BASELINE GROUNDWATER SAMPLING AND MONITORED NATURAL ATTENUATION REPORT
EDGECOMBE COUNTY LANDFILL
EDGECOMBE COUNTY
TARBORO, NORTH CAROLINA

S&ME Project Number 1054-07-238D

Prepared for:

Edgecombe County
Solid Waste Department
PO Box 10
Tarboro, NC 27886

Prepared by:

S&ME, Inc.
3201 Spring Forest Road
Raleigh, North Carolina 27616

Candy Elliott
Staff Scientist

Thomas P. Raymond, P.E.
Senior Consultant

Samuel P. Watts, P.G.
Senior Project Manager

July 19, 2012

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EXECUTIVE SUMMARY

According to the January 16, 2009 Corrective Action Plan Review letter, the North Carolina Department of Environment and Natural Resources- Division of Waste Management (NCDENR-DWM)- Solid Waste Section (Section) recommends that semi-annual sampling be continued at the site for constituents identified in 40 CFR 285 Appendix I (Appendix I). As part of the sampling and analysis plan (SAP), a minimum of four rounds of independent groundwater samples from selected wells (background and compliance) is to be collected and analyzed for constituents listed in 40 CFR 258, Appendix I *Constituents for Detection Monitoring* (Appendix I). The sample results and subsequent statistical analyses obtained from the initial four independent sampling rounds constitute the "baseline" for the semi-annual sampling events to be conducted during the 30 year post-closure period. S&ME sampled three background, eight compliance wells, one upgradient surface water point and one downgradient surface water point during baseline sampling events performed at the landfill on January 19 and July 20, 2010, and January 18 and July 27, 2011. Groundwater levels were gauged in the monitor wells prior to sampling and are presented in **Table 1**. Groundwater and surface water samples collected during these four events were analyzed for the Appendix I list of constituents by EPA Methods 6010 (metals) and 8260 (volatile organic compounds).

During baseline sampling, no Appendix I volatile organic compounds (VOCs) were detected in the background monitoring wells MW-3B, MW-4, and MW-9. The following VOCs were reported in compliance wells MW-5, MW-6, MW-7A, MW-12, MW-13, and MW-15 above the laboratory reporting limits for one or more baseline monitoring events; acetone, benzene, chlorobenzene, chloroethane, 1,4-dichlorobenzene, 1,1-dichloroethane, cis-1,2-dichloroethene, trans-1,2-dichloroethene, 1,2-dichloropropane, methylene chloride, toluene, trichloroethene, and vinyl chloride. Several VOCs were reported in compliance monitoring wells above the 2L Standard, including benzene, 1,4-dichlorobenzene, 1,1-dichloroethane, cis-1,2-dichloroethene, 1,2-dichloropropane, methylene chloride, trichloroethene, and vinyl chloride. Compliance monitoring wells MW-14 and MW-16 reported no detections of VOCs during the sampling period. Groundwater analytical results are found in **Table 2**. Average VOC concentrations are presented in **Table 3**.

The following Appendix I metals were detected above the laboratory reporting limits in all background and compliance wells; antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, lead, nickel, selenium, thallium, vanadium, and zinc. The following Appendix I metals were detected above the North Carolina Groundwater Quality 2L Standards (2L) or the Solid Waste Groundwater Protection Standards (GWPST) in background wells MW-3B and MW-4; antimony, cobalt, thallium, and vanadium. Compliance wells MW-6, MW-7A, MW-12, MW-13, MW-15, and MW-17 reported detections of the following Appendix I metals above the 2L or the GWPST; arsenic, cobalt, nickel, thallium, and vanadium (**Table 2).**

Appendix I metals barium, cobalt, copper, nickel, and zinc were detected in surface water samples collected from both the upgradient (SW-1) as well as the downgradient (SW-2) sampling points during the January 2011 sampling event. During the January 2010 sampling event, cobalt was detected in both surface water samples. The similarity in concentrations of metals for both the upgradient and downgradient samples suggests that the detected metals are either naturally occurring or are originating from another source. Analytical results for surface water samples can be found in **Table 4**.

1.0 INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

Edgecombe County currently operates a solid waste facility on a tract of land located off of Colonial Road (S.R. 1601) in Edgecombe County, south of Tarboro, North Carolina (**Figure 1**). In general, the solid waste facility includes a municipal solid waste (MSW) transfer facility; a construction & demolition (C&D) debris landfill unit; white goods and pallets storage area; soil borrow pits; and various operational buildings. The C&D landfill unit is operated over an existing closed MSW landfill, in general accordance with North Carolina Department of Environment and Natural Resources Division of Waste Management (NCDENR-DWM) Permit No. 33-01. Edgecombe County continues to perform groundwater and surface water monitoring on a semiannual basis to comply with the requirements of North Carolina Solid Waste Management Rules (Solid Waste Rules), 15A NCAC 13B. S&ME has prepared this report on behalf of Edgecombe County to present the results of the baseline monitoring events as required by § .0600 and .1632 of the Solid Waste Rules.

North Carolina Solid Waste Management Rules (15A NCAC 13 B. 1633) require, in part, that the owner/operator prepare a groundwater and surface water sampling and analysis plan (SAP). The site specific SAP was submitted to NCDENR as a part of the WQMP which was originally written in September 1994, revised in June 2008 and again in January 2010. As part of the SAP, a minimum of four rounds of independent groundwater samples from selected wells (background and compliance) are to be collected and analyzed for constituents listed in 40 CFR 258, Appendix I *Constituents for Detection Monitoring* (Appendix I). The sample results and subsequent statistical analyses obtained from the initial four independent sampling rounds constitute the "baseline" for the semi-annual sampling events to be conducted during the 30 year post-closure period.

As proposed in S&ME's correspondence dated June 30, 2011, baseline sampling was conducted at three background wells (MW-3B, MW-4 and MW-9), eight compliance wells (MW-5, MW-6, MW-11, MW-12, MW-13, MW-14, MW-15, and MW-16), and two surface water monitoring points (SW-1 and SW-2). The four independent sampling events were performed in January and July of 2010, and January and July of 2011. Well locations and surface water sampling points are presented in **Figure 2**. The results of these activities are provided in this report.

1.2 BACKGROUND

Groundwater has been monitored at the landfill facility since 1994 in accordance with § .1632 of the Solid Waste Rules under the landfill's *Water Quality Monitoring Plan* (WQMP). The WQMP was originally written in September 1994, revised in June 2008 and again in January 2010. Current groundwater monitoring at the landfill is conducted in general conformance with the January 2010 WQMP.

Volatile organic compounds (VOCs) and inorganic constituents (metals) have been detected above North Carolina groundwater protection standards in groundwater samples collected from groundwater compliance monitoring points at Edgecombe County Landfill. Previous statistical

evaluation of the groundwater monitoring data indicated that a release of VOCs and metals had occurred. In accordance with NCDENR North Carolina Solid Waste Rules defined under 15A NCAC 13B, S&ME has completed the following activities on behalf of Edgecombe County in response to the detections of the VOC and metals in groundwater:

- Statistical analyses (January 2007) of semiannual water quality results of compliance well monitoring system in accordance with the facility's Water Quality Monitoring Plan (WQMP);

- Alternate Source Demonstration (ASD) study (June 10, 2008) in accordance with Solid Waste Rules defined under 15A NCAC 13B.1633(c)(3) and .1634(g)(2);

- Nature and Extent Study (NES) (June 25, 2008) prepared in accordance with Solid Waste Rules defined under 15A NCAC 13B.1634(g)(1);

- Assessment of Corrective Measures (ACM) (June 26, 2008) in accordance with Solid Waste Rules defined under 15A NCAC 13B.1635; and,

- Corrective Action Plan (CAP) (June 30, 2008) in accordance with Solid Waste Rules defined under 15A NCAC 13B.1636.

The groundwater sampling services were completed in general accordance with the requirements of the Solid Waste Rules defined under 15A NCAC 13B .1632 (Groundwater Sampling and Analysis Requirements), .1634 (Assessment Monitoring Program), and .1637 (Implementation of the Corrective Action Program).

2.0 GEOLOGY AND HYDROLOGY

2.1 REGIONAL AND SITE GEOLOGY

Edgecombe County lies within the Coastal Plain Physiographic Province of North Carolina. In general, geologic units in the Coastal Plain Region consist of deep unconsolidated elastic deposits overlying crystalline basement rocks. The Coastal Plain sedimentary formations in this region include, from youngest to oldest (surface to depth):

- The Surficial Deposits (Quaternary)
- The Yorktown Formation (Tertiary)
- The Upper Cape Fear Formation (Cretaceous)

In the site vicinity, the Quaternary sediments are comprised of the Penholoway, Wicomico, and Sunderland Formations. These formations are generally less than 50 feet thick, with an average of 20 to 30 feet, and consist of yellow silty sands and sandy clays. Beneath the Quaternary deposits lies the Yorktown Formation with consist of 30 to 60 feet of blue-gray fossiliferous silty clay with sand clay, shell beds, and fine sands. The Yorktown is extensive throughout the county forming a nearly continuous layer. Beneath the Yorktown lies the Cretaceous Upper Cape Fear Formation, which consists of reddish brown to brown clay, sand and sandy clay with some gravel resting on the irregular bedrock surface. The Cape Fear sediments range in thickness from 30 feet in the west to more than 400 feet in the eastern part of the county.

The Cretaceous sediments are underlain by crystalline igneous and metamorphic rock, with a highly irregular surface than dips gently to the east. The depth to bedrock is approximately 300 feet below the National Geodetic Vertical Datum, or approximately 240 to 400 feet below ground surface (ft bgs).

Previous investigations by S&ME have identified soils on site to consist of sand and silty sand to depths of approximately 4 to 6 ft bgs. Soils underlying the surficial sediments generally consist of sandy silty clay, silty sandy gravel, and sandy clayey silts. A subsurface investigation identified a marine clay layer (the Yorktown Formation) that underlies the near-surface soils at the landfill site at depths ranging from 3 to 20 ft bgs across the site. The full thickness of the Yorktown Formation had not been determined; however, two deep borings have indicated that the Yorktown Formation is at least 25 feet thick at the site. The borings, MW-5D and CPT-1, were advanced at the north and south ends of the site, respectively. Yorktown clays were identified at 10 ft bgs in each boring and extended to 40 ft bgs at MW-5D, and 35 ft bgs in CPT-1.

2.2 REGIONAL AND SITE HYDROLOGY

2.2.1 Surface Water

The site lies within the Tar-Pamlico River basin. Local surface water features included Jerry's Creek, Wright's Creek, drainage features in the waste disposal unit, and the farm pond located in the southeast corner of the site. The undisturbed natural topography in the areas surrounding the

waste management units at the facility is characterized as gradual to moderate slopes toward these local surface water features. The surface of the landfill facility generally mimics these natural slope gradients and also discharges to these surface water features. Jerry's Creek is the primary receptor of surface water runoff from the landfill. Some areas of the landfill drain surface water directly to Jerry's Creek while much of the central portion of the waste disposal unit drains to a topographic "horseshoe" feature in the northern boundary of the landfill. A sedimentation pond which is a remnant of former MSW operations collects the surface drainage in this area. Infiltration and percolation into the upper soil horizon is expected to be moderate due to the sandy loam content within this stratum. The uppermost aquifer underlying the landfill is expected to discharge to the local surface water features. During periods of rainfall with high surface water runoff, Jerry's Creek, Wright's Creek, and the farm pond may recharge the aquifer.

2.2.2 Groundwater

As many as 10 aquifers separated by 9 confining units have been identified in the Coastal Plain; however, the aquifers can be grouped into three major deep aquifer systems in North Carolina: the Quaternary, the Tertiary, and the Cretaceous Aquifer Systems. Each of these aquifers are separated from each other by low permeability units composed of clays and silts. The Quaternary Aquifer is composed of surficial deposits of sandy silt and clay. The Tertiary Aquifer is composed of glauconitic sands, clayey sands, and limestone. The Cretaceous Aquifer is composed of sand, silty and clayey sand, and clay separated by confining units of clay and silt.

The uppermost aquifer at the site is unconfined and is found in the silty sands of the Quaternary Sunderland Formation. This aquifer is recharged by inflow from upgradient areas and by infiltration of precipitation. The Tertiary-age Yorktown formation is a marine clay layer underlying the near surface soil at the landfill site at depths ranging from 3 to 20 ft. bgs, and appears to act as a confining layer below the landfill. In some areas, this water may be "perched" over the Yorktown clays beneath the Quaternary sands, rather than forming a true unconfined aquifer.

Groundwater within and below the landfill appears to result partially from lateral flow recharge through the sandy surficial soils from upland areas to the south flowing downgradient through the waste disposal unit, groundwater levels are very near the ground surface and the water surface in the old sediment pond, which is likely further recharging the groundwater in this area.

2.2.3 Groundwater Elevations and Flow Direction

The uppermost aquifer at the site is unconfined and is found in the silty sands of the Sunderland Formation. This aquifer is recharged by inflow from upgradient areas and by precipitation infiltration. The uppermost aquifer underlying the landfill is expected to discharge to the local surface water features including Jerry's Creek and the drainage features in the active landfill area. During flood conditions, the southwest perimeter trench and the farm pond located in the southeast corner of the site may recharge the aquifer. The marine clay layer (Yorktown Formation) encountered at depths from approximately 8 to 24 feet below the original ground surface acts as an aquitard and semi-confining layer below the landfill.

Shallow monitoring wells and piezometers are installed in the surficial aquifer with the bottoms of the wells resting above, on, or penetrating the top of the Yorktown Formation. As previously discussed, static water levels in fifteen monitor wells and twelve piezometers of the site monitoring network were measured prior to sampling.

Static water level measurements collected during the four baseline sampling events (**Table 1**) were used to calculate the corresponding groundwater elevations based on surveyed top of casing (TOC) elevations. Groundwater potentiometric maps were developed using the groundwater elevations and are presented in previous reports. **Figure 3** shows the potentiometric surface map generated from the most recent data**.** Based upon the groundwater potentiometric surface elevations, the groundwater flow direction was estimated to be to the north-northeast. The average horizontal hydraulic gradient was calculated from three point calculation solutions using two sets (three wells per set) of groundwater elevation data measured on July 27, 2011 and by applying the following equation (Driscoll, 1986):

$$i = \frac{h_1 - h_2}{L}$$

where:

i = Hydraulic gradient
$h_1 - h_2$ = Difference in hydraulic head (feet)
L = Distance along flow path (feet)

The three point calculation is used to estimate the hydraulic gradient perpendicular to a groundwater potentiometric contour of equal elevation determined from high, intermediate, and low groundwater elevations at three monitor wells. The gradient calculated perpendicular to the equal elevation contour plotted from the well set is representative of a true gradient rather than the apparent gradient that is estimated from a two-well point gradient calculation. Based on the Driscoll gradient equation and using a third groundwater elevation to plot the equal elevation contour, the distance L can be measured between h_1 and h_2 perpendicular to the equal elevation contour to estimate the true hydraulic gradient for the three groundwater elevation data points. The average horizontal hydraulic gradient from two three point solutions using well sets MW-3B, MW-7A, and MW-5, and P-1, MW-7A and MW-5 is estimated to be 0.0210 ft/ft. The hydraulic gradient calculations are included in **Appendix III**.

2.2.4 Groundwater Flow Velocity

An approximate average linear groundwater flow velocity (V) was calculated using the following equation (Freeze and Cherry, 1979):

$$V = \frac{Ki}{n}$$

where:

V =	Average linear groundwater flow velocity [feet per year (ft/yr)]
K =	Hydraulic conductivity (ft/yr)
i =	Flow gradient as a ratio (ft/ft)
n =	Effective soil porosity (percent)

Aquifer rising and falling head tests were previously performed at the site by Law Engineering Company (Law) and by S&ME. The aquifer test data were used to estimate the hydraulic conductivity of the sediments in the surficial aquifer intersected by the screened intervals of the monitor wells tested. The aquifer test data (provided in previous reports) were analyzed by the Bouwer and Rice Method.

The hydraulic conductivity, K, values previously measured at the site ranged from 1.29×10^{-5} centimeters per second (cm/sec) to 3.65×10^{-4} cm/sec. An average hydraulic conductivity value of 5.95×10^{-5} cm/sec was used for calculating the site-wide flow velocity. The average hydraulic gradient of 0.0210 ft/ft, calculated from the three point solution described above was used as the site-wide average gradient. An effective soil porosity value (n) of 15% was used as the site-wide average.

The average groundwater flow velocity, V, for the site, using the equation and input values above, was estimated at 8.62 ft/yr. Groundwater flow velocity calculations are included in **Appendix I**. The average groundwater flow velocity information is presented on **Figure 2**.

2.2.5 Groundwater Table

The shallow groundwater is defined in this report as the water table or phreatic surface beneath and in the vicinity of the landfill. The depth to the shallow groundwater was measured in the background wells (MW-3B, MW-4, and MW-9) and the compliance wells (MW-5, MW-6, MW-7A, MW-12, MW-13, MW-14, MW-15, and MW-16) during all four sampling events.

At the time of each sampling event, each well was examined for its general integrity, including protection from surface water inflow, well identification tag, vented cap, lock, and general well security. Each well was opened and the depth to the water table was measured from a referenced mark on the top of the PVC well casing using an electronic water level indicator. The water table elevation at each well was calculated by subtracting the depth measurement from the elevation of the referenced top of casing. **Table 1** shows the depth to groundwater measurements

and groundwater elevation calculations for each of the monitor wells sampled during the four baseline sampling events.

The water table elevations shown on **Figures 3** are indicative of the hydraulic head present at each of the well locations. The added contours on these figures are equipotential lines. Since groundwater flows from areas of higher hydraulic head to areas of lower hydraulic head, water table flow occurs from the higher elevations shown on the water table map to areas where elevations are lower. Water table surface maps were constructed using a CAD-generated base map and plotting the water table elevation calculated for each well location. Groundwater surface potentiometric contours determined from static groundwater measurements recorded on January 2010 (**Figure 2**), July 2010 (**Figure 3**), January 2011 (**Figure 4**), and July 2011 (**Figure 5**).

3.0 BASELINE SAMPLING PROGRAM

In accordance with 15A NCAC 13 B, Section .1632, a groundwater and surface water sampling and analysis plan must be prepared and implemented by the landfill owner/operator. The SAP was prepared by S&ME and submitted to NCDENR as a part of the WQMP which was originally written in September 1994, revised in June 2008 and again in January 2010. The following sections describe the procedures used for the collection of groundwater and surface water samples are described below.

S&ME sampled eight compliance wells and three background wells on January 19 and July 20, 2010, and January 18 and July 27, 2011. Two surface water samples were collected at points along Jerry's Creek in January 2010 and January 2011. No water was present in Jerry's Creek during the July 2010 and the July 2011 sampling events and surface water samples could not be collected. Prior to collecting groundwater samples, the monitor wells and piezometers listed in the WQMP network of points for groundwater elevation measurements were opened and allowed to equilibrate with atmospheric conditions before gauging the liquid level. The measurements were collected to calculate relative groundwater elevations and to estimate the hydraulic gradient and groundwater flow direction at the time of the sampling event. Groundwater depths were measured to an accuracy of ±0.01 feet using an electronic water level indicator, which was decontaminated before its initial use and between measurements. Field personnel wore clean protective/non-reactive gloves at each well location when collecting water level measurements. Water level measurements are presented in **Table 1**.

After the static groundwater level measurements were made from the wellhead, stagnant water from each sampled well was purged using a peristaltic pump. New silicon tubing placed through the drive of the peristaltic pump was attached to a section of dedicated Teflon-lined tubing that was inserted into the monitor well. Low-flow sampling methods were followed to purge and sample groundwater from the monitor wells. As purging proceeded, an YSI® multi-meter with a flow-through cell was used to measure field parameters that included pH, temperature, specific conductance, dissolved oxygen, oxidation-reduction potential, and turbidity on groundwater purged from the monitor wells. Purge parameter measurements were measured and recorded at regular intervals before sampling. The multi-meter was calibrated by Geotech Environmental Equipment and the calibration was field-checked with calibration standards by S&ME personnel before use.

A groundwater sample was collected after field parameters (pH, temperature, and conductivity) stabilized and the turbidity measurement was approximately 30 Nephelometric Turbidity Units (NTUs) or below. In accordance with the WQMP, field parameters were considered stable when they were changing less than 10 percent over three consecutive measurements. The field parameter measurements are presented in **Table 5**.

Groundwater samples were collected through the silicon tubing directly into clean containers provided by the laboratory. Once filled, the sample containers were sealed, labeled, and placed into an insulated container with ice. The samples were submitted under chain-of-custody protocols to Environmental Conservation Laboratories, Inc. (ENCO), a North Carolina-certified

laboratory. ENCO tested the samples for constituents listed in 40 CFR 258 Appendix I and several additional monitored natural attenuation (MNA) parameters, selected to measure the effectiveness of the corrective actions to be implemented at the site.

The samples were analyzed by Environmental Conservation (ENCO) Laboratories for Appendix I constituents via EPA Methods 6010 (metals) and 8260 (volatile organic compounds). The baseline sampling results are summarized below. A summary of the analytical results from all four sampling events is presented in **Table 2**.

Effective December 1, 2006 NCDENR-DWM, Section, changed the standard limits for comparing constituent detections in laboratory analysis from the Practical Quantitation Limits (PQLs) established in 1994 to the Solid Waste Reporting Limits (SWRLs). On February 23, 2007, the Section further revised the reporting limits from the SWRL to the Solid Waste Section Limit (SWSL). The SWSL was defined as the lowest amount of analyte in a sample that can be quantitatively determined with suitable precision and accuracy. The new SWSL limits are lower than the previous PQL limits. Concentrations reported by the laboratory that are above the Method Detection Limit (MDL) but below the SWSL must be qualified as estimated values designated by the letter "J". According to the laboratory quality control performed by ENCO, detections above the MDL but below the method reporting limit (MRL) are considered estimated values, designated by the letter "J".

Constituent concentrations detected above the laboratory MDLs are summarized on **Table 2**. For comparison purposes, these results are shown with their respective SWSL and the 15A North Carolina Administrative Code (NCAC) Subchapter 2L .0200 Groundwater Quality Standards (2L Standard) which were recently revised and became effective January 1, 2010. Where target groundwater constituents have no established 2L Standard, the MDL is the default 2L Standard. However, since the DWM has listed constituent concentrations protective of groundwater, the NCDENR-DWM Section Ground Water Protection Standard (GWPST) established in accordance with the Solid Waste Management Rules, Section .1634(h) is used as the action level for detections where no 2L Standard is established.

4.0 GROUNDWATER SAMPLING RESULTS

The following table summarizes the monitor well locations where Appendix I constituents were detected at levels that are equal to or exceed the **SWSL** concentration in one or more samples in the four semi-annual monitoring events:

Appendix I Constituent Concentration Detected Equal to or Greater than SWSL

Background Monitor Wells	**Appendix I Detected Constituents Equal to or Greater Than Their SWSL**
MW-3B	Barium, beryllium, cobalt, zinc
MW-4	--
MW-9	Barium
Compliance Monitor Wells	**Appendix I Detected Constituents Equal to or Greater Than Their SWSL**
MW-5	Benzene, chlorobenzene, 1,4-dichlorobenze,1,1-dichloroethane, cis-1,2-dichloroethene, trichloroethene, vinyl chloride, arsenic, barium, cobalt
MW-6	Barium
MW-7A	Benzene, arsenic, barium
MW-12	benzene, chlorobenzene, 1,4-dichlorobenzene, barium, cobalt, selenium, zinc
MW-13	Benzene, chlorobenzene, 1,4-dichlorobenzene, cis-1,2-dichloroethene, trichloroethene, vinyl chloride, barium, chromium, cobalt, nickel, zinc
MW-14	Barium
MW-15	cis-1,2-dichloroethene, 1,2-dichloropropane, vinyl chloride, barium, cobalt
MW-16	Arsenic, barium

-- = No Appendix I constituent concentrations were detected above SWSL
* = constituent detected in duplicate sample, but not record sample

No Appendix I VOC concentrations were detected by USEPA Method 8260B in the groundwater samples collected from the upgradient background monitor wells MW-3B, MW-4, and MW-9, nor were they detected in the groundwater samples collected from the downgradient compliance monitor wells MW-6, MW-14, and MW-16. Appendix I metal concentrations were detected by USEPA Method 6010B in groundwater samples collected from the upgradient background monitoring wells MW-3B and MW-4, and in downgradient compliance well MW-16. Both Appendix I VOCs and metals were detected above their respective 2L Standard or GWPST in groundwater samples collected from monitor wells MW-5, MW-7A, MW-12, MW-13, and MW-15. Constituent specific averages of VOCs for compliance wells with detections are presented in **Table 3**. Selected constituents have been charted to assess possible trends and are presented in **Appendix II.**

5.0 SURFACE WATER SAMPLES

No Appendix I VOCs were identified in the surface water samples collected from the upgradient sample collection point (SW-1) or from the downgradient sample collection point (SW-2) during the January 2010 or the January 2011 event. Jerry's Creek was dry during the July 2010 and July 2011 sampling events and no samples were collected

Appendix I metal cadmium was reported in SW-1 and SW-2 during the January 2010 sampling event. Barium, cobalt, copper, and zinc were detected in SW-1, and barium, cobalt, copper, nickel and zinc were detected in SW-2 during the January 2011 sampling event.

Appendix I metals detected in both the upgradient and downgradient surface water samples suggest that metals are being introduced upstream of the landfill. No impact to the surface water by the landfill is indicated. Surface water analytical results are summarized in **Table 4.**

6.0 FIELD PARAMETERS

Specific conductivity, pH, oxygen reduction potential (ORP), dissolved oxygen (DO), and temperature were measured in the field during well purging prior to sample collection. A minimum of three well volumes of water were bailed from each well, and field parameters were measured after each well volume was removed. Field parameters are included in **Table 3** and are discussed below.

During the purging process, field parameters are used as an indication of the equilibration of the groundwater within the well casing. Once the parameters have stabilized to within 10% of the previous two consecutive readings, a sample is collected for analysis. Variations in values between wells and within wells during individual sampling events are reflective of the variable conditions at the site. Average field parameters for the four baseline monitoring events are presented in **Table 6.**

Specific conductance for both background and compliance wells is relatively stable. The highest values are found in monitoring wells MW-5 and MW-13, and the lowest values are found in the background wells. Average specific conductance ranges from 0.185 milliSeimens per centimeter (mS/cm) in MW-9 to 0.946 mS/cm in MW-13. Since specific conductance is a measure of the dissolved salts in water, it is reasonable to expect that wells within the compliance area will report higher specific conductance that those upgradient.

Average pH values for the monitoring wells ranges between 3.25 (MW-3) and 6.10 (MW-14). Values tend to fluctuate seasonally, with higher pH values occurring during the January sampling event when groundwater levels tend to be higher **(Table 3)**. Lower pH values tend to inhibit aerobic bacteria, which in the compliance wells indicate an anaerobic environment; however, pH values do not differ significantly between the background and compliance wells and the natural pH of soils in eastern North Carolina tends to be acidic.

Oxidation reduction potential (ORP) indicates the availability of an environment to accept or to donate electrons. Background monitoring wells tended to report higher average ORP than the compliance wells, indicative of a reducing environment in the compliance wells.

Correlative to the ORP values, dissolved oxygen (DO) tended to be higher in the background monitoring wells when compared to the compliance wells. Average values ranged from 0.22 mg/l in compliance well MW-16 (January 2010 sampling event) to 14.53 mg/l in background monitoring well MW-3B (July 2010). The low levels of DO in the compliance wells are consistent with a reducing (anaerobic) environment.

Groundwater temperature in the monitoring wells ranges from a low of 9.57°C in January 2011 to 26.10°C in July 2011. The variations recorded appear to accurately reflect seasonal ambient temperatures.

7.0 MONITORED NATURAL ATTENUATION PARAMETERS

During the four semi-annual baseline sampling events, groundwater samples were analyzed for monitored natural attenuation (MNA) parameters in upgradient background monitor wells MW-3, MW-4, and MW-9, and downgradient compliance monitor wells MW-5, MW-6, MW-7A, MW-12, MW-13, MW-14, MW-15, and MW-16. In addition to the field parameters listed above (specific conductance, pH, ORP, and DO) MNA parameters monitored during the baseline events include the following performance parameters as required by the NCDENR DWM: chloride, sulfate, alkalinity, biochemical oxygen demand, chemical oxygen demand, total organic carbon, nitrate as N, nitrate/nitrite as N, sulfide, total dissolved solids, iron, manganese, carbon dioxide, ethane, ethene, methane, volatile fatty acids, and hydrogen. **Table 5** is a summary of the geochemical and MNA constituent results from field measurements and from analytical testing performed during the four monitoring events. Average MNA parameters for each well are presented in **Table 6** and discussed below. Selected MNA constituent charts are presented in **Appendix III.**

Alkalinity is an indicator of anaerobic degradation and reductive dechlorination (Weidermeier, et al, 1996). Alkalinity concentrations in compliance wells were, on average, higher than in background wells.

Chloride was detected in the samples collected from background wells MW-3B, MW-4, and MW-9 and downgradient compliance wells MW-5, MW-6, MW-7A, MW-12, MW-13, MW-14, MW-15, and MW-16 during all four sampling events, with the highest concentrations occurring consistently in MW-12 and MW13. Chloride is a byproduct of reductive dechlorination, and is an indicator of the process (S&ME, Inc., 2011).

Sulfate concentrations across the site were low. Sulfate reduces to sulfide as it accepts an electron. Sulfide concentrations in compliance wells are extremely low, indicating that sulfate reducing bacteria do not predominate (AFCEE, 2001).

Nitrate is the preferred electron acceptor in the anaerobic/reductive environment, followed by nitrite, sulfate, iron and manganese. Nitrate and nitrite concentrations were low across the site, indicating that the supply of nitrate and nitrite as electron acceptors has been depleted (AFCEE, 2001).

Total dissolved solids were higher in compliance wells than in background wells, with the highest detections in MW-5 and MW-7A. Total dissolved solids are a general indicator of water quality and measure all ions present within a sample (Mactec, 2011).

Iron concentrations in compliance wells were on average much higher in compliance wells, with the highest values detected in MW-5 and MW-7A. As mentioned above, iron follows nitrate and sulfate as a preferred electron acceptor. Elevated iron levels suggest that iron reduction is occurring.

Manganese, like iron, also serves as an electron receptor. Higher concentrations of manganese were detected in compliance wells, with the highest values reported in MW-5 and MW-13. It is likely that manganese reduction is occurring concomitantly with iron reduction.

Carbon dioxide was detected at much higher concentrations in compliance wells than in background wells. Carbon dioxide is produced at every stage of reductive dechlorination, as well as during the degradation of hydrocarbons (Mactec, 2011). The elevated levels in the compliance wells confirm the attenuation process.

Methane was detected in samples collected from all background and compliance wells, with concentrations much higher in compliance wells than in background wells. Methane, along with carbon dioxide, is produced when vinyl chloride is reduced. Although methane production is not limited to the reductive dechlorination process, it can be a good indicator that vinyl chloride is being reduced (Weidermeier et al, 1996).

Ethene was detected in samples collected from downgradient compliance well MW-5.

Ethane was detected in downgradient compliance wells MW-5, MW-13, and MW-15 in one or more quarters; however, with the exception of MW-5, concentrations were reported above the laboratory method detection limit, but below the laboratory reporting limit. Ethane is the final daughter product of the reduction of chlorinated solvents and detections, even at extremely low concentrations, indicate the complete reduction of vinyl chloride (Weidermeier, 1996).

Volatile fatty acids detected at the site include acetic, propionic, lactic, and butyric acids. The low concentrations of the detections indicate that these acids, produced during what is known as the “acetogenic” phase of bacterial activity, indicate that groundwater at the landfill is now in what is termed the “methanogenic” phase of anaerobic bio-activity (ATSDR, 2001).

Hydrogen is produced during anaerobic fermentation of hydrocarbons. Concentrations in groundwater samples from both background and compliance wells vary widely. Values range from <0.6 to 4. According to information provided by Microseeps, the values reported in groundwater samples at the site indicate sulfate reduction and iron reduction. Sulfate and iron reduction, as well as manganese reduction, can occur simultaneously.

8.0 QUALITY CONTROL

Quality assurance and quality control of field sampling methods and analytical test methods were assessed by collecting and analyzing one duplicate sample, one equipment blank sample, and one trip blank sample during each of the four baseline sampling events. The duplicate and equipment blank samples were analyzed for Appendix I constituents by the same methods and for the same target constituents as the record samples, with the exception of dissolved metals. Duplicate sample analysis documents the consistency of field sampling methods and the consistency of laboratory testing between samples. Equipment blank sample analysis documents the quality of sampling equipment and decontamination procedures used to reduce the potential of cross-contamination or carry-over effects from sampling equipment used on-site. The trip blank is analyzed for VOCs to document the effect of external conditions on samples/sample containers during lab pack preparation and transportation to and from the site. The results from the quality assurance and quality control samples have been previously submitted in the semi-annual reports for January 2010, July 2010, January 2011, and July 2011.

9.0 DISCUSSION AND RECOMMENDATIONS

Baseline concentrations of constituents of concern and geochemical parameters have been established at the landfill. The absence of Appendix I VOCs and the presence of limited metals in the upgradient monitor wells indicate the background concentrations of groundwater and facilitate the evaluation of the groundwater in compliance wells. Using these data, it is possible to gauge the progress of natural attenuation of the constituents of concern and to determine the processes by which attenuation is occurring.

Selected constituents of concern for compliance wells with the greatest impacts have been charted and are presented in Appendices II and III. Through the baseline sampling period, with some fluctuation, constituents of concern have remained stable. The presence of the daughter products of chlorinated VOC's indicates the degradation of chlorinated solvents. Of particular concern are the concentrations of vinyl chloride, the final chlorinated compound in reductive dechlorination. As discussed in section 7.0, the detection of methane, ethene, and ethane indicate that complete reduction is occurring; however, it appears that the process is occurring slowly. Benzene and 1,4-dichlorobenzene degradation products are not measured directly but the breakdown of these compounds is inferred by the reduction of the chlorinated VOC's.

During the development of the geochemical environment of a landfill the soil and groundwater progress through three stages (ATSDR, 2001). Phase I is the aerobic stage in which oxygen is utilized by bacteria to degrade organic matter. During Phase I, volatile fatty acids are produced, particularly acetic acid. Known as the "acetogenic" phase, nitrates are produced which degrade very slowly and can persist into the anaerobic phases of the landfill (Mactec, 2011). Once the oxygen is depleted, Phase II begins in which an anaerobic environment predominates. The nitrates produced during acetogenic phase become the primary electron acceptors. As nitrate, and subsequently nitrite, is depleted, sulfate becomes the predominant electron acceptor. Once sulfate is depleted, iron (Fe^{3+}) becomes the preferred electron receptor, followed by manganese. Phase III, the final stage, is also anaerobic, and is characterized by methane reduction, or methanogenesis. It is important to note that these processes are not static, and can often occur simultaneously within the landfill.

Geochemical parameters indicative of Phase I include the production of volatile fatty acids, elevated DO, relatively neutral pH, low alkalinity, elevated nitrate, low iron (Fe^{2+}), and low manganese. As discussed in section 7.0, the groundwater in the compliance wells report low-to-non-detections of volatile fatty acids, low DO (as compared to background wells), low pH, low nitrate and nitrite, elevated alkalinity, higher iron and manganese, thus the parameters strongly indicate an anaerobic/reductive environment.

As evidenced by the detections of daughter products of constituents of concern, natural attenuation is occurring on site by one or more reductive processes. Edgecombe County is currently in the process of implementing corrective measures at the site that will enhance natural attenuation by reducing the amount of water infiltrating the landfill (S&ME, Inc., 2008).

The geochemical environment at the site has been established to be anaerobic; therefore, S&ME recommends that the following parameters be eliminated from the sampling and analytical schedule: volatile fatty acids, biochemical oxygen demand, chemical oxygen demand, and hydrogen. Volatile fatty acids, BOD, and COD are parameters that provide information in an aerobic environment, but are not key parameters for an anaerobic environment. While hydrogen is a parameter that can be used to indicate the specific anaerobe active within the environment, results have been inconclusive at the site, probably reflective of multiple reductive processes occurring concomitantly.

Baseline levels of Appendix I constituents have been documented for the required two-year, four semi-annual event period in background and compliance wells in accordance with the Water Quality Monitoring Plan (WQMP) submitted by S&ME on June 30, 2008 and revised August 2009 and January 2010.

Based upon the information provided during baseline and monitored natural attenuation sampling, S&ME recommends that geochemical/monitored natural attenuation parameters be discontinued in all monitor wells until corrective measures have been implemented at the site. Once corrective measures are in place, S&ME recommends that monitored natural attenuation parameters be measured every 18 months in compliance monitoring wells MW-5, MW-12, MW-15, and MW-16. Monitor wells MW-5, MW-12, and MW-15 were selected to provide information on the MNA processes in conjunction with the Appendix I analytical data. Monitor well MW-16 acts as a sentinel well and will provide information about the conditions downgradient of the site. This schedule will allow the parameters to be measured during alternating seasons, thus facilitating a more representative analysis of conditions at the site. Field parameters should continue to be monitored semi-annually. In addition to the field parameters listed in the WQMP (pH, temperature, conductivity, and turbidity) the parameters DO and ORP should be added to the WQMP as additional indicators of groundwater conditions at the site. The recommended sampling and analysis plan is presented in **Table 7**.

10.0 CONCLUSIONS

As required by North Carolina Solid Waste Management Rule .1634, these results should be forwarded to the owner/operator of Edgecombe County Landfill for inclusion in the operating record and to the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Waste Management (DWM) for their review.

11.0 REFERENCES

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TABLES

Table 1
Groundwater Elevation and Well Completion Data
Edgecombe County Landfill
Baseline Sampling Events
S&ME Project No. 1054-07-238D

PIEZOMETER OR WELL NUMBER	DEPTH FROM TOC (FEET)					ELEVATIONS (FEET AMSL)				
	STATIC WATER LEVELS				BOTTOM OF WELL	TOP OF CASING	STATIC WATER LEVEL			
Date	19-Jan-10	20-Jul-10	18-Jan-11	27-Jul-11			19-Jan-10	20-Jul-10	18-Jan-11	27-Jul-11
P-1	4.85	9.71	7.66	10.09	21.96	74.48	69.63	64.77	66.82	64.39
P-2A	12.74	14.22	9.80	13.93	27.17	83.61	70.87	69.39	73.81	69.68
P-3A	12.86	13.76	12.84	13.80	27.17	79.77	66.91	66.01	66.93	65.97
P-12	8.89	11.09	9.60	11.30	13.92	54.15	45.26	43.06	44.55	42.85
P-15	4.97	9.42	5.57	9.34	10.36	45.16	40.19	35.74	39.59	35.82
P-17	3.43	8.07	3.36	7.88	10.15	42.45	39.02	34.38	39.09	34.57
P-18	12.72	15.40	13.30	15.77	18.44	54.44	41.72	39.04	41.14	38.67
P-19	10.04	14.24	11.63	13.05	17.67	58.88	48.84	44.64	47.25	45.83
P-25	7.30	9.59	7.46	9.37	12.97	80.57	73.27	70.98	73.11	71.20
P-29	5.09	NM	5.29	6.79	13.19	65.29	60.20	DRY	60.00	58.50
P-34	3.05	8.57	3.10	8.35	13.04	44.34	41.29	35.77	41.24	35.99
P-35	3.94	7.70	3.95	7.16	13.10	44.50	40.56	36.80	40.55	37.34
MW-3B	7.00	10.74	9.12	11.01	22.67	81.18	74.18	70.44	72.06	70.17
MW-4	5.06	6.64	5.33	7.19	20.18	68.95	63.89	62.31	63.62	61.76
MW-5	10.72	13.38	10.70	14.40	23.86	53.75	43.03	40.37	43.05	39.35
MW-5D	9.80	13.74	10.50	13.58	41.63	52.08	42.28	38.34	41.58	38.50
MW-5S	8.34	10.85	8.54	10.78	13.50	50.54	42.20	39.69	42.00	39.76
MW-6	3.16	8.01	3.14	7.92	19.75	46.29	43.13	38.28	43.15	38.37
MW-7A	14.10	15.78	14.09	15.98	26.94	68.43	54.33	52.65	54.34	52.45
MW-8A	10.09	11.43	10.75	11.55	22.38	82.34	72.25	70.91	71.59	70.79
MW-9	4.63	6.41	5.12	6.85	16.85	72.41	67.78	66.00	67.29	65.56
MW-10	3.22	6.09	4.38	6.86	13.57	75.78	72.56	69.69	71.40	68.92
MW-12	6.82	8.98	6.85	8.89	12.68	51.24	44.42	42.26	44.39	42.35
MW-13	5.19	8.84	6.36	8.85	23.00	54.99	49.80	46.15	48.63	46.14
MW-14	3.86	8.25	3.78	7.85	14.63	43.88	40.02	35.63	40.10	36.03
MW-15	5.46	9.32	5.03	8.97	14.27	44.87	39.41	35.55	39.84	35.90
MW-16	8.42	12.98	8.81	12.65	19.85	46.58	38.16	33.60	37.77	33.93
GW-1R	6.42	9.96	8.73	9.57	9.83	81.08	74.66	71.12	72.35	71.51
GW-2R	5.29	9.04	8.46	DRY	9.88	75.72	DRY	66.68	67.26	DRY
GW-3	DRY	DRY	DRY	DRY	5.22	69.00	DRY	DRY	DRY	DRY
GW-4	9.38	10.71	10.02	DRY	12.05	69.93	DRY	59.22	59.91	DRY
GW-5	DRY	DRY	DRY	DRY	12.07	65.23	DRY	DRY	DRY	DRY
GW-6	5.23	9.47	5.59	9.80	9.64	79.02	73.79	69.55	73.43	69.22
GW-7	1.85	5.15	2.49	5.44	9.61	75.02	73.17	69.87	72.53	69.58
GW-8	3.06	8.82	5.04	9.39	9.84	79.92	76.86	71.10	74.88	70.53
GW-9	4.75	8.94	7.91	9.26	9.19	72.69	67.94	63.75	64.78	63.43
GW-10	2.32	4.86	3.23	5.10	10.01	69.17	66.85	64.31	65.94	64.07
GW-11	2.40	9.42	2.39	DRY	9.68	64.19	DRY	54.77	61.80	DRY

NOTES:
TOC = TOP OF CASING - ELEVATIONS FROM SITE SURVEY
AMSL = ABOVE MEAN SEA LEVEL
NM = NOT MEASURED
(A OR B) = REPLACEMENT WELL
D OR S = DEEP OR SHALLOW

Table 2
Groundwater Analytical Results
Edgecombe County Landfill
Baseline Sampling Events
S&ME Project No. 1054-07-238D

APPENDIX I VOCs EPA METHOD 8260B	UNITS	2L STANDARD	BACKGROUND MONITOR WELLS												COMPLIANCE MONITOR WELLS												SWSL	DAF Computation
			MW-3B				MW-4				MW-9				MW-5				MW-6				MW-7A					
Date			1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/20/2010	7/21/2010	1/19/2011	7/28/2011	1/20/2010	7/20/2010	1/18/2011	7/27/2011	1/20/2010	7/21/2010	1/19/2011	7/27/2011		
Acetone		6,000	<1.5	<1.5	<1.5	<1.2	<1.5	<1.5	<1.5	<1.2	<1.5	<1.5	<1.5	<1.2	<15D	<1.5	<15D	<12D	<1.5	<1.5	<1.5	<1.2	<1.5	<1.5	<1.5	<1.2	100	NA
Benzene	µg/l	1	<0.20	<0.20	<0.20	<0.68	<0.20	<0.20	<0.20	<0.68	<0.20	<0.20	<0.20	<0.68	<2.0D	**5.1JD**	<2.0D	<6.8D	<0.20	<0.20	<0.20	<0.68	**2.2**	**1.4**	**1.8**	**1.5**	1	NA
Chlorobenzene	µg/l	50	<0.27	<0.27	<0.27	<0.74	<0.27	<0.27	<0.27	<0.74	<0.27	<0.27	<0.27	<0.74	**11D**	**16D**	**14D**	**15.0D**	<0.27	<0.27	<0.27	<0.74	**2.8J**	**1.8J**	**3.3**	**2.1J**	3	NA
Chloroethane	µg/l	3,000	<0.30	<0.30	<0.30	<0.75	<0.30	<0.30	<0.30	<0.75	<0.30	<0.30	<0.30	<0.75	<3.0D	<3.0D	<3.0D	<7.5D	<0.30	<0.30	<0.30	<0.75	**1.4J**	**2.3J**	<0.30	**2.0J**	10	NA
1,4-Dichlorobenzene	µg/l	6	<0.38	<0.38	<0.38	<0.79	<0.38	<0.38	<0.38	<0.79	<0.38	<0.38	<0.38	<0.79	<3.8D	**9.4JD**	**9.3JD**	<7.9D	<0.38	<0.38	<0.38	<0.79	**0.84J**	**0.62J**	**1.3**	<0.79	1	NA
1,1-Dichloroethane	µg/l	6	<0.33	<0.33	<0.33	<0.080	<0.33	<0.33	<0.33	<0.080	<0.33	<0.33	<0.33	<0.080	**7.7JD**	**8.6JD**	**6.2JD**	**9.0JD**	<0.33	**0.46J**	<0.33	**0.62J**	<0.33	<0.33	<0.33	<0.080	5	NA
cis-1,2-Dichloroethene	µg/l	70	<0.36	<0.36	<0.36	<0.72	<0.36	<0.36	<0.36	<0.72	<0.36	<0.36	<0.36	<0.72	**480D**	**620D**	**470D**	**620D**	<0.36	**0.67J**	<0.36	**1.2J**	**0.46J**	<0.36	**0.54J**	<0.72	5	NA
Dichloroethene	µg/l	100	<0.34	<0.34	<0.34	<0.12	<0.34	<0.34	<0.34	<0.12	<0.34	<0.34	<0.34	<0.12	<3.4D	**4.0JD**	<3.4D	<1.2D	<0.34	<0.34	<0.34	<0.12	<0.34	<0.34	<0.34	<0.12	5	NA
1,2-Dichloropropane	µg/l	0.6	<0.20	<0.20	<0.20	<0.59	<0.20	<0.20	<0.20	<0.59	<0.20	<0.20	<0.20	<0.59	<2.0D	<2.0D	<2.0D	<5.9D	<0.20	<0.20	<0.20	<0.59	<0.20	<0.20	<0.20	<0.59	1	NA
Methylene chloride	µg/l	5	<0.53	<0.53	<0.53	<0.14	<0.53	<0.53	<0.53	<0.14	<0.53	<0.53	<0.53	<0.14	<5.3D	**16BD**	<5.3D	<1.4D	<0.53	<0.53	<0.53	<0.14	<0.53	<0.53	<0.53	<0.14	1	NA
Toluene	µg/l	600	<0.27	<0.27	<0.27	<0.85	<0.27	<0.27	<0.27	<0.85	<0.27	<0.27	<0.27	<0.85	<2.7D	<2.7D	<2.7D	<8.5D	<0.27	<0.27	<0.27	<0.85	<0.27	<0.27	<0.27	<0.85	1	NA
Trichloroethene	µg/l	3	<0.38	<0.38	<0.38	<0.72	<0.38	<0.38	<0.38	<0.72	<0.38	<0.38	<0.38	<0.72	<3.8D	<3.8D	<3.8D	<7.2D	<0.38	<0.38	<0.38	<0.72	<0.38	<0.38	<0.38	<0.72	1	NA
Vinyl chloride	µg/l	0.03	<0.30	<0.30	<0.30	<0.60	<0.30	<0.30	<0.30	<0.60	<0.30	<0.30	<0.30	<0.60	**23D**	**30D**	**27D**	**32.0D**	<0.30	<0.30	<0.30	<0.60	<0.30	<0.30	<0.30	<0.60	1	NA

APP. I INORGANIC COMPOUNDS EPA METHOD 6010B	UNITS	2L STANDARD	BACKGROUND MONITOR WELLS												COMPLIANCE MONITOR WELLS												SWSL	DAF Computation
			MW-3B				MW-4				MW-9				MW-5				MW-6				MW-7A					
Date			1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/20/2010	7/21/2010	1/19/2011	7/28/2011	1/20/2010	7/20/2010	1/18/2011	7/27/2011	1/20/2010	7/21/2010	1/19/2011	7/27/2011		
Antimony (Total)	µg/l	1*	NS	<0.220	<0.220	<0.22	NS	**1.69J**	**0.673J**	**1.39J**	NS	<0.220	<0.220	<0.22	NS	<0.220	**0.600J**	<0.22	NS	<0.220	<0.220	<0.22	NS	<0.220	<0.220	<0.22	6	NA
Antimony (Dissolved)	µg/l		NS	<0.220	NS	NS	NS	**1.78J**	NS	NS	NS	<0.220	<0.220	NS	NS	NS	NS	NS	NS	<0.220	NS	NS	NS	NS	<0.220	NS		
Arsenic (Total)	µg/l	10	NS	**5.02J**	<2.80	<2.80	NS	<2.80	<2.80	<2.80	NS	<2.80	<2.80	<2.80	NS	**29.4B**	**9.89J**	**21.2**	NS	<2.80	<2.80	<2.80	NS	**51.5B**	**16**	<2.80	10	200
Arsenic (Dissolved)	µg/l		NS	<2.80	NS	NS	NS	<2.80	NS	NS	NS	<2.80	<2.80	NS	NS	NS	NS	NS	NS	<2.80	NS	NS	NS	NS	<2.80	NS		
Barium (Total)	µg/l	700	NS	**127**	**113**	**112**	NS	**46.6J**	**75J**	**56.7J**	NS	**128**	**190**	**146**	NS	**158**	**231**	**230**	NS	**196**	**84J**	**302**	NS	**284**	**176**	**215**	100	118
Barium (Dissolved)	µg/l		NS	**133**	NS	NS	NS	**43.2J**	NS	NS	NS	**52.8J**	**91.4J**	NS	NS	NS	NS	NS	NS	**138**	NS	NS	NS	NS	**143**	NS		
Beryllium (Total)	µg/l	4*	NS	**0.709J**	**1.49**	**1.68**	NS	<0.100	<0.100	<0.10	NS	<0.100	<0.100	<0.10	NS	<0.100	<0.100	<0.10	NS	<0.100	**0.231J**	<0.10	NS	**0.225J**	<0.100	<0.10	1	17
Beryllium (Dissolved)	µg/l		NS	**0.623J**	NS	NS	NS	<0.100	NS	NS	NS	<0.100	<0.100	NS	NS	NS	NS	NS	NS	<0.100	NS	NS	NS	NS	<0.100	NS		
Cadmium (Total)	µg/l	2	NS	**0.659J**	**0.599J**	**0.544J**	NS	<0.360	<0.360	<0.36	NS	<0.360	<0.360	<0.36	NS	<0.360	<0.360	<0.36	NS	<0.360	<0.360	<0.36	NS	<0.360	<0.360	<0.36	1	20
Cadmium (Dissolved)	µg/l		NS	**0.613J**	NS	NS	NS	<0.360	NS	NS	NS	<0.360	<0.360	NS	NS	NS	NS	NS	NS	<0.360	NS	NS	NS	NS	<0.360	NS		
Chromium (Total)	µg/l	10	NS	<1.00	<1.00	<1.00	NS	<1.00	<1.00	<1.00	NS	<1.00	<1.00	<1.00	NS	<1.00	<1.00	**8.14J**	NS	<1.00	<1.00	**1.22J**	NS	<1.00	<1.00	<1.00	10	640
Chromium (Dissolved)	µg/l		NS	<1.00	NS	NS	NS	<1.00	NS	NS	NS	<1.00	<1.00	NS	NS	NS	NS	NS	NS	<1.00	NS	NS	NS	NS	<1.00	NS		
Cobalt (Total)	µg/l	1*	**27.1**	**18.1**	**26.4**	**25.4**	**0.467J**	<1.10	<1.10	<1.10	<0.410	<1.10	<1.10	<1.10	**108**	**143**	**177**	**230**	**6.32J**	**1.56J**	**8.63J**	**2.88J**	**0.652J**	<1.10	<1.10	<1.10	10	410
Cobalt (Dissolved)	µg/l		NS	**18.9**	NS	NS	NS	<1.10	NS	NS	NS	<1.10	<1.10	NS	NS	NS	NS	NS	NS	<1.10	NS	NS	NS	NS	<1.10	NS		
Copper (Total)	µg/l	1,000	NS	<1.60	<1.60	<1.60	NS	**5.33J**	**2.13J**	**3.09J**	NS	<1.60	<1.60	<1.60	NS	<1.60	**7.55J**	<1.60	NS	<1.60	<1.60	<1.60	NS	<1.60	**10.1**	**1.61J**	10	210
Copper (Dissolved)	µg/l		NS	<1.60	NS	NS	NS	**5.25J**	NS	NS	NS	<1.60	<1.60	NS	NS	NS	NS	NS	NS	<1.60	NS	NS	NS	NS	**4.99J**	NS		
Lead (Total)	µg/l	15	NS	**2.06J**	<1.90	<1.90	NS	<1.90	<1.90	<1.90	NS	<1.90	<1.90	<1.90	NS	**11.4**	<1.90	<1.90	NS	<1.90	<1.90	<1.90	NS	**6.90J**	<1.90	<1.90	10	360
Lead (Dissolved)	µg/l		NS	**4.40J**	NS	NS	NS	<1.90	NS	NS	NS	**2.26J**	<1.90	NS	NS	NS	NS	NS	NS	<1.90	NS	NS	NS	NS	<1.90	NS		
Nickel (Total)	µg/l	100	NS	**17.7J**	**29.7J**	**27.6J**	NS	<1.80	<1.80	<1.80	NS	<1.80	<1.80	<1.80	NS	**35.7J**	**49.7J**	**55.4**	NS	<1.80	**6.49J**	**2.31J**	NS	<1.80	<1.80	<1.80	50	230
Nickel (Dissolved)	µg/l		NS	**20.1J**	NS	NS	NS	<1.80	NS	NS	NS	<1.80	<1.80	NS	NS	NS	NS	NS	NS	<1.80	NS	NS	NS	NS	<1.80	NS		
Selenium (Total)	µg/l	20	NS	**1.32J**	<0.830	**1.37J**	NS	<0.830	<0.830	<0.83	NS	<0.830	<0.830	<0.83	NS	**1.01J**	**0.855J**	<0.83	NS	**2.10J**	**0.953J**	**4.61J**	NS	**1.25J**	**1.14J**	**2.53J**	10	80
Selenium (Dissolved)	µg/l		NS	**1.20J**	NS	NS	NS	<0.830	NS	NS	NS	<0.830	<0.830	NS	NS	NS	NS	NS	NS	**1.94J**	NS	NS	NS	NS	**2.03J**	NS		
Silver (Total)	µg/l	20	NS	<1.90	<1.90	<1.90	NS	<1.90	<1.90	<1.90	NS	<1.90	<1.90	<1.90	NS	<1.90	**6.47J**	**2.19J**	NS	**2.00J**	<1.90	<1.90	NS	<1.90	<1.90	<1.90	10	NA
Silver (Dissolved)	µg/l		NS	<1.90	NS	NS	NS	<1.90	NS	NS	NS	<1.90	<1.90	NS	NS	NS	NS	NS	NS	<1.90	NS	NS	NS	NS	<1.90	NS		
Thallium (Total)	µg/l	0.28*	NS	**0.239J**	**0.127J**	<0.11	NS	<0.110	<0.110	<0.11	NS	<0.110	<0.110	<0.11	NS	<0.110	<0.110	<0.11	NS	<0.110	<0.110	<0.11	NS	<0.110	<0.110	<0.11	5.5	5
Thallium (Dissolved)	µg/l		NS	**0.386J**	NS	NS	NS	<0.110	NS	NS	NS	<0.110	<0.110	NS	NS	NS	NS	NS	NS	<0.110	NS	NS	NS	NS	<0.110	NS		
Vanadium (Total)	µg/l	0.3*	NS	**3.51J**	<1.40	<1.40	NS	**1.47J**	<1.40	**1.65J**	NS	<1.40	<1.40	<1.40	NS	**1.43J**	<1.40	<1.40	NS	**2.25J**	<1.40	<1.40	NS	**8.39J**	<1.40	<1.40	25	670
Vanadium (Dissolved)	µg/l		NS	<1.40	NS	NS	NS	<1.40	NS	NS	NS	<1.40	<1.40	NS	NS	NS	NS	NS	NS	<1.40	NS	NS	NS	NS	<1.40	NS		
Zinc (Total)	µg/l	1,000	NS	**31.4**	**56**	**54.1**	NS	<3.80	<3.80	<3.80	NS	<3.80	<3.80	<3.80	NS	**54.2**	**61.1**	**84.5**	NS	<3.80	**25.8**	<3.80	NS	<3.80	<3.80	**6.63J**	10	430
Zinc (Dissolved)	µg/l		NS	**19.1**	NS	NS	NS	<3.80	NS	NS	NS	<3.80	<3.80	NS	NS	NS	NS	NS	NS	<3.80	NS	NS	NS	NS	<3.80	NS		

NOTES:
Samples were analyzed by Environmental Conservation Laboratories, Inc. (ENCO). Detection limits are shown on laboratory reports.
Values which are **BOLD** indicate levels above laboratory detection limits.
Values which are **BOLD** and shaded indicate levels above their respective NCDENR 2L or GWPST.
DAF Comuptation = Dilution/Attenuation Factor Computation (ref. S&ME Alternate Source Demonstration, June 2008).
2L STANDARD = North Carolina groundwater standards as promulgated by 15A North Carolina Administrative Code, Subchapter 2L.
SWSL = Solid Waste Section Limit. (ref. NCDENR-DWM, Solid Waste Section February 23, 2007 memorandum)
* Indicates there is currently no 2L Standard. The target analyte was compared to the Solid Waste Groundwater Protection Standard (GWPST).
J = Analyte detected, but below the laboratory reporting limit therefore the result is an estimated concentration.
D = The sample was analyzed at dilution.
B = The analyte was detected in the associated method blank.
NS = Not Sampled for this parameter.
µg/L = Micrograms Per Liter
VOCs = Volatile Organic Compounds
Laboratory analytical reports previously provided in Semi-annual Monitoring Reports

Table 2
Groundwater Analytical Results
Edgecombe County Landfill
Baseline Sampling Events
S&ME Project No. 1054-07-238D

APPENDIX I VOCs EPA METHOD 8260B	UNITS	2L STANDARD	COMPLIANCE MONITOR WELLS																				SWSL	DAF Computation
			MW-12				MW-13				MW-14				MW-15				MW-16					
Date			1/20/2010	7/21/2010	1/19/2011	7/28/2011	1/20/2010	7/21/2010	1/19/2011	7/28/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/20/2010	7/21/2010	1/19/2011	7/28/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011		
Acetone		6,000	<1.5	**3.9J**	<1.5	<1.2	<1.5	<1.5	<1.5	<1.2	<1.5	<1.5	<1.5	<1.2	<1.5	<1.5	<1.5	<1.2	<1.5	<1.5	<1.5	<1.2	100	NA
Benzene	µg/l	1	**2.6**	**3.1**	**2.6**	**4.1**	**0.86J**	**2.3**	<0.20	**1.2**	<0.20	<0.20	<0.20	<0.68	**0.52J**	**0.55J**	<0.20	<0.68	<0.20	<0.20	<0.20	<0.68	1	NA
Chlorobenzene	µg/l	50	**3.1**	**3.4**	**4.1**	**5.1**	**6.2**	**14**	**8.7**	**10**	<0.27	<0.27	<0.27	<0.74	**1.2J**	**1.4J**	**1.2J**	**2.0J**	<0.27	<0.27	<0.27	<0.74	3	NA
Chloroethane	µg/l	3,000	<0.30	**1.4J**	**0.93J**	**1.8J**	<0.30	**0.83J**	<0.30	**0.76J**	<0.30	<0.30	<0.30	<0.75	<0.30	**0.42J**	<0.30	<0.75	<0.30	<0.30	<0.30	<0.75	10	NA
1,4-Dichlorobenzene	µg/l	6	**4.2**	**5.2**	**5.8**	**7.2**	**1.3**	**3.5**	**2.3**	**2.2**	<0.38	<0.38	<0.38	<0.79	<0.38	<0.38	<0.38	<0.79	<0.38	<0.38	<0.38	<0.79	1	NA
1,1-Dichloroethane	µg/l	6	**1.7J**	**1.6J**	**1.2J**	**1.5J**	**1.3J**	**1.4J**	**0.51J**	**0.74J**	<0.33	<0.33	<0.33	<0.080	**1.1J**	**0.94J**	**0.59J**	**0.88J**	<0.33	<0.33	<0.33	<0.080	5	NA
cis-1,2-Dichloroethene	µg/l	70	**1.7J**	**1.0J**	**1.1J**	**0.83J**	**43**	**53**	**18**	**14.0**	<0.36	<0.36	<0.36	<0.72	**24**	**23**	**14**	**21.0**	<0.36	<0.36	<0.36	<0.72	5	NA
Dichloroethene	µg/l	100	<0.34	<0.34	<0.34	<0.12	**0.54J**	**0.60J**	<0.34	<0.12	<0.34	<0.34	<0.34	<0.12	**1.0J**	**0.58J**	**0.67J**	**0.62J**	<0.34	<0.34	<0.34	<0.12	5	NA
1,2-Dichloropropane	µg/l	0.6	<0.20	<0.20	<0.20	<0.59	<0.20	<0.20	<0.20	<0.59	<0.20	<0.20	<0.20	<0.59	**3.5**	**2.4**	**1.6**	**2.0**	<0.20	<0.20	<0.20	<0.59	1	NA
Methylene chloride	µg/l	5	<0.53	<0.53	<0.53	<0.14	<0.53	<0.53	<0.53	<0.14	<0.53	<0.53	<0.53	<0.14	<0.53	<0.53	<0.53	<0.14	<0.53	<0.53	<0.53	<0.14	1	NA
Toluene	µg/l	600	<0.27	<0.27	<0.27	<0.85	<0.27	<0.27	<0.27	<0.85	<0.27	<0.27	<0.27	<0.85	<0.27	<0.27	<0.27	<0.85	<0.27	<0.27	<0.27	<0.85	1	NA
Trichloroethene	µg/l	3	<0.38	<0.38	<0.38	<0.72	**1.9**	**1.4**	**0.59J**	**1.0**	<0.38	<0.38	<0.38	<0.72	<0.38	<0.38	<0.38	<0.72	<0.38	<0.38	<0.38	<0.72	1	NA
Vinyl chloride	µg/l	0.03	<0.30	<0.30	<0.30	<0.60	**4.1**	**3.4**	**1.0**	**2.2**	<0.30	<0.30	<0.30	<0.60	**3.4**	**2.9**	**1.9**	**3.7**	<0.30	<0.30	<0.30	<0.60	1	NA

APP. I INORGANIC COMPOUNDS EPA METHOD 6010B	UNITS	2L STANDARD	COMPLIANCE MONITOR WELLS																				SWSL	DAF Computation
			MW-12				MW-13				MW-14				MW-15				MW-16					
Date			1/20/2010	7/21/2010	1/19/2011	7/28/2011	1/20/2010	7/21/2010	1/19/2011	7/28/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/20/2010	7/21/2010	1/19/2011	7/28/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011		
Antimony (Total)	µg/l	1*	NS	<0.220	<0.220	<0.22	NS	<0.220	<0.220	<0.22	NS	<0.220	<0.220	<0.22	NS	<0.220	<0.220	<0.22	NS	<0.220	<0.220	<0.22	6	NA
Antimony (Dissolved)	µg/l		NS	NS	<0.220	NS	NS	NS	<0.220	<0.22	NS	<0.220	NS	NS	NS	NS	<0.220	NS	NS	<0.220	NS	NS		
Arsenic (Total)	µg/l	10	NS	<2.80	<2.80	<2.80	NS	**6.41JB**	<2.80	<2.80	NS	<2.80	<2.80	<2.80	NS	**8.39JB**	<2.80	**9.98J**	NS	**10.5**	<2.80	<2.80	10	200
Arsenic (Dissolved)	µg/l		NS	NS	<2.80	NS	NS	NS	<2.80	**3.74JB**	NS	<2.80	NS	NS	NS	NS	<2.80	NS	NS	<2.80	NS	NS		
Barium (Total)	µg/l	700	NS	**244**	**303**	**322**	NS	**115**	**217**	**202**	NS	**215**	**245**	**301**	NS	**306**	**395**	**429**	NS	**282**	**315**	**337**	100	118
Barium (Dissolved)	µg/l		NS	NS	**287**	NS	NS	NS	**189**	**161**	NS	**181**	NS	NS	NS	NS	**247**	NS	NS	**116**	NS	NS		
Beryllium (Total)	µg/l	4*	NS	**0.497J**	**0.420J**	**0.528J**	NS	<0.100	<0.100	<0.10	NS	<0.100	<0.100	<0.10	NS	<0.100	<0.100	<0.10	NS	<0.100	<0.100	<0.10	1	17
Beryllium (Dissolved)	µg/l		NS	NS	**0.373J**	NS	NS	NS	<0.100	<0.10	NS	<0.100	NS	NS	NS	NS	<0.100	NS	NS	<0.100	NS	NS		
Cadmium (Total)	µg/l	2	NS	<0.360	<0.360	<0.36	NS	<0.360	<0.360	<0.36	NS	<0.360	<0.360	<0.36	NS	<0.360	<0.360	<0.36	NS	<0.360	<0.360	<0.36	1	20
Cadmium (Dissolved)	µg/l		NS	NS	<0.360	NS	NS	NS	<0.360	<0.36	NS	<0.360	NS	NS	NS	NS	<0.360	NS	NS	<0.360	NS	NS		
Chromium (Total)	µg/l	10	NS	<1.00	<1.00	**1.21J**	NS	<1.00	<1.00	**10.3**	NS	<1.00	<1.00	**1.20J**	NS	<1.00	<1.00	**4.29J**	NS	<1.00	<1.00	<1.00	10	640
Chromium (Dissolved)	µg/l		NS	NS	<1.00	NS	NS	NS	<1.00	**11.0**	NS	<1.00	NS	NS	NS	NS	<1.00	NS	NS	<1.00	NS	NS		
Cobalt (Total)	µg/l	1*	**9.87J**	**11.5**	**13.5**	**15.1**	**202**	**1,260**	**1,400**	**1,540**	<0.410	<1.10	<1.10	<1.10	**11.3**	**9.66J**	**13.5**	**14.1**	**1.45J**	<1.10	**1.86J**	<1.10	10	410
Cobalt (Dissolved)	µg/l		NS	NS	**12.6**	NS	NS	NS	**1,340**	**1,460**	NS	<1.10	NS	NS	NS	NS	**13.8**	NS	NS	<1.10	NS	NS		
Copper (Total)	µg/l	1,000	NS	<1.60	**3.53J**	<1.60	NS	<1.60	**2.28J**	<1.60	NS	<1.60	<1.60	<1.60	NS	<1.60	**3.39J**	<1.60	NS	<1.60	<1.60	<1.60	10	210
Copper (Dissolved)	µg/l		NS	NS	<1.60	NS	NS	NS	<1.60	<1.60	NS	<1.60	NS	NS	NS	NS	<1.60	NS	NS	<1.60	NS	NS		
Lead (Total)	µg/l	15	NS	**2.23J**	<1.90	**1.91J**	NS	**8.12J**	**3.87J**	<1.90	NS	<1.90	<1.90	<1.90	NS	<1.90	<1.90	<1.90	NS	**3.51J**	<1.90	<1.90	10	360
Lead (Dissolved)	µg/l		NS	NS	<1.90	NS	NS	NS	**3.36J**	<1.90	NS	<1.90	NS	NS	NS	NS	<1.90	NS	NS	<1.90	NS	NS		
Nickel (Total)	µg/l	100	NS	**17J**	**22.2J**	**21.6J**	NS	**244**	**306**	**307**	NS	<1.80	<1.80	<1.80	NS	**7.52J**	**13J**	**10.8J**	NS	<1.80	**2.76J**	**2.47J**	50	230
Nickel (Dissolved)	µg/l		NS	NS	**20.4J**	NS	NS	NS	**289**	**292**	NS	<1.80	NS	NS	NS	NS	**12.5J**	NS	NS	**3.33J**	NS	NS		
Selenium (Total)	µg/l	20	NS	**9.79J**	**8.83J**	**15.9**	NS	**7.86J**	**6.24J**	**11.0**	NS	<0.830	<0.830	**1.04J**	NS	**0.881J**	**0.892J**	**1.35J**	NS	**1.78J**	**1.41J**	**2.14J**	10	80
Selenium (Dissolved)	µg/l		NS	NS	**9.14J**	NS	NS	NS	**7.64J**	**8.64J**	NS	<0.830	NS	NS	NS	NS	**2.19J**	NS	NS	**1.87J**	NS	NS		
Silver (Total)	µg/l	20	NS	<1.90	<1.90	<1.90	NS	**5.25J**	**8.87J**	**5.61J**	NS	<1.90	<1.90	<1.90	NS	**2.67J**	**2.94J**	**1.94J**	NS	<1.90	<1.90	<1.90	10	NA
Silver (Dissolved)	µg/l		NS	NS	<1.90	NS	NS	NS	**8.15J**	**7.28J**	NS	<1.90	NS	NS	NS	NS	**2.95J**	NS	NS	<1.90	NS	NS		
Thallium (Total)	µg/l	0.28*	NS	<0.110	**0.139J**	**0.213J**	NS	**0.975J**	**0.748J**	**1.27J**	NS	<0.110	<0.110	<0.11	NS	<0.110	<0.110	<0.11	NS	<0.110	<0.110	<0.11	5.5	5
Thallium (Dissolved)	µg/l		NS	NS	**0.155J**	NS	NS	NS	**0.718J**	**1.25J**	NS	<0.110	NS	NS	NS	NS	<0.110	NS	NS	<0.110	NS	NS		
Vanadium (Total)	µg/l	0.3*	NS	**1.49J**	<1.40	<1.40	NS	<1.40	<1.40	<1.40	NS	<1.40	<1.40	<1.40	NS	<1.40	<1.40	<1.40	NS	**1.86J**	<1.40	<1.40	25	670
Vanadium (Dissolved)	µg/l		NS	NS	<1.40	NS	NS	NS	<1.40	<1.40	NS	<1.40	NS	NS	NS	NS	<1.40	NS	NS	<1.40	NS	NS		
Zinc (Total)	µg/l	1,000	NS	**127**	**149**	**173**	NS	**122**	**153**	**170**	NS	<3.80	<3.80	<3.80	NS	<3.80	**4.22J**	**4.98J**	NS	<3.80	<3.80	<3.80	10	430
Zinc (Dissolved)	µg/l		NS	NS	**132**	NS	NS	NS	**144**	**154**	NS	<3.80	NS	NS	NS	NS	<3.80	NS	NS	<3.80	NS	NS		

NOTES:
Samples were analyzed by Environmental Conservatio
Values which are **BOLD** indicate levels above labora
Values which are **BOLD** and shaded indicate levels a
DAF Comuptation = Dilution/Attenuation Factor Com
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J = Analyte detected, but below the laboratory reporting limit therefore the result is an estimated concentration.
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NS = Not Sampled for this parameter.
µg/L = Micrograms Per Liter
VOCs = Volatile Organic Compounds
Appendix I compounds not shown were not detected during this sampling event. See **Appendix I** of the report for laboratory reports.

Table 3
Average Appendix I VOC Concentrations
Edgecombe County Landfill
S&ME Project No. 1054-07-238D

APPENDIX I VOCs	UNITS	MW-5	MW-7A	MW-12	MW-13	MW-15
Benzene	µg/l	5.1	1.7	3.1	1.5	0.5
Chlorobenzene	µg/l	14.0	2.5	3.9	9.7	1.5
Chloroethane	µg/l	BDL	1.90	1.38	0.80	BDL
1,4-Dichlorobenzene	µg/l	9.35	BDL	5.60	2.33	BDL
1,1-Dichloroethane	µg/l	7.88	BDL	1.50	0.99	0.88
cis-1,2-Dichloroethene	µg/l	547.5	0.5	1.2	32.0	20.5
trans-1,2-Dichloroethene	µg/l	4	BDL	BDL	0.57	0.72
1,2-Dichloropropane	µg/l	BDL	BDL	BDL	BDL	2.38
Methylene chloride	µg/l	16	BDL	BDL	BDL	BDL
Toluene	µg/l	BDL	BDL	BDL	BDL	BDL
Trichloroethene	µg/l	BDL	BDL	BDL	1.2	BDL
Vinyl chloride	µg/l	28	BDL	BDL	2.7	3.0

Notes:
µg/l - micrograms per liter
BDL - Below Detection Limit

Table 4
Surface Water Analytical Results
Baseline Monitoring Events
Edgecombe County Landfill
S&ME Project No. 1054-07-238D

APPENDIX I VOCs by EPA 8250B			SURFACE WATER SAMPLING LOCATION				SWSL	DAF Computation
			UPSTREAM		DOWNSTREAM			
	Date		20-Jan-11	19-Jan-11	20-Jan-10	19-Jan-11		
	Units	2L Standard						
Benzene	µg/l	1	<0.050	<0.20	<0.20	<0.20	1	NA
Chlorobenzene	µg/l	50	<0.069	<0.27	<0.27	<0.27	3	NA
Chloroethane	µg/l	3000	<0.18	<0.30	<0.30	<0.30	10	NA
1,4-Dichlorobenzene	µg/l	6	<0.10	<0.38	<0.38	<0.38	1	NA
1,1-Dichloroethane	µg/l	6	<0.050	<0.33	<0.33	<0.33	5	NA
cis-1,2-Dichloroethene	µg/l	70	<0.075	<0.36	<0.36	<0.36	5	NA
trans-1,2-Dichloroethene	µg/l	100	<0.11	<0.34	<0.34	<0.34	5	NA
1,2-Dichloropropane	µg/l	0.6	<0.098	<0.20	<0.20	<0.20	1	NA
Methylene chloride	µg/l	600	<0.070	<0.53	<0.070	<0.53	1	NA
Trichloroethene	µg/l	3	<0.13	<0.38	<0.38	<0.38	1	NA
Vinyl chloride	µg/l	0.03	<0.083	<0.30	<0.30	<0.30	1	NA
APPENDIX I INORGANICS by EPA 6010B	Units	2L Standard					**SWSL**	**DAF Computation**
Antimony (Total)	µg/l	1*	NS	<0.220	NS	<0.220	6	NA
Arsenic (Total)	µg/l	10	NS	<2.80	NS	<2.80	10	200
Barium (Total)	µg/l	700	NS	**72.9J**	NS	**70.6J**	100	118
Beryllium (Total)	µg/l	4*	NS	<0.100	NS	<0.100	1	17
Cadmium (Total)	µg/l	2	NS	<0.360	NS	<0.360	1	20
Cobalt (Total)	µg/l	1*	**1.08J**	**1.25J**	**2.05J**	**4.88J**	10	410
Copper (Total)	µg/l	1000	NS	**2.81J**	NS	**1.65J**	10	210
Lead (Total)	µg/l	15	NS	<1.90	NS	<1.90	10	360
Nickel (Total)	µg/l	100	NS	<1.80	NS	**4.96J**	50	230
Selenium (Total)	µg/l	20	NS	<0.830	NS	<0.830	10	80
Silver (Total)	µg/l	20	NS	<1.90	NS	<1.90	10	NA
Thallium (Total)	µg/l	0.28*	NS	<0.110	NS	<0.110	5.5	5
Vanadium (Total)	µg/l	0.3*	NS	<1.40	NS	<1.40	25	670
Zinc (Total)	µg/l	1000	NS	**14.7**	NS	**14.1**	10	430

NOTES:
Samples were analyzed by Environmental Conservation Laboratories, Inc. (ENCO). Detection limits are shown on laboratory reports.
Values which are **BOLD** indicate levels above laboratory detection limits.
Values which are **BOLD** and shaded indicate levels above their respective NCDENR 2L or GWPST.
DAF Comuptation = Dilution/Attenuation Factor Computation (ref. S&ME Alternate Source Demonstration, June 2008).
2L STANDARD = North Carolina groundwater standards as promulgated by 15A North Carolina Administrative Code, Subchapter 2L.
SWSL = Solid Waste Section Limit. (ref. NCDENR-DWM, Solid Waste Section February 23, 2007 memorandum)
* Indicates there is currently no 2L Standard. The target analyte was compared to the Solid Waste Groundwater Protection Standard (GWPST).
J = Analyte detected, but below the laboratory reporting limit therefore the result is an estimated concentration.
NS = Not Sampled for this parameter.
µg/L = Micrograms Per Liter
VOCs = Volatile Organic Compounds
Laboratory analytical reports previously provided in Semi-annual Monitoring Reports

Table 5
Geochemical / MNA Constituent Summary
Edgecombe County Landfill
Baseline Sampling Events
S&ME Project No. 1054-07-238D

MONITORED NATURAL ATTENUATION PARAMETERS*	UNITS	BACKGROUND MONITOR WELLS												COMPLIANCE MONITOR WELLS											
		MW-3B				MW-4				MW-9				MW-5				MW-6				MW-7A			
Date		1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011
ph**	Std	4.06	1.58	3.22	4.13	5.86	4.47	6.79	5.83	6.94	3.49	5.53	6.98	6.26	4.30	5.81	6.24	5.24	3.61	5.01	5.95	6.12	5.39	5.75	6.07
Temperature**	^{o}C	14.13	18.81	13.00	19.80	12.48	25.43	12.56	26.10	16.25	22.23	9.57	21.87	16.60	20.21	15.94	20.88	12.46	21.64	11.13	22.01	16.85	21.76	15.26	21.11
Specific Conductance**	mS/cm	0.224	0.345	0.225	0.214	0.175	0.318	0.199	0.297	0.179	0.212	0.134	0.213	0.825	1.129	1.063	1.051	0.242	0.488	0.439	0.569	0.755	0.821	0.899	0.800
Oxygen Reduction Potential ORP**	mV	397.1	454.1	34.0	328.8	181.6	469.1	50.8	244.4	134.9	77.8	45.6	113.5	92.8	77.2	96.5	98.4	238.8	56	76.7	20.6	69.3	44.4	82.3	62.8
Dissolved Oxygen**	mg/L	0.72	14.53	0.72	1.06	1.00	13.93	1.56	4.08	1.92	3.15	4.05	0.82	0.18	7.84	0.55	1.79	0.50	8.25	1.11	1.17	0.38	7.22	1.36	1.41
Chloride	mg/L	35	44	27	32B	7.3	10	3.6J	6.2B	3.7J	4.0J	7	3.2JB	10	13	10	12B	36	46	77	94B	26	28	34	34B
Sulfate	mg/L	48J	61J	42J	40J	29J	64J	3.3J	25JB	2.5J	2.7J	21J	2.9JB	32J	42J	38J	44JB	46J	12J	46J	6.9JB	2.5J	2.2J	3.1J	2.2JB
Alkalinity	mg/L	<8.0	<8.0	<8.0	<12.0	41	55	95	56	90	97	22	97	290D	590D	410D	400D	22	150	37	150	190	380D	140	170D
Biochemical Oxygen Demand (BOD)	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	19	<2.0	5.8	<2.0	<2.0	<2.0	<2.0	3.5	<2.0	10	<6.0
Chemical Oxygen Demand (COD)	mg/L	<2.8	9.6J	12	<10.0	9.6J	42	7.5J	38	<2.8	<2.8	16	<10.0	59	70	77	100	12	36	18	32	40	18	44	45
TOC (Total Organic Carbon)	mg/L	1.3	1.9	0.530J	0.98J	5.9	14	0.410J	9.3	0.58J	0.780J	2.8	0.40J	5.7	6.1	3.6	5.6	7.3	8.1	2.6	5.7	7.4	5.5	3.8	4.6
Nitrate as N	mg/L	0.09J	0.16J	0.034J	0.18J	1.2	0.710J	<0.025	7.8J	0.048J	<0.025	0.560J	0.066J	0.079J	0.067J	0.030J	0.170J	0.022J	<0.025	0.035J	0.13J	0.069J	0.090J	0.047J	0.076J
Nitrate/Nitrite as N	mg/L	0.09J	0.16J	NS	0.180	1.2	0.710	NS	NS	0.048J	<0.025	NS	NS	0.087J	0.067J	NS	NS	0.23	<0.025	NS	NS	0.069J	0.090J	NS	NS
Nitrite at N	mg/L	<0.0056	.0059JB	NS	NS	0.006	<0.0056	NS	NS	<0.0056	<0.0056	NS	NS	0.0075JB	<0.0056	NS	NS	0.0066JB	<0.0056	NS	NS	<0.0056	<0.0056	NS	NS
Sulfate as SO4	mg/L	48J	61J	42	40	29	64	21	25	2.5	2.7	3.3	2.9JB	32	42	38	44JB	46	12	46	6.9JB	2.5	2.2	3.1	2.200
Sulfide	mg/L	<0.031	<0.031	<0.010	<0.01	<0.031	<0.031	<0.010	<0.01	<0.031	<0.031	<0.010	<0.01	<0.031	<0.031	<0.010	<0.01	<0.031	0.073J	<0.010	0.015J	<0.031	<0.031	<0.10	<0.01
Total Dissolved Solids (TDS)	mg/L	NS	180	86	160	NS	180	110	210	NS	170	40	130	NS	580	550	580	NS	320	240	450	NS	380	350	340
Iron	mg/L	0.915	0.971	4.91	3.79	0.832	0.971	5.38	0.243J	4.28	5.6	0.603	6.15	89.3	118	115	169	2.76	13.8	2.35	22.90	216	110	237	175.00
Manganese	mg/L	NS	0.0446J	0.0938	0.0881	NS	0.0446J	0.0646	0.00781J	NS	0.104	0.0141J	0.136	NS	33.3D	35D	34.5D	NS	0.177	0.504	0.233	NS	0.266	0.44	0.331
Carbon Dioxide	mg/L	NS	NS	36.8	69.4	108	NS	11.3	164D	NS	NS	84.2	28.2	468D	467D	370D	844D	NS	NS	172	227D	NS	NS	681D	677D
Ethane	mg/L	NS	NS	<0.0015	<0.001	<0.0004	NS	<0.0015	<0.001	NS	NS	<0.0015	<0.001	0.0008J	<0.0004	<0.0015	0.00216	NS	NS	<0.0015	<0.001	NS	NS	<0.0015	<0.001
Ethene	mg/L	NS	NS	<0.0016	<0.0023	<0.0004	NS	<0.0016	<0.0023	NS	NS	<0.0016	<0.0023	0.003	0.002	<0.0016	0.00597	NS	NS	<0.0016	<0.0023	NS	NS	<0.0016	<0.0023
Methane	mg/L	NS	NS	<0.00049	0.00188	0.0004J	NS	<0.00049	0.0131	NS	NS	<0.00049	0.00487	1.51	0.29	0.327	0.689D	NS	NS	0.00998	2.35D	NS	NS	2.78	7.98D
Acetic Acid (Volatile Fatty Acid)	mg/L	NS	NS	<0.083	<0.200	<0.071	NS	<0.083	<0.200	NS	NS	<0.083	<0.200	0.63	<0.083	<0.083	<0.200	NS	NS	<0.083	<0.200	NS	NS	<0.083	<0.200
Lactic Acid (Volatile Fatty Acid)***	mg/L	NS	NS	<0.440	0.27J	<0.088	NS	<0.440	<0.110	NS	NS	<0.440	0.170J	<0.88	<0.440	<0.440	0.410J	NS	NS	<0.440	<0.110	NS	NS	<0.440	<0.110
Propionic Acid (Volatile Fatty Acid)***	mg/L	NS	NS	<.180	<0.170	<0.054	NS	<.180	<0.170	NS	NS	<0.180	<0.170	<0.054	<0.180	<0.180	<0.170	NS	NS	<0.180	<0.170	NS	NS	<0.180	<0.170
Hydrogen****	nM	NS	NS	<0.600	1.7	1	NS	<0.600	2.3	NS	NS	1.5	2.6	1	1.90	0.630	2.8	NS	NS	<0.600	2.2	NS	NS	0.78	2

Values which are **BOLD** indicate levels above laboratory detection limits.

* Several methods were used in the laboratory analysis for the geochemical parameters. These methods are listed in the laboratory report.

** Parameter analyzed in the field by S&ME personnel. All other parameters analyzed by North Carolina certified laboratories.

***Groundwater samples were analyzed for several additional volatile fatty acids. No additional volatile fatty acids were detected in the groundwater samples.

****Groundwater samples were analyzed outside the recommended hold time of 14 days from collection for hydrogen during one or more event.

J = Analyte detected, but below the laboratory reporting limit therefore the result is an estimated concentration.

D = The sample was analyzed at dilution.

B = The analyte was detected in the associated method blank.

Std = Standard Units

^{o}C = Degrees Celsius

Table 5
Geochemical / MNA Constituent Summary
Edgecombe County Landfill
Baseline Sampling Events
S&ME Project No. 1054-07-238D

MONITORED NATURAL ATTENUATION PARAMETERS*	UNITS	COMPLIANCE MONITOR WELLS																			
		MW-12				MW-13				MW-14				MW-15				MW-16			
Date		1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011	1/19/2010	7/20/2010	1/18/2011	7/27/2011
ph**	Std	4.95	3.56	4.24	4.28	6.42	4.76	5.34	5.78	6.28	5.28	6.12	6.72	6.27	4.88	6.12	6.30	6.13	3.54	5.74	6.03
Temperature**	^{o}C	14.09	20.72	12.27	20.58	15.92	19.69	15.03	20.80	13.06	23.71	10.14	23.32	13.55	20.79	11.16	20.92	14.89	20.54	13.05	20.94
Specific Conductance**	mS/cm	0.576	0.695	0.803	0.836	1.042	0.872	0.966	0.904	0.353	0.404	0.437	0.461	0.628	0.820	0.819	0.735	0.517	0.595	0.617	0.575
Oxygen Reduction Potential ORP**	mV	199.7	297.1	42.3	219.3	9.8	60.6	49.5	10.9	42.8	37.3	171.3	64.4	47	41.6	78.0	84.8	73.7	23.6	176.1	61.0
Dissolved Oxygen**	mg/L	0.17	10.03	1.18	1.18	0.66	11.79	0.42	0.62	0.27	13.67	0.41	1.19	0.23	7.03	0.73	1.07	0.22	11.97	0.61	0.85
Chloride	mg/L	140D	150D	180D	220BD	97	110D	110D	120BD	14	8.9	18	13B	13	14	15	14B	24	25	24	23B
Sulfate	mg/L	67J	51J	64J	50JBD	24J	41J	38J	35JBD	65J	22J	52J	30JB	9.2J	14J	7.9J	13JB	<0.18	<0.12	2.9J	2.2JB
Alkalinity	mg/L	34	8.5J	10J	<12.0	290D	260D	240D	230D	120	180	140	180	340D	410D	410D	340D	100D	260D	200D	220D
Biochemical Oxygen Demand (BOD)	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	4.5	<2.0	2.3	<2.0	<2.0	2.6	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chemical Oxygen Demand (COD)	mg/L	27	20	40	53	33	64	100	96	5.3J	5.3J	16	17	25	16	33	32	40	48	48	53
TOC (Total Organic Carbon)	mg/L	12	11	8.2	11	5.9	8.7	7.4	7.9	6.1	3.6	3.7	3	6.6	4.8	3.6	4.2	17	15	12	12
Nitrate as N	mg/L	0.045J	0.180J	<0.025	0.078J	<0.0056	0.120J	<0.025	0.056J	0.11	<0.025	0.070J	0.086J	0.066J	0.140J	0.062J	0.093J	0.14J	<0.025	0.081J	0.13J
Nitrate/Nitrite as N	mg/L	0.045J	0.180J	NS	NS	<0.021	.120J	NS	NS	0.11	<0.025	NS	NS	0.066J	0.140J	NS	NS	0.14	<0.025	NS	NS
Nitrite at N	mg/L	<0.0056	<0.0056	NS	NS	<0.0056	<0.0056	NS	NS	<0.0056	0.0059	NS	NS	<0.0056	<0.0056	NS	NS	<0.0056	<0.0056	NS	NS
Sulfate as SO4	mg/L	67	510	64	50	24	41	38	35	65	22	52	30	9.2	14	7.9J	13JB	<0.18	<0.12	2.9	2.2
Sulfide	mg/L	<0.031	<0.031	<0.010	<0.01	<0.031	<0.031	<0.010	<0.01	0.096J	0.044J	0.083J	0.014J	<0.031	<0.031	<0.010	<0.01	<0.031	<0.031	0.075J	<0.01
Total Dissolved Solids (TDS)	mg/L	NS	520	410	540	NS	560	490	560	NS	260	220	250	NS	460	400	470	NS	310	310	290
Iron	mg/L	4.5	8.55	9.47	11.80	4.83	29.2	28.1	42.90	5.45	3.62	5.81	5.06	21.6	16.7	22.6	28.70	54.4	43.8	52.2	55
Manganese	mg/L	NS	0.0736	0.121	0.105	NS	36.8D	42.6D	38.7D	NS	0.114	0.184	0.147	NS	6.67	11.1	8.4	NS	0.364	0.415	0.444
Carbon Dioxide	mg/L	652D	667D	556D	1,310D	NS	NS	498D	816D	NS	NS	105	101	NS	NS	296D	269D	362D	308D	34	561D
Ethane	mg/L	<0.0004	<0.0004	<0.0015	<0.001	NS	NS	<0.0015	0.00186J	NS	NS	<0.0015	<0.001	NS	NS	<0.0015	0.00168J	<0.0004	<0.0004	<0.0015	<0.001
Ethene	mg/L	<0.0004	<0.0004	<0.0016	<0.0023	NS	NS	<0.0016	<0.0023	NS	NS	<0.0016	<0.0023	NS	NS	<0.0016	<0.0023	<0.0004	<0.0004	<0.0016	<0.0023
Methane	mg/L	0.173	0.062	<0.00049	0.26D	NS	NS	0.0349	1.27D	NS	NS	0.0643	0.392D	NS	NS	0.414	1.60D	10.6	5.04	6.87	19.30D
Acetic Acid (Volatile Fatty Acid)	mg/L	<0.071	<0.083	2.1	<0.200	NS	NS	4.3	<0.200	NS	NS	<0.083	<0.200	NS	NS	<0.083	<0.200	NS	<0.083	NS	<0.200
Lactic Acid (Volatile Fatty Acid)***	mg/L	<0.088	<0.440	<0.440	<0.110	NS	NS	<0.440	<0.110	NS	NS	<0.440	0.130J	NS	NS	<0.440	0.290J	NS	<0.440	NS	<0.110
Propionic Acid (Volatile Fatty Acid)***	mg/L	<0.054	<0.180	<0.180	12	NS	NS	<0.180	5.5	NS	NS	<0.18	<0.170	NS	NS	<0.18	<0.170	NS	<0.18	NS	<0.170
Hydrogen****	nM	<0.600	0.9	0.69	1.3	NS	NS	2.3	2.3	NS	NS	0.67	2.6	NS	NS	<0.600	1.2	1.2	2.1	0.65	4

Values which are **BOLD** indicate levels above laboratory detection limits
* Several methods were used in the laboratory analysis for the geochemic
** Parameter analyzed in the field by S&ME personnel. All other param
***Groundwater samples were analyzed for several additional volatile fa
****Groundwater samples were analyzed outside the recommended hold
J = Analyte detected, but below the laboratory reporting limit therefore th
D = The sample was analyzed at dilution.
B = The analyte was detected in the associated method blank.
Std = Standard Units
^{o}C = Degrees Celsius

Table 6
Average Geochemical/MNA Parameters
Four Sampling Events - 2010 and 2011
Edgecombe County Landfill
Baseline Sampling Events
S&ME Project No. 1054-07-238D

FIELD PARAMETERS*		Background Monitoring Wells			Compliance Monitoring Wells							
		MW-3B	MW-4	MW-9	MW-5	MW-6	MW-7A	MW-12	MW-13	MW-14	MW-15	MW-16
ph**	Std	3.25	5.74	5.74	5.65	4.95	5.83	4.26	5.58	6.10	5.89	5.36
Temperature**	^{o}C	16.4	19.1	17.5	18.4	16.8	18.7	16.9	17.9	17.6	16.6	17.4
Specific Conductance**	mS/cm	0.252	0.247	0.185	1.017	0.435	0.819	0.728	0.946	0.414	0.751	0.576
Oxygen Reduction Potential ORP**	mV	303.5	236.5	93.0	91.2	98.0	64.7	189.6	32.7	79.0	62.9	83.6
Dissolved Oxygen**	mg/L	4.26	5.14	2.49	2.59	2.76	2.59	3.14	3.37	3.89	2.27	3.41
Chloride	mg/L	35.33	6.78	4.58	11.25	63.25	30.50	172.50	109.25	13.48	14.00	24.00
Sulfate	mg/L	44.50	30.33	7.28	39.00	27.73	2.50	58.00	34.50	42.25	11.03	1.28
Alkalinity	mg/L	BDL	62	77	423	90	220	16	255	155	375	195
Biochemical Oxygen Demand (BOD)	mg/L	BDL	BDL	BDL	6.2	BDL	3.4	BDL	BDL	1.7	0.7	BDL
Chemical Oxygen Demand (COD)	mg/L	5.4	24.3	4.0	76.5	24.5	36.8	35.0	73.3	10.9	26.5	47.3
TOC (Total Organic Carbon)	mg/L	1.178	7.403	1.140	5.250	5.925	5.325	10.550	7.475	4.100	4.800	14.000
Nitrate as N	mg/L	0.116	3.237	0.043	0.087	0.047	0.176	0.076	0.044	0.067	0.090	0.088
Nitrate/Nitrite as N	mg/L	0.143	0.955	0.024	0.077	0.115	0.080	0.113	0.060	0.055	0.103	0.070
Nitrite at N	mg/L	0.0059	0.006	2.85	0.00375	0.0033	BDL	BDL	BDL	0.00295	BDL	BDL
Sulfate as SO4	mg/L	47.75	34.75	2.85	39	2.5	2.5	172.75	34.5	42.25	11.025	1.275
Sulfide	mg/L	BDL	BDL	BDL	BDL	0.022	BDL	BDL	BDL	0.05925	BDL	0.01875
Total Dissolved Solids (TDS)	mg/L	142	167	113	570	337	357	490	537	243	443	303
Iron	mg/L	2.65	1.86	4.16	122.83	10.45	184.50	8.58	26.26	4.99	22.40	51.35
Manganese	mg/L	0.076	0.039	0.085	34.267	0.305	0.346	0.100	39.100	103.000	8.723	0.408
Carbon Dioxide	mg/L	53	94	56	537	200	679	796	657	103	283	316
Ethane	mg/L	BDL	BDL	BDL	0.0007	BDL	BDL	BDL	0.0009	BDL	0.0008	BDL
Ethene	mg/L	BDL	BDL	BDL	0.0027	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Methane	mg/L	0.0019	0.0068	0.0024	0.7040	1.1800	5.3800	0.1238	0.6525	BDL	1.0070	10.4525
Acetic Acid (Volatile Fatty Acid)	mg/L	BDL	BDL	BDL	0.1575	BDL	BDL	0.525	2.15	BDL	BDL	BDL
Lactic Acid (Volatile Fatty Acid)***	mg/L	0.27	BDL	0.085	0.1025	BDL	BDL	BDL	BDL	0.065	0.145	BDL
Propionic Acid (Volatile Fatty Acid)***	mg/L	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.75	BDL	BDL	BDL
Hydrogen****	nM	1.70	1.65	2.05	1.58	1.10	1.39	0.72	2.30	1.64	0.60	1.99

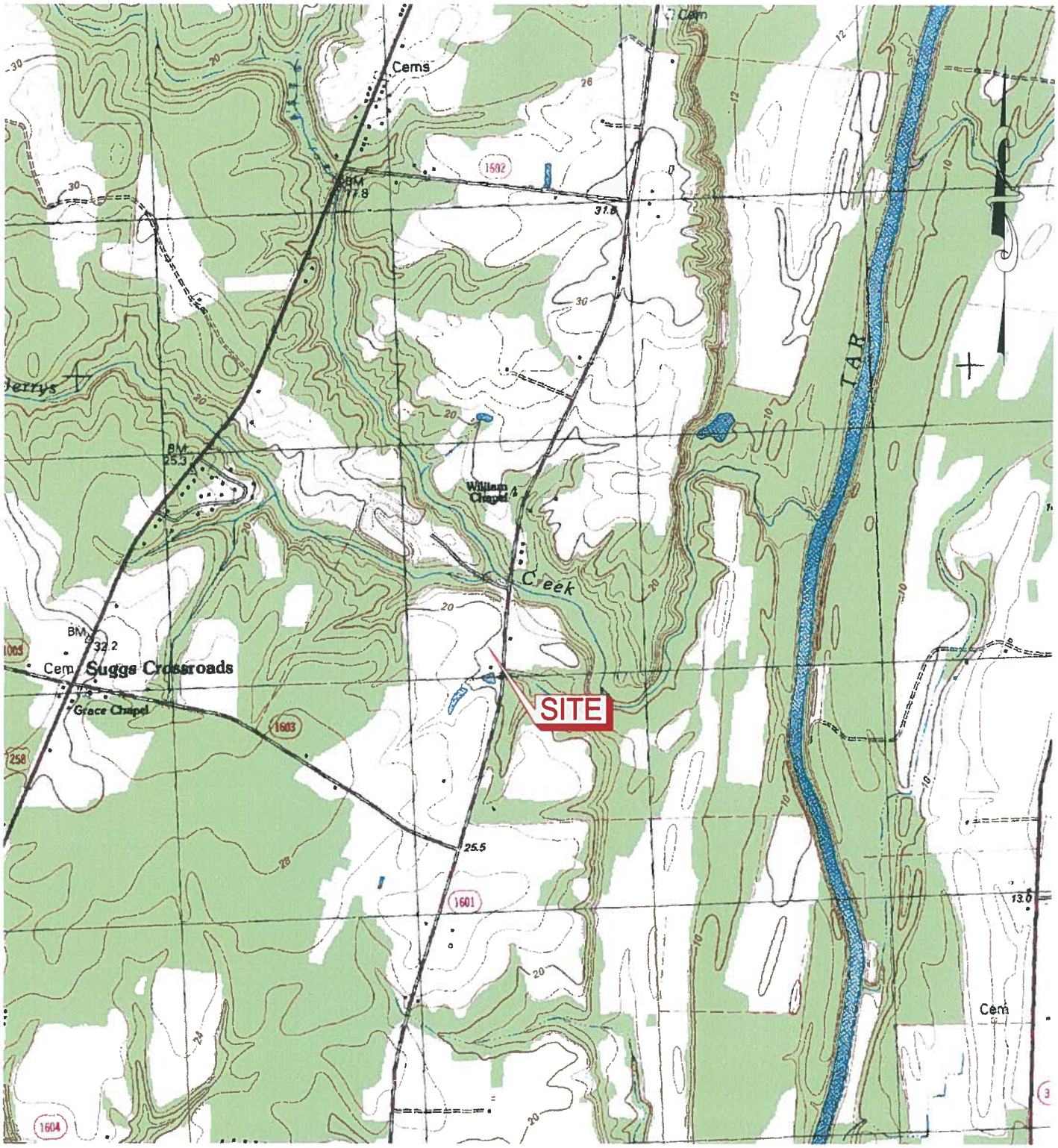
* Several methods were used in the laboratory analysis for the geochemical parameters. These methods are listed in the laboratory report.
** Parameter analyzed in the field by S&ME personnel. All other parameters analyzed by North Carolina certified laboratories.
***Groundwater samples were analyzed for several additional volatile fatty acids. No additional volatile fatty acids were detected in the groundwater samples.
****Groundwater samples were analyzed outside the recommended hold time of 14 days from collection for hydrogen during one or more event.
Std = Standard Units
^{o}C = Degrees Celsius
mS/cm = Microsiemens per Centimeter
mV = Millivolt
mg/L = Millograms Per Liter
nM = Nanomolar
BDL = Below Detection Limit

Table 7
Groundwater and Surface Water Sampling Schedule
Edgecombe County Landfill
S&ME Project No. 1054-07-238D

	GROUNDWATER SAMPLE LOCATIONS											SURFACE WATER SAMPLES	
Analysis	**MW-3B**	**MW-4**	**MW-5**	**MW-6**	**MW-7A**	**MW-9**	**MW-12**	**MW-13**	**MW-14**	**MW-15**	**MW-16**	**Upstream (SW-1)**	**Downstream (SW-2)**
Appendix I VOCs	x	x	x	x	x	x	x	x	x	x	x	x	x
Appendix I metals	x	x	x	x	x	x	x	x	x	x	x	x	x
Field parameters													
pH	x	x	x	x	x	x	x	x	x	x	x	x	x
Conductivity	x	x	x	x	x	x	x	x	x	x	x	x	x
ORP	x	x	x	x	x	x	x	x	x	x	x	x	x
Temperature	x	x	x	x	x	x	x	x	x	x	x	x	x
Turbidity	x	x	x	x	x	x	x	x	x	x	x	x	x
DO													
Monitored Natural Attenuation Parameters*	**ADDITIONAL PARAMETERS TO BE MEASURED ON AN 18-MONTH SCHEDULE**												
Chloride			x				x			x	x		
Sulfate			x				x			x	x		
Alkalinity			x				x			x	x		
Nitrate/Nitrite as N			x				x			x	x		
Sulfide			x				x			x	x		
Total Dissolved Solids			x				x			x	x		
Iron			x				x			x	x		
Manganese			x				x			x	x		
Ethene			x				x			x	x		
Ethane			x				x			x	x		
Methane			x				x			x	x		

* Monitored Natural Attenuation Parameters to be measured on an 18-month basis after corrective measures have been implemented.
Analytical methods may be found in Table 2 and Table 3.

FIGURES



GRAPHIC SCALE

1000 0 500 1000 2000

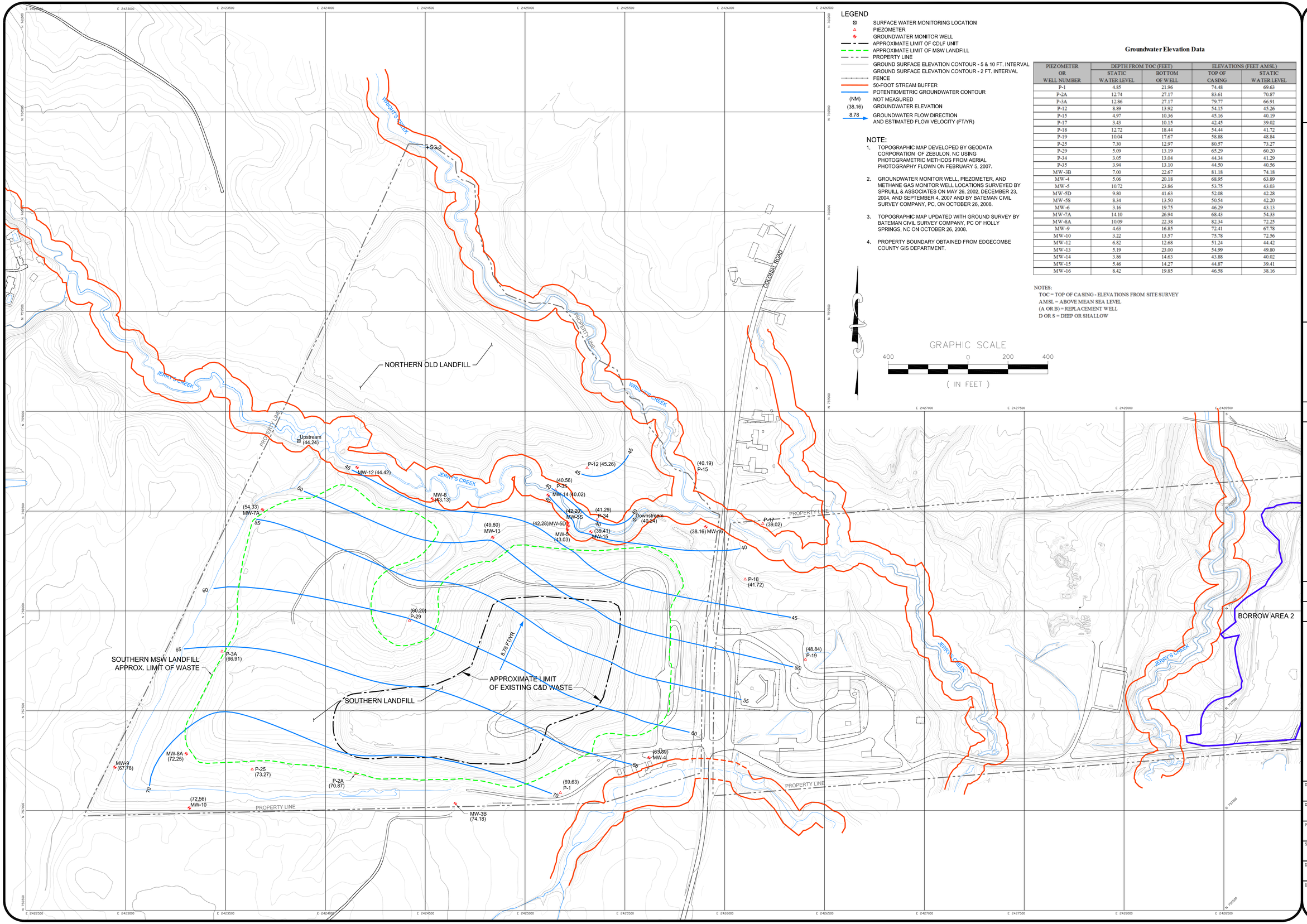
(IN FEET)

TOPO SOURCE: NCGS DRG
OLD SPARTA, NC (035077G5) DATED 1981
CONTOUR INTERVAL: 2 METERS

A-2854

SCALE: 1" = 2000'	S&ME WWW.SMEINC.COM	VICINITY MAP	FIGURE NO.
DATE: JAN. 2012		BASELINE GROUNDWATER SAMPLING & MONITORED NATURAL ATTENUATION REPORT - EDGECOMBE TARBORO, NORTH CAROLINA	1
DRAWN BY:			
PROJECT NO: 1054-07-238D	NC ENGINEER LICENSE #F-0176 3201 SPRING FOREST RD, RALEIGH, NC 27616		

S:\PROJECTS\2007\07-238D Edgecombe - Environmental Monitoring 2011-12\CAD\A2854.dwg, FIG1, 1/9/2012 2:35:33 PM, 1:1



LEGEND

- SURFACE WATER MONITORING LOCATION
- PIEZOMETER
- GROUNDWATER MONITOR WELL
- APPROXIMATE LIMIT OF CDLF UNIT
- APPROXIMATE LIMIT OF MSW LANDFILL
- PROPERTY LINE
- GROUND SURFACE ELEVATION CONTOUR - 5 & 10 FT. INTERVAL
- GROUND SURFACE ELEVATION CONTOUR - 2 FT. INTERVAL
- FENCE
- 50-FOOT STREAM BUFFER
- POTENTIOMETRIC GROUNDWATER CONTOUR
- (NM) NOT MEASURED
- (38,16) GROUNDWATER ELEVATION
- 8.78 GROUNDWATER FLOW DIRECTION AND ESTIMATED FLOW VELOCITY (FT/YR)

NOTE:

1. TOPOGRAPHIC MAP DEVELOPED BY GEODATA CORPORATION OF ZEBULON, NC USING PHOTOGRAMETRIC METHODS FROM AERIAL PHOTOGRAPHY FLOWN ON FEBRUARY 5, 2007.
2. GROUNDWATER MONITOR WELL, PIEZOMETER, AND METHANE GAS MONITOR WELL LOCATIONS SURVEYED BY SPRUILL & ASSOCIATES ON MAY 26, 2002, DECEMBER 23, 2004, AND SEPTEMBER 4, 2007 AND BY BATEMAN CIVIL SURVEY COMPANY, PC, ON OCTOBER 26, 2008.
3. TOPOGRAPHIC MAP UPDATED WITH GROUND SURVEY BY BATEMAN CIVIL SURVEY COMPANY, PC OF HOLLY SPRINGS, NC ON OCTOBER 26, 2008.
4. PROPERTY BOUNDARY OBTAINED FROM EDGECOMBE COUNTY GIS DEPARTMENT.

Groundwater Elevation Data

PIEZOMETER OR WELL NUMBER	DEPTH FROM TOC (FEET)		ELEVATIONS (FEET AMSL)	
	STATIC WATER LEVEL	BOTTOM OF WELL	TOP OF CASING	STATIC WATER LEVEL
P-1	4.85	21.96	74.48	69.63
P-2A	12.74	27.17	83.61	70.87
P-3A	12.86	27.17	79.77	66.91
P-12	8.89	13.92	54.15	45.26
P-15	4.97	10.36	45.16	40.19
P-17	3.43	10.15	42.45	39.02
P-18	12.72	18.44	54.44	41.72
P-19	10.04	17.67	58.88	48.84
P-25	7.30	12.97	80.57	73.27
P-29	5.09	13.19	65.29	60.20
P-34	3.05	13.04	44.34	41.29
P-35	3.94	13.10	44.50	40.56
MW-3B	7.00	22.67	81.18	74.18
MW-4	5.06	20.18	68.95	63.89
MW-5	10.72	23.86	53.75	43.03
MW-5D	9.80	41.63	52.08	42.28
MW-5S	8.34	13.50	50.54	42.20
MW-6	3.16	19.75	46.29	43.13
MW-7A	14.10	26.94	68.43	54.33
MW-8A	10.09	22.38	82.34	72.25
MW-9	4.63	16.85	72.41	67.78
MW-10	3.22	13.57	75.78	72.56
MW-12	6.82	12.68	51.24	44.42
MW-13	5.19	23.00	54.99	49.80
MW-14	3.86	14.63	43.88	40.02
MW-15	5.46	14.27	44.87	39.41
MW-16	8.42	19.85	46.58	38.16

NOTES:
TOC = TOP OF CASING - ELEVATIONS FROM SITE SURVEY
AMSL = ABOVE MEAN SEA LEVEL
(A OR B) = REPLACEMENT WELL
D OR S = DEEP OR SHALLOW

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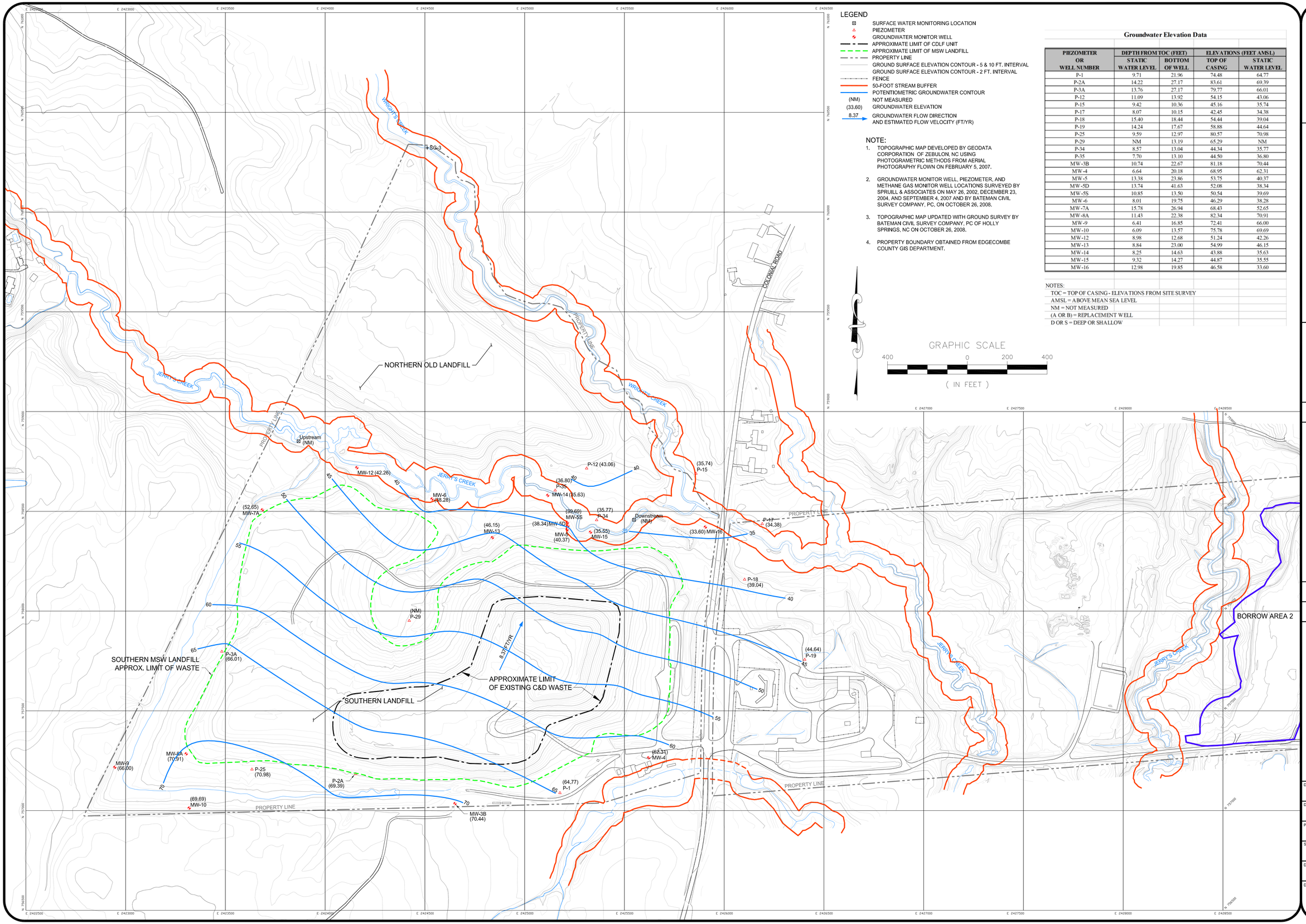
NO.	DATE	DESCRIPTION	BY

GROUNDWATER POTENTIOMETRIC MAP
JANUARY 19, 2010

BASELINE GROUNDWATER SAMPLING & MONITORED NATURAL ATTENUATION REPORT
TARBORO, NORTH CAROLINA

DRAWN BY: BTR	CHECKED BY:
DESIGNED BY:	APPROVED BY:
PROJECT NUMBER: 1054-07-238B	
SCALE: 1" = 200'	DATE: FEB. 2010
DRAWING NUMBER: D-1130	
DRAWING: 2	OF: 5



LEGEND

- SURFACE WATER MONITORING LOCATION
- PIEZOMETER
- GROUNDWATER MONITOR WELL
- APPROXIMATE LIMIT OF CDLF UNIT
- APPROXIMATE LIMIT OF MSW LANDFILL
- PROPERTY LINE
- GROUND SURFACE ELEVATION CONTOUR - 5 & 10 FT. INTERVAL
- GROUND SURFACE ELEVATION CONTOUR - 2 FT. INTERVAL
- FENCE
- 50-FOOT STREAM BUFFER
- POTENTIOMETRIC GROUNDWATER CONTOUR
- (NM) NOT MEASURED
- (33.60) GROUNDWATER ELEVATION
- 8.37 GROUNDWATER FLOW DIRECTION AND ESTIMATED FLOW VELOCITY (FT/YR)

NOTE:

1. TOPOGRAPHIC MAP DEVELOPED BY GEODATA CORPORATION OF ZEBULON, NC USING PHOTOGRAMETRIC METHODS FROM AERIAL PHOTOGRAPHY FLOWN ON FEBRUARY 5, 2007.
2. GROUNDWATER MONITOR WELL, PIEZOMETER, AND METHANE GAS MONITOR WELL LOCATIONS SURVEYED BY SPRUILL & ASSOCIATES ON MAY 26, 2002, DECEMBER 23, 2004, AND SEPTEMBER 4, 2007 AND BY BATEMAN CIVIL SURVEY COMPANY, PC, ON OCTOBER 26, 2008.
3. TOPOGRAPHIC MAP UPDATED WITH GROUND SURVEY BY BATEMAN CIVIL SURVEY COMPANY, PC OF HOLLY SPRINGS, NC ON OCTOBER 26, 2008.
4. PROPERTY BOUNDARY OBTAINED FROM EDGECOMBE COUNTY GIS DEPARTMENT.

Groundwater Elevation Data

PIEZOMETER OR WELL NUMBER	DEPTH FROM TOC (FEET)		ELEVATIONS (FEET AMSL)	
	STATIC WATER LEVEL	BOTTOM OF WELL	TOP OF CASING	STATIC WATER LEVEL
P-1	9.71	21.96	74.48	64.77
P-2A	14.22	27.17	83.61	69.39
P-3A	13.76	27.17	79.77	66.01
P-12	11.09	13.92	54.15	43.06
P-15	9.42	10.36	45.16	35.74
P-17	8.07	10.15	42.45	34.38
P-18	15.40	18.44	54.44	39.04
P-19	14.24	17.67	58.88	44.64
P-25	9.59	12.97	80.57	70.98
P-29	NM	13.19	65.29	NM
P-34	8.57	13.04	44.34	35.77
P-35	7.70	13.10	44.50	36.80
MW-3B	10.74	22.67	81.18	70.44
MW-4	6.64	20.18	68.95	62.31
MW-5	13.38	23.86	53.75	40.37
MW-5D	13.74	41.63	52.08	38.34
MW-5S	10.85	13.50	50.54	39.69
MW-6	8.01	19.75	46.29	38.28
MW-7A	15.78	26.94	68.43	52.65
MW-8A	11.43	22.38	82.34	70.91
MW-9	6.41	16.85	72.41	66.00
MW-10	6.09	13.57	75.78	69.69
MW-12	8.98	12.68	51.24	42.26
MW-13	8.84	23.00	54.99	46.15
MW-14	8.25	14.63	43.88	35.63
MW-15	9.32	14.27	44.87	35.55
MW-16	12.98	19.85	46.58	33.60

NOTES:
TOC = TOP OF CASING - ELEVATIONS FROM SITE SURVEY
AMSL = ABOVE MEAN SEA LEVEL
NM = NOT MEASURED
(A OR B) = REPLACEMENT WELL
D OR S = DEEP OR SHALLOW

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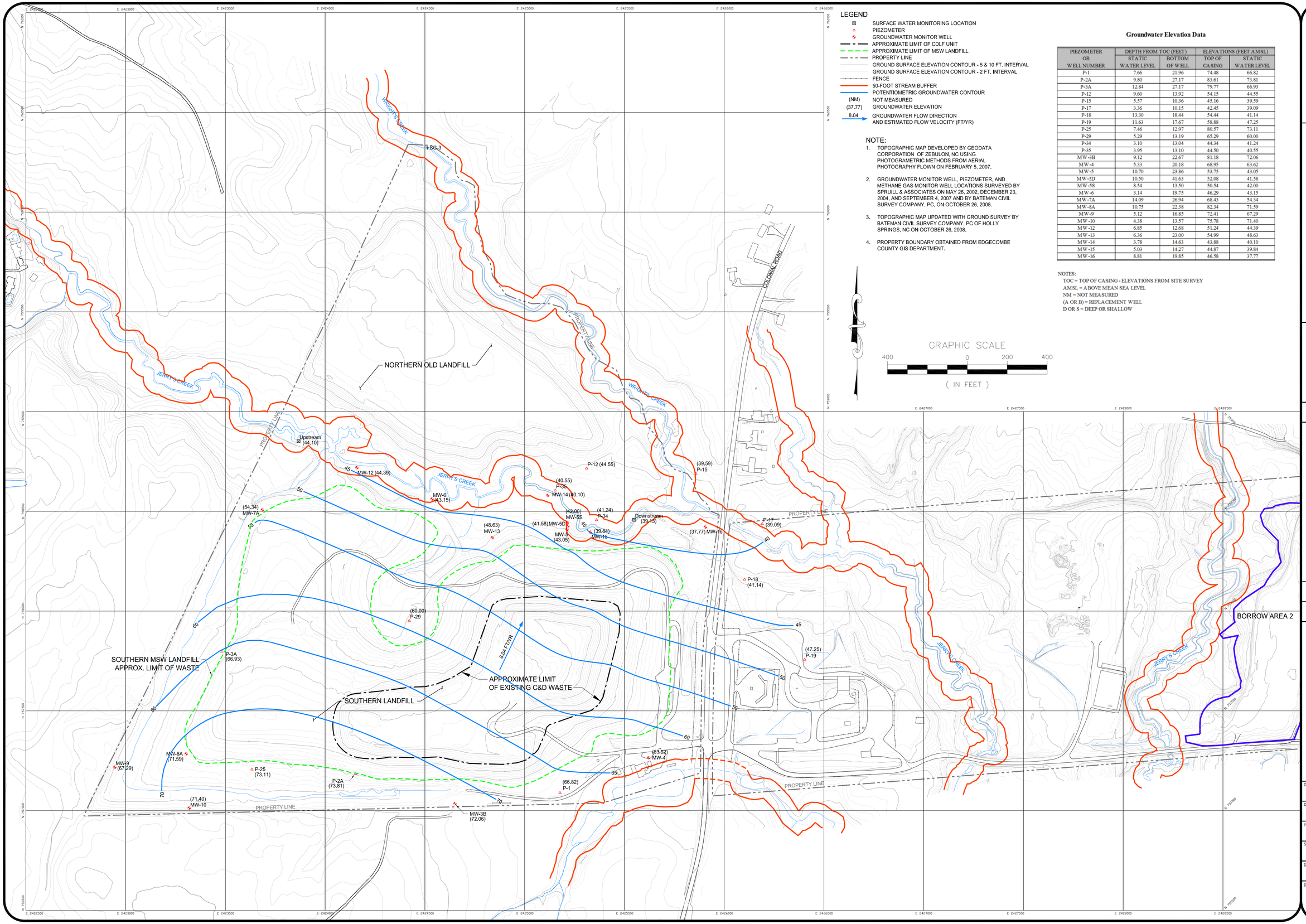
NO.	DATE	DESCRIPTION	BY

GROUNDWATER POTENTIOMETRIC MAP
JULY 20, 2010

BASELINE GROUNDWATER SAMPLING & MONITORED NATURAL ATTENUATION REPORT
TARBORO, NORTH CAROLINA

DRAWN BY: BTR	CHECKED BY:
DESIGNED BY:	APPROVED BY:
PROJECT NUMBER: 1054-07-238C	
SCALE: 1" = 200'	DATE: AUG. 2010
DRAWING NUMBER: D-1186	
DRAWING: 3	OF: 5



LEGEND

- SURFACE WATER MONITORING LOCATION
- PIEZOMETER
- GROUNDWATER MONITOR WELL
- APPROXIMATE LIMIT OF CDLF UNIT
- APPROXIMATE LIMIT OF MSW LANDFILL
- PROPERTY LINE
- GROUND SURFACE ELEVATION CONTOUR - 5 & 10 FT. INTERVAL
- GROUND SURFACE ELEVATION CONTOUR - 2 FT. INTERVAL
- FENCE
- 50-FOOT STREAM BUFFER
- POTENTIOMETRIC GROUNDWATER CONTOUR
- (NM) NOT MEASURED
- (37.77) GROUNDWATER ELEVATION
- 8.04 GROUNDWATER FLOW DIRECTION AND ESTIMATED FLOW VELOCITY (FT/YR)

NOTE:

1. TOPOGRAPHIC MAP DEVELOPED BY GEODATA CORPORATION OF ZEBULON, NC USING PHOTOGRAMETRIC METHODS FROM AERIAL PHOTOGRAPHY FLOWN ON FEBRUARY 5, 2007.
2. GROUNDWATER MONITOR WELL, PIEZOMETER, AND METHANE GAS MONITOR WELL LOCATIONS SURVEYED BY SPRUILL & ASSOCIATES ON MAY 26, 2002, DECEMBER 23, 2004, AND SEPTEMBER 4, 2007 AND BY BATEMAN CIVIL SURVEY COMPANY, PC, ON OCTOBER 26, 2008.
3. TOPOGRAPHIC MAP UPDATED WITH GROUND SURVEY BY BATEMAN CIVIL SURVEY COMPANY, PC OF HOLLY SPRINGS, NC ON OCTOBER 26, 2008.
4. PROPERTY BOUNDARY OBTAINED FROM EDGECOMBE COUNTY GIS DEPARTMENT.

Groundwater Elevation Data

PIEZOMETER OR WELL NUMBER	DEPTH FROM TOC (FEET)		ELEVATIONS (FEET AMSL)	
	STATIC WATER LEVEL	BOTTOM OF WELL	TOP OF CASING	STATIC WATER LEVEL
P-1	7.66	21.96	74.48	66.82
P-2A	9.80	27.17	83.61	73.81
P-3A	12.84	27.17	79.77	66.93
P-12	9.60	13.92	54.15	44.55
P-15	5.57	10.36	45.16	39.59
P-17	3.36	10.15	42.45	39.09
P-18	13.30	18.44	54.44	41.14
P-19	11.63	17.67	58.88	47.25
P-25	7.46	12.97	80.57	73.11
P-29	5.29	13.19	65.29	60.00
P-34	3.10	13.04	44.34	41.24
P-35	3.95	13.10	44.50	40.55
MW-3B	9.12	22.67	81.18	72.06
MW-4	5.33	20.18	68.95	63.62
MW-5	10.70	23.86	53.75	43.05
MW-5D	10.50	41.63	52.08	41.58
MW-5S	8.54	13.50	50.54	42.00
MW-6	3.14	19.75	46.29	43.15
MW-7A	14.09	26.94	68.43	54.34
MW-8A	10.75	22.38	82.34	71.59
MW-9	5.12	16.85	72.41	67.29
MW-10	4.38	13.57	75.78	71.40
MW-12	6.85	12.68	51.24	44.39
MW-13	6.36	23.00	54.99	48.63
MW-14	3.78	14.63	43.88	40.10
MW-15	5.03	14.27	44.87	39.84
MW-16	8.81	19.85	46.58	37.77

NOTES:
TOC = TOP OF CASING - ELEVATIONS FROM SITE SURVEY
AMSL = ABOVE MEAN SEA LEVEL
NM = NOT MEASURED
(A OR B) = REPLACEMENT WELL
D OR S = DEEP OR SHALLOW

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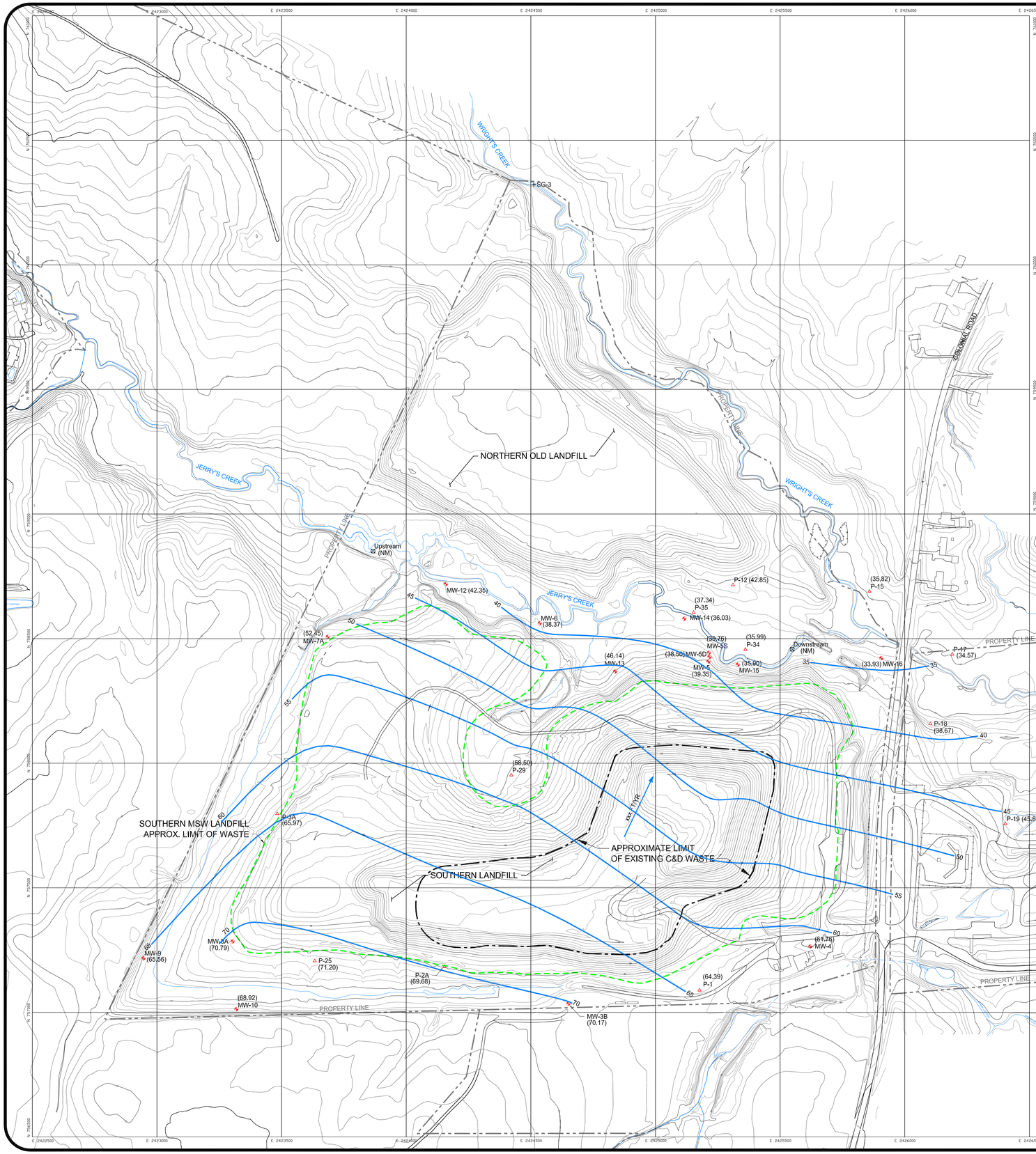
NO.	DATE	DESCRIPTION	BY

GROUNDWATER POTENTIOMETRIC MAP
JANUARY 18, 2011

BASELINE GROUNDWATER SAMPLING & MONITORED NATURAL ATTENUATION REPORT
TARBORO, NORTH CAROLINA

DRAWN BY: BTR	CHECKED BY:
DESIGNED BY:	APPROVED BY:
PROJECT NUMBER: 1054-07-238C	
SCALE: 1" = 200'	DATE: FEB. 2011
DRAWING NUMBER: D-1198	
DRAWING: 4	OF: 5



LEGEND

- SURFACE WATER MONITORING LOCATION
- PIEZOMETER
- GROUNDWATER MONITOR WELL
- APPROXIMATE LIMIT OF CDLF UNIT
- APPROXIMATE LIMIT OF MSW LANDFILL
- PROPERTY LINE
- GROUND SURFACE ELEVATION CONTOUR - 5 & 10 FT. INTERVAL
- GROUND SURFACE ELEVATION CONTOUR - 2 FT. INTERVAL
- FENCE
- 50-FOOT STREAM BUFFER
- POTENTIOMETRIC GROUNDWATER CONTOUR
- (NM) NOT MEASURED
- (33.93) GROUNDWATER ELEVATION
- 8.04 GROUNDWATER FLOW DIRECTION AND ESTIMATED FLOW VELOCITY (FT/YR)

NOTE:

1. TOPOGRAPHIC MAP DEVELOPED BY GEODATA CORPORATION OF ZEBULON, NC USING PHOTOGRAMETRIC METHODS FROM AERIAL PHOTOGRAPHY FLOWN ON FEBRUARY 5, 2007.
2. GROUNDWATER MONITOR WELL, PIEZOMETER, AND METHANE GAS MONITOR WELL LOCATIONS SURVEYED BY SPRUILL & ASSOCIATES ON MAY 26, 2002, DECEMBER 23, 2004, AND SEPTEMBER 4, 2007 AND BY BATEMAN CIVIL SURVEY COMPANY, PC, ON OCTOBER 26, 2008.
3. TOPOGRAPHIC MAP UPDATED WITH GROUND SURVEY BY BATEMAN CIVIL SURVEY COMPANY, PC OF HOLLY SPRINGS, NC ON OCT. 26, 2008, MARCH 2011 AND JULY 2011.
4. PROPERTY BOUNDARY OBTAINED FROM EDGECOMBE COUNTY GIS DEPARTMENT.

GRAPHIC SCALE

400 0 200 400

(IN FEET)

Groundwater Elevation Data

PIEZOMETER OR WELL NUMBER	DEPTH FROM TOC (FEET)		ELEVATIONS (FEET AMSL)	
	STATIC WATER LEVEL	BOTTOM OF WELL	TOP OF CASING	STATIC WATER LEVEL
P-1	10.09	21.96	74.48	64.39
P-2A	13.93	27.17	83.61	69.68
P-3A	13.80	27.17	79.77	65.97
P-12	11.30	13.92	54.15	42.85
P-15	9.34	10.36	45.16	35.82
P-17	7.88	10.15	42.45	34.57
P-18	15.77	18.44	54.44	38.67
P-19	13.05	17.67	58.88	45.83
P-25	9.37	12.97	80.57	71.20
P-29	6.79	13.19	65.29	58.50
P-34	8.35	13.04	44.34	35.99
P-35	7.16	13.10	44.50	37.34
MW-3B	11.01	22.67	81.18	70.17
MW-4	7.19	20.18	68.95	61.76
MW-5	14.40	23.86	53.75	39.35
MW-5D	13.58	41.63	52.08	38.50
MW-5S	10.78	13.50	50.54	39.76
MW-6	7.92	19.75	46.29	38.37
MW-7A	15.98	26.94	68.43	52.45
MW-8A	11.55	22.38	82.34	70.79
MW-9	6.85	16.85	72.41	65.56
MW-10	6.86	13.57	75.78	68.92
MW-12	8.89	12.68	51.24	42.35
MW-13	8.85	23.00	54.99	46.14
MW-14	7.85	14.63	43.88	36.03
MW-15	8.97	14.27	44.87	35.90
MW-16	12.65	19.85	46.58	33.93

NOTES:
TOC = TOP OF CASING - ELEVATIONS FROM SITE SURVEY
AMSL = ABOVE MEAN SEA LEVEL
NM = NOT MEASURED
(A OR B) = REPLACEMENT WELL
D OR S = DEEP OR SHALLOW

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NO.	DATE	DESCRIPTION	BY

GROUNDWATER POTENTIOMETRIC MAP
JULY 27, 2011

BASELINE GROUNDWATER SAMPLING & MONITORED NATURAL ATTENUATION REPORT
TARBORO, NORTH CAROLINA

DRAWN BY: BTR	CHECKED BY:
DESIGNED BY:	APPROVED BY:
PROJECT NUMBER: 1054-07-238D	
SCALE: 1" = 200'	DATE: JAN. 2012
DRAWING NUMBER: D-1255	
DRAWING: 5	OF: 5

APPENDIX I

GROUNDWATER FLOW VELOCITY CALCULATIONS

JOB NAME	Edgecombe County Landfill	JOB NO.	1054-07-238D
SUBJECT	Velocity Calculation	SHEET NO.	1 of 1
		DATE	9/9/2011
		COMPUTED BY	MLL
		CHECKED BY	SPW

PURPOSE:

To determine the average groundwater flow velocity.

CALCULATION:

$$V = \frac{Ki}{n}$$

Where:

V = Average Linear Groundwater Flow Velocity (feet/year = ft/yr)
K = Hydraulic Conductivity (ft/yr)
i = Average True Hydraulic Gradient (ft/ft)
n = Effective Soil Porosity (percent)

$K_{A\ ZONE}$ =	**5.95E-05**	cm/sec		
Convert $K_{A\ ZONE}$ from cm/sec to ft/min =	**5.95E-05**	*	1.9685	
=	0.00011713	ft/min		
Convert $K_{A\ ZONE}$ from ft/min to ft/yr =	0.00011713	ft/min *	1440	min/day
=	0.16866108	ft/day *	365	day/yr
=	**61.561**	**ft/year**		

Average True Gradient, i_{AVG} (MW-3B to MW-5):	**0.0210**	**ft/ft**
n:	**15%**	

$$V = \frac{K_{A\ ZONE}\, i}{n}$$

$$V = \frac{61.561\ ft/yr * 0.0210\ ft/ft}{0.15} = 8.6186\ ft/yr$$

CONCLUSION:

The average groundwater flow velocity, V, equals **8.62 ft/yr**.

JOB NAME	Edgecombe County Landfill	JOB NO.	1054-07-238D
SUBJECT	Hydraulic Gradient	SHEET NO.	1 of 1
		DATE	9/9/2011
		COMPUTED BY	MLL
		CHECKED BY	SPW

PURPOSE:

To determine the average true hydraulic gradient.

GIVEN:

Well	GW Elev
MW-3B	74.18
MW-5	43.03
MW-7A	54.33
P-1	69.63

CALCULATION:

Calculate the average of three point solutions using wells MW-5, MW-7A, MW-3B or P-1.

GRADIENT:

$$i = \frac{h_1 - h_2}{L}$$

Where: i = Hydraulic Gradient (ft/ft)
$h_1 - h_2$ = Difference in Hydraulic Head (ft)
L = Distance Along Flow Path (ft)

Where distance between h_1 and h_2 is parallel to flow, determined by projection from 3 point problem.

$$i_1 = \frac{\text{MW-3B} - \text{MW-5}}{L_1} = \frac{74.18 - 43.03}{1{,}485} = \mathbf{0.02098} \quad \mathbf{ft/ft}$$

Use Elevation of Groundwater at MW-7A to establish 52.45' elevation between MW-3B and MW-5.

$$\frac{\text{MW-3B - MW-7A}}{\text{gradient (MW-3B and MW-5)}} = \frac{74.18 - 54.33}{0.02098} = 946.30 \quad \text{ft}$$

Draw line from MW-7A to point located 853.80 feet from MW-3B to MW-5.

Measure new distance between MW-3B and MW-5 perpendicular to line plotted for 52.45' contour. Recalculate Gradient.

$$i_1 = \frac{\text{MW-3B} - \text{MW-5}}{\text{New } L_1} = \frac{74.18 - 43.03}{1{,}475} = \mathbf{0.02112} \quad \mathbf{ft/ft}$$

True Hydraulic Gradient, i_1 = 0.02112 ft/ft

$$i_2 = \frac{\text{P-1} - \text{MW-5}}{L_2} = \frac{69.63 - 43.03}{1{,}320} = \mathbf{0.02015} \quad \mathbf{ft/ft}$$

Use Elevation of Groundwater at MW-7A to establish 52.45' elevation between P-1 and MW-5.

$$\frac{\text{P-1 - MW-7A}}{\text{gradient (P-1 and MW-5)}} = \frac{69.63 - 54.33}{0.020152} = 759.25 \quad \text{ft}$$

Draw line from MW-7A to point located 629.42 feet from P-1 to MW-5.

Measure new distance between P-1 and MW-5 perpendicular to line plotted for 52.45' contour. Recalculate Gradient.

$$i_2 = \frac{\text{P-1} - \text{MW-5}}{\text{New } L_2} = \frac{69.63 - 43.03}{1{,}185} = \mathbf{0.02245} \quad \mathbf{ft/ft}$$

True Hydraulic Gradient, i_2 = 0.02245 ft/ft

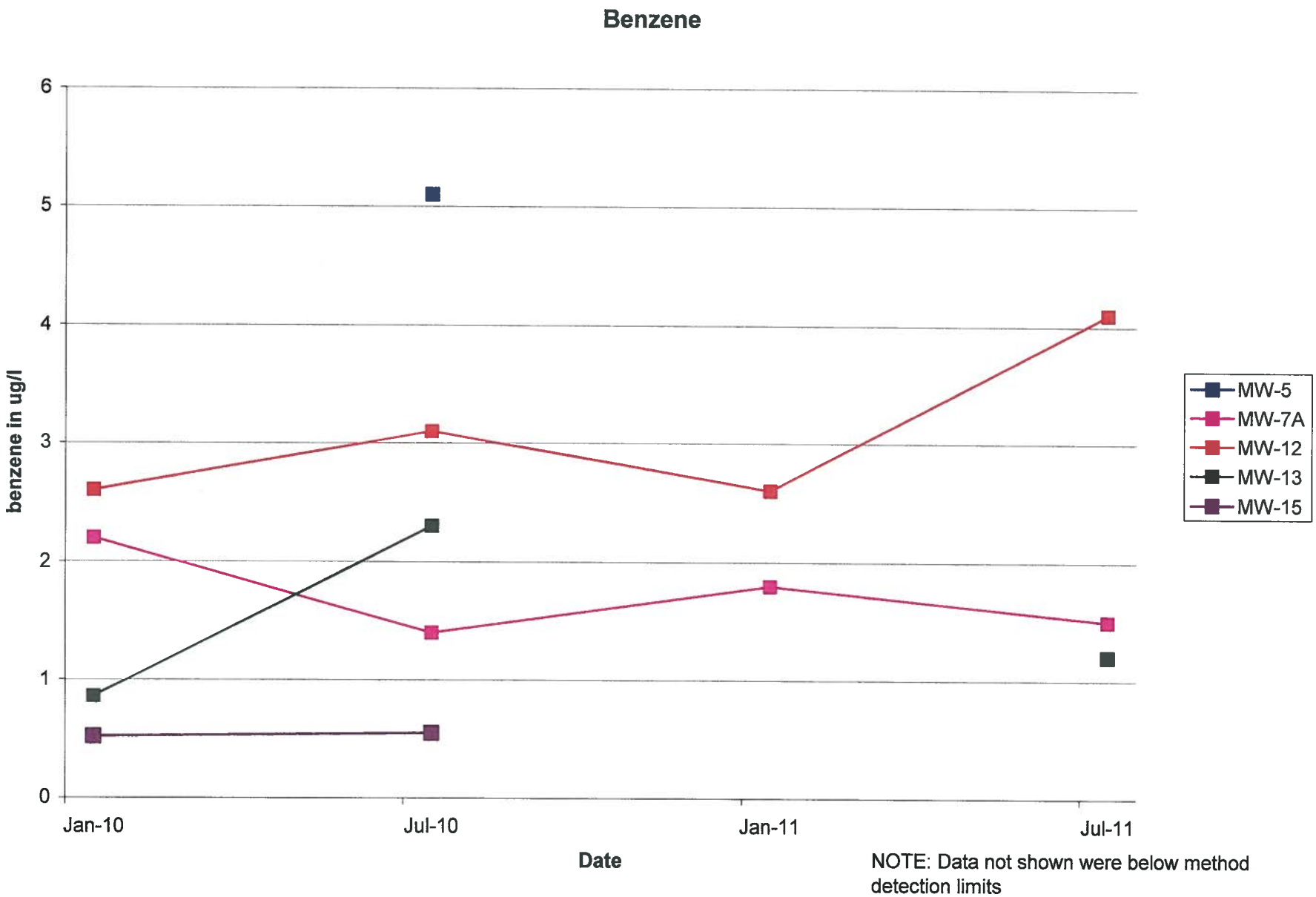
AVERAGE TRUE HYDRAULIC GRADIENT, i_{AVG} = 0.0218 ft/ft

CONCLUSION:

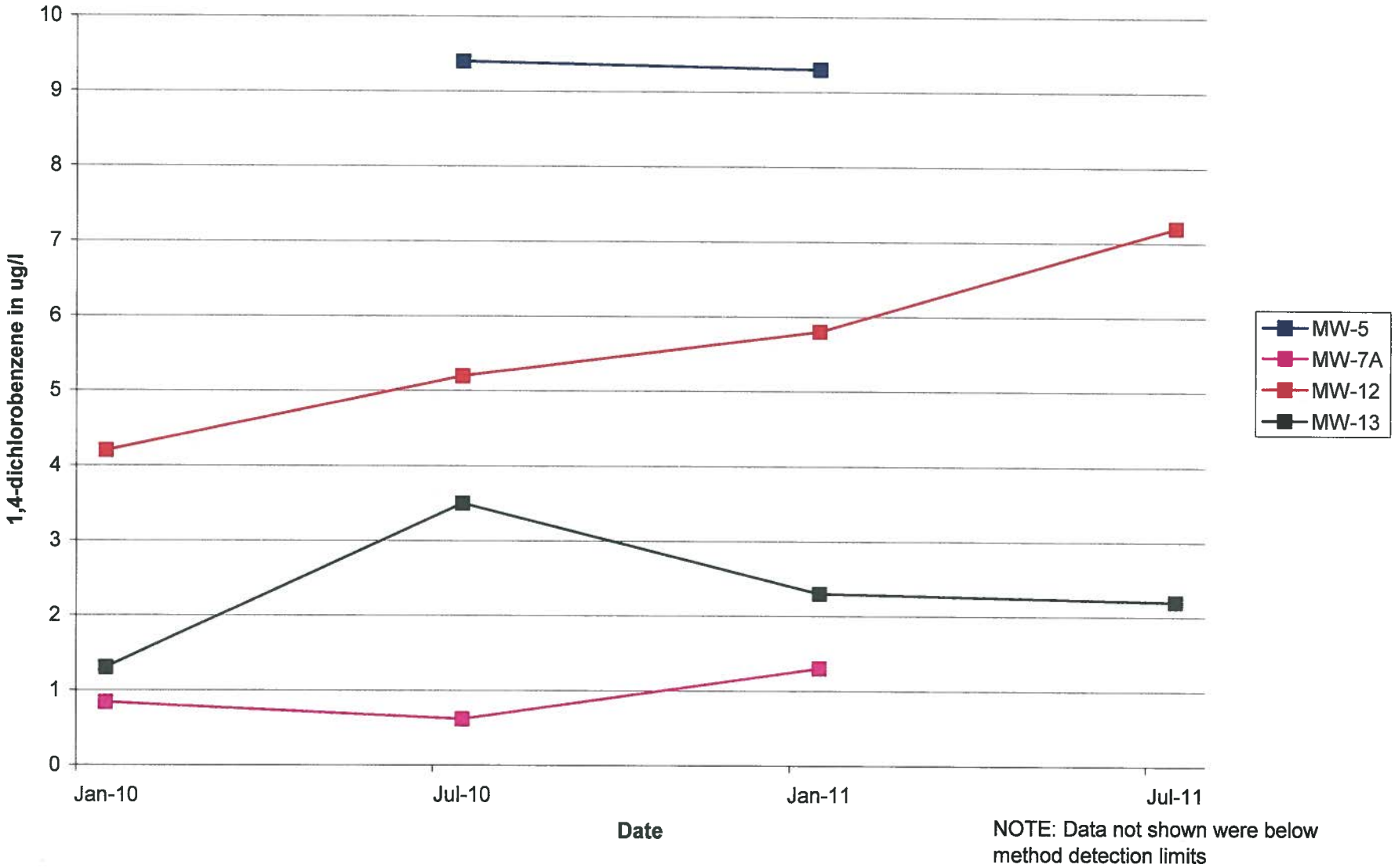
The Average True Hydraulic gradient, i_{AVG} equals **0.0210 ft/ft**.

APPENDIX II

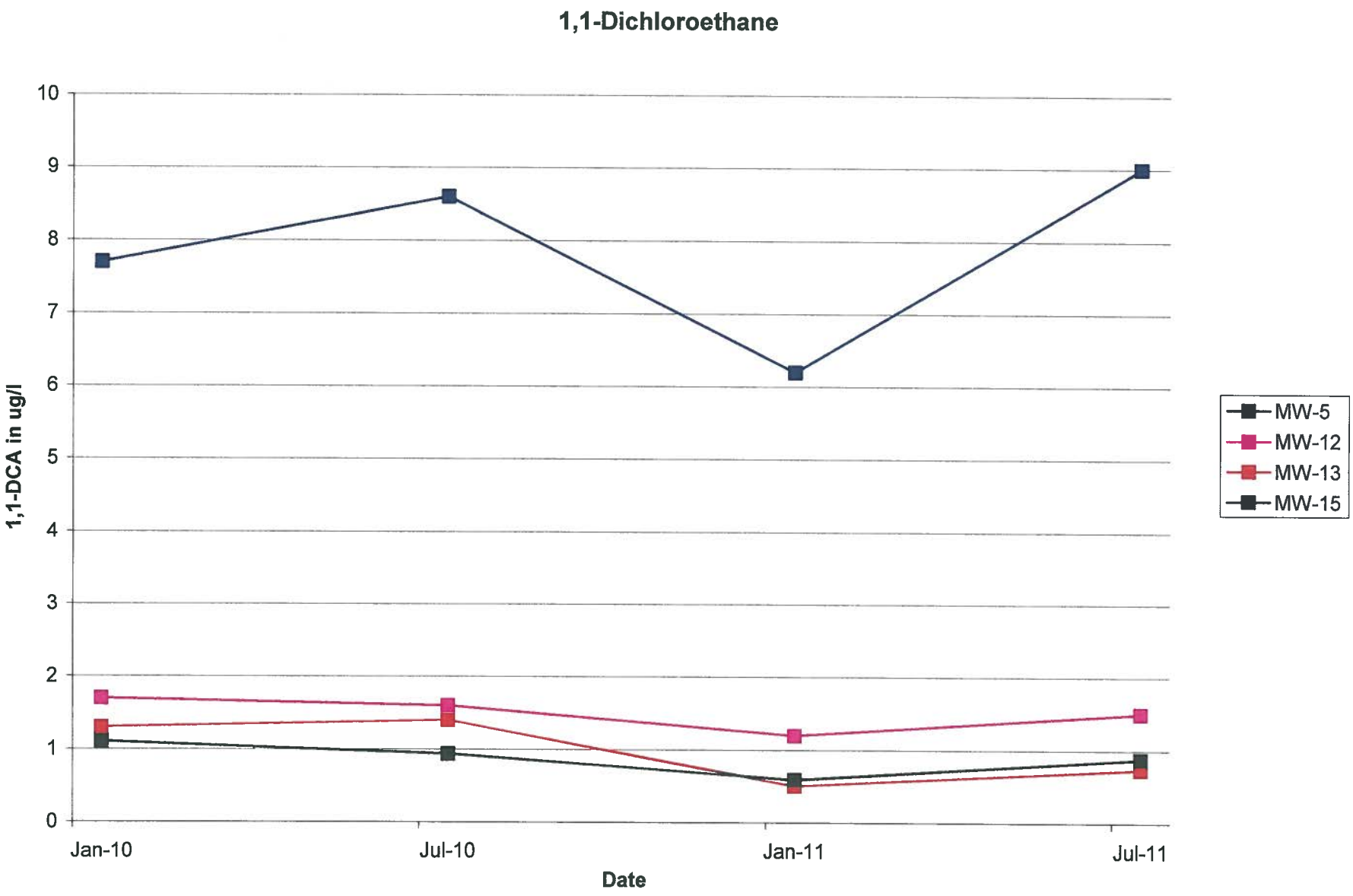
SELECTED VOC CHARTS

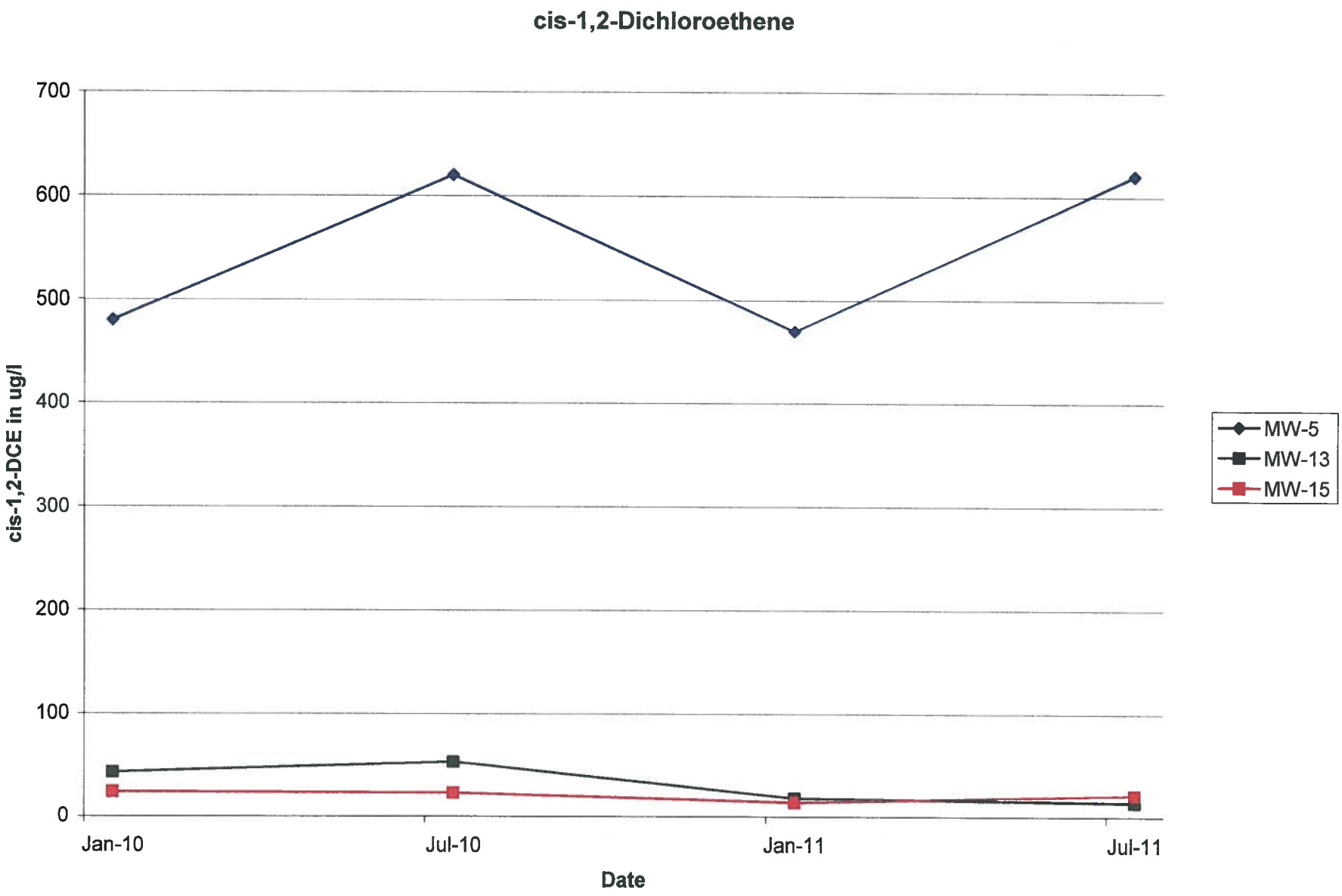

Benzene
6
5
4
3
2
1
0
benzene in ug/l
Jan-10
Jul-10
Jan-11
Jul-11
Date
MW-5
MW-7A
MW-12
MW-13
MW-15
NOTE: Data not shown were below method detection limits

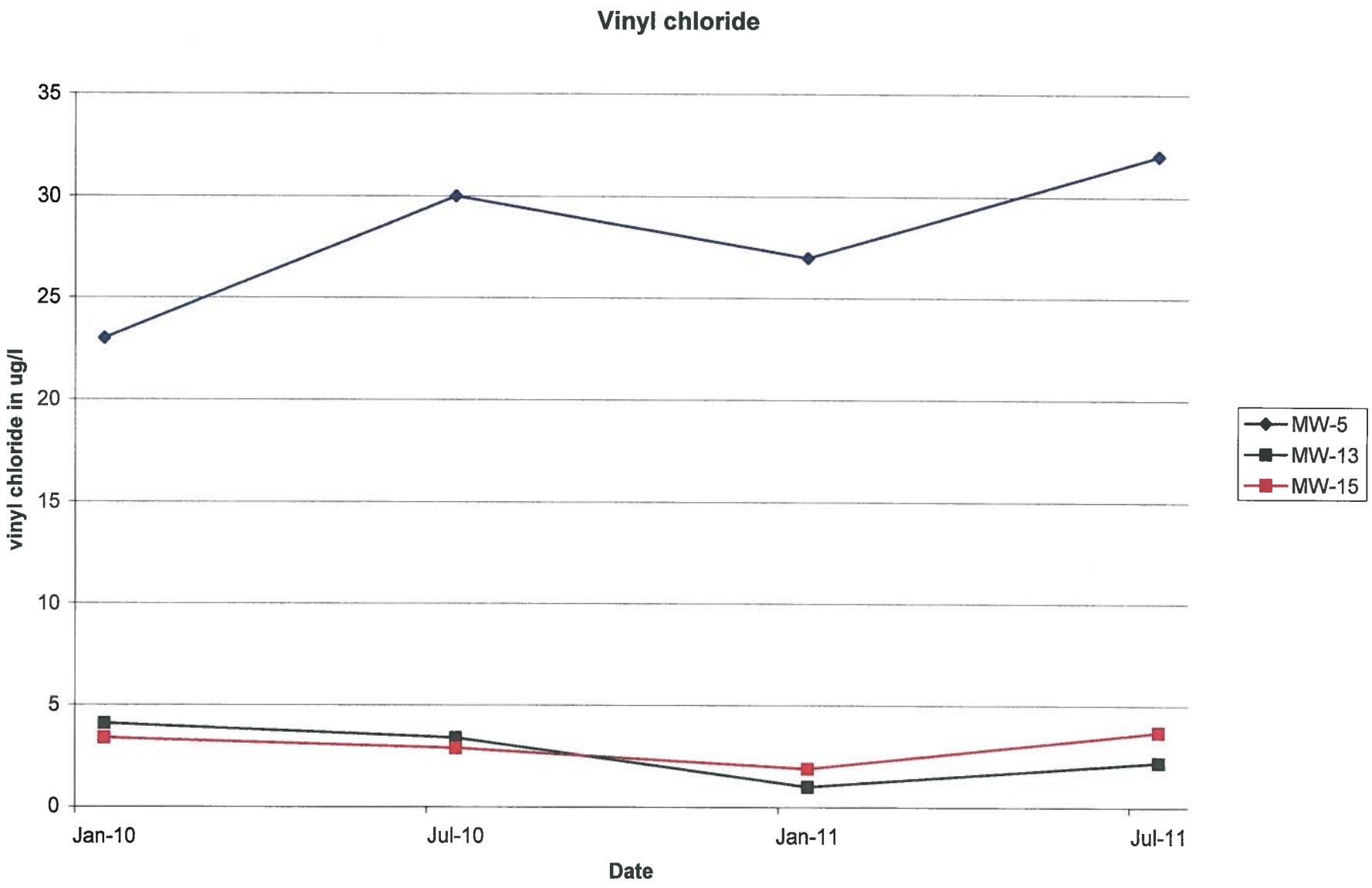
NOTE:
Data not
shown were



NOTE: Data not shown were below
method detection limits

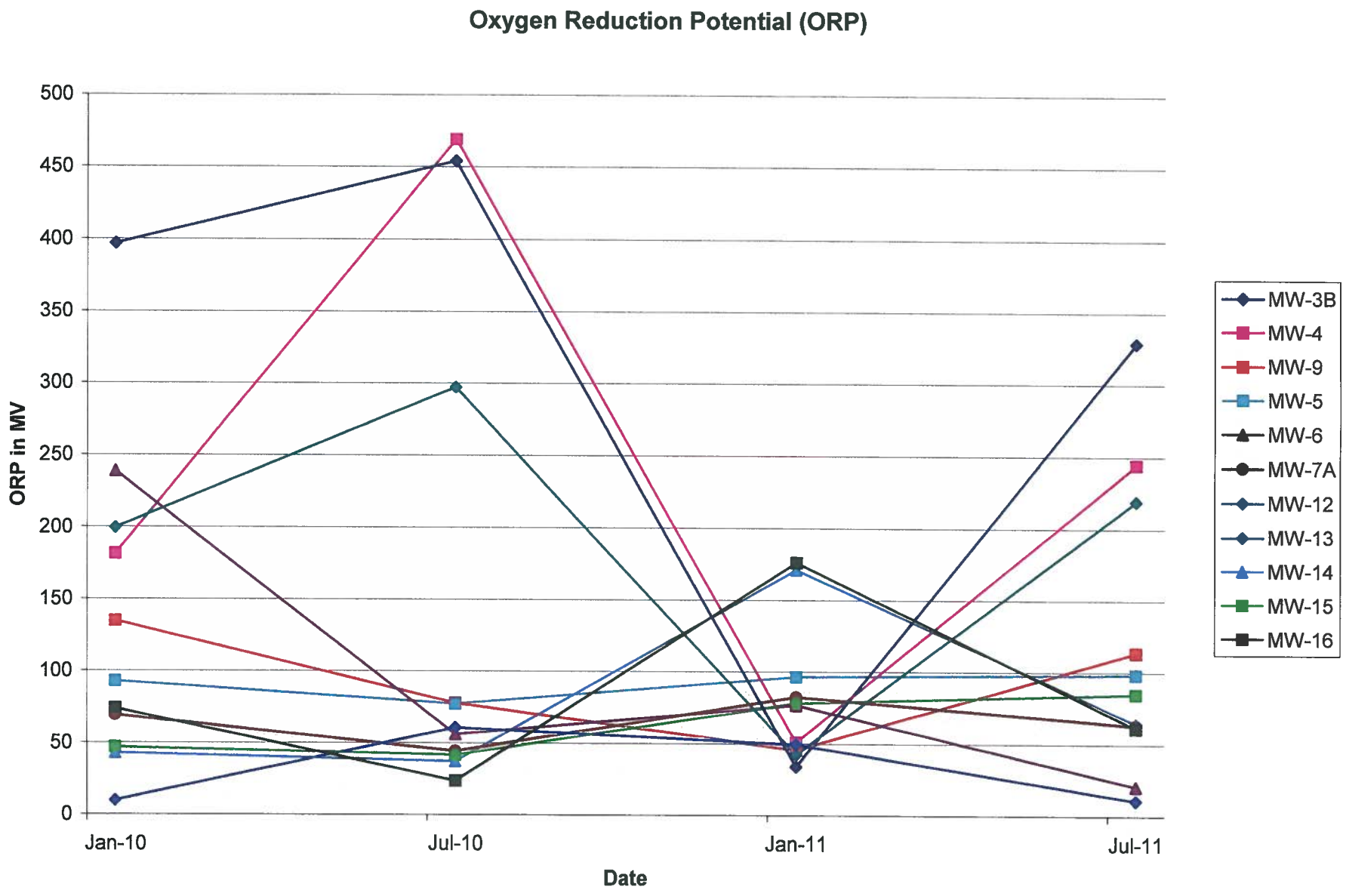

1,1-Dichloroethane
10
9
8
7
6
5
4
3
2
1
0
1,1-DCA in ug/l
Jan-10
Jul-10
Jan-11
Jul-11
Date
MW-5
MW-12
MW-13
MW-15

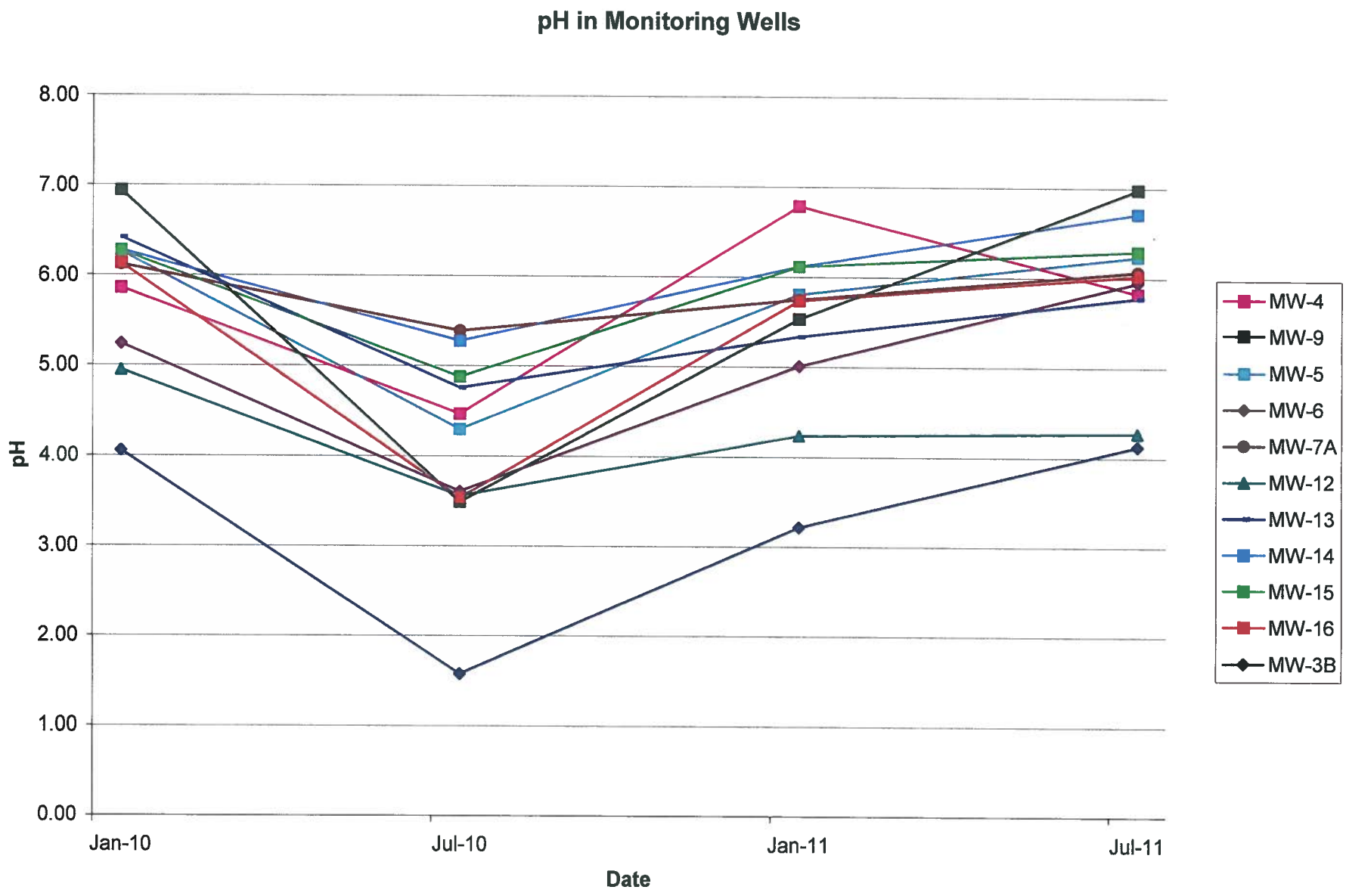

cis-1,2-Dichloroethene
700
600
500
400
300
200
100
0
cis-1,2-DCE in ug/l
Jan-10
Jul-10
Jan-11
Jul-11
Date
MW-5
MW-13
MW-15

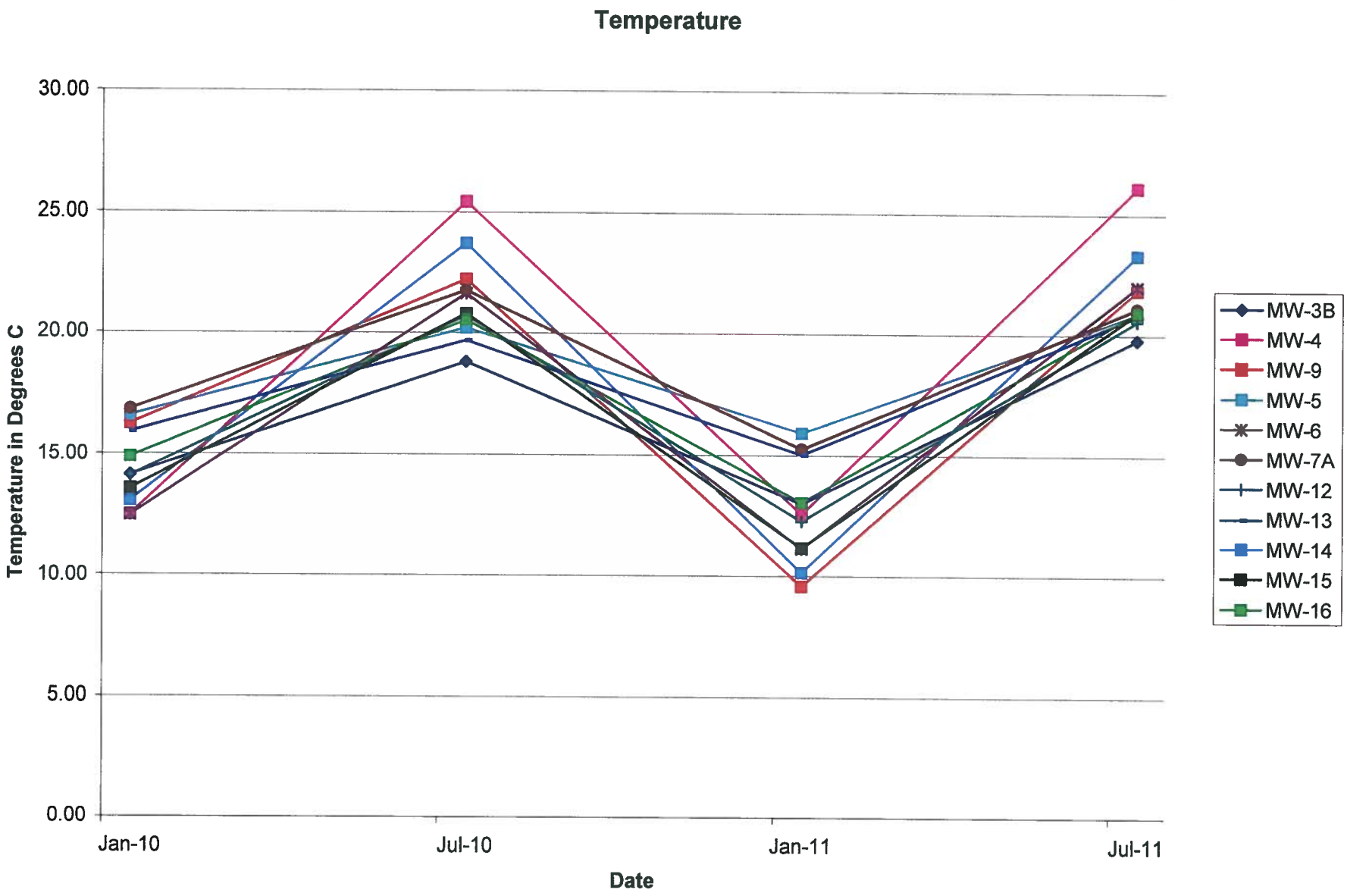

Vinyl chloride
35
30
25
20
15
10
5
0
vinyl chloride in ug/l
Jan-10
Jul-10
Jan-11
Jul-11
Date
MW-5
MW-13
MW-15

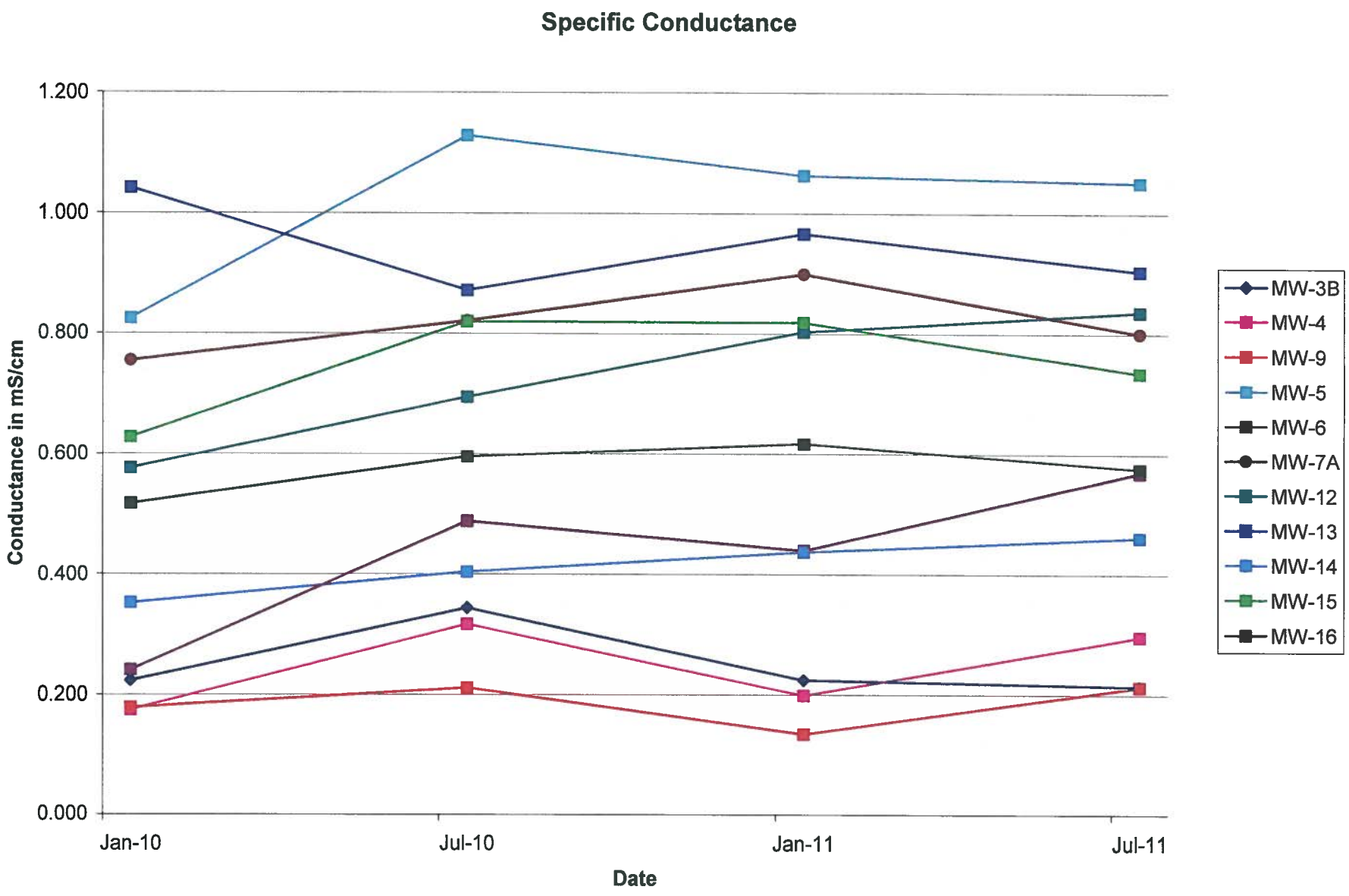
APPENDIX III

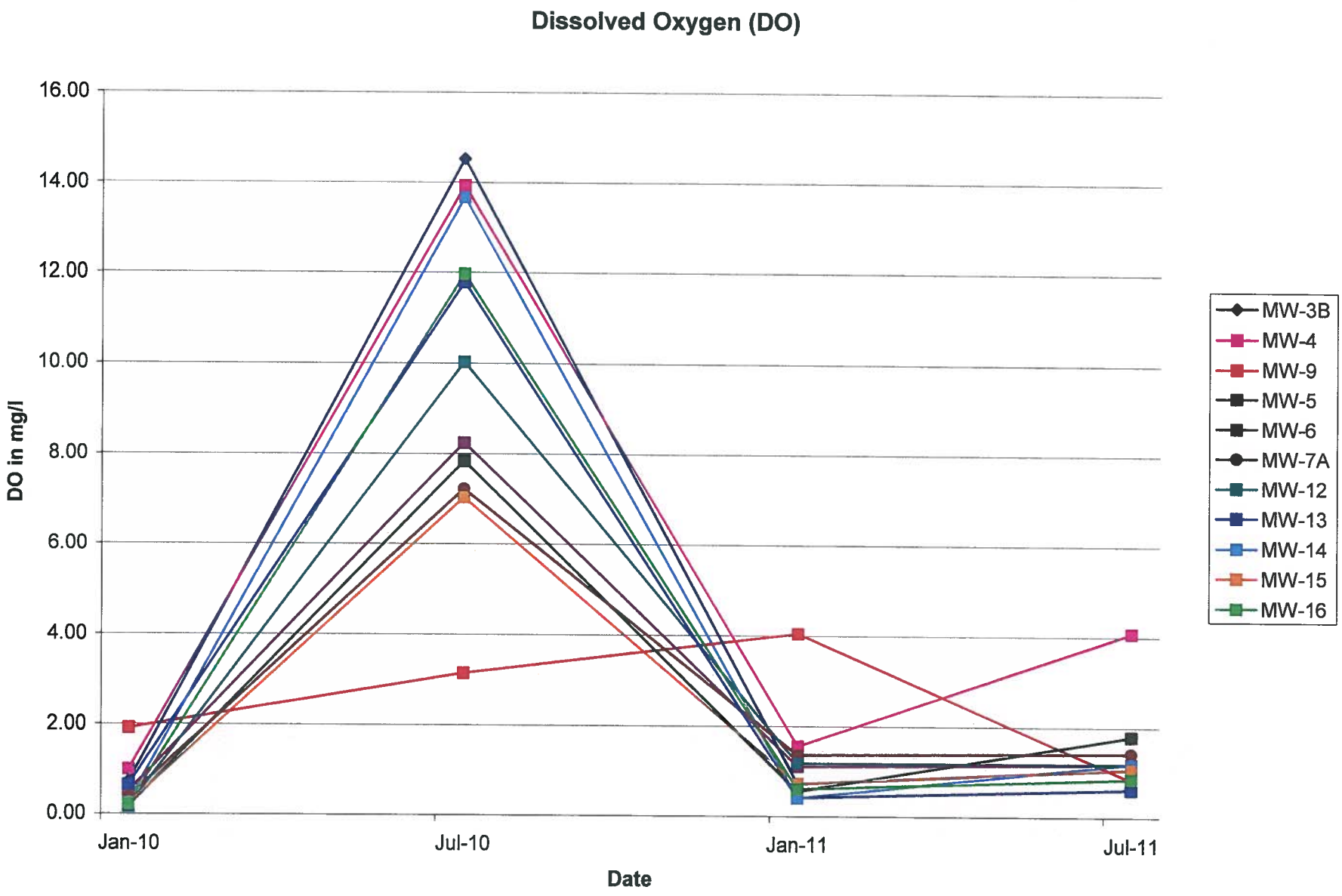
SELECTED GEOCHEMICAL/MNA PARAMETER CHARTS

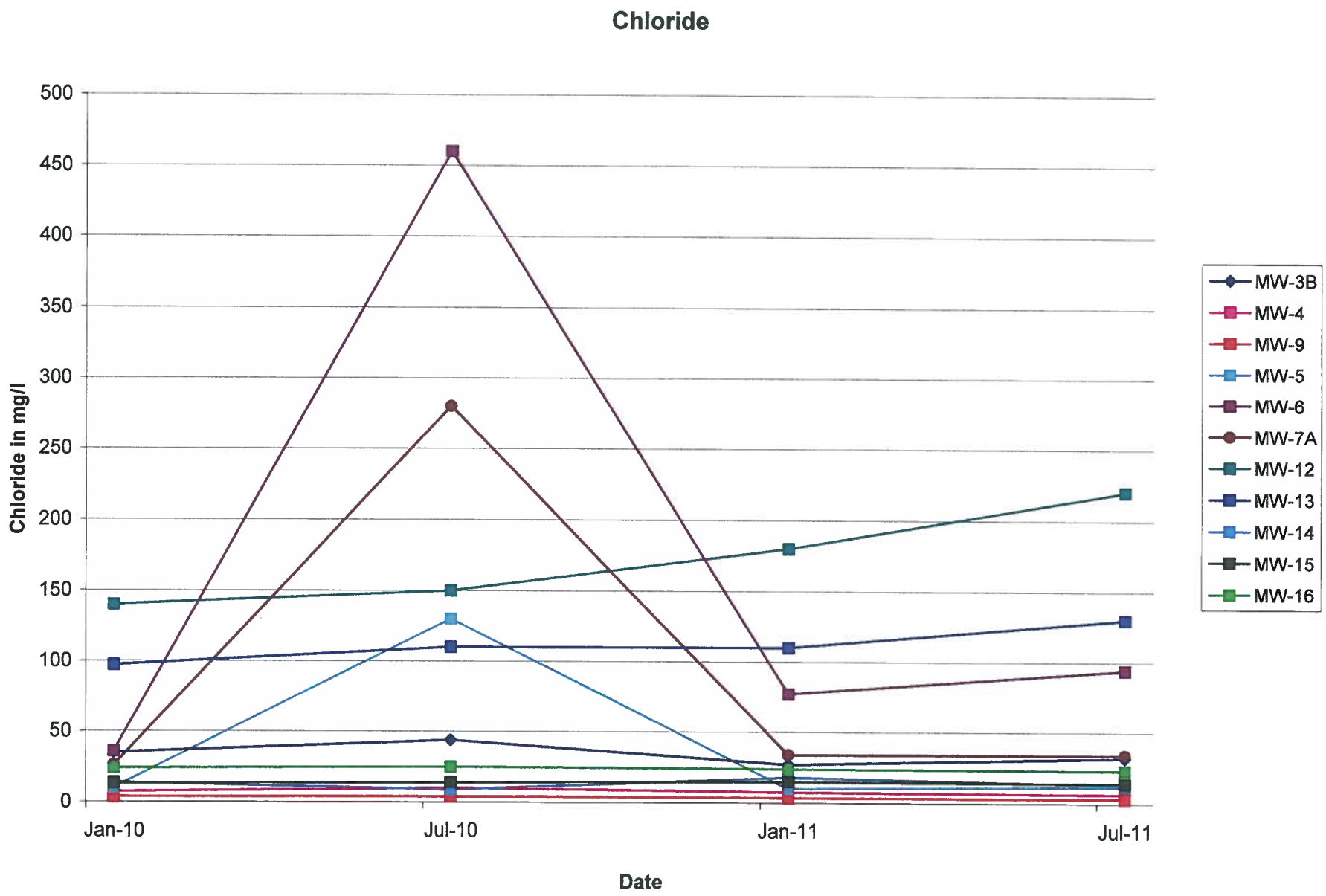

Oxygen Reduction Potential (ORP)
ORP in MV
500
450
400
350
300
250
200
150
100
50
0
Jan-10
Jul-10
Jan-11
Jul-11
Date
MW-3B
MW-4
MW-9
MW-5
MW-6
MW-7A
MW-12
MW-13
MW-14
MW-15
MW-16

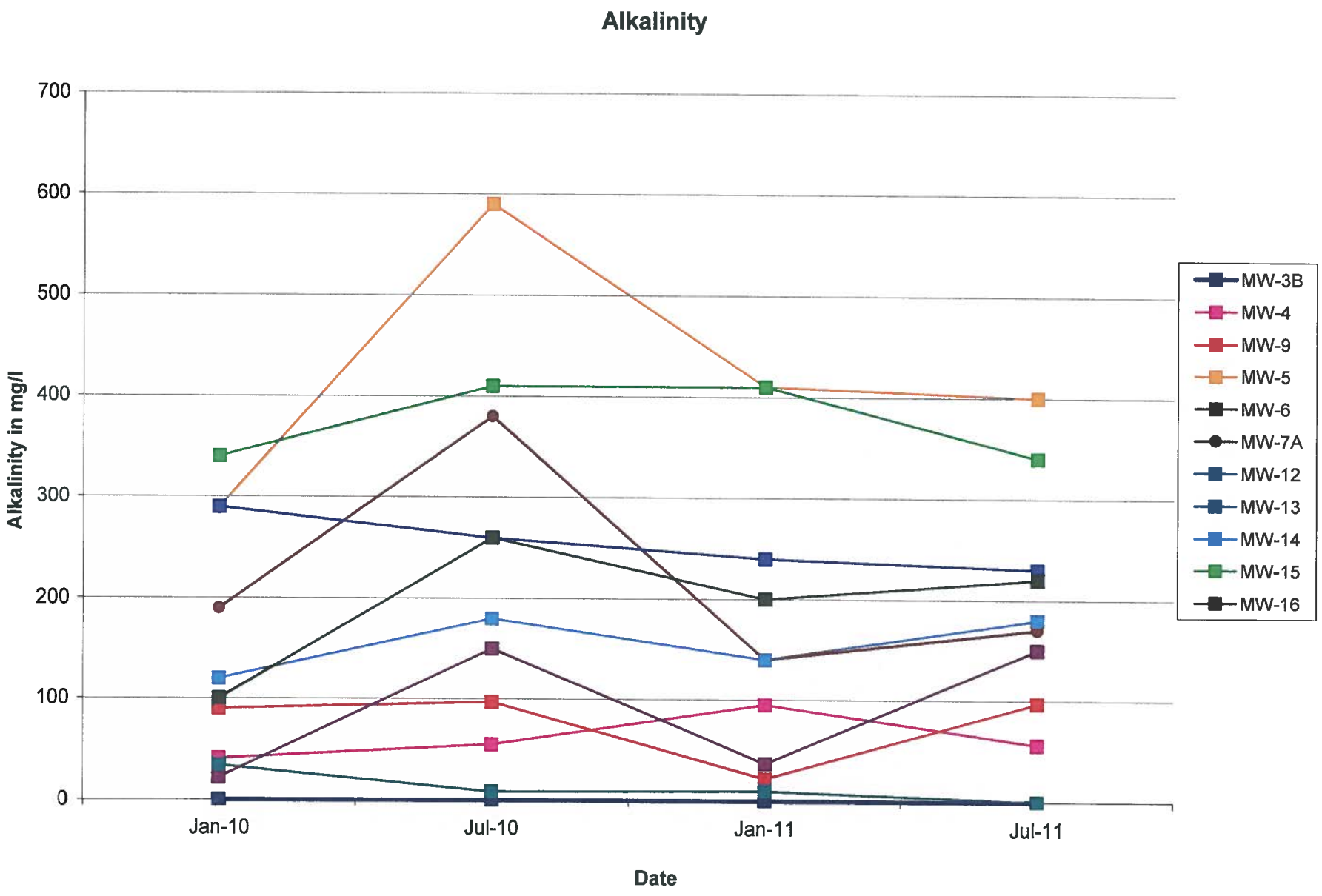

pH in Monitoring Wells
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
pH
Jan-10
Jul-10
Jan-11
Jul-11
Date
MW-4
MW-9
MW-5
MW-6
MW-7A
MW-12
MW-13
MW-14
MW-15
MW-16
MW-3B

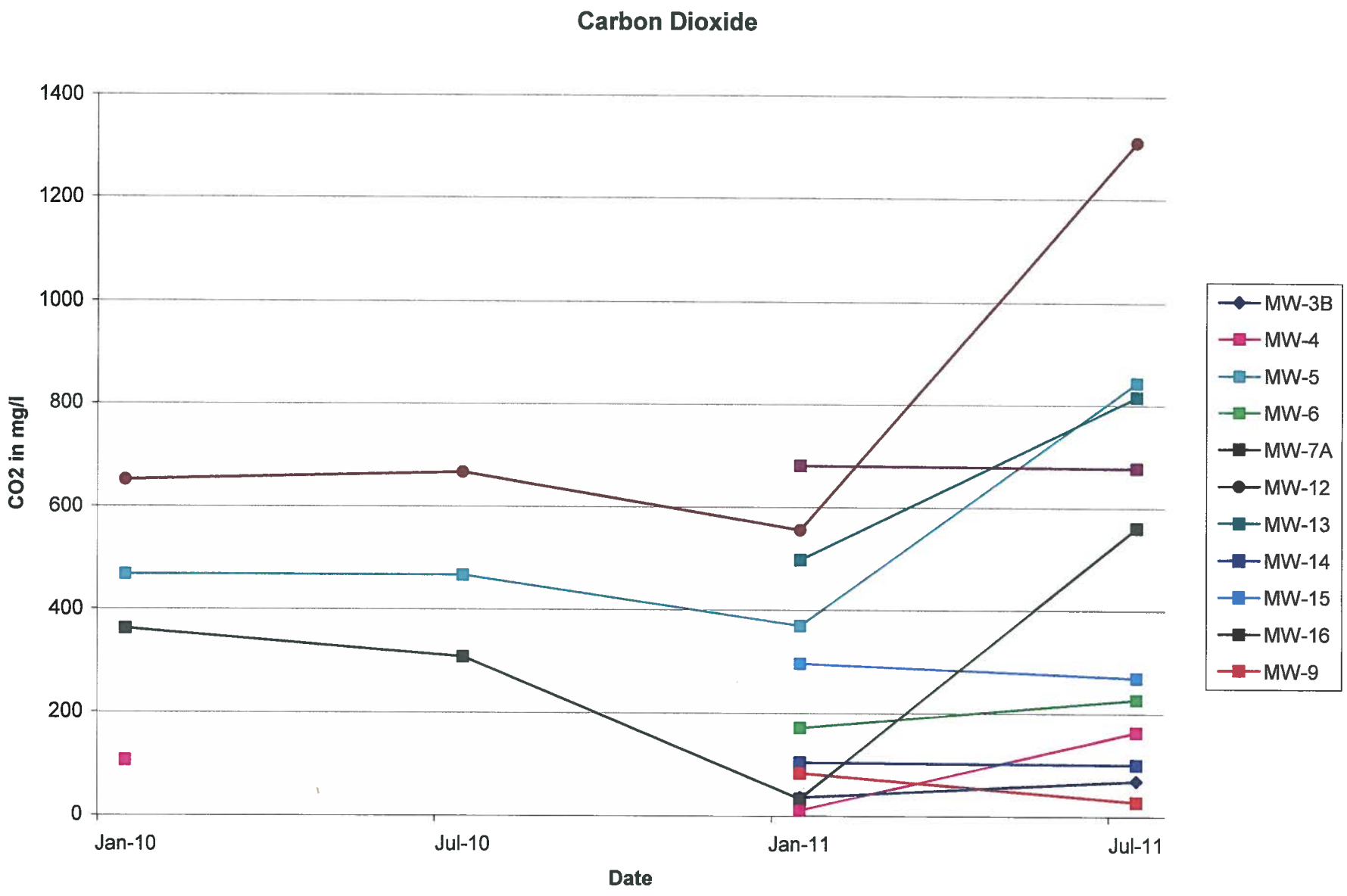

Temperature
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Temperature in Degrees C
Jan-10
Jul-10
Jan-11
Jul-11
Date
MW-3B
MW-4
MW-9
MW-5
MW-6
MW-7A
MW-12
MW-13
MW-14
MW-15
MW-16


Specific Conductance
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Conductance in mS/cm
Jan-10
Jul-10
Jan-11
Jul-11
Date
MW-3B
MW-4
MW-9
MW-5
MW-6
MW-7A
MW-12
MW-13
MW-14
MW-15
MW-16


Dissolved Oxygen (DO)
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
DO in mg/l
Jan-10
Jul-10
Jan-11
Jul-11
Date
MW-3B
MW-4
MW-9
MW-5
MW-6
MW-7A
MW-12
MW-13
MW-14
MW-15
MW-16


Chloride
Chloride in mg/l
500
450
400
350
300
250
200
150
100
50
0
Jan-10
Jul-10
Jan-11
Jul-11
Date
MW-3B
MW-4
MW-9
MW-5
MW-6
MW-7A
MW-12
MW-13
MW-14
MW-15
MW-16


Alkalinity
700
600
500
400
300
200
100
0
Alkalinity in mg/l
Jan-10
Jul-10
Jan-11
Jul-11
Date
MW-3B
MW-4
MW-9
MW-5
MW-6
MW-7A
MW-12
MW-13
MW-14
MW-15
MW-16


Carbon Dioxide
1400
1200
1000
800
600
400
200
0
CO2 in mg/l
Jan-10
Jul-10
Jan-11
Jul-11
Date
MW-3B
MW-4
MW-5
MW-6
MW-7A
MW-12
MW-13
MW-14
MW-15
MW-16
MW-9