Long-Term Monitoring Plan

Colesville Landfill
Broome County, New York
NYSDEC Site 704010

ARCADIS
Infrastructure, buildings, environment, communications

ARCADIS

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Long-Term Monitoring Plan

Colesville Landfill
Broome County, New York
NYSDEC Site 704010

Prepared for:
Broome County Division of Solid Waste Management

Prepared by:
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Our Ref.:
NY000949.0014.00004

Date:
28 June 2002

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1. Introduction

This Long-Term Monitoring Plan (plan) was prepared as part of the January 1987 Order on Consent and the March 1991 Record of Decision (ROD) requirements for the Colesville Landfill site in Colesville, Broome County, New York (Site 704010). The purpose of the plan is to establish a network of wells and sampling points, define the analytical parameters, and establish the schedule to monitor the performance and effectiveness of the on-site groundwater remedy at achieving the remedial goal described in the ROD (collectively termed the long-term monitoring program). Although the September 2000 Explanation of Significant Difference (ESD) issued by the United States Environmental Protection Agency (USEPA) modifies the groundwater remedy, the goal of restoring groundwater quality to achieve the New York State Department of Environmental Conservation (NYSDEC) and USEPA maximum contaminant levels (MCLs) at the site remains unchanged.

The following sections describe the long-term monitoring program objectives, current groundwater quality conditions, the monitoring network (groundwater, spring water, surface water, and treatment systems), sample collection methods and procedures, quality assurance/quality control (QA/QC) requirements, the approach to data evaluation, the contents of the monitoring reports, and the monitoring schedule. This plan also includes other components of the long-term monitoring program, which are provided as appendices herein:

- Sampling and Analysis Plan (SAP) is provided as Appendix A. The SAP presents detailed methodologies to be employed during associated sampling and analysis activities.

- Quality Assurance Project Plan (QAPP) is provided as Appendix B. The QAPP presents QA/QC requirements related to sampling and analysis activities consistent with the current version of this plan.

- Groundwater Remediation System Startup and Performance Analysis Plan is provided as Appendix C. This plan presents detailed methodologies for system startup operational testing.

2. Long-Term Monitoring Program Objectives

The general objective of the long-term monitoring program is to evaluate the effectiveness of the pump-and-treat/enhanced reductive dechlorination (ERD) zone groundwater remedy at achieving ROD requirements. The pump-and-treat component of the remedy intercepts volatile organic compound (VOC)-impacted groundwater within the limiting flowpaths of the highest concentrations of VOCs. The ERD zone component enhances biogeochemical conditions along the section of the landfill boundary where the highest concentrations of VOC-impacted groundwater are migrating downgradient, thereby accelerating the degradation of VOC mass throughout a large volume of aquifer material. The specific objectives of the long-term monitoring program are as follows:

- Monitor, and document local groundwater flow patterns.
- Determine, monitor, and document the initial (baseline) groundwater VOC plume configuration, project area and background groundwater biogeochemical indicator concentrations, and spring water quality and surface water quality in the North Stream Area.
- Determine, monitor, and document reductions in the groundwater VOC concentrations as a result of ERD system operation.
- Determine, monitor, and document the presence of springs located along the North Stream during ERD system operation and whether the quality of spring water, if present, improves over time.
- Determine, monitor, and document that downstream surface water quality in the North Stream has not been affected by landfill-related impacts.
- Determine, monitor, and document that treatment system performance meets or exceeds the requirements set forth in the approved design documents (ARCADIS Geraghty & Miller, Inc. 2000).

3. Current Groundwater Quality Conditions

Several classes of VOCs are present in the site groundwater, including aromatics such as benzene, toluene, and chlorobenzene; chlorinated aliphatics, such as trichloroethene (TCE) and its degradation products, including cis-1,2-dischloroethene (cis-1,2-DCE), and vinyl chloride (VC); and 1,1,1-trichloroethane (TCA) and its degradation products, including 1,1 dichloroethane (1,1-DCA), chloroethane (CA) and the transformation product 1,1-dichloroethene (1,1-DCE). Additional chlorinated intermediates are also present in the groundwater, such as chlorinated methanes and substituted benzenes. The primary constituents on site are TCA and PCE and their transformation products.

The results of the biogeochemical sampling rounds showed that anaerobic and reducing environments were present in groundwater beneath and immediately adjacent to the landfill. These conditions are necessary for natural biological processes to effectively degrade the chlorinated VOCs. At distances further away from the landfill, the geochemical environment transitions to a primarily aerobic environment.

The reductive dechlorination of chlorinated VOCs involves naturally occurring subsurface microbes, which utilize organic carbon in the groundwater as a primary substrate for obtaining energy. During this process, the microbes use the chlorinated VOCs as electron donors, and oxygen, nitrate, and/or iron/manganese, sulfate, and carbon dioxide, as electron acceptors. Enzymes produced by microbes during the more strongly reducing reactions fortuitously degrade the source chlorinated VOCs. The organic carbon necessary for co-metabolic degradation can either be natural (i.e., present in the aquifer matrix) or anthropogenic (such as in the form of other groundwater contaminants, such as benzene, and toluene). The presence of organic carbon is necessary for the anaerobic dechlorination processes to occur. At the Colesville site the presence of organic carbon in the wells in or near the landfill allows for reductive dechlorination to occur. The occurrence of reductive dechlorination mechanisms is evidenced by relatively elevated concentrations of ethene and ethane (final degradation products) in these wells (ARCADIS Geraghty & Miller, Inc. 1999).

4. Monitoring Program

The following subsections of this plan describe the components of the long-term effectiveness and performance monitoring programs.

4.1 Effectiveness Monitoring

The long-term effectiveness monitoring program at the site includes hydraulic monitoring (depth to groundwater measurements), groundwater quality monitoring (groundwater sampling), sampling at spring water locations along the North Stream that were identified during the remedial investigation, and sampling of downstream surface water in the North Stream. A total of 16 existing monitoring wells, three spring water samples locations, and one surface water sample location are included in the long-term monitoring program. The locations of wells and sampling points are shown on Figure 1. Table 1 summarizes the effectiveness monitoring program and testing schedule. Construction specifications for wells in the long-term monitoring program are provided in Table 2. The components of the effectiveness monitoring are described below:

- Monitor groundwater flow patterns on-site during the baseline round and during remedial system operation.
- Monitor VOC concentrations in groundwater, spring water (if present) located along the North Stream, and surface water in the North Stream downstream of the existing springs during the baseline round and during remedial system operation.
- Monitor key biogeochemical indicator parameters in the area immediately downgradient of the ERD injection wells during the baseline round and during remedial system operation.

4.2 Remediation System Operational Performance Monitoring

The monitoring performed during remedial system startup (see Appendix C) and operation includes recording system field parameters for both the pump-and-treat and automated reagent injection systems and collecting water and air samples from the groundwater pump-and-treat system. Operational performance monitoring will be conducted during routine quarterly site visits and will include:

- Routine visual inspection;
- Recording system field parameters.
- Collection of water and air samples.

The need for conducting testing of critical system components will be evaluated during each site visit. The locations of performance monitoring points are shown on Figure 2. Table 3 summarizes the operational performance monitoring program and testing schedule. The performance data will be collected to monitor groundwater treatment system performance relative to design criteria.

5. Hydraulic Measurement Methodology

To monitor groundwater flow directions within and around the project area, the depth to groundwater in monitoring wells will be measured as follows: the depth to groundwater in each well will be measured to the nearest one-hundredth of a foot with an electronic water-level indicator probe. At each well, the depth to groundwater will be measured from the surveyed measuring point on the well casing. Additional details on methodology associated with hydraulic measurements are provided in the SAP (Appendix A - Section 2.1.2).

The equipment used to collect hydraulic measurements will be decontaminated, in accordance with the methods and procedures set forth in the SAP (Appendix A - Section 4) and the QAPP (Appendix B - Section 4.3).

6. Sampling Methodology

The following subsections describe the previously approved methods used to sample groundwater from monitoring wells, spring water, surface water, and air stripper/ filtration process influent/effluent water and air emissions (Geraghty & Miller, Inc. 1996). Sample collection frequency is provided in Tables 1 and 3. Additional details on methodology are provided in the SAP (Appendix A - Section 2.2). Additional details associated with the analytical program, including QA/QC requirements, are provided in the (QAPP (Appendix B - Section 4).

6.1 Monitoring Wells

Consistent with NYSDEC-approved procedures, monitoring wells will be purged using a variable speed, 2-inch diameter submersible pump following USEPA Micropurge/ low-flow protocols. Field parameters will be monitored in a flow-through cell and will include pH, specific conductance, DO, oxidation/reduction potential (redox), turbidity, and temperature. Completion of purging and therefore, the actual volume of water purged from each well will be based on the stabilization protocols described in the Micropurge method. Following stabilization of field parameters, the purge rate will then be reduced to approximately 100 ml/min and the groundwater sample will be collected directly from the pump discharge (USEPA 1998).

6.2 Spring Water and Surface Water

Field observations of the presence or absence of springs along with North Stream will be performed during the sampling rounds. When the springs are present, they are a manifestation of the groundwater table intersecting land surface along, but not within, the streambed. If present, representative spring water samples will be periodically collected as grab samples directly from Locations SP-2, SP-3, and SP-4 (Figure 1).

During sampling, pH, temperature, and specific conductivity will be tested. Additional details on spring water sample collection and QA/QC requirements are provided in the SAP (Appendix A - Section 2.3) and QAPP (Appendix B - Section 4), respectively.

The surface water sample will be collected as a grab sample directly from the North Stream at Location F-6 (see Figure 1). During sampling, pH, temperature, dissolved oxygen, and specific conductivity will be tested. Additional details on surface water sample collection and QA/QC requirements are provided in the SAP (Appendix A - Section 2.3) and QAPP (Appendix B - Section 4), respectively.

6.3 Treatment and Injection Processes

Water samples will be collected as grab samples directly from Production Wells GMPW-3, GMPW-4, and GMPW-5, the combined influent water to the air stripper, and from the combined treated effluent (from the air stripper/filtration process). An effluent air sample will be collected as a grab sample directly from the designated point located on the air stripper stack. Additional operational performance measurements and testing will be performed at the groundwater remedial system at the time of sampling as described in Section 4.2. The locations of all sampling points are shown on Figure 2. Additional details on operational performance measurements and testing requirements are provided in Table 3. Relevant measurements and testing activities that will be performed during startup are described and discussed in the Groundwater Remediation System Startup and Performance Analysis Plan, included as Appendix C of this plan.

6.4 Waste Disposal

Spring water, surface water, and remedial system samples will be obtained as direct grab samples; therefore no waste will be generated. Consistent with NYSDEC and USEPA-approved procedures that were implemented during the RI and prior sampling events, purge water from monitoring wells will be discharged to land surface at the well location.

6.5 Project Quality Assurance/Quality Control Procedures

Project QA/QC procedures for the monitoring program will be carried out consistent with the Quality Assurance Project Plan (QAPP) (Appendix B - Section 4).

Validation of the quarterly water quality data will be performed on an annual basis by following the QA/QC criteria set forth in the USEPA National Functional Guidelines for Organic and Inorganic Data Review (October 1999) (USEPA 1999); the validation program is described in detail in the QAPP (Appendix B - Section 4.6).

6.6 Decontamination

Groundwater sampling and purging equipment will be decontaminated in accordance with the methods and procedures set forth in the SAP (Appendix A - Section 4) and the QAPP (Appendix B - Section 4.3).

7. Analytical Parameters

Tables 1 and 3 provide details on sampling frequency, the various analyses performed, and the various remedial system flow measurements that will be recorded. Water samples will be placed on ice and shipped overnight under chain of custody protocols for laboratory analysis. Water samples submitted for analysis of VOCs will be analyzed for the Target Compound List (TCL) VOCs using USEPA Method 8021. Water samples submitted for analysis of inorganic compounds will be analyzed for manganese, iron, chlorides, organic carbon (total and dissolved); nitrate, nitrite, and sulfate; wells monitored on a semi-annual basis will be analyzed for total organic carbon. Water samples submitted for analysis of permanent gases will be analyzed for carbon dioxide, oxygen, nitrogen, methane, carbon monoxide, ethane, and ethane. Air samples will be analyzed using a modified USEPA Method TO-14A.

Additional details regarding analytical methods, lists of analytes, detection limits, sample container description, and sample preservation methods are provided in the QAPP (Appendix B - Sections 4.2 and 4.5).

8. Data Evaluation and Reporting

Collectively, the monitoring data will be evaluated to assess the overall performance and effectiveness of the groundwater remedy at achieving ROD goals. The following subsections describe the contents of the reports and the approach to evaluating the data collected during the long-term monitoring program. The data evaluation methods described below will be included, as appropriate, in the monitoring reports.

8.1 Hydraulic Data Evaluation

The hydraulic data (depth-to-groundwater measurements) will be tabulated and included in the quarterly groundwater monitoring reports. Groundwater-level elevations will be calculated by subtracting the depth to groundwater in each well from its respective surveyed measuring point elevation. During the first year of operation, groundwater-level elevations will be plotted on a site plan and contoured to illustrate the configuration of the water table and the horizontal direction of groundwater flow on a semiannual basis. These data collectively will serve to document local groundwater flow patterns.

8.2 Water Quality Data Evaluation

The analytical data collected from the monitoring wells, spring water, surface water, and treatment systems (including QA/QC samples) will be provided in tabular form with a comparison to NYS and USEPA MCLs (the latter excludes QA/QC samples) (NYSDEC 1998) (USEPA 1996). Tables and figures will be used collectively to illustrate the performance and effectiveness of the ERD remedy. Graphical methods that may be used to evaluate the groundwater quality data may include one or more of the following:

- Plan-view site maps may be prepared to depict the extent of the VOC plume.

- Time-concentration graphs may be prepared for selected monitoring/production wells for total/individual constituents through the period of record to illustrate long-term trends.

8.3 Air Quality Data Evaluation

The air quality data will be provided in tabular form in the respective report and evaluated, as needed, using the NYSDEC Air Guide I dispersion modeling program.

8.4 Spring Water and Surface Water Quality Data Evaluation

The spring water and surface water quality data will be tabulated, as available, on a quarterly basis. Documentation of field observations of spring areas will also be provided. The surface water quality data will be compared to NYSDEC ambient water quality standards for surface water.

8.5 Monitoring Reports

The report text may include a summary of the monitoring performed, changes to the field program (if any), a discussion and evaluation of the data, followed by conclusions and recommendations, as appropriate.

The quarterly reports will present the hydraulic measurement and water quality data collected from the current round. The fourth quarter report prepared each year shall be prepared as an annual report which will include the four rounds of data collected during the year and may include addition data evaluation, along with the additional figures described above.

Monitoring report appendices will include sample collection and measurement logs, chain of custody records, and data validation memoranda, as needed.

9. Monitoring Schedule

The baseline monitoring round is described in Table 1 and will be conducted prior to startup of the groundwater remediation system. Startup performance testing and measurement activities and sampling frequency are described in Groundwater Remediation System Startup and Performance Analysis Plan (Appendix C).

Tables 1 and 3 provide the monitoring and testing frequency of monitoring wells, springs, surface water, and treatment systems at the site from Year 1 through Year 5. Spring (if present) and surface water sampling will be conducted in the spring/fall of each year.

Data evaluation and preparation of monitoring reports will be completed approximately 60 days after receipt of analytical results of the sampling round from the laboratory.

The monitoring frequency at each location and analyses performed at each location will be assessed on an annual basis based on the ongoing evaluation of the monitoring program. If a change in monitoring frequency/parameters or project reporting is recommended, NYSDEC and USEPA approval will be obtained prior to implementation.

10. References

ARCADIS Geraghty & Miller, Inc. 2000. Groundwater Remedial System at the Colesville Landfill, Broome County, New York Final Design. July 25, 2000. Approved by NYSDEC and USEPA in letter dated August 24, 2000.

ARCADIS Geraghty & Miller, Inc. 1999. Results of Enhanced Reductive Dechlorination Pilot Study, Colesville Landfill, Broome County, New York. October 29, 1999.

Geraghty & Miller, Inc. 1996. Biogeochemical Sampling and Analysis Plan, Colesville Landfill, Colesville, New York. June 1996.

New York State Department of Environmental Conservation (NYSDEC). 1998. Division of Water Technical and Operation Guidance Series (TOGS 1.1.1). Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. Promulgated October 22, 1993. Re-issued June 1998.

U.S. Environmental Protection Agency (USEPA). 1999. Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

U.S. Environmental Protection Agency (USEPA). 1998. Groundwater Sampling Procedure, Low Stress (Low-Flow) Purging and Sampling, USEPA Region II, March 1998.

U.S. Environmental Protection Agency (USEPA). 1996. Office Of Water. Drinking Water Regulations and Health Advisories. EPA 822-B-96-002. October 1996.

Explanation of Significant Differences

COLESVILLE MUNICIPAL LANDFILL SUPERFUND SITE

Colesville Township
Broome County, New York

EPA
Region 2

September 2003

INTRODUCTION

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. §9617(c), and Section 300.435(c)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan, if after the Environmental Protection Agency (EPA) selects a remedial action, there is a significant change with respect to that action, an explanation of the significant differences (ESD) and the reasons such changes were made must be published.

EPA issued a Record of Decision (ROD) in March 1991 for the Colesville Landfill site that called for, among other things, capping the landfill and collecting and treating contaminated groundwater. Installation of the landfill cap was completed in 1995.

In April 2000, EPA performed a five-year review of the site in accordance with Section 121(c) of CERCLA, 42 U.S.C. §9621(c). During an inspection of the site performed as part of the five-year review process, EPA found several springs in the vicinity of the landfill. Contaminated water from these springs discharge to nearby streams. Since the springs are believed to be naturally-occurring, they cannot be easily eliminated.

This ESD presents remedial measures which will be taken to prevent the migration of contaminated water from these springs to the streams.

This ESD will become part of the Administrative Record file for the site. The entire Administrative Record for the site, which includes the remedial investigation and feasibility study (RI/FS) reports, ROD, September 2000 ESD, design reports, April 2000 Five-Year Review Report, and other reports and documents related to the site, are available for public review at the following location:

Town of Colesville Town Hall
Harpursville, NY 13787

New York State Department of
Environmental Conservation
625 Broadway
Albany, NY 12233-7016

and

U.S. Environmental Protection Agency
290 Broadway, 18th floor
New York, New York 10007

The changes to the selected remedy are not considered by EPA and the New York State Department of Environmental Conservation (NYSDEC) to have fundamentally altered the remedy selected in the ROD. The remedy remains protective of human health and the environment.

SUMMARY OF SITE HISTORY, CONTAMINATION PROBLEMS, AND SELECTED REMEDY

Waste disposal operations at the landfill commenced in 1969. The landfill was owned and operated by the Town of Colesville between 1969 and 1971. Broome County purchased the landfill in 1971, operating it until it closed in 1984.

The landfill was primarily used for the disposal of municipal solid waste, although drummed industrial wastes from various sources were also disposed of between 1973 and 1975. The drums were either buried intact or punctured and crushed prior to burial.

In 1983, samples collected by the Broome County Health Department from residential wells in the vicinity of the site indicated that the landfill was contaminating the groundwater in the vicinity of the site. The sample results prompted the Broome County Department of Public Works to install carbon filters on the affected residences, to initiate a residential well monitoring program, and to perform further investigation of the landfill in 1983 and 1984. These investigations showed elevated levels of a number of volatile organic compounds (VOCs) in the groundwater.

The site was proposed for inclusion on the Superfund National Priorities List (NPL) in October 1984 and was listed on the NPL in June 1986. NYSDEC was designated the lead agency for this site.

In 1990, an RI/FS was completed by Broome County and GAF Corporation, potentially responsible parties (PRPs) identified for the site, pursuant to an Order on Consent (Index No. T010687) issued by NYSDEC (the "State Order).

In 1991, based upon the results of the RI/FS, EPA issued a ROD, selecting a remedy for the site. The selected remedy included, among other things, the installation of a multimedia cap on the landfill, the collection and treatment of contaminated groundwater, and the provision of new deep wells for six affected residences located in the vicinity of the site.

Pursuant to the State Order, the PRPs began the design of the selected remedy in 1991. In 1994, the PRPs completed the design for the capping of the landfill and completed the capping of the landfill in 1995.

An alternate water supply well design (deep wells) was approved by the State in 1995. The implementation of the design was delayed, however, while Broome County attempted to purchase the six affected residences and to place deed restrictions preventing the installation and use of groundwater wells on the properties so that there would be no drinking water receptors. The County purchased four of the properties and demolished the structures on two of them. One of the purchased properties was vacated and will remain unoccupied. Although the fourth property is still occupied (the resident has life tenancy on the property), the well was replaced by the resident. One property that was not purchased is unoccupied and does not have a residential well. Broome County installed two wells on the remaining property (two residences) that was not purchased and an abandoned well on one of these properties was condemned and sealed up.

Based on design-related aquifer tests conducted at the site, it was determined that extracting contaminated groundwater from beneath the landfill, as called for in the ROD, would not likely be an effective means of remediating the groundwater at the source in a reasonable time frame. In September 2000, EPA issued an ESD which modified the groundwater remedy by requiring enhanced reductive dechlorination, a process which involves injecting the contaminated groundwater with an easily degradable carbohydrate solution (*i.e*, molasses) which provides excess organic carbon that promotes microbial activity in the subsurface, subsequently enhancing the rates of reductive dechlorination of chlorinated VOCs in the groundwater.

DESCRIPTION OF SIGNIFICANT DIFFERENCES AND THE REASONS FOR THOSE DIFFERENCES

Several springs are located along the stream bank of the North Stream. In addition one spring is located approximately 375 feet to the south of the landfill in a low lying area. The occurrence of stable water levels in these springs, despite the fact that the landfill cap prevents the infiltration of groundwater, suggests that the springs might be a natural occurrence at the site.

Along the stream bank of the North Stream, located to the west and southwest of the landfill, there are several springs that discharge directly into the stream. There is also a stagnant spring that has been observed on the south side of the landfill, which in rainy conditions, may overflow to a vegetated drainage swale that conveys water to the South Stream. Groundwater elevations have remained relatively stable since the landfill was capped, especially in the area between the landfill and the North Stream. North Stream spring samples showed the presence of chlorobenzene, chloroethane, and 1,1-dichloroethane (DCA) at maximum concentrations of 24 micrograms per liter (μg/l), 21 μg/l, and 58 μg/l, respectively. The chlorobenzene detection is greater than the ambient water quality criteria of 5 μg/l for the protection of aquatic organisms from chronic exposure for Class C water bodies. Three other VOCs, cis-1,2-DCA, 1,1,1-trichloroethane, and trichloroethylene, were also detected, but they were found at levels below 5 μg/l. Since there are no detectable levels of VOCs in the North Stream, it appears that the VOCs that discharge into the North Stream from the spring are rapidly attenuated through the processes of dilution and volatilization.

A sediment sample collected from the same spring location showed the presence of 59 milligrams per kilogram of 1,1-DCA. There is no New York State sediment screening criteria for this chemical.

Spring water samples were collected at the spring location on the south side of the landfill in 2002, during which time total VOC concentrations ranged from 154.1 ppb to 115 ppb for spring water samples collected on July 25, 2002 and August 9, 2002, respectively. During a rainfall event, an additional sample collected downgradient of the spring in a stormwater culvert adjacent to the road did not exhibit any detections of VOCs.

Since the springs are naturally-occurring, they cannot be easily eliminated. Remedial measures will be taken to prevent the migration of contaminated water to the streams. Specifically, the remedy for the spring along the North Stream that exceeds clean up levels, consists of a collection trench located immediately downgradient of the spring to collect contaminated groundwater. The collected water will then flow through a mixture of iron and sand to reduce the contaminant concentrations through abiotic reductive dechlorination. The water will then flow through a mixture of peat, compost, and sand to effect anaerobic reductive dechlorination. A vegetated zone will provide aerobic degradation/volatilization, add dissolved oxygen, and provide removal of residual dissolved iron emanating from the iron/sand zone. The final zone will consist of an aerobic cascade comprised of a riprap-lined drainage swale to removed any residual dissolved iron, increase water dissolved oxygen levels, and volatilize any residual VOCs prior to discharge to the respective streams.

The remedy for the spring located to the south of the landfill consists of modifying the existing concrete structure, including the installation of a sand pre-filter and lockable aluminum cover, putting 450 pounds of granular activated carbon in the concrete structure, and installing a 4-inch diameter drainage pipe and effluent filter. In addition, a riprap-lined outlet structure will be installed at the discharge point of the drainage pipe.

A final spring water remediation design, using this technology was approved by NYSDEC on August 22, 2003. It is anticipated that construction will commence in October 2003.

STATE AGENCY COMMENTS

NYSDEC supports the change to the remedy.

AFFIRMATION OF STATUTORY DETERMINATIONS

EPA and NYSDEC believe that the modified remedy is protective of human health and the environment and complies with federal and state requirements that are applicable or relevant and appropriate to this remedial action. In addition, the remedy continues to utilize permanent solutions and alternative treatment technologies to the maximum extent practicable for this site.

PUBLIC PARTICIPATION ACTIVITIES

EPA and NYSDEC are making this ESD and supporting information available to the public in the Administrative Record. EPA and NYSDEC invite comments or questions related to this ESD. Comments or questions should be directed to:

George Jacob, Remedial Project Manager
U.S. Environmental Protection Agency
290 Broadway
New York, NY 10007-1866

Telephone: (212) 637-4266
Telefax: (212) 637-3966

E-mail: jacob.george@epa.gov

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New York, New York 10007-1866

Mr. Joseph Yavonditte
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-7013

ENVIRONMENTAL

Subject:
Notification of Baseline Sampling Event,
Colesville Landfill, Broome County, New York.
(NYSDEC Site# 704010).

Date:
18 July 2002

Contact:
Steve Feldman

Phone:
(631) 391-5244

Email:
sfeldman@arcadis-us.com

Our ref:
NY000949.0014.00003

Dear Messrs. Jacob and Yavonditte:

On behalf of Broome County, ARCADIS is notifying the USEPA and the NYSDEC that we will be collecting the baseline round of groundwater, spring water, and surface water samples at the Colesville Landfill site during the week of July 22, 2002. The sampling scope and methodology will be performed consistent with those described in our June 28, 2002 Long-Term Monitoring Plan, as amended by the e-mail received from USEPA on July 16, 2002. In addition, we will initiate the proposed spring water investigation, as described in our letter to USEPA, dated June 18, 2002.

If you have any questions or comments, please do not hesitate to call.

Sincerely,

ARCADIS G&M, Inc.

Steve Feldman

Steven M. Feldman
Project Manager

Copies:
Ray Standish, Broome County

J. Yavonditte

ARCADIS

Infrastructure, buildings, environment, communications

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U.S. Environmental Protection Agency
290 Broadway, 20th Floor
New York, New York 10007-1866

ENVIRONMENTAL

Subject:
Proposed Spring Water Investigation
Colesville Landfill Project
Broome County, New York

Date:
18 June 2002

Contact:
Steven M. Feldman

Phone:
631-391-5244

Email:
sfeldman@arcadis-us.com

Our ref:
NY000949.0012.00006

Dear Mr. Jacob:

On behalf of Broome County, ARCADIS is providing this plan of action for addressing a spring in the vicinity of the Colesville Landfill site (Site). The spring is located approximately 60 feet southwest of monitoring well PW-2. During the August 14, 2001 spring water sampling event, a number of volatile organic compounds (VOCs) were detected. The highest detected VOC (chlorobenzene) concentration was 80 ug/L. A location sketch and water quality data for the spring located near PW-2 is provided in Attachment 1.

During a recent Site walkover with the United States Environmental Protection Agency (USEPA) and New York State Department of Environmental Conservation (NYSDEC) at the Site on June 6, 2002, a below grade structure, which appeared to be a metal cylinder that was set flush with the ground surface, was observed at this spring location. Therefore, ARCADIS proposes to conduct an investigation to determine: 1) if the spring is seeping from a below grade structure that was observed within the area of standing water; 2) how this structure may be affecting spring water discharge; 3) if an underground pipe is associated with this below grade structure; and, 4) spring water quality at both the source and as it enters the culvert (during a precipitation event) along the north side of East Windsor Road.

Investigation Methodology

In order to assess how the below grade structure may be affecting the spring water discharge, the standing spring water will be pumped down to allow for visual inspection. Fluids generated from the pumping activities will be discharged to land surface adjacent to the spring location in a manner consistent with NYSDEC- and

USEPA-approved procedures that were implemented during previous sampling events. A water sample will be collected at or near the source of the spring water and analyzed for Target Compound List (TCL) VOCs using USEPA Method 8021.

Once the standing spring water has been pumped down, observations regarding the below grade structure and any associated piping will be recorded in a logbook. In addition, visual observations will be recorded regarding the nature of the spring water discharge. During past site reconnaissance activities it was observed that, during dry conditions, spring water was not discharging to the culvert located on the northern side of East Windsor Road. Water that discharges from the spring enters a low-lying area that is only in hydraulic connection with the culvert during a precipitation event. Therefore, a second water sample will be collected during a precipitation event where the spring water enters the culvert area and analyzed for TCL VOCs using USEPA Method 8021.

Once the investigation and water sampling efforts have been completed and the results have been evaluated, a letter report will be prepared and submitted documenting the findings, and providing recommendations on proposed measures to address the spring.

If you have any questions or need additional information, please do not hesitate to contact Ray Standish of Broome County at 607-778-2286, or Steven Feldman of ARCADIS at 631-391-5244.

Sincerely,

ARCADIS G&M, Inc.

Steven Feldman

Steven M. Feldman
Principal Scientist/Project Manager

Copies:
Joe Yavonditte, NYSDEC
Ray Standish, Broome County

ARCADIS

Attachment A

Laboratory Data

Colesville Landfill
Sampled 8/14/01
Samplers: KS, ES

BEL Log #0108131

ClientSampID	TestCode	TestNo	AnalDate	Analyte	PQL	FinalVal	Units	Qual
SEEPHOLE NEAR PW-2	CR6L	SW7196	08/15/01	Chromium, Hexavalent	0.02	**ND**	mg/L	
SEEPHOLE NEAR PW-2	HGNPW	SW7470	08/23/01	Mercury	0.0004	**ND**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Aluminum	0.04	**0.67**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Antimony	0.05	**ND**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Arsenic	0.025	**3.23**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Barium	0.045	**0.845**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Beryllium	0.005	**ND**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Boron	0.05	**ND**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Cadmium	0.005	**0.019**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Calcium	0.21	**85.7**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Chromium	0.005	**0.004**	mg/L	J
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Cobalt	0.015	**0.056**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Copper	0.01	**ND**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Iron	0.035	**392**	mg/L	E
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Lead	0.005	**ND**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Magnesium	0.32	**18**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Manganese	0.005	**10.9**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Nickel	0.01	**0.023**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Potassium	0.26	**3.64**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Selenium	0.02	**0.27**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Silver	0.015	**ND**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Sodium	0.67	**18.6**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Thallium	0.03	**0.011**	mg/L	J
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Vanadium	0.015	**ND**	mg/L	
SEEPHOLE NEAR PW-2	ICP	SW6010A	08/23/01	Zinc	0.01	**0.076**	mg/L	
SEEPHOLE NEAR PW-2	HGNPWDISS	SW7470	08/23/01	Mercury	0.0004	**0.0004**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Aluminum	0.04	**0.118**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Antimony	0.05	**ND**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Arsenic	0.025	**0.024**	mg/L	J
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Barium	0.045	**0.18**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Beryllium	0.005	**ND**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Boron	0.07	**0.406**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Cadmium	0.005	**0.001**	mg/L	J
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Calcium	0.21	**82.6**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Chromium	0.005	**0.003**	mg/L	J

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Samplers: KS, ES

BEL Log #0108131

ClientSampID	TestCode	TestNo	AnalDate	Analyte	PQL	FinalVal	Units	Qual
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Cobalt	0.015	**0.006**	mg/L	J
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Copper	0.01	**0.009**	mg/L	J
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Iron	0.035	**29.9**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/15/01	Lead	0.005	**ND**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Magnesium	0.32	**19.9**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Manganese	0.005	**7.13**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Nickel	0.01	**0.003**	mg/L	J
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Potassium	0.26	**3.53**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Selenium	0.02	**0.019**	mg/L	J
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Silver	0.015	**0.027**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Sodium	0.67	**22.6**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Thallium	0.03	**ND**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Vanadium	0.015	**ND**	mg/L	
SEEPHOLE NEAR PW-2	ICPDISS	SW6010A	10/03/01	Zinc	0.01	**0.072**	mg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,1,1,2-Tetrachloroethane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,1,1-Trichloroethane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,1,2,2-Tetrachloroethane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,1,2-Trichloroethane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,1-Dichloroethane	5	**32**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,1-Dichloroethene	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,2,3-Trichloropropane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,2-Dibromo-3-chloropropane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,2-Dibromoethane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,2-Dichlorobenzene	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,2-Dichloroethane	5	**2**	µg/L	J
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,2-Dichloropropane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,3-Dichlorobenzene	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	1,4-Dichlorobenzene	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	2-Butanone	25	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	2-Hexanone	25	**5**	µg/L	J
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	4-Methyl-2-pentanone	25	**5**	µg/L	J
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Acetone	25	**10**	µg/L	J
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Acrylonitrile	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Benzene	5	**6.3**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Bromochloromethane	5	**ND**	µg/L	

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Samplers: KS, ES

BEL Log #0108131

ClientSampID	TestCode	TestNo	AnalDate	Analyte	PQL	FinalVal	Units	Qual
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Bromodichloromethane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Bromoform	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Bromomethane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Carbon disulfide	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Carbon tetrachloride	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Chlorobenzene	5	**80**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Chloroethane	5	**8.8**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Chloroform	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Chloromethane	5	**3**	µg/L	J
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	cis-1,2-Dichloroethene	5	**2**	µg/L	J
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	cis-1,3-Dichloropropene	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Dibromochloromethane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Dibromomethane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Ethylbenzene	5	**2**	µg/L	J
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Iodomethane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	m,p-Xylene	10	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Methylene chloride	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	o-Xylene	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Styrene	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Tetrachloroethene	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Toluene	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	trans-1,2-Dichloroethene	5	**2**	µg/L	J
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	trans-1,3-Dichloropropene	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	trans-1,4-Dichloro-2-butene	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Trichloroethene	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Trichlorofluoromethane	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Vinyl acetate	5	**3**	µg/L	J
SEEPHOLE NEAR PW-2	M8260_360L	SW8260A	08/28/01	Vinyl chloride	5	**ND**	µg/L	
SEEPHOLE NEAR PW-2	WALK	E310.1	08/21/01	Alkalinity, Total (As CaCO3)	2	**230**	mg/L CaCO3	
SEEPHOLE NEAR PW-2	WBOD5	405.1	08/15/01	Biochemical Oxygen Demand	12	**ND**	mg/L	
SEEPHOLE NEAR PW-2	WCN	E335.2	08/16/01	Cyanide	0.01	**0.001**	mg/L	J
SEEPHOLE NEAR PW-2	WCOD	E410.1	08/16/01	Chemical Oxygen Demand	2	**113**	mg/L	
SEEPHOLE NEAR PW-2	WCOLOR	E110.2	08/15/01	Color	5	**59**	units	
SEEPHOLE NEAR PW-2	WCOND	E120.1	08/14/01	Specific Conductance	5	**681**	µmhos/cm	
SEEPHOLE NEAR PW-2	WEH	D1498	08/14/01	EH	1	**ND**	mV	

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ClientSampID	TestCode	TestNo	AnalDate	Analyte	PQL	FinalVal	Units	Qual
SEEPHOLE NEAR PW-2	WHARD	E130.2	09/20/01	Hardness (As CaCO3)	1	**288**	mg/L	
SEEPHOLE NEAR PW-2	WIC	E300	08/15/01	Bromide	0.05	**0.346**	mg/L	
SEEPHOLE NEAR PW-2	WIC	E300	08/15/01	Chloride	0.05	**32.5**	mg/L	
SEEPHOLE NEAR PW-2	WIC	E300	08/15/01	Nitrogen, Nitrate (As N)	0.05	**ND**	mg/L	
SEEPHOLE NEAR PW-2	WIC	E300	08/15/01	Nitrogen, Nitrite	0.05	**ND**	mg/L	
SEEPHOLE NEAR PW-2	WIC	E300	08/15/01	Sulfate	1	**0.56**	mg/L	J
SEEPHOLE NEAR PW-2	WNH3	E350.1	08/16/01	Nitrogen, Ammonia (As N)	0.2	**4.61**	mg/L	
SEEPHOLE NEAR PW-2	WPHENOL	E420.1	08/16/01	Phenolics, Total Recoverable	0.005	**0.004**	mg/L	J
SEEPHOLE NEAR PW-2	WPHL	E150.1	08/14/01	pH	0.1	**6.75**	pH units	
SEEPHOLE NEAR PW-2	WTDS	E160.1	08/15/01	Total Dissolved Solids (Residu	1	**436**	mg/L	
SEEPHOLE NEAR PW-2	WTEMP	E170.1	08/13/01	Temperature	0.1	**16.9**	°C	
SEEPHOLE NEAR PW-2	WTKN	E351.3	08/21/01	Nitrogen, Kjeldahl, Total	2	**38**	mg/L	
SEEPHOLE NEAR PW-2	WTOC	E415.1	08/16/01	Organic Carbon, Total	0.5	**16.9**	mg/L	
SEEPHOLE NEAR PW-2	WTURB	E180.1	08/14/01	Turbidity	0.05	**146**	NTU	E

This laboratory analysis has been performed in accordance with generally accepted laboratory practices and requirements of the New York State Department of Health ELAP Program. Buck Environmental Laboratories, Inc. makes no recommendations, representations or warranties other than as specifically set forth in this report and shall not be responsible or liable for any action or the consequence of any action taken in connection with this report.

ND ---> Not detected at the PQL indicated
PQL --->Laboratory Practical Limit of Quantitation
J --->Result is estimated, reported value is less than PQL
B ---> Result is estimated, analyte detected in blank
S ---> Result is estimated, surrogate or spike recovery outside of acceptance limits
R ---> Results is estimated, RPD outside of acceptance limits
E ---> Result is estimated, reported value exceeds upper quantitation limit

John H. Buck, P.E.
Laboratory Director
NYSDOH ELAP #10795

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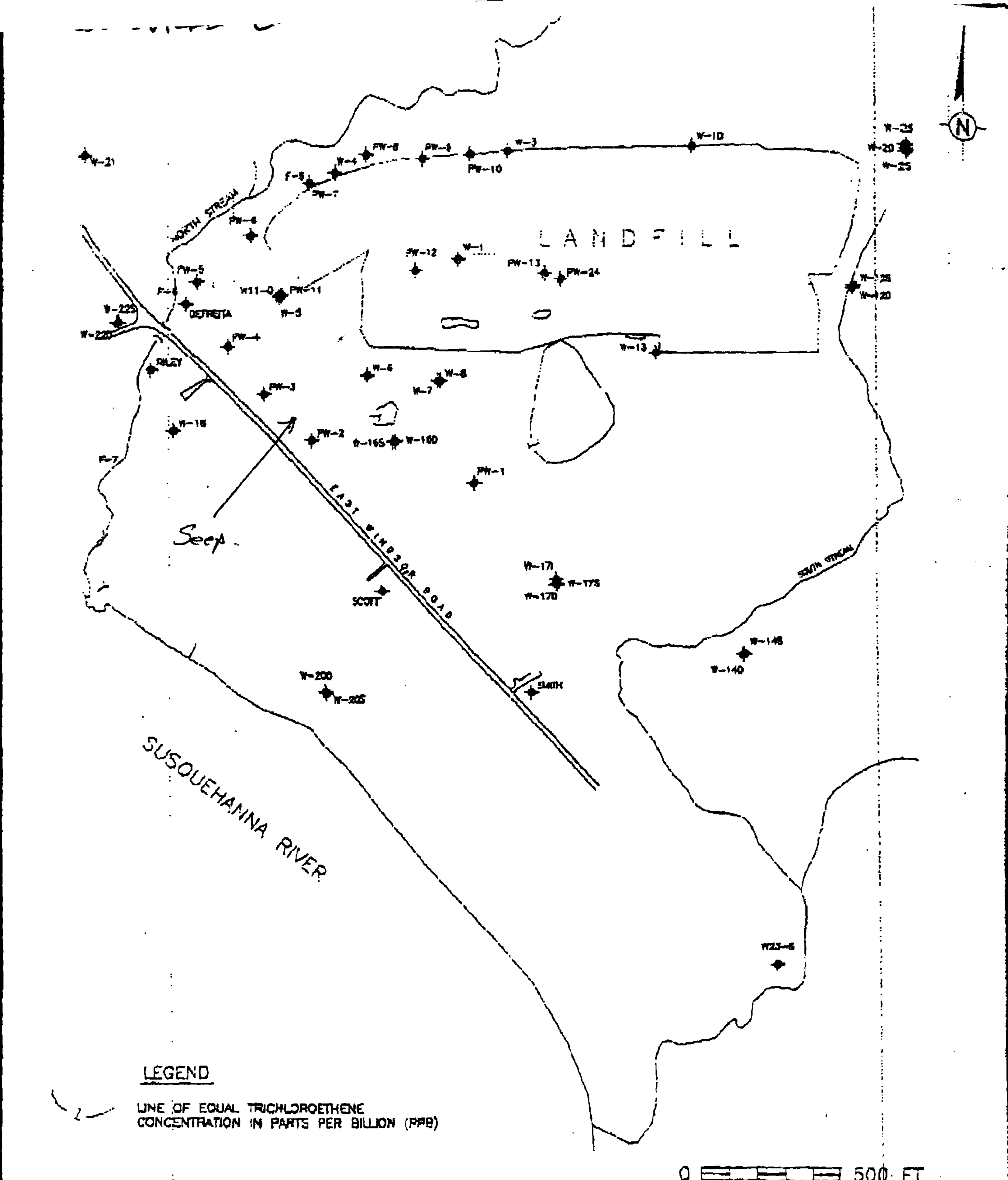

NOTE: CONTOUR INTERVAL AS SHOWN

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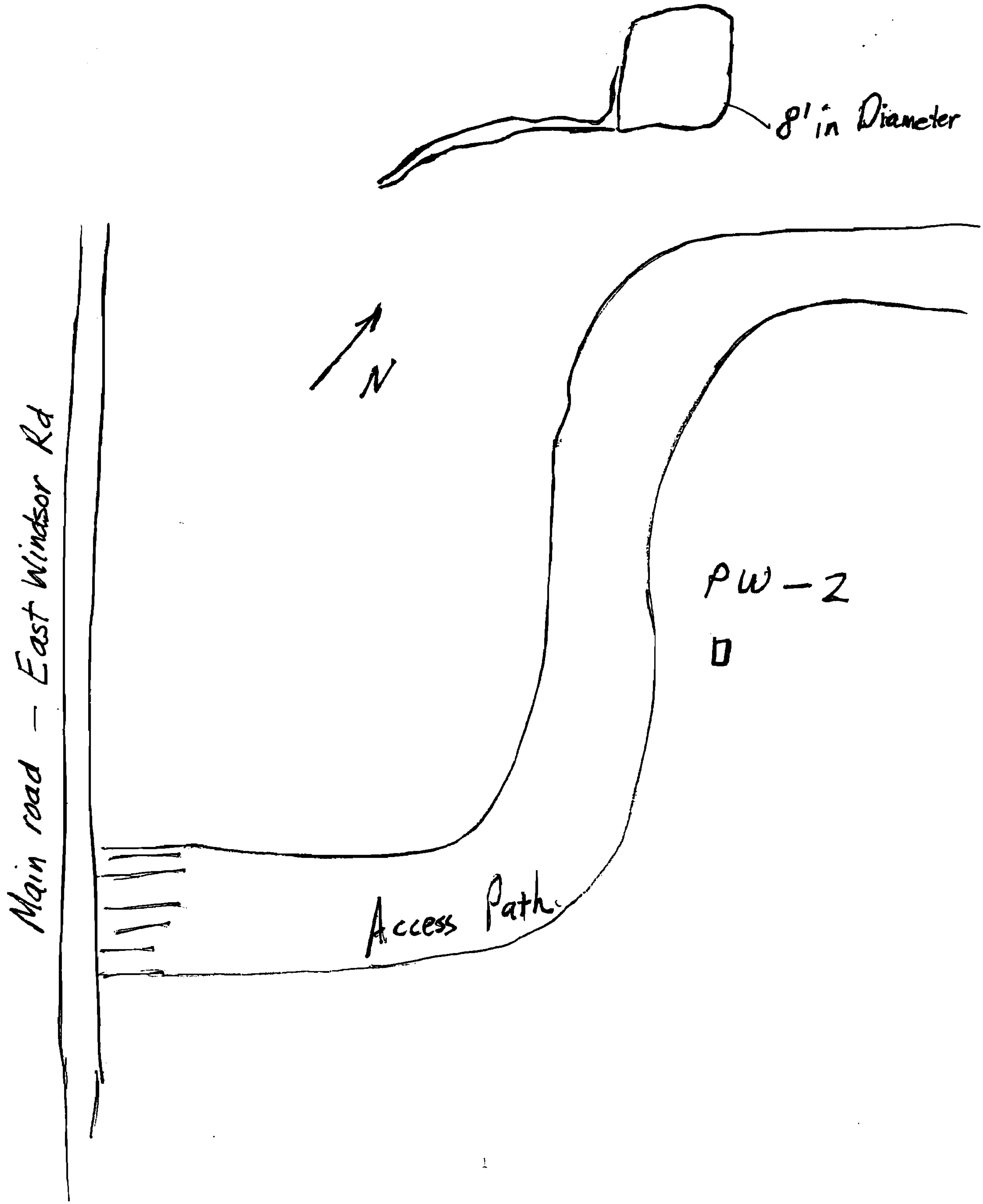
Environmental Services

NATU... JATION
SIMULATED ... OROETHENE
50 YI... APPING

John -
This should work
if not give me
a call
Ray

FIGURE
B-23


8' in Diameter
N
Main road - East Windsor Rd
PW-2
Access Path

ARCADIS

Infrastructure, buildings, environment, communications

ARCADIS G&M, Inc.
88 Duryea Road
Melville
New York 11747
Tel 631 249 7600
Fax 631 249 7610
www.arcadis-us.com

ENVIRONMENTAL

Mr. George Jacob
United Stated Environmental Protection Agency – Region 2
290 Broadway, 20th Floor
New York, New York 10007-1866

Subject:
Long-Term Monitoring Plan, Colesville Landfill, Broome County, New York. (Site No. 704010).

Date:
28 June 2002

Contact:
Steven M. Feldman

Phone:
(631) 391-5244

Email:
sfeldman@arcadis-us.com

Our ref:
NY000949.0014.00004

Dear Mr. Jacob:

On behalf of Broome County, ARCADIS is providing two copies of the Long-Term Monitoring Plan (LTMP) for the groundwater remedy currently under construction at the Colesville Landfill, Broome County, New York. We have tentatively scheduled a baseline groundwater sampling event for the week of July 22, 2002. Accordingly, we would greatly appreciate it if USEPA would provide comments or an approval of the LTMP on or before July 22nd.

Please feel free to contact me if you have any questions or comments.

Sincerely,

ARCADIS G&M, Inc.

Steven M. Feldman
Project Manager

Copies:
Joe Yavonditte, NYSDEC
Ray Standish, Broome County

ARCADIS

Table 1. Long-Term Effectiveness Monitoring and Testing Schedule, Colesville Landfill, Broome County, New York.

Analytical Parameter:	Volatile Organic Compounds [1]									Inorganics [2]								
Sampling	Baseline Round	YEAR 1				YEARS 2 TO 5				Baseline Round	YEAR 1				YEARS 2 TO 5			
Sample Identification / Frequency:		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Quarterly Monitoring Wells																		
GMMW-2	√	√	√	√	√	√	√	√	√	√	√	√	√	√	*	√	*	√
GMMW-5	√	√	√	√	√	√	√	√	√	√	√	√	√	√	*	√	*	√
GMMW-6	√	√	√	√	√	√	√	√	√	√	√	√	√	√	*	√	*	√
W-5	√	√	√	√	√	√	√	√	√	√	√	√	√	√	*	√	*	√
PW-4	√	√	√	√	√	√	√	√	√	√	√	√	√	√	*	√	*	√
W-13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PW-13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semi-Annual Monitoring Wells [7]																		
PW-5	√	--	√	--	√	--	√	--	√	*	--	*	--	*	--	*	--	*
W-6	√	--	√	--	√	--	√	--	√	*	--	*	--	*	--	*	--	*
W-7	√	--	√	--	√	--	√	--	√	*	--	*	--	*	--	*	--	*
W-18	√	--	√	--	√	--	√	--	√	*	--	*	--	*	--	*	--	*
PW-3	√	--	√	--	√	--	√	--	√	*	--	*	--	*	--	*	--	*
Annual Monitoring Wells [7]																		
W-16S	√	--	--	--	√	--	--	--	√	--	--	--	--	--	--	--	--	--
W-17S	√	--	--	--	√	--	--	--	√	--	--	--	--	--	--	--	--	--
W-20S	√	--	--	--	√	--	--	--	√	--	--	--	--	--	--	--	--	--
W-14S (Background)	√	--	--	--	√	--	--	--	√	√	--	--	--	√	--	--	--	√
Springs																		
SP-2	√	√	--	√	--	√	--	√	--	--	--	--	--	--	--	--	--	--
SP-3	√	√	--	√	--	√	--	√	--	--	--	--	--	--	--	--	--	--
SP-4	√	√	--	√	--	√	--	√	--	--	--	--	--	--	--	--	--	--
Surface Water																		
F-6	√	--	--	--	√	--	--	--	√	--	--	--	--	--	--	--	--	--

See notes on last page

Table 1. Long-Term Effectiveness Monitoring and Testing Schedule, Colesville Landfill, Broome County, New York.

Sample Identification	Field Parameters [3,4,5]									Permanent Gases [6]								
Analytical Parameter: / Sampling Frequency:	Baseline Round	YEAR 1				YEARS 2 TO 5				Baseline Round	YEAR 1				YEARS 2 TO 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Quarterly Monitoring Wells																		
GMMW-2	√	√	√	√	√	√	√	√	√	√	√	√	√	√	--	√	--	√
GMMW-5	√	√	√	√	√	√	√	√	√	√	√	√	√	√	--	√	--	√
GMMW-6	√	√	√	√	√	√	√	√	√	√	√	√	√	√	--	√	--	√
W-5	√	√	√	√	√	√	√	√	√	√	√	√	√	√	--	√	--	√
PW-4	√	√	√	√	√	√	√	√	√	√	√	√	√	√	--	√	--	√
W-13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PW-13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semi-Annual Monitoring Wells [7]																		
PW-5	√	--	√	--	√	--	√	--	√	√	--	--	--	√	--	--	--	√
W-6	√	--	√	--	√	--	√	--	√	--	--	--	--	--	--	--	--	--
W-7	√	--	√	--	√	--	√	--	√	--	--	--	--	--	--	--	--	--
W-18	√	--	√	--	√	--	√	--	√	√	--	--	--	√	--	--	--	√
PW-3	√	--	√	--	√	--	√	--	√	√	--	--	--	√	--	--	--	√
Annual Monitoring Wells [7]																		
W-16S	√	--	--	--	√	--	--	--	√	--	--	--	--	--	--	--	--	--
W-17S	√	--	--	--	√	--	--	--	√	--	--	--	--	--	--	--	--	--
W-20S	√	--	--	--	√	--	--	--	√	--	--	--	--	--	--	--	--	--
W-14S (Background)	√	--	--	--	√	--	--	--	√	--	--	--	--	--	--	--	--	--
Springs																		
SP-2	√	√	--	√	--	√	--	√	--	--	--	--	--	--	--	--	--	--
SP-3	√	√	--	√	--	√	--	√	--	--	--	--	--	--	--	--	--	--
SP-4	√	√	--	√	--	√	--	√	--	--	--	--	--	--	--	--	--	--
Surface Water																		
F-6	√	√	√	√	√	√	√	√	√	--	--	--	--	--	--	--	--	--

See notes on last page

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Table 1. Long-Term Effectiveness Monitoring and Testing Schedule, Colesville Landfill, Broome County, New York.

Sample Identification	Analytical Parameter:	Hydraulic Measurements								
	Sampling	Baseline Round	YEAR 1				YEARS 2 TO 5			
	Frequency:		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Quarterly Monitoring Wells										
GMMW-2		√	√	√	√	√	√	√	√	√
GMMW-5		√	√	√	√	√	√	√	√	√
GMMW-6		√	√	√	√	√	√	√	√	√
W-5		√	√	√	√	√	√	√	√	√
PW-4		√	√	√	√	√	√	√	√	√
W-13		√	√	√	√	√	√	√	√	√
PW-13		√	√	√	√	√	√	√	√	√
Semi-Annual Monitoring Wells [7]										
PW-5		√	√	√	√	√	√	√	√	√
W-6		√	√	√	√	√	√	√	√	√
W-7		√	√	√	√	√	√	√	√	√
W-18		√	√	√	√	√	√	√	√	√
PW-3		√	√	√	√	√	√	√	√	√
Annual Monitoring Wells [7]										
W-16S		√	√	√	√	√	√	√	√	√
W-17S		√	√	√	√	√	√	√	√	√
W-20S		√	√	√	√	√	√	√	√	√
W-14S (Background)		√	√	√	√	√	√	√	√	√
Springs										
SP-2		--	--	--	--	--	--	--	--	--
SP-3		--	--	--	--	--	--	--	--	--
SP-4		--	--	--	--	--	--	--	--	--
Surface Water										
F-6		--	--	--	--	--	--	--	--	--

See notes on last page

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Note:

1	VOC analytical parameters include the TCL VOCs.
2	Inorganic analytical parameters include: manganese (dissolved); iron (dissolved); chloride; total organic carbon; nitrate; nitrite; and sulfate.
3	Field parameters monitored in wells include: oxidation-reduction potential (redox); pH; specific conductance; temperature; dissolved oxygen; turbidity (quarterly wells only); and sulfide.
4	Field parameters monitored in springs/surface water include: pH; specific conductance; temperature; redox; and dissolved oxygen.
5	Field parameters monitored in annual monitoring wells include pH; specific conductance; temperature; redox; turbidity (Well W-14S only) and dissolved oxygen.
6	Permanent gases monitored includes: carbon dioxide; oxygen; nitrogen; methane; carbon monoxide; ethene and ethane.
7	Semi-annual rounds also include wells monitored in the quarterly rounds. Annual rounds also include wells monitored in the quarterly and semi-annual rounds.
*	Samples will be collected for total organic carbon.
√	Samples will be collected for indicated parameter.
--	Activity not applicable or sample will not be collected for that parameter.

TCL	Target Compound List
VOCs	Volatile organic compounds
ERD	Enhanced Reductive Dechlorination
PT	Pump and treat
Q1	First Quarter Sampling Round

Table 2. Long-Term Monitoring Program Well Construction Details, Colesville Landfill, Broome County, New York.

Well Indentification	M.P. Elevation (ft msl)	Casing Diameter (in)	Total Depth (ft bls)	Screened Interval (ft bls)
Quarterly Monitoring Wells				
GMMW-2	1030.95	2	60	45 - 55
GMMW-5	1043.66	2	68	53 - 63
GMMW-6	1033.56	2	50	40 - 50
W-5	1051.41	2	61.5	44 - 59
PW-4	1001.75	2	23	8 - 23
W-13	1053.43	2	50	35 - 50
PW-13	1064.37	2	78.5	43.5 - 78.5
Semi-Annual Monitoring Wells				
PW-5	986.12	2	29.7	4.7 - 29.7
W-6	1050.38	2	59.5	44.5 - 59.5
W-7	1049.12	2	51.5	35 - 50
W-18	973.56	2	23	7 - 22
PW-3	988.92	2	29.7	4.7 - 29.7
Annual Monitoring Wells				
W-16S	990.33	2	22	7 - 22
W-17S	959.13	2	20	5 - 20
W-20S	952.88	2	22	7 - 22
W-14S	957.68	2	21	4.5 - 19.5

MP Measuring Point
ft msl feet relative to mean sea level
in inches
ft bls feet below land surface

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Table 3. Remedial System Operational Performance Monitoring and Testing Schedule, Colesville Landfill, Broome County, New York.

Sample Location [a]	Parameter/Measurement	Frequency
PT SYSTEM		
Water Samples		
Production Wells		
GMPW-3	VOCs (USEPA Method 8021), Total Iron (USEPA Method 6010)	Quarterly
GMPW-4	VOCs (USEPA Method 8021), Total Iron (USEPA Method 6010)	Quarterly
GMPW-5	VOCs (USEPA Method 8021), Total Iron (USEPA Method 6010)	Quarterly
Treatment Process		
Influent (Before air stripper unit)	VOCs (USEPA Method 8021), Total Iron (USEPA Method 6010)	Quarterly
Effluent (after air stripper/cartridge filter)	VOCs (USEPA Method 8021), Total Iron (USEPA Method 6010)	Quarterly
Water Flow Measurements		
Production Wells		
GMPW-3	Flow rate (gpm + total gal.)	Quarterly
GMPW-4	Flow rate (gpm + total gal.)	Quarterly
GMPW-5	Flow rate (gpm + total gal.)	Quarterly
Treatment Process [b]		
Air Stripper Tower Effluent (before HT-500 Tank)	Flow rate (gpm + total gal.)	Quarterly
Air Stripper Tower Effluent (before discharge To N. Stream)	Flow rate (gpm + total gal.)	Quarterly
Air Sample		
Air Stripper Stack Effluent	VOCs (EPA Method TO-14A)	Quarterly
Air Flow Measurements		
Air Stripper Stack Effluent	Velocity (acfm)	Quarterly
Air Pressure Measurements		
Air Stripper Stack Effluent	Pressure (in. H_2O)	Quarterly
Air Temperature Measurements		
Air Stripper Stack Effluent	Temperature (°F)	Quarterly

see notes on last page

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Table 3. Remedial System Operational Performance Monitoring and Testing Schedule, Colesville Landfill, Broome County, New York.

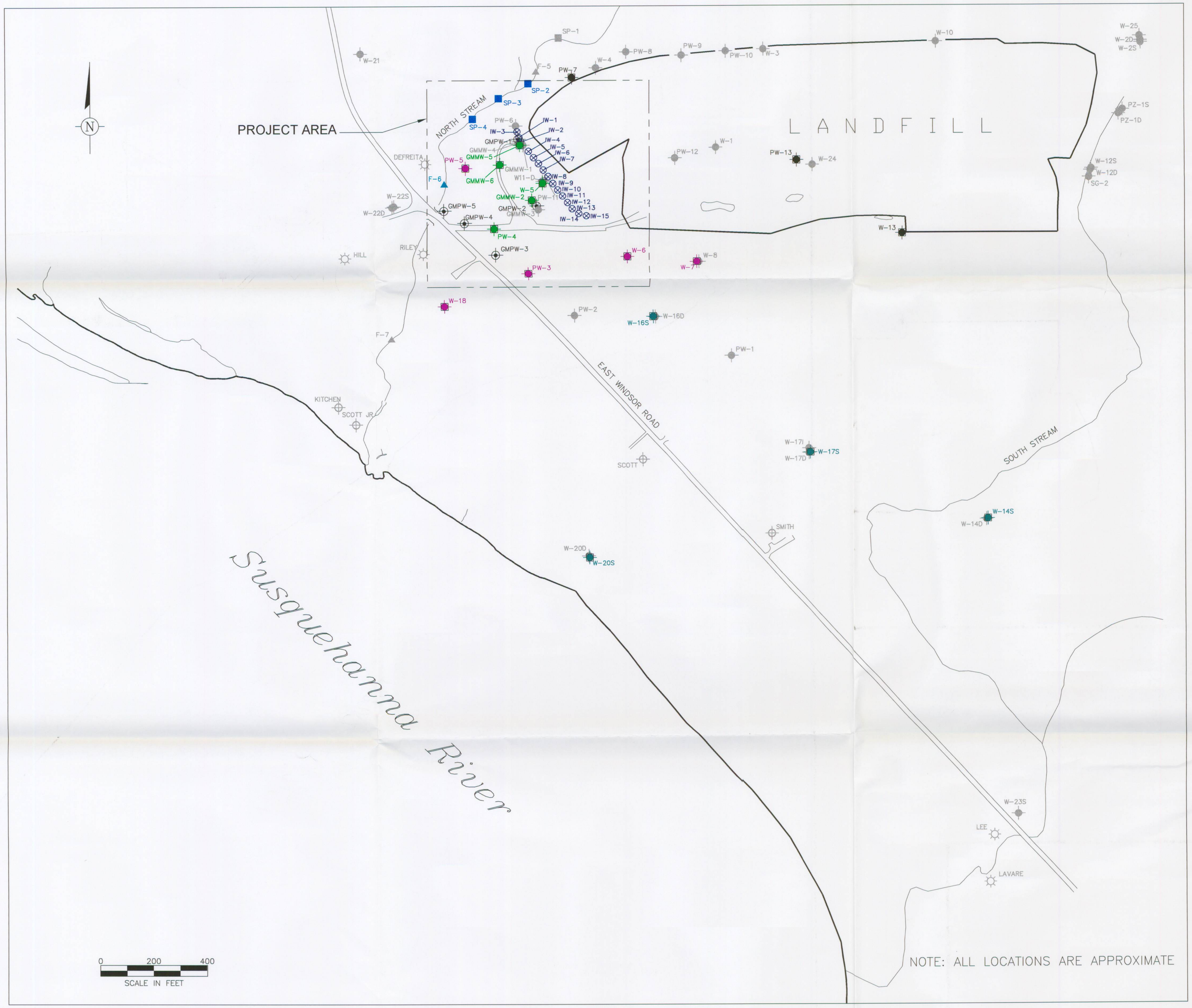
Sample Location [a]	Parameter/Measurement	Frequency
REAGENT INJECTION SYSTEM		
Reagent Injection Process		
Flow Measurements		
Common Header to Injection Wells		
Reagent Solution Injection	Total Gallons (gal)	Quarterly
Treated Water Rinse	Total Gallons (gal)	Quarterly
General Measurements		
Molasses/Water Ratio	Percentage (%)	Quarterly
Injection Frequency	Time (day)	Quarterly
Injection Well Measurements		
IW-3	pH(s.u.),TOC(mg/L)	Quarterly
IW-8	pH(s.u.),TOC(mg/L)	Quarterly
IW-13	pH(s.u.),TOC(mg/L)	Quarterly

Notes:

(a) Addiitonal details on sampling and analysis is provided in the SAP (Appendix A).

(b) Sample will be collected at one of the locations specified, depending on whether the treated production well water is being utlized for injection solution preparation or is being blown off to the North Stream.

PT	Pump and Treat
USEPA	U.S. Environmental Protection Agency
acfm	actual cubic feet per minute
gal.	gallons
gpm	gallons per minute
NYSDEC	New York State Department of Environmental Conservation
in H2O	inches of water
°F	Degrees Fahrenheit
VOCs	Volatile Organic Compounds
TOC	Total Organic Carbon
s.u.	Standard units
mg/L	milligrams per liter
SAP	Sampling and Analysis Plan



EXPLANATION

W-24 LOCATION AND DESIGNATION OF RI MONITORING WELL

SCOTT LOCATION AND DESIGNATION OF EXISTING HOMEOWNER WELL

HILL LOCATION AND DESIGNATION OF FORMER HOMEOWNER WELL

F-5 LOCATION AND DESIGNATION OF RI STREAM SAMPLING POINT

IW-2 LOCATION AND DESIGNATION OF INJECTION WELL

GMPW-2 LOCATION AND DESIGNATION OF PRODUCTION WELL

SP-1 LOCATION AND DESIGNATION OF RI SPRING SAMPLE LOCATION

LONG-TERM MONITORING PLAN

W-5 LOCATION AND DESIGNATION OF QUARTERLY MONITORING WELL

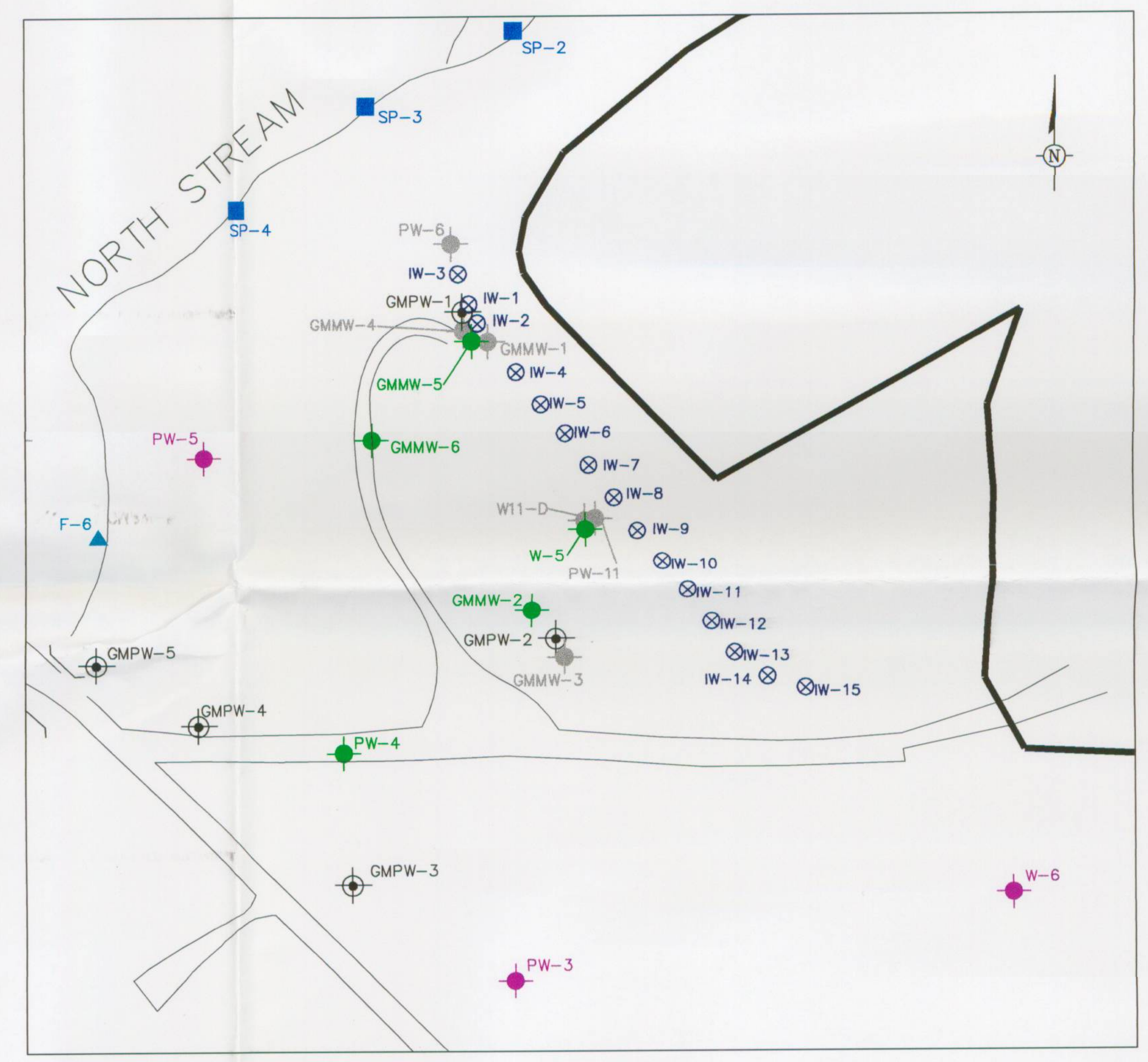
W-6 LOCATION AND DESIGNATION OF SEMI-ANNUAL MONITORING WELL

W-16S LOCATION AND DESIGNATION OF ANNUAL MONITORING WELL

F-6 LOCATION AND DESIGNATION OF SURFACE WATER SAMPLE LOCATION

SP-2 LOCATION AND DESIGNATION OF SPRING SAMPLE LOCATION

LOCATION AND DESIGNATION OF WELLS INCLUDED IN HYDRAULIC MEASUREMENT PROGRAM



SITE PLAN SHOWING PROJECT AREA

NO.	DATE	REVISION DESCRIPTION	BY	CKD

ARCADIS G&M
88 Duryea Road
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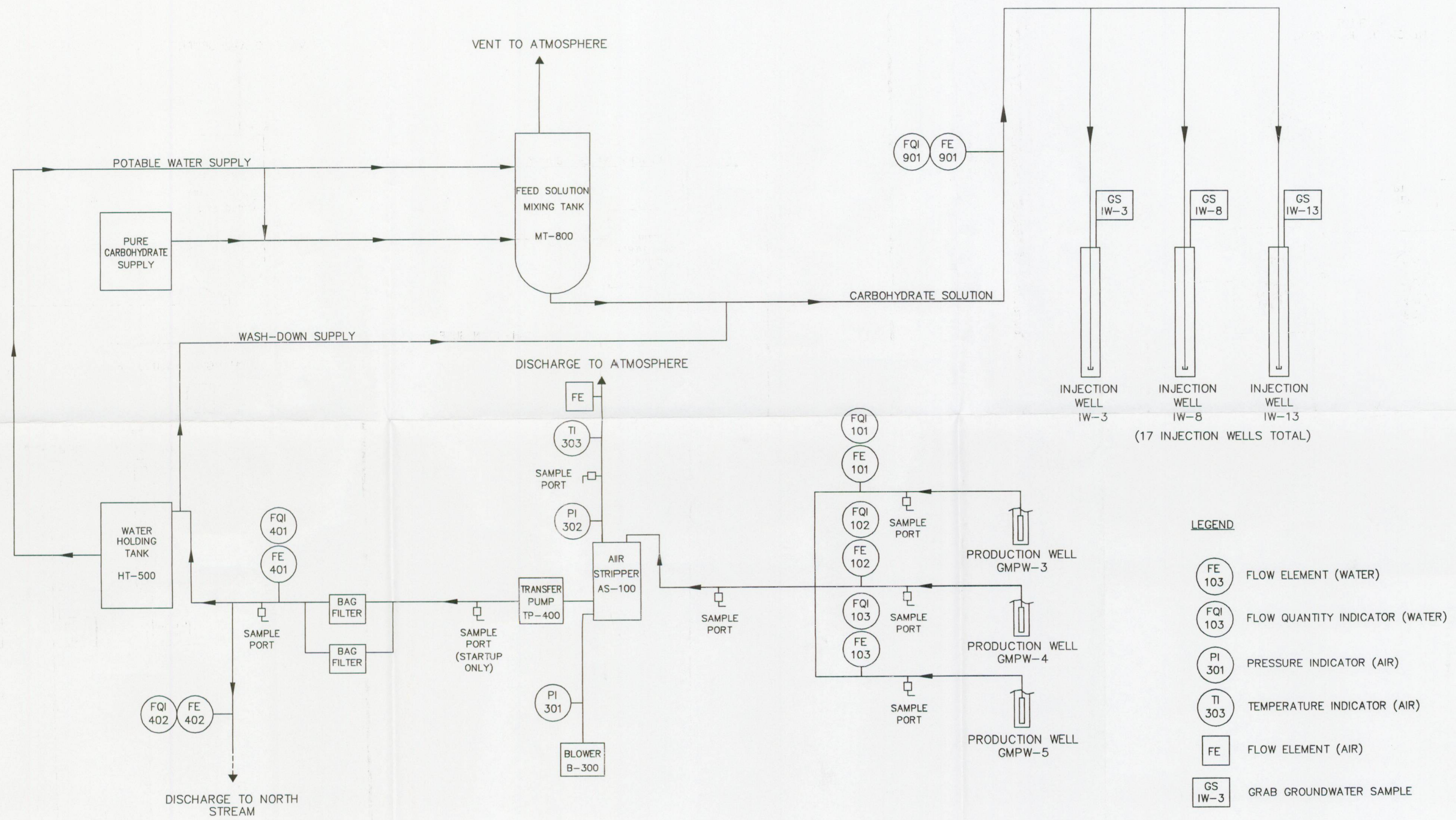
COLESVILLE LANDFILL
COLESVILLE, NEW YORK

LONG-TERM EFFECTIVENESS MONITORING LOCATIONS

DRAWN LMC	DATE 5/7/02	PROJECT MANAGER D. STERN	DEPARTMENT MANAGER
		LEAD DESIGN PROF.	CHECKED D. STERN
		PROJECT NUMBER NY09490014T4	DRAWING NUMBER 1



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NO.	DATE	REVISION DESCRIPTION	BY / CKD

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COLESVILLE LANDFILL
BROOME COUNTY, NEW YORK

DRAWN: LMC	DATE: 5/30/02
PROJECT MANAGER: S. FELDMAN	DEPARTMENT MANAGER:
LEAD DESIGN PROF.:	CHECKED: D. STERN
PROJECT NUMBER: NY00949.0014	DRAWING NUMBER: 2

TREATMENT AND INJECTION PROCESS PERFORMANCE SAMPLING AND MONITORING LOCATIONS

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Appendix A

Sampling and Analysis Plan

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Appendix A

Sampling and Analysis Plan

Long-Term Monitoring Plan,
Colesville Landfill
Broome County, New York
NYSDEC Site 704010

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David E. Stern
Project Hydrogeologist

Steven M. Feldman
Project Manager

Appendix A
Sampling and Analysis Plan
Long-Term Monitoring Plan,
Colesville Landfill
Broome County, New York
NYSDEC Site 704010

Prepared for:
Client

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Date:
28 June 2002

1. Introduction

ARCADIS G&M, Inc. (ARCADIS) has been retained by Broome County Department of Solid Waste Management to prepare the Long-Term Monitoring (LTM) Plan for the groundwater remedy at the Colesville Landfill, East Windsor Road, Broome County, New York (Site 704010). The LTM Plan has been prepared pursuant to the Administrative Order on Consent (AOC) entered into by Broome County with the New York State Department of Environmental Conservation (NYSDEC) on January 1987; and pursuant to the March 1991 Record of Decision (ROD) issued by the NYSDEC for the Colesville Landfill site. The LTM Plan is intended to be the primary reference for the monitoring of the groundwater remedy. ARCADIS has prepared this field Sampling and Analysis Plan (SAP) as a component of the LTM Plan to present the methodologies to be employed during sample collection and analysis activities associated with various monitoring requirements presented in the LTM Plan (i.e., environmental effectiveness, and remedial system performance and compliance). Specifically, the SAP is provided as Appendix A of the LTM Plan. The SAP identifies the procedures to be used to implement hydraulic monitoring (water-level measurements), water quality effectiveness monitoring (sampling of groundwater monitoring wells, spring water, and surface water), and remedial system performance and compliance monitoring (water and/or air sampling associated with groundwater production wells and injection system process components). All procedures and protocols described herein shall be conducted in accordance with the requirements set forth in the Quality Assurance Project Plan (QAPP), provided as Appendix B of the LTM Plan. The remedial system startup and performance analysis plan is provided as Appendix C of the LATM Plan.

2. Sampling and Analysis Activities Associated with Environmental Effectiveness Monitoring

This section identifies the procedures to be used to implement operational monitoring associated with LTM of the remedy. As discussed in the LTM Plan, effectiveness monitoring includes: 1) hydraulic monitoring (water-level measurements), and 2) water quality monitoring (sampling of groundwater monitoring wells, spring water, and surface water). These two elements comprise the environmental effectiveness monitoring component of the LTM Plan (Section 4.1 of the LTM Plan).

2.1 Hydraulic Monitoring

This section summarizes the monitoring locations and schedule, and describes the procedures for collection of water-level measurements to be used for effectiveness hydraulic monitoring.

2.1.1 Hydraulic Monitoring Locations and Schedule

A total of 16 wells comprise the well network for hydraulic monitoring associated with the remedy. In summary, the hydraulic monitoring will be conducted to monitor groundwater flow directions within the project area during operation of the remedy. A more detailed description of the hydraulic monitoring program (including objectives/rationale, monitoring well designations and locations, construction details, and schedule, or frequency, of monitoring) is presented in the LTM Plan.

2.1.2 Hydraulic Measurement Collection Procedures

Hydraulic (i.e., water level) measurements will be collected from the hydraulic monitoring well network using the following procedures. For all monitoring wells, water-level measurements will be collected by measuring the depth to groundwater at each well from the surveyed measuring point identified on each well casing. The water-level measurements will be made to the nearest one-hundredth of a foot with an electronic water-level indicator probe. The probe will be decontaminated between well locations using methods described in the QAPP (Appendix B - Section 4.3). Water-level measurements and other pertinent information (e.g., well designation) will be recorded as outlined in the QAPP (Appendix B - Section 4.1.5).

2.2 Groundwater Quality Monitoring

This section summarizes the sampling locations and schedule, and describes the procedures for groundwater sample collection and analysis to be used for groundwater quality monitoring activities.

2.2.1 Groundwater Sampling Locations and Schedule

A total of 14 wells comprise the groundwater quality monitoring well network associated with evaluating the environmental effectiveness of the remedy. A more detailed description of the groundwater quality monitoring program (including objectives/rationale, monitoring purpose, monitoring well designations and locations, construction details, analytical program, and schedule, or frequency, of monitoring) is presented in the LTM Plan.

2.2.2 Groundwater Sample Collection and Analysis

This subsection describes the methods and procedures used to sample groundwater from monitoring wells. The methods and procedures used to sample spring water and surface water are provided in the following Section 2.3.

Pre-sampling activities include accessing the well, preparing the well site for purging and sampling, and collecting initial measurements. To access the well, the protective casing will be unlocked. The depth to water in the well will be measured to the hundredth of a foot with an electronic water-level indicator and the total depth of the well will be sounded. Information pertinent to the well purging and sampling activities will be recorded as outlined in the QAPP (Appendix B - Section 4.1.5).

Before the collection of each round of groundwater samples, appropriate pre-cleaned sample containers (bottles) will be provided by the laboratory in accordance with procedures and requirements described in the QAPP (Appendix B - Section 4.2). The sample bottles will be inventoried and inspected to make sure all the required bottles are present, unbroken, and have been adequately prepared by the laboratory (i.e., sample preservation requirements, as applicable). Throughout the sample collection and handling process, the sampling technician will wear new disposable gloves for each well sampled.

Consistent with NYSDEC-approved procedures, monitoring wells will be purged using a non-dedicated, variable speed, 2-inch diameter submersible pump. Purging and sampling of groundwater will follow United States Environmental Protection Agency (USEPA) Micropurge/low-flow protocols (USEPA 1998). Field parameters will be monitored in a flow-through cell using calibrated meters and will include pH, specific conductance, dissolved oxygen (DO), oxidation/reduction (redox) potential, sulfide, and temperature; selected wells will also be monitored for turbidity. Field meters will be calibrated daily according to manufacturer's instructions. Completion of purging and therefore, the actual volume of water purged from each well will be based on the stabilization protocols described in the Micropurge method. In summary, the stabilization protocols are as follows: 1) measurements should be taken every three to five minutes; 2) stabilization is achieved after all parameters have stabilized for three successive readings; and 3) three successive readings should be within +/- 0.1 standard units for pH, +/- 3 percent for specific conductance, +/- 10 percent for DO, +/- 10 millivolts (mV) for redox potential, and +/- 10 percent for temperature. Following stabilization of field parameters, the purge rate will then be reduced to approximately 100 milliliters per minute (mL/min) and the groundwater sample will be collected directly from the pump discharge.

Poor yielding wells (i.e., Well W-5) from which a constant pumping rate cannot be achieved using the submersible pump will be monitored and sampled for the field and analytical parameters that do not require use of the Micropurge methodology for the collection of valid results (i.e., VOCs and select field parameters and inorganics). In these instances a disposable bailer will be utilized to purge the well to the extent possible (for some wells, the standing water can be completely evacuated using a bailer).

All groundwater samples will be collected from the pump discharge into laboratory supplied sample bottles. Special care will be taken in filling and capping the VOC vials, so that no headspace or air bubbles are present in the groundwater samples collected for VOC analysis. In addition, overflowing bottles will be avoided to prevent the loss of floating substances or preservatives that have already been added to the bottle. For samples that will be analyzed for dissolved metals (i.e., iron and manganese), the sample will be filtered in the field using an in-line, 0.45-micron disposable filter prior to decanting the sample into the appropriate sample container. All sample bottle caps will be secured snugly, but not over-tightened.

Once sampling is complete, the non-dedicated pump will be gradually removed from the well. Disposable sampling equipment (e.g., tubing) will be disposed of off the site. The wells will be locked when sampling is completed.

All samples (including QA/QC samples, as specified in the attached QAPP – Appendix B) will be properly labeled and identified, and information on the Water Sampling Log and chain-of-custody form will be completed. The QAPP (Appendix B) provides additional details regarding Field Records and QA/QC samples, frequency and protocols (Section 4.1), sample labeling (Section 4.2), and sample custody (Section 4.4). All sample containers will be checked for proper identification/labeling and compared to the chain-of-custody form for accuracy prior to packaging any sample for shipment. The chain-of-custody form will be placed in a sealed plastic bag and taped to the underside of the cooler lid. The samples may then be wrapped with a cushioning material, as needed, to preclude breakage during shipment and placed in a cooler. Sufficient amounts of bagged ice or ice packs will be placed in the cooler to keep the samples cool until arrival at the laboratory. When the cooler is ready, it will be sealed with fiber (duct) tape, and custody seals will be placed in such a manner that any opening of the cooler prior to arrival at the laboratory can be detected.

Samples will be delivered by overnight carrier to the analytical laboratory following sample custody requirements specified in the QAPP. The laboratory will be prepared to receive the samples and perform preliminary extractions or analyses within the analytical method recommended holding times. All groundwater samples (including QA/QC samples) will be analyzed for Target Compound List (TCL) VOCs using USEPA Method 8021, as described in the QAPP (Section 4.5). Groundwater samples submitted for analysis of dissolved iron and manganese will be analyzed using USEPA Methods 6010 and 6060, respectively, as described in the QAPP (Section 4.5). Groundwater samples submitted for total organic carbon will be analyzed using USEPA Method 415.1, as described in the QAPP (Section 4.5). Groundwater samples submitted for nitrate, nitrite, and sulfate will be analyzed using USEPA Methods 353.3, 354.1, and 375.4, respectively, as described in the QAPP (Section 4.5). Groundwater samples submitted for permanent gases (e.g., carbon dioxide, carbon monoxide, oxygen, nitrogen, methane, ethane, and ethane) will be analyzed using Method AM20GAX, as described in the QAPP (Section 4.5).

All non-dedicated well evacuation and sampling equipment (probes, pumps, etc.) will be decontaminated before, after, and between well locations using methods described in the QAPP (Section 4.3).

2.3 Spring and Surface Water Quality Monitoring

This section summarizes the sampling locations and schedule, and describes the procedures for sample collection and analysis to be used for spring water and surface water quality monitoring activities.

2.3.1 Spring and Surface Water Sampling Locations and Schedule

A total of four locations that have historically shown the presence of springs and a single surface water location comprise the spring and surface water monitoring network associated with evaluating the environmental effectiveness of the remedy at the site. A more detailed description of the spring water and surface water quality monitoring program (including program objectives/rationale, monitoring purpose, monitoring well designations and locations, analytical program, and schedule, or frequency, of monitoring) is provided in the LTM Plan.

2.3.2 Spring and Surface Water Sample Collection and Analysis

Representative spring water and surface water samples will be collected from three spring water locations and one surface water location at the site using the following procedures.

Preparation

Identify the sampling location and record all pertinent sampling information on the Water Sampling Log form. Don a new pair of disposable gloves. Prepare the sample bottles, as follows: each bottle must be labeled prior to the collection of water samples; each label should contain (printed in indelible ink) the date, time, sample ID, site name, analysis requested, preservative, and sampler's name; and sample bottles should never be opened prior to receiving samples and should always be stored in the ice chest or transport container.

Field Parameters

Prior to spring water/surface water sampling, remove any organic debris (leaves, sticks, etc.) so the spring water/surface water can flow freely. Spring water/surface water pH, temperature, specific conductivity, oxidation/reduction potential, and dissolved oxygen will then be tested. Samples for these field parameters will be collected in a clean glass or plastic beaker. Before obtaining these measurements, the field instrumentation will be properly calibrated with reference standards in accordance with the manufacturer's recommendations. After calibration, the sample reading will be recorded on the Water Sampling Log (refer to the QAPP - Appendix B).

Sampling Equipment and Techniques

Following recording of the field parameters, the spring water/surface water will be sampled for VOCs (refer to LTM Plan - Section 6.2).

Sample Handling

Once the spring water/surface water to be sampled is retrieved, the water must be immediately placed in the appropriate containers. Special care will be taken in filling and capping the VOC vials, so that no headspace or air bubbles are present in the groundwater samples collected for VOC analysis. In addition, overflowing bottles will be avoided to prevent the loss of floating substances or preservatives that may have already been added to the bottle. All sample bottle caps will be secured snugly, but not over-tightened.

All samples (including QA/QC samples, as specified in the attached QAPP – Appendix B) will be properly labeled and identified, and information on the Water Sampling Log and chain-of-custody form will be completed. The QAPP (Appendix B) provides additional details regarding Field Records and QA/QC samples, frequency and protocols (Section 4.1), sample labeling (Section 4.2), and sample custody (Section 4.4). All sample containers will be checked for proper identification/labeling and compared to the chain-of-custody form for accuracy prior to packaging any sample for shipment. The chain-of-custody form will be placed in a sealed plastic bag and taped to the underside of the cooler lid. The samples may then be wrapped with a cushioning material, as needed, to preclude breakage during shipment and placed in a cooler. Sufficient amounts of bagged ice or ice packs will be placed in the cooler to keep the samples cool until arrival at the laboratory. When the cooler is ready, it will be sealed with fiber (duct) tape, and custody seals will be placed in such a manner that any opening of the cooler prior to arrival at the laboratory can be detected.

Samples will be delivered by overnight carrier to the analytical laboratory following sample custody requirements specified in the QAPP. The laboratory will be prepared to receive the samples and perform preliminary extractions or analyses within the analytical method recommended holding times. All groundwater samples (including QA/QC samples) will be analyzed for Target Compound List (TCL) VOCs using USEPA Method 8021, as described in the QAPP (Section 4.5).

3. Sampling and Analysis Activities Associated with Performance and Compliance Monitoring

This section identifies the procedures to be used to implement performance and compliance monitoring associated with LTM of specific groundwater remediation systems associated with the remedy. Currently, these include the two on-site remedial systems referred to as the pump-and-treat (PT) remedial system and the enhanced reductive de-chlorination (ERD) injection remedial system. As discussed in the LTM Plan, performance and compliance monitoring includes water and air sampling and analysis activities associated with the three primary remediation system components: 1) the remedial system production wells and injection wells, 2) the air stripper/filtration process effluent to the solution mixture tank and blowoff discharge to the North Stream (one location of the two locations will be sampled each round, depending on whether the system is blowing off the treated effluent or is preparing the injection solution), and

3) the air stripper tower effluent stack. The monitoring and testing activities associated with remedial system startup are described and discussed in Appendix C of the LTM Plan.

This section specifically summarizes the associated sampling locations and schedule, and describes the procedures for water and air sample collection and analysis to be used during the long-term operation of the groundwater remedy.

3.1 Sampling Locations and Schedule

The objectives for sample collection and analysis associated with performance and compliance monitoring are presented in the LTM Plan and will be conducted to ensure consistent and proper operation of the systems. In summary, the analytical data will be utilized to 1) evaluate the performance of the remedial systems, 2) determine compliance of air quality within the requirements and limits specified in the LTM Plan, and 3) evaluate the need for operation and maintenance activities.

The specific number of water sampling locations and schedule, or frequency, is defined in the LTM Plan (Table 3). In general, water samples will be collected from the groundwater production well systems (i.e., from the discharge of individual wells GMPW-4, GMPW-4, and GMPW-5), and the air stripper/filtration system (i.e., effluent [after the in-line cartridge filter] to the solution mixture chamber and prior to discharge to the North Stream). Air samples will be collected from the effluent air stack. Figure 2 of the LTM Plan depicts the remedial system process and instrumentation schematic and shows the locations of performance/compliance sampling points.

The schedule, or frequency, of sampling events during operation of the groundwater remediation system is presented in the LTM Plan. Table 3 of the LTM Plan specifies quarterly frequency for performance and compliance monitoring activities for long-term operation of the remedial system.

3.1.1 Groundwater Production Wells and Injection Wells

Field measurements and water sampling locations associated with the PT remedial system include sampling ports associated with the individual Production Wells GMPW-3, GMPW-4, and GMPW-5 (designated as Samples GMPW-3, GMPW-4, and GMPW-5). The sampling ports are located at each wellhead within the associated production well vaults. The metering will allow monitoring of individual production well flow rates and the total flow to the injection system process/North Stream, as appropriate. The sampling port locations will allow for collection of water samples for the periodic evaluation and quantification of VOCs present in groundwater extracted by each individual production well.

Water sampling locations associated with selected individual injection wells include access to the well water at the individual Injection Wells IW-3, IW-8, and IW-13 (designated as Samples IW-3, IW-8, and IW-13). The samples will be collected directly from the wells using a bottom-filling disposable bailer with disposable polypropylene rope. The sampling locations will allow for collection of water samples for the periodic evaluation and quantification of pH and TOC present in individual injection wells. Depending on the results obtained form the aforementioned wells, additional or alternate injection wells may be selected for long-term performance monitoring.

3.1.2 Pump-and-Treat System

Field measurement and water sampling locations associated with the air stripping/filtration system include the remedial system effluent sampling port and prior to the solution mixture chamber (designated as Sample EFF HT-500), and the remedial system effluent sampling port and prior to discharge to the North Stream (designated as Sample EFF NS). The remedial system effluent metering and sampling ports are located along the air stripper outlet piping after the in-line cartridge filter.

3.1.3 Effluent Air Stack

Field measurement and air sampling locations associated with the PT system include the effluent airflow, pressure, and temperature metering and the stack air sampling port (AS Stack). The air stack effluent sampling port and metering are located along the 6-inch diameter stack mounted on Air Stripper AS-100.

3.1.4 ERD System

Field measurements locations associated with the ERD component of the remedial system include monitoring total flow of injection solution at the common header prior to injection to the groundwater system via the injection wells.

3.2 Water Sample Collection and Analysis

Before the collection of each quarterly round of water samples, appropriate pre-cleaned sample containers (bottles) will be provided by the laboratory in accordance with procedures and requirements described in the QAPP (Appendix B - Section 4.2). The sample bottles will be inventoried and inspected to make sure all the required bottles are present, unbroken, and have been adequately prepared by the laboratory (i.e., sample preservation requirements, as applicable). Throughout the sample collection and handling process, the sampling technician will wear new disposable gloves for each location sampled.

To collect a water sample from the desired sample location, the appropriate container will be filled directly from the sample port. The flow of water from the sample port/bailer will be adjusted to ensure slow laminar flow so that no entrained air bubbles result. The headspace (trapped air) should be minimized for each bottle, but should be from 5 to 10 percent of the sample bottle volume for non-VOC samples. Special care will be taken in filling and capping the VOC vials, so that no headspace or air bubbles are present in the water samples collected for VOC analysis. In addition, overflowing bottles will be avoided to prevent the loss of floating substances or preservatives that may have already been added to the bottle. All sample bottle caps will be secured snugly, but not over-tightened.

All samples collected on a quarterly basis (including QA/QC samples specified in the QAPP) will be properly labeled and identified, and information on the Water Sampling Log and chain-of-custody form will be completed. The QAPP provides additional details regarding Field Records and QA/QC samples, frequency and protocols (Section 4.1), sample labeling (Section 4.2), and sample custody (Section 4.4). All sample containers will be checked for proper identification/labeling and compared to the chain-of-custody form for accuracy prior to packaging any sample for shipment. The chain-of-custody form will be placed in a sealed plastic bag and taped to the underside of the cooler lid. The samples may then be wrapped with a cushioning material, as needed, to preclude breakage during shipment and placed in a cooler. Sufficient amounts of bagged ice or ice packs will be placed in the cooler to keep the samples at 4 degrees Celsius until arrival at the laboratory. When the cooler is ready, it will be sealed with fiber (duct) tape, and custody seals will be placed in such a manner that any opening of the cooler prior to arrival at the laboratory can be detected.

Samples collected on a quarterly basis will be delivered by overnight carrier to the analytical laboratory following sample custody requirements specified in the QAPP.

The laboratory will be prepared to receive the samples and perform preliminary extractions or analyses within the analytical method recommended holding times. All water samples (including QA/QC samples) will be analyzed for TCL VOCs using USEPA Method 8021 and for total iron using USEPA Method 6010, as described in the QAPP (Section 4.5).

3.3 Air Sample Collection and Analysis

Before the collection of each round of air samples, appropriate pre-cleaned sample containers will be provided by the laboratory in accordance with procedures and requirements described in the QAPP (Appendix B - Section 4.2), as applicable. The sample containers provided by the laboratory for air sampling will be Teldar Bags. The sample containers will be inventoried and inspected to make sure all the required containers are present and in good condition. Throughout the sample collection and handling process, the sampling technician will wear new disposable gloves for each location sampled.

To collect an air sample from the desired sample location, the Tedlar Bag will be filled from the sample port. Heavy walled disposable Teflon tubing will be used to connect the sample container and the sample port. The Tedlar Bag will be filled completely with the system pressure at the sample port. A sampling vacuum pump is not needed because the air sampling points are under positive pressure.

All samples (including QA/QC samples specified in the QAPP) will be properly labeled and identified, and information on the Field Sampling Log and chain-of-custody form will be completed. The system airflow, pressure, and temperature at the location and time of sample collection will also be recorded on the Field Sampling Log. The QAPP provides additional details regarding Field Records and QA/QC samples, frequency and protocols (Section 4.1), sample labeling (Section 4.2), and sample custody (Section 4.4). All sample containers will be checked for proper identification/labeling and compared to the chain-of-custody form for accuracy prior to packaging any sample for shipment. The chain-of-custody form will be placed in a sealed plastic bag and taped to the underside of the cooler lid. The samples may then be wrapped with a cushioning material, as needed, to preclude damage during shipment and placed in a cooler. The air samples will remain at ambient temperature throughout transport until arrival at the laboratory. When the cooler is ready, it will be sealed with fiber (duct) tape, and custody seals will be placed in such a manner that any opening of the cooler prior to arrival at the laboratory can be detected.

Samples will be delivered by overnight carrier to the analytical laboratory following sample custody requirements specified in the QAPP. The laboratory will be prepared to receive the samples and perform preliminary extractions or analyses within the analytical method recommended holding times. All air samples will be submitted a NYSDOH-approved laboratory for analysis for VOCs using modified USEPA Method TO-14A, as further described in the QAPP.

4. Field Decontamination Procedures

Proper decontamination of non-dedicated field equipment associated with sampling activities will ensure that the data collected in support of the LTM activities for the remedial system will meet the Precision, Accuracy, Representativeness, Comparability and Completeness (PARCC) requirements, as presented in the QAPP (Appendix B - Section 4.3). Field equipment decontamination procedures are presented in detail in the QAPP and include decontamination procedures associated with non-dedicated well evacuation and sampling equipment (i.e., probes and pumps), and personal protective equipment, as applicable.

5. Waste Disposal

All waste generated during sampling activities including, but not limited to, well purge and decontamination water, will be disposed of as outlined in this section. Sampling procedures involving the collection of water or air samples obtained as direct grab sample do not generate waste. Fluids generated from decontamination activities and purge water from monitoring wells will be discharged to land surface at the well location. Disposable sampling equipment (e.g., tubing) will be disposed of off-site.

ARCADIS

Appendix B

Quality Assurance Project Plan

ARCADIS

Appendix B

Quality Assurance Project Plan

Long-Term Monitoring Plan,
Colesville Landfill
Broome County, New York
NYSDEC Site 704010

ARCADIS

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Appendix B
Quality Assurance Project Plan

Long-Term Monitoring Plan,
Colesville Landfill
Broome County, New York
NYSDEC Site 704010

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Our Ref.:
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Date:
28 June 2002

Tables

Attachments

1. Introduction

ARCADIS G&M, Inc. (ARCADIS) has been retained by Broome County Department of Solid Waste Management to prepare the Long-Term Monitoring (LTM) Plan for the groundwater remedy at the Colesville Landfill, East Windsor Road, Broome County, New York (Site 704010). The LTM Plan has been prepared pursuant to the Administrative Order on Consent (AOC) entered into by Broome County with the New York State Department of Environmental Conservation (NYSDEC) on January 1987; and pursuant to the March 1991 Record of Decision (ROD) issued by the NYSDEC for the Colesville Landfill site. The LTM Plan is intended to be the primary reference for the monitoring of the groundwater remedy. ARCADIS has prepared this Quality Assurance Project Plan (QAPP) as a component of the LTM Plan to present the methodologies to be employed during sample collection and analysis activities associated with various monitoring requirements presented in the LTM Plan (i.e., environmental effectiveness, and remedial system performance and compliance). Specifically, the QAPP is provided as Appendix B of the LTM Plan.

The overall objective of the QAPP is to produce data of the highest quality that can be used to support the LTM Plan. This QAPP has been prepared in accordance with the USEPA guidance, "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" (USEPA 1983) and considering requirements of the Order on Consent (NYSDEC, January 1987). This QAPP is intended to address the field sampling and analysis component of the LTM Plan. Therefore, this QAPP presents the project organization and responsibilities, and QA/QC protocols related to field sampling and analysis activities associated with various monitoring requirements presented in the OM&M Manual (i.e., operational, performance, and compliance). The procedures in this QAPP will be implemented to ensure that precision, accuracy, representativeness, completeness, and comparability (PARCC parameters) of the data can be documented.

2. Site Description

Waste disposal operations were conducted at the Site from 1969 until it was closed in 1984. The landfill was primarily used for the disposal of municipal solid waste. Historical data indicate that waste was not placed below the water table during operation of the landfill. Installation of the landfill cap, which was completed on November 1, 1995, will essentially eliminate the generation of landfill leachate over time. In addition to the expected improvement in groundwater quality resulting from this source control measure, VOC mass removal via intrinsic remediation is an ongoing process at the Site.

Groundwater samples collected from beneath and downgradient of the landfill since 1995 indicate that the areal extent of VOC-impacted groundwater is static, and total VOC concentrations are stable to decreasing with time. Evidence of the intrinsic remediation of VOC-impacted groundwater is provided by the distribution and occurrence of the biogeochemical indicators such as ethene, ethane, oxygen, nitrate, sulfate, methane, and soluble iron and manganese.

3. Project Organization and Responsibilities

The responsibilities of the key project personnel are detailed below.

- The Project Director is responsible for overseeing the implementation of the project tasks. The Project Director will review all documents and other correspondence concerning the activities performed pursuant to the requirements contained in the Order on Consent (NYSDEC, January 1987) and the ROD (March 1991). The Project Director is also responsible for the overall QA including technical adequacy of the project activities and reports and conformance to the scope of work.

- The Project Manager is responsible for the following: sampling QC; overall project coordination; adherence to the project schedules; directing, reviewing, and assessing the adequacy of the performance of the technical staff and subcontractors assigned to the project; implementing corrective action, if warranted; interacting with the Project Director; preparing reports; and maintaining full and orderly project documentation.

- The project team members include the task managers, field hydrogeologists, sampling team/field technicians, support staff (e.g., data processors, secretaries, and in-house experts in engineering, etc.) who are responsible for work in their respective specialty areas which are or may be required to meet the project objectives.

- The Project QA/QC Officer is responsible for performing systems auditing and for providing independent data quality review of project documents and reports.

- The Project Health and Safety Coordinator is responsible for implementing the site-specific health and safety directives in the Health and Safety Plan (HASP) and for contingency response.

- The Data Validator is responsible for review of laboratory data for compliance with the QA objectives for the PARCC parameters, and notifications to the project manager of any QC deficiencies.

4. Quality Assurance/Quality Control – Field Sampling and Analysis Activities

The overall QA objective for this aspect of the project is to develop and implement procedures for field measurements, sampling, and analytical testing that will provide data of known quality that is consistent with the intended use of the information. Generally, the specific field sampling and analysis activities to be conducted during this project that require QA/QC protocols include: (1) groundwater, spring, and surface water sampling associated with groundwater quality operational monitoring; and (2) water and air sampling associated with system performance and compliance monitoring. Standard procedures (as outlined in detail in the SAP) are used so that known and acceptable levels of PARCC parameters are maintained for each data set. More detail on the methodologies associated with these activities is provided in the SAP, including calibration and maintenance of field instruments.

Quality assurance/quality control protocols will be used to ensure the PARCC parameters of data collected during these field activities meet the objectives of the overall project. Specifically, all data will be gathered or developed using procedures appropriate for the intended use. The field measurements and laboratory analyses will be used to support one or more steps in evaluating the objectives of the overall project discussed in the LTM Plan. Descriptions of the QA/QC protocols are presented in the following subsections of the QAPP. The QA/QC protocols for this aspect of the project include laboratory analysis and validation procedures, field decontamination procedures, calibration and maintenance of field instruments, and QA/QC sampling procedures.

4.1 Field QA/QC

To ensure that data collected in the field is consistent, accurate and complete, forms will be utilized for repetitive data collection, such as depth to water in wells, groundwater sampling etc. These field forms include a Water-Level Measurement form and a Water Sampling Log, as applicable to a specific field task; sample forms are provided in Attachment A.

Quality assurance/quality control samples will be collected to assure quality control for the groundwater monitoring component (environmental effectiveness) and system performance monitoring component of the LTM Plan. Analyses of QA/QC samples will enable data evaluation for accuracy and integrity. A quality assurance/quality control sample set includes a field (equipment) blank, a trip blank, a site-specific matrix spike/matrix spike duplicate (MS/MSD), and/or a blind duplicate, as applicable, for groundwater and/or water samples associated with the long-term monitoring components identified above. The QA/QC sample set will also vary depending on the parameter or group of parameters specified for analysis. Collection and analyses of QA/QC samples are not specified for air samples associated with system compliance monitoring. A summary of the QA/QC samples is provided in Table B-1. Blanks and duplicate samples will be used to verify the quality of the sampling results. Demonstrated analyte-free water will be supplied by the laboratory for the preparation of QA/QC samples; documentation for the analysis of QA/QC blank water will be provided if contamination is detected in the blanks. A brief description of these QA/QC samples follows.

4.1.1 Field (Equipment Rinsate) Blanks

A field (equipment rinsate) blank is a water sample that consists of laboratory supplied analyte-free water that is poured through or over a decontaminated piece of sampling or other down-hole equipment to assess or document the thoroughness of the decontamination process. A rinsate blank will be collected from the decontaminated down-hole equipment by pouring analyte-free water over the equipment and into sample containers before use in sampling. One field blank will be collected each day non-dedicated (disposable or reusable) equipment is used. These QA/QC samples will only be collected in connection with the collection of aqueous samples associated with spring, and surface water monitoring activities and submitted for the appropriate chemical analysis (see Table B-1).

4.1.2 Trip Blanks

A trip blank will contain laboratory supplied analyte-free water and will be transported to the site and returned to the laboratory without opening. This will serve as a check for contamination originating from sample transport, shipping, and from site conditions. One trip blank per day per sampling team will be utilized during groundwater, spring, and surface water monitoring activities. The maximum number of samples per trip blank is 20. These QA/QC samples will only be collected in connection with the collection of aqueous samples (associated with both groundwater and system performance monitoring) for VOC analysis and submitted for the appropriate chemical analysis (see Table B-1).

4.1.3 Blind (Field) Duplicates

One blind duplicate sample per 20 samples or one per week (whichever is greater) will be used during monitoring well sampling activities and system performance and compliance monitoring activities, including air analyses (see Table B-1). The analytical results for the sample and blind duplicate will be used to determine if the data reported by the laboratory are precise, accurate, representative, and comparable. The blind duplicate samples will be assigned fictitious sample identifications. The correct sample identification number will be recorded in the water sampling logs.

4.1.4 MS/MSD Samples

Site-specific MS and MSD samples will be collected and submitted to the laboratory as separate samples to provide site-specific matrix-interference data. Upon arrival at the laboratory, the MS/MSD samples will be spiked with appropriate analytes and analyzed by the appropriate method. The purpose of spiking and analyzing the samples is to evaluate any site-specific matrix interference on the analytical results. One MS/MSD sample set will be collected for every 20 samples collected during groundwater sampling activities. One MS/MSD sample set per event will be collected during system performance monitoring activities. These QA/QC samples will only be collected in connection with the collection of aqueous samples (associated with both groundwater and system performance monitoring) for VOC analysis and submitted for the appropriate chemical analysis (see Table B-1).

4.1.5 Field Records

Proper documentation will consist of all field personnel maintaining records of all work accomplished including the items listed below:

- Date and time of work events;
- Purpose of work;

- Description of methods;
- Description of samples;
- Number and size of samples;
- Description of sampling point;
- Date and time of collection of sample;
- Sample collector's name;
- Field observations; and
- Field measurements with portable instruments.

All information pertinent to field sampling activities will be recorded in bound, waterproof field books or on the logs provided in Attachment A. Duplicates of field notes/forms will be prepared and kept in a secure place away from the Site.

4.2 Preparation and Preservation of Sample Containers

Laboratory pre-cleaned sample containers will be provided by the laboratory. Each sample container will be provided with a label for sample identification purposes. The information on the label will include a sample identification number, time, date and initials of the sample collector. All sample containers will be accompanied by a full chain-of-custody (see Attachment B).

All sample containers will be thoroughly pre-cleaned at the laboratory prior to sampling and appropriate sample preservatives will be added to the bottles, prior to sample bottle shipment to the client. It is laboratory practice to pre-preserve sample containers in order to minimize potential contaminants in the field and to reduce unnecessary sample handling in the field (the laboratory Quality Assurance Plans will be provided upon request). Table B-2 provides a summary of sample analysis methods, sample containers, holding times and preservation procedures to be used.

4.3 Decontamination

Proper decontamination of all non-dedicated sampling equipment will help ensure that the data collected in support of the LTM Plan will meet the PARCC requirements.

4.3.1 Decontamination Procedures

Field equipment will be decontaminated between well/sampling locations using the following procedures.

4.3.1.1 Field Decontamination of Sampling Equipment

Field decontamination of non-dedicated well evacuation and sampling equipment (i.e., probes and pumps) will consist of 1) surficial wash and manual scrubbing with Micro-90 solution (or equivalent) to remove foreign material inside and out, and 2) de-ionized water rinse. The items will then be stored in such a manner as to preserve their decontaminated condition prior to use at the next sampling location.

4.3.1.2 Personnel Protective Equipment Decontamination Procedures

The personnel protective equipment (PPE) decontamination procedure shall consist of the minimum decontamination stations outlined in the HASP (ARCADIS 2002) (incorporated here by reference), as applicable for the planned field activities or in the case that non-disposable PPE is used while conducting the planned field activities.

4.4 Sample Custody

To maintain and document sample possession, chain-of-custody procedures will be followed. A chain-of-custody form contains the signatures of individuals who have possession of the samples after collection in the field; a sample chain-of-custody form is provided in Attachment B.

A sample is under custody if it is:

1. In one's actual possession; or

2. In one's view, after being in your physical possession; or

3. Was in one's physical possession and then was locked up or sealed to prevent tampering; or

4. It is in a designated secure place restricted to authorized personnel.

Each person involved with the samples will know chain-of-custody procedures. A detailed discussion of the stages of possession (i.e., field collection, transfer, and laboratory custody) is presented below in the following sections.

4.4.1 Environmental Samples Chain-of-Custody

The laboratory begins the chain-of-custody procedure with the preparation of the sample bottles. The field sampler continues the chain-of-custody procedure in the field and is the first to sign the form upon collection of samples. The field sampler is personally responsible for the care and custody of the samples until they are transferred and properly dispatched. Sample labels shall be completed for each sample, using waterproof ink, subjected to proper preservation, and packaged to preclude breakage during shipment. Every sample shall be assigned a unique identification number that is entered on the chain-of-custody form. Samples can be grouped for shipment using a single form.

4.4.2 Transfer of Custody and Shipments

All samples will be accompanied by a chain-of-custody record. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time of transfer. This record documents transfer of custody of samples from the sampler to another person to the analytical laboratory.

Samples will be properly packed for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in each sample cooler. All chemical analytical samples will be delivered to the laboratory within 24 hours of collection.

Whenever samples are split with a facility or government agency, a separate chain-of-custody record will be prepared for those samples and marked to indicate with whom the samples were split.

4.4.3 Laboratory Sample Custody

The laboratory utilized for chemical analysis will have standard operating procedures for documenting receipt, tracking and compilation of sample data. Sample custody, related to sampling procedures and sample transfer, is described below:

1) Shipping or Pickup of Cooler By Client (Sampler).

    (a) Cooler packed at the laboratory after contact with client.

    (b) Cooler wrapped with evidence tape.

    (c) Chain-of-Custody form filled out by field sampling personnel and client.

    (d) Client supplies evidence tape and seals cooler prior to shipment back to the laboratory.

2) Delivery of Cooler to the Analytical Laboratory

    (a) Samplers check for any external damage (such as leaking).

    (b) Samplers sign the waybill for cooler to the laboratory (to shipper).

    (c) The laboratory receives cooler and complete chain of custody.

The samples will be stored at the proper temperature prior to analysis. It is the responsibility of the laboratory to properly dispose of samples beyond the holding period.

4.5 Laboratory Analyses

All groundwater, spring, and surface water samples (including QA/QC samples) will be sent to Buck Laboratories, located in Cortland, New York, for the analysis, the locations and schedule is described in the SAP (Section 2.2 Groundwater Quality Monitoring and 2.3 Spring and Surface Water Quality Monitoring). The Buck Laboratory facility is a NYSDOH-approved laboratory. Groundwater, spring, and surface water samples will be analyzed for Target Compound List (TCL) VOCs using USEPA Method 8021. Groundwater samples will be analyzed for dissolved iron and manganese using USEPA Methods 6010 and 6060, respectively, total organic carbon using USEPA Method 415.1, nitrate, nitrite, and sulfate using USEPA Methods 353.3, 354.1, and 375.4, respectively. Groundwater samples submitted for permanent gases (e.g., carbon dioxide, carbon monoxide, oxygen, nitrogen, methane, ethane, and ethane) will be sent to Microseeps Laboratory, located in Pittsburgh, Pennsylvania and analyzed using Method AM20GAX. Table B-3 summarize the list of the compounds to be analyzed for in groundwater along with the respective required quantitation limits for the following groups of compounds, VOCs, metal and wet chemistry, and permanent gases.

All performance and compliance monitoring water samples (including QA/QC samples) will be analyzed for TCL VOCs using USEPA Method 8021 and for total iron using USEPA Method 6010, the locations and schedule is described in the SAP (Section 3.1 Sampling Locations and Schedule).

All air samples will be analyzed for VOCs using modified USEPA Method TO-14A by a NYSDOH-approved laboratory the locations and schedule is described in the SAP (Section 3.3 Air Sample Collection and Analysis). Specific compounds to be analyzed for in air samples will include, the list of compounds summarized in Table B-4. Table B-4 also summarizes the respective required quantitation limits for influent (performance monitoring) and effluent (compliance monitoring). As noted in Table B-4, required quantitation limits will be equal to or less than the compound-specific NYSDEC Air Guide 1 requirements for analysis of effluent samples.

The internal laboratory Standard Operating Procedures (SOPs) and QA/QC procedures are described in the individual laboratory facility Quality Assurance Plan, an independent plan provided by the analytical laboratory. The Laboratory Quality Assurance Plans will be provided upon request.

4.6 Data Validation

Data validation is a process in which analytical data generated by the laboratory are evaluated against a specific set of requirements and specifications, and determinations of data usability and limitations are made. The data validator examines the criteria pertaining to analytical data generated in accordance with CLP protocols from four perspectives, as follows:

- Technical requirements.
- Contractual requirements.

- Determination of compliance.

- Determination and action of how to define the usability or qualify the data.

Validation of the organic data will be performed following the QA/QC criteria set forth in the NYSDEC ASP, October 1995 and the USEPA CLP National Functional Guidelines for Organic Data Review, October 1999. Validation of the inorganic data will be performed following the QA/QC criteria set forth in the NYSDEC ASP, October 1999 and the USEPA CLP National Functional Guidelines for Inorganic Data Review, February 1994.

Sample collection and analysis is specified in the LTM plan. The monitoring well samples will be collected as part of the baseline sampling round and than on a quarterly, semi-annual, or annually basis. The spring and surface water samples will also be collected as part of the baseline-sampling round. The spring samples will be collected on a semi-annual basis and surface water sample on an annual basis. The performance and compliance monitoring water and air samples will be collected on a quarterly basis.

A full data validation will be conducted on the VOCs, metals, and wet chemistry that are collected as part of the aqueous baseline sampling. The monitoring wells, spring, and surface water quarterly, semi-annual, and annually sampling for VOCs, metals, and/or wet chemistry will be reviewed for completeness and technical compliance. The review of the data packages will include checking the following:

- Chain-of-custody forms.

- Adherence to specified holding times.

- Trip, field, and/or laboratory (method) blank-detected constituents.

- Matrix spike/spike duplicate precision and accuracy.

- Field replicate precision.

For performance and compliance monitoring, VOC sample results will be reviewed for completeness and technical compliance. The review will include checking the following:

- Chain-of-custody form.
- Adherence to specified holding times.
- Laboratory blank-detected constituents.
- Field replicate precision.

Final validation of data obtained during the field sampling and analysis activities will be performed by ARCADIS G&M data validators. The laboratory deliverables will be reviewed for accuracy, precision, completeness, and overall quality of data. All laboratory data will be reviewed for adherence to method-specific QA/QC guidelines and to the data validation guidelines that are described above. If specific data quality issues arise based on the data validation and review guidelines described above, the data validation and review guidelines may be modified, as warranted, in order to address the specific data quality issue. Any such modifications will be utilized until the specific data quality issue is resolved.

4.7 Data Usability

The data validator for the project will review the analytical data for usability including determining if the data are accurate, precise, representative, complete, and comparable. The review of the analytical results will include checking chain-of-custody forms, sample holding times, blank contamination, spike recoveries, surrogate recoveries, internal standards, precision of duplicate sample analysis, and laboratory control samples. This review will be used to classify the data as valid, usable, or unusable. Valid data will indicate that all QA/QC review parameters have been met and are acceptable (as per details outlined in the preceding section). Data will be characterized as usable when QA/QC parameters are marginally outside acceptable limits (example: sample holding times were slightly exceeded) where the data may be questionable, but still usable within limitation. Unusable data will be data that are observed to have gross errors or analytical interference that would render the data invalid for any purpose.

4.8 Performance and System Audits

Performance and system audits will be performed on a periodic basis, as appropriate, to ensure that the work is implemented in accordance with the approved project SOPs and in an overall satisfactory manner. Examples of audits that will be performed during the project activities are as follows:

- The field personnel will supervise and check, on a daily basis during sampling activities, that monitoring well integrity is intact; that field measurements are made accurately; that equipment is thoroughly decontaminated; that samples are collected and handled properly; and that all field work is accurately and neatly documented.

- On a timely basis, the data packages submitted by the laboratory will be checked for the following information: that all requested analyses were performed; that sample holding times were met; that the data were generated through the approved methodology with the appropriate level of QC effort and reporting; and that the analytical results are in conformance with the prescribed acceptance criteria. The quality and limitations of the data will be evaluated based on these factors.

- The project manager will oversee the field personnel and check that the management of the acquired data proceeds in an organized and expeditious manner.

- Audits of the laboratory are performed on a regular basis by regulatory agencies. Audits are discussed in the laboratory Quality Assurance Plan (provided upon request).

4.9 Preventive Maintenance

ARCADIS has established a program for the maintenance of field equipment to ensure the availability of equipment in good working order when and where it is needed, as indicated in the following examples:

- An inventory of equipment, including model and serial number, quantity, and condition will be maintained. Each item will be tagged and signed out when in use, and its operating condition and cleanliness will be checked upon return. Routine checks will be made on the status of equipment, and spare parts will be stocked. An equipment manual library will also be maintained.

- The field personnel are responsible for making sure that the equipment is tested, cleaned, charged, and calibrated in accordance with the manufacturer's instructions before being taken to the field.

The laboratory also follows a well-defined program to prevent the failure of laboratory equipment and instrumentation. This preventive maintenance program is described in the laboratory Quality Assurance Plan (provided upon request).

5. References

ARCADIS G&M, Inc. 2002. Health and Safety Plan, Colesville Landfill, Broome County, New York, June 27, 2002.

Table B-1. Quality Assurance/Quality Control Sample Summary, Colesville Landfill, Broome County, New York.

Matrix	Sampling Event	Sample Location/ Sample Point	Parameters (1)	Frequency	Estimated Sample Quantity per Event	Estimated Field Blanks per Event (2)	Estimated Trip Blanks per Event (3)	Estimated Field Duplicates per Event (4)	Estimated MS/MSD (5) per Event
Aqueous (groundwater)	Groundwater Quality Monitoring	Monitoring Wells	VOCs (6)	Analyzed as per the LTM Plan	14	1	one per day	1	1
			Inorganics (7)	Analyzed as per the LTM Plan	11	1	0	1	0
			Permanent gases (8)	Analyzed as per the LTM Plan	8	1	0	0	0
Aqueous (groundwater)	Groundwater Quality Monitoring	Springs	VOCs (6)	Analyzed as per the LTM Plan	3	1	one per day	1	0
Aqueous (water)	Groundwater Quality Monitoring	Surface Water	VOCs (6)	Analyzed as per the LTM Plan	3	1	one per day	0	0
Aqueous (water)	Remedial System Performance and Compliance Monitoring	Three Production Wells GMPW-3, GMPW-4, & GMPW-5 and Treatment Prrocess Influent/Effluent	VOCs (6)	Analyzed Quarterly	5	0 (9)	1	1	1
			Total Iron	Analyzed Quarterly	5	0 (9)	0	1	1
Air	Remedial System Performance and Compliance Monitoring	Stack Effluent	VOCs	Analyzed Quarterly	1	0	0	0	0

(1) All VOC and inorganic analyses will be performed in accordance with USEPA methods by a CLP-certified NYSDOH-approved laboratory.
(2) One field blank collected per day every time non-dedicated (i.e., disposable or reusable) sampling equipment (i.e., pumps and/or bailers) is used.
(3) Trip blanks will be provided by the analytical laboratory and will accompany specific VOC samples as they are collected and during shipment. Trip blanks collected at a frequency of one per day. A trip blank can be grouped with other samples collected the same day. The maximum number of samples per trip blank is 20.
(4) A field (blind) duplicate can be grouped with other samples (up to 20 samples) of the same matrix. Field duplicate samples collected at a frequency of one per 20 samples.
(5) Matrix spike/matrix spike duplicate (MS/MSD) analysis is performed on a site sample and therefore is not counted as a separate sample. For MS/MSD's, triple sample volume will be provided. MS/MSD sample sets collected at a frequency of one per 20 samples. An MS/MSD sample set can be grouped with other samples (up to 20 samples) of the same matrix.
(6) VOC analytical parameters include the TCL VOCs using USEPA Method 8021.
(7) Inorganic analytical parameters include: manganese (dissolved); iron (dissolved); chloride; total organic carbon; nitrate; nitrite; and/or sulfate.
(8) Permanent gases monitored includes: carbon dioxide; oxygen; nitrogen; methane; carbon monoxide; ethene and ethane.
(9) Remedial well and system samples are collected as grab samples; no equipment used.

MS/MSD Matrix spike/matrix spike duplicate
VOCs Volatile organic compounds
USEPA U.S. Environmental Protection Agency
NYSDEC New York State Department of Environmental Conservation
TCL Target Compound List
LTM Long-Term Moniitoring

Table B-2. Summary of Sample Containers, Preservation, and Holding Times, Colesville Landfill, Broome County, New York.

Matrix	Monitoring Program	Parameters (1)	Analytical Laboratory Methodology	Sample Containers	Preservation	Holding Time
Aqueous (water)	Effectiveness Monitoring	VOCs	USEPA Method 8021	Three (3) 40 mL glass with VOCs vial	Cool 4 degrees C HCl to pH<2	14 days
		Manganese (dissolved) Iron (dissolved)	USEPA 200.7 (6060) USEPA 200.7 (6010)	One (1) 250 mL plastic	HNO3 to pH <2 HNO3 to pH <2	6 months 6 months
		Chloride Nitrate Nitrite Sulfate	USEPA 325.3 USEPA 353.3 USEPA 354.1 USEPA 375.4	One (1) 500 mL plastic	Cool 4 degrees C Cool 4 degrees C Cool 4 degrees C Cool 4 degrees C	28 days 48 hours 48 hours 28 days
		Total Organic Carbon	USEPA 415.1	One (1) 250 mL plastic	Cool 4 degrees C and H2SO4 to pH<2	28 days
		Permanent gases (2)	AM20GAX	Two (2) 40 mL glass with Teflon-lined septa	Cool 4 degrees C	14 days
Aqueous (water)	Remedial System Performance and Compliance Monitoring	VOCs	USEPA Method 8021	Three (3) 40 mL glass with VOC vial	Cool 4 degrees C HCl to pH<2	14 days
		Total Iron	USEPA 200.7 (6010)	One (1) 250 mL plastic	HNO3 to pH <2	6 months
Air	Remedial System Performance and Compliance Monitoring	VOCs	EPA Method TO-14	1L Tedlar bag	NA	14 days

(1) Refer to Table 3 and 4 for specific analyte lists for analysis of aqueous and air samples, respectively.
(2) Permanent gases monitored includes: carbon dioxide; oxygen; nitrogen; methane; carbon monoxide; ethane and ethane.
C Celsius
L Liter
mL Milli-liter
NA Not applicable
VOCs Volatile organic compounds

Table B-3. Analytical List for Analysis of Aqueous Samples, Colesville Landfill, Broome County, New York.

Compound	Detection Limit	Units
Volatile Organic Compounds		
Benzene	1.0	ug/L
Bromobenzene	1.0	ug/L
Bromochloromethane	1.0	ug/L
Bromodichloromethane	1.0	ug/L
Bromoform	1.0	ug/L
Bromomethane	1.0	ug/L
n-Butylbenzene	1.0	ug/L
sec-Butylbenzene	1.0	ug/L
tert-Butylbenzene	1.0	ug/L
Carbon tetrachloride	1.0	ug/L
Chlorobenzene	1.0	ug/L
Chlorodibromomethane	1.0	ug/L
Chloroethane	1.0	ug/L
Chloroform	1.0	ug/L
Chloromethane	1.0	ug/L
2-Chlorotoluene	1.0	ug/L
4-Chlorotoluene	1.0	ug/L
1,2-Dibromo-3-chloropropane	1.0	ug/L
1,2-Dibromoethane	1.0	ug/L
Dibromomethane	1.0	ug/L
1,2-Dichlorobenzene	1.0	ug/L
1,3-Dichlorobenzene	1.0	ug/L
1,4-Dichlorobenzene	1.0	ug/L
Dichlorodifluoromethane	1.0	ug/L
1,1-Dichloroethane	1.0	ug/L
1,2-Dichloroethane	1.0	ug/L
1,1-Dichloroethene	1.0	ug/L
cis-1,2-Dichloroethene	1.0	ug/L
trans-1,2-Dichloroethene	1.0	ug/L
1,2-Dichloropropane	1.0	ug/L
1,3-Dichloropropane	1.0	ug/L
2,2-Dichloropropane	1.0	ug/L
1,1-Dichloropropene	1.0	ug/L
cis-1,3-Dichloropropene	1.0	ug/L
trans-1,3-Dichloropropene	1.0	ug/L
Ethylbenzene	1.0	ug/L
Hexachlorobutadiene	1.0	ug/L
Isopropylbenzene	1.0	ug/L
p-Isopropyltoluene	1.0	ug/L
Methylene chloride	1.0	ug/L
Naphthalene	1.0	ug/L
n-Propylbenzene	1.0	ug/L
Styrene	1.0	ug/L
1,1,1,2-Tetrachloroethane	1.0	ug/L
1,1,2,2-Tetrachloroethane	1.0	ug/L
Tetrachloroethene	1.0	ug/L
Toluene	1.0	ug/L

See notes on last page.

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Table B-3. Analytical List for Analysis of Aqueous Samples, Colesville Landfill, Broome County, New York.

Compound	Detection Limit	Units
Volatile Organic Compounds (cont'd)		
1,2,3-Trichlorobenzene	1.0	ug/L
1,2,4-Trichlorobenzene	1.0	ug/L
1,1,1-Trichloroethane	1.0	ug/L
1,1,2-Trichloroethane	1.0	ug/L
Trichloroethene	1.0	ug/L
Trichlorofluoromethane	1.0	ug/L
1,2,3-Trichloropropane	1.0	ug/L
1,2,4-Trimethylbenzene	1.0	ug/L
1,3,5-Trimethylbenzene	1.0	ug/L
Vinyl chloride	1.0	ug/L
o-Xylene	1.0	ug/L
m/p-xylene	2.0	ug/L
Metal and Wet Chemistry		
Manganese (dissolved)	0.005	mg/L
Iron (dissolved)	0.035	mg/L
Chloride	1.0	mg/L
Nitrate	0.2	mg/L
Nitrite	0.01	mg/L
Sulfate	2.0	mg/L
Total Organic Carbon	0.5	mg/L
Permanent Gases		
Carbon Dioxide	0.6	mg/L
Carbon Monoxide	0.4	mg/L
Methane	0.015	ug/L
Oxygen	0.015	mg/L
Nitrogen	0.4	mg/L
Ethene	5	ng/L
Ethane	5	ng/L

mg/L	milligrams per liter
ug/L	micrograms per liter
ng/L	nanograms per liter
USEPA	United States Environmental Protection Agency

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Table B-4. Analyte List for Analysis of Air Samples, Colesville Landfill, Broome County, New York.

Monitoring Program:	Performance/Compliance Monitoring
Method:	EPA Method TO-14
Matrix:	Air
Constituent (1)	Required Method Detection Limits (ppbv) (2)
Chloromethane	5
Vinyl Choride	5
Chloroethane	5
Methylene chloride	5
1,1-Dichloroethene	5
1,1-Dichloroethane	5
1,2-Dichloroethene (trans)	5
1,2-Dichloroethene (cis)	5
Chloroform	5
1,2-Dichloroethane	5
1,1,1-Trichloroethane	5
Carbon tetrachloride	5
1,2-Dichloropropane	5
Trichloroethene	5
Benzene	5
1,1,2-Trichloroethane	5
1,3,5-Trimethylbenzene	5
1,2,4-Trimethylbenzene	5
1,3-Dichlorobenzene	5
1,4-Dichlorobenzene	5
1,2-Dichlorobenzene	5
Tetrachloroethene	5
1,1,2,2-Tetrachloroethane	5
1,2-Dibromoethane	5
Toluene	5
Chlorobenzene	5
Ethylbenzene	5
o-Xylene	5
m&p-Xylene	5
Freon 12	5
1,2-dichlorotetrafluoroethane	5
Trichlorofluoromethane	5
1,1,2-trichloro-1,2,2-trifluoroethane	5
2-propanol	5
methyl tert-butyl ether	5

(1) Listed constituents based on Target Compound List (TCL) volatile organic compounds (VOCs).
(2) Detection limits for individual VOCs will be based on achieving the associated criteria listed in NYS Air Guide I.
EPA Environmental Protection Agency
ppbv parts per billion by volume
VOC volatile organic compound
NYS New York State

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Attachment A

Field Forms

ARCADIS GERAGHTY & MILLER

Water Level/Pumping Test Record

Page ____ of ____

Project ______________________ Well __________ Site ______________

Screen Setting __________ Measuring Point Description ______________ Height Above Ground Surface __________

Static Water Level __________ Measured With ______________ Date/Time __________

Drawdown ☐ Start of Test ______________ Pumping Well __________

Recovery ☐ End of Test ______________

Distance From Well Measured To Pumping Well® __________ Discharge Rate ______________ Orifice __________

Date & Time	Well Or t (mins)	Held (ft)	Wet (ft)	Depth to Water (ft)	s (ft)	Dew. 1) Corr. (ft)	Art. 2) s' (ft)		Q (gpm)	Mano-meter (in)	Remarks 3)

1) Dewatering Correction 2) Equivalent Artesian Drawdown 3) pH, Spec. Cond., Temp., Weather, Sand, Turbidity, etc.

ARCADIS GERAGHTY & MILLER

Groundwater Sampling Form

Page _____ of _____

Project/No. ____________________ Well __________ Date ____________________

Screen Setting __________ Measuring Point Description ____________________ Casing Diameter (inches) __________

Static Water Level __________ Measured Width ____________________ Well Materials ____ PVC ____ ST. Steel

Total depth __________ Pump On: ____________________ Pump Intake: ____________________

Purge Method Pump Off: ____________________ **Volumes Purged** __________

Centrifugal __________ **Sample Time:** __________

Submersible __________

Other __________ Bailer Type: ____________________ Sampled By: ____________________

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)

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Attachment B

Chain-of-Custody Form

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Laboratory Task Order No./P.O. No.________

CHAIN-OF-CUSTODY RECORD

Project Number/Name ____________________

Project Location ____________________

Laboratory ____________________

Project Manager ____________________

Sampler(s)/Affiliation ____________________

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	ANALYSIS / METHOD / SIZE						Remarks	Total

Sample Matrix: L = Liquid; S = Solid; A = Air

Total No. of Bottles/ Containers ____

Relinquished by: ____________	Organization: ____________	Date __/__/__	Time ______	Seal Intact?
Received by: ____________	Organization: ____________	Date __/__/__	Time ______	Yes No N/A
Relinquished by: ____________	Organization: ____________	Date __/__/__	Time ______	Seal Intact?
Received by: ____________	Organization: ____________	Date __/__/__	Time ______	Yes No N/A

Special Instructions/Remarks: ____________________

____

____

Delivery Method: ☐ In Person ☐ Common Carrier ____________ (SPECIFY) ☐ Lab Courier ☐ Other ____________ (SPECIFY)

AG 05-12/01

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Appendix C

Groundwater Remediation System Startup and Performance Analysis Plan

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Appendix C

Groundwater Remediation System Startup and Performance Analysis Plan

Colesville Landfill
Groundwater Remediation System
Broome, County, New York

Site # 704010

ARCADIS

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Vice President

Groundwater Remediation System Startup and Performance Analysis Plan

Colesville Landfill
Broome County, New York
NYSDEC Site 704010

Prepared for:
Broome County Division of Solid Waste Management

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Our Ref.:
NY000949.0014.00004

Date:
28 June 2002

Table

Attachments

Disclosure Statement

The laws of New York State require that the corporations, which render engineering services in New York, be owned by individuals licensed to practice engineering in the State. ARCADIS G&M, Inc. cannot meet that requirement. Therefore, all engineering services rendered to Broome County, Division of Solid Waste Management (Broome County) are being performed by ARCADIS Engineers and Architects of New York, P.C., a New York professional corporation qualified to render professional engineering in New York. There is no surcharge or extra expense associated with the rendering of professional services by ARCADIS Engineers and Architects of New York, P.C.

ARCADIS G&M, Inc. is performing all those services that do not constitute professional engineering, and is providing administrative and personnel support to ARCADIS Engineers and Architects of New York, P.C. All matters relating to the administration of the contract with Broome County are being performed by ARCADIS G&M, Inc. pursuant to its Amended and Restated Services Agreement with ARCADIS Engineers and Architects of New York, P.C. All communications should be referred to the designated project manager at ARCADIS G&M, Inc.

1. Introduction

ARCADIS was retained by Broome County to design and construct the Colesville Landfill Groundwater Remediation System located at the Colesville Landfill in Broome County, New York (site). Drawing No. 1 "Title Drawing" of the design drawings shows the Site location. The Groundwater Remediation System is comprised of a groundwater pump-and-treat (PT) system combined with an automated reagent injection system for in-situ enhanced reductive dechlorination (ERD). This Groundwater Remediation System Startup and Performance Analysis Plan describes the startup methodology to be implemented following construction of the Groundwater Remediation System to ensure the remediation system performs to the specifications of the remedial design approved on August 24, 2000 by the New York State Department of Environmental Conservation (NYSDEC).

It is anticipated that system startup will be completed over a two-week period. Week 1 will consist of testing mechanical and electrical components to ensure that all system components operate collectively as designed. Week 2 will consist of bringing both remedial system components (i.e., the PT and ERD systems) on-line and conducting system performance testing to ensure that system remedial components function to the specifications of their respective performance design criteria.

This Groundwater Remediation System Startup and Performance Analysis Plan is provided as Appendix C of the Long Term Monitoring (LTM) Plan. The Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) are provided as Appendices A and B, respectively, to the LTM Plan. The startup plan has been organized into five sections. Following the introductory section (Section 1), Section 2 discusses pre-startup injection well monitoring; Section 3 discusses system startup mechanical testing; Section 4 discusses system startup performance testing; Section 5 briefly discusses system long-term performance monitoring and testing; and Section 6 discusses post-construction, startup and long-term reporting.

2. Pre-Startup Injection Well Monitoring

Prior to system startup, groundwater samples will be field tested for pH and shipped to an analytical laboratory for analysis of total organic carbon (TOC) from Injection Wells IW-3, IW-8, and IW-13. All samples analyzed for TOC will be analyzed following USEPA Method 415.1. TOC and pH results will be used to establish baseline (pre-injection) groundwater conditions. Following system startup, Injection Wells IW-3, IW-8 and IW-13 will be monitored for pH and TOC on a quarterly basis to ensure that the molasses solution is being effectively delivered to the subsurface. Quarterly system performance monitoring is described further in the LTM Plan. Drawing No. 3 "Site Plan" of the design drawings shows the locations of all injection wells.

3. System Startup Mechanical Testing

The following section describes the methodology to be used during system startup mechanical testing. System startup mechanical testing will be completed during the first week of system startup and will consist of testing mechanical and electrical components to ensure that all system components operate collectively as designed. In the event that any component of the system fails to operate as designed, adjustments will be made as necessary to ensure the proper operation of all system components prior to system performance sampling (Week 2 of system startup). A description of the mechanical testing methodology is provided below.

3.1 Major Process Equipment

All major process equipment including recovery pumps, low profile air stripper, air compressor, transfer pumps, and mixing and holding tanks will be visually inspected and tested to ensure proper operation. Visual inspections will include, but not be limited to, inspection for leaks in gaskets or mechanical joints, final quality assurance/quality control (QA/QC) confirmation of equipment make and model numbers, and confirmation of installation locations. Testing will include, but not be limited to, manual operation of each piece of process equipment for performance testing. During testing, all motors will be checked for proper rotation and electrical draw, and performance data (e.g., flowrates and pressures) collected during the manual operation of blowers and pumps will be compared to their respective performance curves to ensure that they are operating per their design specifications.

3.2 System Piping and Appurtenances

All system process piping and appurtenances will be visually inspected and tested to ensure proper operation. Visual inspections will include, but not be limited to, looking for leaks in piping connections and final QA/QC confirmation that valves and flowmeters are installed at their proper locations and in the correct direction. Testing will include, but not be limited to, testing of each solenoid valve for proper operation, testing of all flowmeters for proper operation and accuracy, testing of the desiccant air dryer, and testing of the electronic condensate autodrain.

3.3 System Controls, Alarms, and Interlocks

All system controls, alarms and interlocks will be visually inspected and tested to ensure proper operation. Visual inspections will include, but not be limited to, ensuring all temperature and vacuum/pressure switches are installed at the proper location and set to their design set point, final QA/QC confirmation of equipment make and model numbers, and that all level switches are installed at the correct location and in the correct direction. Testing will include, but not be limited to, manually triggering of each temperature, vacuum/pressure, and level switch to ensure that each control functions as designed and to ensure that the Main Control Panel (MCP) system interlocks perform as detailed in the design specifications. In addition, the automated reagent injection system mixing, injection, and rinsing sequences will be manually initiated to ensure that each sequence functions per the design specifications.

3.4 Building Controls

Because of the local climate, site location, and the remedial process (automated injection of molasses solution into the subsurface), the treatment building controls are an essential part of ensuring the remediation system functions as designed. Treatment building controls include the unit heaters, ventilation, and lighting system. During system startup, all building controls will be visually inspected and tested. Visual inspections will include, but not be limited to, inspection of all building controls for proper installation, final QA/QC confirmation of equipment make and model number of installation location. Testing will include, but not be limited to, the manual triggering of all thermostats to ensure that their respective building controls (e.g., unit heaters and roof ventilator) operate properly, testing building interior lighting, and testing exterior motion sensor lighting.

4. System Startup Performance Testing

System startup performance testing will consist of bringing both remedial system components (i.e., the pump-and-treat and automated reagent injection systems) on-line and conducting system performance testing to ensure that system remedial components function per their respective performance design criteria. System performance testing will be completed during the second week of system startup. Groundwater samples collected from the PT system production wells during system startup will be analyzed for volatile organic compounds (VOCs) and total iron following USEPA Methods 8021 and 200.7 (6010), respectively. All vapor samples collected during system startup will be analyzed using a modified USEPA Method TO-14. All sampling and field parameter monitoring locations are depicted on Drawing No. 5 "Piping and Instrumentation Diagram" of the design drawings. Once startup performance testing has been successfully completed, the systems will be left on-line for long-term operation. The following section describes the methodology to be utilized during system startup performance testing.

4.1 Day 1- Startup and Monitoring of Groundwater Pump-and-Treat System

Day 1 of system startup performance testing will consist of bringing the PT system on-line, collecting system field parameters, and collecting groundwater and air samples. A detailed description of the startup procedures is provided below.

1. Startup air compressor AC-200 with individual well compressed air line control valves in the closed position.

2. Startup low profile air stripper blower B-300 and transfer pump TP-400.

3. Inspect PT system valves to ensure that all valves are in their proper operating position. Ensure that solenoid valve SV-23 is in the open position and solenoid valve SV-24 is in the closed position.

4. Startup pneumatic recovery pumps by opening the individual well compressed air line control valves.

5. Record PT system operating parameters as outlined in the System Startup Parameters Field Inspection Log – Pump and Treat System (see Attachment C-1) every hour for 8-hours.

6. At the end of the day, collect individual recovery line groundwater samples (GMPW-3, GMPW-4, and GMPW-5), total influent groundwater sample, total effluent groundwater sample before the bag filters, and total effluent groundwater sample after the bag filters. The total influent groundwater sample and effluent groundwater sample after the bag filters will be analyzed with a 24-hour rush turnaround time.

7. Collect one effluent vapor sample from the low profile air stripper stack at the end of the day.

4.2 Day 2- Startup and Monitoring of Automated Reagent Injection System

Day 2 of system startup performance testing will consist of bringing the automated reagent injection (ERD) system on-line and collecting system field parameters. A detailed description of the startup procedures is provided below.

1. Startup transfer pump TP-900, molasses pump MP-700, and molasses mixer MT-800.

2. Inspect automated reagent injection system control valves to ensure all valves are in their proper operating positions.

3. Manually initiate the molasses mixing sequence.

4. Following completion of the molasses mixing sequence, manually initiate the molasses injection sequence.

5. Record reagent injection system operating parameters as outlined in the System Startup Parameters Field Inspection Log – Automated Reagent Injection System (see Attachment C-2) during the molasses mixing and injection sequences.

6. Set the molasses mixing and injection sequence timers to operate in auto mode.

7. Record PT system operating parameters as outlined in the System Startup Parameters Field Inspection Log – Pump and Treat System (see Attachment C-1) at the beginning and end of the day.

4.3 Day 3- Groundwater Pump-and-Treat and Automated Reagent Injection System Monitoring

Day 3 of system startup performance testing will consist of ensuring proper system operation for both system components and collecting system field parameters and performance samples. A detailed description of the startup procedures is provided below.

1. Ensure proper system operation.

2. Record PT system operating parameters as outlined in the System Startup Parameters Field Inspection Log – Pump and Treat System (see Attachment C-1) at the beginning and end of the day.

3. At the end of the day, collect individual recovery line groundwater samples (GMPW-3, GMPW-4, and GMPW-5), total influent groundwater sample, total effluent groundwater sample before the bag filters, and total effluent groundwater sample after the bag filters.

4. Collect one effluent vapor sample from the low profile air stripper stack at the end of the day.

5. If an injection and/or mixing sequence are initiated, record reagent injection system operating parameters as outlined in the System Startup Parameters Field Inspection Log – Automated Reagent Injection System (see Attachment C-2) during the molasses mixing and injection sequences.

4.4 Day 4- Groundwater Pump-and-Treat and Automated Reagent Injection System Monitoring

Day 4 of system startup performance testing will consist of ensuring proper system operation for both system components and collecting system field parameters. A detailed description of the startup procedures is provided below.

1. Ensure proper system operation.

2. Record PT system operating parameters as outlined in the System Startup Parameters Field Inspection Log – Pump and Treat System (see Attachment C-1) at the beginning and end of the day.

3. If an injection and/or mixing sequence are initiated, record reagent injection (ERD) system operating parameters as outlined in the System Startup Parameters Field Inspection Log – Automated Reagent Injection System (see Attachment C-2) during the molasses mixing and injection sequences.

4.5 Day 5- Groundwater Pump-and-Treat and Automated Reagent Injection System Monitoring

Day 5 of system startup performance testing will consist of ensuring proper system operation for both system components and collecting system field parameters. A detailed description of the startup procedures is provided below.

1. Ensure proper system operation.

2. Record PT system operating parameters as outlined in the System Startup Parameters Field Inspection Log – Pump and Treat System (see Attachment C-1) at the beginning and end of the day.

3. If an injection and/or mixing sequence are initiated, record reagent injection (ERD) system operating parameters as outlined in the System Startup Parameters Field Inspection Log – Automated Reagent Injection System (see Attachment C-2) during the molasses mixing and injection sequences.

5. System Performance Long-Term Monitoring and Testing

System performance long-term monitoring and testing will be conducted during routine quarterly site visits to ensure the proper operation of the Groundwater Remediation System in the long term. The LTM Plan outlines the system performance long-term monitoring and testing methodology.

6. Reporting

Following construction and system startup, a Remedial Action Report (RAR) will be prepared and submitted to the United States Environmental Protection Agency (USEPA) and NYSDEC. The RAR will be prepared following published USEPA guidance documents and will summarize the project background, construction activities, final inspection, proposed operation and maintenance activities, and summarize project costs. The results of system startup, including a summary of field notes, recorded field parameters, and laboratory analytical results will be provided as an appendix to the RAR.

Following preparation of the RAR, system status reports will be submitted to the USEPA and NYSDEC detailing the results of the quarterly system site visits. Status reports will be submitted as detailed in the Long Term Monitoring Plan.

Table C-1. Remedial System Startup Performance Testing Schedule, Colesville Landfill, Broome County, New York.

Sample Location [a]	Parameter/Measurement	Frequency
PRE-STARTUP TESTING		
Water Samples		
Injection Wells		
IW-3	pH(s.u.); TOC(mg/L) (Method 415.1)	Single Event
IW-8	pH(s.u.); TOC(mg/L) (Method 415.1)	Single Event
IW-13	pH(s.u.); TOC(mg/L) (Method 415.1)	Single Event
STARTUP TESTING		
Water Samples		
Production Wells		
GMPW-3	VOCs (USEPA Method 8021), Total Iron (USEPA Method 6010)	Days 1 and 3: End of Day
GMPW-4	VOCs (USEPA Method 8021), Total Iron (USEPA Method 6010)	Days 1 and 3: End of Day
GMPW-5	VOCs (USEPA Method 8021), Total Iron (USEPA Method 6010)	Days 1 and 3: End of Day
Treatment Process		
Influent (Before air stripper unit)	VOCs (USEPA Method 8021), Total Iron (USEPA Method 6010)	Days 1 and 3: End of Day
Effluent (after air stripper/cartridge filter)	VOCs (USEPA Method 8021), Total Iron (USEPA Method 6010)	Days 1 and 3: End of Day
Air Sample		
Air Stripper Stack Effluent	VOCs (EPA Method TO-14A)	Days 1 and 3: End of Day

Notes:

[a] Addiitonal details on sampling and analysis is provided in the SAP (Appendix A).

PT	Pump and Treat
USEPA	U.S. Environmental Protection Agency
NYSDEC	New York State Department of Environmental Conservation
VOCs	Volatile Organic Compounds
TOC	Total Organic Carbon
s.u.	Standard units
mg/L	milligrams per liter
SAP	Sampling and Analysis Plan

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Attachment C-1

System Startup Parameters Field Inspection Log – Pump and Treat System

System Startup Parameters
Field Inspection Log -
Pump and Treat System

Inspector: ______________________ Date: ______________________

Signature: ______________________ Time: ______________________

Compressed Air System

Total Discharge Pressure PI-201 (psi) = ________

PSL-201 Setting (psi) = ________

Individual Wellhead Pressure PI-101 (psi) = ________

Individual Wellhead Pressure PI-102 (psi) = ________

Individual Wellhead Pressure PI-103 (psi) = ________

Groundwater Recovery System

Low Profile Air Stripper

Blower Discharge Pressure PI-301 (iwc) = ________

Blower Stack Pressure PI-302 (iwc) = ________

PSL-301 Setting (iwc) = ________

Blower Effluent Flowrate (acfm) = ________

Blower Stack Temperature TI-303 (F) = ________

Effluent PID Reading (ppmv) = ________

Bag Filters

Pre-Bag Filter Pressure PI-401 (psi) = ________

Post-Bag Filter Pressure PI-403 (psi) = ________

PSH-402 Setting (psi) = ________

Water Recovery and Discharge Rates

Individual Well Totalizer FQI-101 (gal.) = ________

Total Effluent Totalizer FQI-401 (gal.) = ________

Individual Well Totalizer FQI-102 (gal.) = ________

Water Bypass Totalizer FQI-402 (gal.) = ________

Individual Well Totalizer FQI-103 (gal.) = ________

Notes:

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Attachment C-2

System Startup Parameters Field Inspection Log – Automated Reagent Injection System

System Startup Parameters
Field Inspection Log -
Automated Reagent Injection System

Inspector: ______________________ Date: ______________________

Signature: ______________________ Time: ______________________

Automated Reagent Mixing Sequence

Programmed Molasses/Water Ratio (%) = ________

Actual Molasses/Water Ratio (%) = ________

Raw Molasses Volume FQI-701 (gal.) = ________

Potable Water Volume FQI-601 (gal.) = ________

Programmed Mixing Time (min.) = ________

Actual Mixing Time (min.) = ________

Raw Molasses Temperature TI-700 (F) = ________

MP-700 Discharge Pressure PI-702 (psi) = ________

MP-700 Instant. Flowrate FQI-701 (gpm) = ________

TP-600 Instant. Flowrate FQI-601 (gpm) = ________

TP-600 Discharge Pressure PI-601 (psi) = ________

Total Mixing Sequence Time (min.) = ________

PSL-701 Set Point (iwc) = ________

Automated Reagent Injection Sequence

PSN-901 Set Point (psi) = ________

PSH-902 Set Point (psi) = ________

Total Injection Volume (gal.) = ________

Total Injection Time (min.) = ________

Injection Well	Programmed Injection Quantity (gal.)	Actual Injection Quantity (gal.)	Injection Well Pressure (psi)	Injection Well Flowrate (gpm)
PW-6				
IW-3				
IW-1				
IW-2				
GMMW1				
IW-4				
IW-5				
IW-6				
IW-7				
IW-8				
IW-9				
IW-10				
IW-11				
IW-12				
IW-13				
IW-14				
IW-15				

System Startup Parameters
Field Inspection Log -
Automated Reagent Injection System

Automated Reagent Rinse Sequence

Total Rinse Volume (gal.) = ________ Total Rinse Time (min.) = ________

Injection Well	Programmed Rinse Quantity (gal.)	Actual Rinse Quantity (gal.)
PW-6		
IW-3		
IW-1		
IW-2		
GMMW1		
IW-4		
IW-5		
IW-6		
IW-7		
IW-8		
IW-9		
IW-10		
IW-11		
IW-12		
IW-13		
IW-14		
IW-15		

Notes: