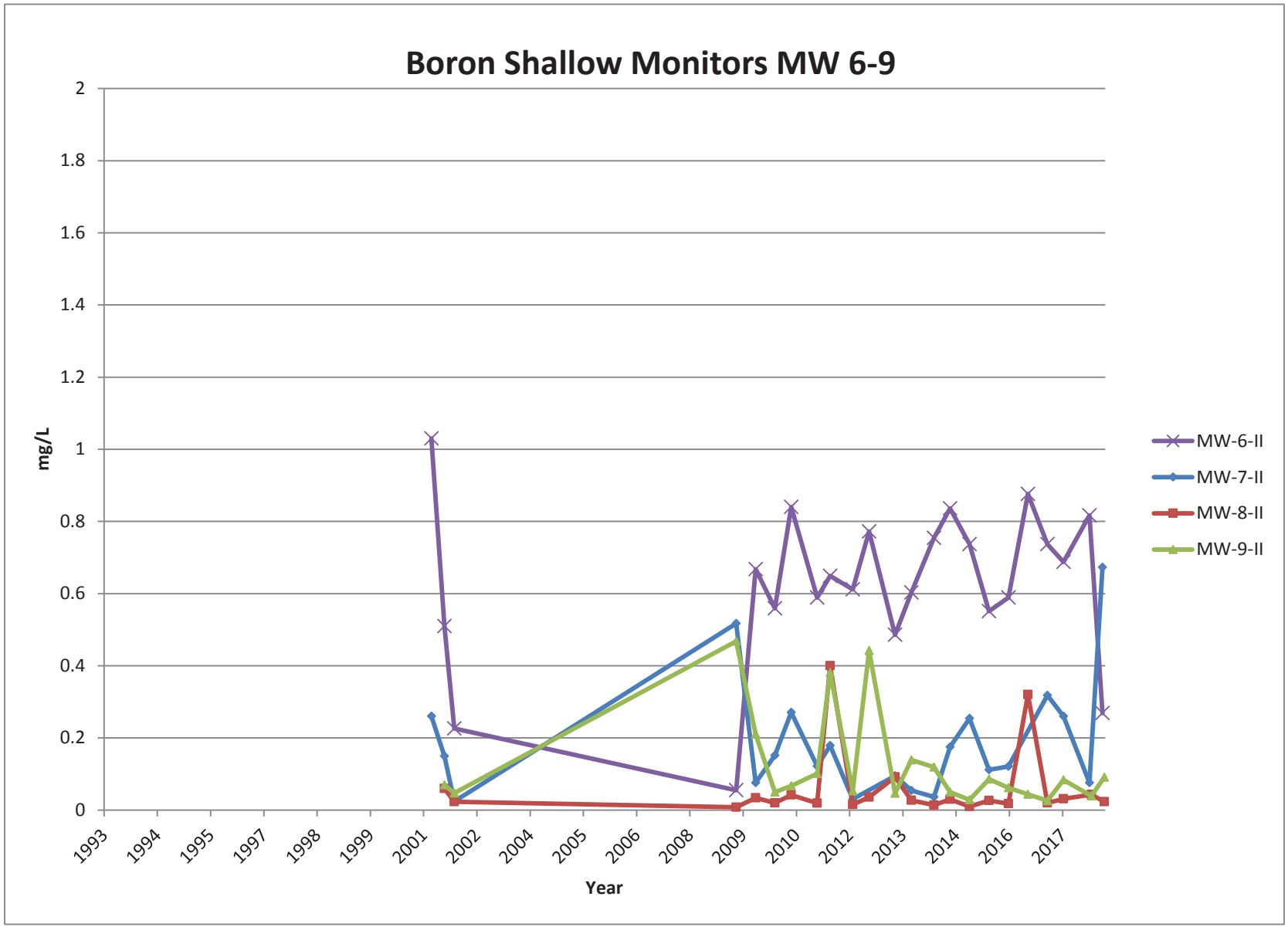
Boron Shallow Monitors MW 6-9
mg/L
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1.6
1.4
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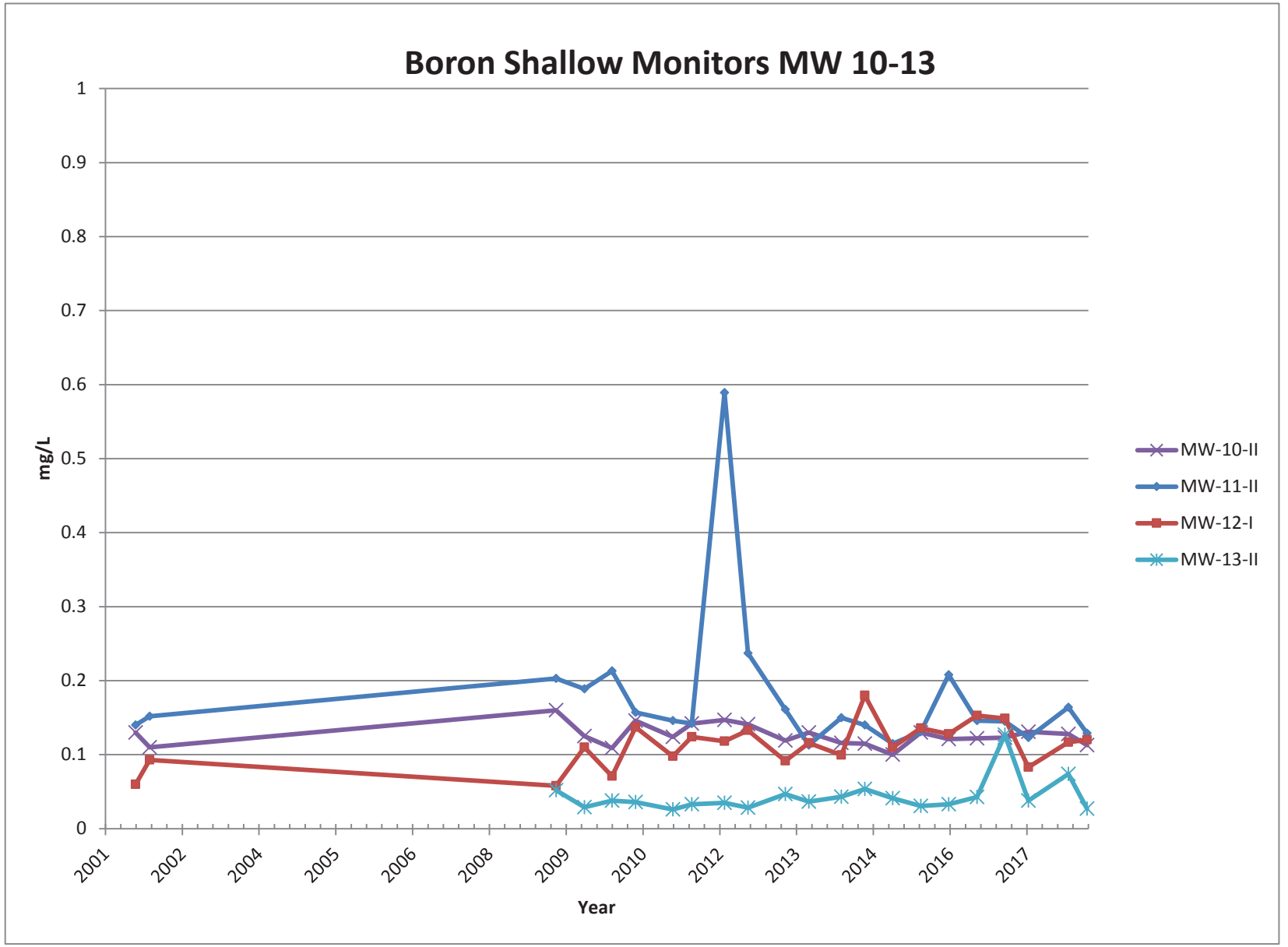
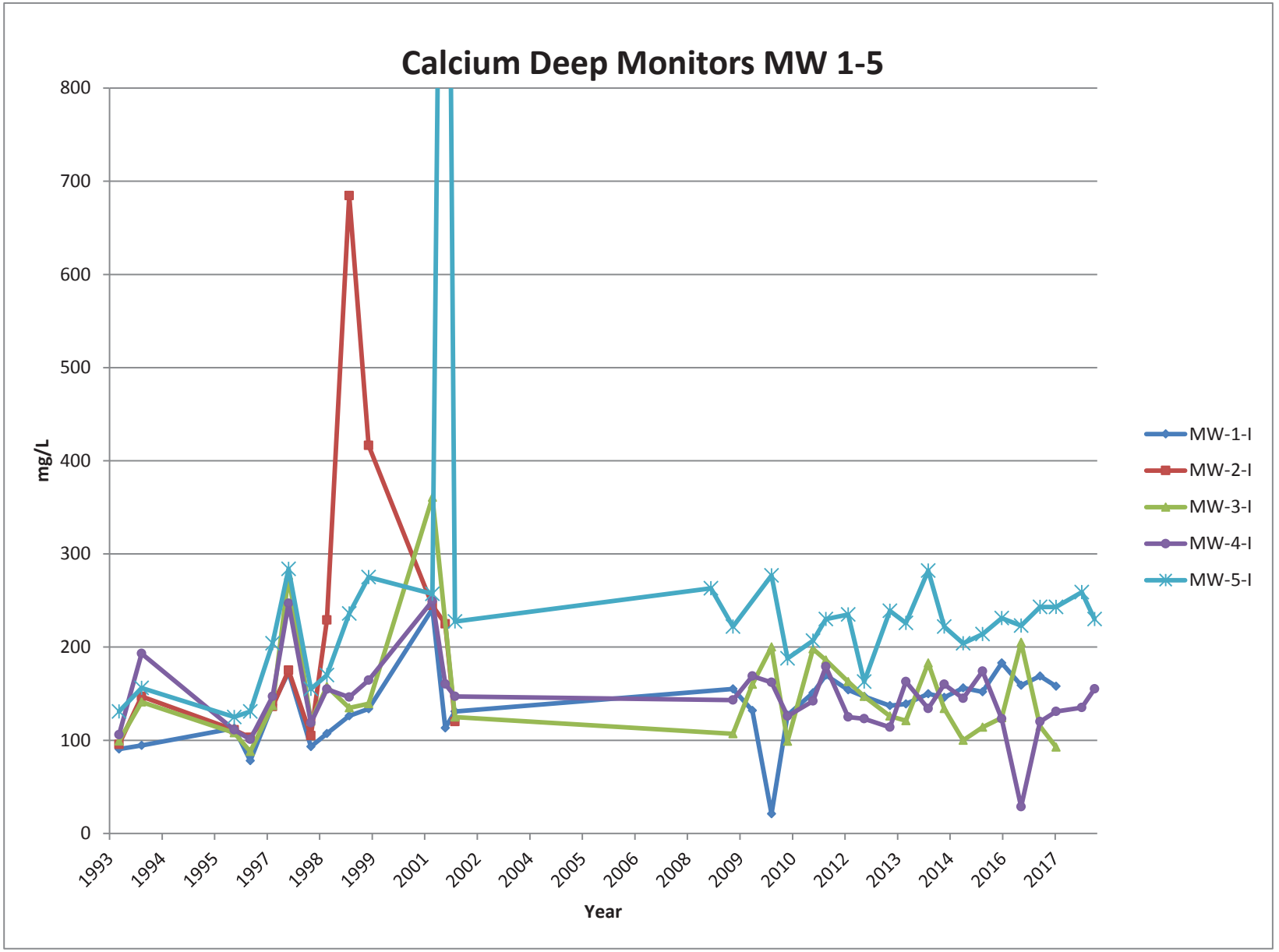
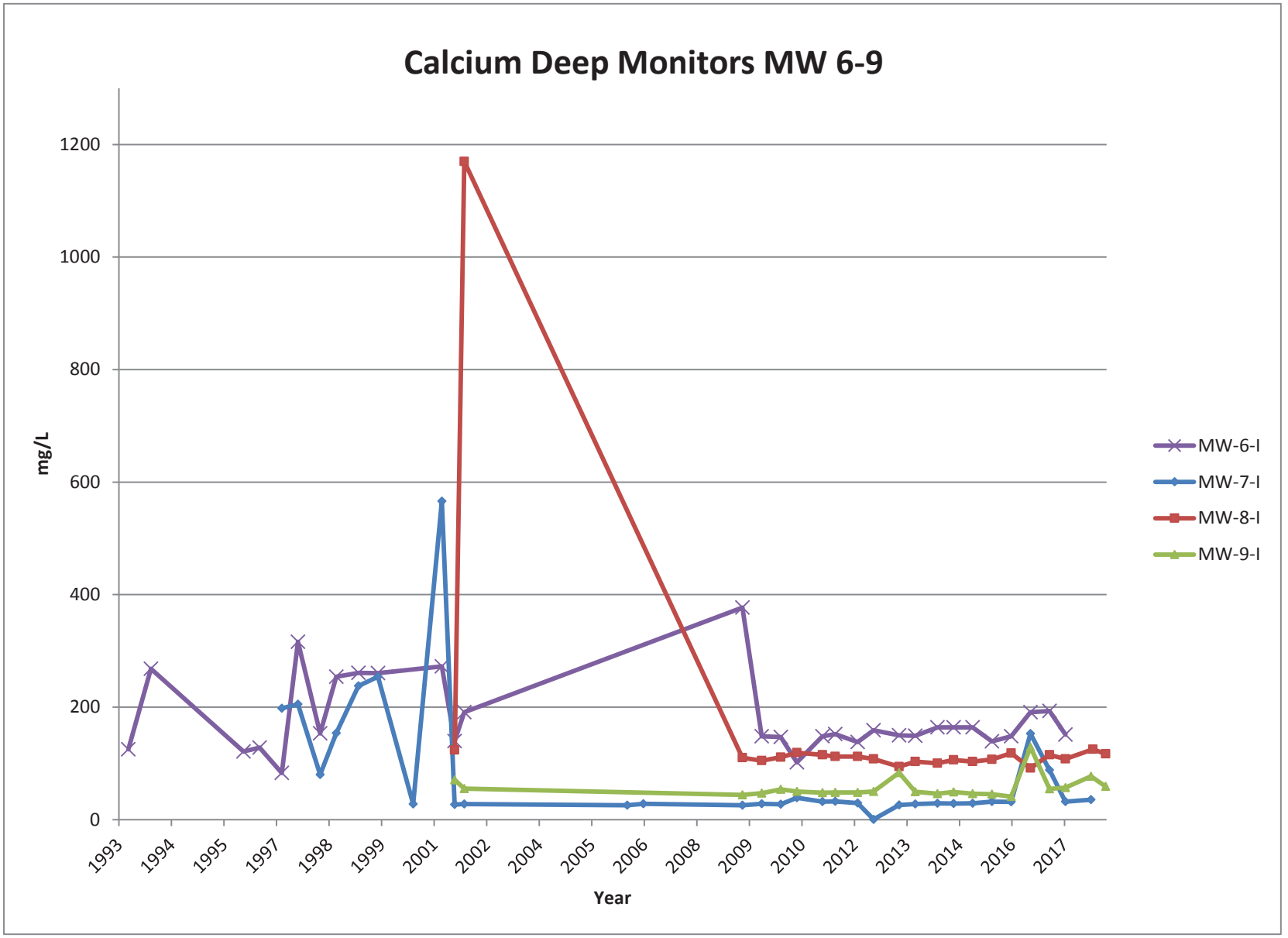
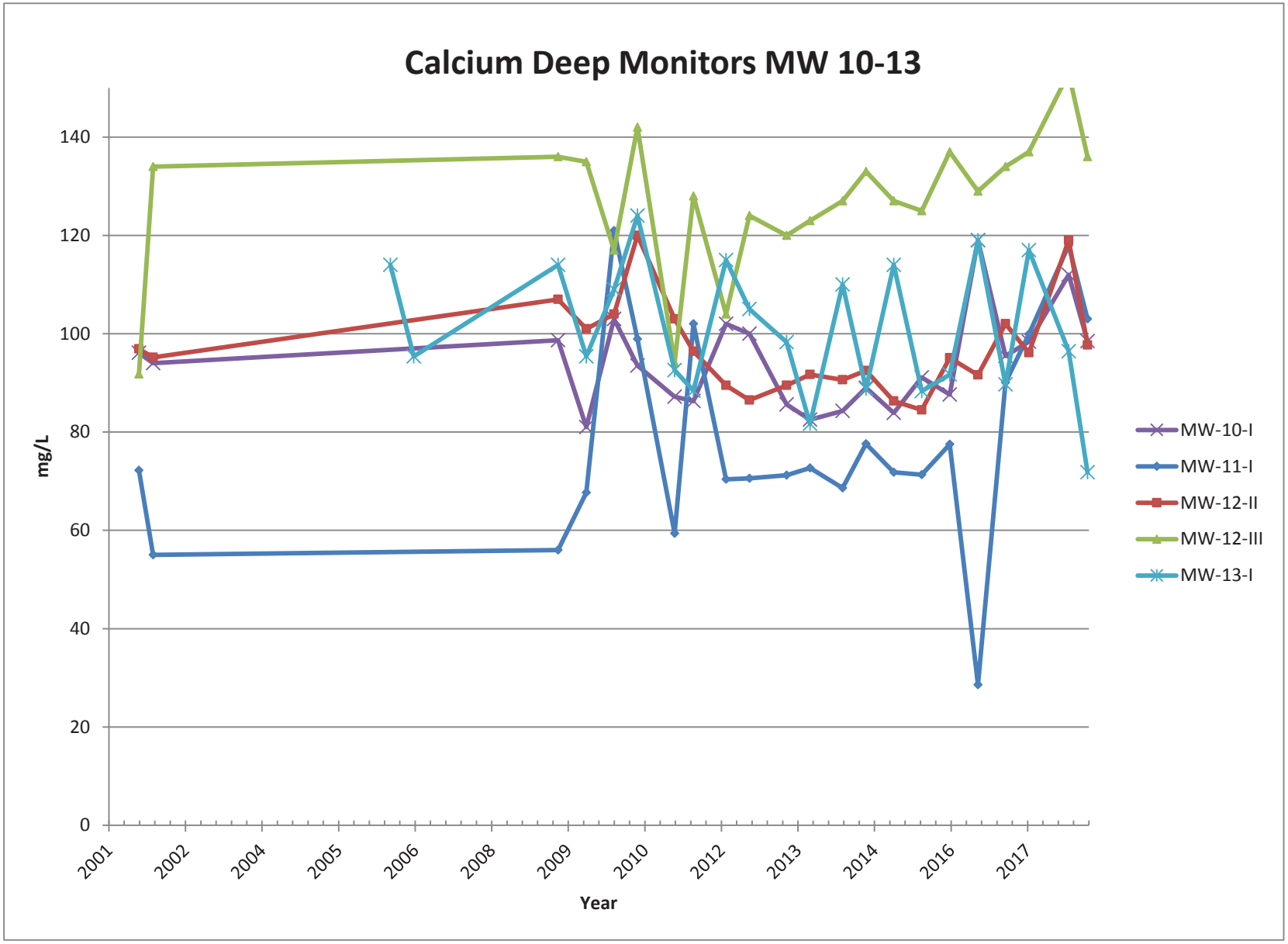
MW-9-II


Boron Shallow Monitors MW 10-13
mg/L
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-10-II
MW-11-II
MW-12-I
MW-13-II


Calcium Deep Monitors MW 1-5
800
700
600
500
400
300
200
100
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-1-I
MW-2-I
MW-3-I
MW-4-I
MW-5-I


Calcium Deep Monitors MW 6-9
mg/L
1200
1000
800
600
400
200
0
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-6-I
MW-7-I
MW-8-I
MW-9-I


Calcium Deep Monitors MW 10-13
mg/L
140
120
100
80
60
40
20
0
2001
2002
2004
2005
2006
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2010
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2014
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2017
Year
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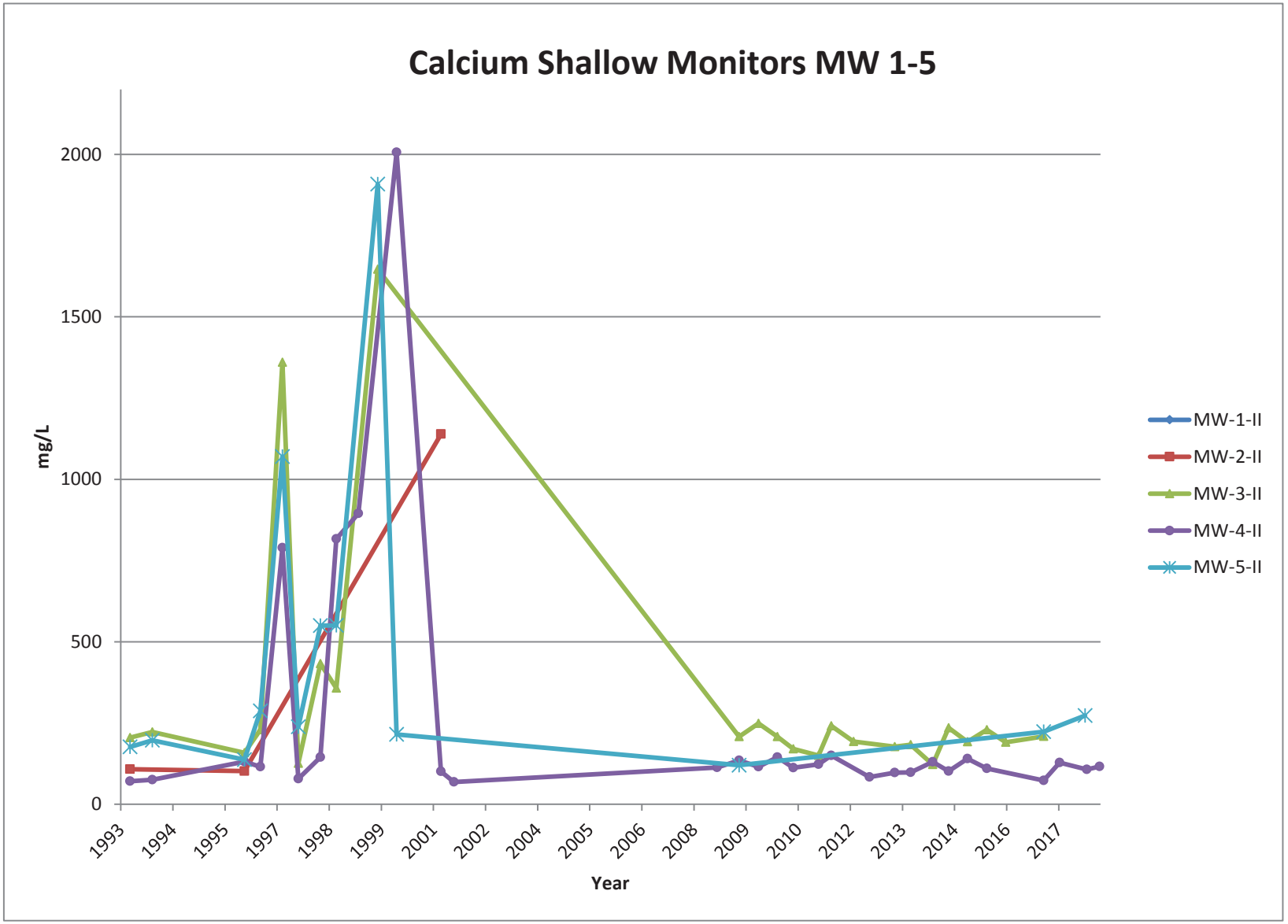
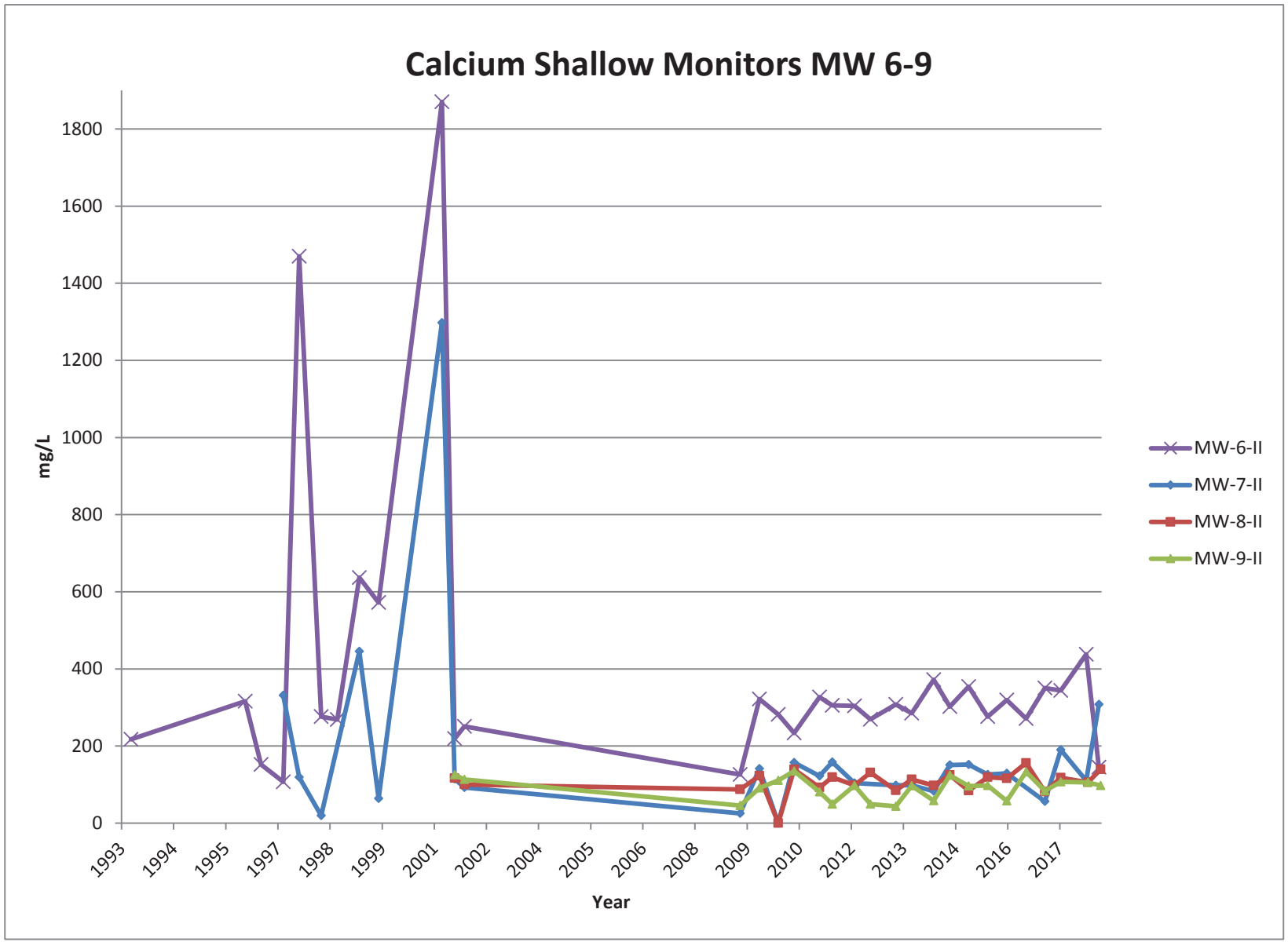
MW-11-I
MW-12-II
MW-12-III
MW-13-I


Calcium Shallow Monitors MW 1-5
2000
1500
1000
500
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-1-II
MW-2-II
MW-3-II
MW-4-II
MW-5-II


Calcium Shallow Monitors MW 6-9
mg/L
1800
1600
1400
1200
1000
800
600
400
200
0
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
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2016
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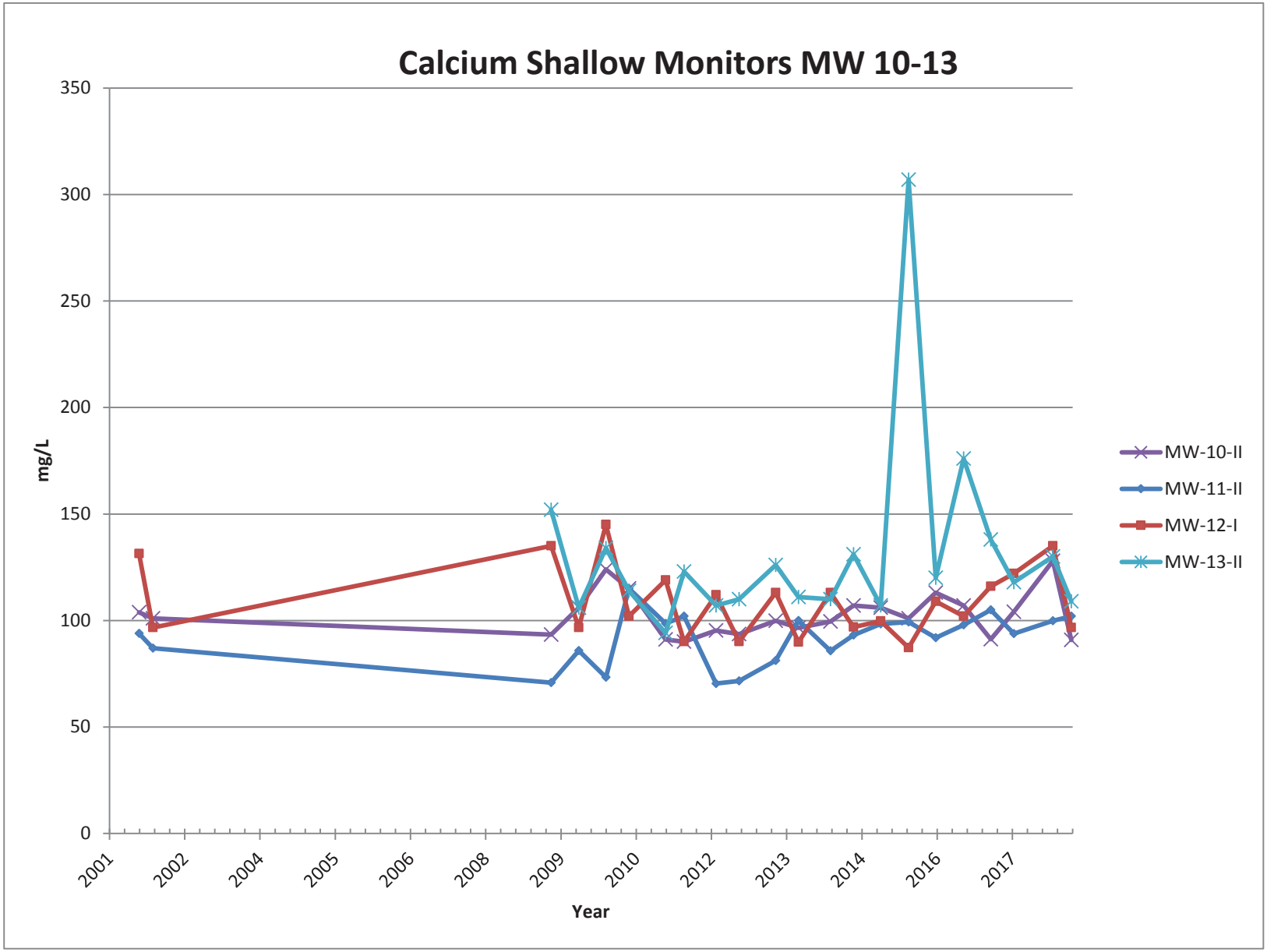
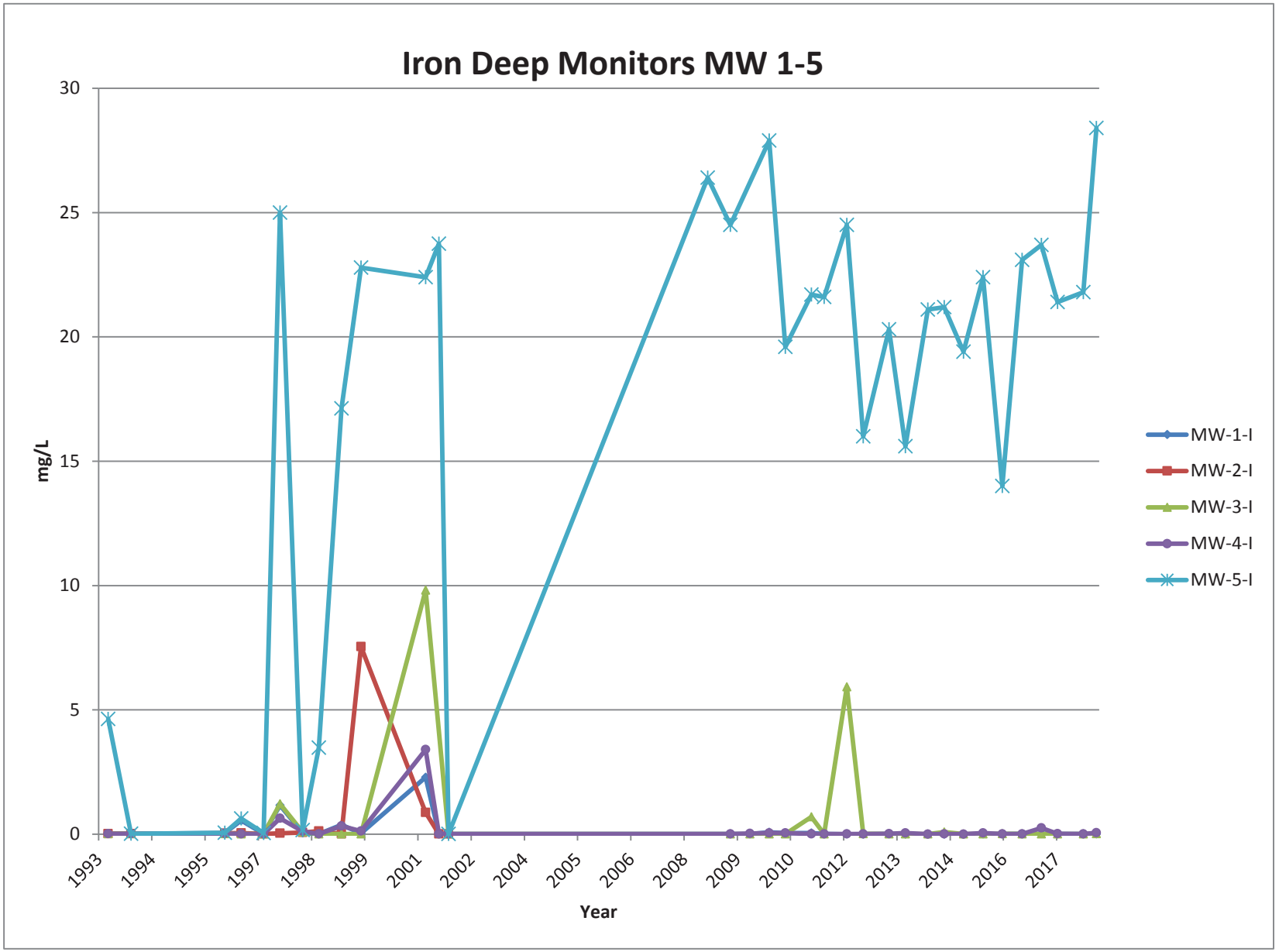
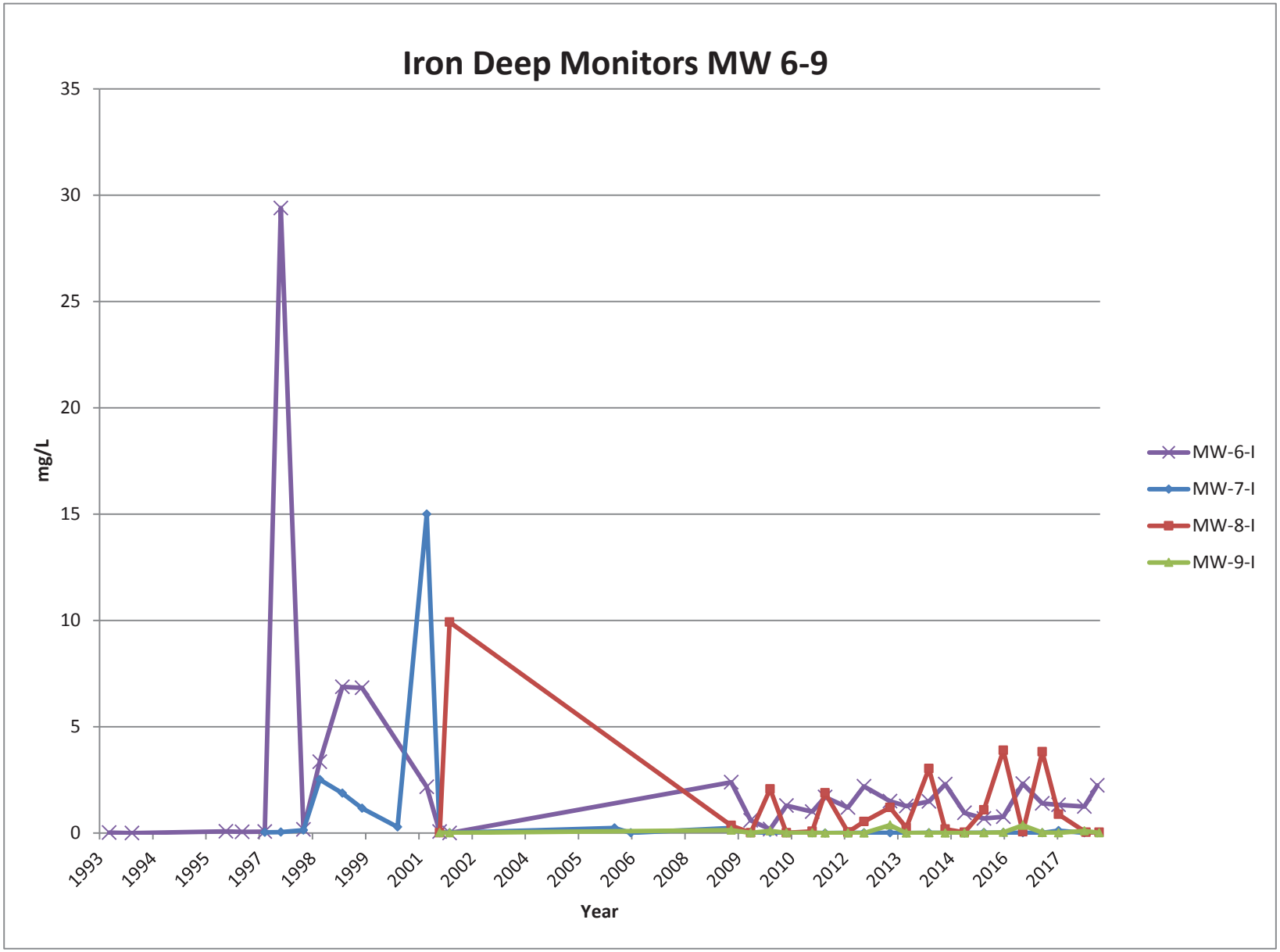
Year
MW-6-II
MW-7-II
MW-8-II
MW-9-II


Calcium Shallow Monitors MW 10-13
350
300
250
200
150
100
50
0
mg/L
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-10-II
MW-11-II
MW-12-I
MW-13-II


Iron Deep Monitors MW 1-5
30
25
20
15
10
5
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-1-I
MW-2-I
MW-3-I
MW-4-I
MW-5-I


Iron Deep Monitors MW 6-9
35
30
25
20
15
10
5
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
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2010
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2013
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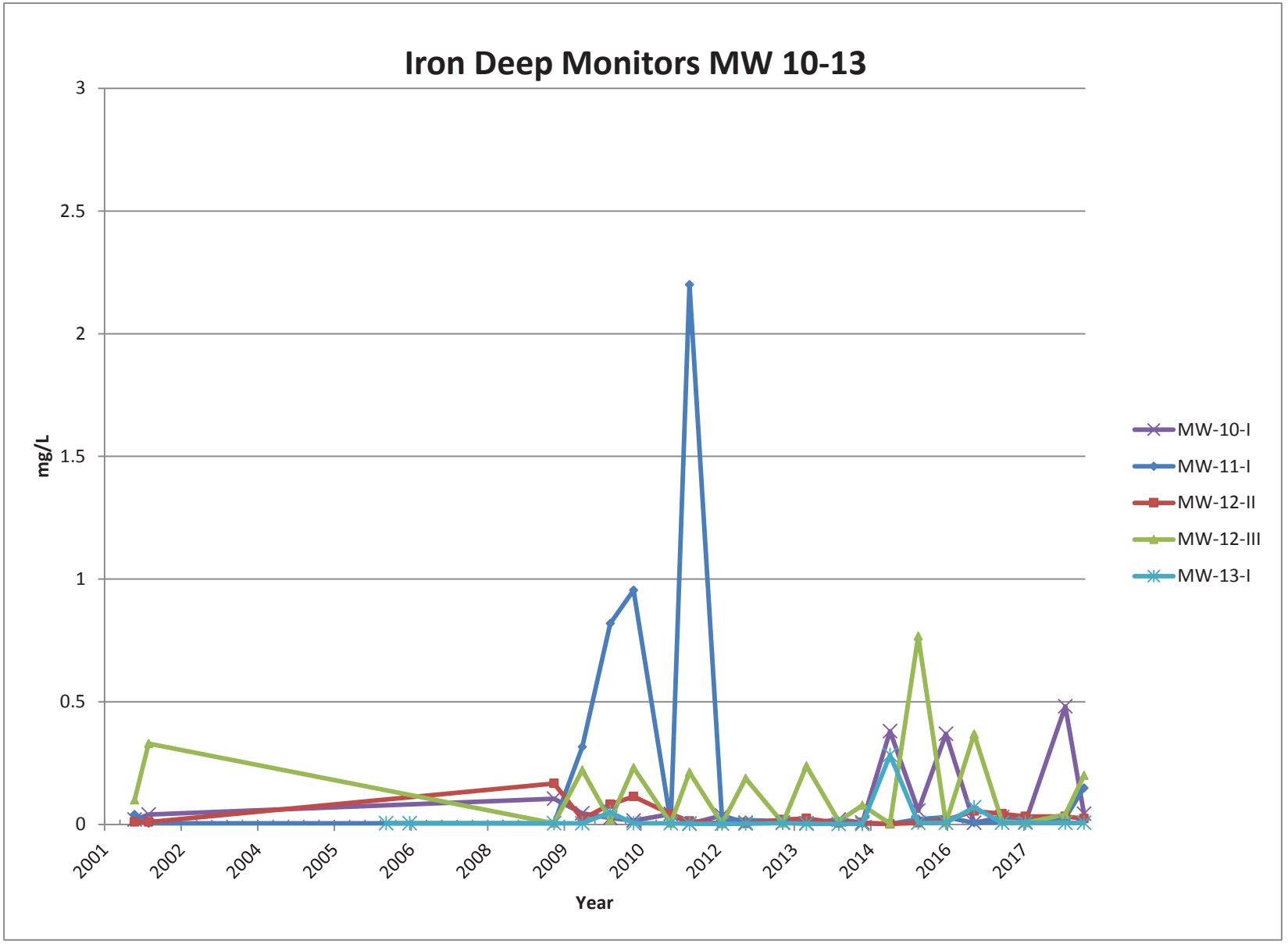
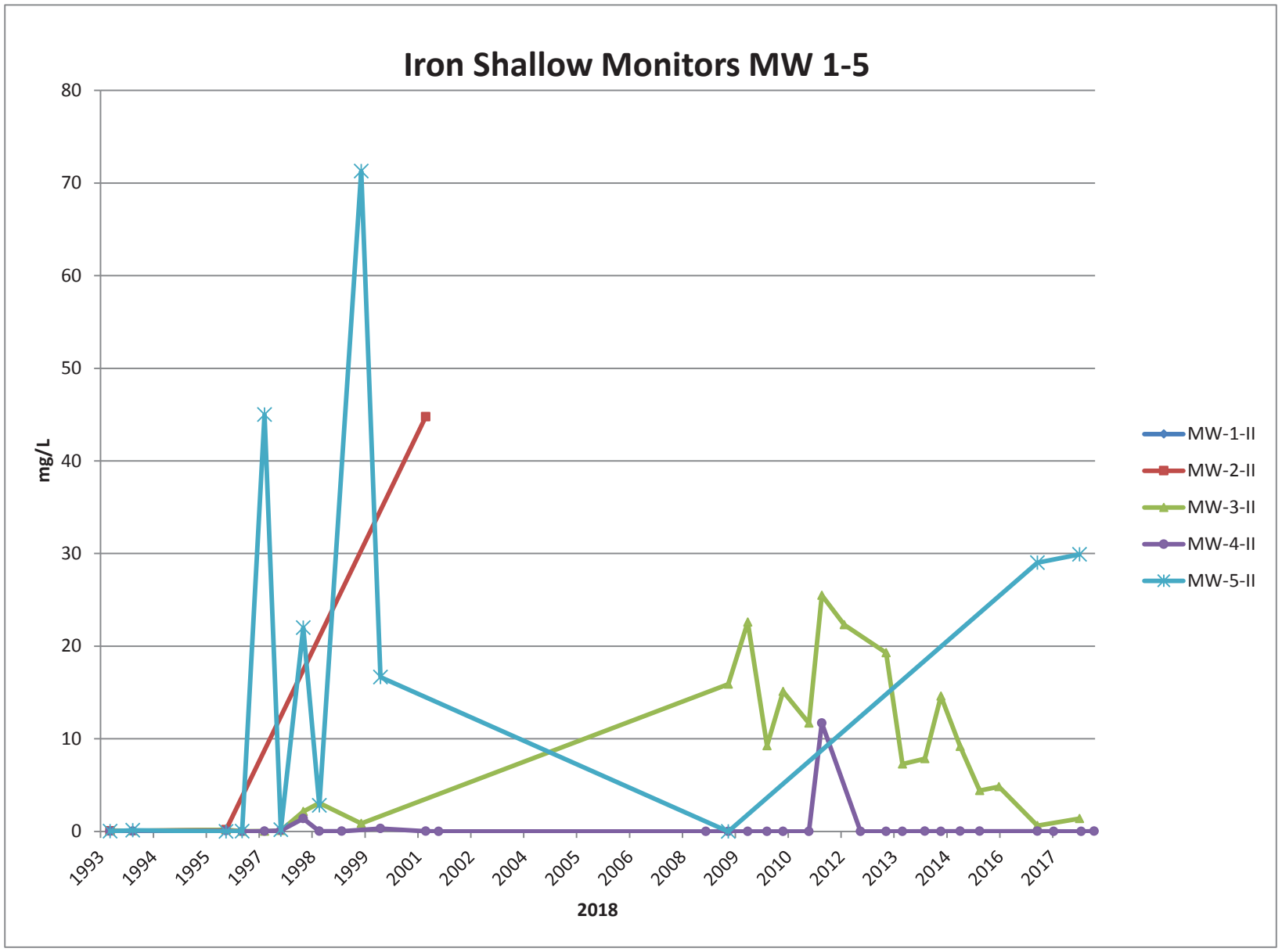
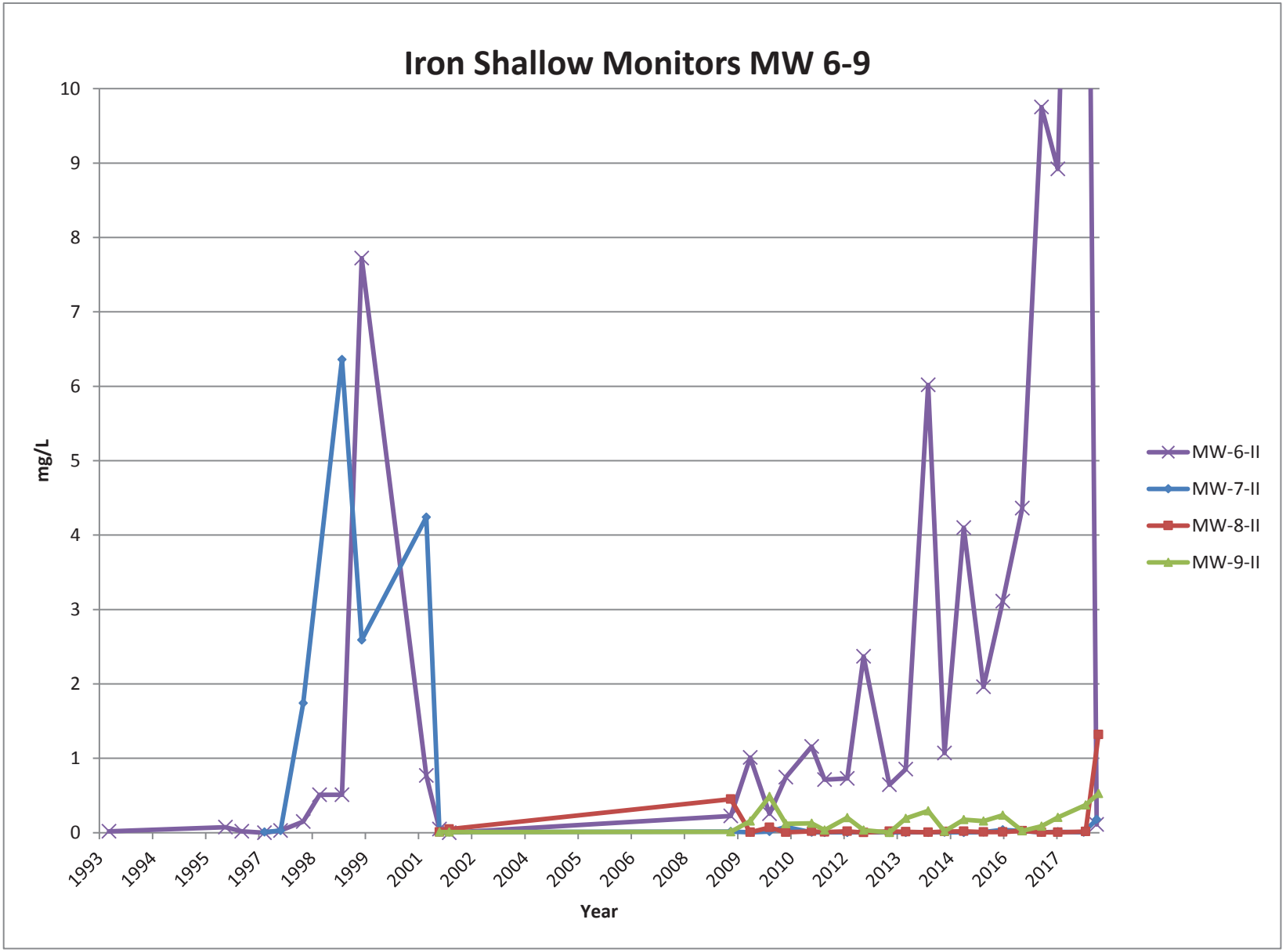
2016
2017
Year
MW-6-I
MW-7-I
MW-8-I
MW-9-I


Iron Deep Monitors MW 10-13
3
2.5
2
1.5
1
0.5
0
mg/L
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-10-I
MW-11-I
MW-12-II
MW-12-III
MW-13-I


Iron Shallow Monitors MW 1-5
mg/L
80
70
60
50
40
30
20
10
0
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
2018
MW-1-II
MW-2-II
MW-3-II
MW-4-II
MW-5-II


Iron Shallow Monitors MW 6-9
mg/L
10
9
8
7
6
5
4
3
2
1
0
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
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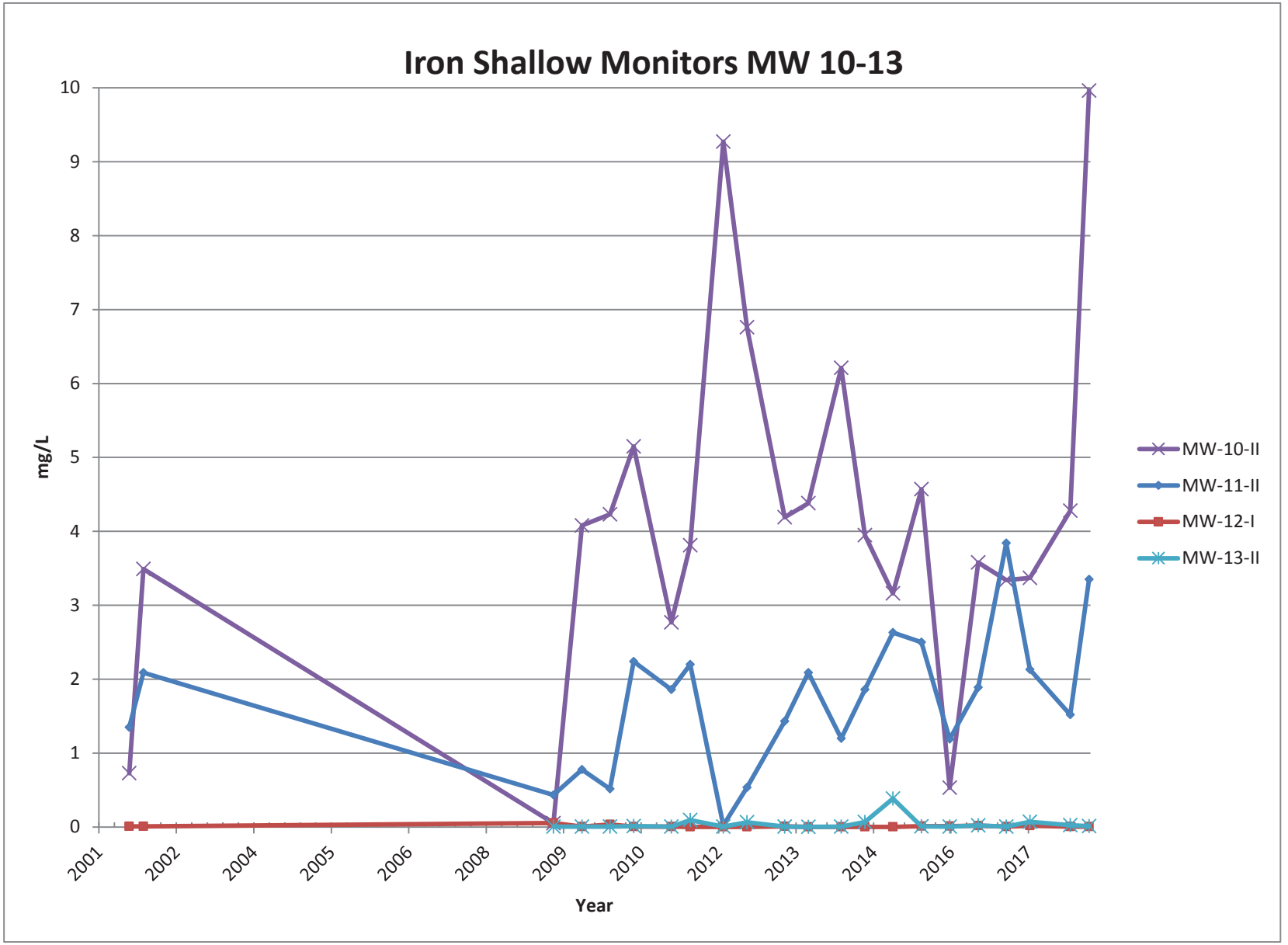
2010
2012
2013
2014
2016
2017
Year
MW-6-II
MW-7-II
MW-8-II
MW-9-II


Iron Shallow Monitors MW 10-13
mg/L
10
9
8
7
6
5
4
3
2
1
0
2001
2002
2004
2005
2006
2008
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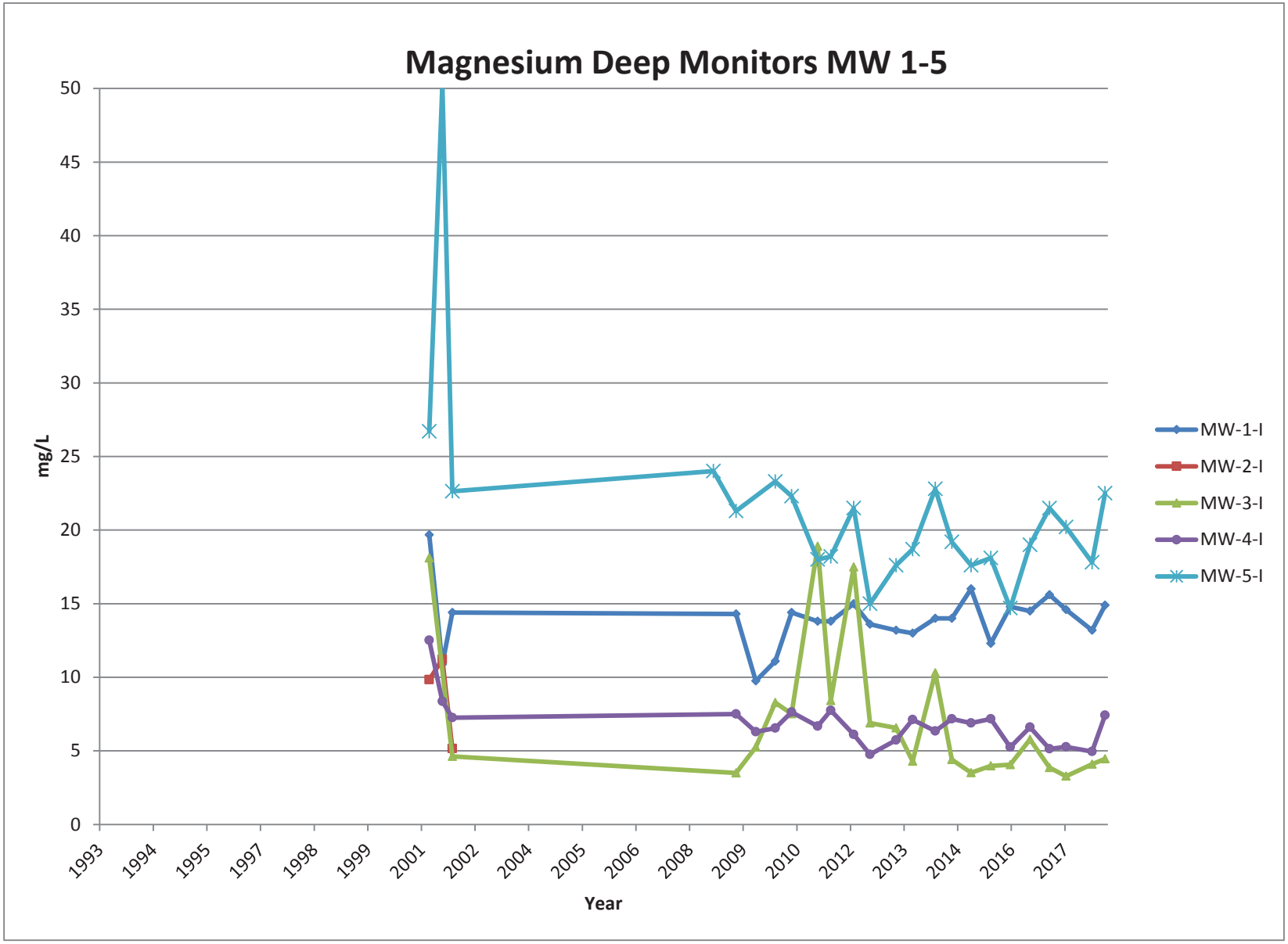
2010
2012
2013
2014
2016
2017
Year
MW-10-II
MW-11-II
MW-12-I
MW-13-II


Magnesium Deep Monitors MW 1-5
mg/L
50
45
40
35
30
25
20
15
10
5
0
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
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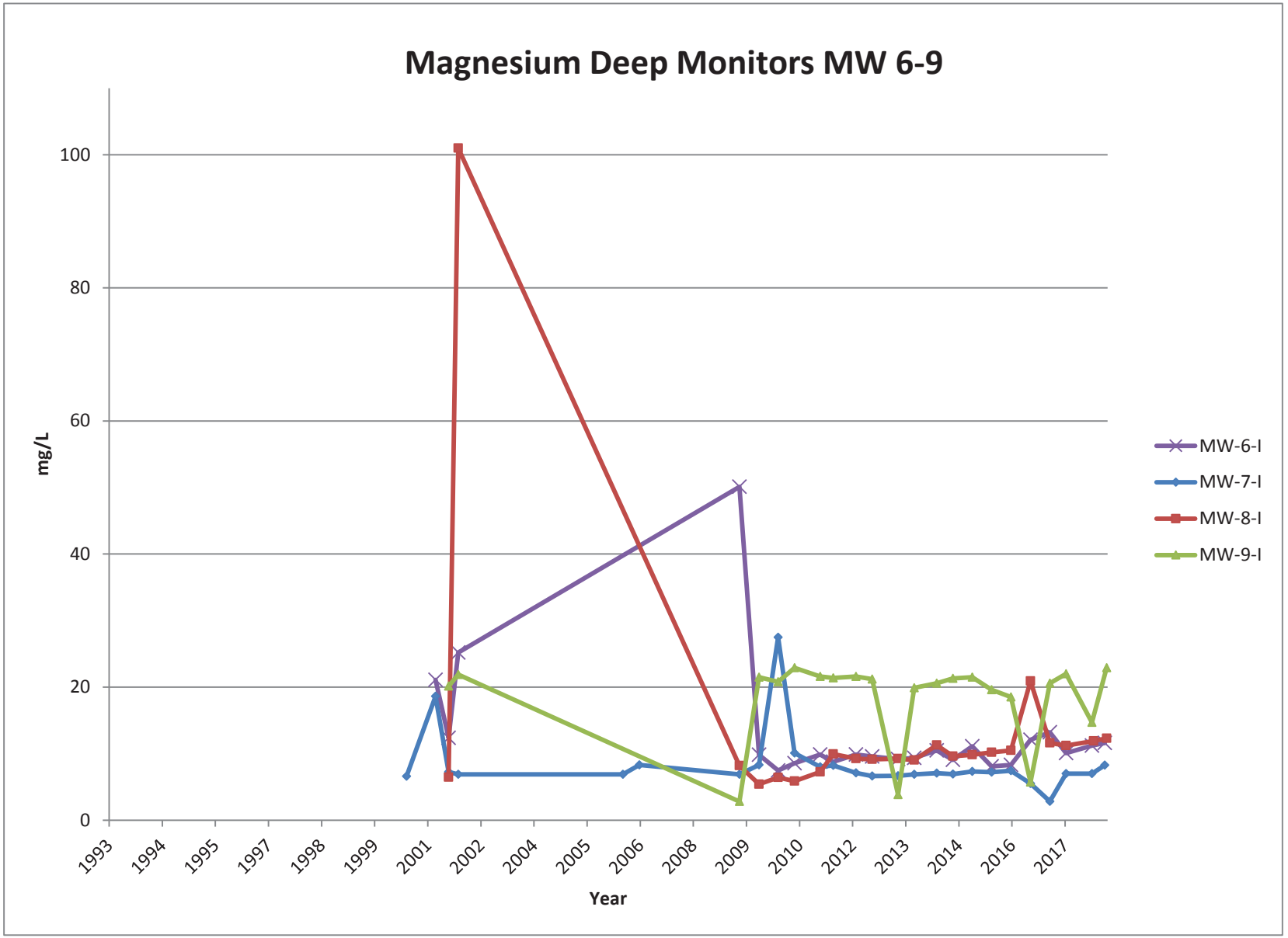
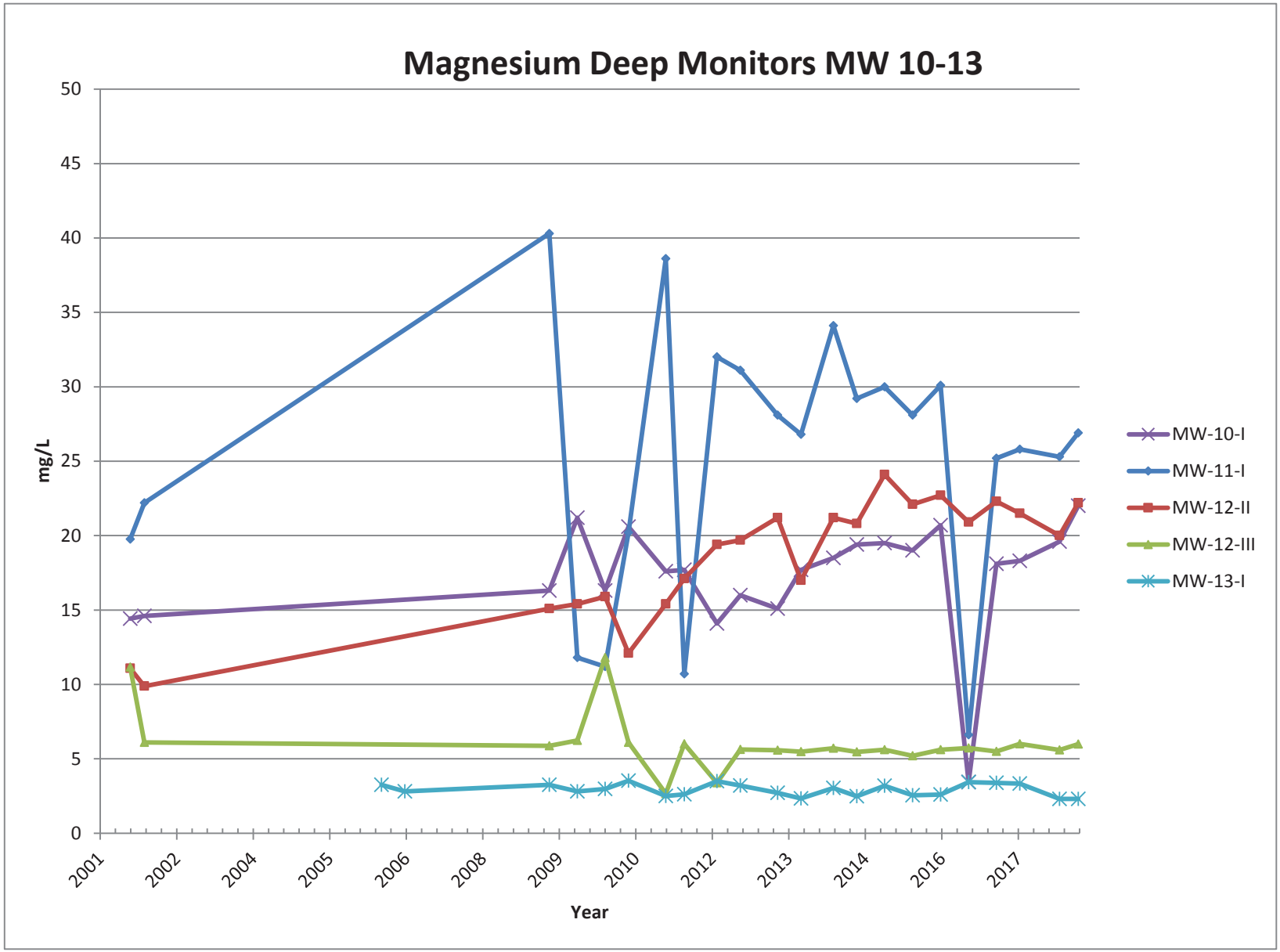
2013
2014
2016
2017
Year
MW-1-I
MW-2-I
MW-3-I
MW-4-I
MW-5-I


Magnesium Deep Monitors MW 6-9
mg/L
100
80
60
40
20
0
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-6-I
MW-7-I
MW-8-I
MW-9-I


Magnesium Deep Monitors MW 10-13
mg/L
50
45
40
35
30
25
20
15
10
5
0
2001
2002
2004
2005
2006
2008
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2010
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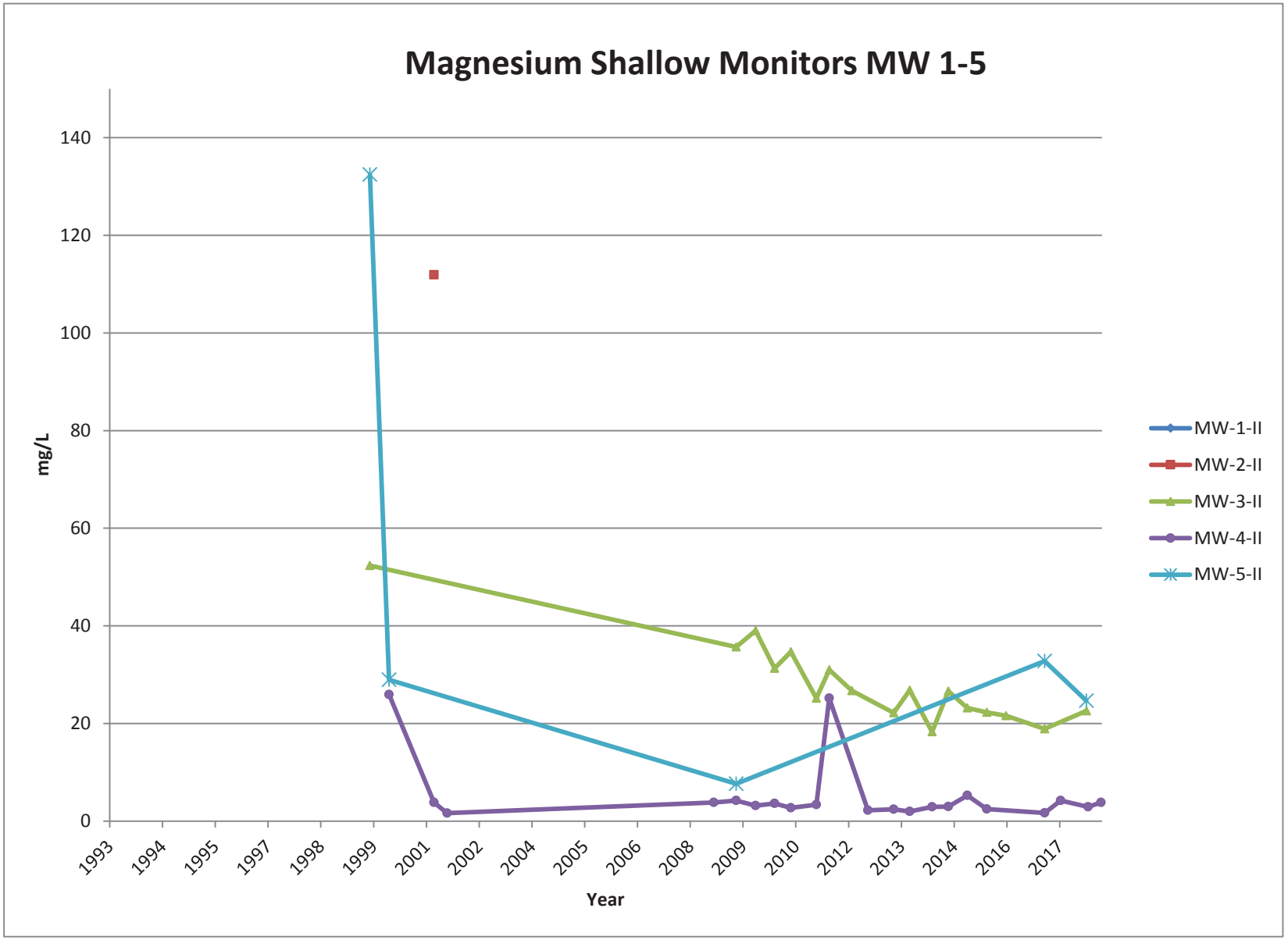
Year
MW-10-I
MW-11-I
MW-12-II
MW-12-III
MW-13-I


Magnesium Shallow Monitors MW 1-5
140
120
100
80
60
40
20
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
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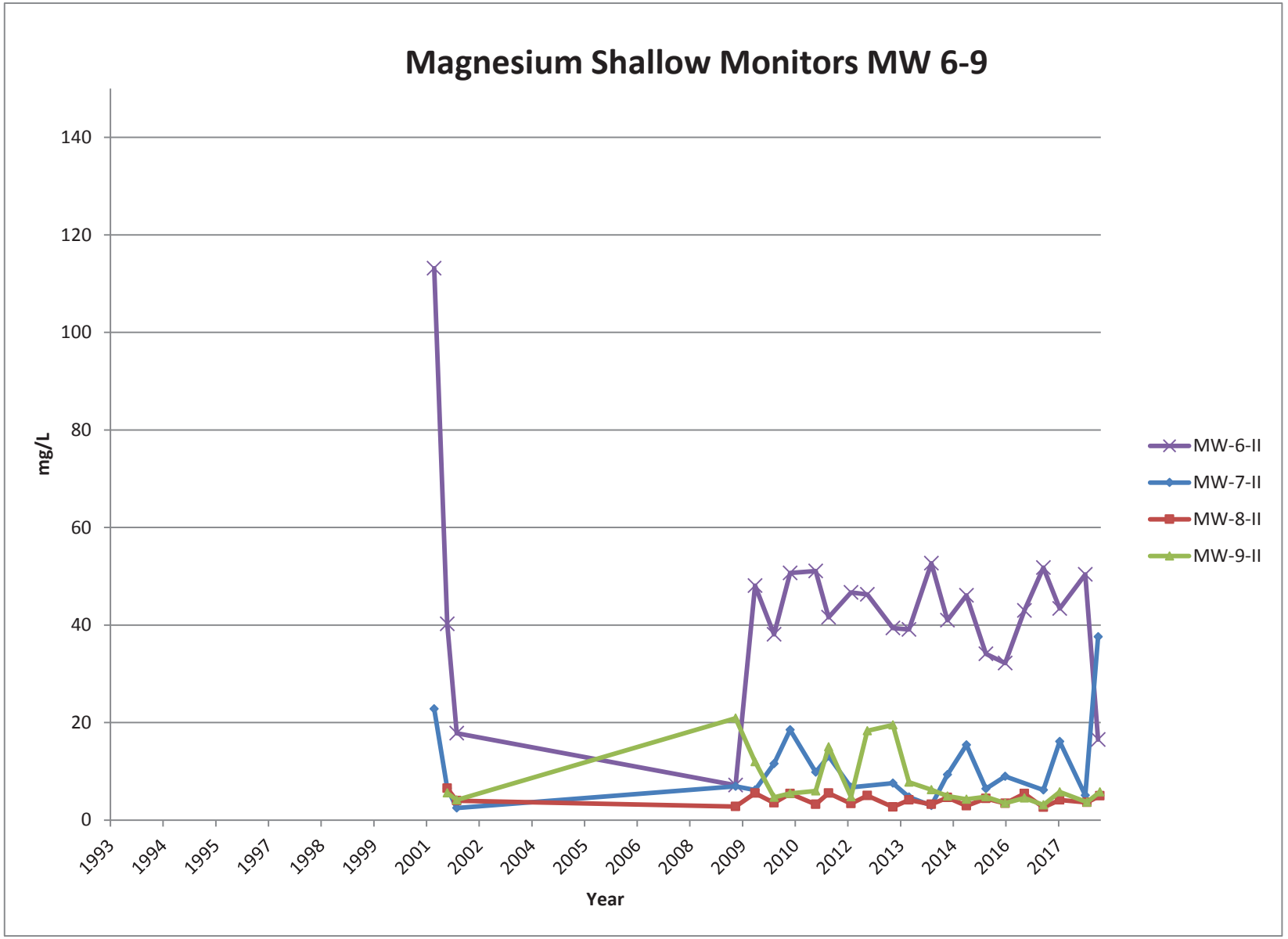
2013
2014
2016
2017
Year
MW-1-II
MW-2-II
MW-3-II
MW-4-II
MW-5-II


Magnesium Shallow Monitors MW 6-9
140
120
100
80
60
40
20
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
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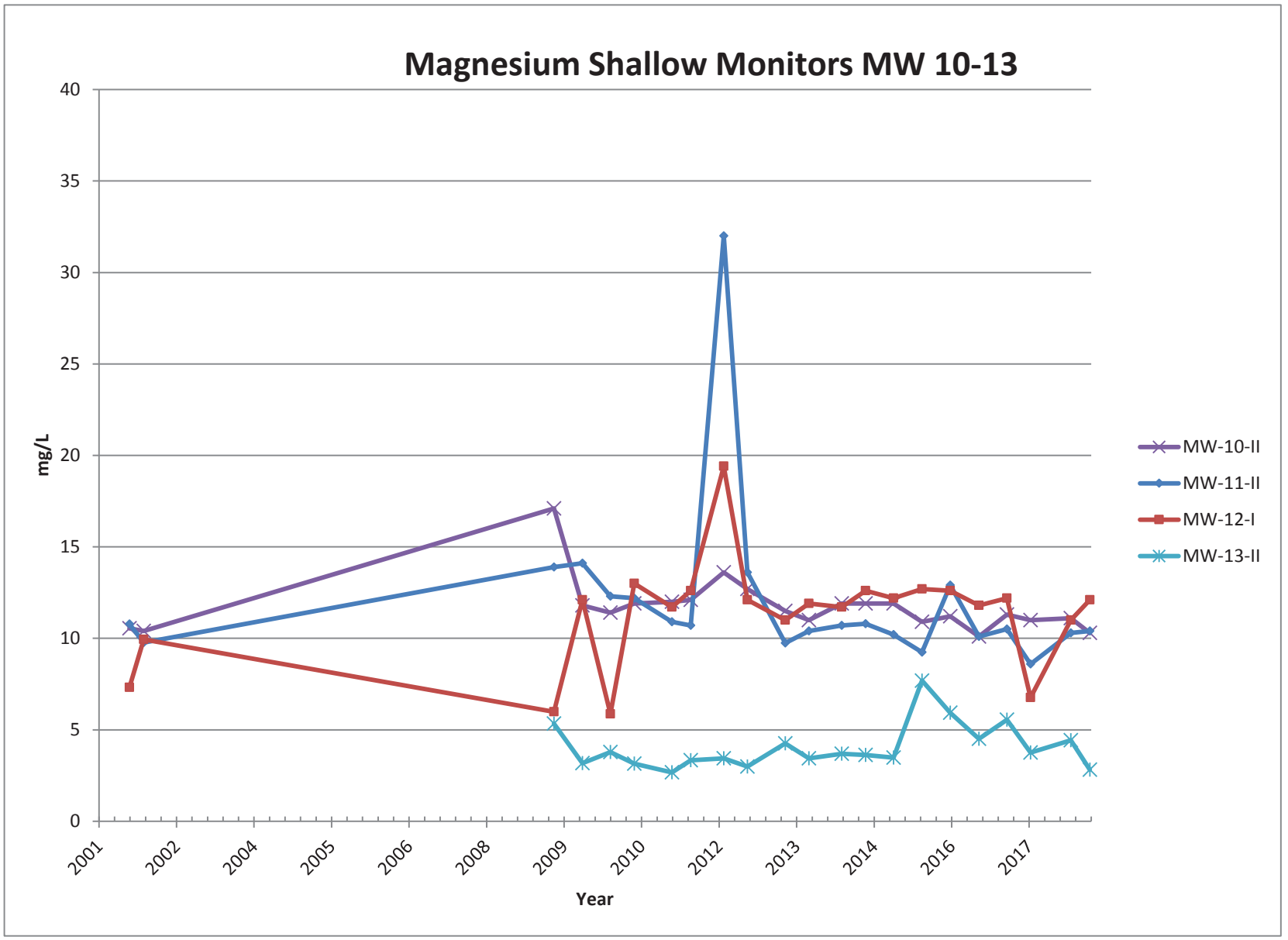
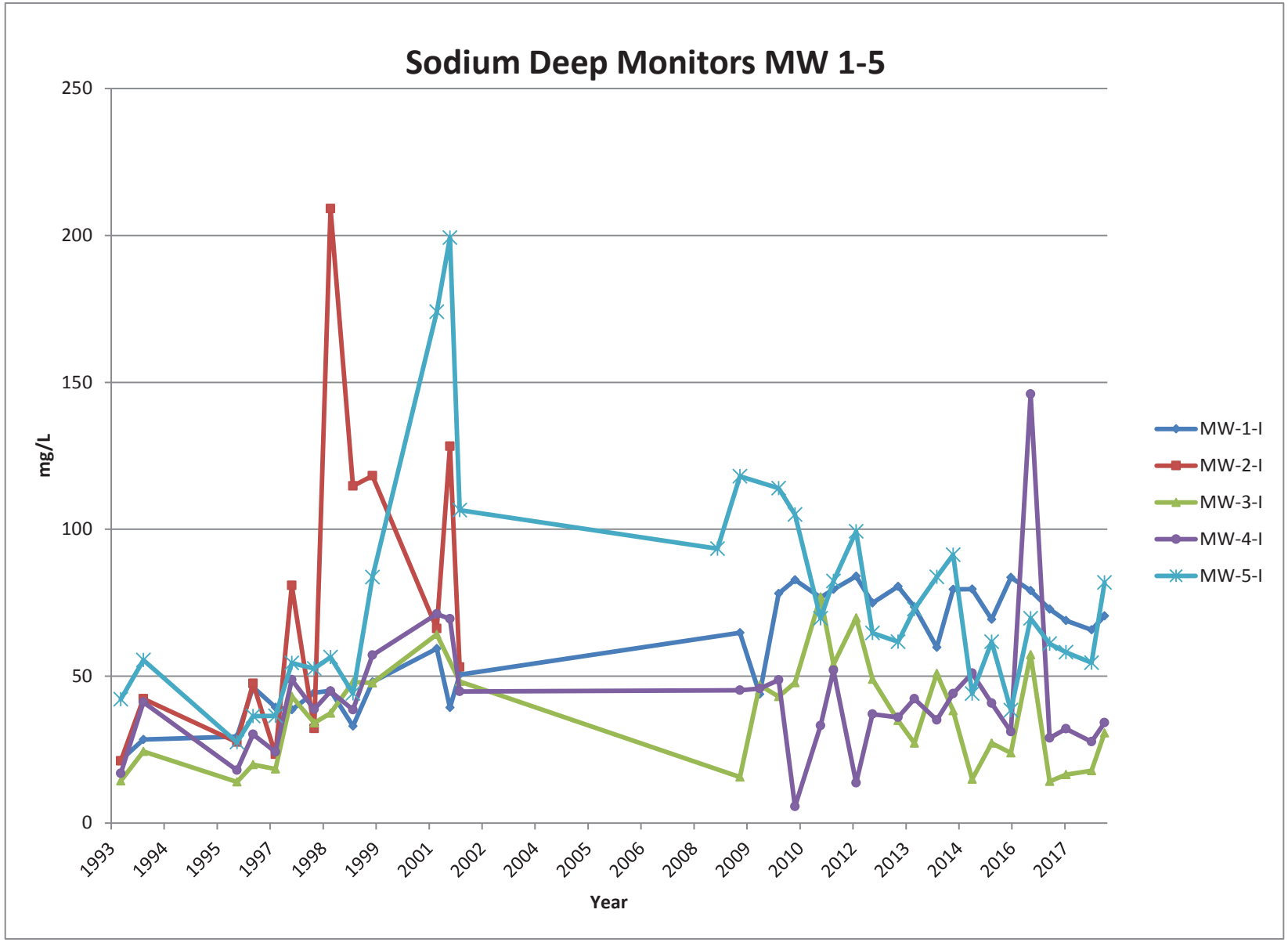
2016
2017
Year
MW-6-II
MW-7-II
MW-8-II
MW-9-II


Magnesium Shallow Monitors MW 10-13
40
35
30
25
20
15
10
5
0
mg/L
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-10-II
MW-11-II
MW-12-I
MW-13-II


Sodium Deep Monitors MW 1-5
250
200
150
100
50
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
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2010
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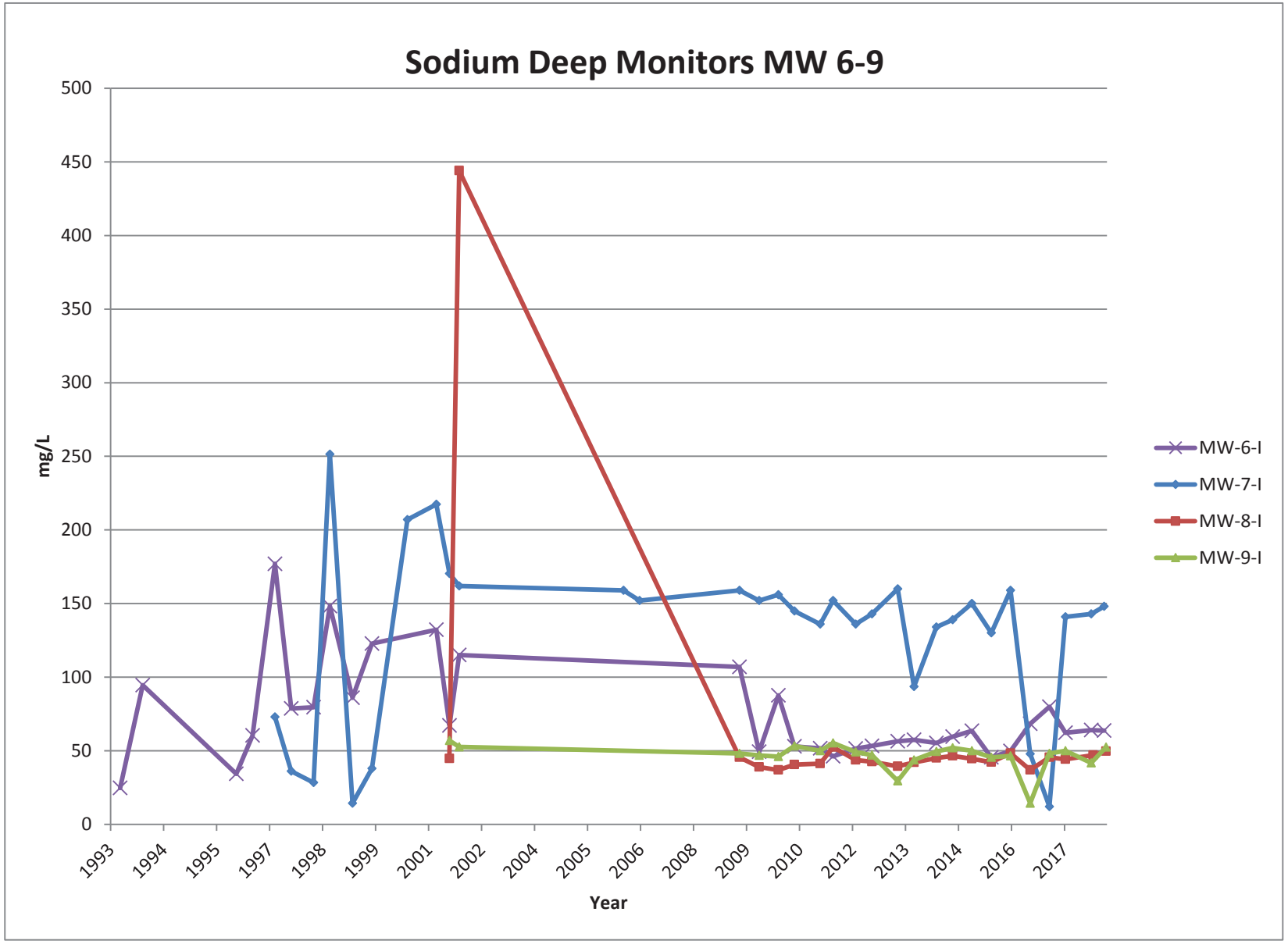
2013
2014
2016
2017
Year
MW-1-I
MW-2-I
MW-3-I
MW-4-I
MW-5-I


Sodium Deep Monitors MW 6-9
500
450
400
350
300
250
200
150
100
50
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
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2016
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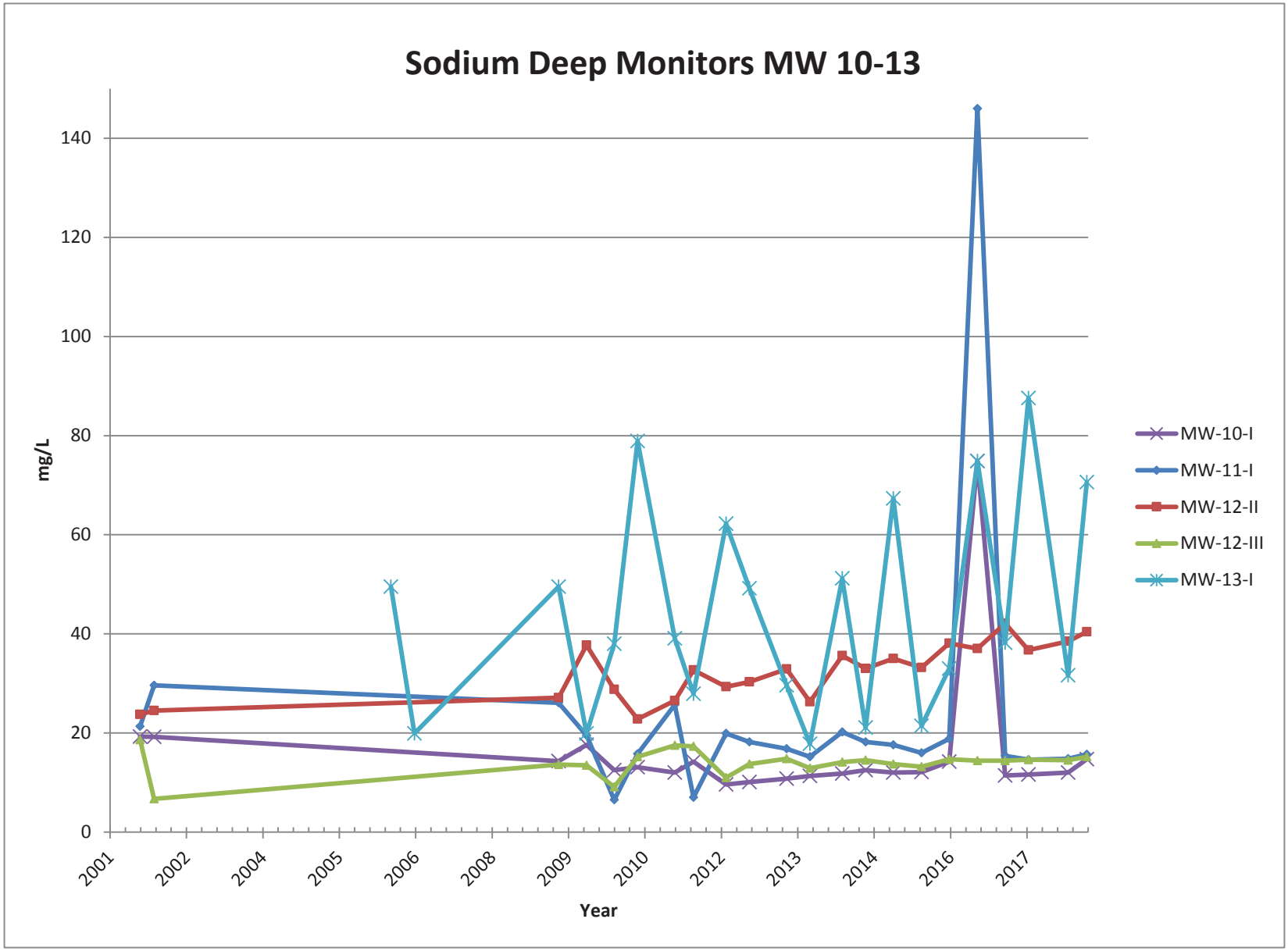
Year
MW-6-I
MW-7-I
MW-8-I
MW-9-I


Sodium Deep Monitors MW 10-13
mg/L
140
120
100
80
60
40
20
0
2001
2002
2004
2005
2006
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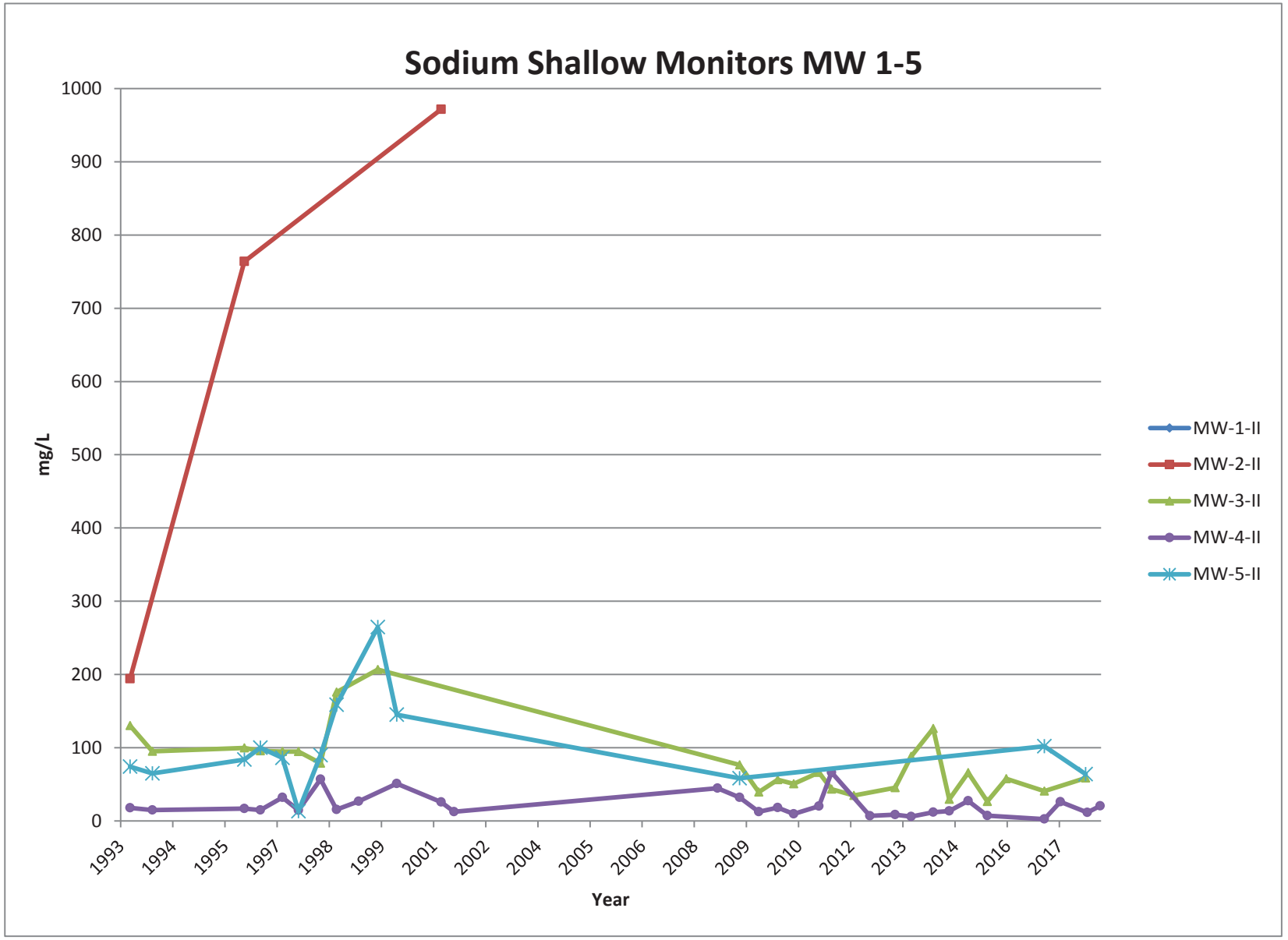
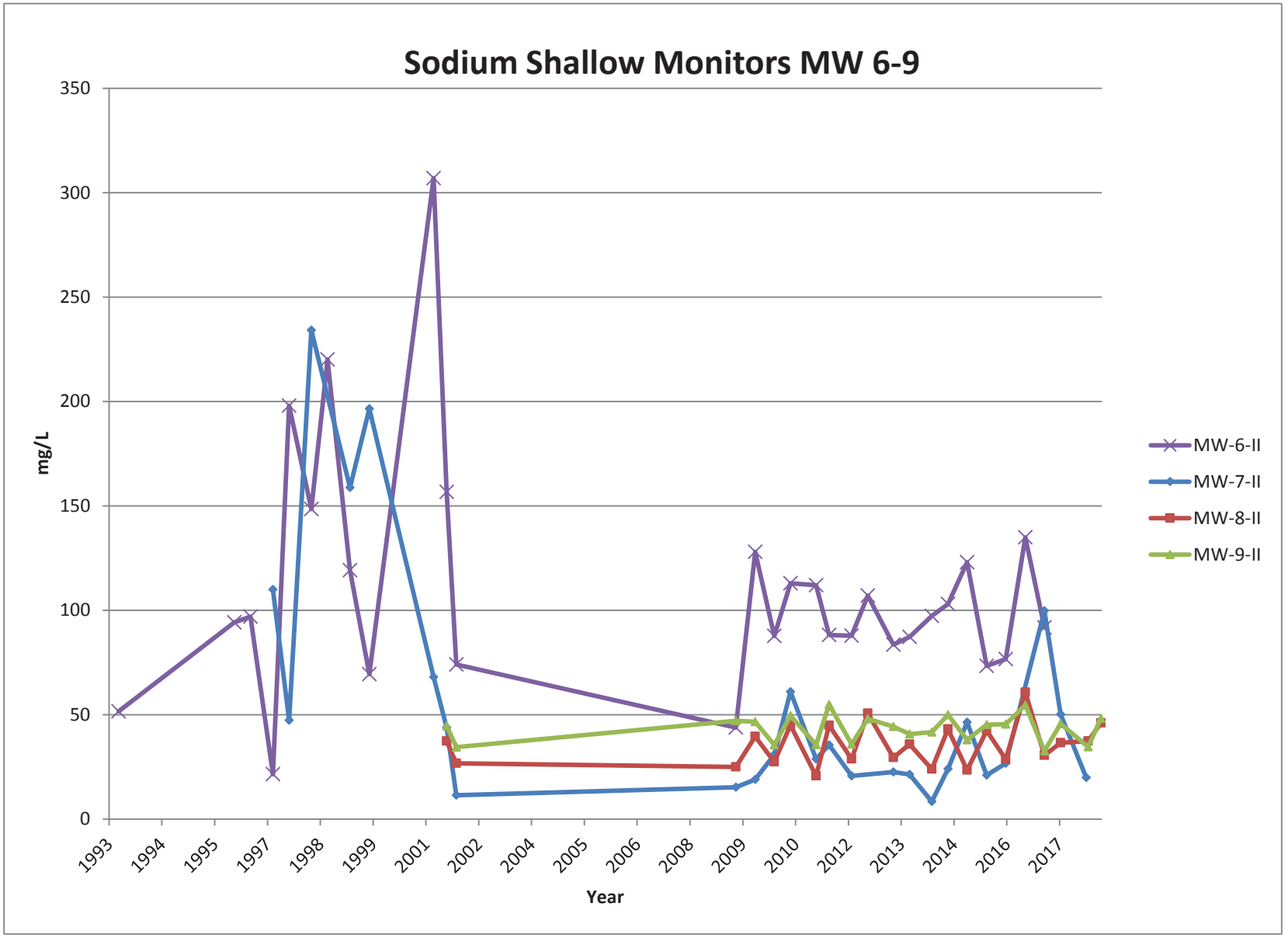
Year
MW-10-I
MW-11-I
MW-12-II
MW-12-III
MW-13-I


Sodium Shallow Monitors MW 1-5
1000
900
800
700
600
500
400
300
200
100
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-1-II
MW-2-II
MW-3-II
MW-4-II
MW-5-II


Sodium Shallow Monitors MW 6-9
350
300
250
200
150
100
50
0
mg/L
1993
1994
1995
1997
1998
1999
2001
2002
2004
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2016
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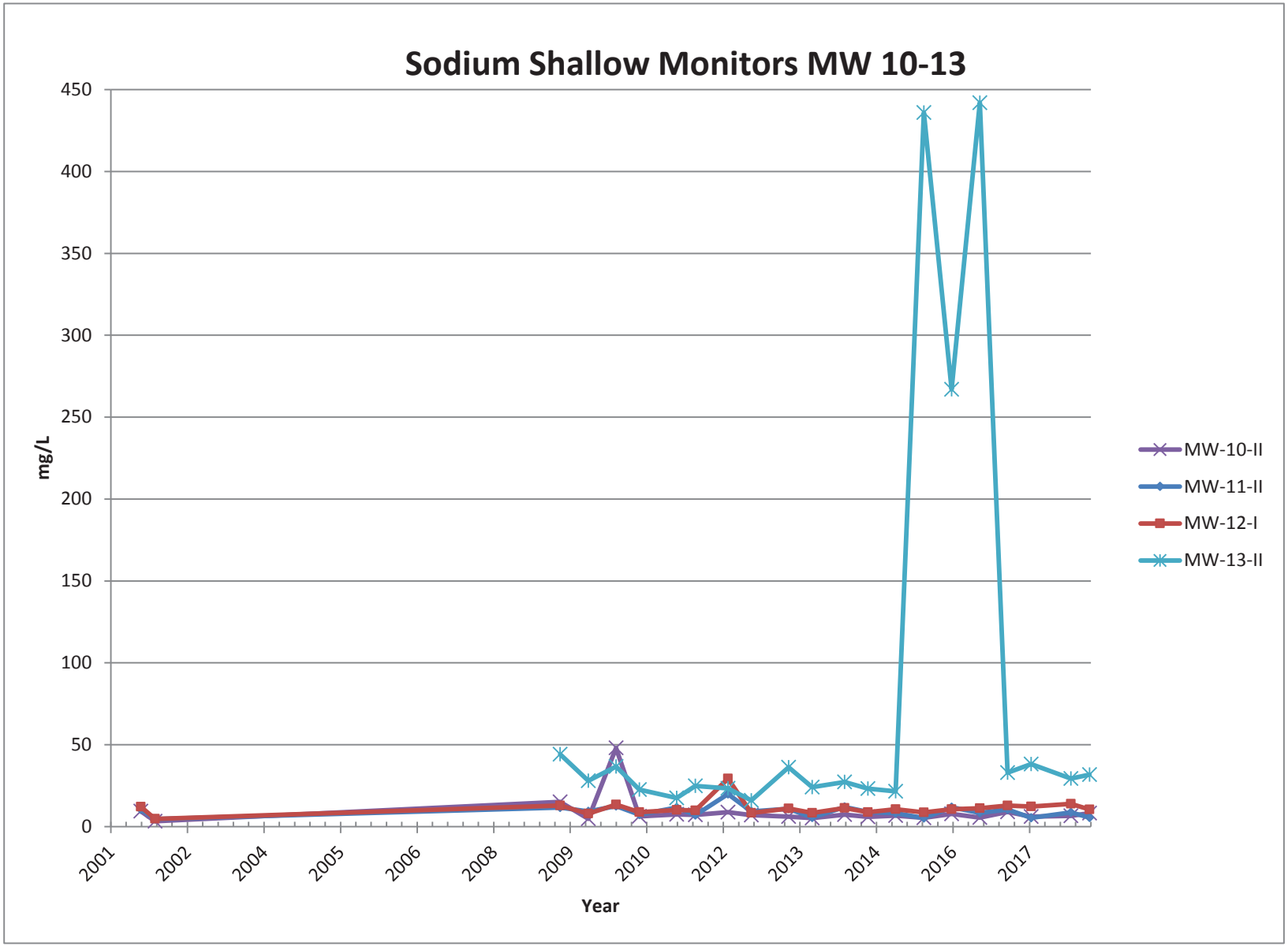
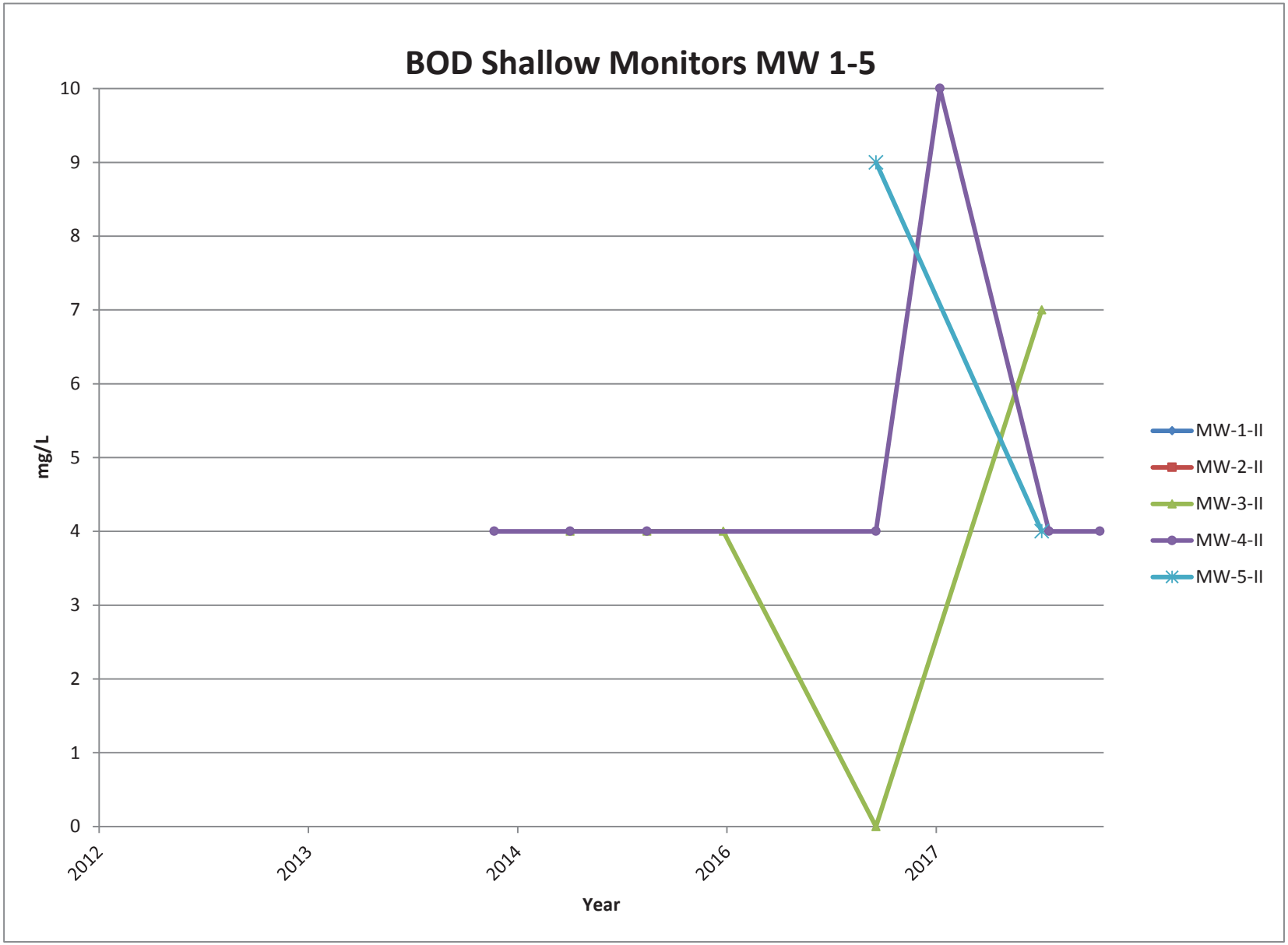
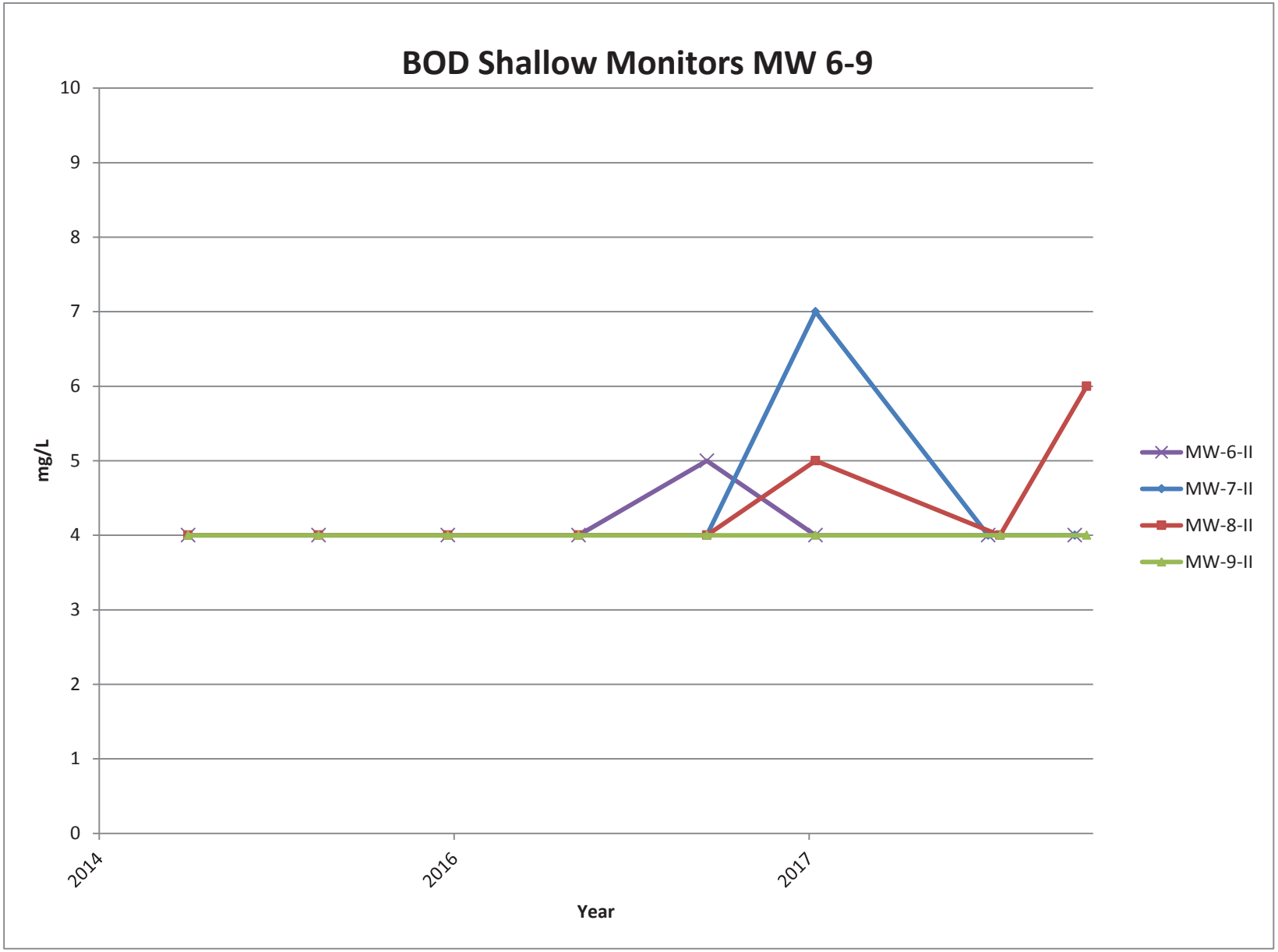
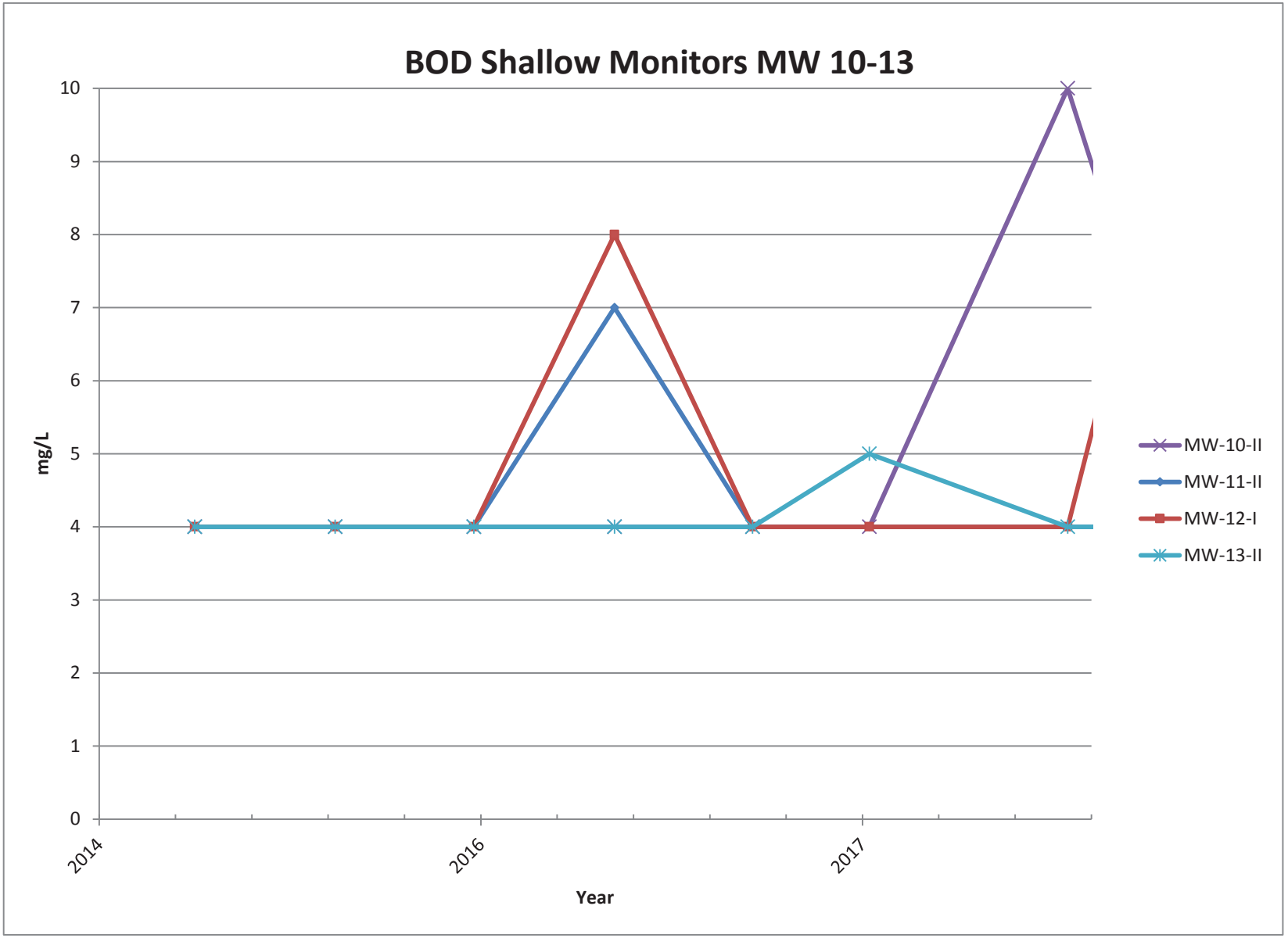
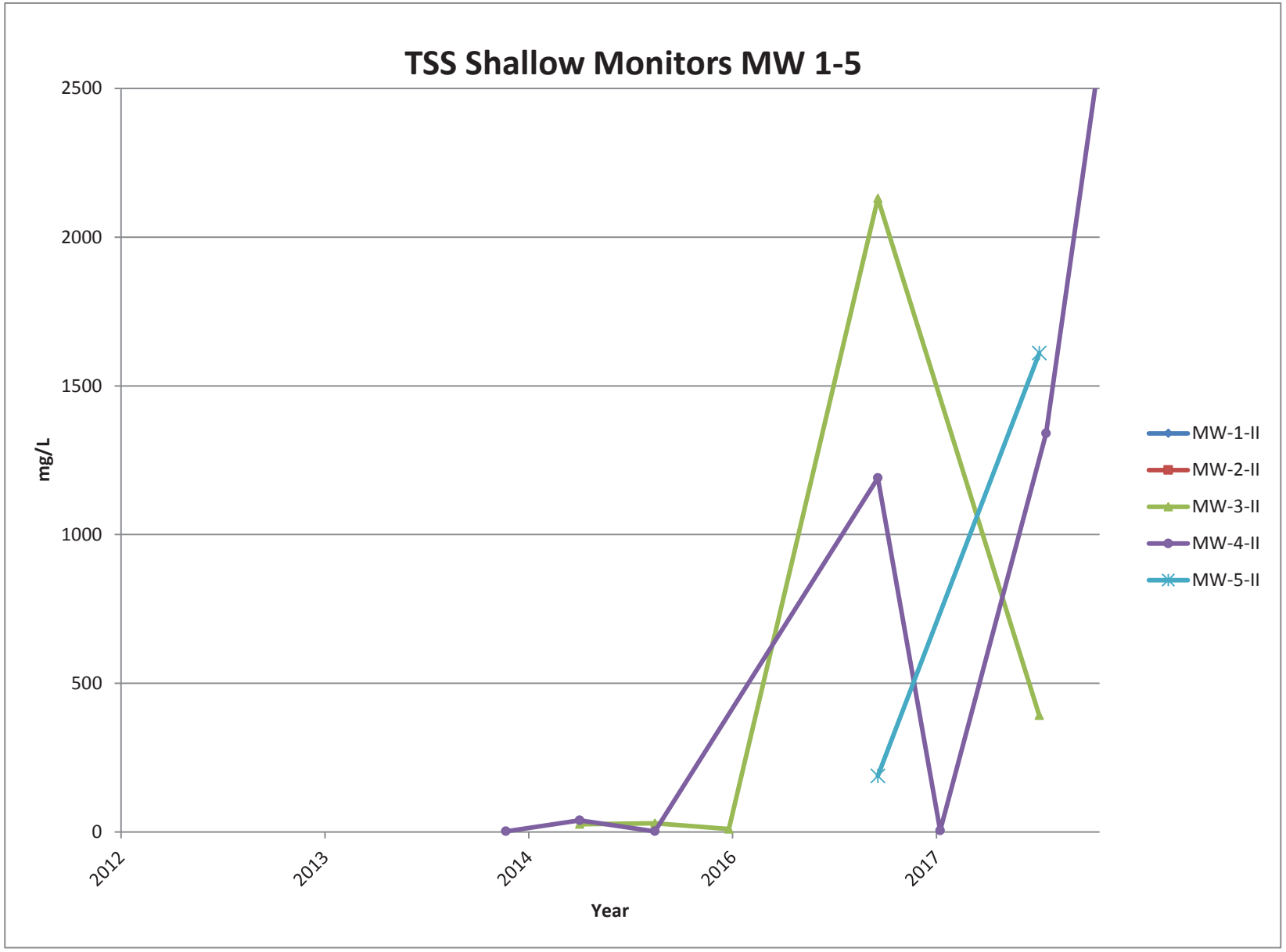
Year
MW-6-II
MW-7-II
MW-8-II
MW-9-II

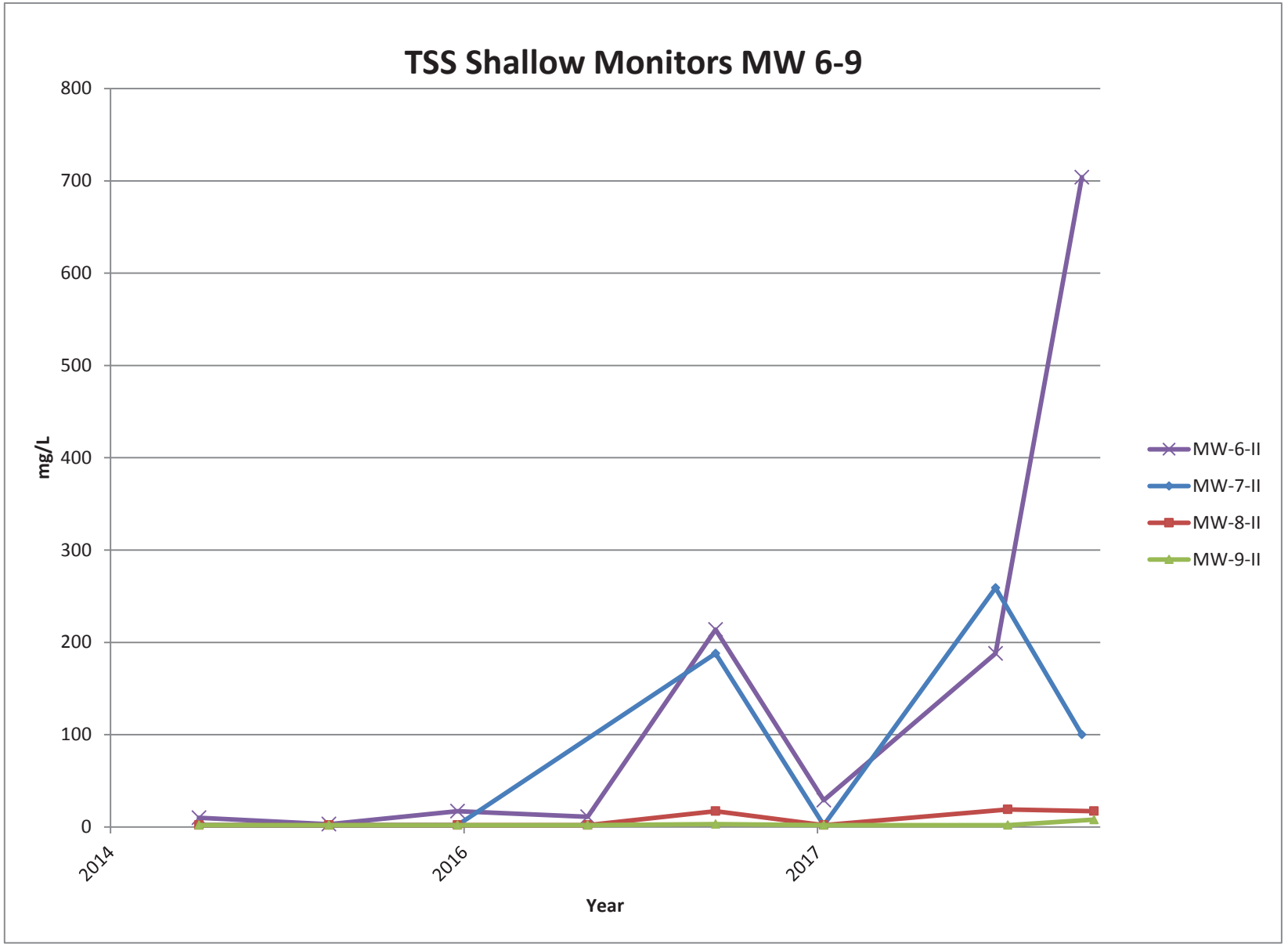

Sodium Shallow Monitors MW 10-13
450
400
350
300
250
200
150
100
50
0
mg/L
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
MW-10-II
MW-11-II
MW-12-I
MW-13-II

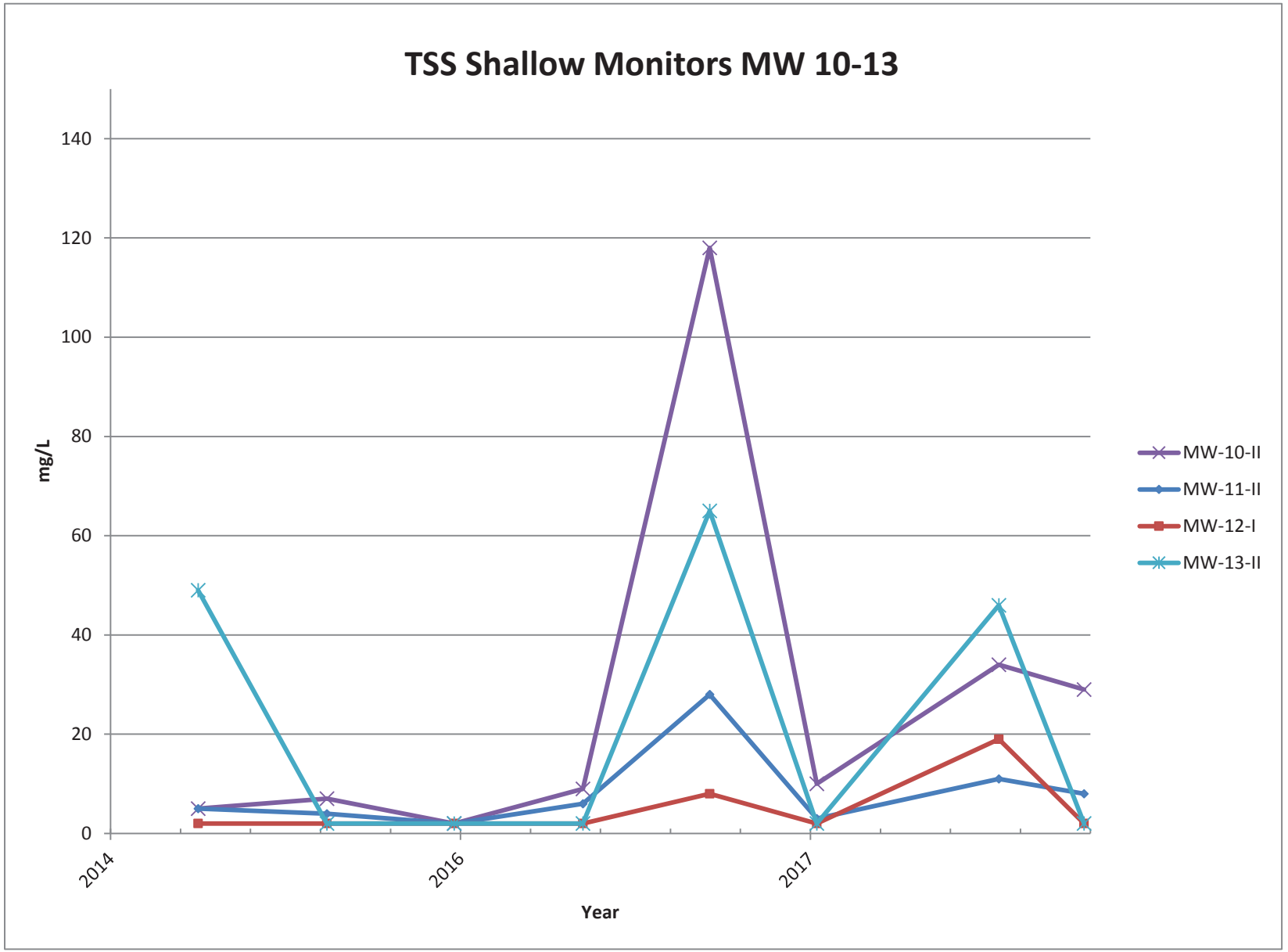

BOD Shallow Monitors MW 1-5
10
9
8
7
6
5
4
3
2
1
0
mg/L
2012
2013
2014
2016
2017
Year
MW-1-II
MW-2-II
MW-3-II
MW-4-II
MW-5-II


BOD Shallow Monitors MW 6-9
10
9
8
7
6
5
4
3
2
1
0
mg/L
2014
2016
2017
Year
MW-6-II
MW-7-II
MW-8-II
MW-9-II


BOD Shallow Monitors MW 10-13
10
9
8
7
6
5
4
3
2
1
0
mg/L
2014
2016
2017
Year
MW-10-II
MW-11-II
MW-12-I
MW-13-II

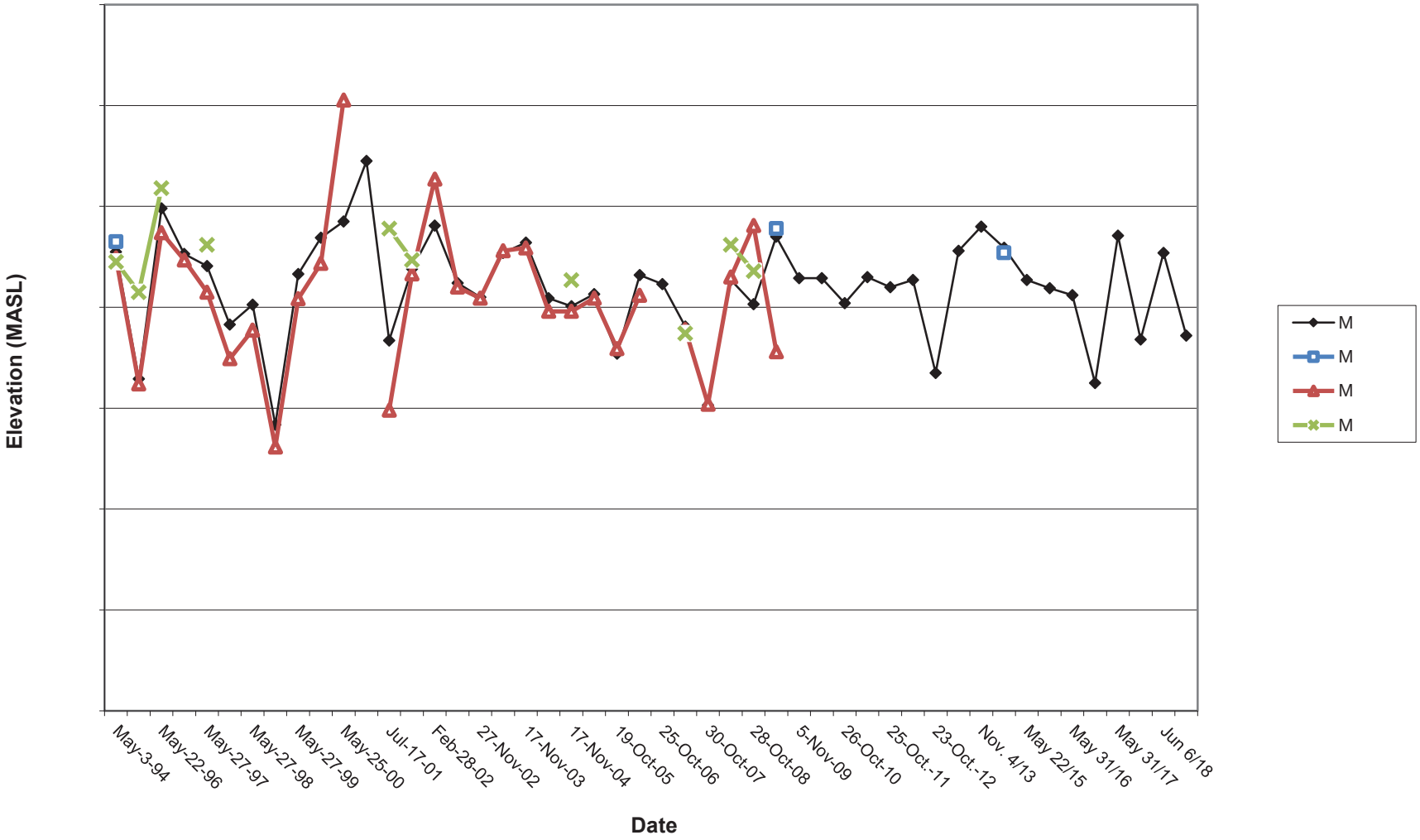

TSS Shallow Monitors MW 1-5
2500
2000
1500
1000
500
0
mg/L
2012
2013
2014
2016
2017
Year
MW-1-II
MW-2-II
MW-3-II
MW-4-II
MW-5-II


TSS Shallow Monitors MW 6-9
800
700
600
500
400
300
200
100
0
mg/L
2014
2016
2017
Year
MW-6-II
MW-7-II
MW-8-II
MW-9-II

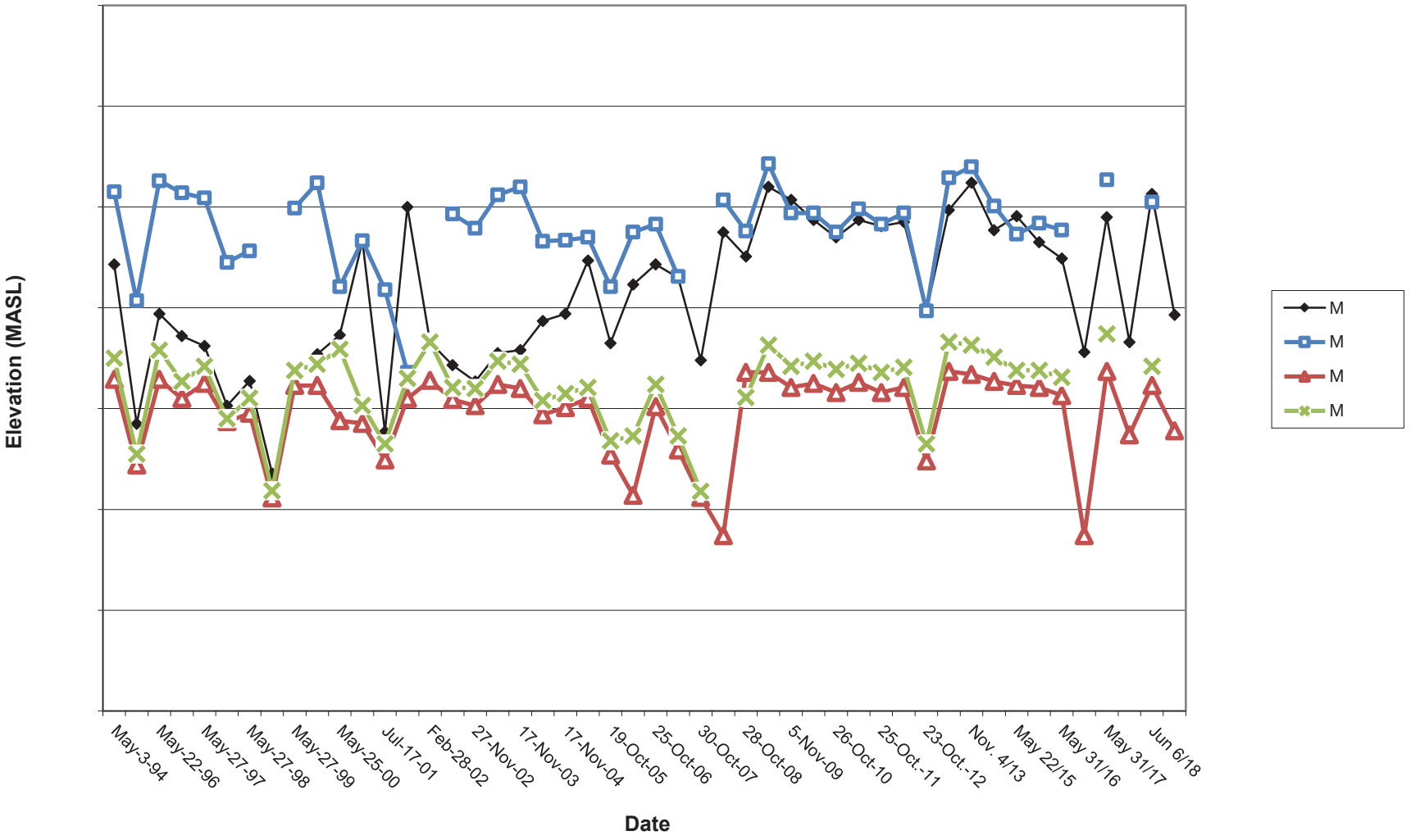

TSS Shallow Monitors MW 10-13
140
120
100
80
60
40
20
0
mg/L
2014
2016
2017
Year
MW-10-II
MW-11-II
MW-12-I
MW-13-II

Appendix D
Water Level Elevations and Hydraulic Gradient Graphs

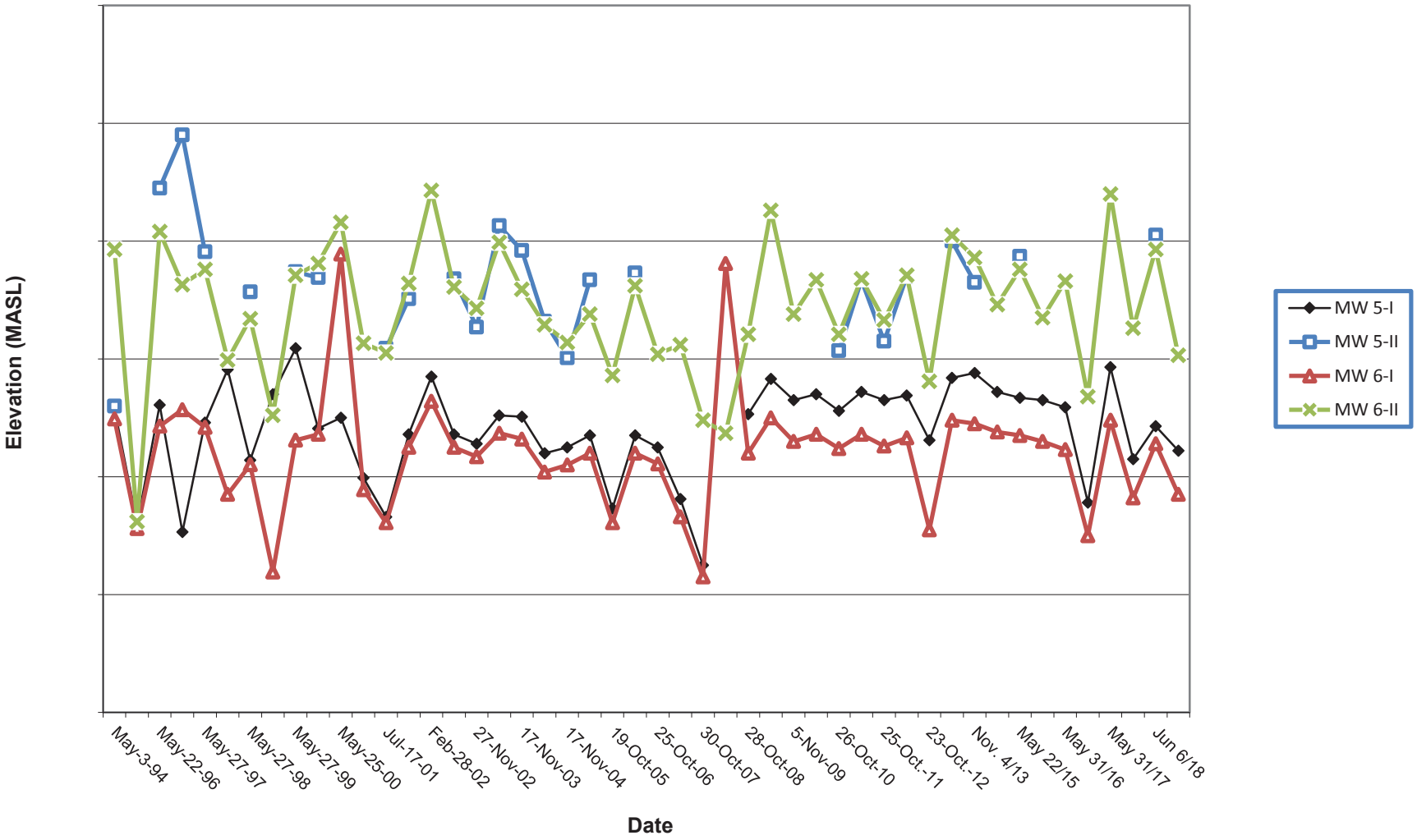
WATERLEVEL ELEVATION



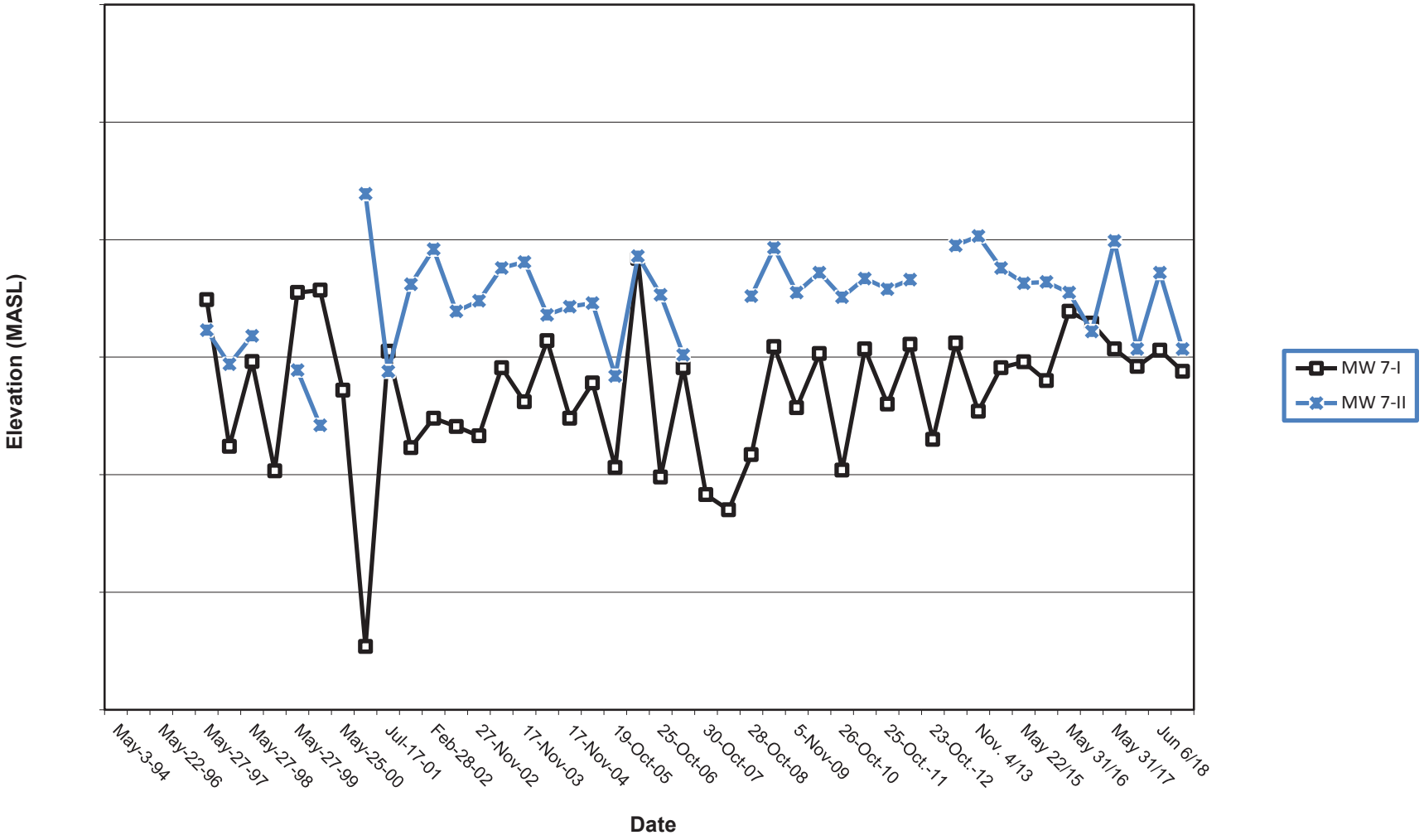
WATERLEVEL ELEVATIONS



WATERLEVEL ELEVATIONS



WATERLEVEL ELEVATIONS



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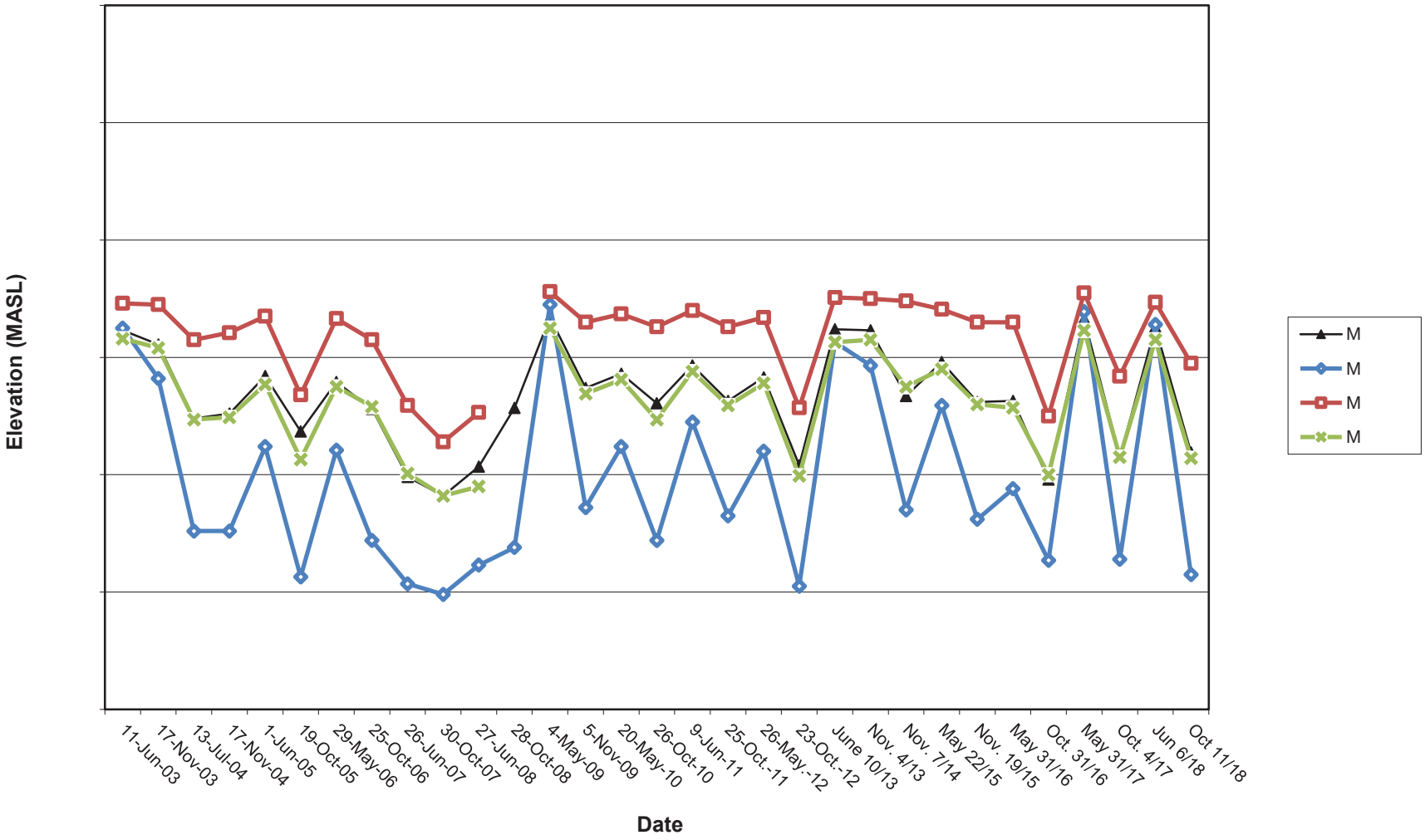

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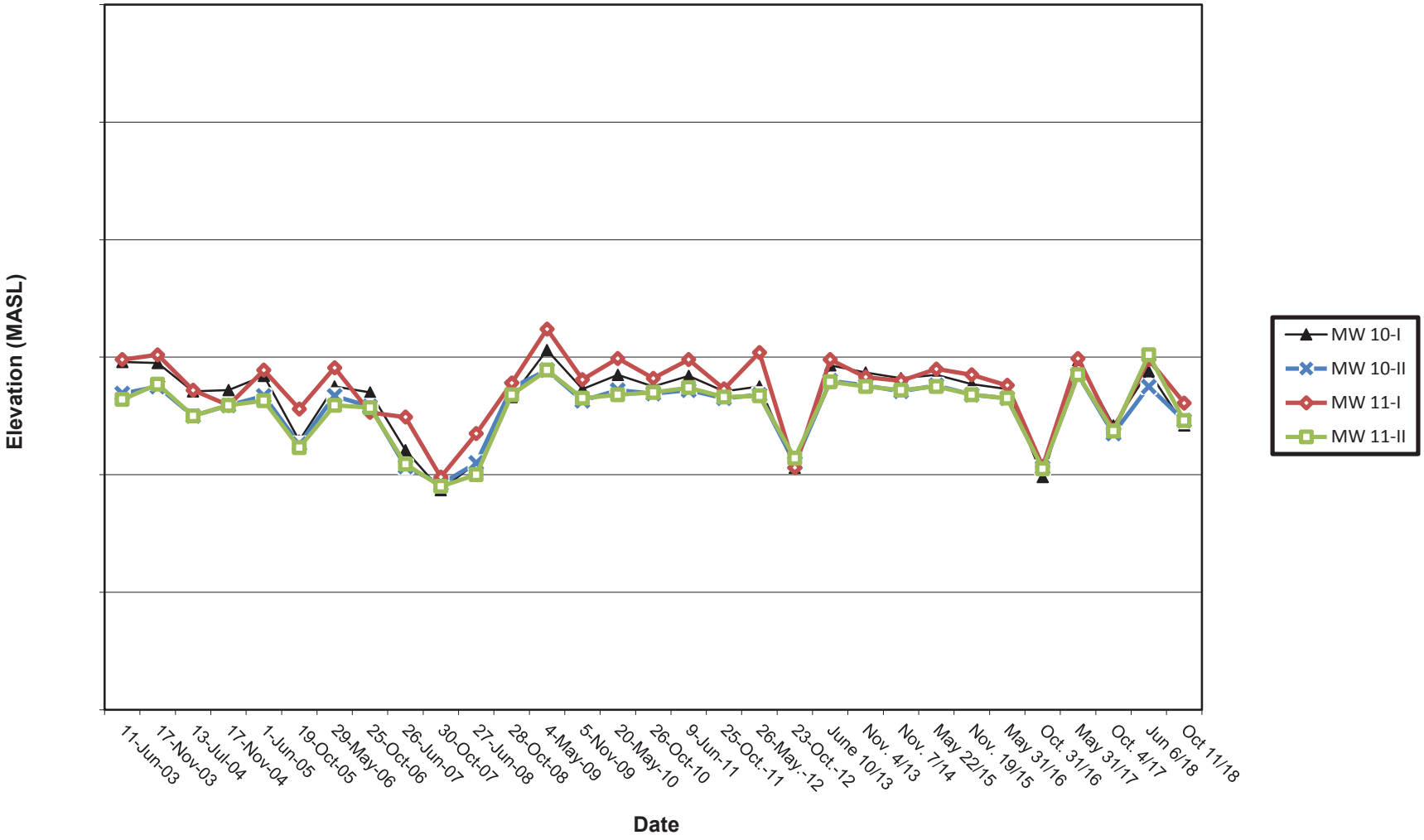
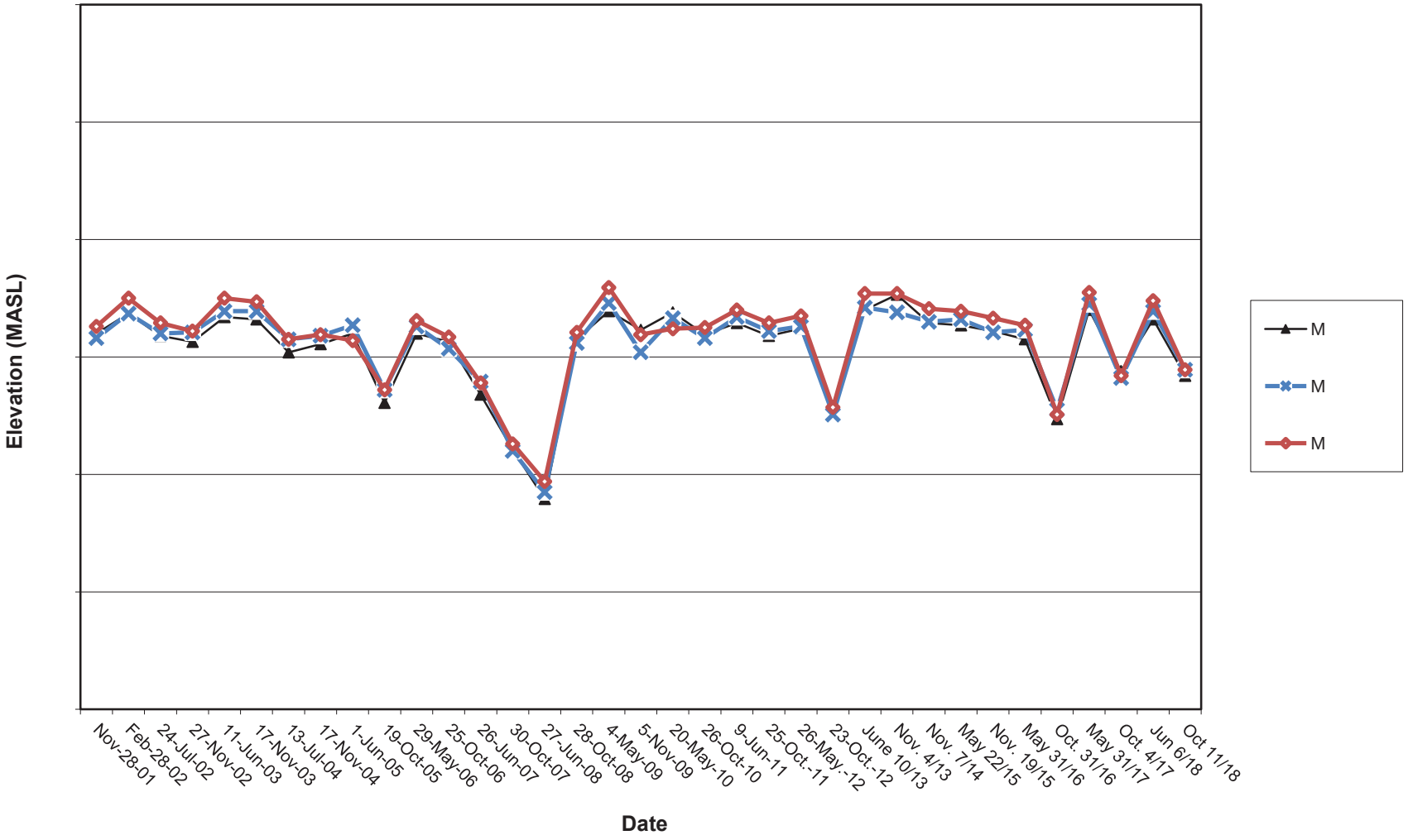
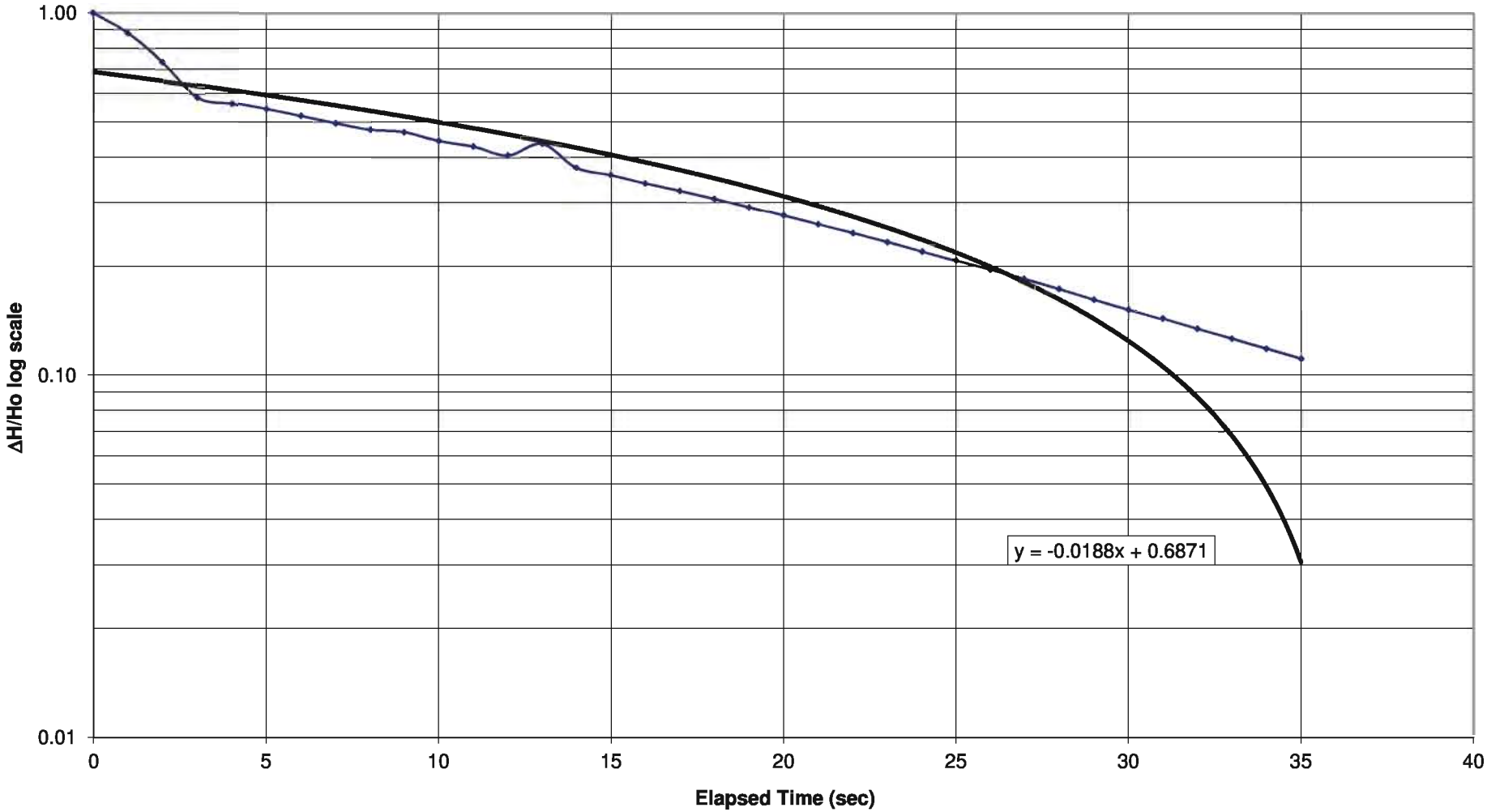


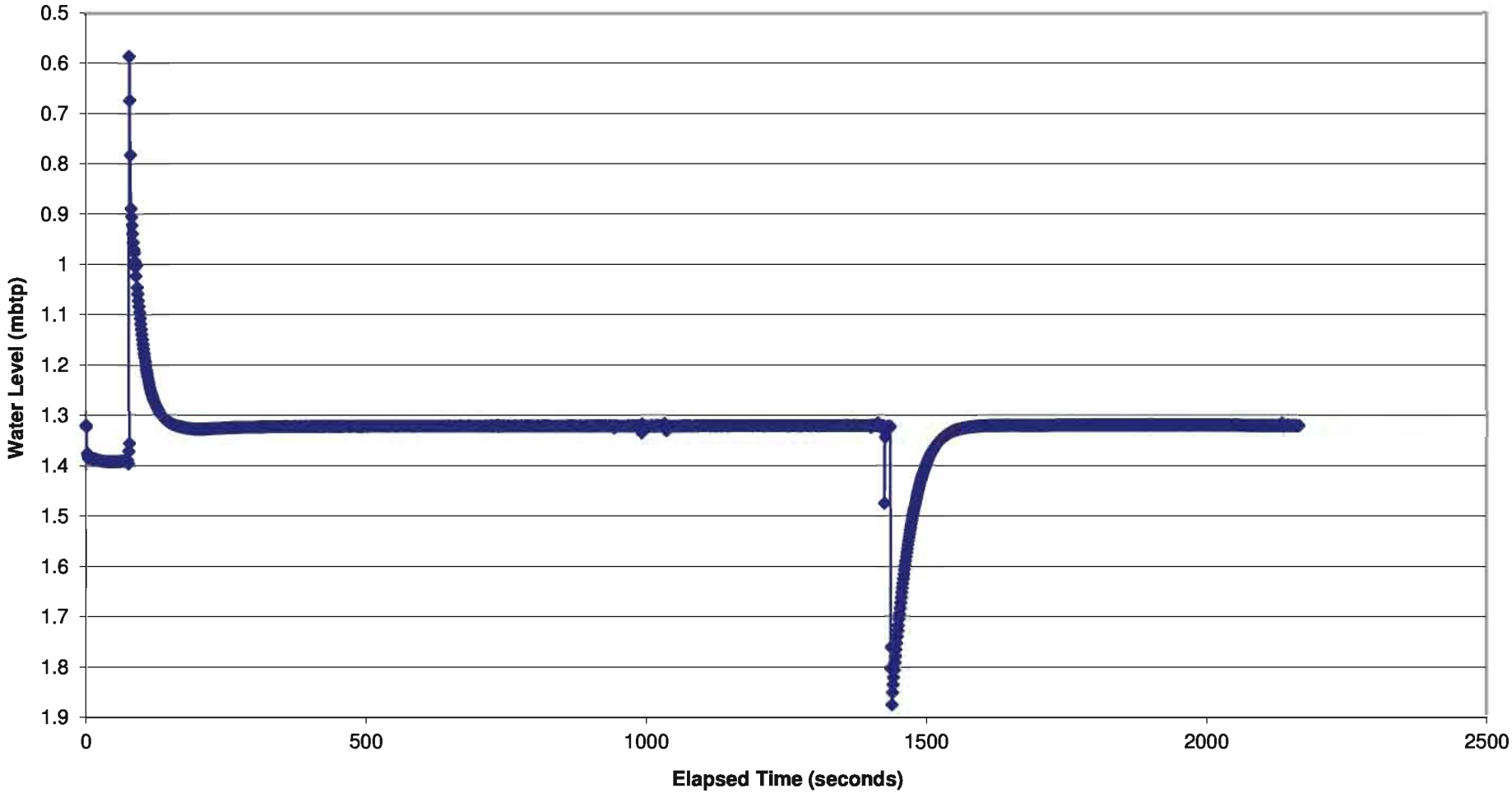
WATERLEVEL ELEVATIONS



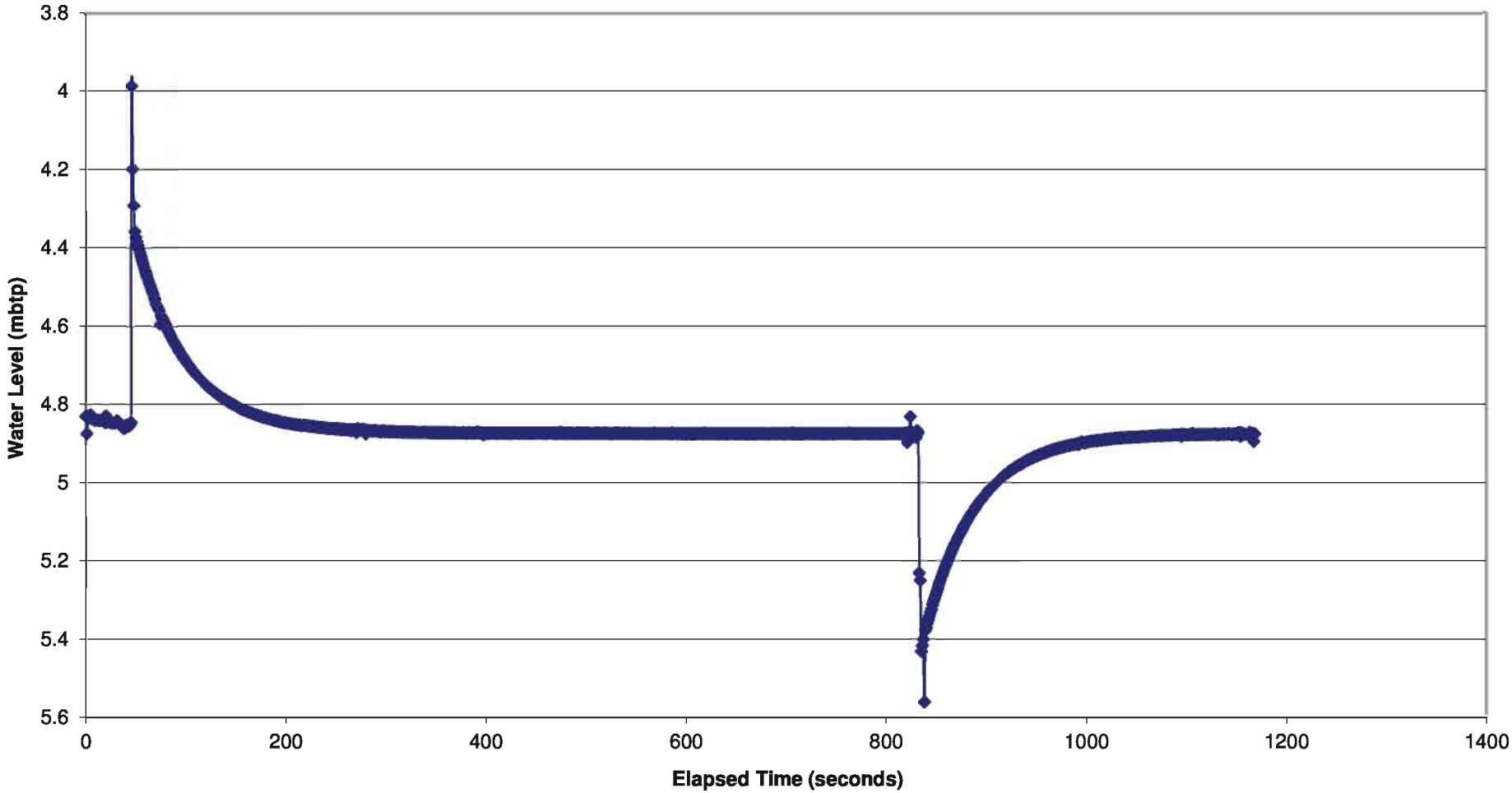
Falling Head Hydraulic Conductivity Analysis at MW-3-1



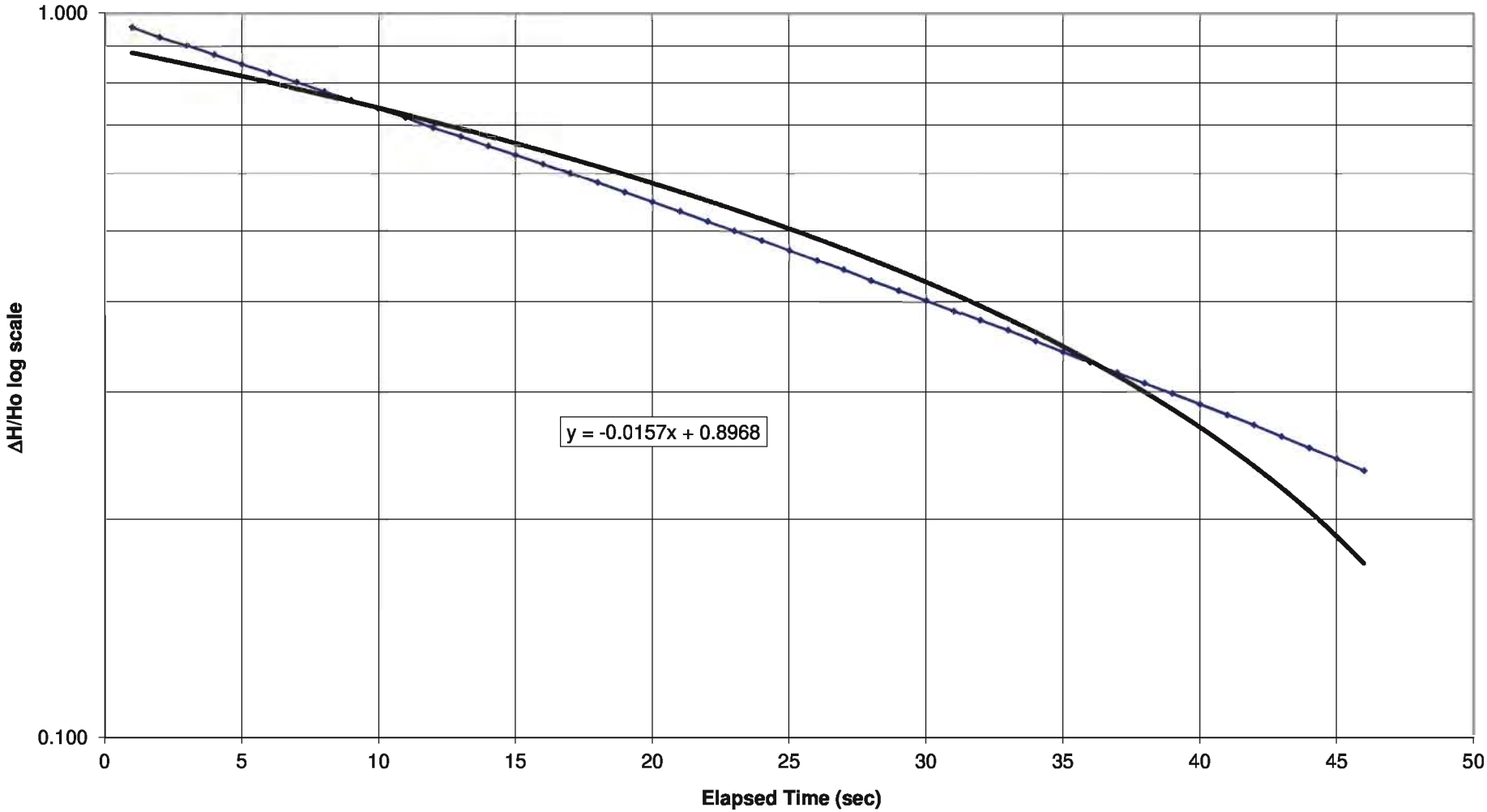
Hydraulic Conductivity Testing at MW-3-1
Hall's Glenn Landfill



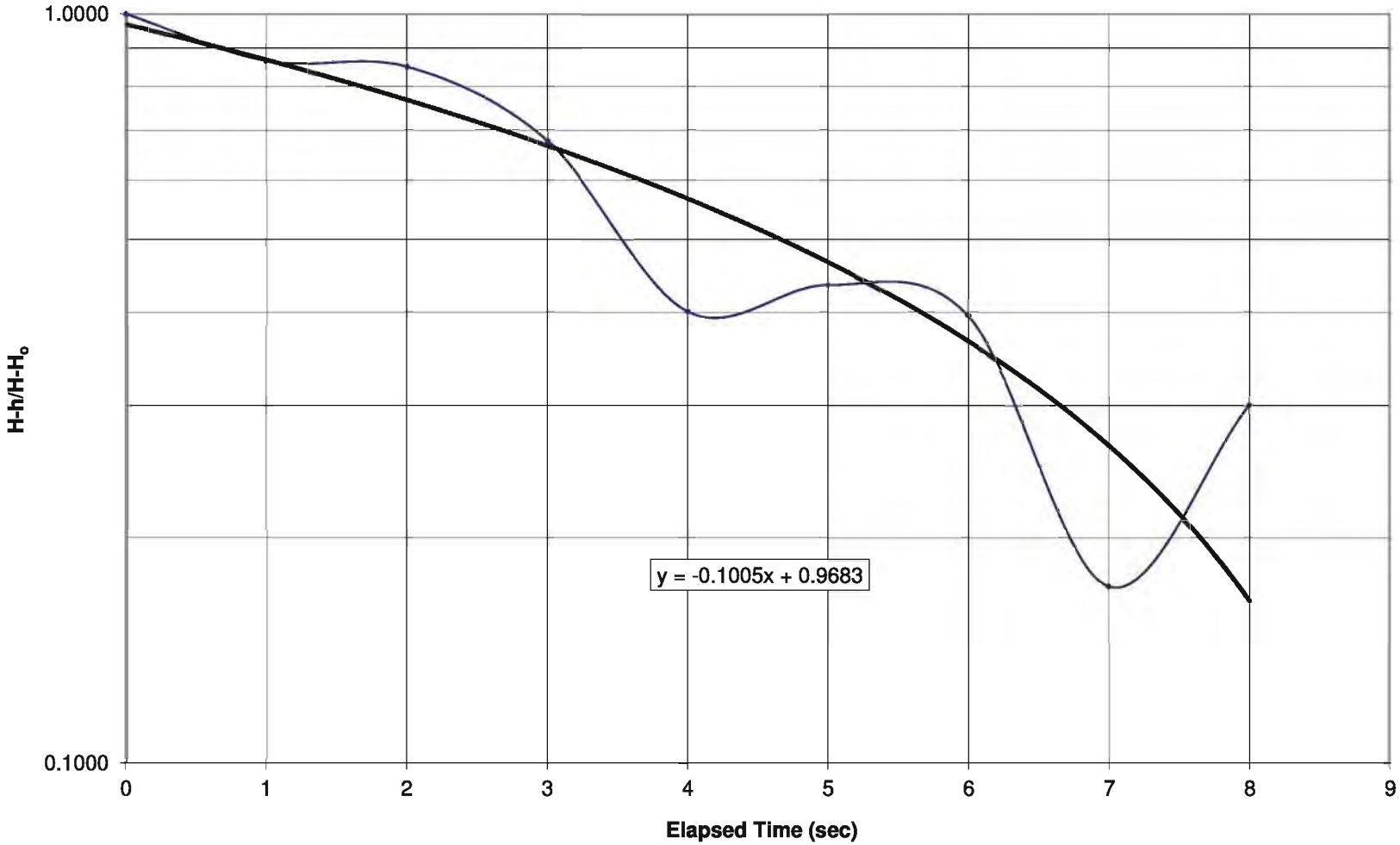
Hydraulic Conductivity Testing at MW-8-1
Hall's Glenn Landfill

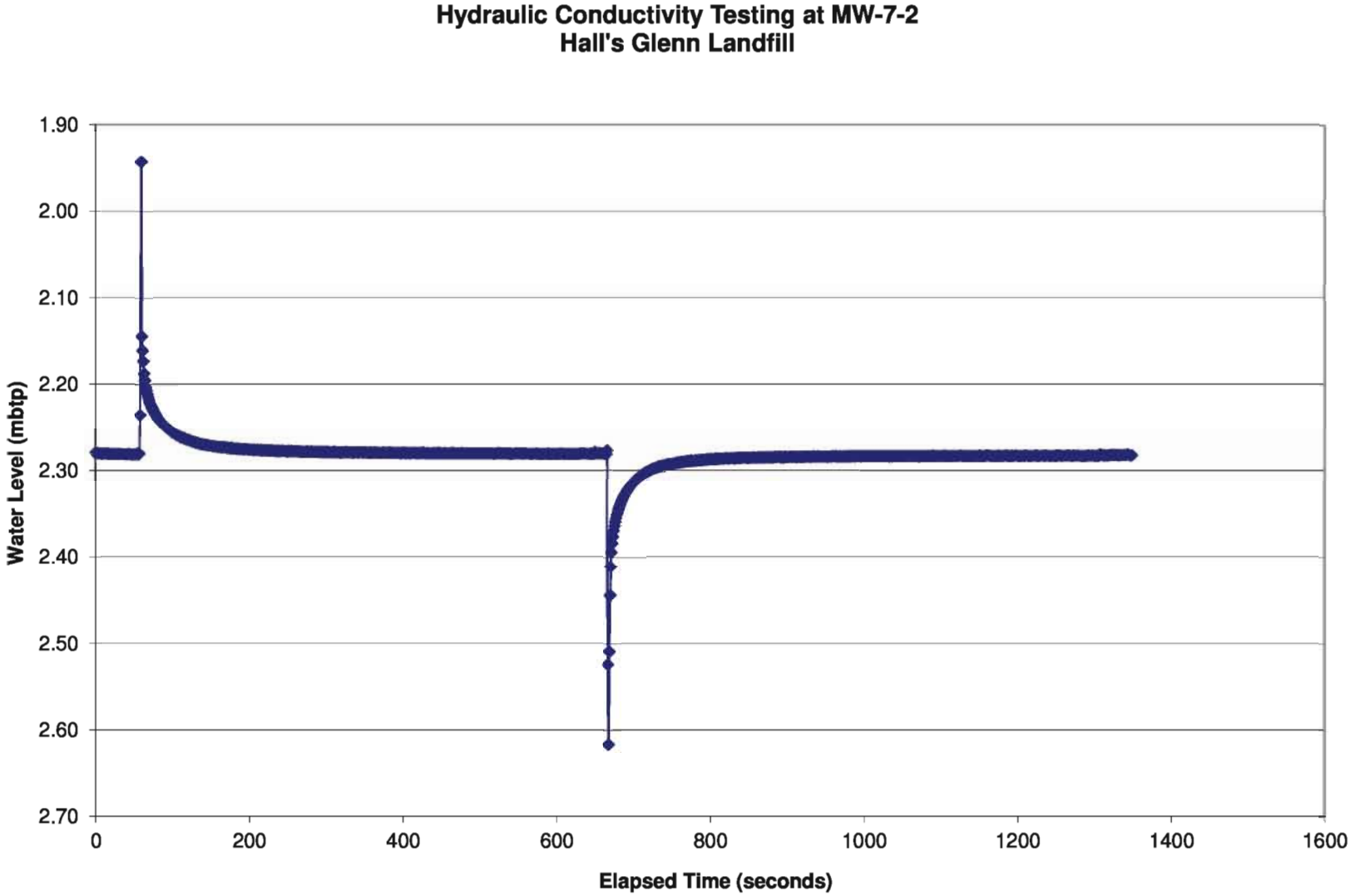


Rising Head Hydraulic Conductivity Analysis at MW-3-1

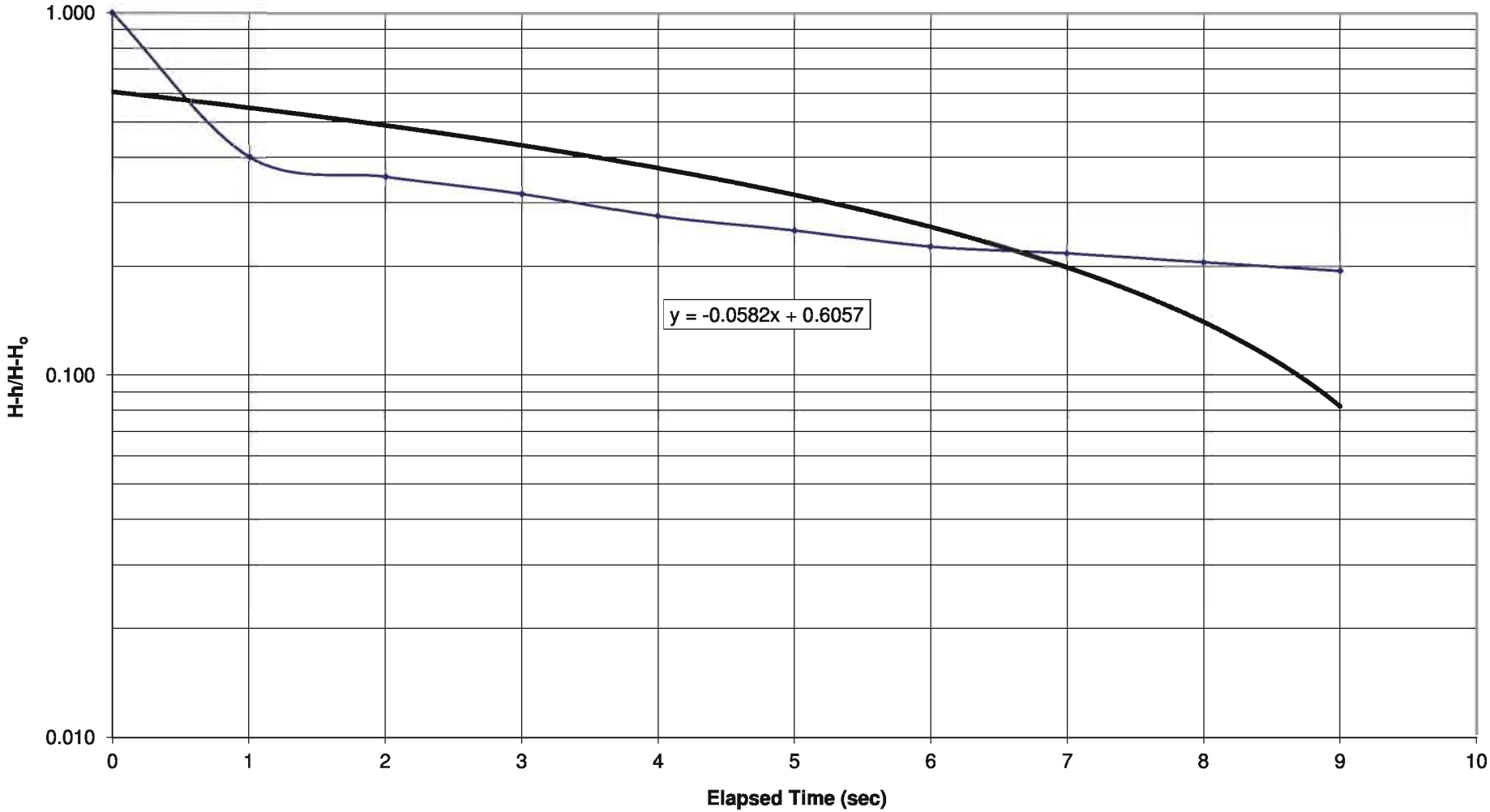


Falling Head Hydraulic Conductivity Analysis at MW-8-2

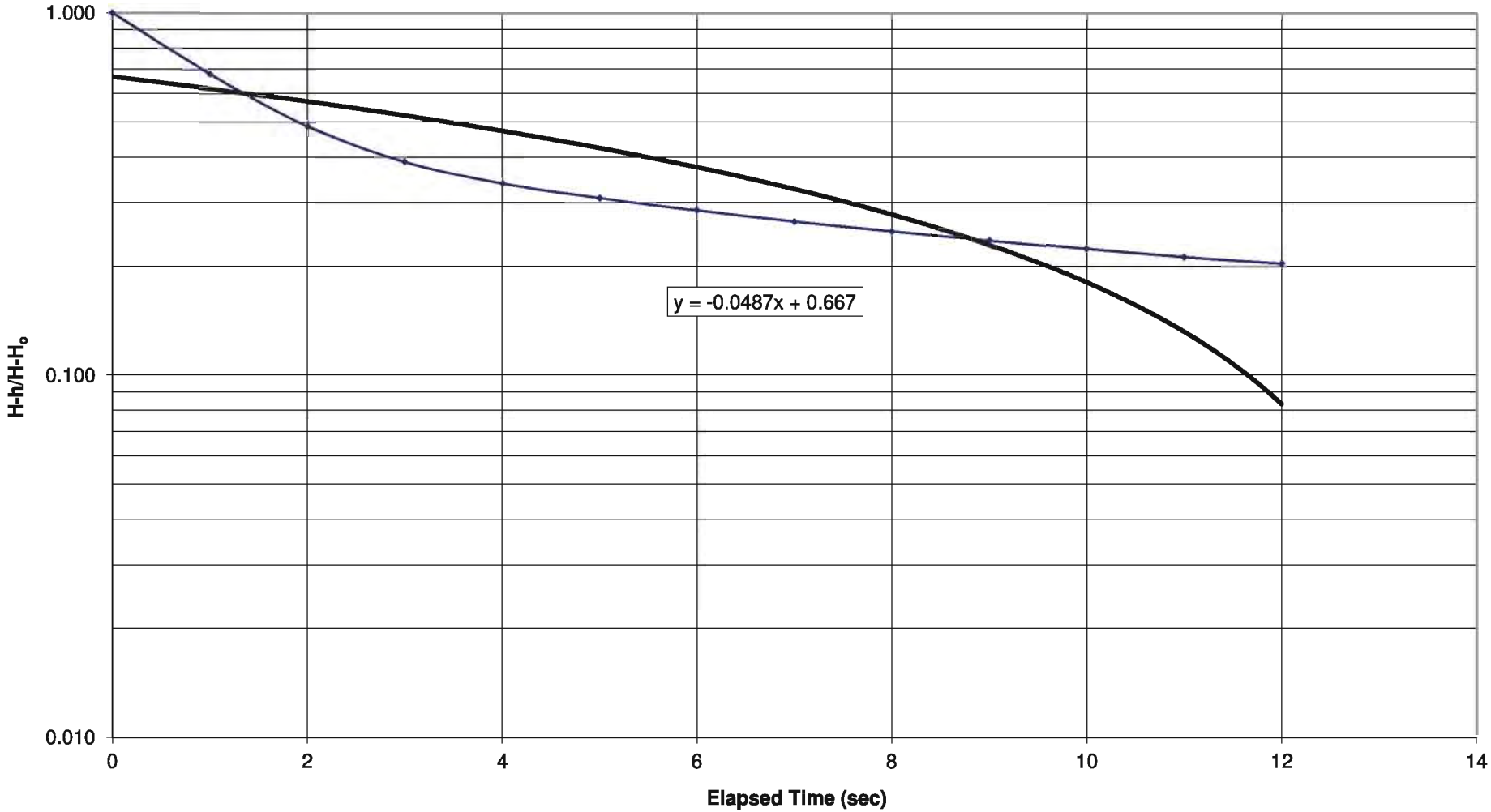



Hydraulic Conductivity Testing at MW-7-2
Hall's Glenn Landfill
Water Level (mbtp)
1.90
2.00
2.10
2.20
2.30
2.40
2.50
2.60
2.70
0
200
400
600
800
1000
1200
1400
1600
Elapsed Time (seconds)

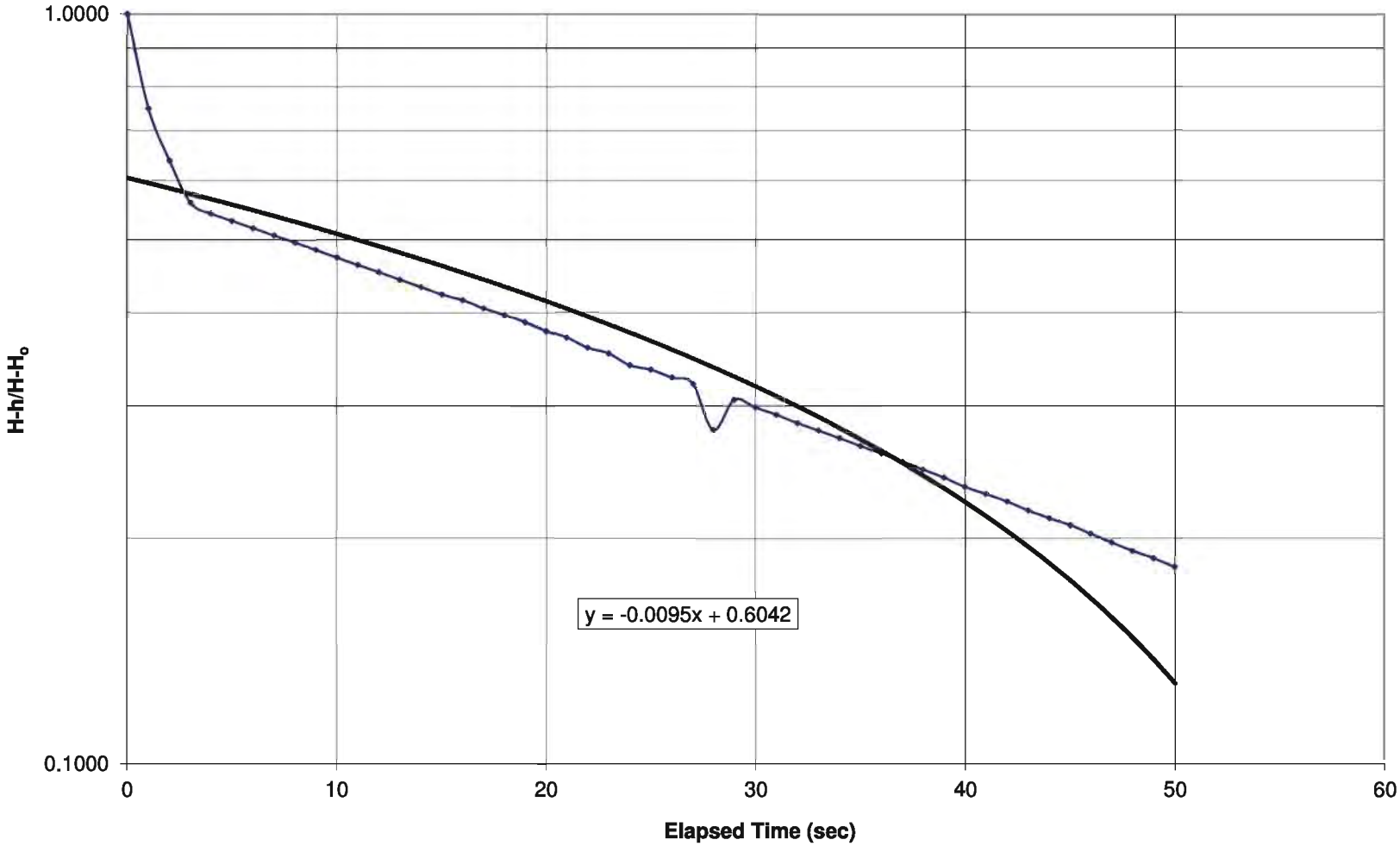
Falling Head Hydraulic Conductivity Analysis at MW-7-2



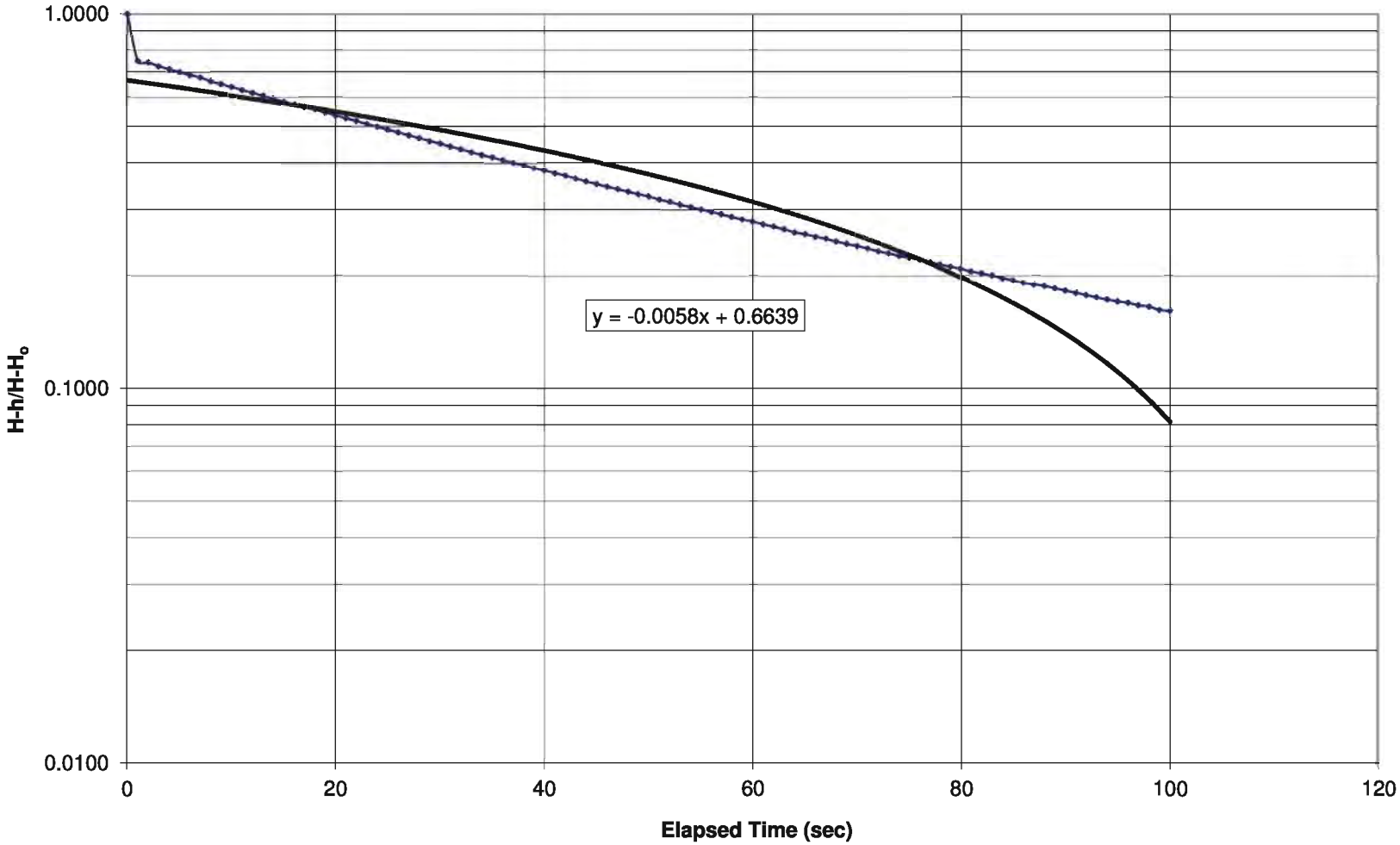
Rising Head Hydraulic Conductivity Analysis at MW-7-2



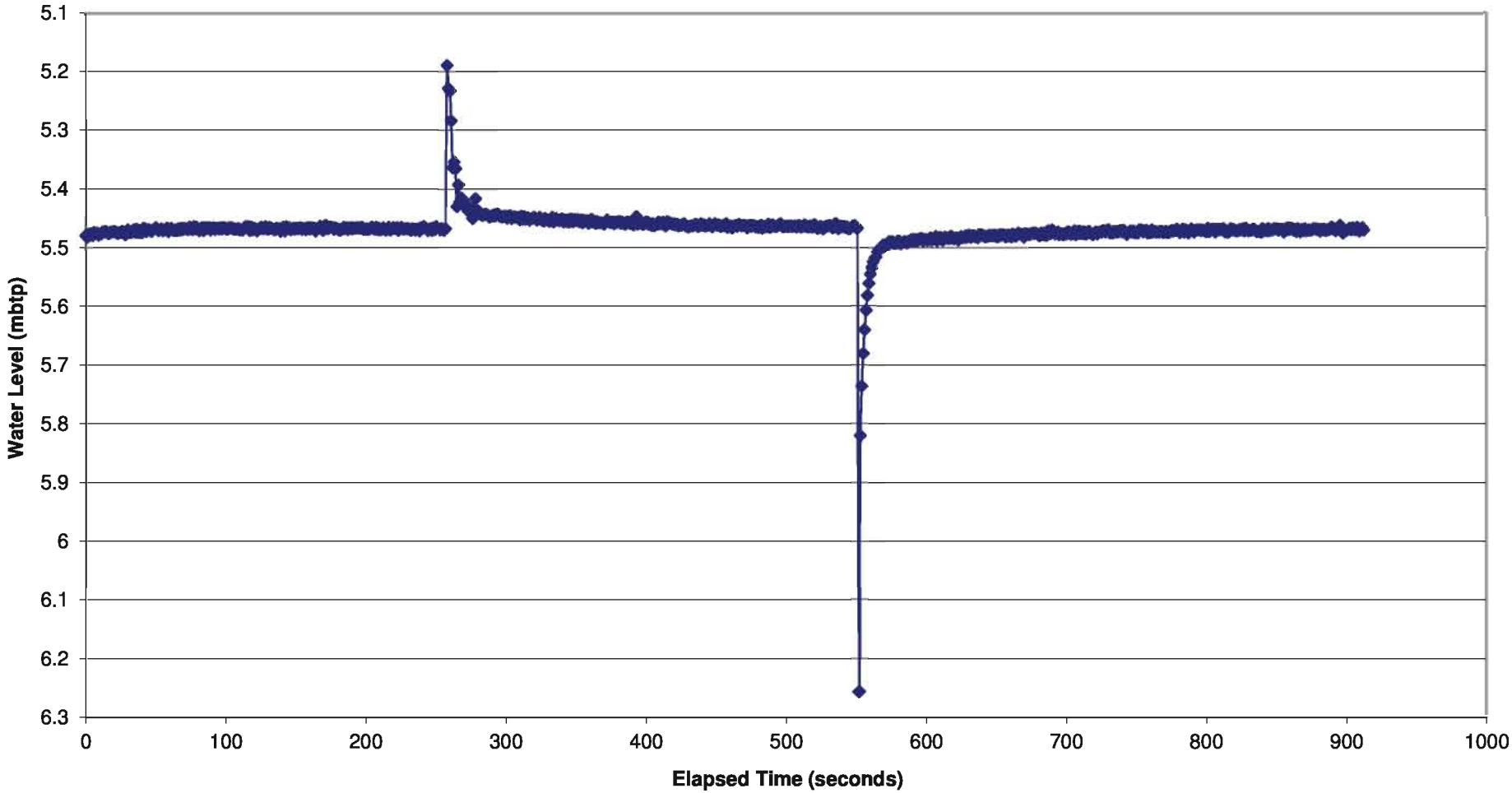
Falling Head Hydraulic Conductivity Analysis at MW-8-1



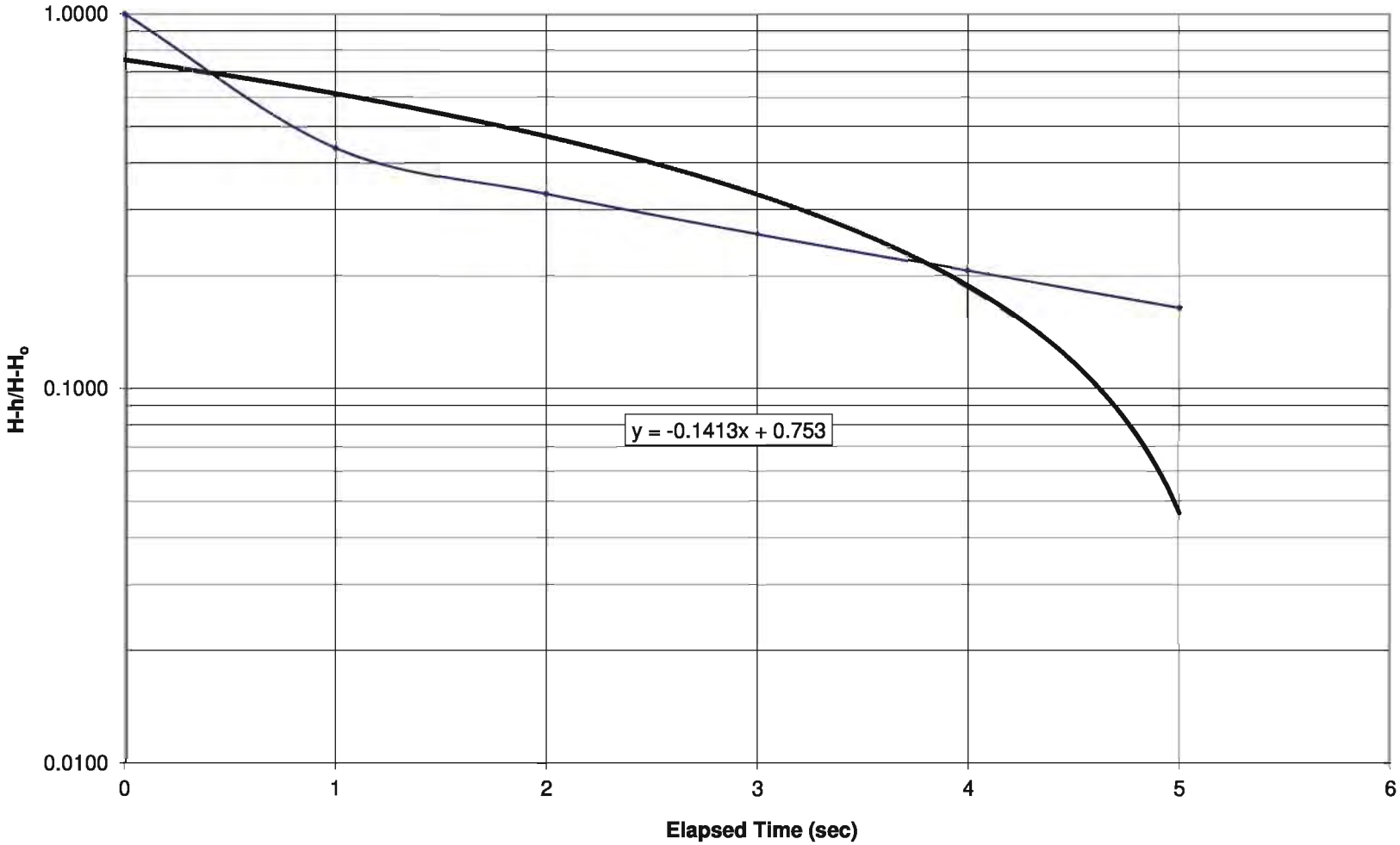
Rising Head Hydraulic Conductivity Analysis at MW-8-1



Hydraulic Conductivity Testing at MW-8-2
Hall's Glenn Landfill



Rising Head Hydraulic Conductivity Analysis at MW-8-2



Appendix E
MOECC Monitoring and Screening Checklist

Appendix D-Monitoring and Screening Checklist
General Information and Instructions

General Information: The checklist is to be completed, and submitted with the Monitoring Report.
Instructions: A complete checklist consists of:
(a) a completed and signed checklist, including any additional pages of information which can be attached as needed to provide further details where indicated.
(b) completed contact information for the Competent Environmental Practitioner (CEP)
(c) self-declaration that CEP(s) meet(s) the qualifications as set out below and in Section 1.2 of the Technical Guidance Document.

Definition of Groundwater CEP:
For groundwater, the CEP must have expertise in hydrogeology and meet one of the following:
(a) the person holds a licence, limited licence or temporary licence under the *Professional Engineers Act*; or
(b) the person holds a certificate of registration under the *Professional Geoscientists Act, 2000* and is a practicing member, temporary, member or limited member of the Association of Professional Geoscientists of Ontario. O. Reg. 66/08, s. 2..
Definition of Surface water CEP:
A CEP for surface water assessments is a scientist, professional engineer or professional geoscientist as described in (a) and (b) above with demonstrated experience and post-secondary education, either a diploma or degree, in hydrology, aquatic ecology, limnology, aquatic biology, physical geography with specialization in surface water, and/or water resource management.

The type of scientific work that a CEP performs must be consistent with that person's education and experience. If an individual has appropriate training and credentials in both groundwater and surface water and is responsible for both areas of expertise, the CEP may then complete and validate both sections of the checklist.

Monitoring Report and Site Information	
Waste Disposal Site Name	Hall's Glenn Landfill Site
Location (e.g. street address, lot, concession)	1951 County Road 6, Part Lot 5, Concession 4, Township of Douro-Dummer (Douro), County of Peterborough
GPS Location (taken within the property boundary at front gate/ front entry)	17 781275E 445174N
Municipality	Township of Douro-Dummer
Client and/or Site Owner	Corporation of the Township of Douro-Dummer
Monitoring Period (Year)	2019
This Monitoring Report is being submitted under the following:	
Environmental Compliance Approval Number:	Provisional Certificate of Approval A341004
Director's Order No.:	N/A
Provincial Officer's Order No.:	N/A
Other:	N/A

Report Submission Frequency	◉ **Annual** ○ **Other**	Specify (Type Here):	
The site is: **(Operation Status)**	○ **Open** ○ **Inactive** ◉ **Closed**		
Does your Site have a Total Approved Capacity?	○ **Yes** ◉ **No**		
If yes, please specify Total Approved Capacity		*Units*	
Does your Site have a Maximum Approved Fill Rate?	○ **Yes** ◉ **No**		
If yes, please specify Maximum Approved Fill Rate		*Units*	
Total Waste Received within Monitoring Period (Year)		*Units*	
Total Waste Received within Monitoring Period (Year) *Methodology*			
Estimated Remaining Capacity		*Units*	
Estimated Remaining Capacity *Methodology*			
Estimated Remaining Capacity *Date Last Determined*	Select Date		
Non-Hazardous Approved Waste Types	☐ Domestic ☐ Industrial, Commercial & Institutional (IC&I) ☐ Source Separated Organics (Green Bin) ☐ Tires	☐ Contaminated Soil ☐ Wood Waste ☐ Blue Box Material ☐ Processed Organics ☐ Leaf and Yard Waste	☐ Food Processing/Preparation Operations Waste ☐ Hauled Sewage Other: Provide any other approved waste types not listed here
Subject Waste Approved Waste Classes: Hazardous & Liquid Industrial *(separate waste classes by comma)*			
Year Site Opened *(enter the Calendar Year only)*	1977	**Current ECA Issue Date**	5-Mar-13
Is your Site required to submit Financial Assurance?	○ **Yes** ◉ **No**		
Describe how your Landfill is designed.	◉ Natural Attenuation only ○ Fully engineered Facility ○ Partially engineered Facility		
Does your Site have an approved Contaminant Attenuation Zone?	○ **Yes** ◉ **No**		

If closed, specify C of A, control or authorizing document closure date:	22-May-96
Has the nature of the operations at the site changed during this monitoring period?	○ **Yes** ◉ **No**
If yes, provide details:	Type Here
Have any measurements been taken since the last reporting period that indicate landfill gas volumes have exceeded the MOE limits for subsurface or adjacent buildings? (i.e. exceeded the LEL for methane)	○ Yes ◉ No

Groundwater WDS Verification:

Based on all available information about the site and site knowledge, it is my opinion that:

Sampling and Monitoring Program Status:

1) The monitoring program continues to effectively characterize site conditions and any groundwater discharges from the site. All monitoring wells are confirmed to be in good condition and are secure:	○ **Yes** ◉ **No**	Monitor R-1
2) All groundwater, leachate and WDS gas sampling and monitoring for the monitoring period being reported on was successfully completed as required by Certificate(s) of Approval or other relevant authorizing/control document (s):	◉ **Yes** ○ **No** ○ **Not Applicable**	If no, list exceptions below or attach information.

Groundwater Sampling Location	**Description/Explanation for change (change in name or location, additions, deletions)**	**Date**
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date

3) a) Is landfill gas being monitored or controlled at the site?	(•) **Yes** ( ) **No**	
If yes to 3(a), please answer the next two questions below.		
b) Have any measurements been taken since the last reporting period that indicate landfill gas is present in the subsurface at levels exceeding criteria established for the site?	( ) **Yes** (•) **No**	
c) Has the sampling and monitoring identified under 3(a) for the monitoring period being reported on was successfully completed in accordance with established protocols, frequencies, locations, and parameters developed as per the Technical Guidance Document:	(•) **Yes** ( ) **No** ( ) **Not Applicable**	If no, list exceptions below or attach additional information.

Groundwater Sampling Location	**Description/Explanation for change (change in name or location, additions, deletions)**	**Date**
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date

4) All field work for groundwater investigations was done in accordance with standard operating procedures as established/outlined per the Technical Guidance Document (including internal/external QA/QC requirements) (Note: A SOP can be from a published source, developed internally by the site owner's consultant, or adopted by the consultant from another organization):	(•) **Yes** ( ) **No**	If no, specify (Type Here):

Sampling and Monitoring Program Results/WDS Conditions and Assessment:

5) The site has an adequate buffer, Contaminant Attenuation Zone (CAZ) and/or contingency plan in place. Design and operational measures, including the size and configuration of any CAZ, are adequate to prevent potential human health impacts and impairment of the environment.	◉ **Yes** ○ **No**	If no, the potential design and operational concerns/exceptions are as follows (Type Here):	
6) The site meets compliance and assessment criteria.	◉ **Yes** ○ **No**	If no, list and explain exceptions (Type Here):	
7) The site continues to perform as anticipated. There have been no unusual trends/ changes in measured leachate and groundwater levels or concentrations.	◉ **Yes** ○ **No**	If no, list exceptions and explain reason for increase/change (Type Here):	
1) Is one or more of the following risk reduction practices in place at the site: ***(a)*** **There is minimal reliance on natural attenuation of leachate due to the presence of an effective waste liner and active leachate collection/ treatment; or** ***(b)*** **There is a predictive monitoring program in-place (modeled indicator concentrations projected over time for key locations); or** ***(c)*** **The site meets the following two conditions (typically achieved after 15 years or longer of site operation):** ***i.*** **The site has developed stable leachate mound(s) and stable leachate plume geometry/concentrations; and** ***ii.*** **Seasonal and annual water levels and water quality fluctuations are well understood.**	◉ **Yes** ○ **No**	**Note which practice(s):**	☐ **(a)** ☐ **(b)** ☒ **(c)**
9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):	◉ **Yes** ○ **No** ○ **Not Applicable**	Monitor R-1 exceeded for Iron. This well is an old dug residential well that has been severely compromised. It has been recommended that the well be abandoned and that a new monitor be constructed in the same area.	

Groundwater CEP Declaration:

I am a licensed professional Engineer or a registered professional geoscientist in Ontario with expertise in hydrogeology, as defined in Appendix D under Instructions. Where additional expertise was needed to evaluate the site monitoring data, I have relied on individuals who I believe to be experts in the relevant discipline, who have co-signed the compliance monitoring report or monitoring program status report, and who have provided evidence to me of their credentials.

I have examined the applicable Certificate of Approval and any other environmental authorizing or control documents that apply to the site. I have read and followed the Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water Technical Guidance Document (MOE, 2010, or as amended), and associated monitoring and sampling guidance documents, as amended from time to time. I have reviewed all of the data collected for the above-referenced site for the monitoring period(s) identified in this checklist. Except as otherwise agreed with the ministry for certain parameters, all of the analytical work has been undertaken by a laboratory which is accredited for the parameters analysed to *ISO/IEC 17025:2005 (E)- General requirements for the competence of testing and calibration laboratories*, or as amended from time to time by the ministry.

If any exceptions or potential concerns have been noted in the questions in the checklist attached to this declaration, it is my opinion that these exceptions and concerns are minor in nature and will be rectified for the next monitoring/reporting period. Where this is not the case, the circumstances concerning the exception or potential concern and my client's proposed action have been documented in writing to the Ministry of the Environment District Manager in a letter from me dated:

1-Mar-19

Recommendations:

Based on my technical review of the monitoring results for the waste disposal site:

○ **No changes to the monitoring program are recommended**	
◉ **The following change(s) to the monitoring program is/are recommended:**	It is recommended that the R-1 monitor be abandoned and a new monitor installed at the same general location.
◉ **No Changes to site design and operation are recommended**	
○ **The following change(s) to the site design and operation is/ are recommended:**	Type Here

Name:	Nyle McIlveen, P.Eng.		
Seal:	Add Image 		
Signature:		**Date:**	22-Mar-20
CEP Contact Information:	Nyle McIlveen, P./Eng.		
Company:	GHD		
Address:	347 Pido Road, Unit 29, Peterborough, Ontario K9J 6X7		
Telephone No.:	(705) 749-3317	Fax No. :	(705) 749-9248
E-mail Address:	nyle.mcilveen@ghd.com		
Co-signers for additional expertise provided:			
Signature:		**Date:**	
Signature:		**Date:**	Select Date

Surface Water WDS Verification:

Provide the name of surface water body/bodies potentially receiving the WDS effluent and the approximate distance to the waterbody (including the nearest surface water body/bodies to the site):

Name (s)	Dummer Lake
Distance(s)	2.5 Km

Based on all available information and site knowledge, it is my opinion that:

Sampling and Monitoring Program Status:

1) The current surface water monitoring program continues to effectively characterize the surface water conditions, and includes data that relates upstream/background and downstream receiving water conditions:	(•) Yes ( ) No	If no, identify issues (Type Here):
2) All surface water sampling for the monitoring period being reported was successfully completed in accordance with the Certificate(s) of Approval or relevant authorizing/control document(s) (if applicable):	(•) Yes ( ) No ( ) **Not applicable (No C of A, authorizing / control document applies)**	If no, specify below or provide details in an attachment.

Surface Water Sampling Location	Description/Explanation for change (change in name or location, additions, deletions)	Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date

3) a) Some or all surface water sampling and monitoring program requirements for the monitoring period have been established outside of a ministry C of A or authorizing/control document.	◉ **Yes** ○ **No** ○ **Not Applicable**	
b) If yes, all surface water sampling and monitoring identified under 3 (a) was successfully completed in accordance with the established program from the site, including sampling protocols, frequencies, locations and parameters) as developed per the Technical Guidance Document:	◉ **Yes** ○ **No** ○ **Not Applicable**	If no, specify below or provide details in an attachment.

Surface Water Sampling Location	**Description/Explanation for change (change in name or location, additions, deletions)**	**Date**
S-2	S-2 is a background surface water location that was established in 2014.	7-May-14
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date

4) All field work for surface water investigations was done in accordance with standard operating procedures, including internal/external QA/QC requirements, as established/outlined as per the Technical Guidance Document, MOE 2010, or as amended. (Note: A SOP can be from a published source, developed internally by the site owner's consultant, or adopted by the consultant from another organization):	◉ **Yes** ○ **No**	If no, specify (Type Here):

Sampling and Monitoring Program Results/WDS Conditions and Assessment:

5) The receiving water body meets surface water-related compliance criteria and assessment criteria: i.e., there are no exceedances of criteria, based on MOE legislation, regulations, Water Management Policies, Guidelines and Provincial Water Quality Objectives and other assessment criteria (e.g., CWQGs, APVs), as noted in Table A or Table B in the Technical Guidance Document (Section 4.6):	◉ **Yes** ○ **No**

If no, list parameters that exceed criteria outlined above and the amount/percentage of the exceedance as per the table below or provide details in an attachment:

Parameter	Compliance or Assessment Criteria or Background	Amount by which Compliance or Assessment Criteria or Background Exceeded
e.g. Nickel	e.g. C of A limit, PWQO, background	e.g. X% above PWQO
Type Here	Type Here	Type Here
Type Here	Type Here	Type Here
Type Here	Type Here	Type Here
Type Here	Type Here	Type Here
6) In my opinion, any exceedances listed in Question 5 are the result of non-WDS related influences (such as background, road salting, sampling site conditions)?	○ **Yes** ○ **No**	If yes, specify (Type Here)

7) All monitoring program surface water parameter concentrations fall within a stable or decreasing trend. The site is not characterized by historical ranges of concentrations above assessment and compliance criteria.	○ **Yes** ◉ **No**	Surface Monitor S-1 exceeded for iron and manganese in the fall sampling. There was very minimal water for sampling at this location. In the past when the surface water at this location at this location was stagnant and / or very minimal (generally in the fall), there have been exceedances similar to this year. We
8) For the monitoring program parameters, does the water quality in the groundwater zones adjacent to surface water receivers exceed assessment or compliance criteria (e.g., PWQOs, CWQGs, or toxicity values for aquatic biota (APVs)):	○ Yes ◉ No ○ Not Known ○ Not Applicable	Monitor R-1 exceeded for Iron. This well is an old dug residential well that has been severely compromised. It has been recommended that the well be abandoned and that a new monitor be constructed in the same area,
9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):	○ **Yes** ◉ **No** ○ **Not Applicable**	If yes, list value(s) that are/have been exceeded and follow-up action taken (Type Here)

Surface Water CEP Declaration:

I, the undersigned hereby declare that I am a Competent Environmental Practitioner as defined in Appendix D under Instructions, holding the necessary level of experience and education to design surface water monitoring and sampling programs, conduct appropriate surface water investigations and interpret the related data as it pertains to the site for this monitoring period.

I have examined the applicable Certificate of Approval and any other environmental authorizing or control documents that apply to the site. I have read and followed the Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water Technical Guidance Document (MOE, 2010, or as amended) and associated monitoring and sampling guidance documents, as amended from time to time. I have reviewed all of the data collected for the above-referenced site for the monitoring period(s) identified in this checklist. Except as otherwise agreed with the ministry for certain parameters, all of the analytical work has been undertaken by a laboratory which is accredited for the parameters analysed to *ISO/IEC 17025:2005 (E)- General requirements for the competence of testing and calibration laboratories,* or as amended from time to time by the ministry.

If any exceptions or potential concerns have been noted in the questions in the checklist attached to this declaration, it is my opinion that these exceptions and concerns are minor in nature or will be rectified for future monitoring events. Where this is not the case, the circumstances concerning the exception or potential concern and my client's proposed action have been documented in writing to the Ministry of the Environment District Manager in a letter from me dated:

Select Date

Recommendations:

Based on my technical review of the monitoring results for the waste disposal site:

◉ **No Changes to the monitoring program are recommended**	Type Here
○ **The following change(s) to the monitoring program is/are recommended:**	
○ **No changes to the site design and operation are recommended**	Monitor R-2 should be decommissioned and a new monitor be installed in the same area.
◉ **The following change(s) to the site design and operation is/are recommended:**	

CEP Signature	
Relevant Discipline	Civil engineering, hydrogeology
Date:	22-Mar-20
CEP Contact Information:	Nyle McIlveen, P.Eng.
Company:	GHD
Address:	347 Pido Road, Unit 29, Peterborough, Ontario K9J 6X7
Telephone No.:	(705) 749-3317
Fax No. :	(705) 749-9248
E-mail Address:	nyle.mcilveen@ghd.com
Save As	**Print Form**