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# **FIVE PERIOD TECHNICAL REPORT**

## **FIRST HALF 2009 THROUGH FIRST HALF 2011**

**FRIENDS RECYCLING  
(FKA Big D Roofing, Inc.)  
2350 NW 27<sup>th</sup> Avenue  
Ocala, Marion County, Florida**

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### **PREPARED FOR:**

Florida Department of Environmental Protection  
Central District  
3319 Maguire Blvd., Suite 232  
Orlando, Florida 32803-3767

### **PREPARED BY:**

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Registration No. 55311  
Certificate of Authorization No. 8692

February 28, 2011



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Florida Department of Environmental Protection  
3319 Maguire Boulevard, Suite 232  
Orlando, FL 32803-3767

Attention: Ms. Gloria Jean DePradine

RE: Five Period Technical Report for the First Half of 2009 through the First Half of 2011  
Friends Recycling C&D Landfill  
Ocala, Marion County, Florida  
Permit No.: SO42-0019600-007

Dear Ms. DePradine:

Enviro-Technologies, Inc. (ETI) has completed the five period technical groundwater monitoring report of the first half of 2009 through the first half of 2011 for the Friends Recycling C&D Landfill located in Ocala, Marion County, Florida.

## **INTRODUCTION**

The groundwater monitoring program for this site consists of groundwater sampling activities on Monitoring Wells: MW-1, MW-5, MW-6, MW-7, MW-8, and MW-9S. Information about the individual wells is provided in the Appendix of this report. To operate the Friends Recycling C&D Landfill, the conditions of the permit require that the following tasks must be performed as part of the five period technical report monitoring program:

- A. Tabular and graphical displays of any data that shows that a monitoring parameter has been detected, including hydrographs for all monitoring wells.
- B. Trend analyses of any monitoring parameters detected.
- C. Comparisons among shallow, middle, and deep zone wells.
- D. Comparison between upgradient and downgradient wells
- E. Correlation between related parameters such as total dissolved solids and specific conductance.
- F. Discussion of erratic and/or poorly correlated data.
- G. An interpretation of the groundwater contour maps, including an evaluation of groundwater flow rates.
- H. An evaluation of the adequacy of the water quality monitoring frequency and sampling locations based upon site conditions

## **TABULAR AND GRAPHICAL DATA**

Tables and graphs of detected parameters have been prepared and are presented in the Appendix. The tables and graphs summarize the data collected for the past five periods. These parameters include: groundwater elevation, groundwater temperature, chloride, nitrate, sulfate, total dissolved solids (TDS), iron, sodium, pH, dissolved oxygen, turbidity, and specific conductance. During the past five periods between the first half of 2009 and the first half of 2011, exceedances above the MCL's were noted for Ammonia as N, Total Arsenic, Iron, Nitrate as N, Sulfate, TDS, and Aluminum only.

## TREND ANALYSIS

During the five periods from the first half of 2009 to the first half of 2011, detectable levels of the following parameters were noted with the following trends:

Parameter	MW-1	MW-5	MW-6	MW-7	MW-8	MW-9S
Aluminum - Total	N	N	N	N	N	N
Ammonia as N	N	N	N	N	N	N
Arsenic - Total	N	N	N	N	N	N
Benzene	N	N	N	N	N	N
Bicarbonate as CaCO <sub>3</sub>	N	N	N	N	N	N
Chloride	N	N	N	N	U	U
Chloromethane	N	N	N	N	N	N
cis-1,2-Dichloroethene	N	N	N	N	N	N
Dissolved Oxygen	N	N	N	N	N	D
Iron - Total	N	N	N	N	N	N
Lead - Total	N	N	N	N	N	N
Mercury - Total	N	N	N	N	N	N
Nitrate as N	N	N	N	N	N	N
Nitrate/Nitrite as N	N	N	N	N	N	N
pH	N	N	N	N	N	N
Phenolics	N	N	N	N	N	N
Sodium - Total	N	N	N	N	N	N
Specific Conductance (EC)	N	N	N	N	N	N
Sulfate	N	N	N	N	N	N
Temperature	D	N	N	N	N	N
Thallium - Total	N	N	N	N	N	N
Tetrachloroethene	N	N	N	N	N	N
Total Alkalinity	N	N	N	N	N	N
Total Dissolved Solids	N	N	N	U	U	U
Trichloroethene	N	N	N	N	N	N
Turbidity	N	N	N	N	N	N
Vanadium - Total	N	N	N	N	N	N
Water Elevation	N	N	N	N	N	N

Notes: D - indicates downward trend

U - indicates upward trend

N - indicates no definitive trend



## **COMPARISONS AMONG SHALLOW, MIDDLE, AND DEEP WELL ZONES**

The Friends Recycling facility is located in the northwestern portion of the City of Ocala in Marion County, Florida. All monitoring wells at this site are between twenty-nine and fifty feet deep and extend directly into the Floridan aquifer, which is considered a deep well zone. There are no shallow or middle well zones in the area. Therefore, no comparisons of the well zones can be made.

## **COMPARISON BETWEEN UP-GRADIENT AND DOWN-GRADIENT WELLS**

A slight downward trend in temperature noted in background well MW-1 did not appear to have a definitive correlation to the parameters noted in compliance wells MW-5, MW-6, MW-7, MW-8, and MW-9S. Variations in arsenic concentrations in MW-5 and MW-8 appeared to increase and decrease in correlation with background well MW-1. Variations in groundwater elevations appeared to correspond between MW-1 and the other wells. Other trends noted in the various compliance wells appeared to have no correlation to the background well MW-1.

## **CORRELATION BETWEEN RELATED PARAMETERS SUCH AS TOTAL DISSOLVED SOLIDS AND SPECIFIC CONDUCTANCE**

There appears to be a correlation between concentration levels of sodium, turbidity, and specific conductance, and total dissolved solids in MW-1 and MW-7 respectively. There also appears to be a correlation between concentration levels sodium and chloride in MW-8.

## **DISCUSSION OF ERRATIC AND/OR POORLY CORRELATED DATA**

There were no significant instances of erratic or poorly correlated data for the period of evaluation.

## **INTERPRETATION OF THE GROUNDWATER CONTOUR MAPS, INCLUDING EVALUATION OF GROUNDWATER FLOW RATES**

The groundwater flow regime has remained consistent through the period of evaluation except for a directional flow reversal during the second half of 2010 and the first half of 2011. Groundwater contour maps for the five periods are presented in the Appendix. Groundwater elevations appear to fluctuate similarly at all monitoring locations. However, there appears to be a greater change in groundwater elevations between MW-9S and MW-7 which allows a trough condition to be formed between these two wells during drought conditions and a ridge condition to be formed during periods of heavy rainfall, thus causing a localized flow reversal situation.

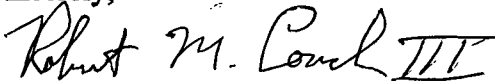
## **EVALUATION OF THE ADEQUACY OF THE WATER QUALITY MONITORING FREQUENCY AND SAMPLING LOCATIONS BASED UPON SITE CONDITIONS**

Based on this review and evaluation, we do not recommend any revisions to the monitoring frequency at this time. The change in the groundwater flow patterns since the implementation of the groundwater monitoring program appear to be fairly consistent with the existing monitoring well layout. Based on the groundwater flow study for the Cross-Florida Barge Canal performed in the 1960's, the flow direction is expected to return to an east-southeasterly direction within the next few monitoring periods. There have been relatively few exceedances in parameters monitored and those exceedances noted could be more reflective of the monitored formation characteristics and background conditions. Therefore no changes to the monitoring locations are recommended at this time.

### **CLOSURE**

Thank you for the opportunity to provide consulting services to the Friends Recycling C&D Landfill. If you have any questions or comments about this report, please feel free to contact me at (352) 694-1799.

Sincerely,



Robert M. Couch III, P.E.  
President  
ENVIRO-TECH, Inc.

Cc: Gloria Jean DePradine- Florida Department of Environmental Protection

# **APPENDIX**

# **TABLES**

Parameter	MW-1	1st Half 2009	2nd Half 2009	1st Half 2010	2nd Half 2010	1st Half 2011
Aluminum - Total (mg/L)	MW-1	0	0	101	0	0
Ammonia as N (mg/L)	MW-1	2.8	3.1	5.7	4.5	3
Arsenic - Total (ug/L)	MW-1	16.8	6.72	19.6	10.4	23.2
Benzene (ug/L)	MW-1	0	0	0	0	0
Bicarbonate as CaCO3 (mg/L)	MW-1	0	0	0	0	0
Chloride (mg/L)	MW-1	29	31	41	28	25
Chloromethane (ug/L)	MW-1	0	0	0	0	0
cis-1,2-Dichloroethene (ug/L)	MW-1	0	0	0	0	0
Dissolved Oxygen (mg/L)	MW-1	0.15	0.29	0.32	0.24	0.24
Iron - Total (ug/L)	MW-1	6230	5650	9850	5950	6390
Copper - Total (ug/L)	MW-1	0	0	0	0	0
Lead - Total (ug/L)	MW-1	0	0	0	0	0
Mercury - Total (ug/L)	MW-1	0	0	0	0	0
Nickel - Total (ug/L)	MW-1	0	0	0	0	0
Nitrate as N	MW-1	0.051	0.93	0.14	0	0.18
Nitrate/Nitrite as N	MW-1	0.051	0	0	0	0
pH (pH Units)	MW-1	6.5	6.45	6.4	6.48	6.53
Phenolics (ug/L)	MW-1	0	0	0	0	0
Sodium - Total (mg/L)	MW-1	38.1	65.4	78	53.5	33.6
Specific Conductance (uS/cm)	MW-1	1407	2119	2202	1717	1336
Sulfate (mg/L)	MW-1	230	660	710	0	0
Temperature (°C)	MW-1	26.46	26.29	26.2	25	24.37
Thallium - Total (ug/L)	MW-1	0	0.334	1.19	0.595	0.507
Tetrachloroethene (ug/L)	MW-1	0	0	0	0	0
Total Alkalinity (mg/L)	MW-1	0	0	0	0	0
Total Dissolved Solids (mg/L)	MW-1	946	1600	1800	1300	840
Trichloroethene (ug/L)	MW-1	0	0	0	0	0
Turbidity (NTUs)	MW-1	2.4	3	5.8	4.6	4.8
Vanadium - Total (ug/L)	MW-1	0	0	1.74	0	0
Water Elevation (ft)	MW-1	40.63	41.39	41.17	43.16	41

Parameter	MW-5	2009 1st Half	2009 2nd Half	2010 1st Half	2010 2nd Half	2011 1st Half
Aluminum - Total (mg/L)	MW-5	0	0	0	0	0
Ammonia as N (mg/L)	MW-5	0.78	1.1	0.84	1.1	0.76
Arsenic - Total (ug/L)	MW-5	4.43	6.63	8.08	5.42	6.17
Benzene (ug/L)	MW-5	0	0	0	0	0
Bicarbonate as CaCO3 (mg/L)	MW-5	480	0	0	0	0
Chloride (mg/L)	MW-5	7.4	7.2	7.4	8.9	8.5
Chloromethane (ug/L)	MW-5	0	0	0	0	0
cis-1,2-Dichloroethene (ug/L)	MW-5	0	0	0	0	0
Dissolved Oxygen (mg/L)	MW-5	0.13	0.31	0.2	0.15	0.84
Iron - Total (ug/L)	MW-5	10000	9030	9130	9940	9470
Copper - Total (ug/L)	MW-5	0	0	0	0	0
Lead - Total (ug/L)	MW-5	0	0	0	0	0
Mercury - Total (ug/L)	MW-5	0	0	0	0	0
Nickel - Total (ug/L)	MW-5	19.5	0	0	0	0
Nitrate as N	MW-5	0.007	0	0	0	0.18
Nitrate/Nitrite as N	MW-5	0.004	0	0	0	0
pH (pH Units)	MW-5	6.5	6.57	6.51	6.56	6.6
Phenolics (ug/L)	MW-5	0	0	0	10	0
Sodium - Total (mg/L)	MW-5	5.19	6.91	5.57	5.45	4.55
Specific Conductance (uS/cm)	MW-5	929	1015	882	928	920
Sulfate (mg/L)	MW-5	0	24	12	22	9.9
Temperature (°C)	MW-5	23.72	23.89	24.02	24.05	23.14
Thallium - Total (ug/L)	MW-5	0	0	0	0	0
Tetrachloroethene (ug/L)	MW-5	0	0	0	0	0
Total Alkalinity (mg/L)	MW-5	480	0	0	0	0
Total Dissolved Solids (mg/L)	MW-5	510	580	550	540	490
Trichloroethene (ug/L)	MW-5	0	0	0	0	0
Turbidity (NTUs)	MW-5	2.3	2.8	2.4	1.3	2.2
Vanadium - Total (ug/L)	MW-5	0	0	0	0	0
Water Elevation (ft)	MW-5	40.43	41.41	40.97	43.02	40.87

Parameter	MW-6	2009 1st Half	2009 2nd Half	2010 1st Half	2010 2nd Half	2011 1st Half
Aluminum - Total (mg/L)	MW-6	0	0	0	220	0
Ammonia as N (mg/L)	MW-6	0	0	0	0	0
Arsenic - Total (ug/L)	MW-6	0	0	0	0	0
Benzene (ug/L)	MW-6	0	0	0	0	0
Bicarbonate as CaCO3 (mg/L)	MW-6	280	0	0	0	0
Chloride (mg/L)	MW-6	5.2	3.9	3.9	3	5.3
Chloromethane (ug/L)	MW-6	0	0	0	0.55	0
cis-1,2-Dichloroethene (ug/L)	MW-6	0	0	0	0	0
Dissolved Oxygen (mg/L)	MW-6	2.9	0.68	0.98	1.53	1.62
Iron - Total (ug/L)	MW-6	0	0	0	39.6	0
Copper - Total (ug/L)	MW-6	6.94	0	0	0	0
Lead - Total (ug/L)	MW-6	0	0	0	0	0
Mercury - Total (ug/L)	MW-6	0.221	0.259	0	0.033	0
Nickel - Total (ug/L)	MW-6	0	0	0	0	0
Nitrate as N	MW-6	2.1	2.8	2.1	1.2	1.6
Nitrate/Nitrite as N	MW-6	2.1	0	0	0	0
pH (pH Units)	MW-6	6.85	6.68	6.59	6.95	6.77
Phenolics (ug/L)	MW-6	0	0	0	0	0
Sodium - Total (mg/L)	MW-6	6.75	8.11	8.26	7.82	5.98
Specific Conductance (uS/cm)	MW-6	620	836	705	711	730
Sulfate (mg/L)	MW-6	0	66	50	35	28
Temperature (°C)	MW-6	33.78	24.29	24.5	24	22.5
Thallium - Total (ug/L)	MW-6	0	0	0	0	0
Tetrachloroethene (ug/L)	MW-6	0	0	0	0	0
Total Alkalinity (mg/L)	MW-6	280	0	0	0	0
Total Dissolved Solids (mg/L)	MW-6	354	500	460	400	400
Trichloroethene (ug/L)	MW-6	0	0	0	0	0
Turbidity (NTUs)	MW-6	4.7	4.4	2.8	6.3	2.6
Vanadium - Total (ug/L)	MW-6	0	2.14	3.15	2.78	1.77
Water Elevation (ft)	MW-6	40.76	41.36	41.24	43.15	40.93

Parameter	MW-7	2009 1st Half	2009 2nd Half	2010 1st Half	2010 2nd Half	2011 1st Half
Aluminum - Total (mg/L)	MW-7	0	258	345	0	417
Ammonia as N (mg/L)	MW-7	0	0	0	0.015	0
Arsenic - Total (ug/L)	MW-7	0	0	0	0	0
Benzene (ug/L)	MW-7	0	0	0	0	0
Bicarbonate as CaCO3 (mg/L)	MW-7	410	0	0	0	0
Chloride (mg/L)	MW-7	11	9.5	9.8	9.6	12
Chloromethane (ug/L)	MW-7	0	0	0	0.58	0
cis-1,2-Dichloroethene (ug/L)	MW-7	0	0	0	0	0.44
Dissolved Oxygen (mg/L)	MW-7	0.15	0.36	0.27	0.17	1.49
Iron - Total (ug/L)	MW-7	0	256	370	0	309
Copper - Total (ug/L)	MW-7	0	0	0	0	0
Lead - Total (ug/L)	MW-7	0	0	0	0	0
Mercury - Total (ug/L)	MW-7	0.046	0.0621	0.3	0.0928	0.286
Nickel - Total (ug/L)	MW-7	0	0	0	0	0
Nitrate as N	MW-7	15	13	14	6.1	8.6
Nitrate/Nitrite as N	MW-7	15	0	0	0	0
pH (pH Units)	MW-7	6.42	6.53	6.45	6.37	6.49
Phenolics (ug/L)	MW-7	0	0	0	0	0
Sodium - Total (mg/L)	MW-7	12.4	12.3	12.2	11.4	11.9
Specific Conductance (uS/cm)	MW-7	971	1023	958	950	968
Sulfate (mg/L)	MW-7	0	33	30	29	57
Temperature (°C)	MW-7	24.61	25.12	24.79	25.14	23.45
Thallium - Total (ug/L)	MW-7	0	0.292	0.573	0.484	0.53
Tetrachloroethene (ug/L)	MW-7	0	0	0	0	0
Total Alkalinity (mg/L)	MW-7	410	0	0	0	0
Total Dissolved Solids (mg/L)	MW-7	604	610	640	580	580
Trichloroethene (ug/L)	MW-7	0	0	0	0	0
Turbidity (NTUs)	MW-7	0.6	5.7	9.9	2.3	5.2
Vanadium - Total (ug/L)	MW-7	12.3	15.5	16.6	12.9	14.7
Water Elevation (ft)	MW-7	40.57	40.08	39.94	41.86	39.15

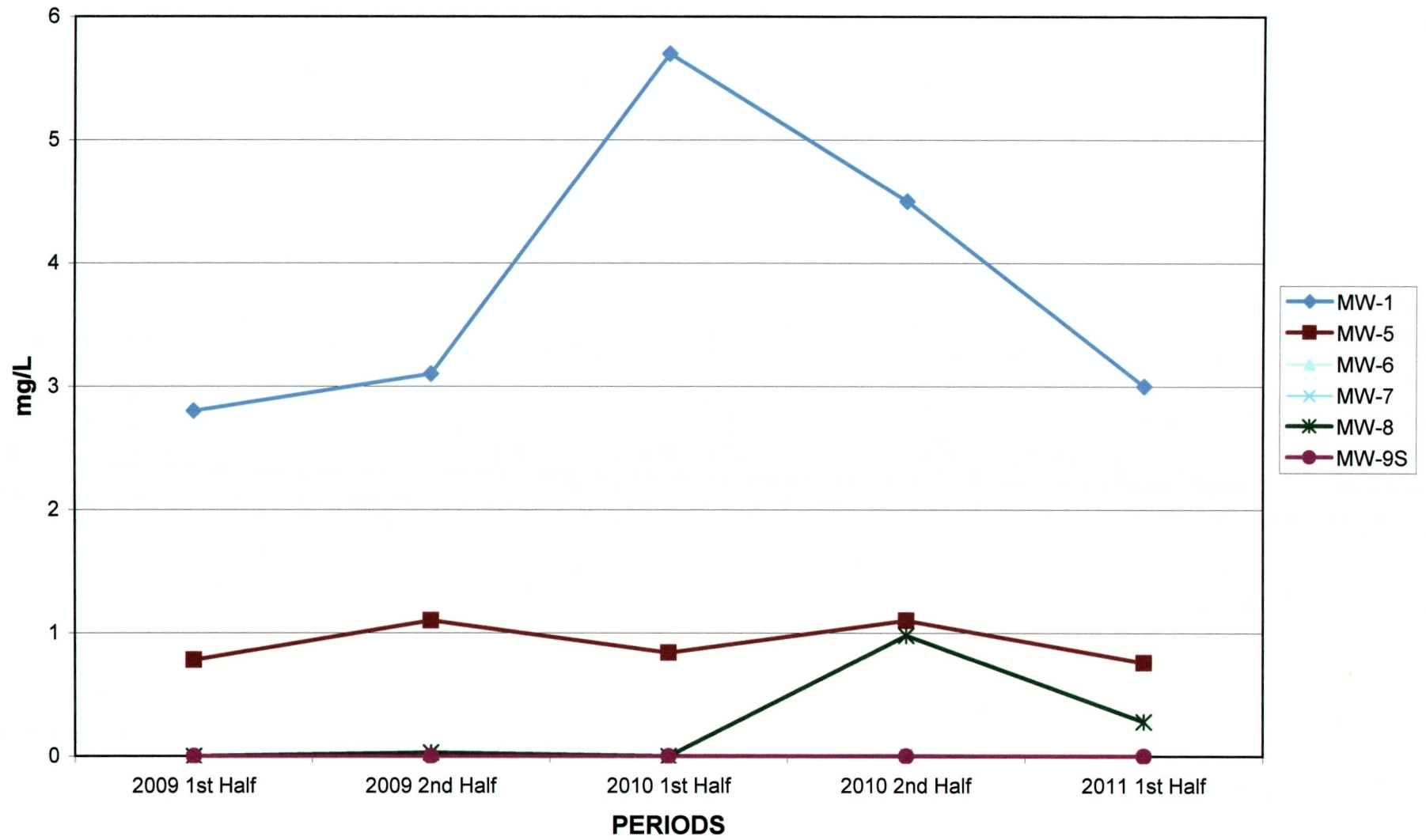


Parameter	MW-8	2009 1st Half	2009 2nd Half	2010 1st Half	2010 2nd Half	2011 1st Half
Aluminum - Total (mg/L)	MW-8	0	0	0	0	0
Ammonia as N (mg/L)	MW-8	0	0.029	0	0.98	0.28
Arsenic - Total (ug/L)	MW-8	0	0	4.5	0	6.88
Benzene (ug/L)	MW-8	0.69	0	1	2.2	1.7
Bicarbonate as CaCO3 (mg/L)	MW-8	560	0	0	0	0
Chloride (mg/L)	MW-8	10	9.3	9.5	13	19
Chloromethane (ug/L)	MW-8	0	0	0	0.53	0
cis-1,2-Dichloroethene (ug/L)	MW-8	0	0	0.43	1.2	1.1
Dissolved Oxygen (mg/L)	MW-8	0.15	0.41	0.24	0	0.41
Iron - Total (ug/L)	MW-8	1370	1110	2370	15500	9990
Copper - Total (ug/L)	MW-8	0	0	0	0	0
Lead - Total (ug/L)	MW-8	0	0	0	0	1.71
Mercury - Total (ug/L)	MW-8	0	0	0	0	0
Nickel - Total (ug/L)	MW-8	5.29	0	0	0	0
Nitrate as N	MW-8	0	0	0	0	0.18
Nitrate/Nitrite as N	MW-8	0.005	0	0	0	0
pH (pH Units)	MW-8	6.36	6.39	6.35	6.32	6.37
Phenolics (ug/L)	MW-8	0	0	0	0	0
Sodium - Total (mg/L)	MW-8	5.49	5.44	5.65	8.32	11.6
Specific Conductance (uS/cm)	MW-8	1080	1070	1014	1141	1142
Sulfate (mg/L)	MW-8	0	7.6	7.9	3.3	5.7
Temperature (°C)	MW-8	24.38	25.05	25.42	25.13	24.19
Thallium - Total (ug/L)	MW-8	0	0	0.29	0	0
Tetrachloroethene (ug/L)	MW-8	0.48	0	0	0	0
Total Alkalinity (mg/L)	MW-8	560	0	0	0	0
Total Dissolved Solids (mg/L)	MW-8	608	620	630	640	660
Trichloroethene (ug/L)	MW-8	0	0	0	0.71	0
Turbidity (NTUs)	MW-8	4.1	6.3	4.5	2.8	3.4
Vanadium - Total (ug/L)	MW-8	0	0	1.05	0	0
Water Elevation (ft)	MW-8	40.52	41.32	41.09	43.16	40.89

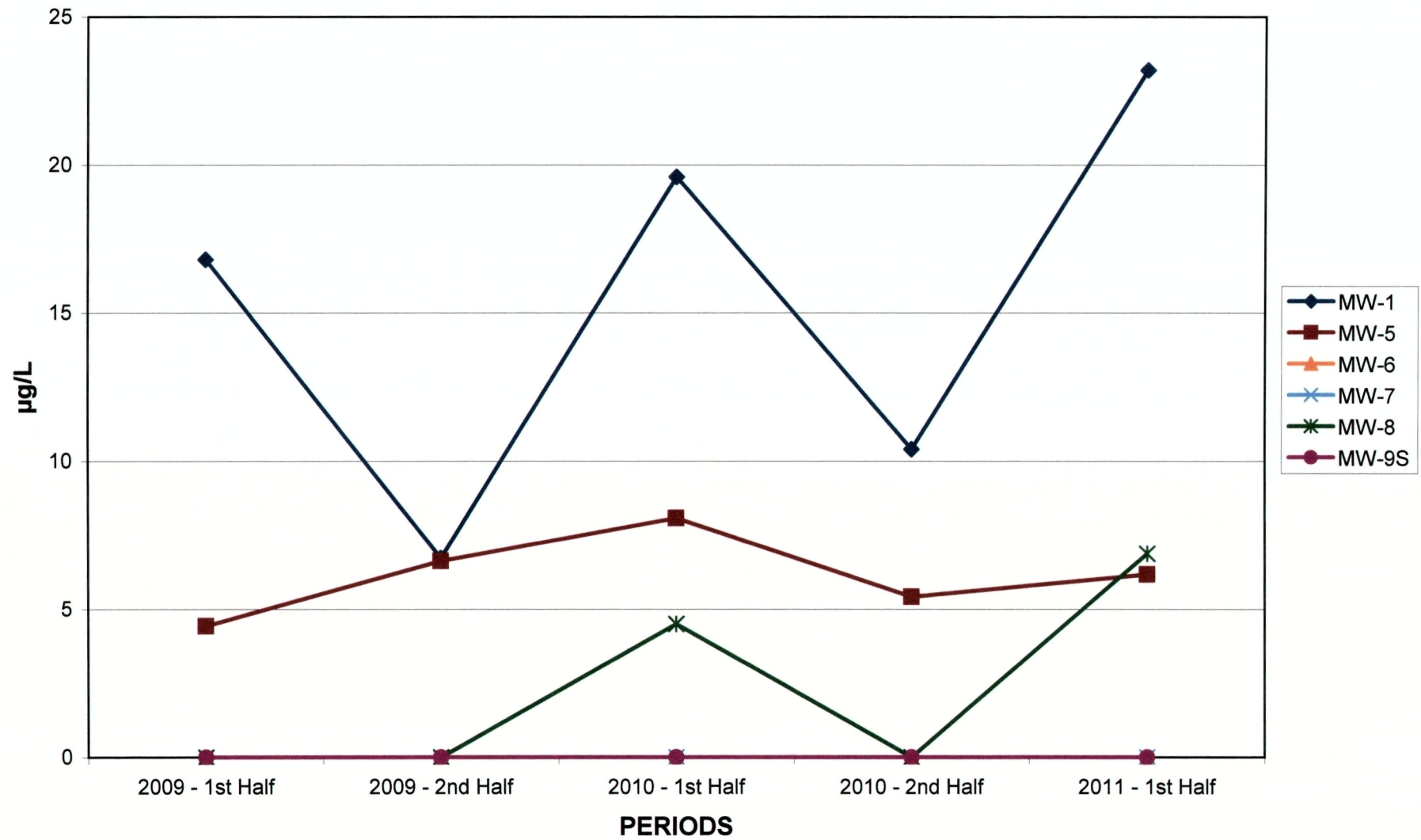
Parameter	MW-9S	2009 1st Half	2009 2nd Half	2010 1st Half	2010 2nd Half	2011 1st Half
Aluminum - Total (mg/L)	MW-9S	0	267	208	81.4	0
Ammonia as N (mg/L)	MW-9S	0	0	0	0	0
Arsenic - Total (ug/L)	MW-9S	0	0	0	0	0
Benzene (ug/L)	MW-9S	0	0	0	0	0
Bicarbonate as CaCO3 (mg/L)	MW-9S	390	0	0	0	0
Chloride (mg/L)	MW-9S	21	21	25	28	29
Chloromethane (ug/L)	MW-9S	0	0	0 .58l		0
cis-1,2-Dichloroethene (ug/L)	MW-9S	0	0	0	0	0
Dissolved Oxygen (mg/L)	MW-9S	0.84	0.53	0.44	0.24	0.24
Iron - Total (ug/L)	MW-9S	0	78	66.5	0	0
Copper - Total (ug/L)	MW-9S	2.94	0	0	0	0
Lead - Total (ug/L)	MW-9S	0	0	0	0	0
Mercury - Total (ug/L)	MW-9S	0.023	0.23	0.118	0.0573	0
Nickel - Total (ug/L)	MW-9S	0	0	0	0	0
Nitrate as N	MW-9S	0.19	0.59	0.4	0.27	0.58
Nitrate/Nitrite as N	MW-9S	0.19	0	0	0	0
pH (pH Units)	MW-9S	6.73	6.67	6	6.57	6.62
Phenolics (ug/L)	MW-9S	0	0	0	0	0
Sodium - Total (mg/L)	MW-9S	8.53	15.3	20.6	12	11.5
Specific Conductance (uS/cm)	MW-9S	709	908	861	888	974
Sulfate (mg/L)	MW-9S	0	43	51	65	67
Temperature (°C)	MW-9S	23.27	24.78	23.83	23.09	22.62
Thallium - Total (ug/L)	MW-9S	0	0	0.603	0	0
Tetrachloroethene (ug/L)	MW-9S	0	0	0	0	0
Total Alkalinity (mg/L)	MW-9S	390	0	0	0	0
Total Dissolved Solids (mg/L)	MW-9S	466	550	570	580	590
Trichloroethene (ug/L)	MW-9S	0	0	0	0	0
Turbidity (NTUs)	MW-9S	2.2	11	9.2	4.9	4.9
Vanadium - Total (ug/L)	MW-9S	3.11	5.73	7.12	5.46	4.78
Water Elevation (ft)	MW-9S	40.41	41.15	40.92	42.93	40.69

# GRAPHS

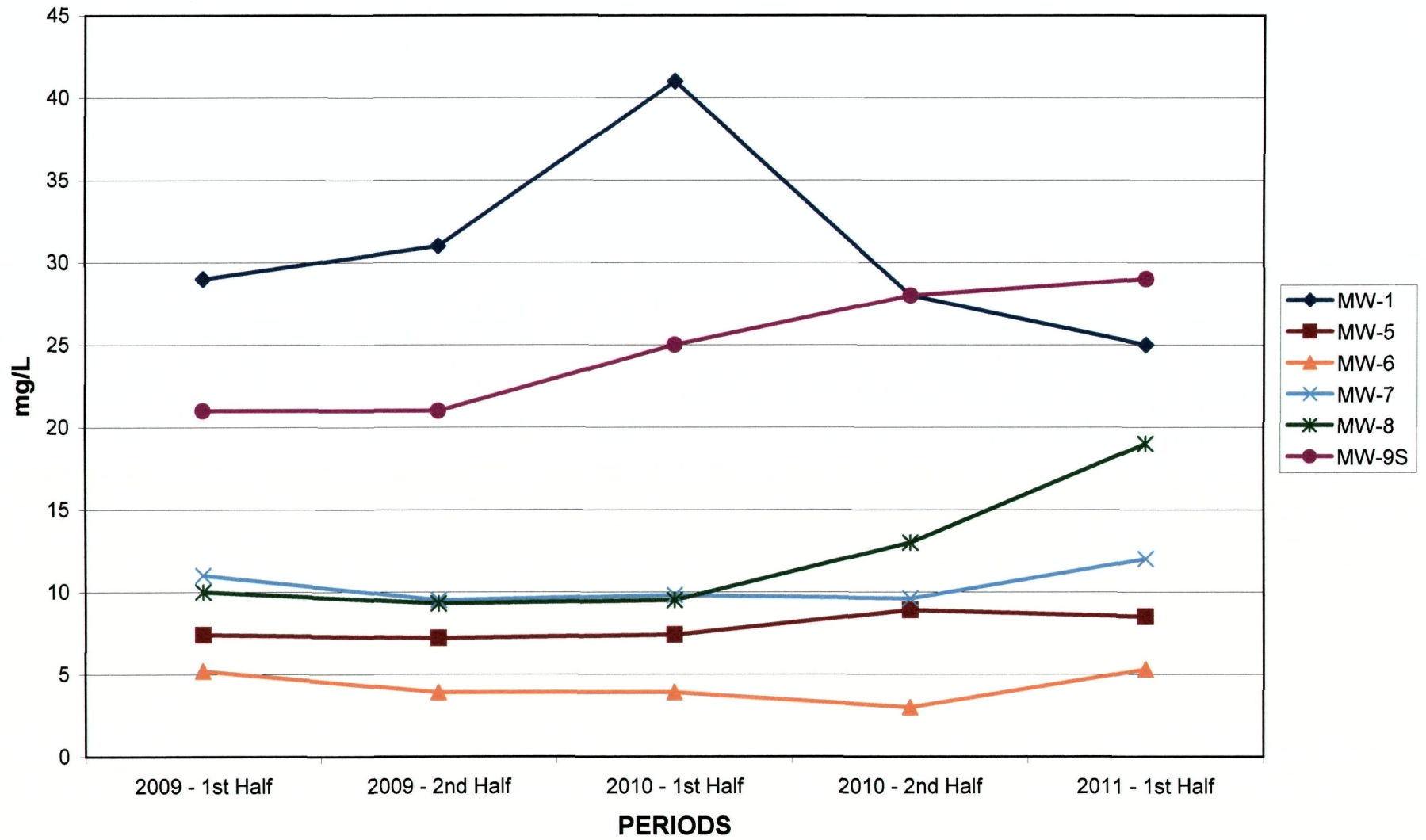
## Ammonia as N



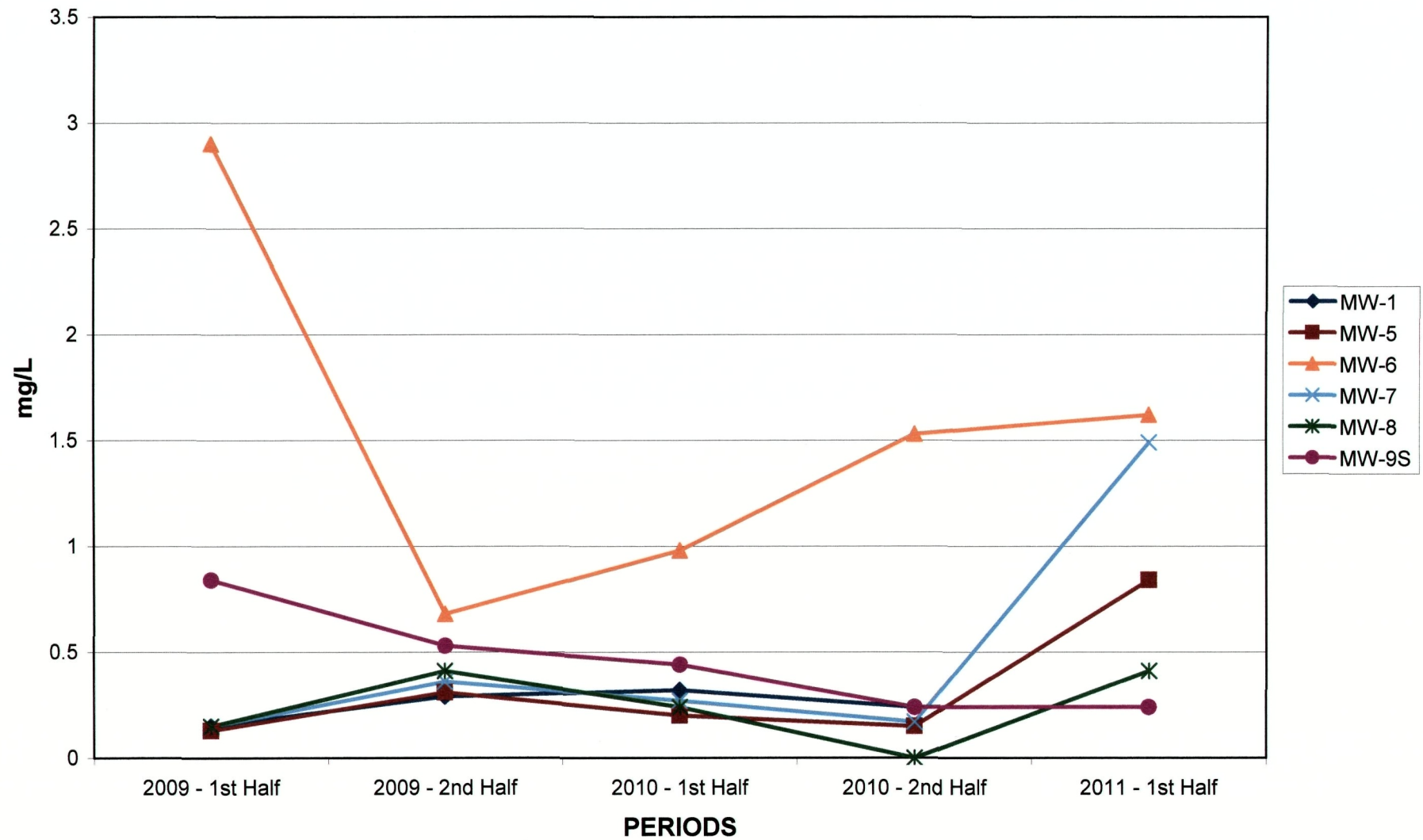
## ARSENIC - TOTAL



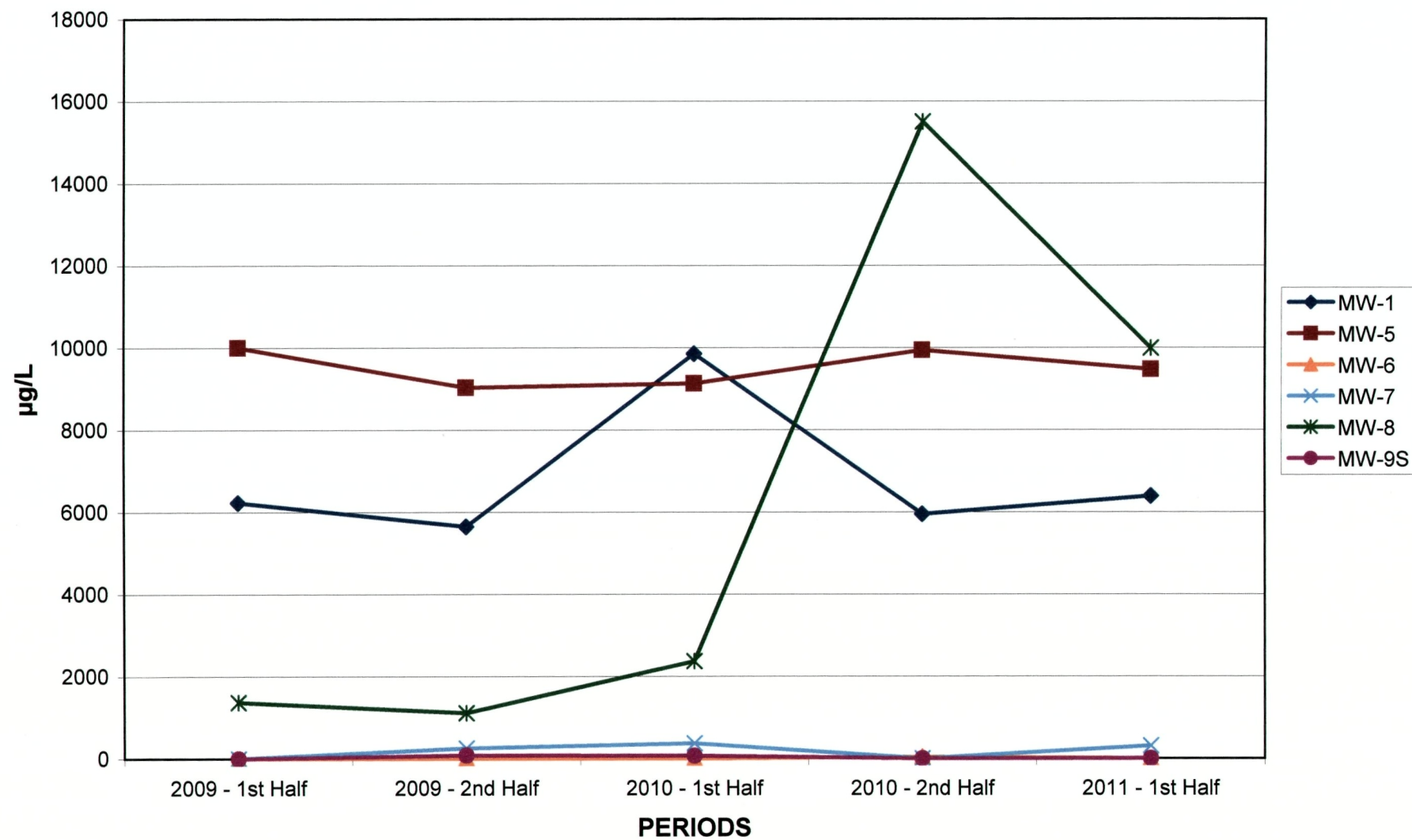
## CHLORIDE



## DISSOLVED OXYGEN



# IRON

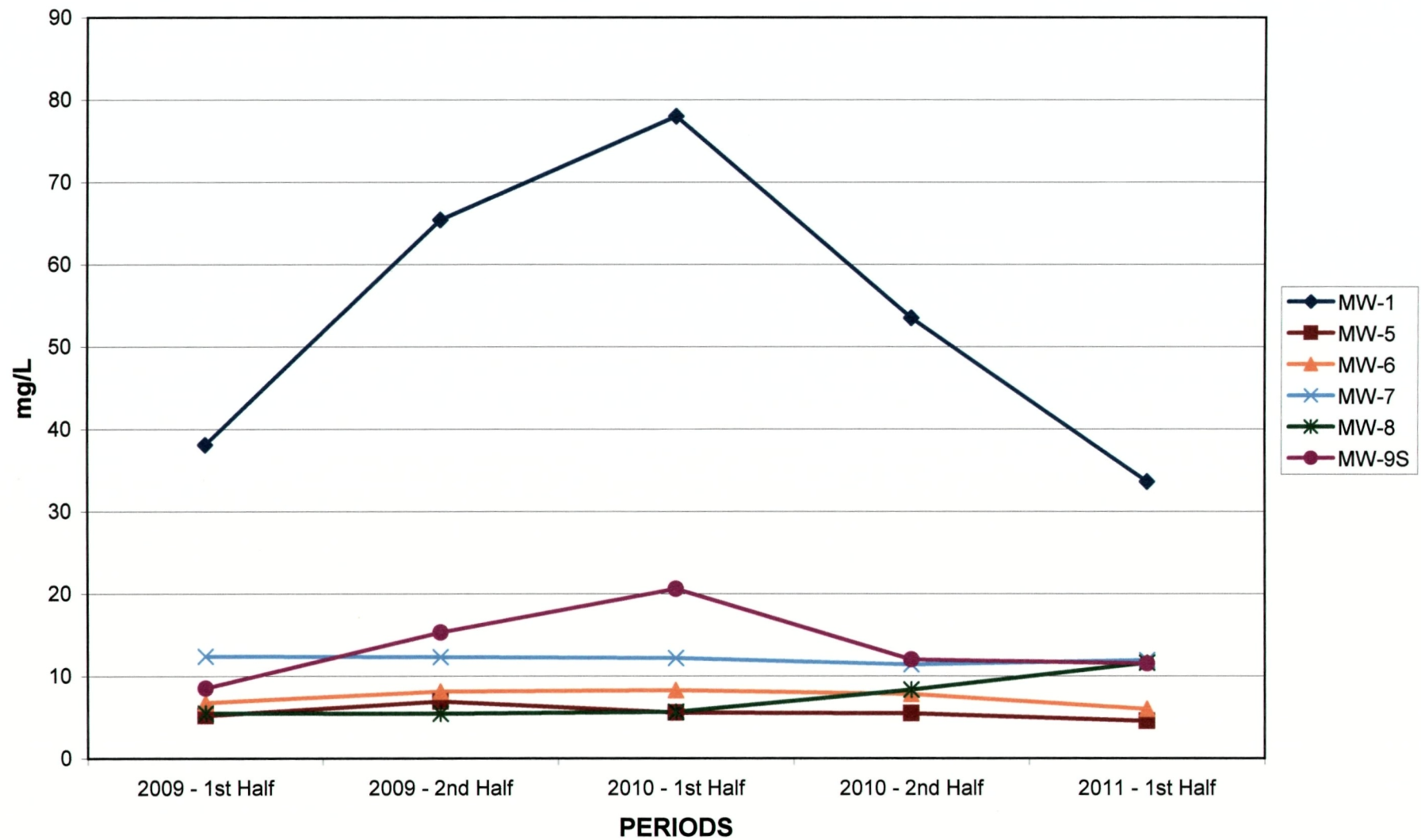




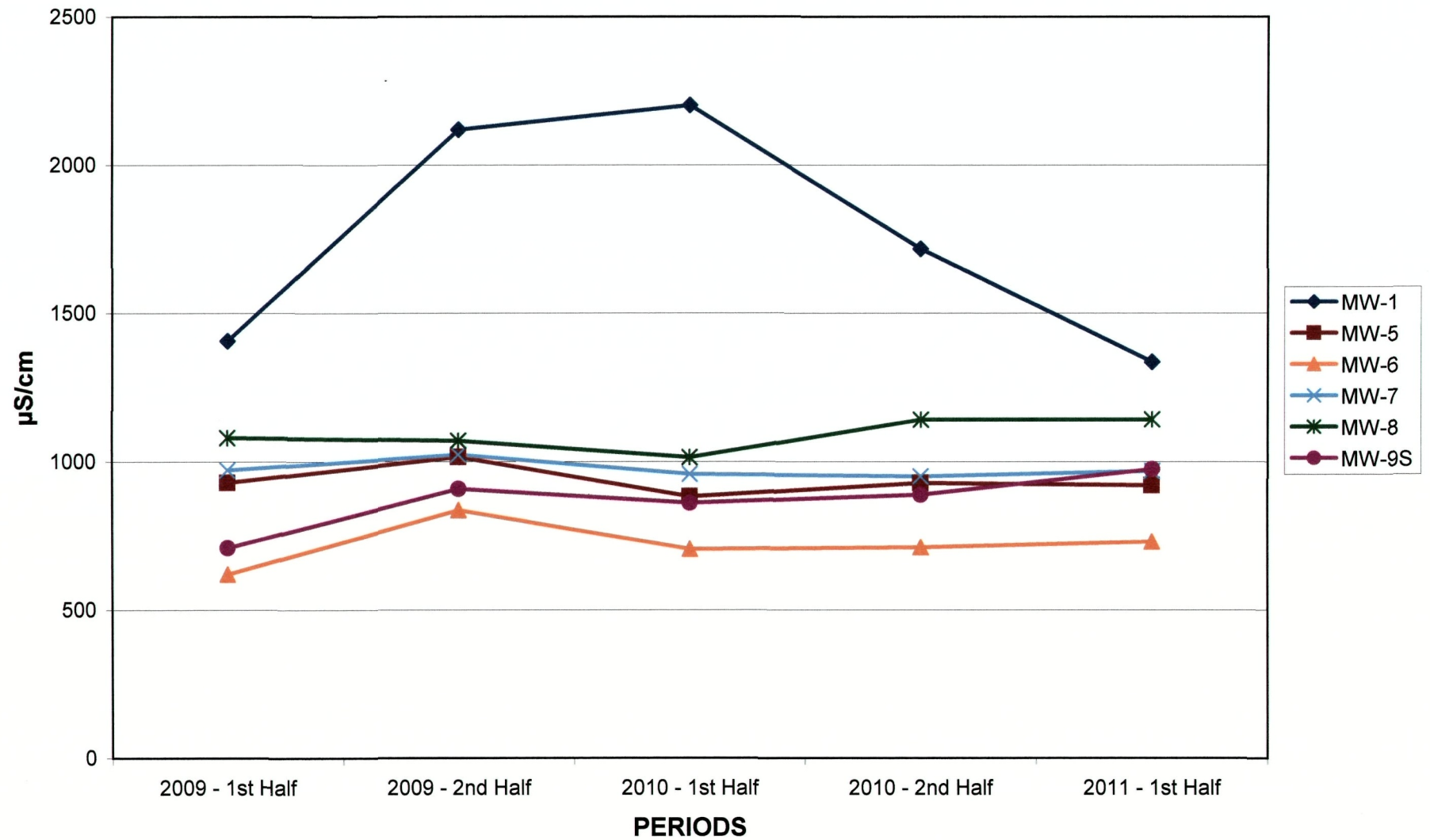
# pH



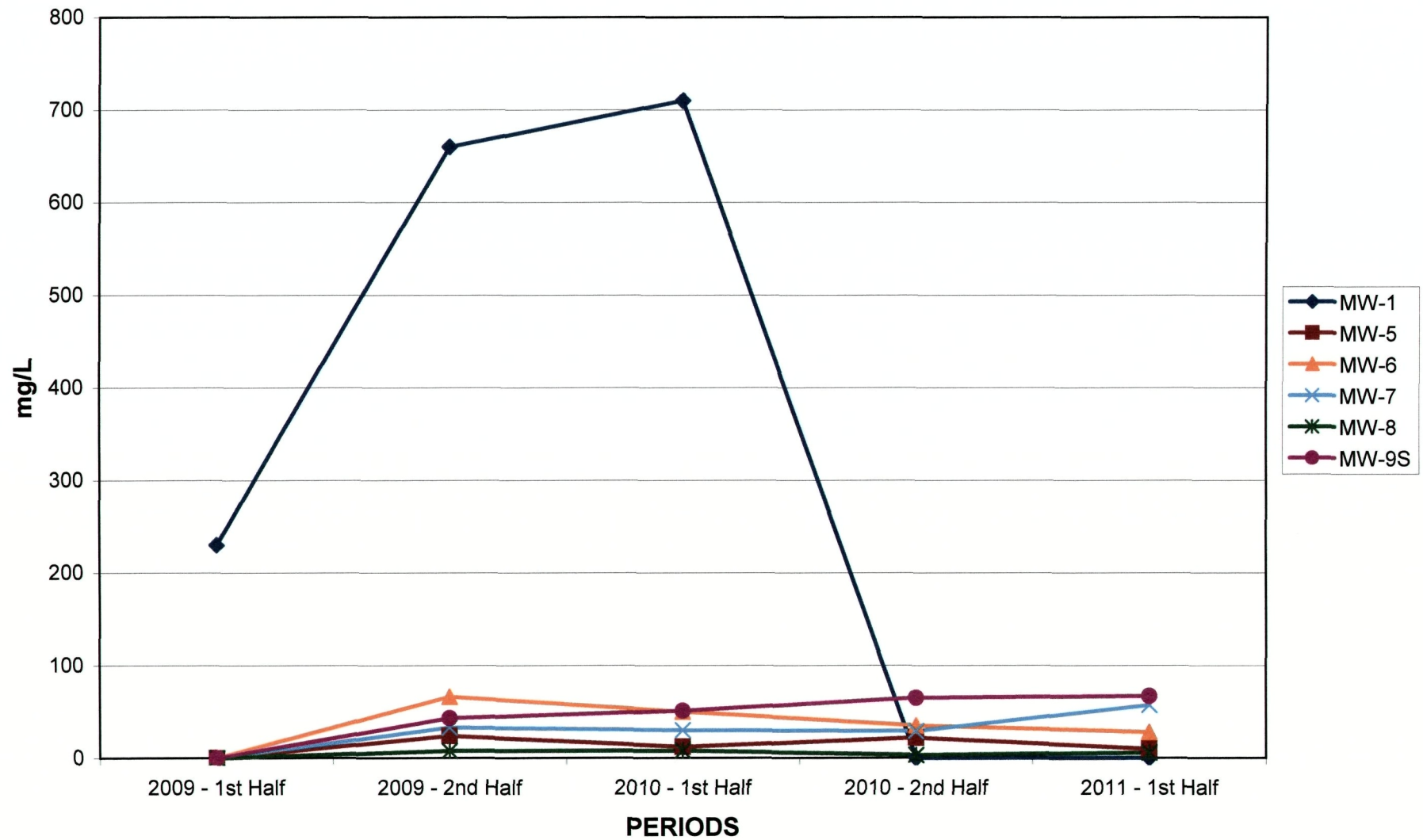
## SODIUM - TOTAL



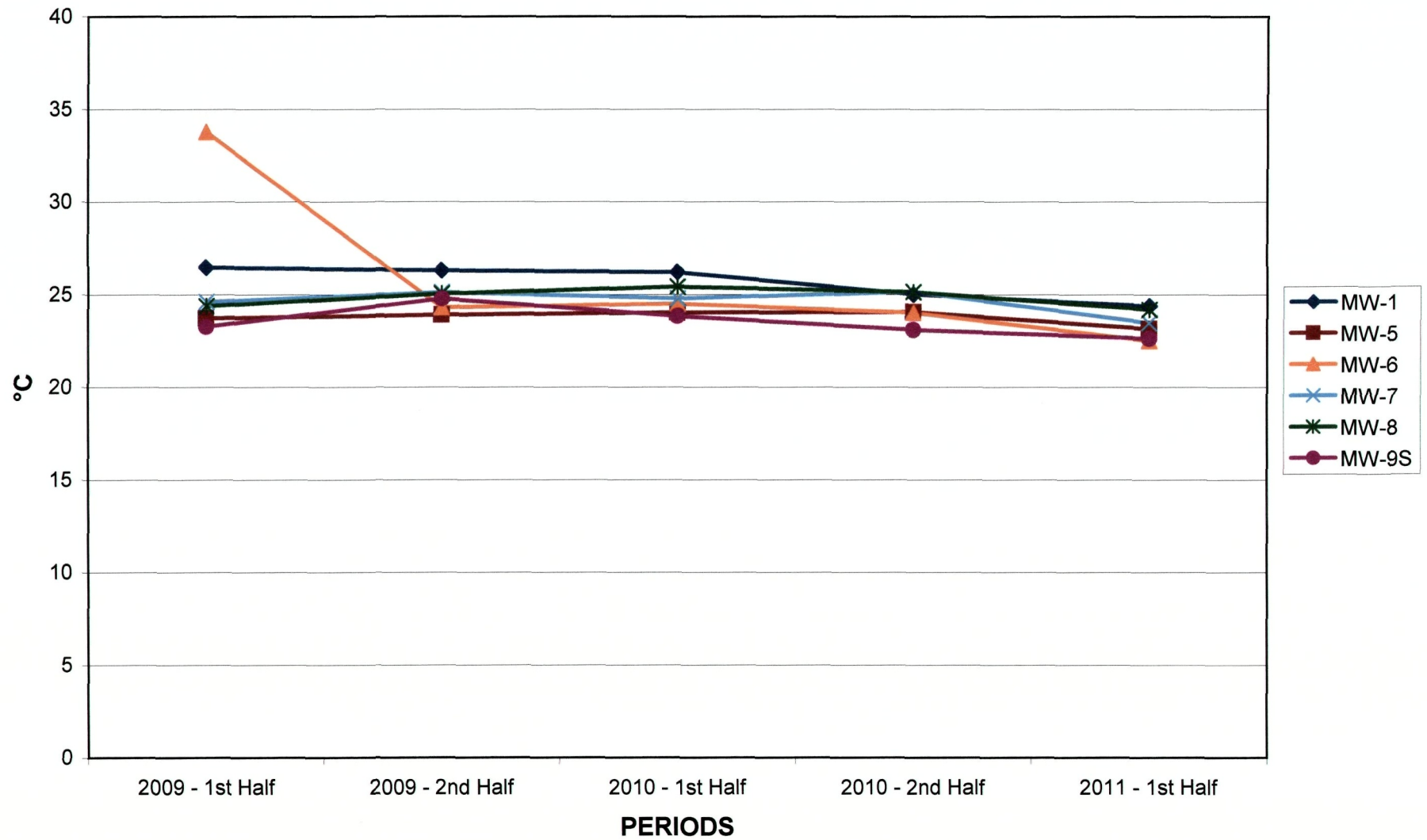
## SPECIFIC CONDUCTANCE (EC)



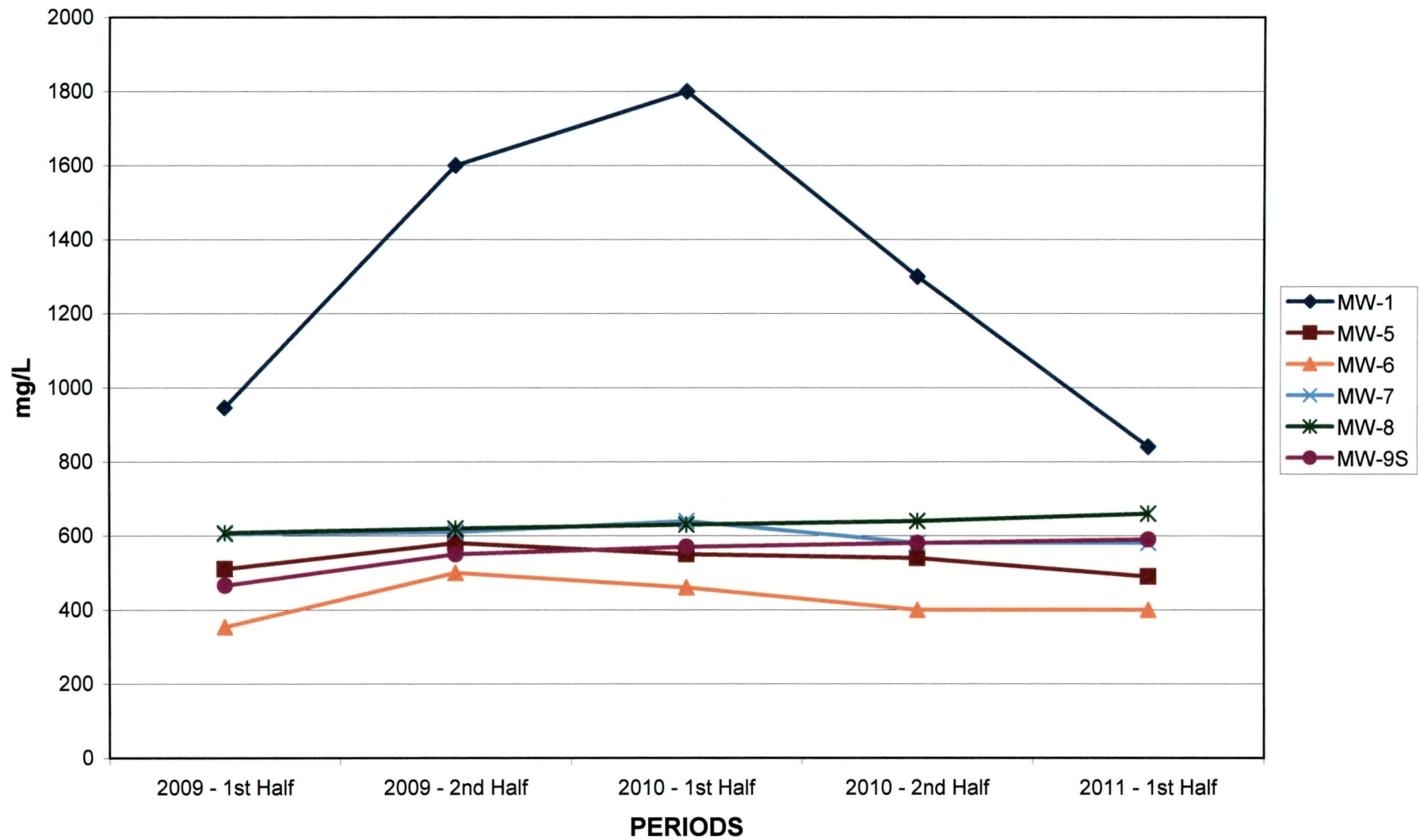
## SULFATE



## TEMPERATURE

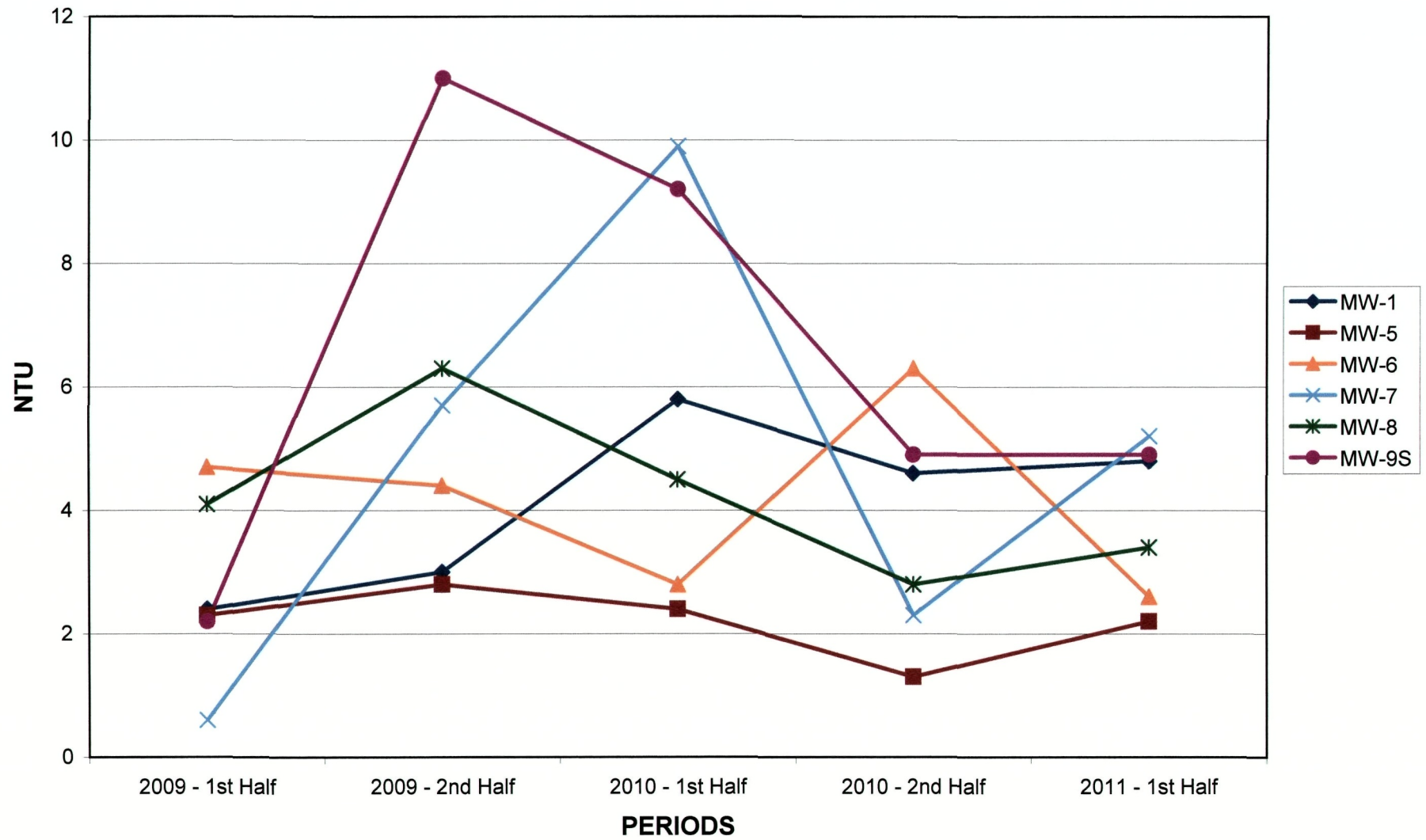


## TOTAL DISSOLVED SOLIDS

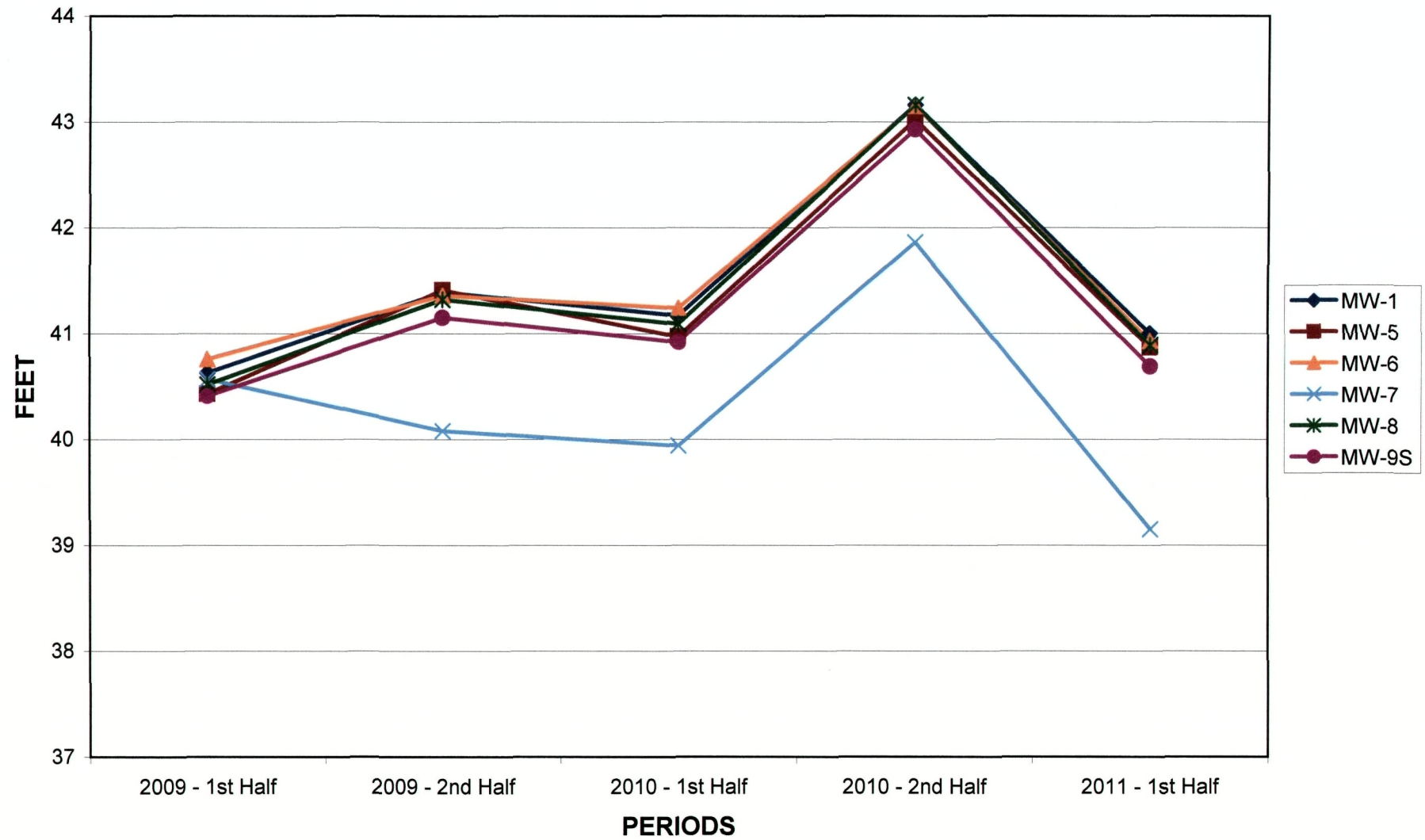




## TURBIDITY

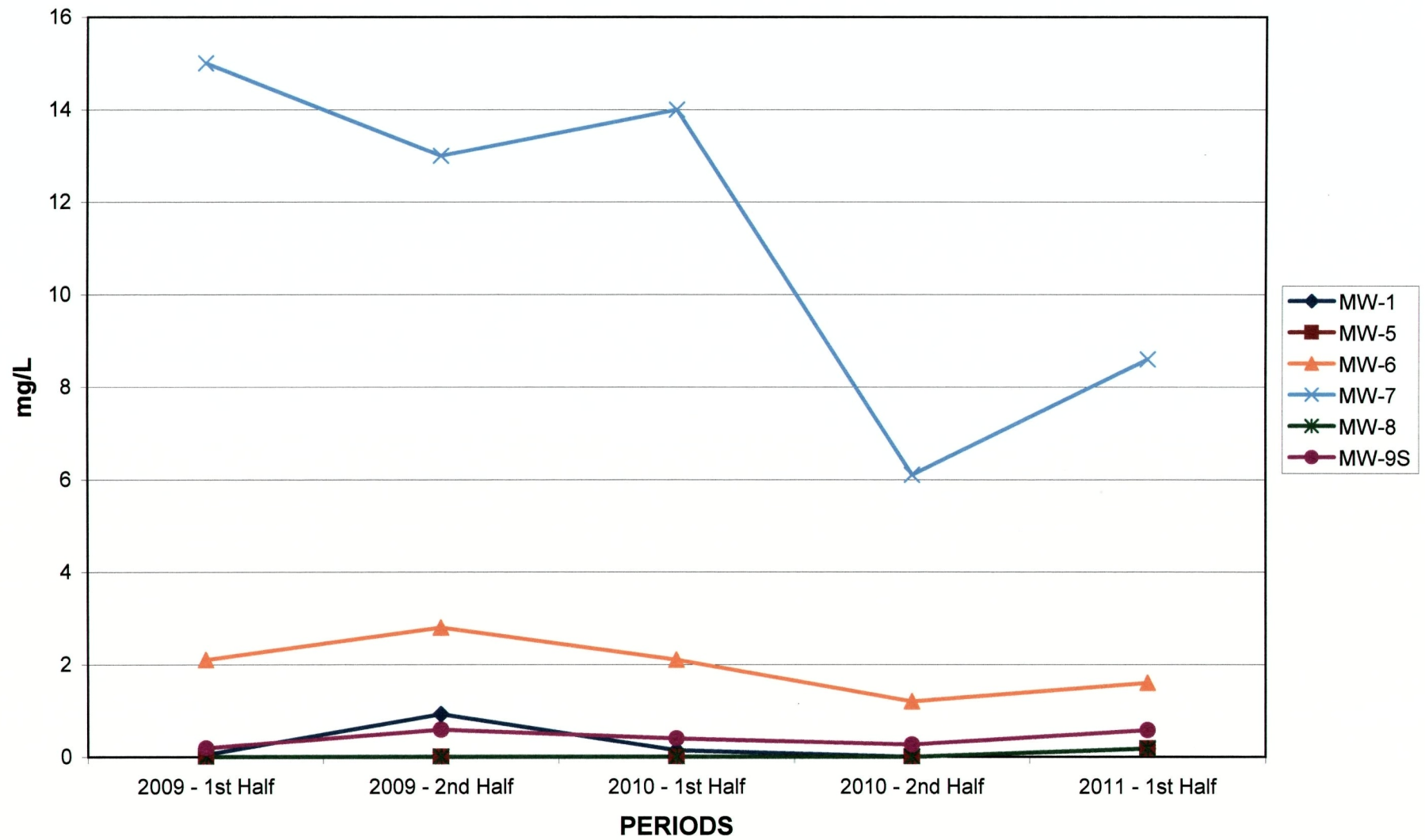


## WATER ELEVATION

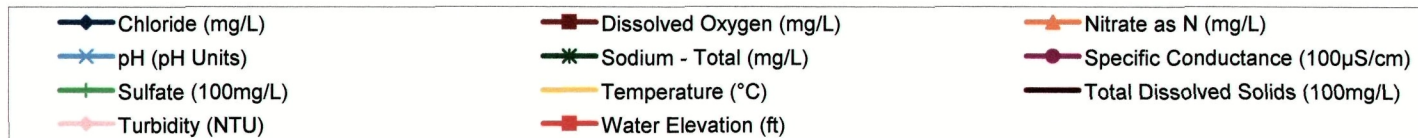
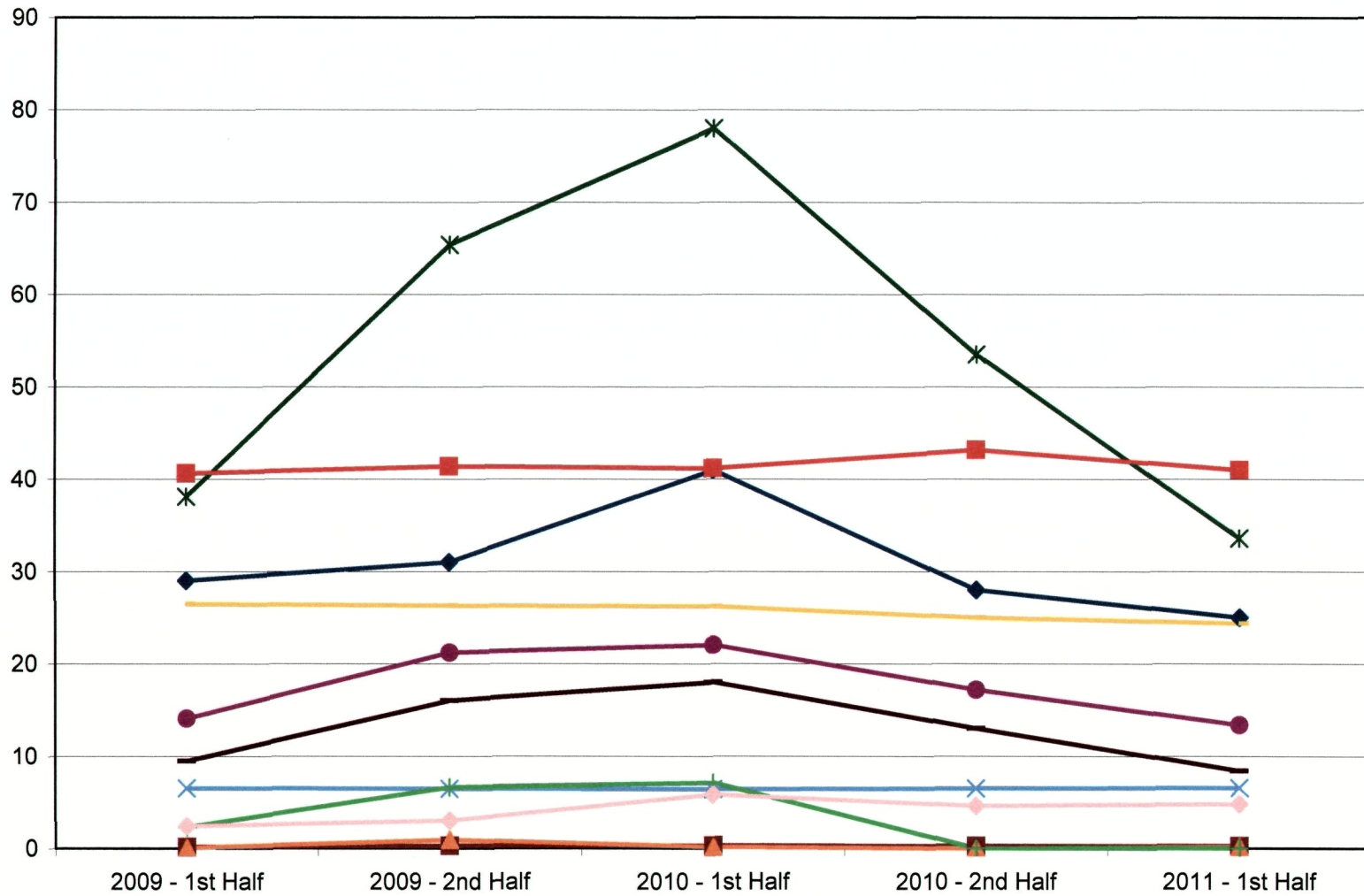




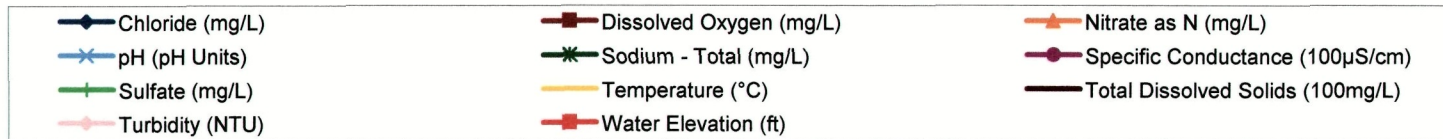
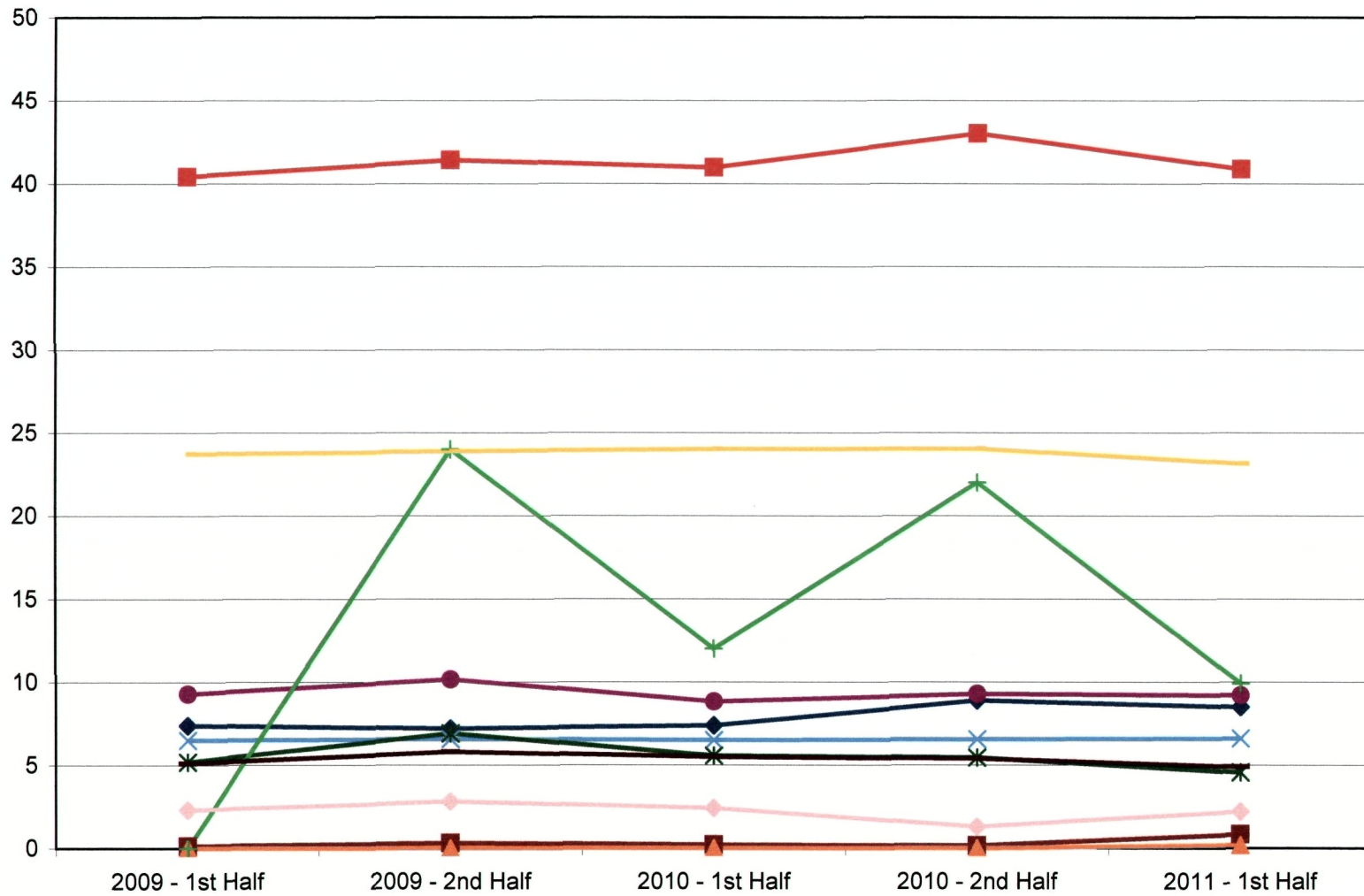
## NITRATE AS N



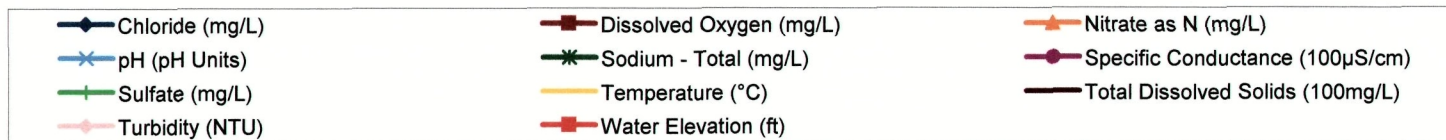
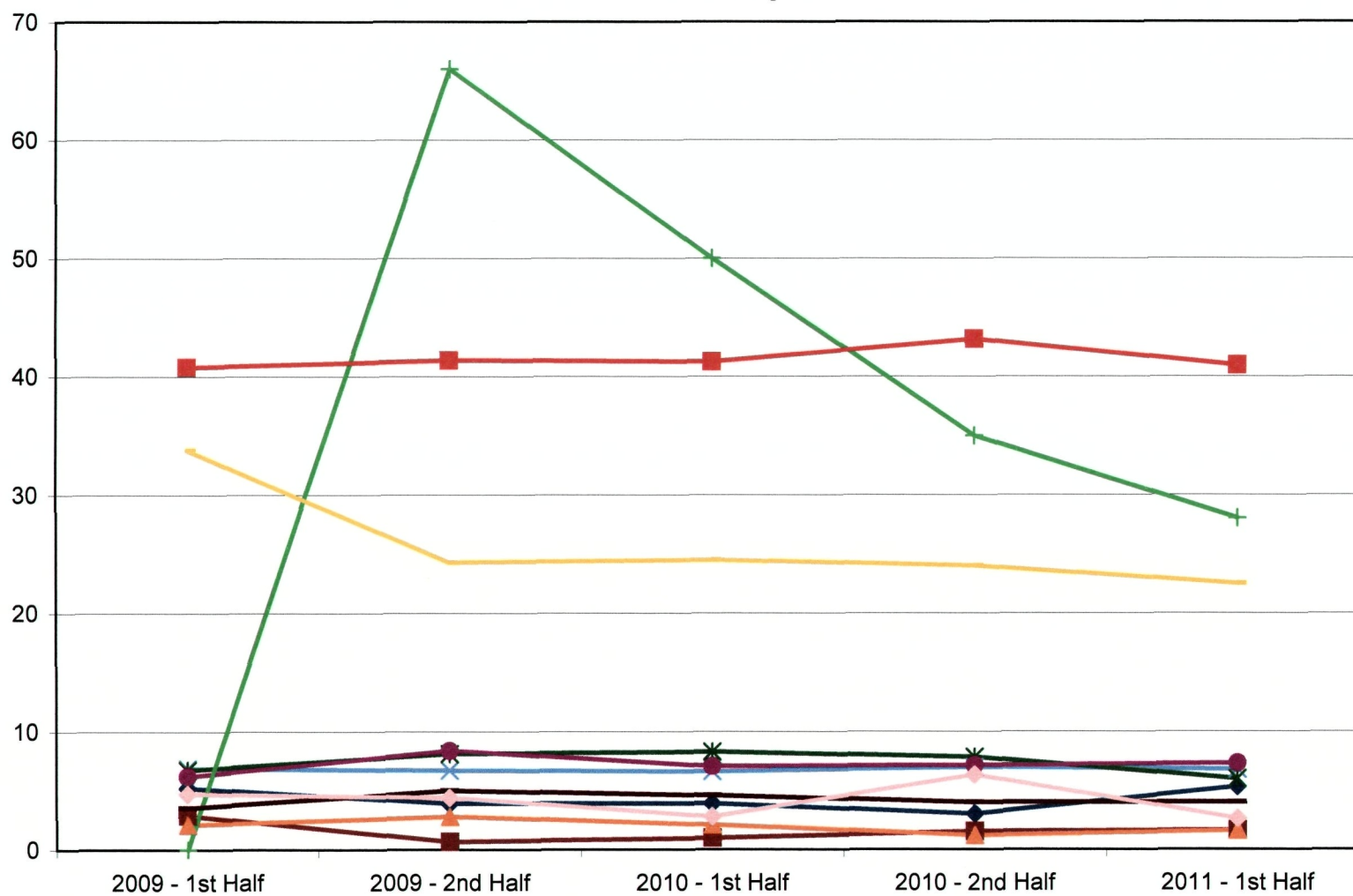
## MW-1 Comparison



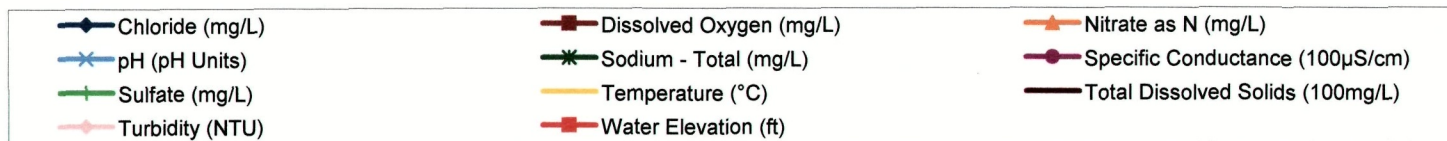
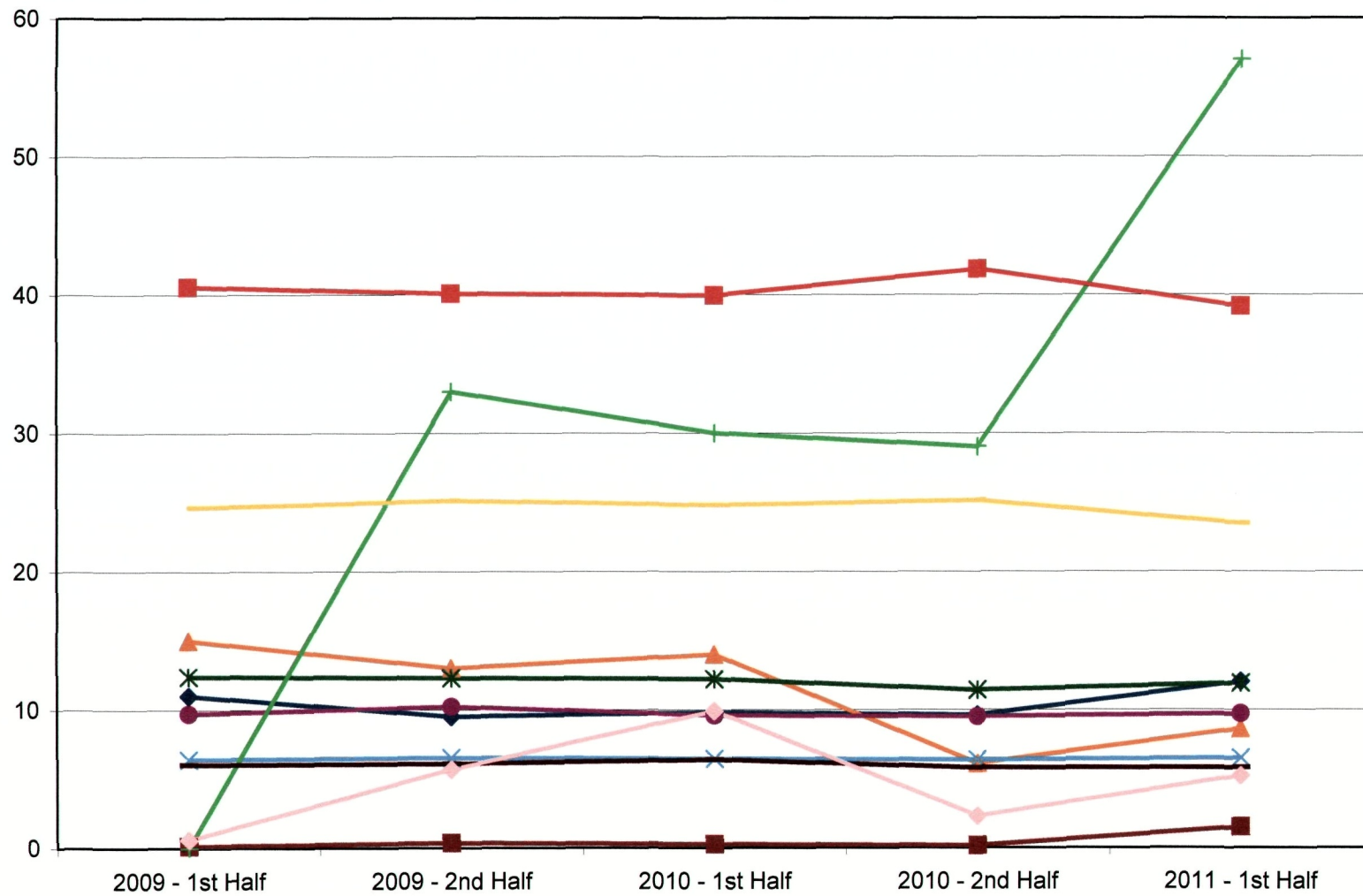
## MW-5 Comparison



## MW-6 Comparison

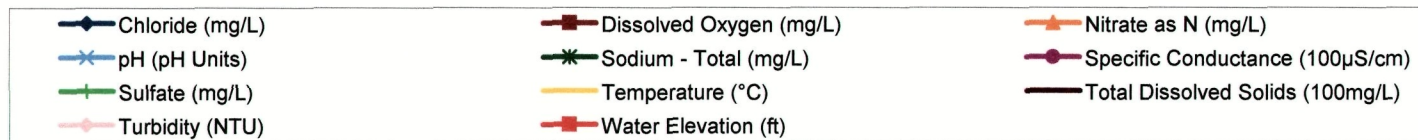
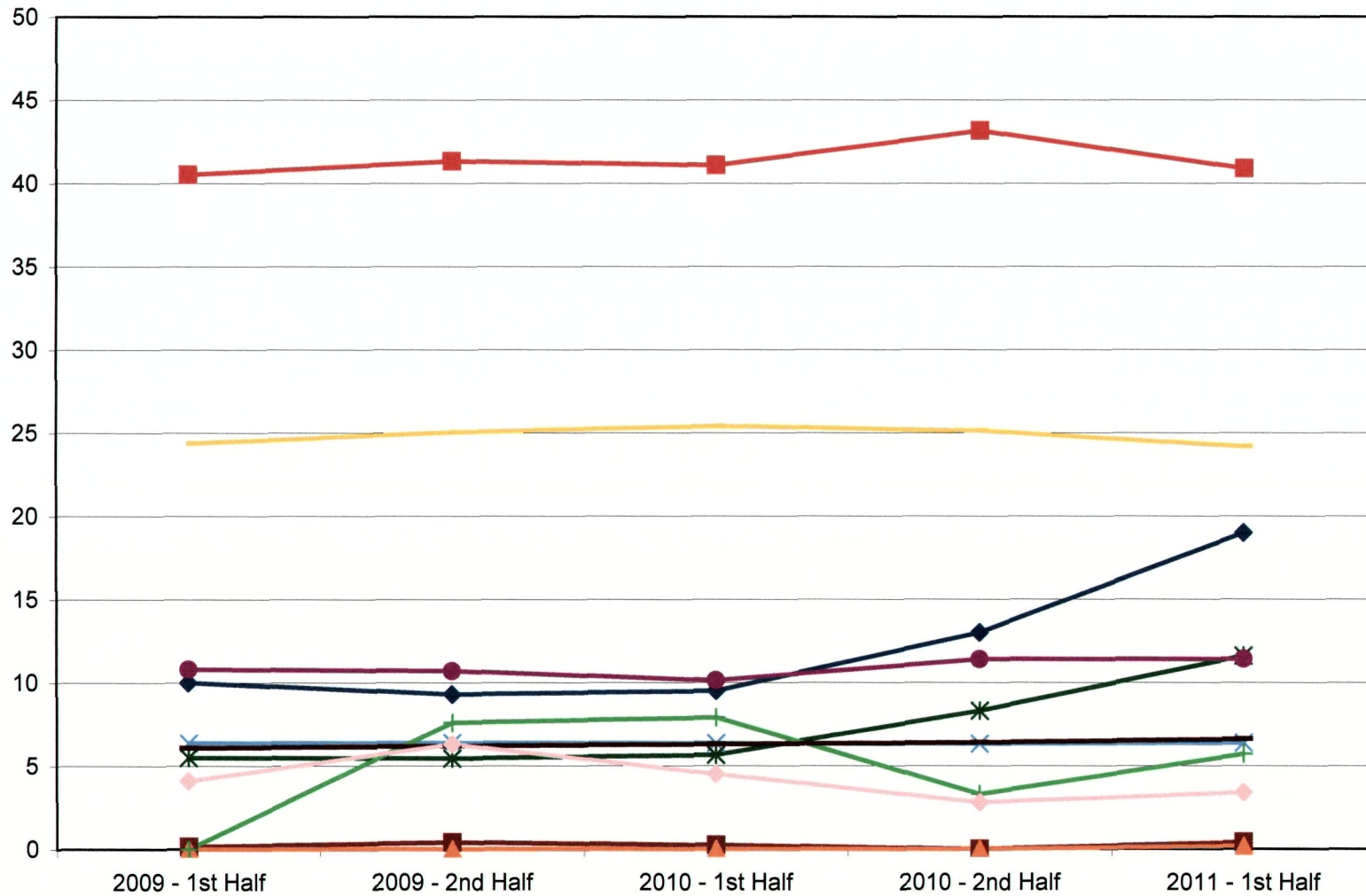


## MW-7 Comparison





## MW-8 Comparison



## MW-9S Comparison

