CITY OF NORTHAMPTON, MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
125 Locust Street
Northampton, MA 01060

413-587-1570
Fax 413-587-1576

Edward S. Huntley, P.E.
Director

Memorandum

To: Northampton City Council (with enclosure)

From: Edward S. Huntley, P.E. Director of Public Works

CC: Dan Hall, Department of Environmental Protection (without enclosure)
Mayor Michael Tautznik, Easthampton (without enclosure)
Easthampton City Council (without enclosure)
Easthampton Department of Public Works (without enclosure)
BAPAC (without enclosure)
Jo-Anne Bessette, Water Not Waste (without enclosure)

Date: June 30, 2010

Re: Northampton Landfill – Response to Barnes Aquifer Protection Advisory Committee

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The Northampton Department of Public Works is in receipt of correspondence to City Council President David Narkewicz from the Barnes Aquifer Protection Advisory Committee (BAPAC), dated June 28, 2010. In this document BAPAC makes several comments about the impacts of the Northampton Landfill on groundwater quality, including unsubstantiated comments about increasing leachate leaking from the landfill. These same statements and issues were previously made by BAPAC in correspondence to Mayor Clare Higgins on January 28, 2010. To respond to the issues raised by BAPAC the Department of Public Works (DPW) contracted with Brown and Caldwell to respond to hypothesis and assertions made by BAPAC. The Brown and Caldwell letter report dated April 14, 2010 (copy enclosed) was forwarded by the DPW on April 27, 2010 (copy enclosed) to BAPAC and the other parties copied on this memorandum.

This most recent letter by BAPAC does not mention the analyses completed by Brown and Caldwell in the April 14, 2010 document. In addition, the DPW has never received any reply from BAPAC about the work that Brown and Caldwell completed in regard to these questions. We have also offered to meet with BAPAC in this regard.

This information is provided to the City Council so that a complete record is available as this Ordinance change is considered.

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Edward S. Huntley, P.E.
Director

Memorandum

To: Mayor Clare Higgins

From: Edward S. Huntley, P.E. Director of Public Works

CC: Dan Hall, Department of Environmental Protection
Northampton City Council
Mayor Michael Tautznik, Easthampton
Easthampton City Council
Easthampton Department of Public Works
BAPAC

Date: April 27, 2010

Re: Northampton Landfill – Response to Barnes Aquifer Protection Advisory Committee

The Northampton Department of Public Works requested that our consultant Brown and Caldwell, prepare a response to the letter sent to you by the Barnes Aquifer Protection Advisory Committee (BAPAC), dated January 28, 2010. We trust the attached letter by Brown and Caldwell dated April 14, 2010 clarifies questions raised by BAPAC in their letter to you. We are available to meet with BAPAC as desired to discuss this information. BAPAC is also welcome to contact me with any questions.

One Technology Drive
Suite 310
Andover, MA 01810
Tel: (978) 794-0336
Fax: (978) 794-0534

BROWN AND CALDWELL

April 14, 2010

Mr. Ned Huntley, P.E.
Director of Public Works
Department of Public Works
125 Locust Street
Northampton, MA 01060

138164.001

Subject: BAPAC Letter
Northampton Landfill, Northampton, Massachusetts

Dear Mr. Huntley:

This letter has been prepared in response to the Barnes Aquifer Protection Advisory Committee's (BAPAC's) letter to the City of Northampton dated January 28, 2010 which identified several concerns related to the Northampton Landfill (hereafter referred to as the Landfill). In particular, BAPAC speculated that the amount of leachate leaking from the Landfill is increasing, which led them to ask the following two questions:

1. *What specifically, is the DEP and City of Northampton doing to determine why the amount of leachate leaking from the landfill is increasing?*
2. *What is going to be done to correct this situation before it gets worse?*

The purpose of this letter is to respond to these two questions. The letter has been structured to first give the reader an overview of our responses, and to then provide the backup information used to support our positions.

Overview

Brown and Caldwell has reviewed the data and recognizes that the iron and manganese concentrations appear to be increasing at well MW-B, however, we do not believe there is adequate evidence to support BAPAC's conclusion that the amount of leachate leaking from the landfill is increasing. The organic odors detected in well MW-B are likely related to poor construction of the well (which may allow surface water from the wetlands to impact groundwater quality in the well) as opposed to an indication of leachate. In addition, evaluation of the analytical results from leachate, and wells upgradient of the Landfill to well MW-B, provide strong evidence that the chemistry in well MW-B is not leachate. The likely cause for the increasing iron and manganese concentrations in the well is the dissolution of naturally occurring iron and manganese in the aquifer under reducing conditions caused by elevated levels of dissolved organic carbon. The primary causes of these high levels of dissolved organic

carbon are likely related to composting operations located upgradient of the Landfill, and possibly also the unlined Landfill.

The City of Northampton has already taken the actions required by the Solid Waste Regulations (310 CMR 19.000) to protect the quality of groundwater and surface water resources at the site including capping of the unlined Landfill, lining the new Landfill, and capping each cell of the new Landfill after it is filled. The City is also complying with the Solid Waste Regulations regarding the need for monitoring related to the wetlands. In addition, the City voluntarily had Gradient Corporation conduct a focused risk characterization in 2008 to assess potential risk to human health and the environment. At the public's request, in 2008 and 2009 the Massachusetts Department of Public Health completed three risk evaluations related to the Landfill. The results of these various risk evaluations do not indicate downgradient impacts from the Landfill that pose a Significant Risk to human or ecological receptors. Therefore, in accordance with the Solid Waste Regulations, there are no requirements that corrective actions be implemented associated with the wetlands. As required, the City will continue to monitor groundwater, private wells, and surface water on a semi-annual basis. Bi-annual flora and fauna assessments of Hannum Brook and the associated wetlands will continue to be performed. In the event that conditions change which indicate a potential Significant Risk to human or ecological receptors, the City will initiate additional evaluation and/or corrective actions as appropriate to comply with the regulations.

Detailed Discussion

Question 1 – What is being done to determine why the amount of leachate leaking from the landfill is increasing?

The evidence which BAPAC presents that leachate leaking from the Landfill is increasing is based on the following; the location of well MW-B directly downgradient of the landfill, the presence of a strong organic odor in that well, the area of iron flocculate in the wetland adjacent to the well is expanding, and concentrations of iron and manganese in the well are increasing. However, in response to the first question raised by BAPAC and as discussed below, we do not believe that evidence is an indication of an increasing amount of leachate leaking from the Landfill.

We acknowledge that a strong organic odor has been detected in monitoring well MW-B during sampling of the well. However, this is unlikely an indication of leachate (leachate has a very distinct odor compared to an organic odor), and the field data sheets do not refer to the odor as that of leachate. A review of the construction of the well as described in the Hydrogeologic Study of the Northampton Sanitary Landfill (Wagner and Associates, Inc., 1985) indicates that due to limited accessibility (MW-B is located in wetlands); it was installed by hand to a depth of 16 feet below grade. Unfortunately, there is no boring log for this well to indicate specific construction

details. The Initial Site Assessment Report (C.T. Male Associates, 1992) indicates that the well does not have an annular seal, and recent observations indicate that the well does not have a concrete pad. As a result, surface water has the potential to flow directly down the annular space into the well screen and groundwater quality in the well can be influenced by surface water conditions. Therefore, the organic odor in the well could be caused by the short circuiting of surface water which is in contact with organic rich sediments in the wetlands (these organics can easily generate a strong organic odor in the confined space of a capped well). In conclusion, the strong organic odor, which is noticeably different than a leachate odor, may be the result of natural organics in the wetlands sediments.

To further evaluate the issue of whether leachate is the cause of odors in the well, we have conducted a standard geochemical analysis of groundwater monitoring results using Piper diagrams. Piper diagrams are useful in that they allow a graphical representation of a given water sample, and a comparison of the chemical similarity between different water samples (i.e., how closely different water samples cluster together on the diagram). The standard Piper diagram used in this analysis consists of plotting the major cations (sodium/potassium, calcium, and magnesium) in percentages of milliequivalents in a triangular plot (the cation triangle). The relative abundance of the major anions (chloride, sulfate, bicarbonate/calcium carbonate) is plotted in percentages of milliequivalents in the anion triangle. The two data points on the cation and anion triangles are then combined into the quadrilateral field that shows the overall chemical property of the water sample represented as a single point.

For this analysis, Brown and Caldwell plotted the most recent semi-annual groundwater analytical results (November 2009) because this was the first round in several years to include the sampling of upgradient monitoring wells MW5-1S, MW5-1I, and MW5-1D. Also, Piper diagrams require analytical results for potassium and magnesium; two constituents that are not part of the semi-annual monitoring program. To conduct our evaluation, we requested that the laboratory which performed the analysis of the semi-annual sampling (Phoenix Environmental Laboratories, Inc.) obtain the results for these parameters from the previous analytical runs. The potassium and magnesium results are included in updated laboratory analytical data sheets provided in Attachment 1.

Piper diagrams are particularly useful in evaluating the potential for the mixing of different waters. For the groundwater chemistry in a particular location to be the result of the physical mixing of two different liquids (in this case, the mixing of background upgradient groundwater with landfill leachate), the resulting chemistry of the mixed liquid would fall along a line connecting the two original liquids on the Piper diagram. As indicated in Figure 1, the chemistry of the sample from monitoring well MW-B does not plot anywhere near the line that would connect the leachate and the background wells. This analysis provides strong evidence that the groundwater

chemistry observed in well MW-B is not the result of leachate mixing with background groundwater at the Site.

We recognize that the leachate data used in the Piper diagram is for a sample collected from the lined landfill (leachate data is not available for the unlined landfill because there is no liner to have contained the leachate for sample collection). However, both landfills have received municipal solid waste (MSW) and therefore the leachate generated by each is expected to have a similar chemical composition with respect to the major cations and anions plotted on the Piper diagram.

As opposed to the speculation that the iron and manganese in well MW-B and the iron flocculate observed in the wetlands are the result of increased leaking of leachate, we believe these data are indicative of reducing conditions. It has been well documented in the literature that high levels of dissolved organic carbon in groundwater causes an increase in microbial activity as naturally occurring bacteria in the aquifer utilize the organic carbon as a food source. Microbial metabolism is a coupled reaction involving oxidation of organic matter and reduction of an electron acceptor, with oxygen being the preferred receptor. Once the available oxygen in the groundwater has been depleted, a change in conditions from oxidizing to reducing can mobilize significant amounts of metal oxides such as iron and manganese that are naturally occurring in soils. When the groundwater that is under reducing conditions discharges at the ground surface (for example to wetlands or streams), it is exposed to oxidizing conditions. At that point, the reducing conditions reverse and the dissolved iron and manganese in the groundwater begin to precipitate into solid form. It is these precipitated oxides, particularly the iron oxides, which produce the visible staining and flocculate in the wetland sediments. Based on the process outlined above, the migration of iron and manganese to the wetlands will continue until the available dissolved organic carbon has decreased to an amount that will allow the groundwater to return to its normal oxygenated state.

It should be noted that the process described above can occur regardless of the source of the dissolved organic carbon. Some potential sources of dissolved organic carbon in the vicinity of the Landfill include the migration of organic matter from the unlined Landfill into the underlying groundwater, the percolation of rainwater through the large composting piles and large areas of compost and wood chips that have been spread across the gravel pits to the north of the Landfill, manure and leach fields on adjacent properties, and the natural decay of organic matter in wetland sediments. As has been noted in the Hannum Brook Evaluation Updates (described below), in a letter dated May 9, 1969 (prior to the operation of the landfill) iron oxide seeps were noted on the banks of Hannum Brook. Thus, there is evidence of iron seeps that are unrelated to the operation of the Landfill. However, we acknowledge that the primary cause of the elevated levels of iron in the groundwater at MW-B and the iron precipitate in the vicinity of that well is likely not caused by natural conditions. The

most likely sources of the dissolved organic carbon that would affect this area are the unlined Landfill or the composting operations which have occurred north of the Landfill since the 1990s (Drawing 1 shows the approximate location of the composting operations plotted on the groundwater contour map included in the November 2009 Water Quality Monitoring Report dated January 7, 2010). As shown on Figure 2, elevated levels of iron have frequently been detected in groundwater at upgradient well MW-Q, and this well has had a history of elevated iron levels relative to upgradient well MW-1. Similarly, Figure 3 shows low concentrations of dissolved oxygen (as measured in the field) in wells MW-B and MW-Q relative to well MW-1, or the recently sampled upgradient triplet at MW5-1S, MW5-1L, and MW5-1D. Given that well MW-Q is located directly downgradient of the composting operations, the high iron and low dissolved oxygen levels in this well provide strong evidence that these operations are a significant, if not leading, contributor to the source of dissolved organic carbon in the aquifer and the resulting iron precipitate in the wetlands.

To summarize, we do not believe there is adequate evidence to support the BAPAC conclusion that the amount of leachate leaking from the Landfill is increasing. Rather, the conditions observed in the wetlands and at well MW-B are likely the result of dissolution of naturally occurring metals in the aquifer under reducing conditions caused by elevated levels of dissolved organic carbon from the composting operations, and possibly the unlined Landfill.

Question 2 – ***What is going to be done to correct this situation before it gets worse?***

In accordance with the Massachusetts Solid Waste Management regulations (310 CMR 19.000), the City has already completed required actions to address potential impacts from the Landfill. These actions include the capping of the unlined Landfill in 1995 to reduce infiltration through the waste, the collection and treatment of leachate generated from waste in the newer lined Landfill, and the capping of those portions of the lined Landfill that have been completed. When the final cell in the lined Landfill is filled, it will also be capped in accordance with the regulations.

The Solid Waste regulations prescribe a defined process for when and how remedial actions associated with landfills should be conducted as described in 310 CMR 19.150 and 19.151. This process begins with conducting an Initial Site Assessment (ISA) followed by a Comprehensive Site Assessment (CSA). The intent of the CSA is to characterize the impact of the landfill on public health, safety and the surrounding environment. The Massachusetts Department of Environmental Protection (MassDEP) then reviews the CSA to determine the need for subsequent phases of assessment or corrective action.

In accordance with this process, the ISA and CSA for the Landfill were completed by C.T. Male Associates, P.C. in April, 1992, and October, 1997, respectively. In the MassDEP's approval of the CSA dated March 10, 1998, they required further review and an update of the need for a wetland remediation system after a one year time period to allow for additional monitoring data to be collected to address iron and manganese concentrations in some water quality samples in wetlands to the south of the Landfill and associated with Hannum Brook. On March 2, 1999, MassDEP requested that the City of Northampton determine if wetland remediation, in the vicinity of Hannum Brook, was warranted due to the high iron and manganese concentrations reported in the water quality samples. The first evaluation of Hannum Brook in response to this request was prepared by Dufresne-Henry and submitted to MassDEP on July 14, 1999. Based on a qualitative review of flora and fauna in the wetlands and Hannum Brook, the report concluded that mitigation of groundwater was not required, as no obvious impacts to the wetlands system had occurred. This conclusion was based in part on documentation regarding the presence of iron precipitate in the Brook prior to the initiation of the landfill operations, and the location of iron-rich seeps on the opposite bank of the stream from the Landfill. Given that other sources could be contributing to the iron levels in Hannum Brook, it was uncertain whether a mitigation program would lead to a significant decrease in iron levels. The MassDEP approval of that submittal required that an evaluation of the Brook be completed every two years and submitted to MassDEP for review. Subsequent Hannum Brook Evaluation updates were submitted in 2001, 2003, 2005, 2007, and 2009 by Dufresne-Henry (now Stantec). Each of these subsequent reports concluded that mitigation was not necessary because no harmful effects to the ecosystem have been observed.

As noted in the BAPAC letter, the recent Hannum Brook Evaluation indicated that at sampling station S-6 (wetland area in close proximity to well MW-B) "*there has been some change in the extent of the staining since observations were initiated in 2001; an increase in the amount of stained substrate is apparent. No quantification of this increase has been made.*" However, the update also noted that the presence of iron and manganese precipitates can be a natural occurrence (particularly given the observation of iron precipitates prior to the operation of the Landfill). Regardless, even in the vicinity of S-6 where precipitates were at their highest concentrations, vegetation stress was not noted. Furthermore, the 2009 Evaluation update indicated that "*while there may be an aesthetic impact to the stream due to the precipitate, no harmful effects to the ecosystem have been recorded.*" They also concluded that "*based on the consistency of observations between the 1999 through 2009 monitoring periods, we conclude that mitigation of the iron and manganese concentrations in the groundwater is not required to protect the receiving wetland areas from impact, as no obvious ecological stress to the system has been observed.*"

In addition to these qualitative assessments, Gradient Corporation prepared a Focused Risk Characterization for the City in February 2008 to assess potential risks to human

health and the environment from exposures to sediment and surface water potentially impacted by the Landfill. In response to concerns from the public, the Massachusetts Department of Public Health (MDPH) recently issued the following three reports evaluating potential risks to the public:

- Health Consultation – Evaluation of Private Drinking Water within 0.5 miles of the Northampton Sanitary Landfill, March 6, 2008,
- Evaluation of Health Outcome Data in Northampton and Easthampton, MA and among Neighborhoods in Closest Proximity to the Northampton Regional Landfill, September 2008, and
- Health Consultation – Evaluation of Sediment and Surface Water Sampling Data at the Northampton Sanitary Landfill, July 9, 2009.

The following provides brief summaries of each of these studies in the order they were conducted, and their resulting conclusions:

- Gradient Corporation's Focused Risk Characterization assessed potential risks to human health and the environment from exposures to sediment and surface water (Hannum Brook and surrounding wetlands) as well as potential human health risks from use of groundwater as a source of potable water at residences near the Landfill. Their risk assessment utilized procedures defined in the Massachusetts Contingency Plan (310 CMR 40.0993) and associated MassDEP guidance documents. With respect to human health, Gradient concluded that "*the Site poses No Significant Risks to human health from sediment and surface water in Hannum Brook*". They also concluded that "*private well water quality has not been impacted by landfill operations and is unlikely to be in the future*". Based on a Stage I environmental screening, they concluded that "*estimated surface water concentrations in the Wetland Study Area exceeded respective surface water benchmarks for iron and manganese. However, field investigations of wetland vegetation and invertebrates in the Wetland Study Area indicated no apparent harmful effects. Therefore, the Site poses No Significant Risks to the environment.*"

- In the March 2008 Health Consultation, at the request of concerned residents, the MDPH evaluated the analytical results of water samples collected in July 2007 from 31 private wells located at residential properties within ½ mile of the Landfill (residences sampled were along Park Hill Road, Glendale Road, and Westhampton Road). These results were compared to drinking water standards known as Massachusetts Maximum Contaminant Levels (MMCLs), health based comparison values established by the United States Agency for Toxic Substances and Disease Registry (ATSDR), or Risk-Based Concentrations developed by the United States Environmental Protection Agency (EPA). As indicated in the report, "*based on MDPH's evaluation of 2007*

drinking water sample data, ATSDR would classify the drinking water from all of the private wells sampled as posing No Apparent Public Health Hazard." MDPH recommended regular testing of two private drinking water wells in which arsenic (981 Park Hill Road) and lead (696 Park Hill Road) were detected slightly above MMCLs to ensure that concentrations of these metals remain approximately at or below the Massachusetts drinking water standards. Resampling of these wells (August 2007, as well as three subsequent semi-annual sampling events conducted in November 2008, May 2009, and November 2009) did not detect any exceedances of the MCLs for these two metals.

- The MDPH Health Consultation dated September 2008 consisted of an evaluation of available health outcome data for the City of Northampton and the Town of Easthampton due to community concerns about potential environmental exposures in the area surrounding the Landfill, and past and current potential health effects. The investigation provided a review of health outcome data including nine types of cancer, birth defects, low birth weight, birth defects, asthma, childhood blood levels, and autism. The primary purposes of this assessment were to evaluate whether any unusual patterns emerged when assessing disease incidence in the community, particularly in relation to the Landfill, and/or to generate hypotheses for possible future public health investigation. Based on this epidemiologic investigation, the MDPH made the following conclusion: *"Overall, a review of cancer incidence data and other readily available health outcome data did not reveal any unusual patterns in either Northampton or Easthampton, in the census tracts in closest proximity to the Northampton Regional Landfill, or in the one-mile radius surrounding the Northampton regional landfill."*

- A Health Consultation was issued by MDPH in July 2009 in response to residents concerns about coming into contact with chemicals that may have migrated from the landfill to sediments and surface water in streams and wetlands downstream of the landfill. This study included an evaluation of analytical results for sediment and surface water samples collected from Hannum Brook, the wetland area located south of the landfill, the unnamed stream flowing from the wetlands into Hannum Brook, and the storm water detention basin outlet. The review included the analytical results for 54 surface water samples collected from 2004 through 2008, and 33 sediment samples collected in 1994, 1997, 2007, and 2008. For surface water, MDPH calculated exposure doses for those constituents that exceeded ATSDR comparison values or MassDEP standards for public drinking water supplies. For sediment, they compared calculated exposure doses to ATSDR Chronic Minimal Risk Levels and EPA Chronic Reference Doses. Based on their evaluation, MDPH concluded that *"touching and incidentally eating or drinking small*

amounts of sediments and surface water in streams and wetlands downstream from the Landfill is not expected to result in health effects. This was because levels of chemicals in sediment and surface water that could get into a child's, or adolescent's, or an adult's body during recreational activities are below levels that would affect their health."

To summarize, the four recent risk evaluations described above (three of which were conducted by the MDPH) do not indicate downgradient impacts from the Landfill that pose a Significant Risk to human or ecological receptors. Therefore, in accordance with the Solid Waste Regulations, there is no basis to conduct corrective actions. As required by the MassDEP, the City of Northampton will continue to conduct semi-annual monitoring of groundwater, private wells, and surface water. The City will also continue to conduct the bi-annual flora and fauna assessments of Hannum Brook and the associated wetlands. In the event that conditions change which indicate a potential Significant Risk to human or ecological receptors, then in accordance with the regulations the City will initiate additional evaluation and/or corrective actions as appropriate.

If you have any questions, please contact me.

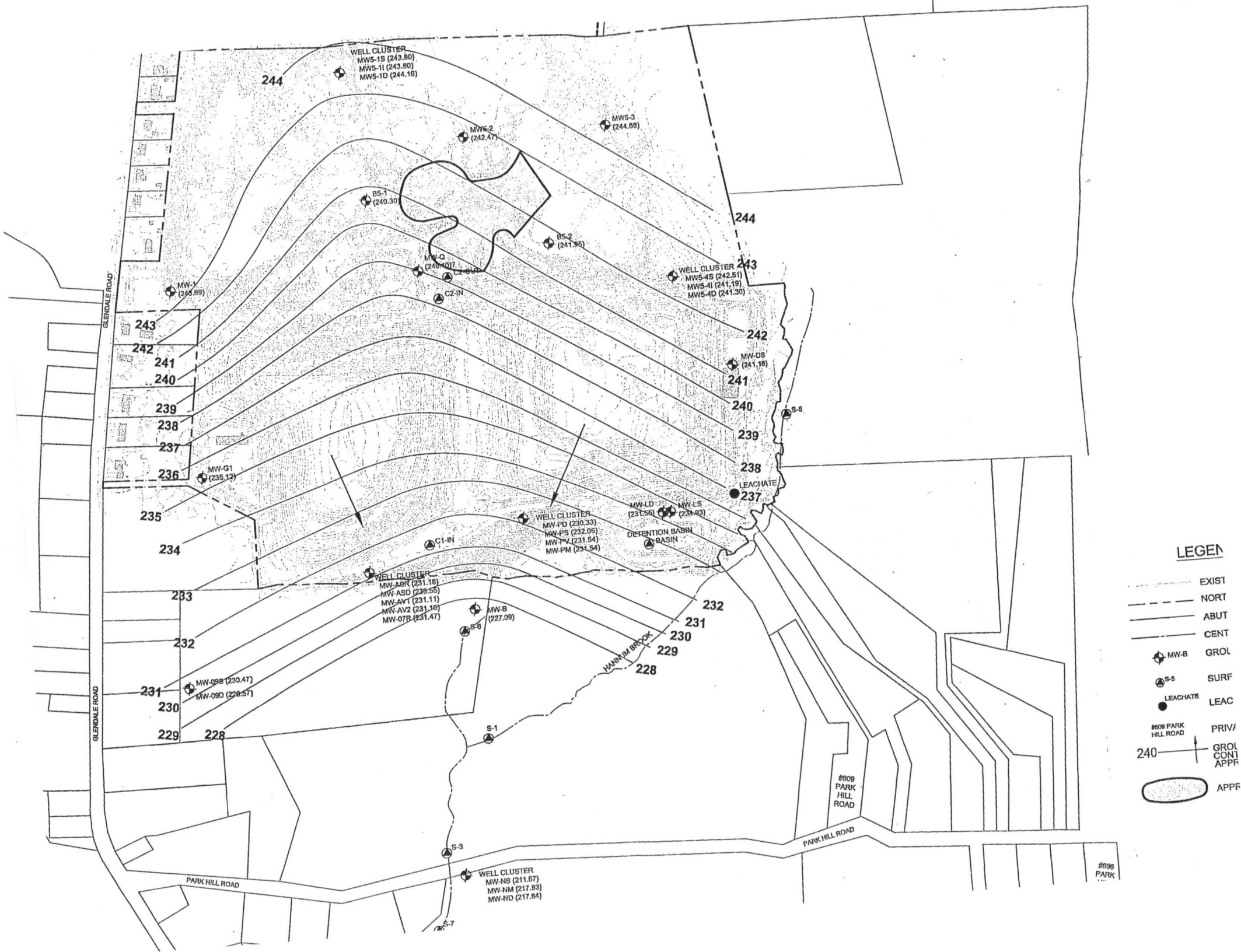
Very truly yours,

BROWN AND CALDWELL

Donald W. Podsen, LSP
Certified Ground Water Professional

cc: J. Laurila – City Engineer

Attachment 1 – Groundwater Analytical Data Sheets


WELL CLUSTER
MW5-1S (243.80)
MW5-1I (243.80)
MW5-1D (244.16)
MW5-2 (242.47)
MW5-3 (244.68)
B5-1 (240.30)
B5-2 (241.95)
MW-Q (240.10)?
C2-OUT
C2-IN
MW-1 (244.89)
WELL CLUSTER
MW5-4S (242.51)
MW5-4I (241.19)
MW5-4D (241.30)
MW-DS (241.18)
S-5
LEACHATE
MW-G1 (235.12)
MW-LD (231.55)
MW-LS (231.93)
WELL CLUSTER
MW-PD (230.33)
MW-PS (232.05)
MW-PV (231.54)
MW-PM (231.54)
DETENTION BASIN
BASIN
C1-IN
WELL CLUSTER
MW-ASR (231.16)
MW-ASD (230.55)
MW-AV1 (231.11)
MW-AV2 (231.16)
MW-07R (231.47)
MW-B (227.09)
S-6
HANNUM BROOK
MW-09B (230.47)
MW-09D (228.57)
S-1
S-3
WELL CLUSTER
MW-NS (211.67)
MW-NM (217.83)
MW-ND (217.84)
S-7
GLENDALE ROAD
GLENDALE ROAD
PARK HILL ROAD
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ABUT
CENT
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SURF
LEACHATE
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240
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CONT
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APPR

Figure 1
Piper Diagram – MW5-1S, -1I, -1D, MW-B, and Leachate
November 2009

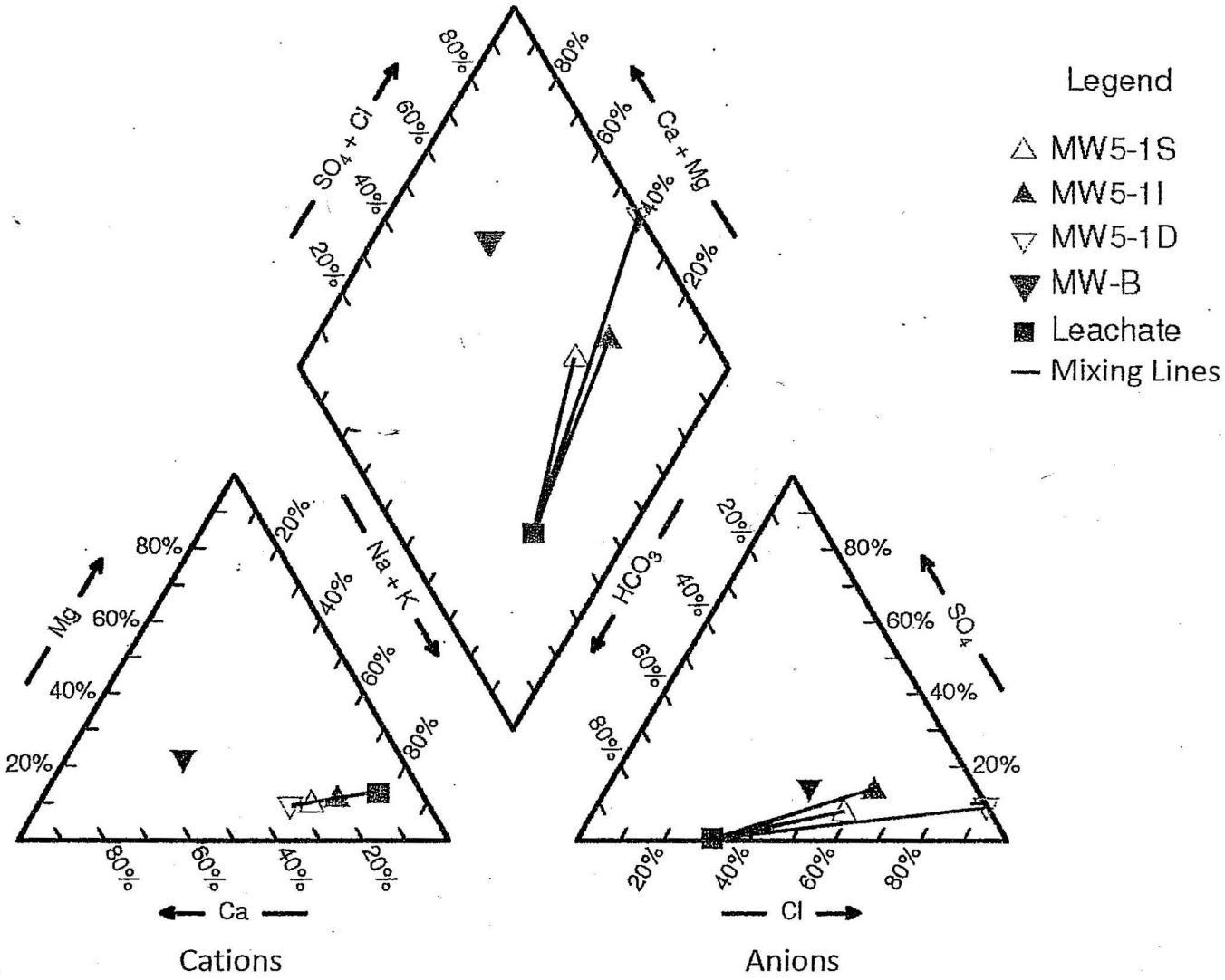
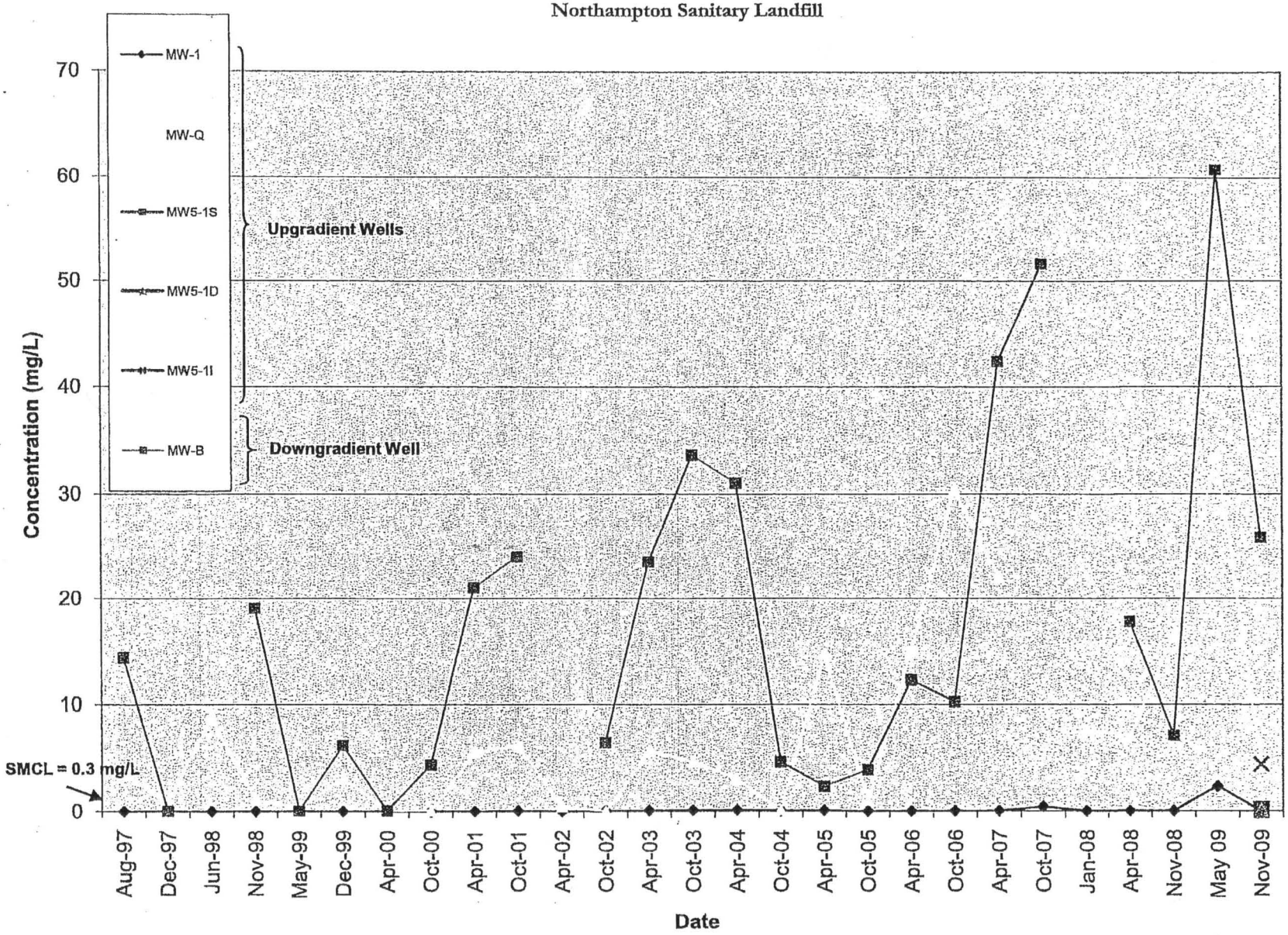


Figure 2
Dissolved Iron in Groundwater
Northampton Sanitary Landfill



SMCL - Secondary Maximum Contaminant Levels (Spring 2008)

*Total iron data for MW-Q from October 2007 not included as sample was analyzed for total iron rather than dissolved iron.

Figure 3
Dissolved Oxygen in Groundwater
Northampton Sanitary Landfill