Corrective Action Plan-Addendum

Prepared for

Alexander County Landfill - Permit #02-01
Taylorsville, Alexander County, North Carolina

MESCO Project Number: G07060.0

Prepared on 12/20/10

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1 INTRODUCTION

1.1 Site Background

[Alexander County, North Carolina retained Municipal Engineering Services Company, P.A. (MESCO) to develop a *Corrective Action Plan* (CAP) for the closed construction and demolition landfill (C&D) constructed over an existing municipal solid waste landfill (MSW) located at 2500 Payne Dairy Road, Taylorsville, North Carolina. The purpose of the CAP was to create a site-specific remediation plan to address groundwater contamination possibly associated with the closed C&D/MSW landfill. A CAP was prepared in accordance with Rules 15A NCAC 13B.1636 & .1637 and was submitted to the North Carolina Department of Environment and Natural Resources, Division of Waste Management, Solid Waste Section (Section) on September 19, 2008. A *Corrective Action Plan-Revision 1* was submitted to the Section on February 6, 2009 and approved on February 19, 2009. On August 10, 2010, MESCO personnel requested the Section approve a modification to the CAP based on reduced contaminant concentrations and changing geochemical conditions since selection of the original remedy. On August 24, 2010, MESCO personnel submitted an Injection Permit Application to the Division of Water Quality, Aquifer Protection Section, Underground Injection Control (UIC) Program to inject edible oil substrate (EOS®) and bacteria (BAC 9®) into the subsurface. The requested Injection Permit was issued on November 26, 2010. A topographic map showing the location of the site is included as **Plate 1**. Amendments to the currently approved *Corrective Action Plan-Revision 1* are presented herein and designated by [*underline and brackets*].

2 CONTAMINANT CHARACTERIZATION

[*No amendments to this Section.*]

3 SELECTED AND APPROVED REMEDY / TECHNICAL APPROACH

A number of factors influenced selection of remediation alternatives.

- Groundwater contamination exists in both the surficial (unconfined) and upper bedrock aquifers.
- Groundwater contamination exists at relatively low levels (ppb range).
- Groundwater contamination is below risk exposure levels.
- Groundwater contamination has migrated past the compliance boundary in some locations.
- Groundwater contamination is likely being controlled and influenced by landfill gas at some locations.

Remediation of relatively low level contamination in the 100 ppb range can be difficult, expensive and may not be achievable. A multi-phase remedial approach is, therefore, necessary to address contamination across the site.

3.1 Technical Approach

3.1.1 MW-24 Area (Monitored Natural Attenuation w/ Phytoremediation)

Groundwater contaminants exist within the unconfined, shallow aquifer. Natural attenuation mechanisms are actively controlling groundwater contaminant movement in this area. Bioscreen was initially run for MW-24 to assess the potential effectiveness of MNA. Bioscreen focused on benzene, due to its high half life of 2 years. Bioscreen results showed a 53% decrease in contamination in 5 years through 1st order decay and a 100% decrease in contamination through the instantaneous reaction model.

Phytoremediation procedures will be implemented to enhance remediation by monitored natural attenuation of low level contaminants. To accelerate the natural evapotranspiration process and to allow for hydraulic containment (plume control), the area will be thinned of juvenile trees (those trees with a diameter of less than 3 inches) and pines, and planted with hybrid willows of the genus *Salix*. Hybrid willows have been recognized as being phreatophytic (water-loving) trees with root systems that can extend up to 40 feet bgs[11]. Phytoremediation is expected to occur through several processes: the release of enzymes from the root system that break down hydrocarbons (phytodegradation), limitation of infiltration by increasing evapotranspiration, and eventual uptake of hydrocarbons (phytoextraction). Available literature (e.g. Schnoor, 1997 [11]) indicates an initial planting density of 1,000-2,000 trees/acre (~43 ft^2/tree). As the trees become established over time (1-2 years) competition between plants will reduce this density to ~600-800 trees/acre. The proposed phytoremediation area comprises approximately 4 acres. At the aforementioned planting density a minimum of 4,000 hybrid willow seedlings will need to

be planted at the onset of corrective action. Planting of seedlings will likely be performed by mechanical methods to reduce installation costs, and is tentatively scheduled to occur during May-June 2009. Protective fencing to prevent damage to the seedlings by wildlife (e.g. deer) shall be constructed around the area of planting. The proposed phytoremediation area is depicted in **Plate 5**.

In order to more fully delineate the contaminant plume in this area two (2) additional monitoring wells, MW-28 and MW-29, are proposed for installation. Both wells will be constructed of 2”-I.D. Sch. 40 PVC casing with a 0.010”-slotted screen interval. Based upon the boring log for MW-24 the estimated depth for the two new wells is 35-40 ft. bgs, with a 15-foot screened interval. The proposed well locations are depicted in **Plate 5**.

Groundwater sampling will be performed semi-annually on monitoring wells MW-6, MW-7, MW-12, MW-12D, MW-13, MW-24, MW-25, MW-28, and MW-29. Baseline sampling for the suite of MNA performance parameters listed in **Section 4** and **Appendix B** shall be performed for two years following planting of hybrid willow trees. Monitoring of stream quality in the adjacent unnamed tributary of the Little River will be achieved through surface water sampling at sampling point SW-4R (see **Plate 2**). Surfacewater sampling parameters will include Appendix I [and/or Appendix II-listed constituents, as required in 15A NCAC 13B.] Soil sampling may also be conducted to monitor potential salt accumulation in the root zone. Phytoremediation sampling and monitoring results, in addition to information on tree growth and health, shall be included as a separate section within the semi-annual monitoring reports.

Water levels in MW-12 and MW-24 will be monitored on a daily basis with pressure transducer data loggers that will be installed in the wells prior to planting of the hybrid willow trees. Water level readings will be recorded twice daily, and the water level data downloaded from the data loggers on a monthly basis by MESCO field personnel. Once the trees are semi-established (1-2 years) water levels in these wells are expected to decrease, particularly in conjunction with the spring growing season.

3.1.2 MW-26 Area (Monitored Natural Attenuation w/ EOS Injection)

Groundwater contaminants exist within the upper bedrock aquifer, requiring a remedial technology to supplement MNA. Bioscreen was initially run for MW-26 to assess the potential effectiveness of MNA. Bioscreen focused on benzene, due to its high half life of 2 years. Bioscreen results showed a 46% decrease in contamination in 5 years through 1st order decay and a 100% decrease in contamination through the instantaneous reaction model.

[MESCO proposes supplementing natural attenuation by stimulating the *in-situ* anaerobic bacteria initially through introduction of additional bacteria into the subsurface and then later through introduction of a biological enhancement substrate (BES). At this project, MESCO proposes using BAC-9™, which according to its manufacturer (EOS Remediation, Raleigh, NC), consists of "…an enriched bioaugmentation culture capable of degrading chlorinated solvents …via halorespiration." BAC-9™ will be injected into the subsurface using vendor-supplied Summa® canisters and/or nitrogen-pressurized "kegs".]

[BAC-9™ will be injected into a new injection well (IW-1) proposed to be constructed between existing monitor wells MW-11 and MW-26. Based upon boring logs for the two wells, the new well will be advanced to approximately 50 feet below the existing ground surface (bgs). The well will be constructed as a "Type 5I Well" in accordance with 15A NCAC 2C .0209(e)(3)(c) and consist of a 15-foot, 4-inch (ID) section of Schedule 40 PVC machine-slotted (0.020") screen with sufficient riser to extend the well approximately three feet above the ground surface. The well bore annular space (annulus) will be backfilled with clean pea gravel (#67 or #78 rounded aggregate or equivalent) up to approximately one foot above the top of the screen. Approximately one foot of bentonite pellets will be placed on top of the gravel and hydrated. Once the bentonite has cured, a minimum 20-foot thick section of grout will be tremied into the annulus to seal the well up to a level just below the ground surface. The well will be finished with a lockable expansion cap, lockable protective metal casing, a 2'x2' concrete pad, and an injection well identification plate (well tag). Two additional monitoring wells (MW-30 and MW-31) are also proposed for installation and will be constructed in similar fashion except for using 15-foot, 2-inch (ID) sections of 0.010 machine-slotted screen and #2 filter sand (instead of gravel) in the annulus. MW-30 will be installed near the transfer station driveway and will provide groundwater quality information for the area between the MW-24 and MW-26 plume areas. MW-31 will be installed downgradient of MW-26. All three wells are expected to be terminated in bedrock. The proposed well locations are depicted in **Plate 5**.]

[Once the BAC-9™ is established, MESCO proposes to use a BES to feed the bacteria and stimulate biotic growth. As the bacteria "feed", they gain energy by splitting the BES compounds, reductively dechlorinate chlorinated solvent compounds, and generate harmless waste products (ethenes and ethanes). As their numbers increase through the additional food source, the level and effectiveness of the reductive dechlorination process also increases. According to various BES suppliers, one application of BES might last up to twelve months in the subsurface. Multiple injection events would, therefore, be necessary during the course of corrective action. At this time, MESCO proposes to use edible oil substrate (EOS®),

also manufactured by EOS Remediation. EOS® reportedly provides quickly-available carbon (lactate) and slow-release carbon (soybean oil) to "feed" the bacteria and stimulate biotic growth.]

Since groundwater flow in bedrock occurs within interconnected discontinuities such as fractures, joints, and faults within the rock mass (secondary porosity), the [EOS] mixture will necessarily permeate only those areas impacted by groundwater contaminants. The [EOS] will, therefore, travel downgradient through the contaminant plume. Typical injection rates are on the order of 4 gallons per minute (gpm) at a pressure of 10 pounds per square inch (psi). Actual injection rates are contingent upon the permeability of the formation material at the injection points, and care should be taken during injection so as not to compromise monitoring well integrity. Since [EOS] can remain resident in the subsurface for [up to twelve months after introduction, multiple injection events would, therefore, be necessary during the course of corrective action. The UIC Program has issued Injection Permit WI0300160 for this project.]

Baseline sampling will be instated as a part of the monitoring protocol. Monitoring will incorporate the select MNA parameters. Sampling will be performed semi-annually on monitoring wells MW-26, MW-27, MW-11 and MW-3. Baseline sampling for the suite of MNA performance parameters listed in **Section 4** and **Appendix B** shall be performed for two years following implementation of corrective action. *It must be noted that due to the persistence of EOS in the subsurface after initial injection, groundwater in the injection wells may not be of adequate quality to sample.*

3.1.3 MW-16 Area (Monitored Natural Attenuation w/ EOS Injection)

Groundwater contaminants in the MW-16 area have reached the property line of the facility, requiring an additional remedial approach to supplement MNA. Modeling results indicate that MNA has the potential to reduce groundwater contamination. Bioscreen was initially run for MW-16 to assess the potential effectiveness of MNA. Bioscreen focused on benzene, due to its high half life of 2 years. Bioscreen results showed a 44% decrease in contamination in five years through 1st order decay and a 100% decrease in contamination through the instantaneous reaction model. Surfacewater analytical results from sampling point SW-5 do not indicate the presence of COC concentrations above either NCAC 2B or 2L standards, indicating that natural attenuation is reducing contaminant levels in the shallow aquifer to below water quality standards prior to groundwater discharge to surface water.

Since chlorinated hydrocarbons make up the majority of COCs in the plume, [EOS] can be used to enhance reductive dechlorination at this location. It is proposed that [EOS] be injected into the shallow, unconfined aquifer using truck or rig-mounted direct-push technology. Injection points will be spaced at approximate 10-ft intervals in a line transverse to groundwater flow, and located at the upgradient end of

the plume near the waste limit. The injection point line will extend for a distance of 100 ft. north and south from MW-5, along the east side of the roadway between MW-5 and the waste limit (see **Plate 5**), for a total distance of 200 lineal feet (20 injection points total). The injection depth at this location will be approximately 30-40 ft. bgs. This application of [EOS] is intended to create a reactive barrier that will breakdown COCs near the source area before they can be transported further downgradient. The existing plume will then be subject to natural biodegradation processes as it will be cut off from the contaminant source. Multiple injection events may be needed at roughly 18-month intervals in order to effectively implement this form of corrective action. Monitoring wells MW-5 and MW-16 may also be used for [EOS] injection; however, these wells will be more effectively utilized as performance wells.

In order to more fully delineate the contaminant plume in this area, three (3) additional monitoring wells, MW-32 through MW-34, are proposed for installation. All wells will be constructed of 2”-I.D. Sch. 40 PVC casing with a 0.010”-slotted screen interval. Based upon existing boring logs the estimated depth for the new wells is ~50 ft. bgs, with 15-foot screened intervals. MW-32 will be installed downgradient of MW-10. MW-33 and MW-34 will be installed downgradient of MW-5 and MW-16, and will act as sentinel wells between those existing wells and the adjacent stream. Since MW-33 and MW-34 will be located on property not owned or controlled by Alexander County, an access agreement between Alexander County and the relevant property owner will be needed prior to well installation. The proposed well locations are depicted in **Plate 5**.

Baseline sampling of monitoring wells MW-5, MW-16, MW-32, MW-33, and MW-34 will be performed semi-annually for a two-year period, and will incorporate the MNA performance parameters listed in **Section 4** and **Appendix B**. *It must be noted that due to the persistence of EOS in the subsurface after initial injection, groundwater in the injection wells may not be of adequate quality to sample.* Monitoring of stream quality will consist of sampling existing downstream surfacewater sampling point SW-5, located along the unnamed tributary of the Catawba River (see **Plate 2**).

3.1.4 MW-1B Area (Active Methane Extraction)

Contamination has reached the adjacent property line. Landfill gas is believed to be affecting migration of the contaminant plume in this area. Alexander County is in the process of purchasing the adjacent property in order to increase the compliance boundary at this location. Based on *ACM* observations, the most efficient and cost effective method of remediation is to install an active methane gas system. Although a passive system presently exists at the MSW, installation of an active system would provide more efficient and cost effective contaminant reduction.

Ten (10) active methane wells will be installed along the periphery and outside of the current waste limits. Wells will be ordered sequentially starting near MW-16 inside the current property line and following the edge of waste counterclockwise through MW-5, crossing the access road then running parallel to the waste limit and the scale house. The last well will be installed adjacent to the maintenance buildings. Each well will have an individual release valve to ensure optimum gas pressure. Methane will travel from the wells through pipes to the flares. Care will be taken to not exceed the EPA Clean Air Act standards in addition to complying with gas control standards set in the 15A NCAC 13B rules. Proposed methane wells and flare locations are shown in **Plate 6**.

Monitoring of the active methane system will be implemented through the quarterly monitoring of existing methane probes already in effect. Groundwater sampling parameters will include Appendix I VOCs and metals. Additionally, groundwater samples may be analyzed for dissolved methane to aid in determining the influence of landfill gas on plume migration.

4 GROUNDWATER AND SURFACEWATER MONITORING PLAN

4.1 Groundwater Sampling and Monitoring

Data with which to monitor and evaluate the performance of remediation shall be obtained through a groundwater sampling and monitoring program. All groundwater samples collected from the monitoring wells will be analyzed for Appendix I [and/or Appendix II-listed constituents, as required in 15A NCAC 13B.] Appendix I volatile organic compounds will be analyzed via EPA Test Method 8260, and inorganic compounds will be analyzed via EPA Test Methods 6010 and 7470. Additionally, groundwater samples collected from monitoring wells located in the areas subject to MNA, phytoremediation, and EOS injection will be analyzed for the following MNA performance parameters:

MNA Performance Parameters		
Parameter	**Analysis Type**	**Analytical Method**
Dissolved Oxygen (DO)	Field Reading	Multi-parameter Field Instrument w/ flow-through cell
pH	Field Reading	
Oxidation-Reduction Potential (ORP)	Field Reading	
Turbidity	Field Reading	
Conductivity	Field Reading	
Temperature	Field Reading	
Dissolved CO_2	Field Reading	Field Instrument / Hach Kit
Alkalinity (Total as $CaCO_3$)*	Laboratory/Field*	EPA 310.2
Chloride*	Laboratory/Field*	SM 4500-CLB
Iron	Laboratory	SM3111B
Nitrate*	Laboratory/Field*	EPA 353.2 / SM 2320B
Sulfate*	Laboratory/Field*	EPA 375.4 / SM 4500-SO4E
Sulfide*	Laboratory/Field*	EPA 376.1 or SM 4500SE
TOC/BOD/COD	Laboratory	EPA 415.1 / EPA 405.1 / EPA 410.1
Methane	Laboratory	RSK 175
Ethane, Ethene	Laboratory	RSK 175
Hydrogen	Laboratory	AM19GA
Volatile Fatty Acids	Laboratory	AM23G
*For budgetary considerations these analyses may be performed in the field using Hach® brand color wheel test kits. Historical iron concentrations have exceeded Hach kit quantitation limits.		

4.2 Surfacewater Sampling and Monitoring

Surfacewater sampling will be conducted to monitor COC concentrations in the adjacent stream areas. To date [June 2010], surfacewater COC concentrations have been below respective NCAC 2B and 2L standards. Surfacewater sampling point locations are depicted in **Plate 2**. Surfacewater sampling point SW-4R is located downstream of the landfill on the tributary of Little River where it flows past the western side of the landfill. Surfacewater sampling points SW-3 and SW-5 are located downstream of the landfill on another tributary of the Catawba River. All surfacewater samples will be analyzed for Appendix I [and/or Appendix II-listed constituents, as required in 15A NCAC 13B.] The complete *Groundwater and Surfacewater Sampling and Analysis Plan* is presented as **Appendix B**.

5 EVALUATION OF EFFECTIVENESS AND REPORT SUBMITTALS

5.1 Evaluation of Effectiveness

As remediation progresses at the site certain changes in the physical and chemical characteristics of the contaminant plumes should occur. In all areas contaminant concentrations are expected to decrease over the period of remediation, thus resulting in a decrease in the physical extent of the plume. The various methods for evaluating the effectiveness of remediation are discussed in the sections below.

5.1.1 Qualitative and Quantitative Evaluation

Qualitative Evaluation

Qualitative methods include graphical analysis of groundwater analytical data over time in order to visualize changing trends in groundwater chemistry that are expected to occur over time as a result of the various remedial mechanisms/processes that are occurring at the site (e.g. biodegradation, phytoremediation, EOS injection). Examples of graphical analyses that will be used include, but are not be limited to, time-series graphs of contaminant concentrations and groundwater levels, distance-concentration graphs of analytical data, and mapping of the contaminant plumes over time. For the plume near MW-24, tree growth (height and girth) will be monitored monthly to bi-monthly for the first two years following planting. Correlation of contaminant plume size and migration with hybrid willow growth may be used to further evaluate the progress of phytoremediation.

Quantitative Evaluation

Quantitative evaluation will be conducted through annual revision of Bioscreen models, and through analysis of groundwater analytical data using statistical tests for significance. Statistical significance tests can be grouped into two types, *inter-well* and *intra-well.* *Inter-well* methods determine statistical significance by examining trends in contaminant concentrations from performance wells with respect to those from background wells, which are used as a control group. As remediation progresses, the performance well data is expected to exhibit decreases in contaminant concentrations, while contaminant concentrations in the background wells are expected to remain relatively stable. Background wells are selected on the basis of location (typically upgradient) and analytical history (non-impacted wells are best). *Intra-well* methods determine statistical significance within individual performance wells by examining historical analytical results (time series) for a given well, thus indicating if changing contaminant concentrations at a given well location result from either remedial activity or natural fluctuation. Comparisons of background well data with sentinel and compliance well data will also be performed to monitor groundwater contaminant movement over time.

Various types of significance tests have been developed to analyze differing types of data populations based upon characteristics such as distribution type (normal vs. non-normal), trend type (changing vs. non-changing), percentage of "non-detect" results for a given population, and the sample population size. This allows for the selection of particular methods that are appropriate for a given situation. For the remedial activity at the subject facility the following statistical tests are proposed for use, although others may be used as the course of remediation progresses:

- Wilcoxon Rank-Sum (Inter-well) - *normal or non-normal data, invariant trends, < 90% non-detects, >3 samples/per well.*
- Parametric Prediction Limit (Inter-well) – *normal data, varying trends,< 15% non-detects.*
- Parametric Prediction Limit (Intra-well) – *normal data, varying trends,≥ 4 samples/well, < 15% non-detects.*
- Non-Parametric Prediction Limit (Inter-Well & Intra-Well) – *normal or non-normal data, can tolerate high percentage of non-detects, compares recent to historical data.*

As indicated by the list above, it is important to note that prior to conducting any test of statistical significance a baseline of analytical data must first be established. For the MNA parameters listed in **Section 4.0** this baseline will consist of the four (4) semi-annual sampling events mentioned previously. *Since some plume areas do not have upgradient wells that are suitable for use as background wells, non-impacted compliance wells may be used if necessary for inter-well statistical analyses.*

5.1.2 Evaluation of Plume Areas

Plume Area MW-24

Since monitoring well MW-25 is located upgradient of MW-24 and has previously been unimpacted, MW-25 will be used as a background well for inter-well statistical analysis of MNA data from this area. Monitoring wells MW-24, MW-12, and MW-12D will be used as performance wells. The proposed new wells MW-28 and MW-29 will be used as either compliance or sentinel wells, depending upon the results of initial groundwater sample analyses. Qualitative evaluation of phytoremediation will include the methods discussed in **Section 5.1.1.** Significant changes in groundwater chemistry and contaminant concentrations are not expected to occur until 3-5 years after initiation of corrective action in this area.

Plume Area MW-26

Since monitoring wells MW-3 and MW-11 are proposed for EOS injection, and are both impacted by groundwater contaminants in excess of 2L standards, no suitable background wells exist at this location for use in inter-well statistical analyses. Intra-well analyses will, therefore, be used to quantitatively evaluate the effectiveness of remediation. Monitoring wells MW-3, MW-11, and MW-26 will be used as performance wells. The proposed new well MW-31 will be used as a sentinel well.

Within 1-3 months of EOS injection, decreases in groundwater contaminant concentrations on the order of a few ppb are expected to occur at wells MW-3 and MW-11. Increases in acetone, total organic carbon, and VFAs are expected to occur as the process of reductive dechlorination breaks down chlorinated hydrocarbons. Consequently, end products such as ethane, ethene, and chloride are also expected to increase as COC concentrations decrease. Follow-up sampling at 30-day, 60-day, and 90-day intervals will be required by the NCDENR Underground Injection Control Section as part of their injection permit requirements. Reduction in contaminant concentrations should be observed in the monitoring wells within 6 to 12 months after EOS injection.

Plume Area MW-16

Since monitoring wells MW-5 and MW-16 are both impacted by groundwater contaminants, no suitable background wells exist at this location for use in inter-well statistical analyses. Intra-well analyses will, therefore, be used to quantitatively evaluate the effectiveness of remediation. Monitoring wells MW-5 and MW-16 will be used as performance wells. The proposed new wells MW-32 through MW-34 will be used as sentinel wells.

Within 1-3 months of EOS injection decreases in groundwater contaminant concentrations on the order of a few ppb are to be expected to occur. Increases in acetone, total organic carbon, and VFAs are expected to occur as the process of reductive dechlorination breaks down chlorinated hydrocarbons. Consequently, end products such as methane, ethane, ethene, and chloride are also expected to increase as COC concentrations decrease. However, since time will be necessary for the EOS to permeate through the formation material, the effects of EOS injection may not be immediately recognizable in laboratory analyses of groundwater samples collected from the performance wells. Direct-push groundwater sampling may be necessary to collect samples with which to evaluate EOS performance, although the quantity of groundwater that can be collected at a given point may be limited.

Plume Area MW-1B

Evaluation of effectiveness for the plume area associated with MW-1B will be determined through semi-annual sampling events to monitor potential decreases in contaminant levels. Since this area is located at the topographic high at the site, no un-impacted wells exist for use as background wells for inter-well statistical analysis. Intra-well analyses will, therefore, be used to quantitatively evaluate the effectiveness of remediation. Monitoring wells MW-1 and MW-1B will be used as performance wells.

5.2 Refining the Site Conceptual Model

Over the course of corrective action the site conceptual model will be refined in order to determine the appropriate course of remediation. Additional information on groundwater chemistry, site lithology, plume characteristics, etc. will be used to further improve understanding of contaminant fate and transport at the site, and to determine any changes to the approved remedial measures if necessary.

5.3 Report Submittals

Corrective action sampling and monitoring reports will be submitted on a semi-annual basis, within 30 days of receiving all complete laboratory analytical reports. All reports submitted regarding evaluation of effectiveness will establish trends of the indicator parameters and contain tables, maps and figures relating to field and laboratory data. Laboratory reports, groundwater maps, contamination concentration maps and cross sections will be included. Specific parameters for individual plume areas will also be ascertained. A separate section detailing the status of phytoremediation (tree health, growth, appearance, rainfall, etc.) will be included with each report.

Injection reports for the areas where [EOS] injection is proposed will be submitted in accordance with the injection permits to be issued for the site by the [UIC Program]. These reports typically consist of an *Injection Event Record* report detailing the actual event, and subsequent monitoring reports submitted at semi-annual intervals.

6 CONTINGENCY PLAN

[*No amendments to this Section.*]

7 SCHEDULE AND MAINTENANCE

7.1 Operations & Maintenance

Alexander County will oversee day-to-day operation and upkeep of the remediation technology. Any equipment required for remediation will be the responsibility of Alexander County. If problems with the remediation system arise, the Solid Waste Section will be notified and a written report will be issued. The Alexander Department of Solid Waste can be contacted at (828) 632-9467 regarding daily activities.

7.2 Timeline

Implementation of corrective action will begin within 30 days of CAP approval. Initial activities will consist primarily of administrative tasks including scheduling of drilling and remediation subcontractors, permit preparation/submittal, and materials purchasing. BAC-9™ injection is planned for first quarter 2011. A timeline estimate for sampling events and performance evaluation is presented in **Table 9**.

8 FINANCIAL ASSURANCE REQUIREMENTS

[*No amendments to this Section.*]

9 COMPLETENESS OF CORRECTIVE ACTION

Results indicate that reduction of the low level contamination can be achieved through natural attenuation, [BAC-9™ injection, EOS injection], active methane extraction, and phytoremediation. The purchase of the property associated with the plume fingers near MW-16 and MW-1B will allow for the expansion of the relevant point of compliance. As per 15A NCAC 13B .1631(a)(2)(A) the new compliance boundary would be established no more than 250 feet from the waste limit, and be at least 50 feet within the facility property boundary. Prior to establishing the new compliance boundary a petition would have to be submitted to the SWS Permitting Branch. For Alexander County to control all property associated with the plume migration patterns would also eliminate the need for off-site access permits. There is no indication that the contamination would reach the new relative point of compliance within a reasonable time period. Institutional controls limit access to the site. The source area has been capped to limit infiltration. The on-site, non-potable water supply well located near the scale house should be abandoned to eliminate a potential contaminant migration pathway.

10 REFERENCES

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TABLES

TABLE 1
WELL CONSTRUCTION DETAILS

Alexander County MSWLF
Taylorsville, NC
MESCO Project No. G07060.0
December 17, 2010

Monitoring Well	Date Installed	Ground Elevation	Top-of-Casing Elevation	Northing	Easting	Well Diameter	Boring Diameter	Screen Interval (BGS)	TOR	Status
MW-1	09/14/1990	1077.98	1080.68	767134.0364	1363442.6050	2	6	25-40	31.00	Performance Well
MW-1A	09/30/1994	1083.28	1085.32	767200.3163	1363503.3553	2	-	32.5-47.5	41.00	Monitoring Well
MW-1B	05/21/2003	1079.56	1082.56	767195.2993	1363465.9606	2	6	46-61	-	Performance Well
MW-2	09/06/1990	1002.28	1004.48	766674.3685	1362089.6189	2	10	15-30	-	Monitoring Well
MW-3	09/19/1990	1024.23	1024.73	766250.3839	1362679.0876	2	6	13-33	23.10	Performance Well
MW-4R	09/30/1994	1008.54	1012.64	766301.7951	1363401.6259	2	-	5.5-20.5	18.00	Monitoring Well
MW-5	09/16/1994	1049.01	1051.26	766547.9303	1363808.9110	2	-	33.8-48.8	42.00	Performance Well
MW-6	09/29/1994	1008.29	1010.79	766433.2733	1361867.3868	2	-	26-41	24.00	Monitoring Well
MW-7	09/29/1994	1005.84	1009.24	766240.2892	1362135.0386	2	-	38-53	36.50	Monitoring Well
MW-8	09/29/1994	1019.01	1022.01	767017.6867	1362679.5452	2	-	12.5-27.5	14.00	Background Well
MW-9	10/24/2000	993.76	996.27	766114.0184	1363340.8075	2	6	16.5-31.5	7.00	Monitoring Well
MW-10	10/25/2000	1037.83	1040.80	766278.6433	1363705.7044	2	6.5	76-91	36.00	Monitoring Well
MW-11	10/24/2000	1008.98	1011.96	766061.8888	1362636.9409	2	6.5	41-56	36.00	Performance Well
MW-12	10/23/2000	1004.46	1007.35	766005.5659	1362030.9237	2	6	51.5-66.5	66.00	Performance Well
MW-12D	06/09/2000	1006.03	1008.46	766005.1529	1362038.5108	2	3.88	90-100	-	Performance Well
MW-13	10/25/2000	1001.63	1004.56	766375.4660	1361820.1834	2	6.5	45.5-60.5	30.00	Monitoring Well
MW-14	10/26/2000	994.06	997.44	766663.1022	1362045.4545	2	6	25.0-40.5	37.50	Monitoring Well
MW-15	10/25/2000	1020.81	1023.44	766979.9418	1362543.9150	2	6	19-35	26.00	Monitoring Well
MW-16	12/20/2007	1034.94	1037.56	766458.4917	1363828.4046	2	7.75	25.25-40.25	-	Performance Well
MW-17	06/10/2003	988.36	991.16	767043.7701	1362461.2129	2	6	7.3-22.3	-	Monitoring Well
MW-18	12/19/2007	1081.52	1084.33	767212.2504	1363776.4901	2	6	41.7-56.7	20.50	Background Well
MW-19	12/20/2007	1068.67	1071.48	767200.6858	1363194.7175	2	6	48.92-63.92	43.00	Monitoring Well
MW-20	12/20/2007	1044.19	1046.92	767200.0703	1362748.8204	2	6	48.55-63.55	38.00	Monitoring Well
MW-21	12/19/2007	987.08	990.00	767046.2058	1362368.8492	2	6	26.05-41.05	-	Monitoring Well
MW-22	12/19/2007	956.21	958.97	766871.4240	1362092.4590	2	6	8.12-18.12	-	Monitoring Well
MW-23	12/19/2007	947.83	950.48	766686.4251	1361922.3394	2	6	6.54-21.54	21.54	Monitoring Well
MW-24	12/20/2007	971.29	974.04	765972.4283	1361780.7942	2	6	20.35-35.35	35.35	Monitoring Well
MW-25	12/19/2007	979.93	981.93	765849.7417	1361936.5943	2	6	29.48-44.48	22.80	Background Well
MW-26	12/20/2007	988.08	990.69	765876.1807	1362646.1678	2	6	34.8-49.8	31.85	Monitoring Well
MW-27	12/20/2007	989.19	992.19	765934.3152	1362968.1353	2	6	34.82-49.82	23.70	Monitoring Well
*MW-28**	*3/1/2011*	*~972*	-	*766218.15*	*1361636.24*	*2*	*6*	*25-40*	*40.00*	*Sentinel/Compliance Well*
*MW-29**	*3/1/2011*	*~962*	-	*765882.93*	*1361711.49*	*2*	*6*	*25-40*	*40.00*	*Sentinel/Compliance Well*
MW-30	*8/16/2010*			*Survey incomplete*						*Dry-abandoned in place*
MW-31	*8/16/2010*	*~984*	-	*Survey incomplete*		*2*	*6*	*18-35*	*50.00*	*Sentinel Well*
MW-32	*8/16/2010*	*~1025*	-	*Survey incomplete*		*2*	*6*	*28-48*	*50.00*	*Sentinel Well*
*MW-33**	*3/1/2011*	*~1033*	-	*766326.70*	*1363793.79*	*2*	*6*	*35-50*	*50.00*	*Sentinel Well*
*MW-34**	*3/1/2011*	*~1025*	-	*766422.12*	*1363885.82*	*2*	*6*	*35-50*	*50.00*	*Sentinel Well*

NOTE:
1. Ground, datum and TOR elevation are in units of feet, well and boring diameter are in units of inches.
2. TOR = Top of rock below ground surface (bgs)

* Proposed monitoring wells; all elevations, coordinates, & depths are estimated.

TABLE 2
HISTORICAL GROUNDWATER ELEVATION DATA
Alexander County MSWLF
Taylorsville, NC
MESCO Project Number G07060.0
December 17, 2010

Name	01/31/1995	02/15/1995	03/08/1995	12/06/1995	05/06/1996	11/11/1996	06/24/1997	12/03/1997	03/23/1998	04/30/1998	06/04/1998
MW-1	1047.54	1047.89	1048.09	1045.20	1045.84	1044.96	1046.93	1044.93	1047.68	1047.09	1046.94
MW-1A	1039.92	1039.19	1040.47	1037.47	1038.47	1037.53	1042.22	1038.97	1041.36	1042.38	1042.76
MW-1B	-	-	-	-	-	-	-	-	-	-	-
MW-2	984.48	981.98	985.88	982.05	983.48	-	-	-	-	-	-
MW-3	1000.23	999.13	1000.08	999.05	999.33	998.97	999.38	999.10	988.11	999.37	999.44
MW-4R	1000.64	1001.44	1001.39	996.41	997.16	996.48	997.95	996.85	998.24	998.24	997.74
MW-5	1014.14	1013.73	1015.16	1011.38	1012.76	1011.10	1012.90	1011.83	1025.82	1014.49	1013.54
MW-6	986.29	984.02	989.74	980.97	982.44	979.79	981.97	977.87	987.31	986.26	982.91
MW-7	971.54	967.86	973.74	969.86	973.24	969.34	974.72	969.32	974.68	974.94	974.89
MW-8	1011.96	1011.91	1014.21	1008.52	1010.14	1009.56	1012.42	1009.16	1012.56	1011.56	1010.54
MW-9	-	-	-	-	-	-	-	-	-	-	-
MW-10	-	-	-	-	-	-	-	-	-	-	-
MW-11	-	-	-	-	-	-	-	-	-	-	-
MW-12	-	-	-	-	-	-	-	-	-	-	-
MW-12D	-	-	-	-	-	-	-	-	-	-	-
MW-13	-	-	-	-	-	-	-	-	-	-	-
MW-14	-	-	-	-	-	-	-	-	-	-	-
MW-15	-	-	-	-	-	-	-	-	-	-	-
MW-17	-	-	-	-	-	-	-	-	-	-	-

TABLE 2
HISTORICAL GROUNDWATER ELEVATION DATA
Alexander County MSWLF
Taylorsville, NC
MESCO Project Number G07060.0
December 17, 2010

Name	11/18/1998	05/13/1999	12/06/1999	05/17/2000	12/11/2000	06/11/2001	12/27/2001	06/12/2002	01/02/2003	06/24/2003	12/11/2003
MW-1	1044.77	1044.98	1044.51	1044.82	1044.36	1044.66	1044.58	1044.73	1044.97	1047.76	1044.77
MW-1A	1037.78	-	-	-	1036.72	1036.30	1036.26	1036.14	1036.79	1042.56	1038.90
MW-1B	-	-	-	-	-	-	-	-	-	1046.21	1040.92
MW-2	-	-	977.04	-	-	-	-	-	-	-	-
MW-3	999.08	999.31	998.62	999.10	998.50	998.12	998.18	998.77	999.21	999.45	999.11
MW-4R	996.24	996.45	995.71	995.95	995.37	995.48	995.32	995.37	996.50	997.82	996.59
MW-5	1010.76	1011.36	1008.92	1010.91	1007.84	1008.53	1007.50	1008.10	1011.16	1014.07	1010.19
MW-6	975.71	983.04	975.47	980.85	973.63	975.74	973.83	976.93	982.55	987.07	976.69
MW-7	968.46	969.54	967.92	968.97	967.92	967.98	967.86	967.90	968.40	977.75	968.29
MW-8	1006.75	1009.37	1007.56	1009.30	1005.47	1007.66	1007.73	1007.16	1011.16	1012.26	1012.06
MW-9	-	-	-	-	982.86	983.04	983.48	982.96	984.94	984.71	984.26
MW-10	-	-	-	-	1001.75	1001.90	1001.30	1001.57	1002.78	1004.80	1003.05
MW-11	-	-	-	-	968.75	969.66	969.78	969.39	976.35	958.76	970.34
MW-12	-	-	-	-	951.83	952.72	951.62	952.85	957.04	966.65	954.07
MW-12D	-	-	-	-	-	-	-	-	-	963.97	958.06
MW-13	-	-	-	-	958.33	958.41	957.51	960.03	964.43	975.00	963.61
MW-14	-	-	-	-	956.03	956.94	956.23	957.47	959.44	961.32	957.99
MW-15	-	-	-	-	996.60	997.74	997.38	997.83	1001.52	1002.37	999.19
MW-17	-	-	-	-	-	-	-	-	-	979.50	977.96

TABLE 2
HISTORICAL GROUNDWATER ELEVATION DATA

Alexander County MSWLF
Taylorsville, NC
MESCO Project Number G07060.0
December 17, 2010

Name	**06/15/2004**	**12/29/2004**	**06/22/2005**	**01/12/2006**	**07/06/2006**	**12/14/2006**	**06/27/2007**	**12/19/2007**			
MW-1	1044.65	1044.69	1044.62	1044.60	1044.25	1044.62	1044.47	1044.13			
MW-1A	1036.72	-	-	-	-	-	-	-			
MW-1B	1038.18	1038.16	1038.67	1038.00	1037.14	1037.52	1037.75	1036.10			
MW-2	-	-	-	-	-	979.17	977.28	975.12			
MW-3	999.13	999.31	999.23	999.29	999.10	999.31	999.24	998.82			
MW-4R	996.25	996.77	996.39	996.96	996.77	996.19	995.93	995.56			
MW-5	1009.61	1011.18	1009.85	1010.43	1009.02	1009.69	1009.14	1007.51			
MW-6	979.11	983.49	979.72	984.52	979.52	983.07	977.36	975.63			
MW-7	967.83	968.52	969.83	968.01	967.77	967.94	967.42	976.18			
MW-8	1008.40	1011.21	1010.54	1013.56	1013.63	1009.86	1007.57	-			
MW-9	984.03	984.92	983.86	985.68	985.57	984.32	983.42	983.54			
MW-10	1002.86	1003.33	1003.25	1003.21	1002.89	1002.99	1003.00	1002.03			
MW-11	969.97	973.56	970.52	973.57	971.14	971.46	969.55	969.05			
MW-12	954.60	955.95	957.26	954.29	953.70	954.67	954.81	951.15			
MW-12D	952.82	952.78	949.27	948.26	947.66	948.10	947.29	943.50			
MW-13	966.55	970.00	967.41	968.67	965.14	968.76	965.10	958.99			
MW-14	958.05	960.16	958.25	960.08	955.93	958.32	957.89	956.58			
MW-15	998.61	1000.90	999.22	1001.79	1000.78	999.56	995.44	994.91			
MW-17	974.55	976.48	975.91	978.55	979.39	975.49	981.03	973.31			

TABLE 2
HISTORICAL GROUNDWATER ELEVATION DATA
Alexander County MSWLF
Taylorsville, NC
MESCO Project Number G07060.0
December 17, 2010

Name	6/20/2008	12/20/2008	6/20/2009	12/20/2009	07/20/2010						
MW-1	1044.34	1044.46	1044.66	1044.47	1044.50						
MW-1B	1035.58	1035.55	1038.05	1037.98	1039.54						
MW-2	977.83	978.03	984.43	984.47	979.33						
MW-3	999.16	1009.54	999.28	999.73	999.05						
MW-4R	995.63	997.82	997.47	997.65	996.76						
MW-5	1007.90	1007.91	1011.12	1011.18	1009.95						
MW-6	979.98	978.84	985.34	986.33	978.54						
MW-7	967.20	965.44	971.03	967.29	968.30						
MW-9	983.17	985.46	985.09	986.02	983.73						
MW-10	1002.42	1002.37	1003.98	1003.65	1003.48						
MW-11	969.26	971.11	974.34	974.91	970.35						
MW-12	953.63	951.85	958.17	955.72	957.77						
MW-12D		943.95	650.51	949.08	951.22						
MW-13	958.56	961.95	971.75	969.66	963.83						
MW-14	958.23	958.43	960.45	962.45	958.38						
MW-15	998.27	1000.51	1001.26	1002.13	998.93						
MW-16	1006.08	1005.66	1007.94	1007.75	1007.16						
MW-17	971.21	973.71	976.27	978.36	975.16						
MW-18	1029.63	1029.13	1031.85	1031.59	1034.35						
MW-19	1018.09	1018.08	1019.20	1019.70	1021.53						
MW-20	1006.52	1005.99	1007.51	1007.21	1007.94						
MW-21	957.59	957.86	953.65	964.15	963.20						
MW-22	943.52	943.47	944.20	944.96	944.14						
MW-23	932.49	932.74	934.27	935.43	933.08						
MW-24	941.92	940.94	944.98	944.04	945.01						
MW-25	949.95	949.00	957.03	955.04	956.50						
MW-26	960.61	962.45	971.39	971.44	962.81						
MW-27	969.98	971.84	977.14	979.67	970.81						

TABLE 2
HISTORICAL GROUNDWATER ELEVATION DATA

Alexander County MSWLF
Taylorsville, NC
MESCO Project Number G07060.0
December 17, 2010

Name	Observed High	Observed Low	Difference	Average		Name	Observed High	Observed Low	Difference	Average	
MW-1	1048.09	1044.34	3.75	1045.57							
MW-1A	1042.76	1036.14	6.62	1039.06		MW-16	1007.94	1005.66	2.28	1006.92	
MW-1B	1046.21	1035.55	10.66	1039.12		MW-18	1034.35	1029.13	5.22	1031.31	
MW-2	985.88	977.04	8.84	981.73		MW-19	1021.53	1018.08	3.45	1019.32	
MW-3	1009.54	988.11	21.43	999.13		MW-20	1007.94	1005.99	1.95	1007.03	
MW-4R	1001.44	995.32	6.12	997.21		MW-21	964.15	953.65	10.50	959.29	
MW-5	1025.82	1007.50	18.32	1011.64		MW-22	944.96	943.47	1.49	944.06	
MW-6	989.74	973.63	16.11	981.12		MW-23	935.43	932.49	2.94	933.60	
MW-7	977.75	965.44	12.31	970.16		MW-24	945.01	940.94	4.07	943.38	
MW-8	1014.21	1005.47	8.74	1009.96		MW-25	957.03	949.00	8.03	953.50	
MW-9	986.02	982.86	3.16	984.14		MW-26	971.44	960.61	10.83	965.74	
MW-10	1004.80	1001.30	3.50	1002.75		MW-27	979.67	969.98	9.69	973.89	
MW-11	976.35	958.76	17.59	970.25							
MW-12	966.65	951.62	15.03	955.33							
MW-12D	963.97	958.06	5.91	640.68							
MW-13	975.00	957.51	17.49	963.59							
MW-14	962.45	956.03	6.42	958.61							
MW-15	1002.37	996.60	5.77	999.48							
MW-17	981.03	973.31	7.72	987.12							

TABLE 3
SLUG TEST SUMMARY

Alexander County MSWLF
Taylorsville, NC
MESCO Project No. G07060.0
December 17, 2010

Well	Screen Interval (BGS)	Initial DTW (BTOC)	Initial Head Change	K (cm/sec)	Lithology
MW-1A	32.5-47.5	46.50	31.50	5.60E-05	Gneiss
MW-2	15-30	22.80	3.20	3.70E-06	Silty Sand
MW-3	13-33	25.50	25.50	3.90E-06	PWR/Gneiss
MW-4R	5.5-20.5	14.80	4.80	4.90E-04	Silty Clay/Gneiss
MW-5	33.8-48.8	39.90	39.90	6.40E-05	Saprolite
MW-6	26-41	33.20	33.20	2.40E-05	Gneiss
MW-7	38-53	40.60	40.60	1.60E-06	Gneiss
MW-8	12.5-27.5	14.20	14.20	1.30E-05	Gneiss
MW-16	25.25-40.25	31.97	3.82	8.72E-04	Silty Sand
MW-18	41.7-56.7	55.00	2.48	1.19E-04	Gneiss
MW-19	48.92-63.92	56.48	1.56	1.92E-06	Gneiss
MW-20	48.55-63.55	40.80	5.72	5.49E-05	Gneiss
MW-21	26.05-41.05	30.51	3.98	3.77E-03	Silty Sand
MW-22	8.12-18.12	15.31	4.16	6.04E-04	Silty Sand
MW-23	6.54-21.51	17.60	4.97	9.83E-04	Silty Sand
MW-24	20.35-35.35	33.71	1.39	1.33E-02	PWR
MW-25	29.48-44.48	33.05	5.13	5.41E-05	Gneiss
MW-26	34.8-49.8	29.91	9.02	1.16E-04	Gneiss
MW-27	34.82-49.82	20.38	4.97	2.83E-05	Gneiss

Summary Statistics			
Geometric Mean (GM)	7.72E-05	Maximum	1.33E-02
Geo. Std. Deviation (σ_{GSD})	12.5	Minimum	1.60E-06
GM / GSD ($-1\sigma_{GSD}$)	6.18E-06	Median	5.60E-05
GM * GSD ($+1\sigma_{GSD}$)	9.64E-04	Count	19

Silty Sand			
Geometric Mean (GM)	3.73E-04	Maximum	3.77E-03
Geo. Std. Deviation (σ_{GSD})	14.4	Minimum	3.70E-06
GM / GSD ($-1\sigma_{GSD}$)	2.58E-05	Median	8.72E-04
GM * GSD ($+1\sigma_{GSD}$)	5.39E-03		

Gneiss			
Geometric Mean (GM)	2.65E-05	Maximum	4.90E-04
Geo. Std. Deviation (σ_{GSD})	5.73	Minimum	1.60E-06
GM / GSD ($-1\sigma_{GSD}$)	4.62E-06	Median	4.12E-05
GM * GSD ($+1\sigma_{GSD}$)	1.52E-04		

Notes: BGS = Below Ground Surface
BTOC = Below Top-of-Casing

TABLE 4
HISTORICAL ORGANIC 2L STANDARD EXCEEDANCES

Alexander County MSWLF
Taylorsville, NC
MESCO Project No. G07063.0
December 20, 2010

Well ID	Parameter Name [1]	Sample Date	Sample Results (ug/L)	PQL [2]	2L STANDARD [3]
MW-1					
	1,4-Dichlorobenzene	12/27/2007	3.8	0.15	1.4
		06/28/2007	2.0	0.15	1.4
		06/20/2008	3.2	0.20	1.4
		12/30/2008	3.2	0.38	1.4
		06/25/2009	3.4	0.33	1.4
		12/16/2009	3.3	0.33	1.4
	Benzene	11/18/1998	3.0	2.00	1.0
		12/15/2006	4.2	3.00	1.0
		06/13/2002	7.2	5.00	1.0
		01/13/2006	6.0	5.00	1.0
		06/23/2005	5.0	5.00	1.0
		05/13/1999	5.7	5.00	1.0
		12/30/2004	5.7	5.00	1.0
		06/28/2007	5.0	0.12	1.0
		12/06/1999	5.7	5.00	1.0
		06/13/2001	5.9	5.00	1.0
		12/27/2007	5.6	0.12	1.0
		06/20/2008	4.0	0.20	1.0
		12/30/2008	4.5	0.20	1.0
		06/25/2009	5.0	0.25	1.0
		12/16/2009	5.5	0.25	1.0
		07/08/2010	7.1	0.25	1.0
	Vinyl chloride	07/08/2010	0.7	0.62	0.030
MW-1B					
	1,4-Dichlorobenzene	12/28/2007	2.4	0.15	1.4
		12/15/2006	1.9	3.00	1.4
		06/20/2008	2.1	0.20	1.4
		12/30/2008	1.8	0.38	1.4
		06/24/2009	0.33	0.38	1.4
		12/15/2009	3.6	0.33	1.4
	Benzene	06/28/2007	1.7	0.12	1.0
		12/15/2006	1.3	3.00	1.0
		06/20/2008	1.7	0.20	1.0
		12/30/2008	1.4	0.20	1.0
		12/15/2009	3.6	0.25	1.0
		07/07/2010	3.4	0.25	1.0
MW-2					
	1,4-Dichlorobenzene	12/15/2006	5.0	3.00	1.4
		06/28/2007	5.2	0.15	1.4
		02/11/2008	3.4	0.21	1.4
		12/28/2007	4.4	0.15	1.4
		12/06/1999	5.1	5.00	1.4
		06/19/2008	4.8	0.20	1.4
		06/24/2009	4.2	0.33	1.4
		12/16/2009	3.1	0.33	1.4

TABLE 4
HISTORICAL ORGANIC 2L STANDARD EXCEEDANCES
Alexander County MSWLF
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Well ID	Parameter Name [1]	Sample Date	Sample Results (ug/L)	PQL [2]	2L STANDARD [3]
	Benzene	03/07/1995	5.0	5.00	1.0
		06/28/2007	2.8	0.12	1.0
		12/28/2007	1.8	0.12	1.0
		02/15/1995	5.0	5.00	1.0
		12/15/2006	3.0	3.00	1.0
		02/11/2008	2.6	0.16	1.0
		12/06/1995	5.0	5.00	1.0
		06/19/2008	1.9	0.20	1.0
		06/24/2009	2.5	0.25	1.0
		12/16/2009	2.2	0.25	1.0
		07/08/2010	3.0	0.25	1.0
	Trichloroethylene	01/31/1995	6.0	5.00	2.8
		02/15/1995	6.0	5.00	2.8
		10/01/1994	5.0	5.00	2.8
		12/06/1995	6.0	5.00	2.8
		03/07/1995	6.0	5.00	2.8
	Vinyl chloride	06/19/2008	0.5	0.30	0.015
		12/16/2009	0.8	0.62	0.015
		07/08/2010	1.4	0.62	0.030
MW-3					
	1,2-Dichloroethane	07/01/2009	0.5	0.12	0.38
	1,2-Dichloropropane	03/07/1995	7.0	5.00	0.5
		02/15/1995	9.0	5.00	0.5
		01/31/1995	6.0	5.00	0.5
		10/01/1994	11.0	5.00	0.5
		12/03/1997	2.0	1.00	0.5
	1,4-Dichlorobenzene	12/03/1997	8.0	1.00	1.4
		11/11/1996	5.2	5.00	1.4
		12/11/2000	7.4	5.00	1.4
		12/28/2007	9.8	0.15	1.4
		11/18/1998	4.6	2.00	1.4
		05/17/2000	7.6	5.00	1.4
		06/27/2007	5.8	0.15	1.4
		12/14/2006	3.8	3.00	1.4
		06/24/2003	9.5	5.00	1.4
		06/13/2002	8.4	5.00	1.4
		06/22/2005	11.0	5.00	1.4
		12/07/1995	6.0	5.00	1.4
		06/04/1998	7.6	5.00	1.4
		12/27/2001	7.5	5.00	1.4
		06/12/2001	6.6	5.00	1.4
		12/11/2003	7.5	5.00	1.4
		06/15/2004	5.6	5.00	1.4
		12/06/1999	7.7	5.00	1.4
		12/29/2004	8.9	5.00	1.4

TABLE 4
HISTORICAL ORGANIC 2L STANDARD EXCEEDANCES
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Well ID	Parameter Name [1]	Sample Date	Sample Results (ug/L)	PQL [2]	2L STANDARD [3]
		05/13/1999	7.4	5.00	1.4
		06/20/2008	7.0	0.20	1.4
		07/01/2009	9.5	0.33	1.4
		12/18/2009	7.0	0.33	1.4
	Benzene	12/06/1999	11.0	5.00	1.0
		11/18/1998	5.7	2.00	1.0
		06/04/1998	8.8	5.00	1.0
		06/24/1997	8.3	5.00	1.0
		12/28/2007	8.0	0.12	1.0
		05/13/1999	7.9	5.00	1.0
		06/24/2003	11.0	5.00	1.0
		02/15/1995	9.0	5.00	1.0
		06/27/2007	8.0	0.12	1.0
		06/13/2002	10.0	5.00	1.0
		05/17/2000	9.5	5.00	1.0
		12/11/2000	10.0	5.00	1.0
		12/27/2001	11.0	5.00	1.0
		03/07/1995	6.0	5.00	1.0
		05/06/1996	9.0	5.00	1.0
		11/11/1996	11.0	5.00	1.0
		12/03/1997	10.0	1.00	1.0
		06/15/2004	6.9	5.00	1.0
		01/31/1995	8.0	5.00	1.0
		12/29/2004	8.5	5.00	1.0
		12/14/2006	4.8	3.00	1.0
		01/03/2003	7.5	5.00	1.0
		12/11/2003	7.9	5.00	1.0
		06/22/2005	7.0	5.00	1.0
		10/01/1994	9.0	5.00	1.0
		06/12/2001	13.0	5.00	1.0
		06/20/2008	6.7	0.20	1.0
		07/01/2009	8.1	0.25	1.0
		12/18/2009	7.2	0.25	1.0
		07/14/2010	6.0	0.25	1.0
	Heptachlor	12/03/1997	0.1	0.05	0.008
	Methylene chloride	10/01/1994	24.0	10.00	4.6
		02/15/1995	14.0	10.00	4.6
	Tetrachloroethylene	12/03/1997	1.0	1.00	0.7
	Trichloroethylene	12/03/1997	4.0	1.00	2.8
	Trichloroethylene	02/15/1995	5.0	5.00	2.8
	Vinyl chloride	06/27/2007	0.2	0.15	0.015
		12/03/1997	2.0	1.00	0.015
		06/20/2008	0.93	0.30	0.015
		07/01/2009	1.30	0.62	0.015
		12/18/2009	0.83	0.62	0.015

TABLE 4
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Well ID	Parameter Name [1]	Sample Date	Sample Results (ug/L)	PQL [2]	2L STANDARD [3]
		07/14/2010	1.10	0.62	0.030
MW-4					
	1,4-Dichlorobenzene	12/03/1997	3.0	1.00	1.4
	Benzene	12/03/1997	4.0	1.00	1.0
	Trichloroethylene	12/03/1997	3.0	1.00	2.8
MW-4R					
	1,4-Dichlorobenzene	12/27/2007	3.6	0.15	1.4
		12/14/2006	3.3	3.00	1.4
		06/27/2007	3.6	0.15	1.4
		06/19/2008	3.3	0.20	1.4
		06/24/2009	5.1	0.33	1.4
		12/16/2009	2.2	0.33	1.4
	Benzene	06/13/2001	5.6	5.00	1.0
		06/27/2007	2.8	0.12	1.0
		11/18/1998	2.3	2.00	1.0
		06/25/2003	5.1	5.00	1.0
		12/14/2006	2.4	3.00	1.0
		06/19/2008	1.1	0.20	1.0
		06/24/2009	3.0	0.25	1.0
		12/16/2009	1.7	0.25	1.0
		07/08/2010	2.5	0.25	1.0
MW-5					
	1,4-Dichlorobenzene	07/01/2009	1.8	0.33	1.4
		12/17/2009	2.2	0.33	1.4
	Benzene	06/13/2001	6.1	5.00	1.0
		12/14/2006	2.8	3.00	1.0
		11/18/1998	2.5	2.00	1.0
		06/27/2007	3.2	0.12	1.0
		12/19/2007	3.2	0.12	1.0
		12/03/1997	4.0	1.00	1.0
		06/04/1998	5.6	5.00	1.0
		06/20/2008	3.3	0.20	1.0
		07/01/2009	3.8	0.25	1.0
		12/17/2009	4.1	0.25	1.0
		07/13/2010	3.6	0.25	1.0
	Tetrachloroethylene	12/03/1997	1.0	1.00	0.7
		12/14/2006	1.2	3.00	0.7
	Trichloroethylene	12/03/1997	4.0	1.00	2.8
MW-6					
	Benzene	12/19/2007	1.1	0.12	1.0

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Well ID	Parameter Name [1]	Sample Date	Sample Results (ug/L)	PQL [2]	2L STANDARD [3]
MW-7					
	1,4-Dichlorobenzene	12/27/2007	2.1	0.15	1.4
		12/14/2006	3.0	3.00	1.4
		06/20/2008	2.0	0.20	1.4
	Benzene	12/03/1997	2.0	1.00	1.0
		12/28/2001	5.6	5.00	1.0
		06/25/2003	6.7	5.00	1.0
		12/27/2007	4.7	0.12	1.0
		06/27/2007	3.2	0.12	1.0
		01/12/2006	5.1	5.00	1.0
		06/13/2001	6.0	5.00	1.0
		06/20/2008	4.1	0.20	1.0
		07/01/2009	3.3	0.25	1.0
		12/18/2009	4.1	0.25	1.0
		07/31/2010	4.2	0.25	1.0
	Methylene chloride	03/07/1995	11.0	10.00	4.6
		01/31/1995	29.0	10.00	4.6
		02/15/1995	26.0	10.00	4.6
		12/06/1995	20.0	10.00	4.6
		10/01/1994	24.0	10.00	4.6
MW-8					
	1,4-Dichlorobenzene	02/11/2008	5.4	0.21	1.4
MW-9					
MW-10					
	Benzene	06/27/2007	2.1	0.12	1.0
		12/15/2009	1.2	0.25	1.0
		07/07/2010	1.1	0.25	1.0
MW-11					
	1,1,2,2-Tetrachloroethane	06/20/2008	1.0	0.33	0.18
	1,1-Dichloroethane	12/11/2000	11.0	5.00	70.0
	1,4-Dichlorobenzene	06/12/2001	6.9	5.00	1.4
		07/07/2006	11.6	5.00	1.4
		06/15/2004	9.0	5.00	1.4
		12/11/2003	8.3	5.00	1.4
		06/22/2005	11.0	5.00	1.4
		12/29/2004	8.4	5.00	1.4
		12/14/2006	7.5	3.00	1.4
		12/27/2007	5.9	0.15	1.4
		06/24/2003	7.7	5.00	1.4
		12/27/2001	7.8	5.00	1.4
		06/20/2008	7.9	0.20	1.4
		06/30/2009	8.5	0.33	1.4
		12/17/2009	8.6	0.33	1.4

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Well ID	Parameter Name [1]	Sample Date	Sample Results (ug/L)	PQL [2]	2L STANDARD [3]
		07/14/2010	9.4	0.33	6.0
	Benzene	12/11/2000	5.2	5.00	1.0
		12/27/2001	6.9	5.00	1.0
		06/13/2002	7.7	5.00	1.0
		06/15/2004	5.3	5.00	1.0
		12/29/2004	5.6	5.00	1.0
		01/03/2003	6.4	5.00	1.0
		12/11/2003	6.4	5.00	1.0
		12/27/2007	4.2	0.12	1.0
		06/22/2005	6.0	5.00	1.0
		06/24/2003	6.3	5.00	1.0
		06/27/2007	6.0	0.12	1.0
		06/12/2001	7.8	5.00	1.0
		12/14/2006	4.6	3.00	1.0
		07/07/2006	5.1	5.00	1.0
		06/20/2008	3.5	0.20	1.0
		06/30/2009	5.0	0.25	1.0
		12/17/2009	4.5	0.25	1.0
		07/14/2010	5.9	0.25	1.0
	Ethylene dichloride	12/14/2006	1.1	3.00	0.4
	Tetrachloroethylene	12/14/2006	1.1	3.00	0.7
	Vinyl chloride	12/27/2007	0.79	0.15	0.015
		06/27/2007	0.94	0.15	0.015
		06/20/2008	0.60	0.30	0.015
		06/30/2009	0.94	0.62	0.015
		12/17/2009	0.85	0.62	0.015
		07/14/2010	0.91	0.62	0.030
MW-12					
	1,4-Dichlorobenzene	06/15/2004	6.4	5.00	1.4
		06/12/2002	5.6	5.00	1.4
		06/24/2003	6.8	5.00	1.4
		06/13/2001	5.6	5.00	1.4
		06/28/2007	7.5	0.15	1.4
		07/07/2006	10.9	5.00	1.4
		12/11/2003	5.7	5.00	1.4
		01/12/2006	8.1	5.00	1.4
		06/23/2005	8.0	5.00	1.4
		12/30/2004	6.2	5.00	1.4
		12/27/2001	6.4	5.00	1.4
		12/11/2000	6.3	5.00	1.4
		12/14/2006	6.9	3.00	1.4
		12/28/2007	7.4	0.15	1.4
		06/20/2008	7.4	0.20	1.4
		12/17/2008	6.9	0.38	1.4
		07/01/2009	6.9	0.33	1.4
		12/17/2009	7.8	0.33	1.4

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Well ID	Parameter Name [1]	Sample Date	Sample Results (ug/L)	PQL [2]	2L STANDARD [3]
		07/13/2010	6.1	0.33	6.0
	Benzene	12/11/2000	7.0	5.00	1.0
		06/13/2001	8.2	5.00	1.0
		12/28/2007	7.1	0.12	1.0
		12/27/2001	7.6	5.00	1.0
		01/12/2006	7.1	5.00	1.0
		07/07/2006	8.1	5.00	1.0
		06/23/2005	6.0	5.00	1.0
		12/30/2004	5.8	5.00	1.0
		06/28/2007	7.2	0.12	1.0
		06/15/2004	5.0	5.00	1.0
		12/14/2006	6.3	3.00	1.0
		06/12/2002	5.6	5.00	1.0
		06/24/2003	6.5	5.00	1.0
		06/20/2008	6.4	0.20	1.0
		12/17/2008	6.2	0.20	1.0
		07/01/2009	6.0	0.25	1.0
		12/17/2009	6.7	0.25	1.0
		07/13/2010	5.6	0.25	1.0
	Methylene chloride	06/13/2001	10.0	5.00	4.6
		12/11/2000	13.0	5.00	4.6
		12/27/2001	12.0	5.00	4.6
		06/12/2002	7.4	5.00	4.6
	Tetrachloroethylene	12/28/2007	1.0	0.25	0.7
		06/28/2007	1.3	0.25	0.7
		12/14/2006	2.0	3.00	0.7
		06/20/2008	1.0	0.36	0.7
		12/17/2008	1.1	0.36	0.7
		07/01/2009	1.1	0.46	0.7
		12/17/2009	1.2	0.46	0.7
		07/13/2010	0.8	0.46	0.7
MW-12D					
	Bromodichloromethane	06/20/2008	0.8	0.20	0.56
MW-13					
MW-14					
	1,4-Dichlorobenzene	06/13/2002	7.5	5.00	1.4
		07/07/2006	6.4	5.00	1.4
		06/28/2007	3.9	0.15	1.4
		12/15/2006	4.0	3.00	1.4
		12/11/2003	5.5	5.00	1.4
		12/28/2007	4.6	0.15	1.4
		06/19/2008	4.0	0.20	1.4
		06/24/2009	2.5	0.33	1.4
		12/15/2009	1.9	0.33	1.4

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Well ID	Parameter Name [1]	Sample Date	Sample Results (ug/L)	PQL [2]	2L STANDARD [3]
	Benzene	12/28/2007	1.2	0.12	1.0
		06/28/2007	2.0	0.12	1.0
		12/15/2006	1.9	3.00	1.0
MW-15					
	Benzene	06/12/2001	5.3	5.00	1.0
		06/28/2007	2.6	0.12	1.0
		12/15/2006	2.2	3.00	1.0
		06/25/2009	2.5	0.25	1.0
		12/15/2009	2.4	0.25	1.0
		07/08/2010	3.4	0.25	1.0
	Methylene chloride	12/30/2004	13.0	10.00	4.6
		06/25/2003	16.0	5.00	4.6
MW-16					
	1,1-Dichloroethane	07/14/2010	11.9	0.32	6.00
	1,2-Dichloropropane	01/08/2008	1.0	0.18	0.51
		04/17/2008	1.0	0.18	0.51
		06/20/2008	0.9	0.20	0.51
		12/30/2008	0.8	0.20	0.51
		07/01/2009	0.58	0.27	0.51
		12/17/2009	0.86	0.27	0.51
		07/14/2010	1.10	0.27	0.60
	1,4-Dichlorobenzene	04/17/2008	1.6	0.15	1.4
		01/08/2008	1.8	0.15	1.4
		06/20/2008	1.8	0.20	1.4
		12/30/2008	1.8	0.38	1.4
		07/01/2009	2.1	0.33	1.4
		12/17/2009	1.9	0.33	1.4
	Benzene	01/08/2008	3.3	0.12	1.0
		04/17/2008	3.6	0.12	1.0
		06/20/2008	3.2	0.20	1.0
		12/30/2008	3.1	0.20	1.0
		07/01/2009	4.9	0.25	1.0
		12/17/2009	3.7	0.25	1.0
		07/14/2010	3.7	0.25	1.0
	Tetrachloroethylene	01/08/2008	2.5	0.25	0.7
		04/17/2008	3.3	0.25	0.7
		06/20/2008	2.4	0.36	0.7
		12/30/2008	2.6	0.36	0.7
		07/01/2009	2.1	0.46	0.7
		12/17/2009	2.9	0.46	0.7
		07/14/2010	2.8	0.46	0.7
	Trichloroethylene	04/17/2008	3.6	0.23	2.8
		01/08/2008	3.7	0.23	2.8

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Well ID	Parameter Name [1]	Sample Date	Sample Results (ug/L)	PQL [2]	2L STANDARD [3]
		06/20/2008	3.5	0.25	2.8
		12/30/2008	3.3	0.38	2.8
		12/17/2009	3.5	0.47	2.8
		07/14/2010	3.5	0.47	3.0
MW-17					
	Benzene	12/27/2007	1.1	0.12	1.0
		06/28/2007	1.4	0.12	1.0
		12/15/2006	1.1	3.00	1.0
		07/07/2010	1.2	0.25	1.0
	Methylene chloride	06/25/2003	9.7	5.00	4.6
MW-23					
MW-24					
	1,4-Dichlorobenzene	01/08/2008	2.7	0.15	1.4
		04/17/2008	2.5	0.15	1.4
		06/20/2008	2.2	0.20	1.4
		12/17/2008	2.6	0.38	1.4
		12/16/2009	1.6	0.33	1.4
	Benzene	04/17/2008	1.3	0.12	1.0
		01/08/2008	1.6	0.12	1.0
		12/17/2008	1.2	0.12	1.0
		12/17/2009	1.4	0.25	1.0
MW-26					
	1,4-Dichlorobenzene	04/17/2008	3.2	0.15	1.4
		01/09/2008	3.1	0.15	1.4
		06/20/2008	2.4	0.20	1.4
		12/17/2008	3.1	0.38	1.4
		07/14/2010	6.5	0.33	6.0
	Benzene	04/17/2008	1.6	0.12	1.0
		01/09/2008	1.9	0.12	1.0
		06/20/2008	1.6	0.20	1.0
		12/17/2008	1.7	0.20	1.0
		06/30/2009	1.4	0.25	1.0
		12/17/2009	1.4	0.25	1.0
		07/14/2010	3.2	0.25	1.0

[1] Table contains only 2L Standard exceedances.
[2] **PQL** refers to the Laboratory Practical Quantitation Limit.
[3] **2L Standard** refers to the North Carolina Ground Water Standard as promulgated in 15A NCAC 2l.

TABLE 5
HISTORICAL BACKGROUND RESULTS

Alexander County MSWLF
Taylorsville, NC
MESCO Project NO. G07063.0
December 20, 2010

Well ID	Parameter Name [1]	Sample Date	Sample Results (ug/L)	PQL [2]	2L Standard [3]
MW-1					
	1,4-Dichlorobenzene	12/27/2007	3.8	0.15	1.4
		06/28/2007	2.0	0.15	1.4
		06/20/2008	3.2	0.20	1.4
		12/30/2008	3.2	0.38	1.4
		06/25/2009	3.4	0.33	1.4
		12/16/2009	3.3	0.33	1.4
	Benzene	11/18/1998	3.0	2.00	1.0
		12/15/2006	4.2	3.00	1.0
		06/13/2002	7.2	5.00	1.0
		01/13/2006	6.0	5.00	1.0
		06/23/2005	5.0	5.00	1.0
		05/13/1999	5.7	5.00	1.0
		12/30/2004	5.7	5.00	1.0
		06/28/2007	5.0	0.12	1.0
		12/06/1999	5.7	5.00	1.0
		06/13/2001	5.9	5.00	1.0
		12/27/2007	5.6	0.12	1.0
		06/20/2008	4.0	0.20	1.0
		12/30/2008	4.5	0.20	1.0
		06/25/2009	5.0	0.25	1.0
		12/16/2009	5.5	0.25	1.0
		07/08/2010	7.1	0.25	1.0
	Vinyl chloride	07/08/2010	0.7	0.62	0.030
MW-1B					
	1,4-Dichlorobenzene	12/15/2006	1.9	3.00	1.4
		12/28/2007	2.4	0.15	1.4
		12/15/2006	1.9	3.00	1.4
		06/20/2008	2.1	0.20	1.4
		12/30/2008	1.8	0.38	1.4
		06/24/2009	0.33	0.38	1.4
		12/15/2009	3.6	0.33	1.4
	Benzene	06/28/2007	1.7	0.12	1.0
		12/15/2006	1.3	3.00	1.0
		06/20/2008	1.7	0.20	1.0
		12/30/2008	1.4	0.20	1.0
		12/15/2009	3.6	0.25	1.0
		07/07/2010	3.4	0.25	1.0

[1] Table contains 2L Standard exceedances.
[2] PQL = Practical Quantitation Limit
[3] 2L Standard refers to the North Carolina Ground Water Standard as promulgated in 15A NCAC

TABLE 7
RECENT GROUNDWATER SAMPLE DETECTIONS

Alexander County MSWLF
Taylorsville, NC
MESCO Project No. 607063.0
December 20, 2010

Well ID	Parameter Name [1]	Sample Date	Result	Unit	MDL [2]	SWSL [3]	2L [4]	2B [5]	GWP [6]
MW-1									
	1,4-Dichlorobenzene	7/8/2010	3.5	ug/L	0.33	1	6.		
	Benzene	**7/8/2010**	**7.1**	**ug/L**	**0.25**	**1**	**1.**		
	cis-1,2-Dichloroethene	7/8/2010	10.1	ug/L	0.19	5	70.		
	Cobalt	7/8/2010	85.7	ug/L	0.6	10			70
	Vinyl chloride	**7/8/2010**	**0.66j**	**ug/L**	**0.62**	**1**	**0.03**		
	Zinc	7/8/2010	16.1	ug/L	0.4	10	1050.		
MW-1B									
	1,4-Dichlorobenzene	7/7/2010	3.1	ug/L	0.33	1	6.		
	Benzene	**7/7/2010**	**3.4**	**ug/L**	**0.25**	**1**	**1.**		
	cis-1,2-Dichloroethene	7/7/2010	5.9	ug/L	0.19	5	70.		
	Cobalt	7/7/2010	116.	ug/L	0.6	10			70
	Zinc	7/7/2010	18.4	ug/L	0.4	10	1050.		
MW-2									
	1,4-Dichlorobenzene	7/8/2010	4.2	ug/L	0.33	1	6.		
	Benzene	**7/8/2010**	**3.**	**ug/L**	**0.25**	**1**	**1.**		
	cis-1,2-Dichloroethene	7/8/2010	20.3	ug/L	0.19	5	70.		
	Cobalt	7/8/2010	543.	ug/L	0.6	10			70
	Thallium	7/8/2010	6.2	ug/L	3	5.5			0.28
	Trichloroethene	7/8/2010	1.8	ug/L	0.47	1	3.		
	Vinyl chloride	**7/8/2010**	**1.4**	**ug/L**	**0.62**	**1**	**0.03**		
	Zinc	7/8/2010	55.2	ug/L	0.4	10	1050.		
MW-3									
	1,4-Dichlorobenzene	7/14/2010	3.3	ug/L	0.33	1	6.		
	Benzene	**7/14/2010**	**6.**	**ug/L**	**0.25**	**1**	**1.**		
	cis-1,2-Dichloroethene	7/14/2010	9.3	ug/L	0.19	5	70.		
	Cobalt	7/14/2010	26.7	ug/L	0.6	10			70
	Ethylbenzene	7/14/2010	1.5	ug/L	0.3	1	550.		
	Lead	7/14/2010	14.9	ug/L	4	10	10.		
	Nickel	7/14/2010	60.5	ug/L	1.7	50	100.		
	Toluene	7/14/2010	2.1	ug/L	0.26	1	1000.		
	Vinyl chloride	**7/14/2010**	**1.1**	**ug/L**	**0.62**	**1**	**0.03**		
	Xylene (Total)	7/14/2010	8.2	ug/L	0.66	5	530.		
MW-4R									
	1,4-Dichlorobenzene	7/8/2010	4.1	ug/L	0.33	1	6.		
	Barium	7/8/2010	103.	ug/L	0.2	100	700.		
	Benzene	**7/8/2010**	**2.5**	**ug/L**	**0.25**	**1**	**1.**		
	cis-1,2-Dichloroethene	7/8/2010	15.1	ug/L	0.19	5	70.		
	Cobalt	7/8/2010	203.	ug/L	0.6	10			70
	Thallium	7/8/2010	5.4j	ug/L	3	5.5			0.28

TABLE 7
RECENT GROUNDWATER SAMPLE DETECTIONS
Alexander County MSWLF
Taylorsville, NC
MESCO Project No. 607063.0
December 20, 2010

Well ID	Parameter Name [1]	Sample Date	Result	Unit	MDL [2]	SWSL [3]	2L [4]	2B [5]	GWP [6]
MW-5									
	1,4-Dichlorobenzene	7/13/2010	2.1	ug/L	0.33	1	6.		
	Benzene	**7/13/2010**	**3.6**	**ug/L**	**0.25**	**1**	**1.**		
	Chromium	**7/13/2010**	**11.**	**ug/L**	**0.4**	**10**	**50.**		
	cis-1,2-Dichloroethene	7/13/2010	10.5	ug/L	0.19	5	70.		
	Cobalt	7/13/2010	32.7	ug/L	0.6	10			70
	Vanadium	7/13/2010	8.6j	ug/L	0.2	25			3.5
	Zinc	7/13/2010	26.4	ug/L	0.4	10	1050.		
MW-6									
	Cobalt	7/12/2010	18.7	ug/L	0.6	10			70
MW-7									
	Benzene	**7/13/2010**	**4.2**	**ug/L**	**0.25**	**1**	**1.**		
	Cobalt	7/13/2010	18.1	ug/L	0.6	10			70
MW-9									
	Barium	7/7/2010	115.	ug/L	0.2	100	700.		
	cis-1,2-Dichloroethene	7/7/2010	13.9	ug/L	0.19	5	70.		
	Cobalt	7/7/2010	49.	ug/L	0.6	10			70
	Thallium	7/7/2010	5.6	ug/L	3	5.5			0.28
MW-10									
	Benzene	**7/7/2010**	**1.1**	**ug/L**	**0.25**	**1**	**1.**		
MW-11									
	1,4-Dichlorobenzene	**7/14/2010**	**9.4**	**ug/L**	**0.33**	**1**	**6.**		
	Barium	7/14/2010	120.	ug/L	0.2	100	700.		
	Benzene	**7/14/2010**	**5.9**	**ug/L**	**0.25**	**1**	**1.**		
	cis-1,2-Dichloroethene	7/14/2010	24.6	ug/L	0.19	5	70.		
	Cobalt	7/14/2010	136.	ug/L	0.6	10			70
	Thallium	7/14/2010	5.6	ug/L	3	5.5			0.28
	Vinyl chloride	**7/14/2010**	**0.91j**	**ug/L**	**0.62**	**1**	**0.03**		
	Zinc	7/14/2010	73.2	ug/L	0.4	10	1050.		
MW-12									
	1,4-Dichlorobenzene	**7/13/2010**	**6.1**	**ug/L**	**0.33**	**1**	**6.**		
	Barium	7/13/2010	106.	ug/L	0.2	100	700.		
	Benzene	**7/13/2010**	**5.6**	**ug/L**	**0.25**	**1**	**1.**		
	cis-1,2-Dichloroethene	7/13/2010	11.9	ug/L	0.19	5	70.		
	Cobalt	7/13/2010	37.2	ug/L	0.6	10			70
	Tetrachloroethene	**7/13/2010**	**0.82j**	**ug/L**	**0.46**	**1**	**0.7**		
	Trichloroethene	7/13/2010	2.	ug/L	0.47	1	3.		
	Zinc	7/13/2010	18.3	ug/L	0.4	10	1050.		
MW-14									
	1,4-Dichlorobenzene	7/8/2010	2.7	ug/L	0.33	1	6.		
	cis-1,2-Dichloroethene	7/8/2010	10.9	ug/L	0.19	5	70.		
	Cobalt	7/8/2010	183.	ug/L	0.6	10			70
	Zinc	7/8/2010	17.3	ug/L	0.4	10	1050.		

TABLE 7
RECENT GROUNDWATER SAMPLE DETECTIONS

Alexander County MSWLF
Taylorsville, NC
MESCO Project No. 607063.0
December 20, 2010

Well ID	Parameter Name [1]	Sample Date	Result	Unit	MDL [2]	SWSL [3]	2L [4]	2B [5]	GWP [6]
MW-15									
	Benzene	**7/8/2010**	**3.4**	**ug/L**	**0.25**	**1**	**1.**		
	cis-1,2-Dichloroethene	7/8/2010	8.5	ug/L	0.19	5	70.		
	Cobalt	7/8/2010	13.8	ug/L	0.6	10			70
	Mercury	**7/8/2010**	**16.2**	**ug/L**	**0.4**	**1**	**1.05**		
	Mercury	8/12/2010	0.62j	ug/L	0.4	1	1.05		
MW-16									
	1,1-Dichloroethane	**7/14/2010**	**11.9**	**ug/L**	**0.32**	**5**	**6.**		
	1,2-Dichloropropane	**7/14/2010**	**1.1**	**ug/L**	**0.27**	**1**	**0.6**		
	1,4-Dichlorobenzene	7/14/2010	2.5	ug/L	0.33	1	6.		
	Benzene	**7/14/2010**	**3.7**	**ug/L**	**0.25**	**1**	**1.**		
	cis-1,2-Dichloroethene	7/14/2010	18.	ug/L	0.19	5	70.		
	Cobalt	7/14/2010	17.9	ug/L	0.6	10			70
	Tetrachloroethene	**7/14/2010**	**2.8**	**ug/L**	**0.46**	**1**	**0.7**		
	Trichloroethene	**7/14/2010**	**3.5**	**ug/L**	**0.47**	**1**	**3.**		
MW-17									
	Benzene	**7/7/2010**	**1.2**	**ug/L**	**0.25**	**1**	**1.**		
	Cobalt	7/7/2010	12.9	ug/L	0.6	10			70
	Zinc	7/7/2010	21.1	ug/L	0.4	10	1050.		
MW-18									
	Chromium	**7/8/2010**	**22.6**	**ug/L**	**0.4**	**10**	**10.**		
	Cobalt	7/8/2010	22.2	ug/L	0.6	10			70
	Copper	7/8/2010	43.1	ug/L	0.3	10	1000.		
	Vanadium	7/8/2010	38.6	ug/L	0.2	25			3.5
	Zinc	7/8/2010	38.8	ug/L	0.4	10	1050.		
MW-21									
	Zinc	7/7/2010	24.4	ug/L	0.4	10	1050.		
MW-22									
	Vanadium	7/7/2010	4.1j	ug/L	0.2	25			3.5
MW-24									
	1,4-Dichlorobenzene	7/12/2010	1.6	ug/L	0.33	1	6.		
	Chromium	**7/12/2010**	**12.9**	**ug/L**	**0.4**	**10**	**10.**		
	Cobalt	7/12/2010	15.	ug/L	0.6	10			70
	Vanadium	7/12/2010	7.5j	ug/L	0.2	25			3.5
	Zinc	7/12/2010	21.5	ug/L	0.4	10	1050.		
MW-26									
	1,4-Dichlorobenzene	**7/14/2010**	**6.5**	**ug/L**	**0.33**	**1**	**6.**		
	Benzene	**7/14/2010**	**3.2**	**ug/L**	**0.25**	**1**	**1.**		
	cis-1,2-Dichloroethene	7/14/2010	29.8	ug/L	0.19	5	70.		
	Cobalt	7/14/2010	145.	ug/L	0.6	10			70
	Thallium	7/14/2010	3.3j	ug/L	3	5.5			0.28
	Zinc	7/14/2010	31.6	ug/L	0.4	10	1050.		

TABLE 7
RECENT GROUNDWATER SAMPLE DETECTIONS

Alexander County MSWLF
Taylorsville, NC
MESCO Project No. 607063.0
December 20, 2010

Well ID	Parameter Name [1]	Sample Date	Result	Unit	MDL [2]	SWSL [3]	2L [4]	2B [5]	GWP [6]
MW-27									
	cis-1,2-Dichloroethene	7/13/2010	24.6	ug/L	0.19	5	70.		
SW-5									
	Cobalt	7/7/2010	14.5	ug/L	0.6	10		270	

NOTES:

[1] Table contains only Appendix I constituents detected above SWSL, GWP, 2L, or 2B

[2] MDL = Method Detection Limit

[3] SWSL = Solid Waste Section Reporting Limit (Current as of Sampling Event)

[4] 2L = North Carolina 15A NCAC 2L Groundwater Qualtity Standard (Current as of Sampling Event)

[6] 2B = North Carolina 15 NCAC 2B Surface Water Quality Standard for this Specific Stream Classification

[7] GWP = Groundwater Protection Standard (Current as of Sampling Event)

[J] =The reported value is between the laboratory method detection limit (MDL) and the laboratory method reporting adjusted for actual sample preparation data and moisture content, where applicable.

A = Artifact Contamination from Field &/or Laboratory. Confirmed by subsequent verification event.

BOLD = Concentration > 2L, or 2B Standard (Current as of Sampling Event)

TABLE 9
TIMELINE/INJECTION SCHEDULE

Alexander County MSWLF
Taylorsville, NC
MESCO Project No. G07063.0
December 20, 2010

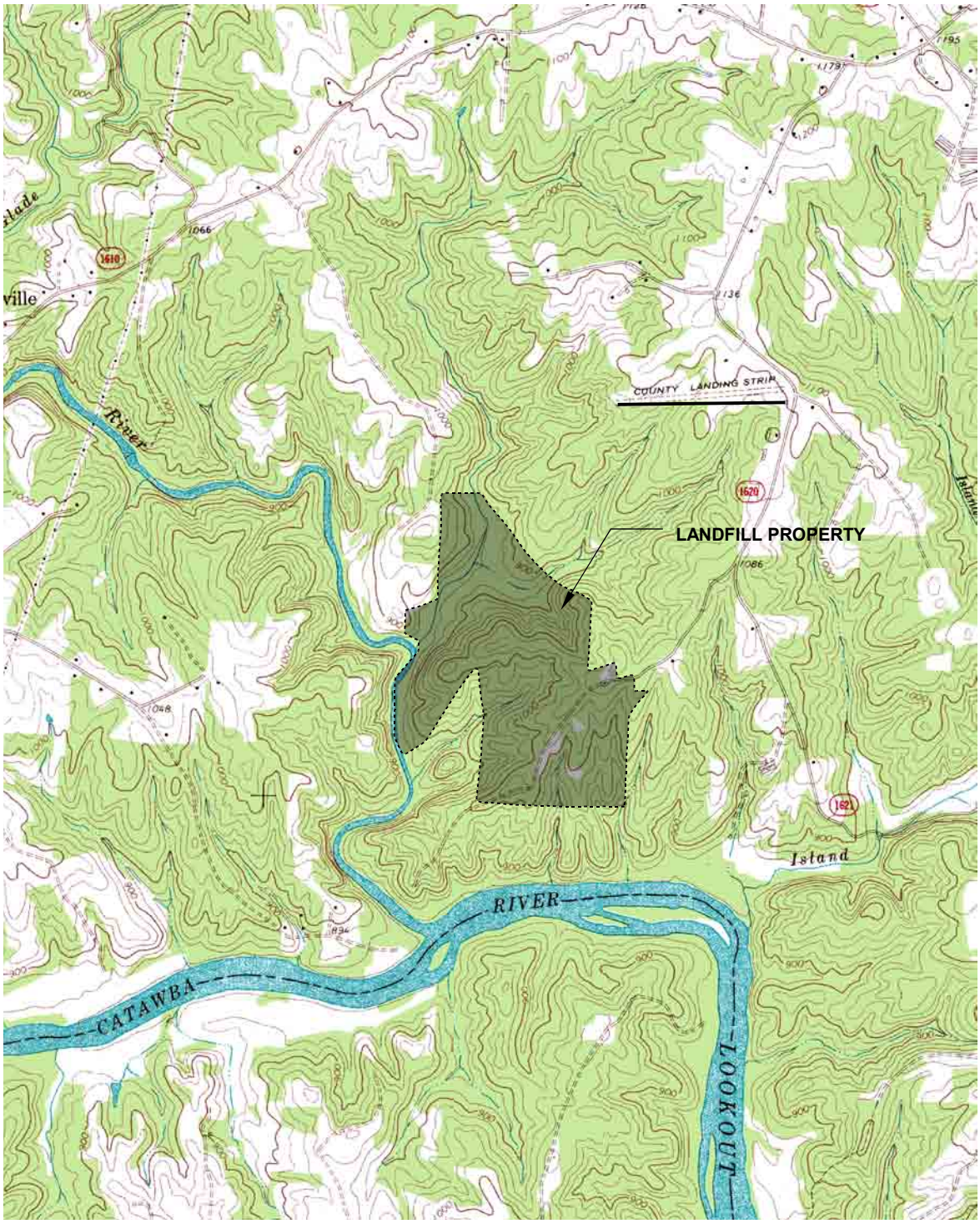
DATE	EVENT DESCRIPTION
May 2009	Monitoring well installation, tree thinning for phytoremediation & hybrid willow planting.
August 2010	Submit UIC Permit Application
October 2010	UIC Permit # WI 0300160 Issued
January 2011	**BAC-9™ Injection at IW-1**
February 2011	Injection Event Report (~30 days after injection)
June 2011	Semi-Annual Water Quality Sampling Event
December 2011	Semi-Annual Water Quality Sampling Event
January 2012	**EOS® Injection at IW-1**
February 2012	Initial Summary Report
February 2012	Injection Event Report (~30 days after injection)
June 2012	Semi-Annual Water Quality Sampling Event
December 2012	Semi-Annual Water Quality Sampling Event
January 2013	**EOS® Injection at MW-5 Barrier Wall**
February 2013	Injection Event Report (~30 days after injection)
June 2013	Semi-Annual Water Quality Sampling Event
December 2013	Semi-Annual Water Quality Sampling Event
June 2014	Semi-Annual Water Quality Sampling Event
December 2014	Semi-Annual Water Quality Sampling Event
March 2015	**MNA Effectiveness /Evaluation and Report. MNA Analytical Requirement Modifications.**

Plates

Topographic Map with Landfill Location

PLATE 1

Alexander County Landfill



QUADRANGLE LEGEND

ROAD CLASSIFICATION

Primary highway, hard surface

Light-duty road, hard or improved surface

Secondary highway, hard surface

Unimproved road

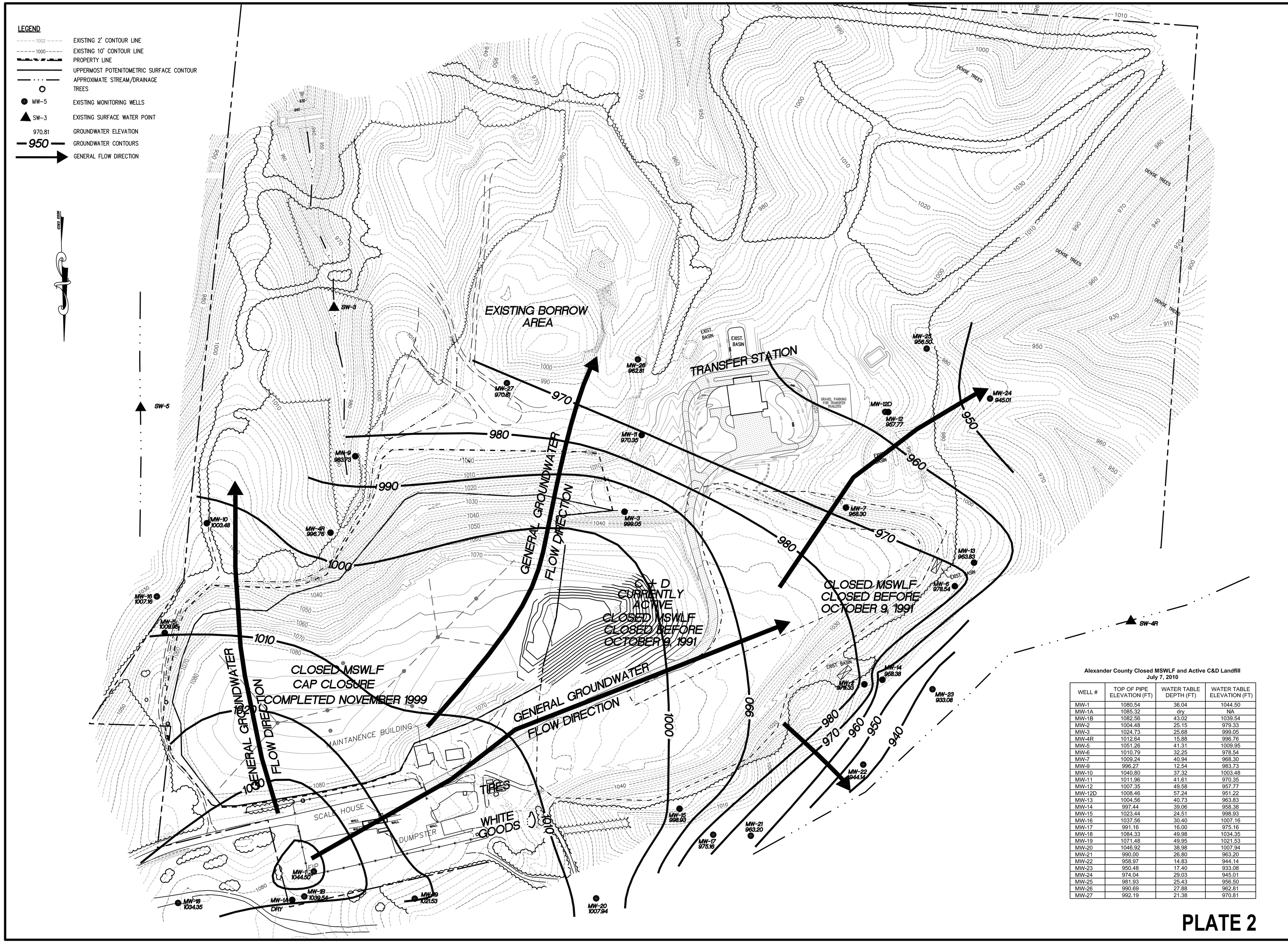
Interstate Route U. S. Route State Route

NOTE: Topographical map assembled from corresponding USGS 7.5-min. quadrangles of the subject region.

Date Completed	08/04/2008
Created By	M. German
Project Name	Corrective Action Plan
Site Name	Alexander County Landfill
Project Number	G07060.0

Municipal Engineering Services Company, PA

0 1/2 1 MILE



Alexander County Closed MSWLF and Active C&D Landfill
July 7, 2010

WELL #	TOP OF PIPE ELEVATION (FT)	WATER TABLE DEPTH (FT)	WATER TABLE ELEVATION (FT)
MW-1	1080.54	36.04	1044.50
MW-1A	1085.32	dry	NA
MW-1B	1082.56	43.02	1039.54
MW-2	1004.48	25.15	979.33
MW-3	1024.73	25.68	999.05
MW-4R	1012.64	15.88	996.76
MW-5	1051.26	41.31	1009.95
MW-6	1010.79	32.25	978.54
MW-7	1009.24	40.94	968.30
MW-9	996.27	12.54	983.73
MW-10	1040.80	37.32	1003.48
MW-11	1011.96	41.61	970.35
MW-12	1007.35	49.58	957.77
MW-12D	1008.46	57.24	951.22
MW-13	1004.56	40.73	963.83
MW-14	997.44	39.06	958.38
MW-15	1023.44	24.51	998.93
MW-16	1037.56	30.40	1007.16
MW-17	991.16	16.00	975.16
MW-18	1084.33	49.98	1034.35
MW-19	1071.48	49.95	1021.53
MW-20	1046.92	38.98	1007.94
MW-21	990.00	26.80	963.20
MW-22	958.97	14.83	944.14
MW-23	950.48	17.40	933.08
MW-24	974.04	29.03	945.01
MW-25	981.93	25.43	956.50
MW-26	990.69	27.88	962.81
MW-27	992.19	21.38	970.81

PLATE 2

Municipal Services Engineering Company, P.A.
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393

ACTIVE C and D OVER CLOSED MSW LANDFILL FACILITY
ALEXANDER COUNTY NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION

SINGLE DAY POTENTIOMETRIC MAP (UPPERMOST AQUIFER) 07/07/10

SCALE: 1" = 100'
DATE: 09/14/10
DRWN. BY: J PFOHL
CHKD. BY: M. BROWN
PROJECT NUMBER G10003
DRAWING NO. PLATE 2
SHEET NO. 1 OF 1

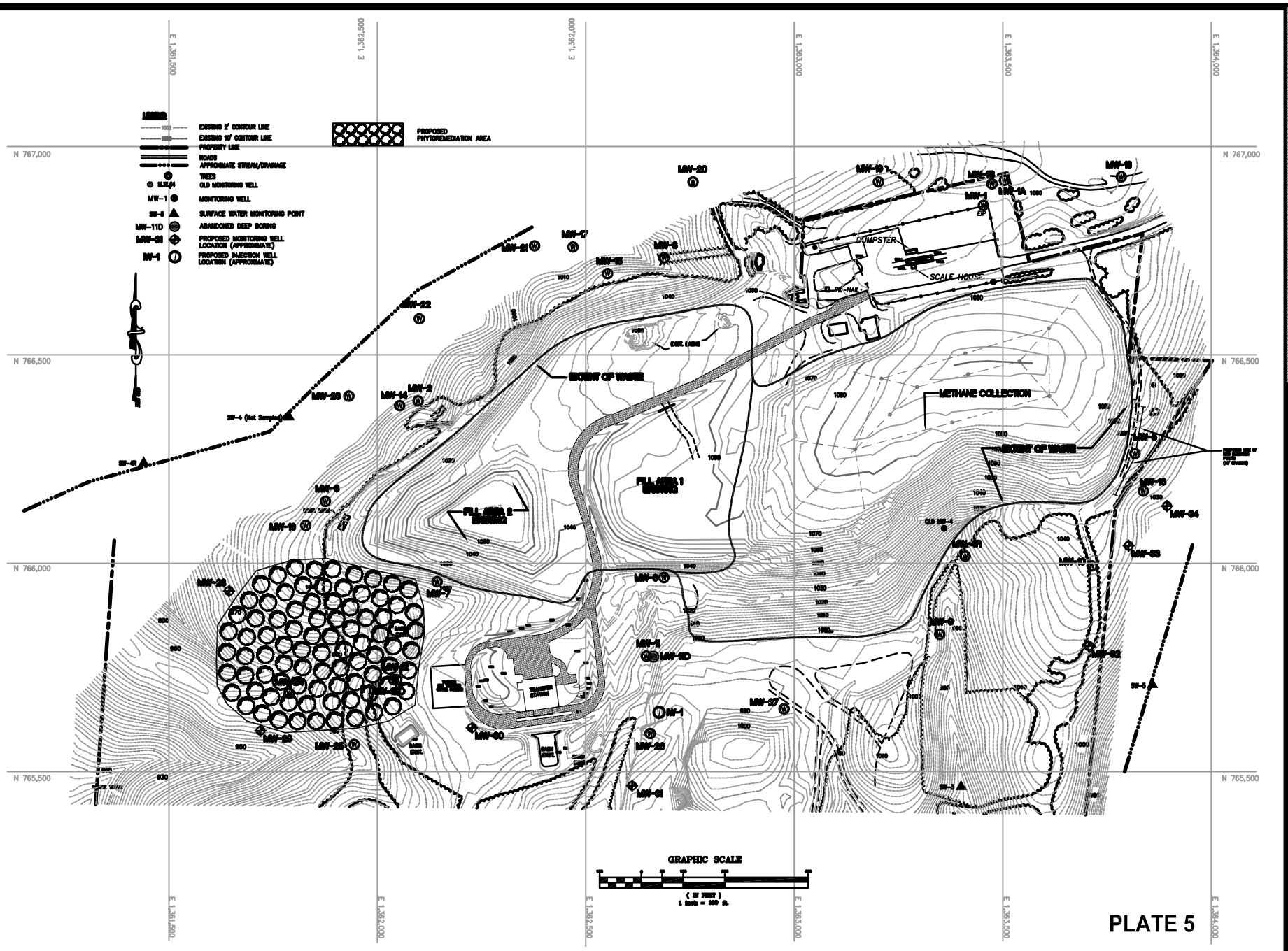


PLATE 5

Municipal Services Engineering Company, P.A.

LICENSE NUMBER: C-1281

CONSTRUCTION AND DEMOLITION LANDFILL FACILITY
ALEXANDER COUNTY
NORTH CAROLINA

REMEDIATION AREA MAP

SCALE: 1" = 100'
DATE: 9/20/99
DRAWN BY: R. KERNS
CHECK BY: R. KERNS
PROJECT NUMBER: 610229.0

DRAWING NO. PLATE 5 | SHEET NO. 1 OF 1

APPENDIX B

Groundwater and Surface Water Sampling and Analysis Plan

Groundwater and Surface Water Sampling and Analysis Plan

Prepared for

Alexander County C&D Landfill
Taylorsville, North Carolina

MESCO Project Number: G07060.0

This report is included as Appendix B the
Corrective Action Plan completed for Alexander County.
Revision 2 prepared on 12/20/2010
[Revisions bracketed and underlined]

Municipal Services Garner, NC — Engineering Company, P.A. Boone, NC

Municipal Engineering Services Company, P.A.
Garner, Boone and Morehead City, North Carolina

NORTH CAROLINA LICENSED GEOLOGIST STEPHEN MARK BROWN 1711 12/20/10

Stephen Mark Brown, LG, PG

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1.4 Sampling Containers 3

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[SINCE THE INFORMATION LISTED BELOW WAS NOT MODIFIED AS PART OF THIS ADDENDUM, PLEASE REFER TO THE ORIGINAL SAP.]

TABLES

Table E-1 ..... Summary of Ground and Surfacewater Monitoring Points

PLATES

Plate A ..... Topographic Map
Plate B ..... Site Map with Monitoring Locations
Plate C ..... Typical Monitoring Well
Plate D ..... Graphical Plot of Standing Volumes of Water

ATTACHMENTS

Attachment 1 ..... NCDENR Solid Waste Section Sampling & Monitoring Guidance

1 INTRODUCTION

1.1 Objective

The objective of the Groundwater and Surface Water Sampling and Analysis Plan (SAP) is to provide clear guidelines and procedures for field and laboratory personnel when obtaining and testing ground and surface water samples. This plan is an update, and supersedes the November 1995 SAP for the Alexander County C&D landfill on top of MSW landfill. The sampling procedures outlined in this analysis plan are guidelines by which sampling will be performed. Deviation from the procedures may be warranted depending on facility conditions or unforeseen sampling variables. Alternative sampling procedures must conform to the N.C. Water Quality Monitoring Guidance Document for Solid Waste Facilities (Guidance Document). Copies of the NCDENR Solid Waste Section technical guidelines for sampling and monitoring are presented in the **Attachments**.

All groundwater and surfacewater monitoring points shall be sampled semi-annually for the constituents listed in Appendix I [and or Appendix II –listed constituents as promulgated in 15A NCAC 13B]. In addition to the Appendix I constituents monitoring wells MW-3, MW-6, MW-7, MW-11, MW-12, MW-12D, MW-13, MW-24, MW-25, MW-26, MW-27, MW-28, MW-29, MW-31, MW-33, and MW-34 will be sampled for the following suite of Monitored Natural Attenuation (MNA) parameters.

MNA Performance Parameters		
Parameter	**Analysis Type**	**Analytical Method**
Dissolved Oxygen (DO)	Field Reading	Multi-parameter Field Instrument w/ flow-through cell
pH	Field Reading	
Oxidation-Reduction Potential (ORP)	Field Reading	
Turbidity	Field Reading	
Conductivity	Field Reading	
Temperature	Field Reading	
Dissolved CO_2	Field Reading	Field Instrument / Hach Kit
Alkalinity (Total as $CaCO_3$)*	Laboratory/Field*	EPA 310.2
Chloride*	Laboratory/Field*	SM 4500-CLB
Iron	Laboratory	SM3111B
Nitrate*	Laboratory/Field*	EPA 353.2 / SM 2320B
Sulfate*	Laboratory/Field*	EPA 375.4 / SM 4500-SO4E
Sulfide*	Laboratory/Field*	EPA 376.1 or SM 4500SE
TOC/BOD/COD	Laboratory	EPA 415.1 / EPA 405.1 / EPA 410.1
Methane	Laboratory	RSK 175
Ethane, Ethene	Laboratory	RSK 175
Hydrogen	Laboratory	AM19GA
Volatile Fatty Acids	Laboratory	AM23G
*For budgetary considerations these analyses may be performed in the field using Hach® brand color wheel test kits. Historical iron concentrations have exceeded Hach kit quantitation limits.		

1.2 Water Quality Monitoring Summary

The nature of the groundwater flow, geology, location of creeks, and close proximity of several drainage features will require extensive monitoring for early detection of a release. The monitoring plan consists of thirty (30) monitoring wells (MW-1 through MW-3, MW-4R, MW-5 through MW-27, MW-1A, MW-1B, MW-12D) and three (3) surfacewater monitoring points (SW-3, SW-4R and SW-5). Monitoring points included in this plan are summarized in **Table E-1**. A topographic map is provided as **Plate A**. Locations of monitoring points are shown on **Plate B**.

Monitoring well MW-1 is the original background well located upgradient of the landfill. It has since been replaced with upgradient background wells MW-1A, MW-1B, and recently by MW-18. MW-5, MW-16, and MW-10 are downgradient wells utilized for the detection of a release from the northeastern portion of the landfill. MW-4R and MW-9 are downgradient wells installed on the southeastern half of the landfill. MW-3 is a downgradient monitoring well located just outside of the waste limit in the center of the landfill, selected based on the southerly flow of groundwater in the northern portion of the landfill. MW-11, MW-26, and MW-27 are also downgradient wells positioned to monitor the center of the landfill. MW-7, MW-12, MW-24, and MW-25 are southwestern, downgradient monitoring wells, positioned to intersect the more southerly flow from the northern portion of both units. Monitoring well MW-12D is utilized for monitoring the bedrock aquifer. MW-6 and MW-13 are downgradient monitoring wells located on the western side of the landfill, positioned to detect a release flowing in the direction of the tributary of the Catawba River. MW-2 and MW-14 are downgradient monitoring wells on the western portion positioned to monitor groundwater flow from the northern portion prior to reaching the property line. MW-8 is a downgradient monitoring well located in the northern portion of the landfill. MW-21, MW-22, and MW-23 are newly installed wells along the northwestern side of the landfill positioned to monitor groundwater before reaching the tributary of the Catawba River. Monitoring wells MW-8, MW-15, and MW-17 are located north of the landfill and are positioned to monitor a release flowing in the direction of the tributary of the Catawba River. MW-19 is a new well located slightly off the property north of the facility as a downgradient monitoring well. MW- 20 is a downgradient monitoring well located north of the facility.

Surfacewater sampling point SW-3 is located south of the landfill downstream on a tributary of the Catawba River. Surfacewater sampling point SW-4R is located downstream of the landfill on a tributary of the Little River where it flows past the landfill on the northwestern side. Surfacewater sampling point SW-5 is located along another tributary of the Catawba River on the eastern side. Surfacewater sampling locations are shown in **Plate B**.

[Water Quality] Monitoring

[Water Quality] monitoring will be performed on MW-1, MW-1A, MW-1B, MW-2, MW-4R, MW-8, MW-9, MW-10, MW-14, MW-15, MW-17, MW-18, MW-19, MW-20, MW-21, MW-22 and MW-23. [Water Quality] monitoring will consist of the collection of groundwater for analysis for the Appendix I [and or Appendix II –listed constituents as promulgated in 15A NCAC 13B]. In addition field parameters including dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, temperature, turbidity, and conductivity will also be collected.

[Natural Attenuation] Monitoring

As indicated in the *Corrective Action Plan*, [natural attenuation] monitoring will be performed on monitoring wells MW-3, MW-5, MW-6, MW-7, MW-11, MW-12, MW-12D, MW-13, MW-16, MW-24, MW-25, MW-26, and MW-27.

1.3 Sampling Equipment

Groundwater purging and sampling will be performed using a submersible pump and disposable polyethylene bailers. A new bailer will be used to sample each individual well. *Under no circumstance will a disposable bailer used to sample a given well be used to sample any remaining well.* The following procedure will be used decontaminate the submersible pump:

1. Phosphate-free detergent & de-ionized or distilled water rinse.
2. De-ionized or distilled water rinse.
3. Isopropyl alcohol (isopropanol) rinse.
4. De-ionized or distilled water rinse.

At least one (1) equipment blank will be collected during pump decontamination procedures to ensure that cross-contamination has not occurred as a result of the decontamination process. The standard equipment necessary to conduct sampling for each well consists of sample containers (including trip blanks and equipment blanks), one wide-mouth container, at least one 100-ft spool of nylon twine, at least one box of disposable latex/nitrile gloves, temperature/pH/ORP/conductivity indicator, water level indicator, storage coolers, and ice. All equipment subject to damage and contamination will be transported in sealed, plastic bags or storage containers. The water level indicator will be decontaminated in accordance with Steps 2 and 3 described above prior to placement in a clean plastic bag or storage container.

1.4 Sampling Containers

Samples will be collected for the various analyses in laboratory-supplied containers. Each sample container will be clearly labeled providing the following information: site name, county location, sample identification number, parameters to be analyzed, preservative added, date and time of sampling, and initials of the sampler.

All sample containers will be obtained from an independent laboratory in a sterilized condition and with the appropriate, method-specific preservative. Care will be taken by the field technician to not allow the preservative to wash out of the sample containers during sampling.

[Water Quality] Sampling Containers

Samples to be analyzed for VOC concentrations will be collected into three 40-ml glass vials with Teflon septa caps. The sample vials will be completely filled with zero headspace in the vials. Samples to be analyzed for inorganic compound concentrations will be collected into 1-liter polyethylene containers, with ½ inch space for air permitted. All sample containers will be obtained from an independent laboratory in a sterilized condition. Some of the containers will have a pre-measured amount of preservative in them as necessary. In this event, care will be taken not to rinse the container or to allow the preservative to wash out during sampling.

MNA Sampling Containers

Groundwater samples to be analyzed for MNA performance parameters will be collected into the container types listed in the table below.

MNA Parameter	Volume	Bottle Type	Preservative
Alkalinity	250 mL	Plastic	none; cool to 4°C
Chloride	125 mL	Plastic	none; cool to 4°C
TOC/COD	250 mL	Glass	Sulfuric acid (H_2SO_4)
BOD	500 mL	Polyethylene	none; cool to 4°C
Iron	125 mL	Plastic	Nitric acid (HNO_3)
Nitrate	125 mL	Plastic	Sulfuric acid (H_2SO_4)
Sulfate	125 mL	Plastic	none; cool to 4°C
Sulfide	250 mL	Glass	Sodium hydroxide (NaOH)
Methane/Ethane/Ethene	125 mL	Plastic	none; cool to 4°C
Hydrogen	-	-	proprietary lab sampler
Volatile Fatty Acids	40 mL	Glass	Hydrochloric Acid (HC1)

2 SAMPLING

Wells will be sampled from upgradient to downgradient; or when previous analytical data is available, from least to greatest contamination. This procedure is required to limit the potential of cross contamination between sampling points.

2.1 Set-Up

A clean sheet of plastic will be placed around the well to provide a clean surface for sampling equipment. The total well depth read from the well tag and the measured depth to water, determined using the water level indicator, will be used to compute the depth of water in the well. The total well depth will be measured and compared to the depth indicated on the well tag as a check for silt buildup or blockage at depth.

All meters used to monitor purge parameters will be calibrated immediately prior to purging and sampling, and those readings recorded in a field logbook. Entries will always include pre- and post-calibration readings as well as the model and serial number of the equipment and the date, time, and person performing the calibration(s). Two standards, which bracket the average or suspected measurements for pH and specific conductance, will be used at the site. Since natural waters (including those impacted by environmental contaminants) tend to have pH values less than 7.0, pH buffers of 4.0 and 7.0 will typically be used for instrument calibration.

Disposable nitrile gloves will be worn by the field technician during sampling to minimize the risk of personal exposure to potentially harmful chemical substances and to minimize the risk of sample cross-contamination. Fresh pairs of nitrile gloves will be worn during each purge and sampling event. The groundwater samples will be transferred from the bailers into method-specific and appropriately preserved containers and placed into a clean cooler containing ice to chill the samples to a temperature of approximately 4°C.

Indicator parameters such as pH, temperature and specific conductance will be measured during purging as an indication that groundwater representative of the formation surrounding a given well is being sampled. Purging is considered complete when at least three well volumes have been purged and indicator parameters have stabilized such that three successive readings vary by no more than 10%. Purging may need to be continued beyond five well volumes if indicator parameters have not stabilized. All information will be recorded on a field data sheet or in a field logbook with copies submitted to the Division of Waste Management with the analytical results.

2.2 Purging

Each well will be purged of approximately three (3) to five (5) volumes of standing water and allowed to settle prior to collection of groundwater samples. If the well should go dry and not recharge before the requisite well volumes are removed, the well will be allowed to recharge and a sample will be collected within 24 hours of the initial purging. The amount of standing water will be calculated by first subtracting the depth-to-water from total well depth. The amount of water in the well (in gallons) will then be determined by using the chart on **Plate C**. For example, a two-inch well that is 29 feet deep and contains 19 feet of standing water will have a well volume of ~3.3 gallons.

After determination of the amount of water to be purged from a given well, the equipment necessary for purging will be assembled at the well. The disposable bailer will be maintained in a stable, upright position while the upper portion of the plastic wrapping will be pulled away to expose only the eyelet used for securing twine to the bailer. After the twine has been secured to the bailer with gloved hands, the bailer will be suspended as the remaining plastic is removed. The bailer will be lowered slowly into the well until the bailer contacts groundwater. The bailer twine will then be cut to an adequate length and secured to prevent loss of the bailer in the well. At no time during purging will the bailer twine be allowed to touch the ground. In order to not allow the twine to touch the ground during purging, the twine will be collected when raising the bailer either by loops gathered in one hand or by alternating hand-to-hand as the bailer is pulled from the well. When purging deep wells (in excess of 40 feet), the ground and the well head may be covered with a clean plastic bag or sheet of plastic with a slit cut to allow the plastic to slide over the well head. This will be a separate sheet of plastic from the one used for the sampling equipment.

2.3 Groundwater Sample Collection

The bailer will be lowered slowly into the well to avoid volatilization of any dissolved-phase compounds that may be present in the groundwater. Once full, the bailer will be retrieved and containers filled by emptying the water through the hole at the bottom of the bailer. Glass 40-mL vials for VOC analyses will be filled in such a manner as to produce zero headspace in the vials. Polyethylene containers for metals analyses will be filled and sealed with the cap, leaving about ½-inch of airspace at the top. In addition to collecting the samples, water will be collected in the wide-mouth container for pH, temperature, and conductivity measurements. Upon completion of sampling, all groundwater samples, including equipment and trip blanks, will be placed in labeled and sealed plastic bags and stored in ice-filled coolers to chill the samples to 4°C pending transport to a NCDENR-certified analytical laboratory. Contaminated nitrile gloves and twine will be discarded.

2.4 Surface Water Sample Collection

Surfacewater sampling will be taken with given consideration to minimize turbulence and aeration. As during groundwater sampling, surfacewater samples will be collected by a field technician wearing disposable gloves. Containers will be dipped at sampling location points by gently dipping the sample container into surfacewater and allowing surfacewater to flow over the mouth of container so as not to displace any preservative within the sample container. If there is little current movement, the container will be moved slowly through the water laterally. During times of low water, if the water is not deep enough to allow filling of sample containers, an appropriately decontaminated sampling cup will be used to retrieve the sample. All containers will be treated in the same manner as the groundwater samples. The samples will be sealed in labeled, plastic bags, and stored in an ice-filled cooler to chill the samples to 4°C pending transport to a NCDENR-certified analytical laboratory.

2.5 Chain of Custody

Chain-of-custody forms will be used to document the handling of all samples collected and listing all individuals who have taken possession of a given set of samples, including field personnel, laboratory couriers, and laboratory personnel. Trip blanks, equipment blanks, and sample containers will all travel and be stored together. Trip blanks will remain in the condition they are received from the laboratory and will not be opened or tampered with during the sampling. A chain-of-custody record will be completed for each day's samples, indicating the date and time, sample location, sample matrix (soil, water, etc.), and laboratory analyses to be conducted.

3 ANALYSIS

When the water samples reach the laboratory, they will be transferred to a sample custodian who will sign the chain of custody documentation as receipt of the samples. Internal control of the water samples in the laboratory will be in accordance with QA/QC procedures for the laboratory. Copies of QA/QC manuals for approved laboratories are on file at the Division of Solid Waste.

Groundwater and surface water samples will be analyzed for the Appendix I list of constituents; QA/QC procedures utilized during the testing will be in conformance with the laboratory QA/QC manual. Monitoring wells MW-3, MW-5, MW-6, MW-7, MW-11, MW-12, MW-12D, MW-13, MW-16, MW-24, MW-25, MW-26, MW-27, MW-28, MW-29, and MW-31 through MW-34 will be sampled for the Appendix I [<u>and or Appendix II –listed constituents as promulgated in 15A NCAC 13B</u>] and the aforementioned MNA performance parameters.

4 CONCLUSION

This report is included as part of the Corrective Action Plan for the Alexander County C&D Landfill. The ground and surfacewater monitoring plan is designed to be effective in the early detection of any possible release of hazardous constituents to the unconfined surficial and upper bedrock aquifers, and to provide indicator parameters of the natural degradation, EOS® and BAC-9™ injection, and phytoremediation processes.

Table E-1. Summary of Ground and Surface Water Monitoring Points

Sampling Point	Type	Gradient	Total Depth (ft)	Designation
MW-1	Monitoring Well	Down	40	Performance Well
MW-1A	Monitoring Well	Up	47.5	Monitoring Well
MW-1B	Monitoring Well	Up	61	Performance Well
MW-2	Monitoring Well	Down	30	Monitoring Well
MW-3	Monitoring Well	Down	33	Performance Well
MW-4R	Monitoring Well	Down	20.5	Monitoring Well
MW-5	Monitoring Well	Down	48.8	Monitoring Well
MW-6	Monitoring Well	Down	41	Monitoring Well
MW-7	Monitoring Well	Down	53	Monitoring Well
MW-8	Monitoring Well	Down	27.5	Background Well
MW-9	Monitoring Well	Down	31.5	Monitoring Well
MW-10	Monitoring Well	Down	91	Monitoring Well
MW-11	Monitoring Well	Down	56	Performance Well
MW-12	Monitoring Well	Down	66.5	Performance Well
MW-12D	Monitoring Well	Down	100	Performance Well
MW-13	Monitoring Well	Down	60.5	Monitoring Well
MW-14	Monitoring Well	Down	40.5	Monitoring Well
MW-15	Monitoring Well	Down	35	Monitoring Well
MW-16	Monitoring Well	Down	40.25	Performance Well
MW-17	Monitoring Well	Down	22.3	Monitoring Well
MW-18	Monitoring Well	Up	56.7	Background Well
MW-19	Monitoring Well	Down	63.92	Monitoring Well
MW-20	Monitoring Well	Down	63.55	Monitoring Well
MW-21	Monitoring Well	Down	41.05	Monitoring Well
MW-22	Monitoring Well	Down	18.12	Monitoring Well
MW-23	Monitoring Well	Down	21.54	Monitoring Well
MW-24	Monitoring Well	Down	35.35	Monitoring Well
MW-25	Monitoring Well	Down	44.48	Background Well
MW-26	Monitoring Well	Down	49.8	Monitoring Well
MW-27	Monitoring Well	Down	49.82	Monitoring Well
*MW-28**	Monitoring Well	Down	~40	Sentinel/Compliance Well
*MW-29**	Monitoring Well	Down	~40	Sentinel/Compliance Well
*MW-30**	Monitoring Well	Down	~50	Monitoring Well
*MW-31**	Monitoring Well	Down	~50	Sentinel Well
*MW-32**	Monitoring Well	Down	~50	Sentinel Well
*MW-33**	Monitoring Well	Down	~50	Sentinel Well
*MW-34**	Monitoring Well	Down	~50	Sentinel Well
SW-3	Surface Water	Down Stream		Tributary
SW-4R	Surface Water	Down Stream		Tributary
SW-5	Surface Water	Down Stream		Tributary

**Proposed monitoring well to be installed by end of 2010.*

APPENDIX C

EOS Remediation

Michael F. Easley, Governor

William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Alan W. Klimek, P.E. Director
Division of Water Quality

January 25, 2007

Gary Birk
Director of Marketing & Sales
EOS Remediation, Inc.
1101 Nowell Road
Raleigh, NC 27607

Subject: EOS® Remediation Product Line Risk Assessment

Dear Mr. Birk,

In response to our conversations over the past week regarding risk evaluation for the EOS® product line, you stated that the product, EOS® that was originally approved in 2003 has been renamed to EOS® 598B42. From my conversation today with Dr. Luanne Williams of the Division of Public Health, Epidemiology Section the products EOS® 400, EOS® 450, EOS® 598, EOS® 600 and EOS® 600EX can all be considered approved under the original approval for EOS® now called EOS® 598B42. This approval stems from the similarities in the formulation noted from her inspection of the product literature at the EOS® Remediation Inc. web site: http://www.eosremediation.com/literature/EOS_Family_of_%20Products.html.

If you have any questions regarding this letter, please contact me at (919) 715-6164 or Peter.Pozzo@NCmail.net.

Sincerely,

Peter Pozzo
Hydrogeologist
Aquifer Protection Section

cc: UIC Files
Dr. Luanne Williams, Epidemiology Section

Aquifer Protection Section
Internet: http://h2o.enr.state.nc.us

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Michael F. Easley, Governor
Dempsey Benton, Secretary

Leah Devlin, DDS, MPH
State Health Director

January 18, 2008

MEMORANDUM

TO: Qu Qi
Underground Injection Control Program
Aquifer Protection Section

FROM: Luanne K. Williams, Pharm.D., Toxicologist
Medical Evaluation and Risk Assessment Unit
Occupational and Environmental Epidemiology Branch
North Carolina Department of Health and Human Services

SUBJECT: Use of a Biological Product BAC-9® to Enhance Biodegradation of Groundwater Contaminated with Chlorinated Compounds

I am writing in response to a request for a health risk evaluation regarding the use of use of a biological product BAC-9 ® to enhance biodegradation of groundwater contaminated with chlorinated compounds. Based upon my review of the information submitted, I offer the following health risk evaluation:

PRECAUTIONS DURING APPLICATION

1. The microorganisms in BAC-9® are naturally found in soil. These microorganisms are not ordinarily associated with infection in healthy humans (except through an existing wound). However, these microorganisms may cause infection in the young, the aged, and immunocompromised such as individuals with AIDS, cancer, hepatitis, or with individuals following dialysis or surgical procedures. In addition, some of the ingredients within the BAC-9 ® product have been known to cause eye, skin, and lung irritation.

2. Also, be aware that mixing potassium with some of the metal and acid ingredients listed in the product have been reported to be possibly explosive. Care should be taken to review the MSDS sheets for each ingredient listed to ensure that there would be no explosive hazard.

3. If the products are released into the environment in a way that could result in a suspension of fine solid or liquid particles (e.g., grinding, blending, vigorous shaking or mixing), then it is imperative that proper personal protective equipment be used. The application process should be reviewed by an industrial hygienist to ensure that the most appropriate personal protective equipment is used.

4. Persons working with this product should at least wear goggles or a face shield, gloves, and protective clothing. Face and body protection should be used for anticipated splashes or sprays. Again, consult with an industrial hygienist to ensure proper protection.

5. Eating, drinking, smoking, handling contact lenses, and applying cosmetics should never be permitted in the application area during or immediately following application. Safety controls should be in place to ensure that the check valve and the pressure delivery systems are working properly.

6. The Material Safety Data Sheets should be followed to prevent adverse reactions and injuries.

7. Access to the area of application should be limited to the workers applying the product. In order to minimize exposure to unprotected individuals, measures should be taken to prevent access to the area of application.

8. Efforts should be made to prevent contamination of existing or future wells and surface water that may be located near the application area.

Please do not hesitate to call me if you have any questions at (919) 707-5912.

cc: Dr. Robert Steffan
Shaw Environmental, Inc.
17 Princess Road
Lawrenceville, NJ 08648

Mr. Gary Birk
Ms. Susan Bostian
EOS Remediation, Inc.
1101 Nowell Road
Raleigh, NC 27607

EOS Remediation, LLC

Formulations

EOS® Family of Proven Products

EOS Remediation's family of soybean oil emulsions / emulsified vegetable oil (EVO™) includes several product formulations. Selecting the appropriate product for your project is important. The comparison chart below provides information needed to compare and understand each product offering.

Ingredients / Composition	EOS® 450 (% by Weight)	EOS® 598 (% by Weight)	EOS® 598B42 (% by Weight)
Soybean Oil (food grade)	49.9 ± 2%	59.8 ± 2%	59.8 ± 2%
Long Chain Fatty Acids	0.9 ± 0.2%	0	0
Fast Release Soluble Substrate	4 ± 0.2%	4 ± 0.2%	4 ± 0.2%
Food Additives / Emulsifiers / Preservatives	10.1 ± 0.2%	10.1 ± 0.2%	10.1 ± 0.2%
Extracts	No	No	2 ± 0.2%
Water	Balance	Balance	Balance
Percent Organic, by weight	63 ± 2%	72 ± 2%	74 ± 2%
EOS® Vitamin B_{12} Supplement	No	No	Yes

*EOS Remediation reserves the right to change Product specifications and formulations without notice and without liability for such changes.

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EOS Remediation, LLC

Benefits

Benefit of B_{12} for *Dehalococcoides ethenogenes*

Several studies have shown that growth of dechlorinating microorganisms may be enhanced by providing these bacteria with amino acids and/or vitamins (Deweerd et al, Appl. Environ. Micro, 1929-1934, 1991; Holliger et al, Arch. Microbiol, 313-321, 1998; Maymo-Gatell et al, Science, 1568-1571, 1997). Consequently, microbiologists often include vitamin B_{12} and yeast extract to generate conditions for optimum growth (Morse et al, Draft Technical Protocol: A Treatability Test for Evaluating the Potential Applicability of the Reductive Anaerobic Biological In Situ Treatment Technology (RABITT) to Remediate Chloroethenes, ESTCP, 1998).

EOS® 598B42 offers added value by providing an optimal diet for the halorespiring bacteria.

In January 2005, researchers at Cornell University issued a press release on a bacterium that detoxifies PCE. The news release states that "... the academic and corporate researchers are learning more about Dehalococcoides husbandry. For example, it seems to like a cocktail of acetate, vitamin B_{12} and extracts of mixed microbial cultures as nutrients."

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EOS Remediation, LLC

BAC-9™

Accelerating the Effectiveness of Biostimulation

EOS Remediation offers ***BAC-9™*** - an enriched bioaugmentation culture capable of degrading chlorinated solvents to innocuous compounds efficiently via halorespiration. Time can often be a significant factor and expense for *in situ* bioremediation projects. By initial addition of ***BAC-9™*** at a project site, the contaminated area receives a "jump start" from the microbial community, reducing the time required to grow the *Dehalococcoides* . population to effective cell densities.sp

Types of Application

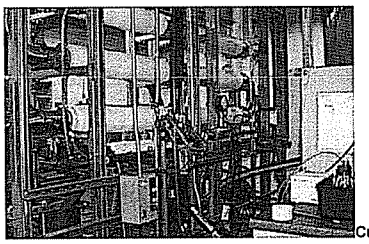
- Direct injection for *in situ* treatment of chlorinated ethenes.
- Inoculation of on-site bioreactors.

Best Conditions for Use

- Accelerated site closeout preference.
- Inadequate native dechlorinator population density.

Application Results

- Rapidly and completely degrades *cis*-1,2-dichloroethene (*cis*-DCE) and vinyl chloride (VC).
- Effective on many other chlorinated solvents: tetrachloroethene (PCE), trichloroethene, (TCE), trichloroethane (TCA), carbon tetrachloride (CT), chloroform (CF).
- Resistant to and effectively reduces high contaminant concentrations.



Custom Enrichments

If indigenous *Dehalococcoides* group organisms are at low population densities, EOS Remediation has resources to develop enrichments from site groundwater for use during bioaugmentation. Based on your site requirements, custom indigenous enrichments can be produced in fermentors ranging from 7 to 4000 liters per batch. *Dehalococcoides sp.* cell density is monitored using real-time quantitative polymerase chain reaction (PCR).

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