2010 POST-CLOSURE LANDFILL MONITORING
TOWN OF BRIGHTON

May 2011

Submitted To:
New York State Department of Environmental Conservation
Region 5 Office

Submitted By:
Town of Brighton

Prepared By:
F. X. Browne, Inc.

2010 POST-CLOSURE LANDFILL MONITORING
TOWN OF BRIGHTON

May 2011

Submitted To:

New York State Department of Environmental Conservation
Region 5 Office
Route 86
Ray Brook, NY 12977

Submitted By:

Town of Brighton
P.O. Box 260
Paul Smiths, NY 12970

Prepared By:

F. X. Browne, Inc.
1519 State Route 86
Saranac Lake, NY 12983

F. X. Browne, Inc. Project No. NY1566-10

Table of Contents

List of Appendices

List of Tables

List of Figures

Executive Summary

The Town of Brighton retained F. X. Browne, Inc. to perform post-closure water quality and explosive gas monitoring at the inactive Brighton Municipal Solid Waste Landfill on County Route 55, Gabriels, NY. In November 2004, the Town of Brighton received a variance to reduce their monitoring frequency to one annual baseline survey. On June 20, 2007, the Town of Brighton was granted a second variance for further reductions to the post-closure monitoring program based on an analysis of past water quality data.

F. X. Browne, Inc. performed water quality monitoring on August 24, 2010. Water quality samples were analyzed for 6 NYCRR Part 360 baseline parameters by Upstate Laboratories of East Syracuse, NY (NYS DOH ELAP No. 10170). Groundwater samples, field water quality measurements, and explosive gas measurements were taken during the sampling event.

During 2010, New York State groundwater quality standards were exceeded for iron (all three wells and duplicate), manganese (all three wells and duplicate), color (MW-2, MW-3 and duplicate), and total dissolved solids (MW-2). Elevated iron and manganese concentrations in the groundwater may be naturally occurring, although the concentrations of these two parameters were higher at the downgradient wells than the upgradient well, indicating the potential presence of landfill leachate. Several other parameters were also higher at the downgradient wells as compared to the upgradient well, including total organic carbon, total dissolved solids, sulfate, alkalinity, turbidity, calcium, magnesium, potassium, and sodium. Many of the parameters were found at the highest concentrations at MW-2. Field pH values were above 6.5 units in all three wells, indicating less acidic conditions than in past years. No volatile organic compounds (VOCs) were present in concentrations that exceeded groundwater standards.

Although it appears that landfill leachate is impacting the groundwater at the Brighton Landfill to a certain degree, any impact on area groundwater is low and there are no apparent public health concerns. It appears that there may be an improving trend in leachate indicators in the downgradient wells with respect to ammonia and iron.

None of the perimeter soil probe measurements exceeded the 50% Lower Explosive Limit (LEL) for methane gas during 2010. No visible signs of vectors, cracks, erosion or groundwater leaks were evident during 2010. The vegetation on the landfill cap was in good condition. The Town of Brighton has installed “no trespassing” signs around the landfill cap, which seem to be working. There was no evidence of ATV riding on the landfill cap this year. The access road around the landfill cap needs to be mowed all the way around. The Town of Brighton should work with the owner of the landfill access road to make sure that access to the landfill is maintained and a key to the gate is made available. The next monitoring event should take place during August or September of 2011.

1.0 Introduction

The Town of Brighton retained F. X. Browne, Inc. to perform post-closure water quality and explosive gas monitoring at the inactive Brighton Municipal Solid Waste Landfill on County Route 55, Gabriels, NY. The landfill accepted household waste between the late-1960s and May 1992. It was closed in November 1998. The landfill consists of one capped area, with three monitoring wells and ten gas vents. The total landfill area is approximately two acres in size.

On November 4, 2004, the Town of Brighton was granted a variance in post-closure monitoring frequency in accordance with the 1996 general variance provisions. The required monitoring frequency was reduced from quarterly to one annual baseline monitoring event. On June 20, 2007, the Town of Brighton was granted a second variance for further reductions to the post-closure monitoring program based on an analysis of past water quality data. The following parameters were dropped from the baseline parameter analysis, since they have not been detected at the landfill in the past and are not considered landfill leachate indicators: cadmium, cyanide, beryllium, copper, mercury, vanadium, nitrate, antimony, boron, chromium, nickel, total Kjeldahl nitrogen, barium, bromide, hexavalent chromium, and silver.

F. X. Browne, Inc. performed water quality monitoring on August 24, 2010. Water quality samples were analyzed for 6 NYCRR Part 360 baseline parameters by Upstate Laboratories of East Syracuse, NY. (NYS DOH ELAP No. 10170). A map of the landfill showing the locations of the monitoring wells and gas vents is provided in Appendix A.

2.0 Methodology

Groundwater samples were collected at all three sampling wells using disposable bailers. Three times the volume of water in the wells was removed using hand bailers, the wells were allowed to recharge, and the samples were collected.

Table 1 shows sample locations and times for the August 24, 2010 water quality sampling event. The duplicate sample was taken at MW-3. No dissolved metals samples were required during the 2010 monitoring event. Dissolved metal samples are required whenever the turbidity measures higher than 50 NTUs in the field.

In addition to the groundwater samples, field parameters were measured during each sampling event for pH, turbidity, salinity, dissolved oxygen, specific conductance, redox potential, and temperature at each sampling well.

Explosive gas measurements were taken around the perimeter landfill cap using a soil probe and explosive gas meter.

Table 1 2010 Groundwater Sample Locations and Times			
Well	**Date**	**Time**	**Location Description**
MW-1	8/24/2010	14:15	North of the landfill cap, upgradient
MW-2	8/24/2010	13:45	East of the landfill cap, downgradient
MW-3	8/24/2010	12:45	South of the landfill cap, downgradient
Duplicate	8/24/2010	13:00	Collected at MW-3

3.0 Weather Conditions

On August 24, 2010 the weather was clear, sunny, and cool. The temperature was 69 degrees Fahrenheit with a barometric pressure of 30.13 inches of mercury and falling. Weather conditions had been relatively dry in the weeks prior to sampling, although approximately 3 inches of rain fell two days before sampling.

4.0 Groundwater Elevation

The groundwater elevation in each monitoring well was measured with a depth sensor during the 2010 sampling event. Based on the water elevation, three volumes of water were purged from each well prior to sampling. Table 2 shows the groundwater elevation data for each well on the sampling date, as well as the volume of water removed prior to sampling.

Table 2 Groundwater Elevation and Well Purging Data						
Well	**Date**	**Static Water Level (ft)**	**Water Depth (ft)**	**Well Casing Diameter (in)**	**Water Volume in well (gal)**	**Water Volume Purged (gal)**
MW-1	8/24/2010	62.2	4.9	2	0.8	2.4
MW-2	8/24/2010	37.9	6.9	2	1.1	3.4
MW-3	8/24/2010	42.0	6.2	2	1.1	3.2

5.0 Summary of Groundwater Quality Results

During 2010, groundwater quality samples were analyzed for 6 NYCRR Part 360 (1988) baseline parameters. No dissolved metals samples were required. New York State groundwater quality standards were exceeded for iron (all three wells and duplicate), manganese (all three wells and duplicate), color (MW-2, MW-3 and duplicate), and total dissolved solids (MW-2). Elevated iron and manganese concentrations in the groundwater may be naturally occurring, although the concentrations of these two parameters were higher at the downgradient wells than the upgradient well, indicating the potential presence of landfill leachate. Several other parameters were also higher at the downgradient wells as compared to the upgradient well, including total organic carbon, total dissolved solids, sulfate, alkalinity, turbidity, calcium, magnesium, potassium, and sodium. Many of the parameters were found at the highest concentrations at MW-2. Field pH values were above 6.5 units in all three wells, indicating less acidic conditions than in past years. No volatile organic compounds (VOCs) were present in concentrations that exceeded groundwater standards.

Field parameter results are presented in Table 3. Baseline analytical chemical and metals results are provided in Appendix B. Volatile organic compound results are provided in Appendix C.

Table 3
2010 Water Quality Results for Field Parameters

Parameter	MW-1	MW-2	MW-3
Temperature (ºC)			11.6
Turbidity (NTU)	2.64	5.01	6.36
pH (units)	8.74	8.39	9.65
Redox Potential (Eh)	-159.9	-172.2	-142.5
Dissolved Oxygen (mg/L)	4.6	2.40	3.3
Specific Conductance (µmhos/cm)	174	730	418
Salinity (%)	0.08	0.36	0.20

6.0 Water Quality Trends

Time plots to detect possible trends or water quality degradation were prepared using the 2002 through 2010 data for the following leachate parameters: total volatile organic compounds (total VOCs), total organic carbon (TOC), sulfate, alkalinity, calcium, ammonia, chemical oxygen demand (COD), total dissolved solids (TDS), iron and manganese.

Total Volatile Organic Compounds

Volatile organic compounds (VOCs) are organic compounds such as hydrocarbons, aromatics, and ketones that are soluble in groundwater but are readily lost to the atmosphere upon exposure to air. At the Brighton Landfill, VOCs are measured each year as part of the annual baseline water quality investigation. No VOCs have been present in amounts that exceeded the NYS groundwater standard. During 2010, VOCs were detected at the downgradient wells MW-2 and MW-3. Historically, VOC concentrations have been highest at MW-2, and no VOCs have been present at MW-1. None of the VOCs were present in amounts exceeding the NYS groundwater standards during 2010.

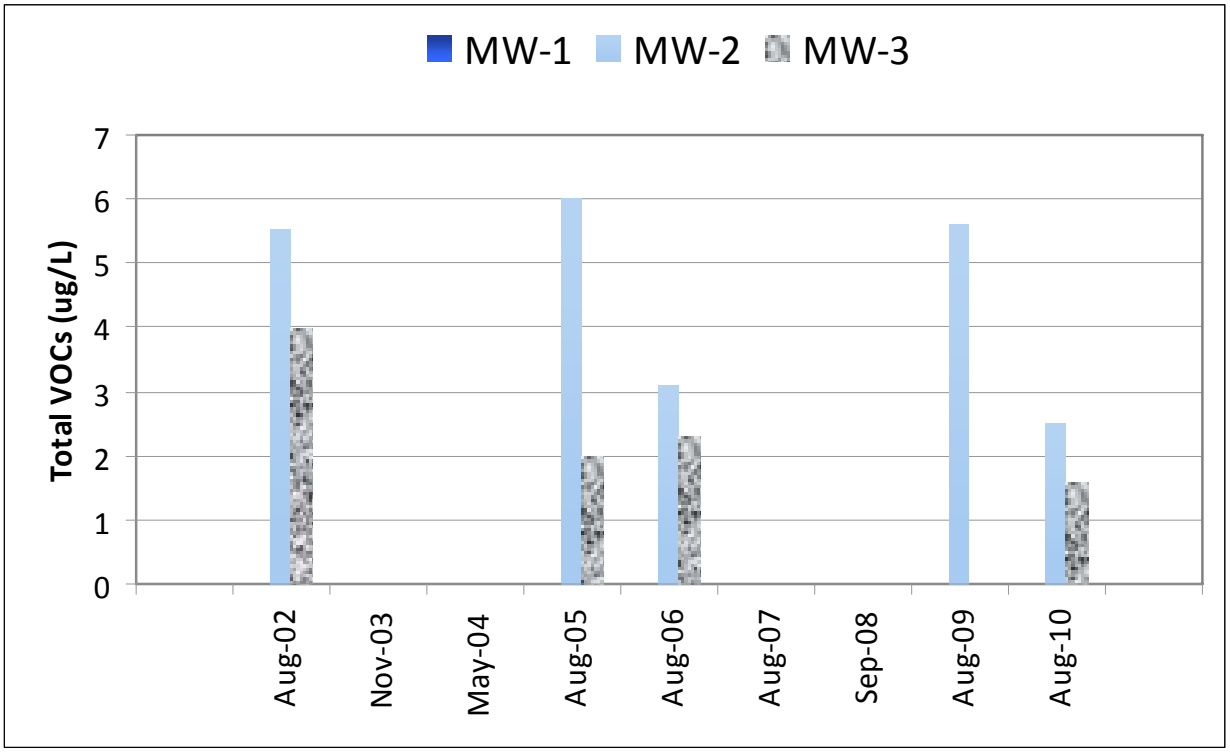


Figure 1 Trends in Volatile Organic Compounds at the Brighton Landfill

Total Organic Carbon

Total organic carbon (TOC) is a measurement of dissolved carbon attributable to organic substances. It is an indicator of landfill leachate, but can also be attributed to naturally occurring decay processes. No NYS groundwater standard is in effect for TOC. TOC levels have been variable in all three wells at the Brighton Landfill over the monitoring period, as shown in Figure 2. The TOC concentrations have been highest at the downgradient well MW-2 during nearly all of the monitoring events. TOC levels appeared to be generally decreasing in the downgradient wells over time, until a spike in MW-2 was recorded for 2010.

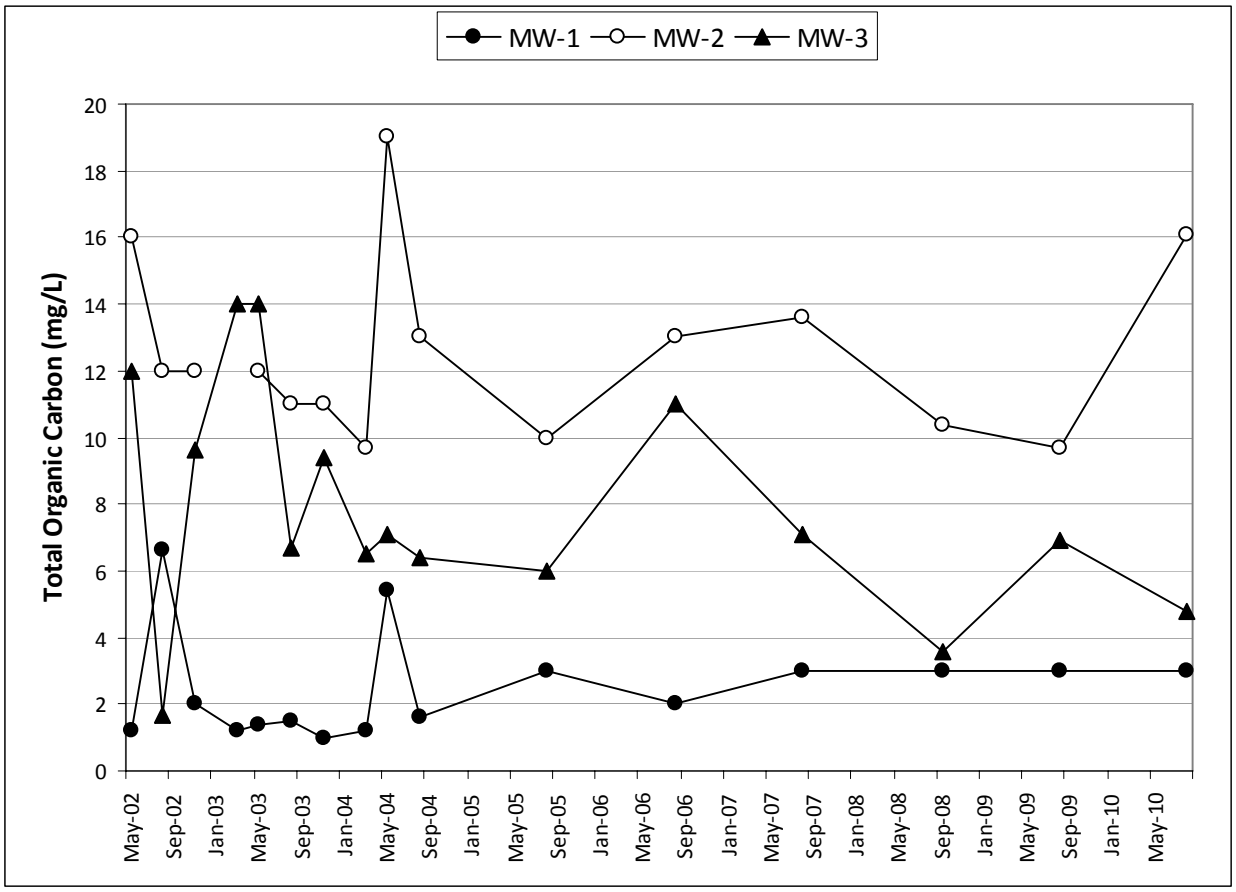


Figure 2 Trends in Total Organic Carbon Concentrations at the Brighton Landfill

Sulfate

Sulfate can be a component of landfill leachate, but it is also naturally occurring in the environment when sulfur-fixing bacteria are present in the soil. At the Brighton Landfill, all of the sulfate concentrations have been well below the NYS groundwater standard of 250 mg/L, as shown in Figure 3. Sulfate concentrations were highest at all three wells during the initial monitoring event, and have been variable but low during all the other monitoring events at all three wells. During several of the monitoring events, the sulfate concentrations were higher at the upgradient well (MW-1) than at the two downgradient wells, indicating that factors other than landfill leachate may be influencing the sulfate concentrations at the Brighton Landfill. Sulfate concentrations have increasing at MW-3 but appear to be decreasing at MW-2 in the last few years, with a slight increase for 2010.

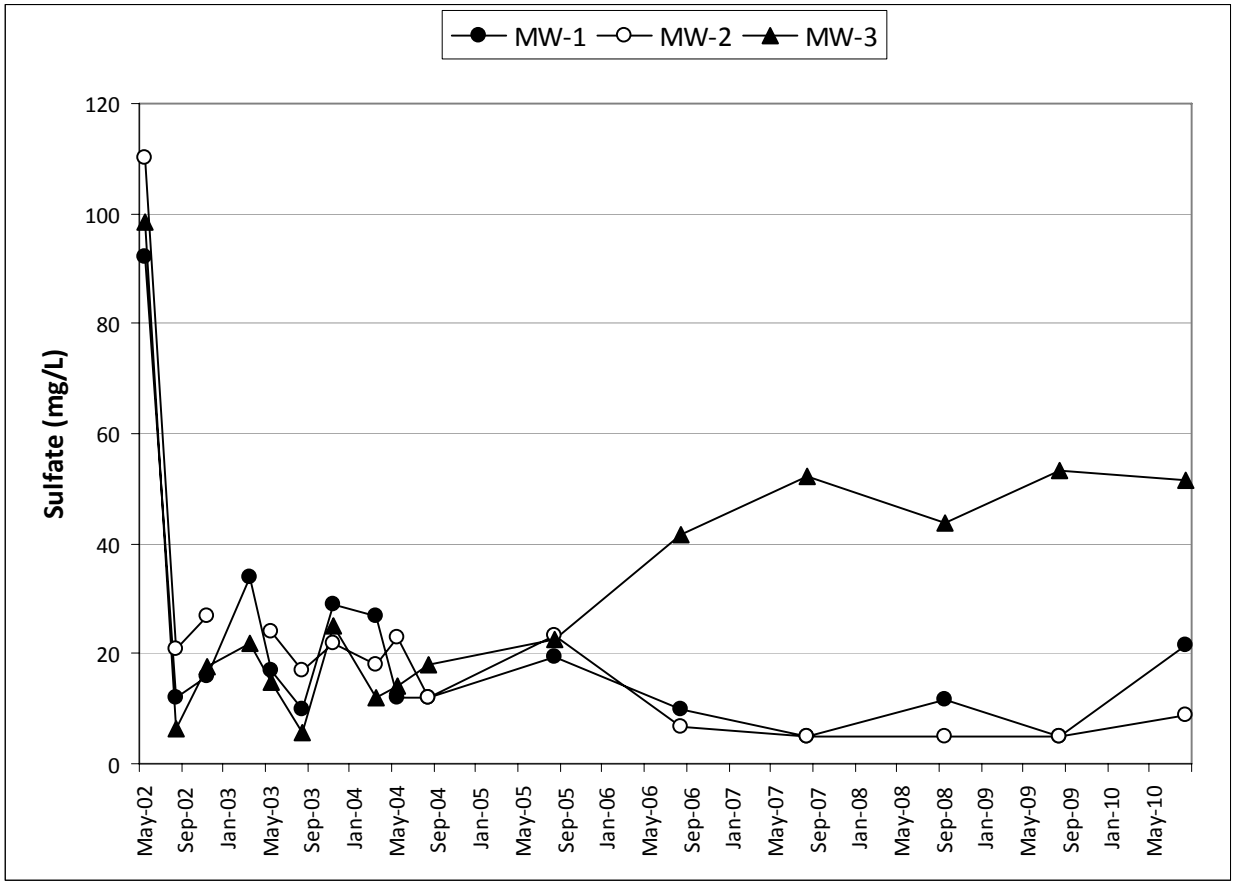


Figure 3 Trends in Sulfate Concentrations at the Brighton Landfill

Alkalinity

Alkalinity is a measure of the buffering capacity in groundwater. It can be an indicator of landfill leachate, especially when the alkalinity concentrations exceed the calcium concentrations. This was the case at the Brighton Landfill. No NYS groundwater standard is in effect for alkalinity. The alkalinity concentrations in the downgradient wells (MW-2 and MW-3) at the Brighton landfill were generally higher than the concentrations in the upgradient well during the study period, as shown in Figure 4. The alkalinity concentrations in the downgradient well MW-2 were higher than the concentrations at the other two wells.

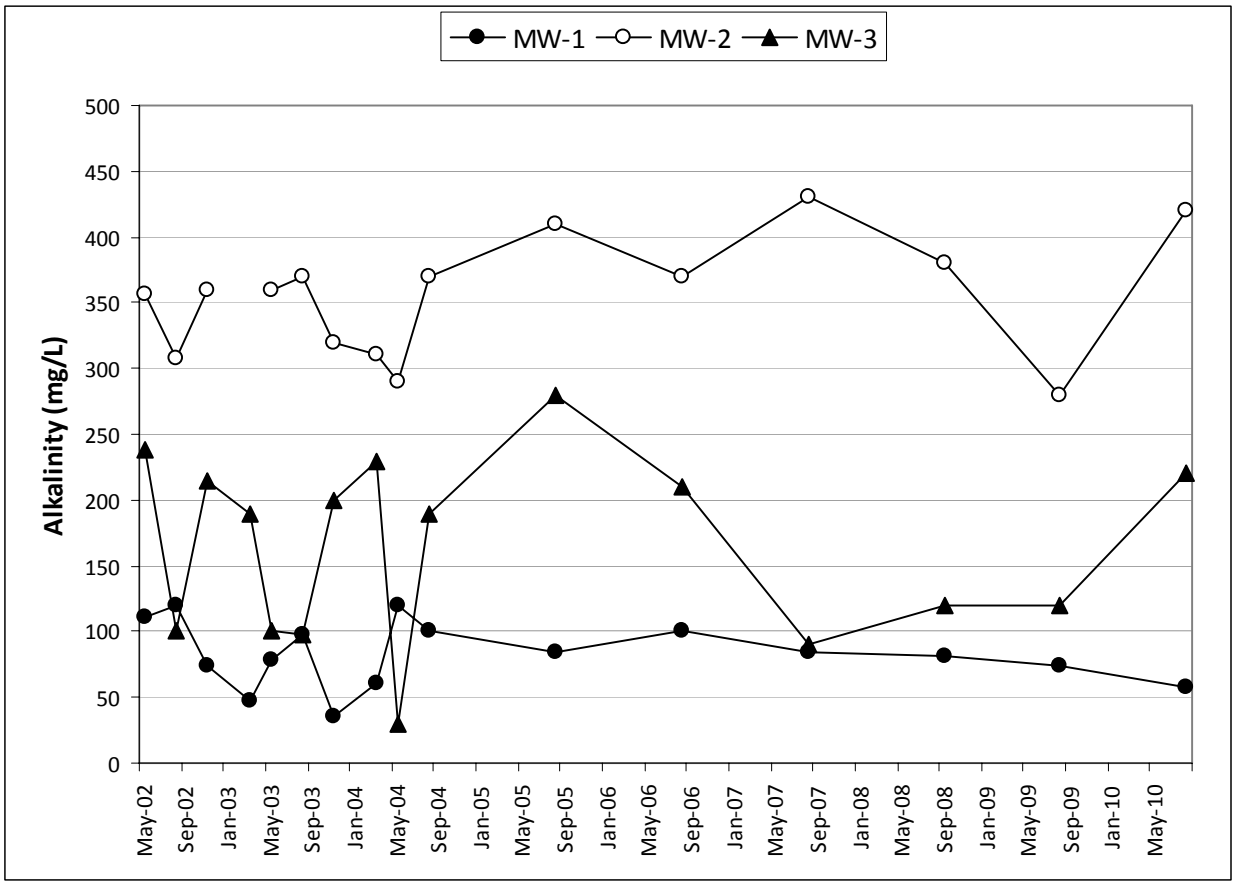


Figure 4 Trends in Alkalinity Concentration at the Brighton Landfill

Calcium

Calcium is naturally abundant in groundwater depending on the soil type, but when viewed in conjunction with alkalinity data, it can be an indicator of landfill leachate. No NYS groundwater standard is in effect for calcium. The calcium concentrations show a similar pattern to the alkalinity concentrations at the Brighton Landfill over the study period, as shown in Figure 5. The calcium concentrations were much higher at the downgradient well, MW-2 than at the other two wells over the entire study period. However, calcium concentrations at the upgradient well, MW-1, were higher than the other downgradient well, MW-3 during most of the sampling events, although MW-3 has increased above MW-1 for 2009 and 2010. This indicates that factors other than landfill leachate may be influencing the calcium concentrations at the Brighton Landfill.

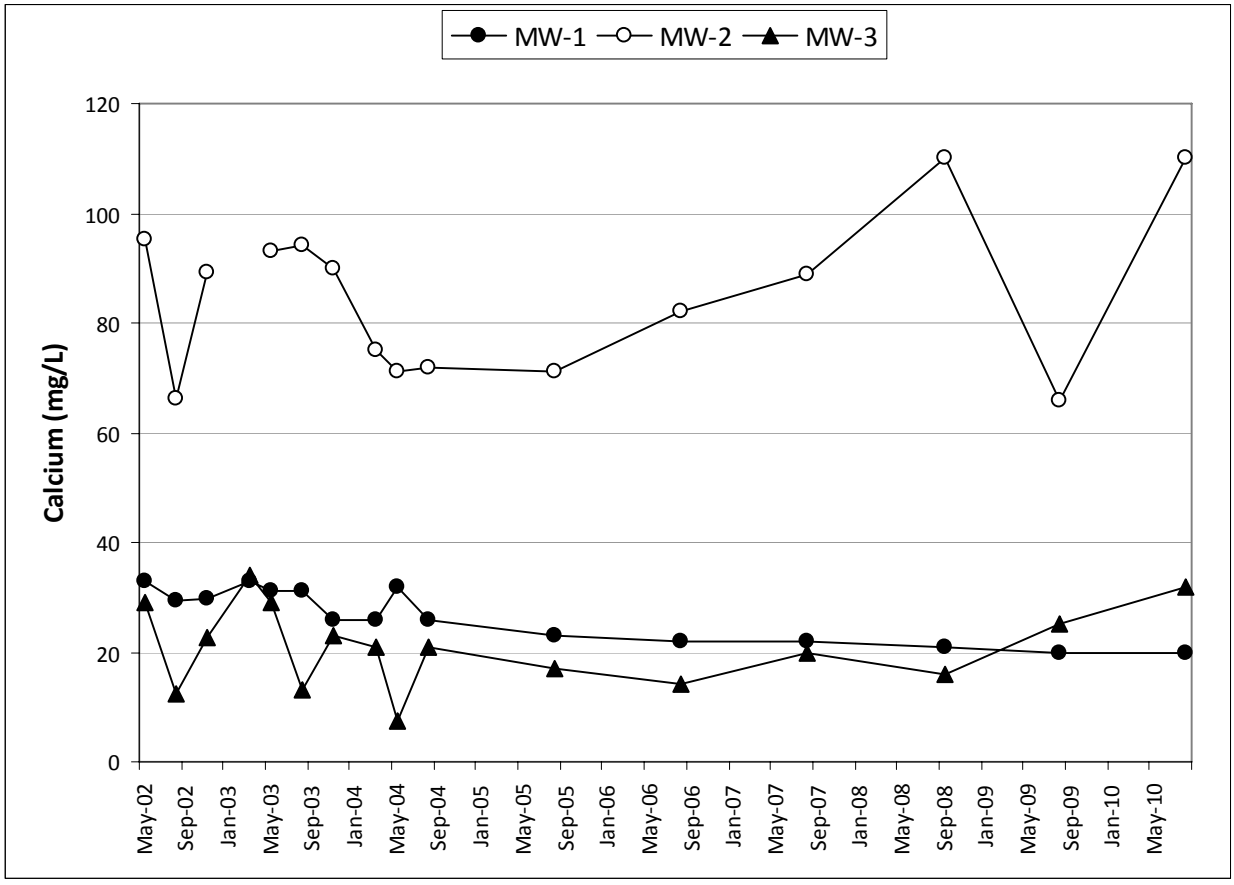


Figure 5 Trends in Calcium Concentrations at the Brighton Landfill

Ammonia

Ammonia is an inorganic form of nitrogen. It is readily oxidized to nitrate when exposed to air, but it can accumulate underground under anoxic conditions as a product of organic decay. Ammonia concentrations have been below the NYS groundwater standard of 2 mg/L at wells MW-1 and MW-2 at the Brighton Landfill during the majority of the study period, as shown in Figure 6. Ammonia concentrations have been above the groundwater standard during 2002-2003 in MW-3. However ammonia concentrations have been below the groundwater standard at MW-3 since then and have been decreasing over time. During 2005 through 2010, ammonia concentrations were nearly identical at all three wells.

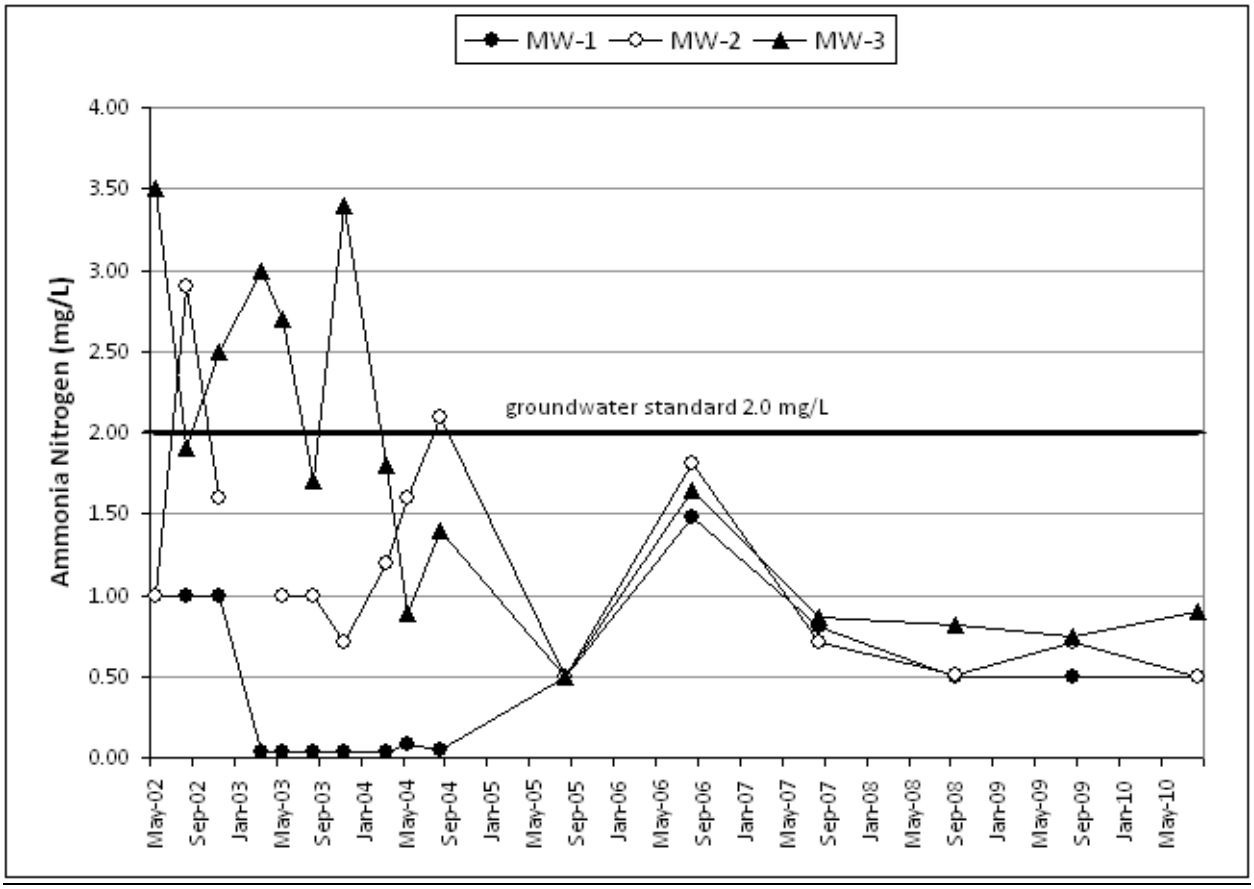


Figure 6 Trends in Ammonia Nitrogen Concentrations at the Brighton Landfill

Chemical Oxygen Demand

Chemical oxygen demand (COD) is a leachate parameter that indicates the presence of mineral or inorganic material in groundwater. It also indicates redox conditions in the groundwater; as reducing conditions increase, COD increases. Overall, COD concentrations have been fairly low in the Brighton Landfill monitoring wells, as shown in Figure 7. No NYS groundwater standard is in place for COD. COD concentrations were higher at both of the downgradient wells (MW-2 and MW-3) than at the upgradient well during the entire study period. COD concentrations appear to be generally decreasing over time at both downgradient wells.

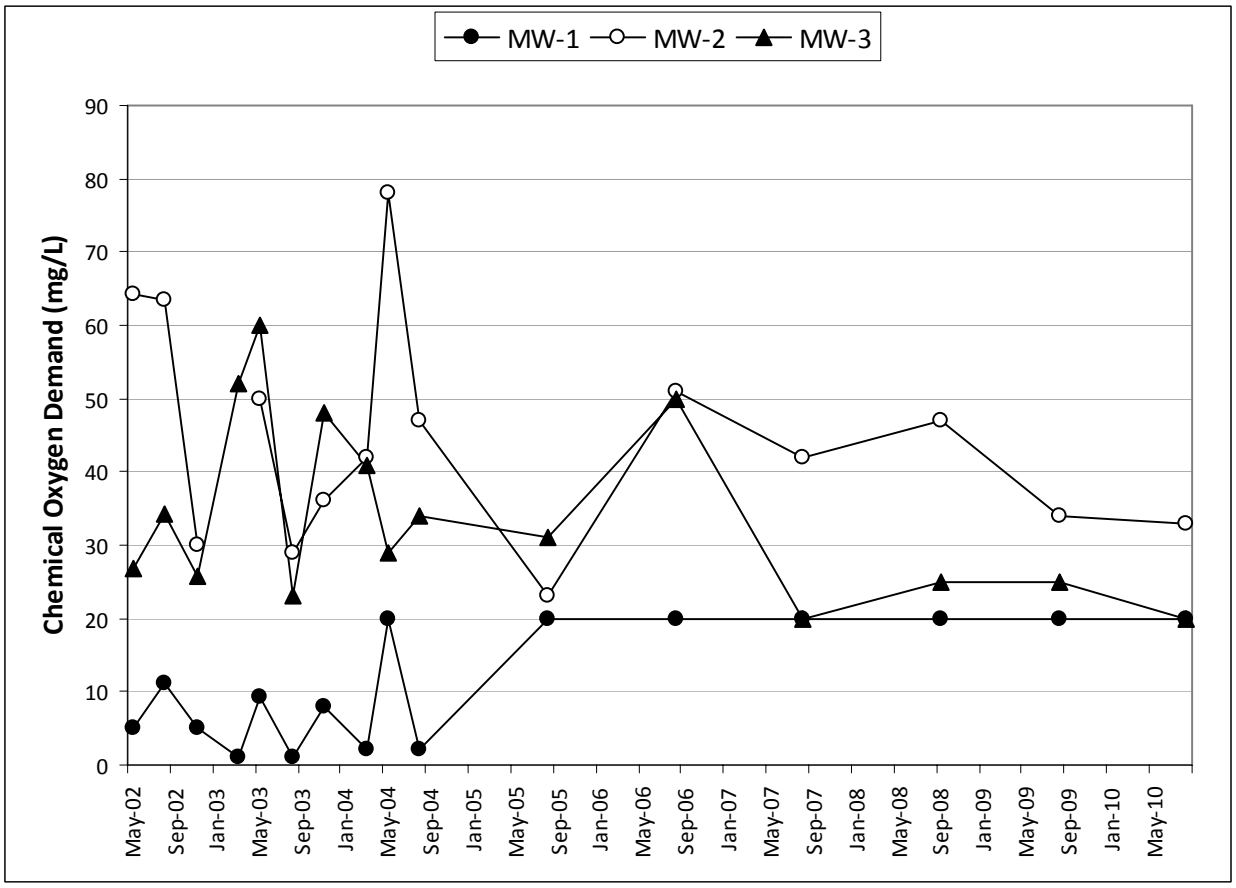


Figure 7 Trends in Chemical Oxygen Demand at the Brighton Landfill

Total Dissolved Solids

Total dissolved solids (TDS) is a measure of the amount of dissolved matter in the groundwater. Usually this measurement represents inorganic matter, but when organic solvents reach high levels, they can also contribute to TDS. At the Brighton Landfill, none of the three wells exceeded the NYS groundwater standard of 500 mg/L for TDS during the study period, with the exceptions of MW-3 during 2009, and MW-2 in 2010, as shown in Figure 8. It is unclear what caused the sudden spike in TDS at the downgradient well MW-3 in 2009, but the 2010 datum has returned to consistent levels of recent years. This well will need to be watched closely; however, since no other parameters spiked at that well, it could just be an anomaly. The TDS concentrations have generally been higher at the upgradient well MW-2 than at MW-1 or MW-3.

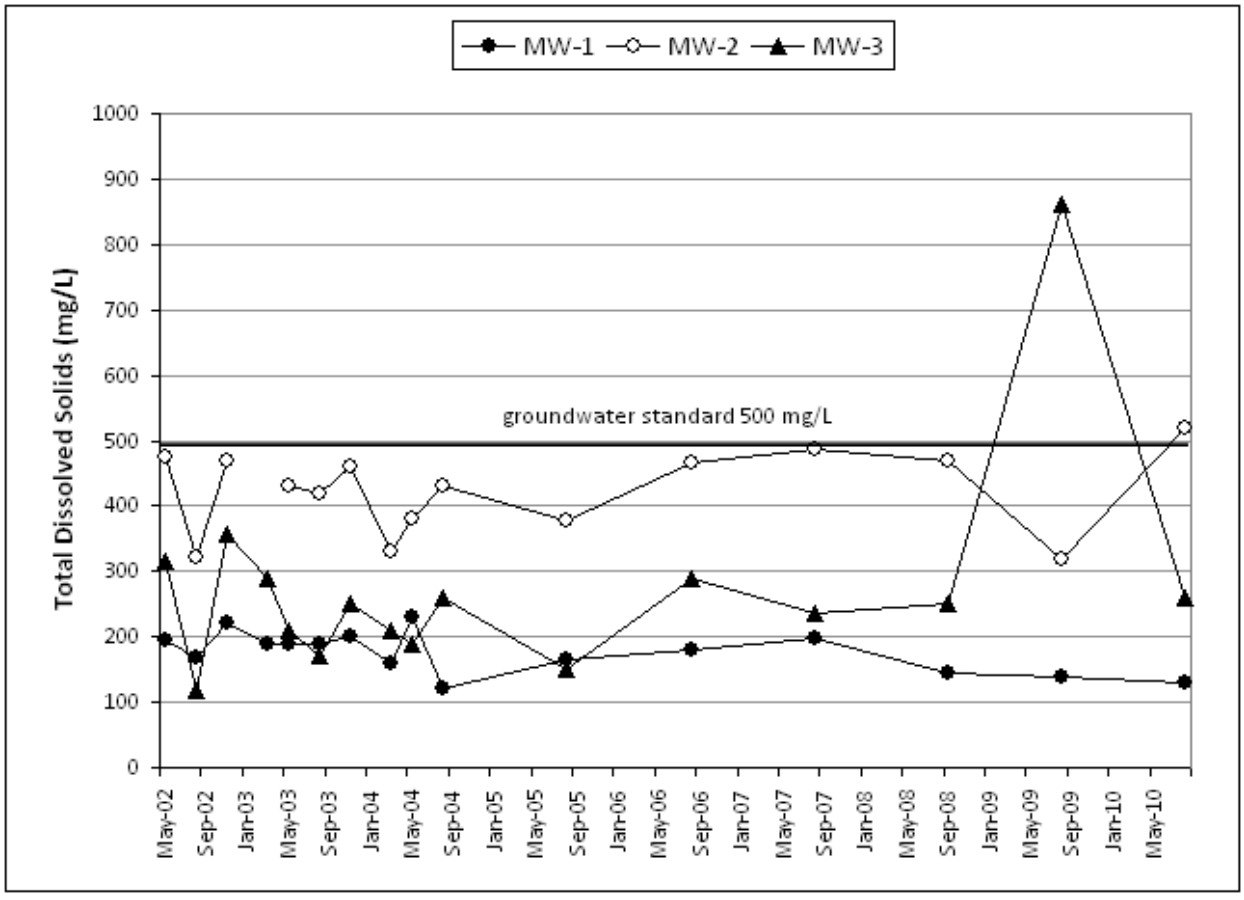


Figure 8 Trends in Total Dissolved Solids at the Brighton Landfill

Iron and Manganese

Iron and manganese are both heavy metals that can be found naturally occurring in the soil. However, both metals are also leachate indicators. While neither metal is derived from municipal waste, both can be readily leached from the soil in the presence of landfill leachate. At the Brighton Landfill, both iron and manganese are present in concentrations well above the groundwater standard (0.03 mg/L for both metals) at all three wells, including the upgradient well as show in Figures 9 and 10. However, both metals are present in much higher amounts in the downgradient wells. An improving trend in iron concentrations can be seen in recent years in the downgradient wells, as shown in Figure 9. The same can not be said for manganese concentrations, as manganese concentrations have been increasing at the downgradient wells with respect to the upgradient well in recent years, as shown in Figure 10. Both of these trends should be followed closely in the future.

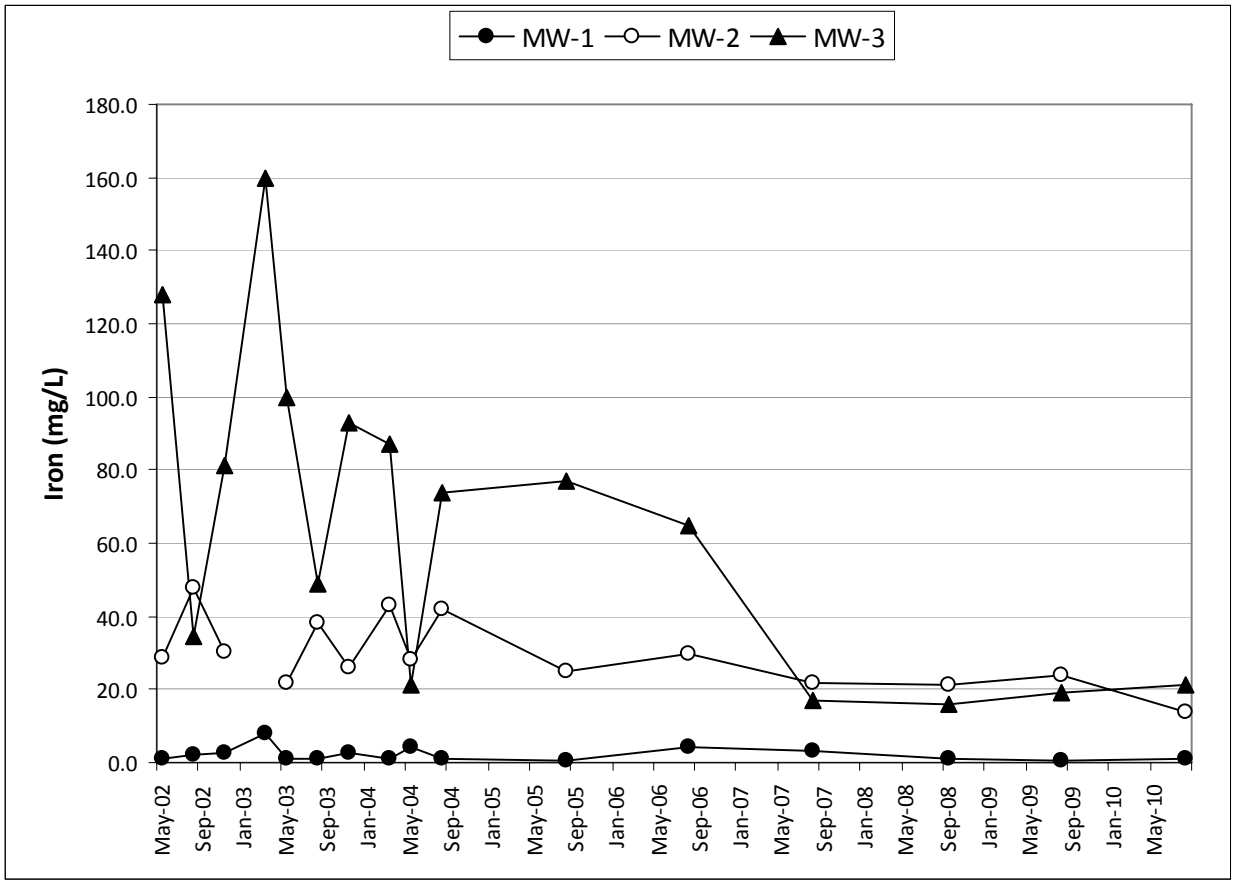


Figure 9 Trends in Iron Concentrations at the Brighton Landfill

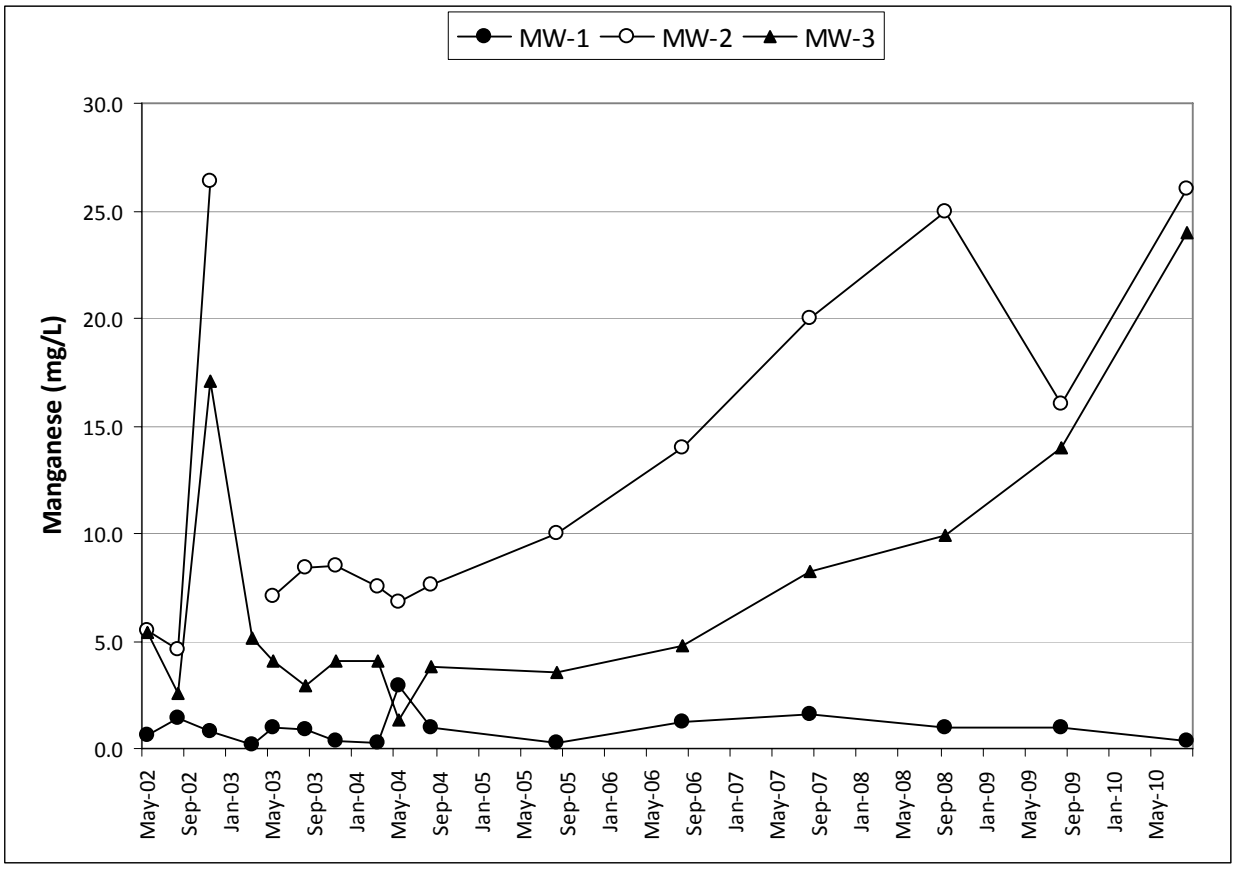


Figure 10 Trends in Manganese Concentrations at the Brighton Landfill

Water Quality Trends Summary

One of the downgradient wells, MW-2, had higher concentrations of manganese, TOC, COD, alkalinity, calcium, total dissolved solids, and total VOCs than the other two wells during the study period. MW-2 should be closely watched in the future for any additional landfill leachate indicators.

Although it appears that landfill leachate is impacting the groundwater at the Brighton Landfill to a certain degree, any impact on area groundwater is low and there are no apparent public health concerns. It appears that there may be an improving trend in leachate indicators in the downgradient wells with respect to ammonia and iron.

7.0 Explosive Gas Survey Results

Explosive gas was measured at the Brighton landfill during 2010 using a portable gas meter. Measurements were taken with a soil probe every 100 feet around the perimeter of the cap. None of the perimeter soil probe measurements exceeded the 50% Lower Explosive Limit (LEL) for methane. Explosive gas measurements are provided in Appendix D.

8.0 Landfill Site Inspection

No visible signs of vectors, cracks, erosion or groundwater leaks were evident during 2010. The vegetation on the landfill cap was in good condition. The Town of Brighton has installed "no trespassing" signs around the landfill cap, which seem to be working. There was no evidence of ATV riding on the landfill cap this year. The access road around the landfill cap needs to be mowed all the way around.

9.0 Conclusions and Recommendations

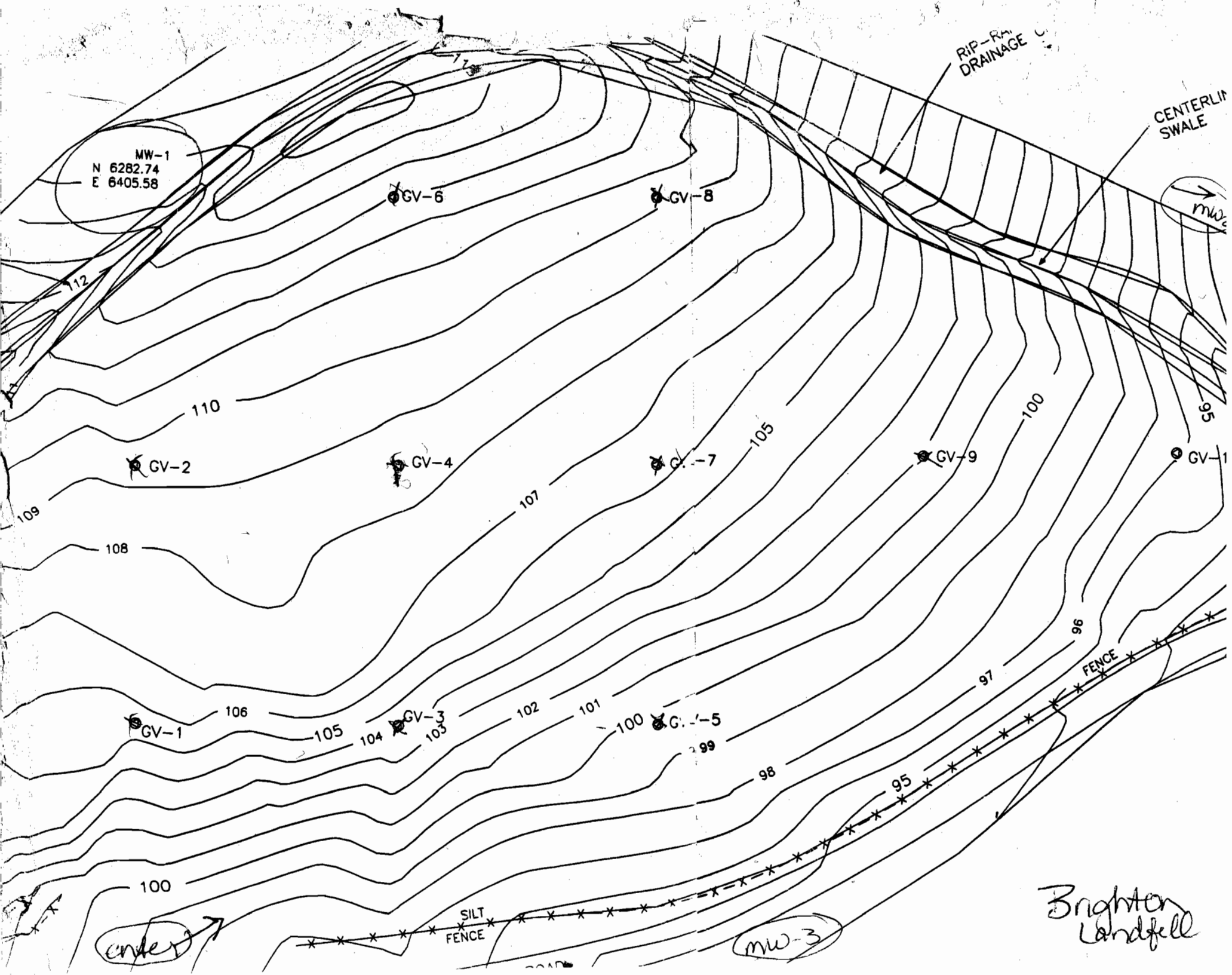
The landfill cap should continue to be mowed at least once a year to prohibit the growth of woody shrubs. Care must be taken when mowing so that neither the cap nor the gas vents are disturbed. Only light equipment should be allowed on the cap itself so that the soil on the cap is not compacted. The access road should continue to be maintained around the site.

The Town of Brighton should work with the owner to the landfill access road to make sure that access to the landfill is maintained and a key to the gate is made available. The Town of Brighton has deeded access to the landfill via the access road, and regardless of the ownership of the land across which the access road travels; the town needs to ensure that they can get through the gate for maintenance and monitoring purposes.

The next monitoring event will take place during August or September of 2011.

APPENDIX A

MAP OF THE BRIGHTON LANDFILL


MW-1
N 6282.74
E 6405.58
GV-6
GV-8
GV-2
GV-4
GV-7
GV-9
GV-1
GV-3
GV-5
RIP-RAP
DRAINAGE
CENTERLINE
SWALE
112
110
109
108
107
106
105
104
103
102
101
100
99
98
97
96
95
FENCE
SILT
FENCE
MW-3
Brighton
Landfill

APPENDIX B

SUMMARY OF BASELINE GROUNDWATER QUALITY RESULT

F. X. Browne, Inc. Project No. 1566-10

Town of Brighton Landfill Sampling

Summary of Baseline Inorganic Parameters

2010 Sampling Event

Sample Well	NH3-N mg/L	COD mg/L	BOD mg/L	TOC mg/L	TDS mg/L	SO4 mg/L	Alkalinity mg/L	Phenols mg/L	Chloride mg/L	Hardness mg/L	Color units	Turbidity NTU
MW-1	<0.500	<20	<4.0	<3.0	130	21.7	58	<0.005	2.99	82	10	5.2
MW-2	<0.500	33	<4.0	16.1	520	8.91	420	<0.005	1.38	370	250	84.5
MW-3	0.894	<20	<4.0	4.8	260	51.4	220	<0.005	1.39	170	120	45
Duplicate	1.05	22	<4.0	6.1	270	44.7	190	<0.005	2.26	150	280	85.5
GW Std	2	none	none	none	500	250	none	0.001	250	none	15	none
RPD %	16	10	0	24	4	14	15	0	48	13	80	62

Sample Well	Aluminum mg/L	Arsenic mg/L	Calcium mg/L	Cobalt mg/L	Iron mg/L	Lead mg/L	Magnesium mg/L	Manganese mg/L	Potassium mg/L	Selenium mg/L	Sodium mg/L	Thallium mg/L	Zinc mg/L
MW-1	0.093	<0.010	20	<0.050	0.83	<0.001	7.6	0.38	1.2	<0.005	2.3	<0.003	0.02
MW-2	0.07	<0.010	110	<0.050	14	<0.001	24	26	6.3	<0.005	3.7	<0.003	0.026
MW-3	0.1	<0.010	32	0.064	21	<0.001	21	24	5.1	<0.005	5.7	<0.003	0.044
Duplicate	0.06	<0.010	30	0.069	24	<0.001	19	21	4.9	<0.005	6	<0.003	0.047
GW Std	none	0.025	none	none	0.3	0.025	35	0.3	none	0.01	20	0.004	0.3
RPD %	50	0	6	8	13	0	10	13	4	0	5	0	7

NOTE: Groundwater standards for Magnesium represents NYS DEC guidance values where a standard has not been established

RPD is the Relative Percent Difference between the Duplicate and reference well (MW-3) for QA/QC purposes

Shaded cells indicate concentrations that exceed the NYCRR Part 703 Groundwater Standard

APPENDIX C

SUMMARY OF VOLATILE ORGANIC GROUNDWATER QUALITY RESULTS

F. X. Browne, Inc. Project No. 1566-10

Town of Brighton Landfill Sampling

Summary of Baseline Volatile Organic Parameters

2010 Sampling Event

Analyte	MW-1	MW-2	MW-3	Duplicate	Blank	GW Std.
Benzene	<1	<1	<1	<1	<1	1
Bromodichloromethane	<1	<1	<1	<1	<1	5
Bromoform	<1	<1	<1	<1	<1	50
Bromomethane	<1	<1	<1	<1	<1	50
Carbon tetrachloride	<1	<1	<1	<1	<1	5
Chlorobenzene	<1	<1	<1	<1	<1	5
2-Chloroethyl vinyl ether	<1	<1	<1	<1	<1	5
Chloroethane	<1	<1	<1	<1	<1	5
Chloroform	<1	<1	<1	<1	<1	7
Chloromethane	<1	<1	<1	<1	<1	5
Dibromochloromethane	<1	<1	<1	<1	<1	50
1,2-Dichlorobenzene	<1	<1	<1	<1	<1	5
1,3-Dichlorobenzene	<1	<1	<1	<1	<1	4.7
Dichlorodifluoromethane	<1	<1	<1	<1	<1	5
1,4-Dichlorobenzene	<1	1.5	1.6	1.7	<1	4.7
trans-1,2-Dichloroethene	<1	<1	<1	<1	<1	5
trans-1,3-Dichloropropene	<1	<1	<1	<1	<1	5
1,2-Dichloropropane	<1	<1	<1	<1	<1	5
1,1-Dichloroethane	<1	<1	<1	<1	<1	5
1,2-Dichloroethane	<1	<1	<1	<1	<1	5
1,1-Dichloroethene	<1	<1	<1	<1	<1	5
cis-1,2-Dichloroethene	<1	1.0	<1	<1	<1	5
cis-1,3-Dichloropropene	<1	<1	<1	<1	<1	5
Ethyl benzene	<1	<1	<1	<1	<1	5
Methylene chloride	<1	<1	<1	<1	<1	5
1,1,2,2-Tetrachloroethane	<1	<1	<1	<1	<1	5
Tetrachloroethene	<1	<1	<1	<1	<1	5
Toluene	<1	<1	<1	<1	<1	5
1,1,1-Trichloroethane	<1	<1	<1	<1	<1	5
1,1,2-Trichloroethane	<1	<1	<1	<1	<1	5
Thrichloroethene	<1	<1	<1	<1	<1	5
Trichlorofluoromethane	<1	<1	<1	<1	<1	5
Vinyl chloride	<1	<1	<1	<1	<1	2
o-Xylene	<1	<1	<1	<1	<1	5
m,p-Xylene	<1	<1	<1	<1	<1	5

All values are in micrograms per liter

Duplicate samples taken at MW-3

APPENDIX D

SUMMARY OF EXPLOSIVE GAS MONITORING RESULTS

F. X. Browne, Inc. Project No. 1566-10

Town of Brighton Landfill Sampling

Summary of Explosive Gas Measurements

Location	2005 Methane (% LEL)	2006 Methane (% LEL)	2007 Methane (% LEL)	2008 Methane (% LEL)	2009 Methane (% LEL)	2010 Methane (% LEL)
Gas Vents						
GV-1	0	0		0	35	0
GV-2	0	0		0	0	0
GV-3	0	0		0	21	7
GV-4	0	0		6	>50	3
GV-5	0	0		3	>50	27
GV-6	0	0		0	3	0
GV-7	0	0		0	12	0
GV-8	0	0		0	2	0
GV-9	0	0		0	22	0
GV-10	0	0		0	0	0
Monitoring Wells						
MW-1	0	0		0	0	0
MW-2	0	0		0	1	9
MW-3	0	0		0	0	0
Perimeter						
0	0	0	0	0	0	0
100	0	0	0	0	0	0
200	0	0	0	0	0	0
300	0	0	0	0	0	0
400	0	0	0	0	0	0
500	0	0	0	0	0	0
600	0	0	0	0	0	0
700	0	0	0	0	0	0
800	0	0	0	0	0	0
900	0	0	0	0	0	0
1000	0	0	0	0	0	0
1100		0			0	0
1200		0			0	0
1300		0			0	0
1400						0

* % LEL is the Lower Exposure Limit