

Carmen Johnson

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VOLUME I OF II

**Groundwater and Surface Water
Assessment Monitoring Results Report
Initial Background Data Set
First Quarter Event**

**Watauga County Landfill
Watauga County, North Carolina
NCDEHNR Permit No. 95-02**

Prepared for:

Watauga County Board of Commissioners

and

North Carolina Department of Environment, Health and Natural Resources
Division of Solid Waste Management
Solid Waste Section

Prepared by:

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DAA Job No. 6520-20

November 2, 1994

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November 11, 1994

Mr. Mark Poindexter
Hydrogeologist
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P.O. Box 27687
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Re: Watauga County Landfill, First Quarter Assessment Monitoring Background Report,
DAA Job No. 6520-20

Dear Mr. Poindexter:

Please find enclosed a copy of the first quarter background data set report for Assessment Monitoring at the Watauga County Landfill, for your review. The enclosed report presents the findings of the first background Assessment Monitoring groundwater and surface water sampling event conducted on June 20-23, 1994 by Draper Aden Associates.

Volume I of the report discusses sampling procedures, analytical results, and overall conclusions of the first quarter event. Copies of all associated laboratory data are contained in Volume II of the report. Volume II is comprised of three separate bound sections divided into CLP Metal, CLP Volatile, and SW-846 Method 8021 Analytical Results. Volume II also contains Data Validation Forms summarizing the guidelines and results of data validation procedures utilized for evaluating the data discussed in this report.

The enclosed First Quarter Assessment Monitoring Background Report will be available to the public on November 14, 1994.

The second quarter Assessment Monitoring sampling event was recently conducted on September 27-29, 1994. Draper Aden Associates will prepare and submit a Quarterly Assessment Report for the second event upon receipt and review of the analytical data.

Mr. Mark Poindexter
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November 11, 1994

If you should have any questions concerning the enclosed report or the initial assessment groundwater and surface water sampling event, please do not hesitate to contact me.

Sincerely,
Draper Aden Associates



Jeffrey E. Smith
Project Geologist

JES/rc

cc: Mr. James S. Ratchford, Watauga County manager
Mr. Richard M. DiSalvo, Jr., P.E., Director of Engineering Services, DAA
Mr. Justin E. Babendreier, Environmental Project Manager, DAA

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Eleven (11) of the eighteen (18) groundwater monitoring wells were recently installed in January and February of 1994. Four (4) of the previous seven (7) monitoring wells, MW-2, MW-3, MW-4, and MW-6, are denoted as core assessment wells based on the decision criteria and available data. MW-1 is also evaluated similarly for purposes of comparison. All other assessment monitoring wells are initially denoted as boundary assessment wells for this initial assessment background sampling event. All assessment monitoring wells will be appropriately reclassified based on the evaluation of the first sampling event conducted on the upgraded assessment monitoring well network (Section VI herein).

B. Surface Water Sampling Locations

The goal of the surface water monitoring system at Watauga County Landfill is to provide representative surface water samples for assessing the potential impact of landfill runoff and leachate on the streams located downgradient of the waste disposal area. Four (4) surface water monitoring points combined with the sampling of any observed leachate production serve to provide this objective.

Surface water sampling locations summarized below are shown on the Groundwater and Surface Water Monitoring Program site map (Figure 1).

•(S1) The last of the series of sediment ponds is sampled to provide a representative sample for assessing the quality of the surface water originating from the landfill before the water discharges into the stream.

•(S2) The spring capture outfall located adjacent to the last of the series of sediment ponds is sampled to provide a representative sample for assessing the quality of the water originating from the spring capture system located beneath the fill area.

•(S3) The stream is sampled at the landfill property boundary (approximately 600 feet below the last sediment pond) to provide a representative sample for assessing the water quality of the stream below the waste disposal area. No sampling location is available upstream of the waste disposal area since the stream originates immediately below and adjacent to the disposal area.

•(S4) The stream located below the Bolick site is sampled approximately thirty (30) feet below the landfill property boundary to provide a representative sample for assessing the water quality of the surface water below the Bolick site. This sampling location is chosen instead of the sediment pond located on the Bolick site to provide a sample that is more representative of the potential influence of groundwater from the soil aquifer.

In addition to the four surface water sampling locations, any leachate production observed during surface water sampling events is also sampled. A grid field screening inspection of the landfill is conducted concurrent with the surface water sampling event to verify the present or absence of leachate production occurring within the fill. Observations resulting from the inspection is documented in the field notes (Appendix II).

No leachate production was observed at the landfill during the initial background sampling event (June 20-23, 1994). A seep (S5), located below the waste disposal area and directly above the sediment pond, north of MW-10, was observed to be flowing. This seep (S5) was sampled in addition to the four (4) originally proposed surface water monitoring locations.

As per recommendations by the NCDEHNR, a spring located along the base of Rocky Knob, adjacent to the landfill, will also be sampled if observed flowing during future sampling events. This spring will be sampled in addition to the five (5) surface water sampling points identified above. This spring, located at the head of the drainage adjacent to the Carroll residence well (well reference no. 12), was not observed to be flowing during the initial background sampling event.

The decision criteria for subsequent sampling of the springs located in the Rocky Mountain Heights subdivision will be based on the results of the initial spring sampling outlined above, as well as additional monitoring well and potable well sampling and analyses results. Springs located in other areas of the site, as designated on Figure 1, will also be considered for sampling based on evaluations of future sampling events.

C. Sampling and Analysis Schedule

Groundwater

During the first year of Assessment groundwater monitoring, four (4) quarterly sampling events will be conducted on each groundwater monitoring well. Semi-annual sampling events will be conducted after the first year. The groundwater assessment monitoring schedule is outlined in Table 1.

The analytical scans performed on each monitoring well during the first year of assessment groundwater monitoring are designed to analyze for all the target analytes detected and tentatively confirmed as a result of the first comprehensive sampling event performed on the previously existing monitoring well network MW-1 through MW-7 on March 5, 1993. The initial March 5, 1993 sampling event was comprised of the complete EPA Appendix II List of Hazardous Inorganic and Organic Analytes (40 CFR, Part 258) currently required for Assessment Monitoring under the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR) requirements for Municipal Solid Waste Landfills (15A NCAC 13B Section .1600). A summary and evaluation of the results of the initial March 5, 1993 sampling event are contained in Appendix III of this report and detailed in Sections II and III of the Assessment Plan (DAA, September 3, 1993).

One year after completion of the four (4) quarterly Assessment background groundwater monitoring events and on an annual basis thereafter, the complete EPA Appendix II analysis will be repeated on the network of core plume assessment wells. If any additional analytes are detected, and verified through QA/QC validation as being present, that were not identified in prior Assessment monitoring events, amendments to the existing target analyte list will be evaluated and reviewed with the NCDEHNR. For amended target analytes, four (4) independent samples will be collected and analyzed for those additional analytes during the following four (4) semi-annual sampling events at all core and boundary assessment wells to establish background.

Groundwater monitoring events will also continue to be conducted on all wells on a semi-annual basis for the target analytes detected as a result of the complete EPA Appendix II analysis. Reevaluation of the site network and monitoring scheme will be conducted after review of the results of each sampling event.

The groundwater monitoring program follows a two-tiered analytical approach utilizing both EPA Contract Laboratory Program Statement of Work (CLP SOW) - Organic and Inorganic analysis, and low level risk assessment (LLRA) screening methods by EPA-SW846. The CLP SOWs are utilized to generate high-level quality data with documented QA/QC protocols. The LLRA Methods (EPA-SW-846) are utilized for risk assessment screening to preliminarily identify low levels of analytes that may be present. The groundwater analysis schedule indicating methods designated for the core and boundary wells is outlined in Table 1.

During the first year of Assessment Monitoring, analyses of the core assessment monitoring wells utilize CLP SOWs for all four (4) quarterly events. Analyses of the boundary assessment monitoring wells alternate between CLP and LLRA analytical methods for each quarterly event.

After the first year of quarterly sampling events, the core assessment monitoring wells will be monitored on a semi-annual basis. The first semi-annual core sampling event will analyze for all the assessment monitoring analytes included in the EPA Appendix II List of Hazardous Inorganic and Organic Analytes (40 CFR Part 258) utilizing LLRA analytical methods. The second semi-annual core sampling event will analyze for the target analyte assessment monitoring analytes using CLP-SOWs.

After the first year of quarterly sampling events, boundary assessment wells will also be monitored on a semi-annual basis for the target analyte assessment monitoring analytes. Analysis of semi-annual boundary well monitoring events will continue to alternate between CLP and LLRA methods for each semi-annual event.

Surface Water

Surface water and leachate monitoring will be conducted on a semi-annual basis during the first year of the Assessment Plan groundwater monitoring program and will continue semi-annually thereafter. The analytical scans that will be performed on the surface water and leachate samples will utilize CLP SOW and will be designed to analyze for all the target analytes detected as a result of the annual comprehensive Appendix II analysis. The surface water assessment monitoring schedule is outlined in Table 1.

II. GROUNDWATER AND SURFACE WATER SAMPLING FIELD PROCEDURES

Groundwater and surface water samples were collected according to the Watauga County Landfill Groundwater and Surface Water Monitoring Plan (DAA, September 3, 1993), to insure representative samples were collected, received by the laboratory and subject to analysis. Field notes, contained in Appendix II, document groundwater sample collection procedures.

A. Well Purging and Sample Collection

Dedicated stainless steel and TEFLON electrical submersible pumps were permanently installed in the new well network subsequent to the first event. Environmental Technicians from Draper Aden Associates used the dedicated pumps to purge and collect groundwater samples from the monitoring well network from the June 20-23, 1994 sampling event. All non-dedicated equipment was decontaminated between sampling of each monitoring well.

A minimum of three well volumes of groundwater, inclusive of water residing in the well casing and filter pack, were removed from each monitoring well prior to sample collection. A well volume was calculated from measurements of depth to water, and total well depth taken prior to purging. Stabilization of field analyses for pH and Specific Conductivity were used to verify that stagnant water within the well was removed during purging, and that groundwater representative of the near-aquifer was being sampled. Field notes recorded during each sampling event, contained in Appendix II, summarize and document well purging calculations and results.

Monitoring well MW-5 was observed to be dry during the June 20-23, 1994 sampling event. Static water level data collected since the installation of MW-5 in October 1992 indicate the lowering of the potentiometric surface in this area is a recent phenomena. The potentiometric surface was observed to be seasonally low during the June 1994 event, although recent capping of the waste disposal areas may be contributing to lower potentiometric elevations. The potentiometric surface inferred from static water level elevations obtained during the June 1994 sampling event is presented on the enclosed Groundwater and Surface Water Monitoring Program Site Map (Figure 1).

B. Field Meter Calibration

Measurements of pH and Specific Conductivity were analyzed at each well by completing multiple measurements in the field, at the time of groundwater purging. Although pH and Specific Conductivity are not assessment monitoring analytes, the measurements were used to ensure groundwater quality and stabilization.

A Corning Checkmate 90 pH/Conductivity/Temperature instrument was used for the field analyses of pH, and conductivity. The field meter was calibrated using laboratory-grade buffers for pH, and KCl solution for Specific Conductivity. Field notes in Appendix II document field meter calibration methods for each sampling event.

C. Quality Control Blank Samples

Due to the use of dedicated purging and sampling equipment for each monitoring well, field blanks were not collected.

Trip Blanks were utilized as part of the assessment monitoring program. Trip Blanks were prepared by the analyzing laboratories to accompany the sample kits at all times. The Trip Blanks employed sample containers and volumes identical in physical and chemical integrity to the samples used for actual sample collection. The Trip Blank was analyzed for all analytes included in the sampling event. The Trip Blank served as a control on sample kit preparation, analysis in the laboratory, and sample kit transportation. As detailed in Section III.D, the Trip Blank represents a limited number of samples, as a Trip Blank did not accompany all sample shipments to the laboratory.

D. Sample Containers and Shipment

Groundwater samples were collected in U.S. EPA approved containers prepared and supplied by the analyzing laboratories. Where applicable, the analyzing laboratory prepared organic sample containers with hydrochloric acid (HCl) prior to sample collection. Total metal samples were preserved in the field using nitric acid supplied by the analyzing laboratory. All samples were placed on ice in a cooler at approximately 4°C immediately after collection. A chain of custody seal was placed on each sample and each cooler to verify samples were not disturbed during transport. The coolers were shipped to the analyzing laboratory by overnight courier service.

E. Chain of Custody Documentation

Chain of Custody documentation and analysis requests are contained within each laboratory report for each event. Laboratory analytical data sheets are found in Volume II.

Chain of Custody (COC) forms provided by the analyzing laboratories or developed by Draper Aden Associates were used to document the custody of the samples from the time they were collected in the field to the time the custody of the samples was relinquished by Draper Aden personnel. Relinquishing custody of the samples was accomplished by shipping through an overnight carrier service. The information recorded in the Chain of Custody included sampling location, sampling points, number of samples, type of sampling containers, sample preservation procedures, matrix spike samples, if any, blanks accompanying the samples, date and time of sample collection, and the date and time custody was relinquished. These COC forms were sent with the samples to the analyzing laboratories. Analysis request forms which included lists of analytes required to be analyzed for the different analytical methods to be used were also attached along with the COC forms. Draper Aden Associates also requested the analyzing laboratories to attach these COC documents with the certificate analysis supplied by them after analysis of samples was complete.

III. LABORATORY ANALYSIS AND DATA VALIDATION

A. List of Laboratories

Volatile analysis and Total Metal analysis by EPA Contract Laboratory Program (CLP) statements of work (SOW) were performed by Compuchem Environmental Corporation of Research Triangle Park, North Carolina. Volatile analysis by EPA SW-846 Method #8021 was performed by Triangle Laboratories of Dublin, Ohio.

B. Analytical Methods

All CLP analytical techniques used were in accordance with the procedures listed in the Contract Laboratory Program SOW Organics OLMO1.9 (3/90), Inorganics ILMO3.0.

All LLRA analytical techniques (SW-846) used were in accordance with the procedures listed in the U.S. EPA document Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846 (latest edition).

C. Data Quality Objectives

Quality Assurance Objectives for Measurements

Data quality objectives (DQO) are established to ensure that the data collected throughout is sufficient and of adequate quality for the intended use. Overall data quality objectives included the following:

- Precision - A measurement of the reproducibility of measurements compared to their average value. Precision is measured by the use of splits, replicate samples, or co-located samples and field audit samples.
- Accuracy - This measures the bias in a measurement system by comparing a measured value to a true or standard value. Accuracy is measured by the use of standards, spiked samples, and field audit samples.
- Representativeness - This is the degree to which a sample represents the characteristic of the population being measured. Representativeness is controlled by defining sample collection protocols and adhering to them throughout the evaluation.
- Completeness - This is the ratio of validated data points to the total samples collected. Completeness is achieved through duplicate sampling and resampling, when necessary.
- Comparability - This is the confidence that one data set can be compared to another. Comparability is achieved through the use of standard methods to control the precision and accuracy of the data sets to be compared by use of field audit samples.

The CLP SOWs are utilized to generate a high level quality data with documented QA/QC protocols. The SW-846 methods are utilized to generate data for risk assessment to preliminarily identify low levels of analytes that may be present. Estimated results, above the laboratory determined Limit of Detection (LOD) but below the laboratory determined Limit of Quantification (LOQ) for LLRA, between the Instrument Detection Limit (IDL) and the Contract Required Detection Limit (CRDL) for Inorganics, and less than the Contract Required Detection Limit (CRQL) for Organics, are similarly provided for preliminary assessment purposes only. Estimated data is not intended for use in determining regulatory compliance issues.

Analytical Procedures

Analytical methods and detected analytes are provided in Tables 2A, 2B, 3A, and 3C (Summary Tables - Assessment Monitoring Results; Appendix I).

Internal Quality Control

i. Field Quality Control

Field Quality Control procedures are summarized in Section II of this report.

ii. Analytical Quality Control

Analytical Quality Control procedures for CLP analytical techniques are guided by adherence to Contract Laboratory Program (CLP) deliverables. Analytical Quality Control procedures for LLRA analytical techniques are detailed in the SW-846 Method description. All quality control data and records generated by the laboratory were examined by Draper Aden Associates for adherence to method requirements. A laboratory quality control report generally consists of the following components:

- spikes
- blanks
- duplicates
- surrogate analytes
- instrument adjustment
- calibration
- additional QC requirements (organic and inorganic)
- quantification
- raw data
- chromatograms

For this project, QC reports are provided with the target analyte analytical results for all sampling events. Documentation of adherence to Analytical Quality Control procedures for LLRA Methods, (Method 8021), was not provided for non-target analytes.

D. Data Validation

Draper Aden Associates conducted preliminary data validation of each data set. The results from each sampling event were evaluated in association with corresponding QA/QC information to provide specific useability statements to the end user of the data. Data validation was completed for LLRA using SW-846 method requirements, and guidance from the "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", (Document 1) USEPA, February, 1993; and "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review - February 1994" (Document 2). Data validation for CLP-SOW were evaluated with the CLP guidance documents noted above.

The analyses for organic as well as inorganic analytes were performed in adherence to the relevant Contract Laboratory Program-Statement of Works (CLP-SOW), with the exception of GC analysis by Method 8021. Results of the CLP-SOW analyses were summarized and reported by the analyzing laboratory in standard CLP reporting format. **Data Reporting** qualifiers were used to qualify the sample results with reference to the relevant QA/QC criteria, in the analysis summary prepared by the laboratories. These qualifiers were useful in identifying the specific QC problem (if any), and performing required validation per validation criteria. The organic **Data Reporting** qualifiers used are dissimilar in definition to the

inorganic **Data Reporting** qualifiers. Data Validation was performed as explained in the first paragraph above on the results presented in the laboratory analysis report, and the validated results were flagged where required using the appropriate **National Data Validation** qualifiers denoted in the CLP guidance documents. Please note that **Data Validation** qualifiers (as defined in Documents 1 and 2 above) are different from the **Data Reporting** qualifiers. Definitions for Data Reporting qualifiers are presented in Volume II of this report. Definitions for the Data Validation qualifiers used in this project are presented below.

- U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- N - The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification".
- NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Additionally, project specifications require the laboratory performing the analytical services to utilize the following data qualifiers:

- D - the sample was diluted to obtain the result.
- S - Method of Standard Additional was utilized to obtain the result.
- E - Laboratory recoveries fell outside EPA control limits. Results are approximate concentrations.
- TI - The laboratory tentatively identified the analyte.

Limit of Detection (LOD). The Limit of Detection is the lowest concentration that can be determined to be statistically different from a blank, and is numerically defined as three times the standard deviation of seven replicate measurements. The LOD is defined for each analyte, and is specific to the individual laboratory.

Limit of Quantitation (LOQ). The Limit of Quantitation is the level above which quantitative results may be obtained with a specified degree of confidence, and is numerically defined as 10 times the standard deviation of seven replicate measurements. The LOQ is determined for each analyte, and is specific to the individual laboratory.

CRDL. Contract Required Detection Limit (associated with CLP-inorganics only).

IDL. Instrument Detection Limit (Associated with CLP-inorganics only). Inorganic Data qualified with a "U" refers to IDL.

CRQL. Contract required Quantitation Limit (associated with CLP organics only). Organic Data qualified with a "U", refer to CRQL.

i. Inorganic Data Review (CLP)

Inorganic analysis was performed by relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method, in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0. The samples were analyzed for total concentrations of 4 metal analytes, Barium, Cadmium, Iron and Mercury. Mercury was analyzed for by Cold Vapor Atomic Adsorption technique. Compuchem Environmental Corporation of Research Triangle Park, North Carolina performed these analyses.

The results of preliminary data validation presented herein are based upon an extensive review of holding times, preservation procedures and standards, spike analysis on sample matrix, laboratory control samples, post digestion spike results, blank results (method, trip, equipment, and continuing calibration blanks), duplicate sample results, ICP serial dilution results, and interference check sample results.

A brief summary of important data validation results is presented below. Detailed validation notes are presented in Section 2, Volume II of this report.

As noted in the previous sections, a total of 22 samples including 17 groundwater samples, and 5 surface water samples were collected and analyzed for the metal analytes previously stated. The samples were analyzed in three batches, in order to adhere to the GMP analysis batch size specifications. Samples MW1, MW2, MW6, MW7, MW14, S1, S2, S3, S4 and S5 were analyzed as one batch, MW3, MW4, MW9, MW10, MW13, MW15, MW16, MW17, MW18 were analyzed as another batch, and samples MW8, MW11, MW12 were analyzed in the third batch. Only one Trip Blank was supplied by the laboratory and it is representative of samples MW2, MW3, MW4, MW8, MW9, MW10, MW11, MW12, MW13, MW15, MW16, MW17, MW18, S4, S5. No contamination was evident in the trip blank. The remaining samples did not have an associated trip blank.

Samples from MW1, MW8 and MW3 were spiked with standards to identify any possible matrix interferences in their recoveries. Spike recoveries were within the acceptable range for all analytes except Cadmium. Percent recoveries for Cadmium were outside the recovery range of 75%-125% for spikes on MW3 and MW8. Percent Recovery for MW1 spike was at the lower periphery of the acceptable range. Post digestion spikes varied in their behaviors with acceptable recovery in one case and poor recovery in another. Due to these conflicting results, it was impossible to identify the exact reason for these poor recoveries. However, it can be clearly inferred that interferences occurred either from the sample matrix, or digested solution, or from the analysis procedure itself. Hence all Cadmium results for groundwater samples were validated as Estimated and flagged with "J". However, surface water sample results S1, S2, S3, S4 and S5 cannot be considered to have the same matrix effects as for a groundwater matrix. Since no matrix spike analyses was performed on surface water matrices, an estimation cannot be made of possible matrix interferences in surface water samples.

Laboratory derived contamination was observed from evaluation of Continuing Calibration Blanks (CCB), and Method Blanks. Cadmium was observed in CCB4, but no samples were related to this blank. Hence no further validation was required. However, ICP Serial Dilution criteria was not met for Iron, relevant to samples MW8, MW11, MW12. Hence, Iron results for these samples were validated as Estimated and flagged with "J".

It should also be noted that sample results less than the Contract Required Detection Limit (CRDL) may not represent reliable and reproducible results and were validated as estimated, "J", during the data validation process.

ii. Organic Data Review (CLP and LLRA)

Organic data review was conducted for the following 12 volatile organic target analytes:

- Tetrachloroethene (PCE)
- Trichloroethene (TCE)
- 1,1-Dichloroethene (1,1-DCE)
- Methylene Chloride
- Dichlorodifluoromethane
- 1,1,1-Trichloroethane (1,1,1-TCA)
- cis-1,1-Dichloroethene (cis-1,2-DCE) (analyzed as total 1,2-DCE)
- Benzene
- 1,1-Dichloroethane (1,1-DCA)
- Chloroethane
- trans-1,3-Dichloropropane
- Vinyl Chloride

Additional non-target analytes were analyzed by the CLP-SOW for organic analysis and method 8021 and were preliminarily validated. Detected non-target analytes are presented in Tables 3A and 3B.

Organic target analytes were analyzed in accordance with USEPA CLP-SOW OLM01.9 (3/90) for samples collected from monitoring wells MW-1, MW-2, MW-3, MW-4 and MW-6 and surface water sampling locations S1 through S5. Organic target analytes for risk assessment purposes were analyzed using USEPA SW-846 method 8021 and are associated with samples collected from monitoring wells MW-7 through MW-18.

CLP-SOW analytical data for the target analytes was accompanied by a Quality Assurance/Quality Control package compiled and produced by CompuChem Environmental Corporation, RTP, North Carolina. USEPA SW-846 method 8021 analytical data for the target analytes was accompanied by a Quality Assurance/Quality Control package compiled and produced by Triangle Laboratories of Columbus, Inc., Dublin, Ohio. The packages contained instrument calibration internal standard results, raw data from all analyses and accompanying chromatographic and spectral results. Draper Aden Associates reviewed the volatile organic packages presented by CompuChem Environmental Corporation and Triangle Laboratories by reviewing technical holding times, preservation requirements, performance checks, initial calibrations, continuing calibrations, blank analyses, surrogate spike results, matrix spike and duplicate analyses, and internal standard criteria.

USEPA CLP SOW OLMO1.9 (3/90)

Organic data review for the June 20-23, 1994 sampling event was conducted on a total of 34 volatile organic analytes (CLP SOW VOA list and Dichlorodifluoromethane) analyzed using CLP Statement of Work (3/90) OLMO1.9. Samples collected from monitoring wells MW-1, MW-2, MW-3, MW-4, and MW-6 and surface water points S1, S2, S3, S4, and S5. The data package submitted by CompuChem Environmental Corporation contained two separate data sets; one containing analytical results for MW-3 (Case# 28899, SDG# 00014) and the second containing analytical results for monitoring wells MW-1, MW-2, MW-4, and MW-6, and surface water points S1, S2, S3, S4, and S5 (Case# 28899 SDG# 00001). With the exception of a Trip Blank associated with MW2, MW3, MW4, S4 and S5, project specific QC samples were associated with each data set.

The analytical data set prepared by CompuChem was accompanied by a CLP Quality Assurance/Quality Control (QA/QC) package containing instrument calibration and internal standard results, raw data from all analyses and accompanying chromatographic and spectral results. Draper Aden Associates reviewed the volatile organic packages presented by CompuChem by reviewing technical holding times, preservation requirements, performance checks, initial calibrations, continuing calibrations, blank analyses, surrogate spike results, matrix spike and duplicate analyses, and internal standard criteria. The review of this data package is considered preliminary, and does not account for data transcription errors, calculation errors.

Analytical data was qualified by DAA using the known national data qualification symbols presented in Section 3.

A brief summary of data validation results is presented below. Detailed data validation notes are presented in Section 2, Volume II of this report.

Analytical data for monitoring well MW-3 displayed complications with the initial calibration, quality control blanks and Matrix Spikes and Duplicates. Review of response factors (RF) showed that Acetone and 2-Butanone failed %RSD requirements in the Initial Calibration (ICAL). For each analyte, the lowest calibration point, RF10, was dropped and the %RSD was recalculated. After recalculation, both analytes passed %RSD criteria. Although both analytes passed the four-point calibration, samples results for both analytes were estimated with exception of MW1, MW2, and MW6 for Acetone. Results for these wells were reported in the linear portion of the calibration curve. 1,1,2,2-Tetrachloroethane failed the CLP contractual RRF minimum requirement of 0.5. Therefore, all sample results of 1,1,2,2-Tetrachloroethane were validated as estimated and flagged with "J."

One of two laboratory quality control blanks, or Method Blanks, contained a low level concentration of Methylene Chloride. According to the Contract Laboratory Program, "Functional Guidelines for Organic Data Review," all blanks should be free from contamination. Since the Method Blank is a laboratory-derived sample, the contamination shown in the analytical results for VBLK VX was considered to be laboratory artifact. Therefore, all samples containing Methylene Chloride associated with VBLK VX were validated based on the Method Blank concentration of Methylene Chloride. Methylene Chloride was detected in sample MW-3 at 6 $\mu\text{g/l}$, less than the result of the VBLK VX concentration (2 $\mu\text{g/l}$) multiplied by a factor of ten, and less than its respective CRQL value. Therefore, laboratory contamination was considered to be source of Methylene Chloride in sample MW-3.

Benzene and 1,1-Dichloroethene failed CLP requirements for relative percent difference between Matrix Spike and Matrix Spike Duplicate samples. The RPD for Benzene was calculated to be 17%, exceeding its maximum RPD of 14%, and the RPD of 1,1-Dichloroethene was calculated to be 16%, exceeding its maximum RPD of 11%. However, Percent Recoveries for both analyte were within acceptable limits. Neither analyte was detected above the CRQL in MW-3 and was not detected in the VBLK. According to CLP guidelines, no action can be taken on Matrix Spike/Duplicate data alone. Therefore, no qualification of the data based on Matrix Spike/Matrix Spike Duplicate results was performed.

Analytical data submitted in the second package (SDG# 00001) contained the same complications of initial calibration response and Method Blank contamination and warranted the same data validation and qualification as data set SDG# 00014. However, the second data set did not contain complications with Matrix Spike and Matrix Spike Duplicates for the analytes Benzene and 1,1-Dichloroethene.

All other analyte results less than CRQL required no qualification. Analytical results less than CRQL which displayed a concentration followed by "J" were reported in original laboratory reporting format after final data validation. For SDG# 00014, 1,1-Dichloroethane, 1,2-Dichloroethene, 1,1,1-Trichloroethane, Trichloroethene, and Tetrachloroethene were detected at concentrations higher than respective CRQL values. For SDG# 00001, Acetone, 4-Methyl-2-Pentanone, Ethylbenzene, Xylene, 1,1-Dichloroethene, 1,1,1-Trichloroethane, 1,2-Dichloroethene, Chloroethane, Trichloroethene and Tetrachloroethane were detected at concentrations higher than respective CRQL values. For these analytes, no data qualification was necessary.

Analytical results for cis-1,2-Dichloroethene were reported by CompuChem Environmental as part of a total concentration of both cis- and trans- isomers of the analyte.

USEPA SW-846 Method #8021

A review and preliminary data validation were performed on laboratory GC analytical results generated from Gas Chromatographic (GC) analysis. USEPA SW-846 method 8021 was prescribed in the GMP to analyze for twelve target analytes in samples collected from monitoring wells MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, MW-13, MW-14, MW-15, MW-16, MW-17, and MW-18. Method 8021 was specified for analysis of Vinyl Chloride, Methylene Chloride, Dichlorodifluoromethane, Chloroethane, 1,1-Dichloroethene, 1,1-Dichloroethane, cis-1,2-Dichloroethene, 1,1,1-Trichloroethane, Benzene, Trichloroethene, trans-1,3-Dichloropropene, and Tetrachloroethene. The laboratory report prepared by Triangle Laboratories of Columbus, Inc., included; extraction notes, instrument calibration data, raw chromatographic data printouts, Quality Assurance/Quality Control (QA/QC) documentation, and tabulated results. Preliminary validation of Triangle Laboratories' compliance with Method 8021 and analytical limitations of the data encompassed review of the following items: sample holding times, sample preservation requirements, sample extraction procedures, laboratory QA/QC performance checks, instrumental calibrations, blank analyses, surrogate spike analyses, and matrix spike analyses. Review of transcriptions from raw data to summary sheets and specific calculations were performed on random data points. A more intensive review of the data set was performed upon the identification of potential inconsistencies or abnormalities in the data set.

Detailed data validation notes can be found in Section II, Volume II of the report.

Target Analytes Data Validation Method 8021 Summary

Excessive Methylene Chloride recoveries in QC samples indicated that Methylene Chloride could potentially have been by a common laboratory contaminant. Methylene chloride calibration incorporated only four (4) standard points in the linear regression. Therefore, Methylene Chloride results were validated as estimated and labeled with a "J".

Vinyl Chloride Standard calibration run also used only four (4) standard data points for the instrument calibration linear regression. Therefore, Vinyl Chloride results were also validated as estimated and labeled with a "J".

As shown in the analytical data set notes presented in Volume II, several of the target analytes detected in multiple wells were at concentrations that exceeded the standard calibration ranges. Analytes that exceed calibration ranges are considered to be conservative estimates of the actual concentrations present in the sample and must be interpreted as being equal to and potentially greater than the reported concentration. Therefore, analytes that exceeded calibration ranges were validated as being estimated and labeled with a "J".

Validation of Additional Analytes Not Specified in the Target Analyte List:

Ten additional non-target analytes were listed, but not quantified in the laboratory report. Draper Aden Associates requested the quantification of the analytes from Triangle Laboratories of Columbus, Inc. This information was submitted to Draper Aden Associates under a separate cover. The QC data presented for these additional analytes was not extensive, therefore, all additional analyte concentrations were validated as being estimated and labeled with a "J", until outstanding information can be obtained, if possible, from the laboratory and the data set can undergo a data validation process.

IV. Discussion of Analytical Results

Tables 2A and 2B (Assessment Target Analyte Analytical Results: Appendix I) provide a summary of the target analyte analytical results obtained from the Contract Laboratory Program (CLP) SOW and the Low Level Risk Assessment (LLRA) analytical methods employed, respectively. These results were validated in-house by Draper Aden Associates according to the discussion provided in Section III.D of this report. Tables 2A and 2B lists for each analyte, as applicable, a Maximum Contaminant Level (MCL) established by the USEPA and groundwater quality standards established by the state of North Carolina (NCS), the Instrument Detection Level for CLP - Inorganic results, the Contract Required Detection Limit (CRQL) for CLP-Organic results, and the analytical method.

Estimated analytical results for the target analytes are provided in Tables 2A and 2B for preliminary assessment purpose only. Estimated analytical data is not intended for use in determining regulatory compliance issues.

A summary of additional non-target analyte analytical results obtained from the Contract Laboratory Program (CLP) SOW and the Low Level Risk Assessment (LLRA) analytical methods employed, is provided in tables 3A and 3B respectively. Non-target analyte data is provided for preliminary assessment purpose only and is not intended for use in determining regulatory compliance issues.

A. Inorganic Analytical Results

The evaluation of existing inorganic data on twelve (12) metal analytes collected prior to development of the Assessment Plan, indicated the tentative presence of four (4) metals at elevated concentrations in the groundwater beneath the Watauga County Landfill. Previous metal concentrations detected in the groundwater are generally low or are below analytical method quantitation limits. However, two metals, cadmium and iron, were historically observed at levels above those established by the EPA MCL and Secondary MCL, respectively. Barium, a common naturally occurring analyte, was also observed at relatively elevated levels, but below water quality standards. Mercury was also detected, although only once for each well in the six or more sampling and analysis events previously conducted.

The analytical results for the four target metal analytes obtained from the recent initial assessment sampling event are summarized in Tables 2A and 2B and discussed below. A discussion of analyte distribution trends for each target analyte is presented in the following Section V.

Review of Tables 2A and 2B indicates the total Mercury CLP analysis resulted in the non-detection of Mercury in all seventeen (17) monitoring wells sampled, and all five (5) surface water sampling locations.

Barium and Iron, both common naturally occurring analytes, were detected in almost all monitoring wells and surface water sampling locations. Although observed to be occurring widespread, Barium was detected at levels below the EPA MCL and North Carolina groundwater standard of 2,000 $\mu\text{g}/\text{l}$. Iron was detected in all but four (4) of the monitoring wells, and often at levels significantly above associated water quality criteria.

The detection of Cadmium, although estimated at levels above water quality standards, was observed in only two monitoring wells, MW-1 (the upgradient well) and MW-3 (an original downgradient well), and at no surface water sampling locations. The apparent discrepancy in Cadmium detections may be a result of higher detection limits required because of sample matrix interference problems experience by the laboratory.

B. Organic Analytical Results

i. Target Organic Analytes

The evaluation of existing organic data, compiled prior and during development of the Assessment Plan, indicated the tentative presence of twelve (12) primary target organic analytes occurring in the groundwater beneath the Watauga County Landfill. The analytical results for the target organic analytes obtained from the recent initial assessment sampling event are summarized in Tables 2A and 2B. The recent analytical results obtained from each target organic analytes are individually discussed below. It should be noted references to CRQL/LOQ should be interpreted as LOQ for analysis by SW-846 methods and as CRQL for analysis by CLP SOW methods for organics. A discussion of analyte distribution trends for each target organic analyte is presented in the following Section V.

Tetrachloroethene (PCE)

Tetrachloroethene (PCE) was detected at concentrations above the EPA MCL of 5 $\mu\text{g}/\text{l}$ and above the North Carolina groundwater standard (NCS) of 0.7 $\mu\text{g}/\text{l}$ in three groundwater monitoring wells (MW-3, MW-12, AND MW-17) and one surface water sampling location (S4). Estimated concentrations for PCE (detected below the method CRQL/LOQ) were also observed above the EPA MCL and above the NCS in three additional groundwater monitoring wells (MW-6, MW-8, and MW-11.). PCE was observed below the method LOQ (estimated) in four additional groundwater monitoring wells (MW-7, MW-9, MW-10, and MW-14). The estimated PCE concentrations observed for three of these wells (MW-7, MW-9, and MW-10) were above the NCS but below the EPA MCL.

Trichloroethene (TCE)

Trichloroethene (TCE) was detected above the method CRQL at concentrations above the EPA MCL of 5 $\mu\text{g/l}$ and above the NCS of 2.8 $\mu\text{g/l}$ in one groundwater monitoring well (MW-3) and one surface water sampling location (S4). Estimated concentrations for TCE (detected below the method CRQL/LOQ) were also observed above the EPA MCL and NCS in three additional groundwater monitoring wells (MW-6, MW-12, and MW-17). TCE was also observed below the method CRQL (estimated) and below applicable water quality standards in one additional surface water sampling location (S2).

1,1-Dichloroethene (1,1-DCE)

1,1-Dichloroethene (1,1-DCE) was detected above the method CRQL/LOQ at concentrations above the EPA MCL and NCS of 7 $\mu\text{g/l}$ in two groundwater monitoring wells (MW-2 and MW-10). 1,1-DCE was also estimated (observed below the method CRQL/LOQ) below applicable water quality standards in four additional wells (MW-3, MW-8, MW-12, and MW-17).

Methylene Chloride

Estimated concentrations for Methylene Chloride were observed above the EPA MCL and NCS of 5 $\mu\text{g/l}$ in five groundwater monitoring wells (MW-1, MW-3, MW-6, MW-9 and MW-12) and three surface water sampling locations (S1, S2, and S5). The estimated concentration for Methylene Chloride for one well (MW-9) was 28 times greater than the EPA MCL and NCS and exceeded the calibration range during analysis. All other estimated concentrations for Methylene Chloride exceeding the EPA MCL or NCS were less than twice the associated water quality standards, and were less than the method CRQL/LOQ. Estimated concentrations for Methylene Chloride (detected below the CRQL) were observed below the EPA MCL and NCS in the other two surface water sampling locations (S3 and S5).

As discussed in the previous Section II.D, validation of low level detections of Methylene Chloride are questionable due to laboratory solvent interferences. The estimated results for Methylene Chloride may prove to falsely indicate the presence of Methylene Chloride at the three additional monitoring wells and five surface water sampling locations. Note that one of the estimated detections for Methylene Chloride was observed in the upgradient well MW-1. To date, no volatile organic analytes have been confirmed by repeated sampling at MW-1.

Dichlorodifluoromethane

Estimated elevated concentrations for Dichlorodifluoromethane were observed at concentrations above the North Carolina groundwater standard (NCS) of 0.19 $\mu\text{g/l}$ in two groundwater monitoring wells (MW-9 and MW-12). No EPA MCL exists for Dichlorodifluoromethane. Lower estimated concentrations for Dichlorodifluoromethane (detected below the method CRQL/LOQ) were also observed above the NCS in four additional groundwater monitoring wells (MW-3, MW-8, MW-11, and MW-17) and one surface water sampling point (S2).

1,1,1-Trichloroethane (1,1,1-TCA)

1,1,1-Trichloroethane (1,1,1-TCA) was detected above the method CRQL at concentrations above the EPA MCL and North Carolina groundwater standard (NCS) of 200 $\mu\text{g/l}$ in one monitoring well (MW-2). 1,1,1-TCA was also detected above the method CRQL but below the EPA MCL and below the NCS in one additional groundwater monitoring well (MW-3). Estimated concentrations (below the CRQL/LOQ) of 1,1,1-TCA were also observed below the EPA MCL and NCS in seven additional groundwater monitoring wells (MW-8, MW-9, MW-10, MW-11, MW-12, MW-15, and MW-17) and two surface water sampling points (S2 and S4).

Cis-1,1-Dichloroethene (cis-1,2-DCE)

As previously discussed in Section III, CLP-SOW analytical results for cis-1,2-Dichloroethene were reported as part of a total concentration of cis- and trans- isomers of the analyte (i.e. for MW-1 through MW-6 and S2 through S5).

Total 1,2-Dichloroethene (1,2-DCE) was detected above the method CRQL at concentrations above the EPA MCL and North Carolina groundwater standard (NCS) of 70 $\mu\text{g/l}$ in one groundwater monitoring well (MW-6). Total 1,2-DCE (CLP-SOW) and/or cis-1,2-DCE (LLRA) was also detected above the method CRQL/LOQ but below the EPA MCL and below the NCS in three additional groundwater monitoring wells (MW-3, MW-8, and MW-12) and one surface water monitoring point (S4). Estimated concentrations for cis-1,2-DCE were observed in four groundwater monitoring wells (MW-7, MW-9, MW-11, and MW-17). Estimated concentrations for total 1,2-DCE were observed in one surface water sampling point (S2).

Benzene

No concentrations of Benzene above the method CRQL/LOQ were observed in any monitoring wells or surface water sampling locations. Estimated concentrations of Benzene (detected below the method CRQL) were observed above the EPA MCL of 5 $\mu\text{g/l}$ and above the NCS of 1 $\mu\text{g/l}$ in one groundwater monitoring well (MW-6). Benzene was also detected (estimated) below the method CRQL/LOQ and below the EPA MCL and NCS in three additional groundwater monitoring wells (MW-7, MW-8, and MW-9) and below the EPA MCL but at or above the NCS in two surface water sampling locations (S2 and S4).

1,1-Dichloroethane (1,1-DCA)

1,1-Dichloroethane (1,1-DCA) was detected at concentrations below the North Carolina groundwater standard (NCS) of 700 $\mu\text{g/l}$ in two groundwater monitoring wells (MW-3 and MW-6) and two surface water sampling locations (S2 and S4). No EPA MCL exists for 1,1-DCA. Estimated concentrations of 1,1-DCA were also observed below the NCS in nine additional wells (MW-3, MW-7 through MW-13, MW-15, and MW-17) and two additional surface water sampling locations (S1 and S5).

Chloroethane

Chloroethane was detected at concentrations above the method CRQL/LOQ in four groundwater monitoring wells (MW-8, MW-9, MW-12 and MW-17) and two surface water sampling locations (S2 and S5). The concentration of Chloroethane in MW-9 exceeded the calibration range and was therefore approximated. Estimated concentrations of Chloroethane (detected below the method CRQL/LOQ) were also observed in four additional wells (MW-3, MW-6, MW-7, and MW-11). No EPA MCL or North Carolina groundwater standard (NCS) exists for Chloroethane.

Trans-1,3-Dichloropropene

Trans-1,3-Dichloropropene was not detected above or estimated below the method CRQL/LOQ in any monitoring wells or surface water sampling locations.

Vinyl Chloride

Vinyl Chloride was not detected above the method CRQL/LOQ in any monitoring wells or surface water sampling locations, but was estimated (detected below the CRQL) at a concentration above the EPA MCL of 2 $\mu\text{g/l}$ and above the North Carolina groundwater standard (NCS) of 0.015 $\mu\text{g/l}$ in one groundwater monitoring well (MW-6).

ii. Non-Target Organic Analyses

The analytical results of additional non-target organic analytes detected as a result of utilizing the appropriate CLP SOW on core wells, and LLRA (USEPA SW-846 Method #8021) on boundary wells are summarized in Tables 3A and 3B, respectively. The analytical results obtained for those non-target analytes, analyzed utilizing USEPA SW-846 Method #8021 are provided to identify those analytes which, although not analyzed and/or validated with the rigorous analytical quality control procedures of the target analytes, will be continually monitored. If upon completion of background data collection, the presence of any non-target analytes are confirmed by repeated analysis, the analyte will be added to the Target Analyte list.

CLP Analysis

Out of the four monitoring wells and five surface water sampling locations analyzed utilizing CLP SOW for organic analysis, additional non-target analytes were detected in only one monitoring well, MW-1 (the upgradient well), and one surface water location, S2 (the landfill spring capture outfall).

The six non-target analytes detected in MW-1 (Acetone, 4-Methyl-2-Pentanone, 1,1,2,2-Tetrachloroethane, Ethylbenzene, Xylene [total], and Toluene) were not detected in the matrix spike or matrix spike duplicate samples performed on MW-1 (contained in Volume II). The absence of the six non-target analytes in these two analytical quality control samples for MW-1 suggest that the detection of these analytes is not representative of true groundwater quality but rather contamination introduced into the sample during sampling or analysis. Confirmation of the presence or absence of these six non-target analytes in MW-1 will be evaluated on the following background monitoring events.

Four of the six non-target analytes detected in MW-1 (4-Methyl-2-Pentanone, Ethylbenzene, Xylene [total], and Toluene) were also detected in the landfill spring capture outfall (S-2). No matrix spike or matrix spike duplicate samples were collected or performed on S-2. Out of the total four non-target analytes detected in S2, three are BTEX components (ie: Toluene, Ethylbenzene, and Xylene [total]). Similar to the evaluation of non-target analytes detected in MW-1, confirmation of the presence or absence of these four non-target analytes in the landfill spring capture outfall will be evaluated on the following background monitoring events.

LLRA Analysis

Additional non-target analytes were detected in eight of the twelve total Boundary monitoring wells sampled and analyzed utilizing USEPA SW-846 Method #8021. A total of ten non-target analytes were detected by SW-846 Method #8021. Five of these non-target analytes are benzene derivatives. Half of all the total non-target analyte detects were observed in only two of these twelve monitoring wells; MW-12 (located below the Nissan-Mazda septic field) and MW-9 (located adjacent to the Carroll property). Three of the five benzene derivatives were detected in MW-9 and four of the five benzene derivatives were detected in MW-12. Naphthalene and Styrene were also both observed in MW-9 and MW-12.

Of particular note is the detection of Trichlorofluoromethane in MW-9, (estimated at 20.50 J $\mu\text{g/l}$). The target analyte, Dichlorodifluoromethane, was also detected at the highest estimated concentration in MW-9 (13.92J $\mu\text{g/l}$). Trichloroflouromethane was not detected in the only other location where Dichlorodifluoromethane was detected above the LOQ, well MW-12 (9.83 $\mu\text{g/l}$).

The coeluting Benzene derivatives, tert-Butylbenzene, 1,2,4-Trimethylbenzene, and sec-Butylbenzene, were detected at total estimated concentrations in MW-7 (44.97 J $\mu\text{g/l}$). These coeluting benzene derivatives were also detected at MW-8 (8.91 J $\mu\text{g/l}$) and at trace levels in MW-12 (0.83 J $\mu\text{g/l}$). The non-target analyte trans-1,2-dichloroethene was detected in these same three wells, MW-7, MW-8, and MW-12, as well as detected at a similar level in MW-17. Two other non-target analytes, Naphthalene and o-Xylene, were also detected in MW-7.

Low level non-target analyte detects were observed in several wells that do not indicate significant impact by the target analytes (ie: MW-13, MW-16, and MW-18). Additional background data collection will be used to confirm the presence of the non-target analytes in these wells.

V. ANALYTE DISTRIBUTION TRENDS

A. Inorganic Analytical Results

Mercury

The presence of Mercury in the groundwater and surface waters at the site is not supported by the analytical results of the first quarter assessment background monitoring event. No concentrations of Mercury were observed above the IDL of 0.20 $\mu\text{g/l}$. If Mercury is confirmed to be absent upon completion of background data collection and the first complete annual EPA Appendix II List sampling event (utilizing LLRA analytical methods), it will be removed from the Target Analyte List.

Barium

Barium distribution trends, indicated by the analytical results of the first quarter assessment monitoring event, indicate a relationship between Barium distribution and proximity to the waste disposal areas. Although Barium was detected at every point sampled, a majority of the Barium detected at the site was reported at concentrations less than 120 $\mu\text{g/l}$. The five monitoring wells for which Barium was observed at concentrations above 120 $\mu\text{g/l}$ (MW-1, MW-6, MW-7, MW-8, and MW-9) are all located near the waste disposal area. Notably absent from this group of wells is MW-10, located directly downgradient and adjacent to the waste disposal area. An estimated concentration for Barium was observed at MW-10 (109J $\mu\text{g/l}$). Barium was also observed at elevated levels directly below the waste disposal area at the landfill spring capture outfall (755 $\mu\text{g/l}$) and downstream of the spring capture outfall at the landfill property boundary, S3 (366 $\mu\text{g/l}$).

Cadmium

Cadmium distribution trends, indicated by the analytical results of the first quarter assessment monitoring event, are inconclusive due to matrix interference problems. Matrix interference problems resulted in an elevated CRDL and may have also resulted in the non-detection of elevated levels of Cadmium present due to data validation concerns. The resultant Cadmium concentrations are validated as UJ in Tables 2A and 2B. Four quarterly events of background analytical data for Cadmium will be collected and evaluated during the initial year of assessment monitoring. Solutions to the matrix interference problems will be evaluated with respect to CLP SOW.

Iron

Iron distribution trends, indicated by the analytical results of the recent initial assessment monitoring event, indicate a relationship between Iron distribution and proximity to the waste disposal area. The three monitoring wells for which Iron was observed at the highest concentrations (MW-6, MW-7, and MW-8) are located adjacent and west of the waste disposal area. The following four elevated Iron concentrations were detected in the other two monitoring wells (MW-9 and MW-10), located adjacent to the waste disposal area and in the nested well pair (MW-3 and MW-17), located directly downgradient of the location where the three highest concentrations of Iron were detected. Iron concentrations continue to decrease at the nested well pair, MW-11 and MW-12, located downgradient of MW-3 and MW-17, and were not detected at all at the nested well pair, MW-2 and MW-4.

B. Organic Analytical Results

i. Target Organic Analyses

It should be noted, as in Section IV.B, that references to CRQL/LOQ should be interpreted as the LOQ for analysis by SW-846 methods and as the CRQL for analysis by CLP-SOW methods for organics.

Tetrachloroethene (PCE)

Tetrachloroethene (PCE) distribution trends, indicated by the analytical results of the first quarter assessment monitoring event, differ from PCE distribution trends previously observed (presented in Appendix III) by the non-detection of PCE in MW-2 and MW-4. With few exceptions, PCE was detected primarily along the west drainage basin adjacent to the landfill, located within and below the "Bolick" site.

PCE was detected at the highest concentrations in the shallow well MW-3 (44 mg/l) and the deep well MW-17 (37.43 $\mu\text{g/l}$), located at the downgradient property boundary of the Bolick site. PCE was also detected downgradient of the Bolick site in the shallow well MW-11 (7.47J $\mu\text{g/l}$) and the deep well MW-12 (22.78 $\mu\text{g/l}$), as well as the surface water sampling point S4 (18 $\mu\text{g/l}$) located below the Bolick site. PCE was similarly estimated above the EPA MCL (5 $\mu\text{g/l}$) in MW-8 (7.55J $\mu\text{g/l}$), located with the Bolick site and in MW-6 (6J $\mu\text{g/l}$), located between the landfill and the Bolick site.

Other PCE detections were observed in MW-9 (2.15J $\mu\text{g/l}$) and estimated in MW-10 (1.30J $\mu\text{g/l}$), MW-14 (0.24J $\mu\text{g/l}$), and MW-7 (0.88J $\mu\text{g/l}$).

Trichloroethene (TCE)

Trichloroethene (TCE) distribution trends, indicated by the analytical results of the first quarter assessment monitoring event, also differ from TCE distribution trends previously observed (presented in Appendix III), by the non-detection of TCE in MW-2 and MW-4 (in a similar manner as PCE distribution trends). With one exception (S2), TCE was only detected along the west drainage basin adjacent to the landfill, located within and below the "Bolick" site.

TCE was detected at the highest concentrations in the shallow well MW-3 (16 $\mu\text{g/l}$) and the deep well MW-17 (15.70J $\mu\text{g/l}$), located at the downgradient property boundary of the Bolick site. TCE was also detected downgradient of the Bolick site in the deep well MW-12 (5.74J $\mu\text{g/l}$) and the surface water sampling point S4 (13 $\mu\text{g/l}$). TCE was not detected in the shallow well MW-11, located downgradient of the Bolick site. TCE was also observed below the method CRQL (estimated) at concentrations above the EPA MCL (5 $\mu\text{g/l}$) and NCS (2.8 $\mu\text{g/l}$) in MW-6 (21J $\mu\text{g/l}$), located between the landfill and the Bolick site.

The only TCE observed outside of the west drainage basin was detected below the method CRQL (estimated below applicable water quality standards at 1J $\mu\text{g/l}$) in the landfill spring capture outfall surface water sampling location (S2).

1,1-Dichloroethene (1,1-DCE)

1,1-Dichloroethene (1,1-DCE) distribution trends, indicated by the analytical results of the first quarter assessment monitoring event, differ from 1,1-DCE distribution trends previously observed (presented in Appendix III), by the lower estimated concentrations (below the method CRQL and EPA MCL) of 1,1-DCE in MW-3. Additional monitoring wells located in the west drainage basin reveal similar low level, estimated concentrations as well as the non-detection of 1,1-DCE.

1,1-DCE was observed below the method CRQL/LOQ (estimated) for the four monitoring wells, MW-3 (5J $\mu\text{g/l}$), MW-8 (0.30J $\mu\text{g/l}$), MW-12 (1.15J $\mu\text{g/l}$), and MW-17 (1.09J $\mu\text{g/l}$), located in the west drainage basin. 1,1-DCE was not detected in the shallow well MW-11, located adjacent to the deep well MW-12 in this west drainage basin.

1,1-DCE was observed at the highest concentrations in the deep well MW-2 (160 $\mu\text{g/l}$), located in northern drainage basin below the landfill. 1,1-DCE was also observed above the EPA MCL and method LOQ in MW-10 (32.29 $\mu\text{g/l}$), located in the northern drainage directly below the fill areas. 1,1-DCE was not detected in the shallow wells MW-4 and MW-16, located in the northern drainage basin below the landfill.

Methylene Chloride

Methylene Chloride distribution trends, indicated by the analytical results of the first quarter assessment monitoring event, are similar to Methylene Chloride distribution trends previously observed (presented in Appendix III). Exceptions to these distribution trends occur at MW-12 (located below the Nissan-Mazda septic field) and MW-9 (located adjacent to the Carroll property).

Estimated elevated concentrations of Methylene Chloride were observed in MW-12 at 8.58J $\mu\text{g/l}$ and MW-9 at 140.10J $\mu\text{g/l}$. Both of these estimated Methylene Chloride concentrations are above the EPA MCL and North Carolina groundwater standard (NCS) of 5 $\mu\text{g/l}$.

Lower estimated concentrations (below the method CRQL/LOQ) of Methylene Chloride were observed to be randomly distributed in three other monitoring wells and were observed at all five surface water sampling locations. The random distribution of the lower estimated concentrations detected reinforces the previous discussion regarding the questionable detection of the low level Methylene Chloride data due to laboratory solvent interferences. Estimated concentrations of Methylene Chloride were observed in MW-3 (6J $\mu\text{g/l}$) but not in the adjacent

well MW-17 or nearby downgradient wells MW-11 and MW-12; and in MW-6 (11J $\mu\text{g/l}$) but not in nearby MW-8; and in the background upgradient well MW-1 (8J $\mu\text{g/l}$). The estimated concentrations of Methylene Chloride in the surface water sampling locations ranged from 1 $\mu\text{g/l}$ to 9 $\mu\text{g/l}$. The lowest estimated Methylene Chloride concentration was observed in the otherwise most significantly impacted surface water sampling location, S4.

Dichlorodifluoromethane

Dichlorodifluoromethane distribution trends, indicated by the analytical results of the first quarter assessment monitoring event, are similar to Dichlorodifluoromethane distribution trends previously observed (presented in Appendix III). Similar to Methylene Chloride distribution trends, exceptions to Dichlorodifluoromethane distribution trends occur at MW-12 (located below the Nissan-Mazda septic field) and MW-9 (located adjacent to the Carroll property).

Estimated elevated concentrations of Dichlorodifluoromethane were observed in MW-12 at 13.92J $\mu\text{g/l}$ and in MW-9 at 9.83J $\mu\text{g/l}$. Both of these Dichlorodifluoromethane concentrations are above the North Carolina groundwater standard (NCS) of 0.19 $\mu\text{g/l}$. No EPA MCL exists for Dichlorodifluoromethane.

Lower estimated concentrations (below the method CRQL/LOQ) of Dichlorodifluoromethane were observed in four other monitoring wells located within the west drainage basin adjacent to the landfill; MW-3 (7J $\mu\text{g/l}$), MW-8 (2.26J $\mu\text{g/l}$), MW-11 (1.88J $\mu\text{g/l}$), and MW-17 (1.44J $\mu\text{g/l}$). Dichlorodifluoromethane was detected in no other monitoring wells at the site.

An estimated concentration of Dichlorodifluoromethane was detected in only one surface water sampling location, S2 (4J $\mu\text{g/l}$), located at the landfill spring capture outfall.

1,1,1-Trichloroethane (1,1,1-TCA)

1,1,1-Trichloroethane (1,1,1-TCA) distribution trends, indicated by the analytical results of the first quarter assessment monitoring event, are similar to 1,1,1-TCA distribution trends previously observed (presented in Appendix III).

1,1,1-TCA was observed at the highest concentration (above the EPA MCL and NCS of 200 $\mu\text{g/l}$) in the deep well MW-2 (1800 $\mu\text{g/l}$) located in the northern drainage below the landfill. 1,1,1-TCA was notable absent from the shallow wells, MW-4 and MW-16, located adjacent to and nearby downgradient, respectively, of MW-2. 1,1,1-TCA was estimated (exceeded calibration range) at a concentration below the EPA MCL and NCS in MW-10 (130.14E $\mu\text{g/l}$), located upgradient of MW-2.

1,1,1-TCA was also observed below the EPA MCL and NCS in both the deep and shallow wells of the two nested pairs located in the west drainage basin, shallow MW-3 (31 $\mu\text{g/l}$) and deep MW-17 (13.39J $\mu\text{g/l}$), and shallow MW-11 (4.83J $\mu\text{g/l}$) and deep MW-12 (16.79J $\mu\text{g/l}$), at and downgradient of the Bolick Site property boundary, respectively. A lower estimated concentration (below the LOQ) of 1,1,1-TCA was observed in MW-8 (2.42J $\mu\text{g/l}$), located upgradient of these two nested pairs of wells.

1,1,1-TCA was additionally detected (estimated) in MW-9 (11.89J $\mu\text{g/l}$), located adjacent to the Carroll property.

Cis-1,2-Dichloroethene (cis-1,2-DCE)

Cis-1,2-Dichloroethene (cis-1,2-DCE) distribution trends, indicated by the analytical results of the first quarter assessment monitoring event, are similar to distribution trends previously observed (presented in Appendix III).

As previously discussed in Section III, CLP-SOW analytical result for cis-1,2-Dichloroethene were reported as part of a total concentration of cis- and trans- isomers of the analyte (i.e. for MW-1 through MW-6 and S1 through S5).

Total 1,2-DCE was observed at the highest concentrations (above the EPA MCL and NCS of 70 $\mu\text{g/l}$) in MW-6 (330 $\mu\text{g/l}$), located adjacent to the landfill and the Bolick site, and in the surface water sampling location, S4 (58 $\mu\text{g/l}$), located in the west drainage below the Bolick site. Elevated concentrations of cis-1,2-DCE (below the EPA MCL and NCS) were also observed within the Bolick site at MW-8 (28.90 $\mu\text{g/l}$) at the downgradient property boundary of the Bolick site at the nested well pair, shallow well MW-3 (total 1,2-DCE at 37 $\mu\text{g/l}$) and deep well MW-17 (60.79E $\mu\text{g/l}$), and downgradient of the Bolick site at the nested well pair, shallow well MW-11 (5.05J $\mu\text{g/l}$) and deep well MW-12 (28.13 $\mu\text{g/l}$).

Lower level detections of cis-1,2-DCE were also estimated at the two monitoring wells, MW-7 (0.97J $\mu\text{g/l}$) and MW-9 (0.95J $\mu\text{g/l}$), and at the surface water sampling location S2 (total 1,2-DCE at 4J $\mu\text{g/l}$).

Benzene

Benzene distribution trends, indicated by the analytical results of the first quarter assessment monitoring event, are inconclusive since no concentrations of Benzene were observed above the Method CRQL/LOQ in any monitoring wells or surface water sampling locations.

Estimated Benzene results (below the Method CRQL) indicate analyte levels in MW-6 (9J $\mu\text{g/l}$) at concentrations above the EPA MCL (5 $\mu\text{g/l}$) and NCS (1 $\mu\text{g/l}$) similar to levels previously observed at this location (presented in Appendix III). Estimated Benzene concentrations between the lower North Carolina groundwater quality standard (NCS) and the higher EPA MCL were observed in the two surface water sampling locations, the landfill spring capture outfall, S2 (3J $\mu\text{g/l}$), and the stream located below the Bolick site, S4 (1J $\mu\text{g/l}$). Lower estimated Benzene concentrations were observed at levels below associated water quality standards in three other wells located adjacent to the waste disposal area; MW-7 (0.42J $\mu\text{g/l}$), MW-8 (0.72J $\mu\text{g/l}$), MW-9 (0.40J $\mu\text{g/l}$),

1,1-Dichloroethane (1,1-DCA)

1,1-Dichloroethane (1,1-DCA) distribution trends, indicated by the analytical results of the first quarter assessment monitoring event, are similar to 1,1-DCA distribution trends previously observed (presented in Appendix III).

1,1-DCA was observed in more monitoring wells than any other target analyte. No established EPA MCL or NCS exists for 1,1-DCA. 1,1-DCA was observed at the highest concentrations (below the proposed North Carolina groundwater quality standard of 700 $\mu\text{g/l}$) in the nested well pair, shallow MW-3 (160 $\mu\text{g/l}$) and deep well MW-17 (105.03E $\mu\text{g/l}$), located at the downgradient property boundary of the Bolick site. Elevated concentrations of 1,1-DCA were also observed between the landfill and the Bolick site at MW-6 (97 $\mu\text{g/l}$). Elevated estimated concentrations of 1,1-DCA were observed within the Bolick site at MW-8 (35.33J $\mu\text{g/l}$), and downgradient of the Bolick site at the nested well pair, shallow well MW-11 (25.23J $\mu\text{g/l}$) and deep well MW-12 (82.77J $\mu\text{g/l}$ E).

Elevated estimated concentrations of 1,1-DCA were also observed at MW-2 (75J $\mu\text{g/l}$).

1,1-DCA was also observed above the method CRQL at elevated concentrations at the two most significantly impacted surface water sampling locations; the landfill spring capture outfall, S2 (23 $\mu\text{g/l}$), and the stream located below the Bolick site, S4 (59 $\mu\text{g/l}$).

Lower level estimated concentrations of 1,1-DCA were observed at MW-7 (10.42J $\mu\text{g/l}$) and MW-9 (13.63J $\mu\text{g/l}$).

Estimated concentrations near the LOD of 1,1-DCA (below the Method LOQ) were observed at the two monitoring wells, MW-13 (0.99J $\mu\text{g/l}$), and MW-15 (0.26J $\mu\text{g/l}$), and at the two surface water sampling locations, S1 (1J $\mu\text{g/l}$) and S5 (2J $\mu\text{g/l}$).

Chloroethane

Chloroethane distribution trends, indicated by the analytical results of the first quarter assessment monitoring event, support the inclusion of Chloroethane in the target analyte list. Chloroethane distribution trends previously observed (presented in Appendix III) were inconclusive, although enough Chloroethane detects were previously noted to warrant the initial inclusion of Chloroethane in the target analyte list.

Chloroethane was observed in the recent monitoring event at the highest concentration in MW-9 (56.78E $\mu\text{g/l}$), located adjacent to the Carroll property. A similar elevated concentration of Chloroethane was also observed at the landfill spring capture outfall, S2 (56 $\mu\text{g/l}$). Lower concentrations of Chloroethane were also observed in the seep located below the waste disposal area, S5 (11 $\mu\text{g/l}$).

Other elevated concentrations of Chloroethane were observed at MW-17 (28.21 $\mu\text{g/l}$) and MW-12 (20.23 $\mu\text{g/l}$), located in the west drainage adjacent to the landfill. Lower concentrations of Chloroethane were observed in MW-8 (9.44 $\mu\text{g/l}$), located within the Bolick site. Estimated concentrations of Chloroethane (below the Method LOQ) were observed in other monitoring wells located in the west drainage; shallow well MW-3 (6J $\mu\text{g/l}$), located adjacent to deep well MW-17, shallow well MW-11 (1.16J $\mu\text{g/l}$), located adjacent to deep well MW-12, MW-6 (8J $\mu\text{g/l}$), located between the landfill and the Bolick site, and MW-7 (7.33 $\mu\text{g/l}$), located southeast of the Bolick site.

Trans-1,3-Dichloropropene

The presence of trans-1,3-Dichloropropene in the groundwater and surface waters at the site is not supported by the analytical results of the first quarter assessment monitoring event. Previous organic analysis results (presented in Appendix III) indicated the presence of trans-1,3-Dichloropropene in the west drainage adjacent to the landfill. The recent sampling and analysis, conducted at a similar method LOD, did not confirm the presence of trans-1,3-Dichloropropene.

If upon completion of background data collection and the first annual EPA Appendix II list sampling event (utilizing LLRA analytical methods), the absence of trans-1,3-Dichloropropene in the groundwater and surface waters at the site is confirmed, trans-1,3-Dichloropropene will be removed from the Target Analyte List.

Vinyl Chloride

A pervasive presence of Vinyl Chloride in the groundwater and surface waters at the site also is not supported by the analytical results of the first quarter assessment monitoring event. Previous organic analysis results (presented in Appendix III) indicated elevated levels of Vinyl Chloride in the west drainage adjacent to the landfill. The recent sampling and analysis, conducted at a similar method CRQL/LOQ, did not confirm the presence of Vinyl Chloride, except an estimated detection observed at one monitoring well, MW-6 (105 $\mu\text{g/l}$).

ii. NON-TARGET ORGANIC ANALYTES

As previously discussed in Section IV.B., half of all the total non-target analytes detected utilizing USEPA SW-846 Method #8021 were observed in MW-9 (located adjacent to the Carroll property) and MW-12 (located below the Nissan-Mazda septic field). The distribution of these non-target analytes in MW-9 and MW-12 mimics the distribution trends observed for a majority of the target analytes. Both the non-target contaminants detected in MW-9 and MW-12, and the target contaminant distribution trends observed in MW-9 and MW-12, are significantly different than those observed in other groundwater wells and surface water sampling locations in the assessment monitoring network. The detection of the non-target analytes, Styrene, Naphthalene, and various Benzene derivatives, observed in MW-9 and MW-12, and the elevated levels of the target analytes, Methylene Chloride and Dichlorodifluoromethane, observed in MW-9 and MW-12, indicate a significantly different mechanism is involved in the occurrence of these analytes in the groundwater at MW-9 and MW-12.

Other non-target analyte distribution trends that will continue to be evaluated is the detection of the coeluting benzene derivatives tert-Butylbenzene, 1,2,4-Trimethylbenzene, Sec-Butylbenzene, at elevated total concentrations in MW-7 (44.97J $\mu\text{g/l}$) and MW-8 (8.91J $\mu\text{g/l}$), as well as the detection of trans-1,2-Dichloroethene at these same two monitoring wells. Trans-1,2-Dichloroethene was also detected in two other wells, MW-12 and MW-17. The detection of trans-1,2-Dichloroethene in these wells is significant in consideration of the fact that the target analyte, cis-1,2-Dichloroethene, coelutes with trans-1,2-Dichloroethene when utilizing CLP-SOW methods.

VI. CONCLUSIONS

A. Analyte Distribution

The analytical results obtained from the first quarter assessment background monitoring event indicate that the detection of target analytes in the Watauga County Landfill monitoring network was reported only for those groundwater and surface water locations existing south of the proposed route 421 bypass (Figure 2; Appendix I).

The relocation of five (5) of the assessment monitoring wells (MW-12, MW-13, MW-14, MW-15, and MW-18), as originally proposed in the Assessment Plan (DAA, September 3, 1993), was necessary due to the proposed rerouting of U.S. Highway 421. The construction right-of-way for the proposed bypass would have directly impacted the original locations for these five wells, likely requiring their premature abandonment. Four of these wells were relocated north of the proposed bypass (MW-13, MW-14, MW-15, and MW-18) and one well was relocated south of the proposed bypass (MW-12).

The recent analytical results indicate no significant detections in the four monitoring wells relocated north of the proposed bypass. Conversely, the recent analytical results reveal eight target analytes detected above the method LOQ in MW-12, relocated south of the proposed bypass. The analytical results indicate the northern edge of the area defined by the occurrence of assessment target analytes exists within the construction right-of-way for the proposed U.S. Highway 421 bypass.

South of the proposed bypass, the detection of assessment target analytes was reported only for the saddle between the landfill and the Rocky Mountain Heights Subdivision and the west and north drainages below the landfill.

In the west drainage, the detection of target analytes above groundwater standards is observed in both the soil and bedrock aquifer media, extending from the landfill to the proposed bypass. Organic analysis, performed on the piezometer network installed on the Bolick Site on November 16-18, 1992 by Draper Aden Associates, additionally indicates the target analytes were detected only the groundwater within the trough of the west drainage. Three target analytes were found to exceed the EPA MCL and NCS at the surface water sampling location in the west drainage. The impact observed at this surface water sampling location is reflective of groundwater discharge.

In the north drainage, the detection of target analytes above groundwater standards is only observed in the bedrock aquifer medium. No target analytes were detected in the two monitoring wells accessing the soil aquifer medium in the north drainage. The levels of the target analytes detected in the two monitoring wells accessing the bedrock aquifer medium indicate the detected target analytes have preferentially migrated to deeper fracture zones within the bedrock. The recent analytical results indicate little if any impact on two of the three surface water locations in the north drainage. The landfill spring capture outfall is the only surface water location in the north drainage where significant impact by target analytes was observed.

The organic compounds detected in the monitoring well located along the saddle between the landfill and the Rocky Mountain Heights subdivision (MW-9) and the organic compounds detected the monitoring well located below the Nissan-Mazda septic field (MW-12) were observed at markedly different concentrations than the levels of the organic compounds detected in the remainder of the monitoring well network. In addition, several different organic compounds were detected along the saddle between the landfill and the Rocky Mountain Heights subdivision as well as detected immediately below the Nissan-Mazda septic field that were not detected in the remainder of the monitoring well network.

B. Target Analyte Summary

The detection of PCE, TCE, cis-1,2-Dichlorodifluoromethane, and Chloroethane was primarily reported within the west drainage.

The detection of 1,1,1-TCA and 1,1-DCA was observed in both the west and the north drainages, although 1,1,1-TCA was observed at significantly higher elevated levels in the north drainage at the deep bedrock well MW-2.

The detection of 1,1-DCE was concentrated in the north drainage, although 1,1-DCE was detected above the EPA MCL at the surface water sampling location in the west drainage (S4).

Methylene Chloride and Dichlorodifluoromethane were estimated at significantly higher levels in MW-9 and MW-12 than in other sampling locations in the monitoring well network. A majority of detected non-target analytes were also observed in MW-9 and MW-12.

Benzene was not detected above the method LOQ in any monitoring well or surface water sampling location. Estimated concentrations (below the LOQ) of Benzene are preferentially distributed adjacent to the disposal area.

Trans-1,2-Dichloropropene were not detected above or estimated below the method LOQ in any groundwater wells or surface water sampling locations in the monitoring network.

Vinyl Chloride was only detected (estimated below the LOQ) in one monitoring well and was not detected above or estimated below the method LOQ in any surface water sampling locations in the monitoring network.

C. Continuing Investigations

Three areas not fully characterized by the existing monitoring network that will continue to be evaluated during ongoing groundwater investigations are described below.

West Drainage

As detailed in the Assessment Plan Activity Report (DAA, July 29, 1994), the west drainage adjacent to the landfill trends parallel to the orientation of two lineament sets observed at the site. Upper reaches of the west drainage trend parallel to mineral layering, lineation, and foliation in the host bedrock as well as parallel to the general northwest trending contact between the amphibolite/hornblende gneiss-mica schist and gneiss and the "mixed rocks" assemblage (N55°W). Upon reaching an area where the amphibolite/hornblende gneiss is not stratigraphically overlain by the mica schist and gneiss (inferred from drilling of MW-18 as well as the distribution of residual soil distributions depicted on the Watauga County Soil Survey), the drainage trends N10°E, parallel to bedrock fracture and joint lineations.

The original proposed locations for MW-13 and MW-18 were at the junction of the N55°W and N10°E lineament sets. MW-13 and MW-18 were relocated along the N10°E lineament set to account for the flow direction of the surface water drainage. Trace level detections observed in the BREMCO potable well (Potable Well Analysis Summary Table, Appendix IV) indicate the possibility that deeper groundwater flow within the bedrock may follow the N55°W lineament set. Therefore, the area between the proposed bypass and the BREMCO potable well is one area that will continue to be evaluated during ongoing groundwater investigations.

North Drainage

The recent analytical results indicate elevated levels above groundwater standards for the target analytes in the northern drainage below the landfill at the deep bedrock monitoring well, MW-2. Downgradient of this point the bedrock aquifer system enters the central watershed of Rocky Branch and is likely significantly diluted. Groundwater entering the Rocky Branch watershed from the northern drainage may be exhibiting lateral stratification. Rather than continuing to follow the northern drainage orientation, groundwater may flow N55°W, parallel to Rocky Branch, before reaching the apex of the watershed. Therefore, the area between the nested well pair, MW-14 and MW-15, and the Chevrolet Dealership will continue to be evaluated during ongoing groundwater investigations. The non-detection of organic analytes at the Chevrolet Dealership's potable well suggests non-impact at the dealership's well location.

Southern Saddle

The recent analytical results obtained from the monitoring well installed along the saddle between the landfill and the Rocky Mountain Heights Subdivision (MW-9) indicates the organic analytes observed in Carroll residence potable well are not confined to the Carroll property. To examine potential flow pathways not currently investigated by the Residential and Business potable well sampling program (described in the Assessment Plan and Activity Report and summarized herein in Appendix IV), the area directly downgradient and south of the Carroll property will be evaluated for additional groundwater investigations. A residential well does not currently exist immediately downgradient of the Carroll property. To further investigate the analyte distributions across the saddle from the Carroll property, the area between the landfill and MW-9 will also be evaluated for additional groundwater investigations.

D. Closing

The second quarterly assessment background monitoring event was performed by Draper Aden Associates on September 27-30, 1994. Revisions to the network of core and boundary assessment wells resulted in the upgrading of six of the eleven recently installed monitoring wells to "core" status (MW-8, MW-9, MW-10, MW-11, MW-12, and MW-17). As indicated in the Assessment Monitoring schedule (Table 1, Appendix I), both core and boundary assessment wells will be analyzed using CLP analytical methods for the second assessment background monitoring event.

The spring located at the head of the drainage adjacent to the Carroll residence (well reference no 12) was observed flowing and was sampled during the second assessment monitoring event. The analytical results from this spring sampling will be utilized to continue to evaluate the extent of the organic analytes detected in the Carroll residence well and MW-9.

As detailed in the Activity Report (DAA, July 29, 1994), the ongoing potable well sampling program will continue to concentrate on sampling those few wells that have previously shown trace level detections of organics similar to those detected in the landfill groundwater monitoring network. Duplicate sampling will indicate whether the organics detected are A persistent occurrence or common events. Although alternate water supplies are currently provided, the two significantly impacted wells, the Nissan-Mazda dealership well (well reference no. 4) and the Carroll residence well (well reference no 12) will also be periodically sampled.

The results of the potable well sampling program will assist ongoing groundwater investigations within areas not fully characterized by the existing monitoring well network. The results of the second assessment background monitoring event will be evaluated with respect to observations gained from the initial event described in this report. Appropriate additional groundwater investigations will be conducted upon consultation and approval from the NCDEHNR Solid Waste Section.

APPENDIX I
TABLES AND FIGURES

Table 1

**Watauga County Landfill
Groundwater and Surface Water
Assessment Monitoring Schedule**

GROUNDWATER MONITORING	1st Year Quarterly Sampling Event				2nd Year Semi-Annual Sampling Events	
"CORE" ASSESSMENT WELLS						
Assessment Monitoring Analytes (ie: 40 CFR Part 258 Appendix II List)	-	-	-	-	-	Low Level Risk Assessment Screening Methods
Target Analyte Monitoring Analytes	CLP Methods	CLP Methods	CLP Methods	CLP Methods	CLP Methods	CLP Methods
"BOUNDARY" ASSESSMENT WELLS						
Target Analyte Monitoring Analytes	LLRA Methods	CLP Methods	LLRA Methods	CLP Methods	LLRA Methods	CLP Methods
SURFACE WATER MONITORING						
Target Analyte Monitoring Analytes	CLP Methods	-	CLP Methods	-	CLP Methods	CLP Methods

CLP - EPA Contract Laboratory Program Methods
LLRA - Low Level Risk Assessment Screening Methods (EPA SW-846)

Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1
10/28/94

Table 2A
Assessment Target Compound Analytical Results
Core Groundwater Monitoring Wells and Surface Water Sampling Locations
Contract Laboratory Program (CLP) Statements of Work(SOW) - Organic and Inorganic Analysis

Parameter	Event	Results ug/L(ppb)										S5	Trip Blank	NCS (ug/L)	MCL (ug/L)	
		MW-1	MW-2	MW-3	MW-4	MW-6	S1	S2	S3	S4	S4					
Metals, Total																
Barium, Total	6/20/94	203	199	123	24.2	652	133	755	366	94.1	197	4.0	U	2000	2000	
Iron, Total	6/20/94	409	24.4	9950	24.4	24900	11300	30800	8600	1040	26400	24.4	U	300*	300*	
Cadmium, Total	6/20/94	6.0	4.5	5.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	U	5	5	
Mercury, Total	6/20/94	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	U	1.1	2	
Organics																
Benzene	6/20/94	10	120	10	10	10	10	10	10	10	10	10	U	1	5	
Chloroethane	6/20/94	10	120	6	10	8	10	56	10	10	11	10	U	-	-	
Dichlorodifluoromethane	6/20/94	10	120	7	10	25	10	4	10	10	10	10	U	0.19	-	
1,1-Dichloroethane	6/20/94	10	75	160	10	97	1	23	10	59	2	10	U	700**	-	
1,1-Dichloroethene	6/20/94	10	160	5	10	25	10	10	10	10	10	10	U	7	7	
1,2-Dichloroethene(Total)	6/20/94	10	120	37	10	330	10	4	10	58	10	10	U	70	70	
trans-1,3-Dichloropropene	6/20/94	10	120	10	10	25	10	10	10	10	10	10	U	-	-	
Methylene Chloride	6/20/94	6	120	6	10	11	6	9	3	1	8	10	U	5	5	
Tetrachloroethene	6/20/94	10	120	44	10	6	10	10	10	13	10	10	U	0.7	5	
Trichloroethene	6/20/94	10	120	16	10	21	10	1	10	13	10	10	U	2.8	5	
1,1,1-Trichloroethane	6/20/94	10	1800	31	10	25	10	2	10	3	10	10	U	200	200	
Vinyl Chloride	6/20/94	10	120	10	10	10	10	10	10	10	10	10	U	0.015	2	

Notes:

- NCS Denotes North Carolina Groundwater Quality Standard (T15A; 02L 0200)
 - MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
 - U Denotes not detected above Instrument Detection Level(IDL) for Inorganics and not detected above CRQL for Organics (CLP SOW Only)
 - J Denotes an estimated value
 - B Denotes presence in a blank
 - CRQL Contract Required Quantification Limit
 - * Denotes a Secondary Maximum Contaminant Level (SMCL) for Total Iron
 - ** Denotes a proposed NCS
 - Denotes Not Available or Not Sampled
 - Shading denotes parameter results that meet or exceed U.S. EPA Maximum Contaminant Levels.
- NOTE: 1) Well MW-5 was dry for the 6/20-23/94 event.
2) CLP analytical methods utilize relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method, in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0.

Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1

10/28/94

Table 2B
Assessment Target Compound Analytical Results
Boundary Groundwater Monitoring Wells
Contract Laboratory Program (CLP) Statement of Work(SOW) - Inorganics
Low Level Risk Assessment (LLRA) Analytical Method - Organics

Parameter	Event	Results ug/(ppb)											MW-16	MW-17	MW-18	Tnp Blank	NCS (ug/L)	MCL (ug/L)
		MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16	MW-17						
Metals																		
Barium, Total	6/20/94	439	281	710	109	117	101	54.2	18.4	94.9	66.8	117	79.6	0.6	2000	2000		
Iron, Total	6/20/94	15200	16100	7060	5460	337	1800	283	100	2110	78.6	3220	24.4	24.4	300*	300*		
Cadmium, Total	6/20/94	4.5	4.6	4.5	4.5	4.6	4.6	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5	5		
Mercury, Total	6/20/94	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.1	2		
Organics																		
Benzene	6/20/94	0.42	J	0.40	J	5.30	U	5.30	U	5.30	U	5.30	U	5.30	U	1	5	
Chloroethane	6/20/94	7.33	J	9.44	56.78	J	9.29	U	1.16	J	20.23	U	9.29	U	9.29	U	-	
Dichlorodifluoromethane	6/20/94	46.64	U	2.26	J	13.92	J	46.64	U	1.88	J	9.83	J	46.64	U	46.64	U	0.19
1,1-Dichloroethane	6/20/94	10.42	J	35.33	J	13.63	J	28.62	J	25.23	J	82.77	J	0.99	J	43.10	U	700**
1,1-Dichloroethene	6/20/94	9.75	U	0.30	J	9.75	U	32.29	U	9.75	U	1.15	J	9.75	U	1.09	J	7
cis-1,2-Dichloroethene	6/20/94	0.97	J	28.90	0.95	J	9.49	U	5.05	J	28.13	U	9.49	U	9.49	U	70	
trans-1,3-Dichloropropene	6/20/94	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	-
Methylene Chloride	6/20/94	36.20	U	36.20	U	36.20	U	36.20	U	36.20	U	36.20	U	36.20	U	36.20	U	5
Tetrachloroethene	6/20/94	0.88	J	7.55	J	2.15	J	1.30	J	7.47	J	22.78	J	7.84	U	37.43	U	5
Trichloroethene	6/20/94	21.20	U	21.20	U	21.20	U	21.20	U	21.20	U	21.20	U	21.20	U	21.20	U	5
1,1,1-Trichloroethane	6/20/94	30.11	U	2.42	J	11.89	J	130.14	J	4.83	J	16.79	J	13.39	J	30.11	U	200
Vinyl Chloride	6/20/94	6.60	U	6.60	U	6.60	U	6.60	U	6.60	U	6.60	U	6.60	U	6.60	U	0.015

Notes:
NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
U Denotes not detected above Instrument Detection Limit (IDL) for Inorganics (CLP SOW only) and not detected above LOQ for Organics (LLRA Method only)
J Denotes an estimated value
* Denotes a Secondary Maximum Contaminant Level (SMCL) for Total Iron
** Denotes a proposed NCS
- Denotes Not Available or Not Sampled
Shaded denotes parameter results that meet or exceed U.S. EPA Maximum Contaminant Levels.
NOTE: 1) Well MW-5 was dry for the 6/20-23/94 event.
2) CLP analytical methods utilize relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method, in accordance with EPA Contract Laboratory Program (CLP) Statement of Work (LMO 3.0).
3) LLRA analytical methods utilize EPA SW-846 Method #8021

Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1
10/28/94

Table 3A
Detected Non-Target Organic Compound Analytical Results
Core Groundwater Monitoring Wells and Surface Water Sampling Locations
 Contract Laboratory Program (CLP) Statement of Work (SOW) - Organics

Parameter	Event	Results ug/(ppb)											NCS (ug/L)	MCL (ug/L)										
		MW-1	MW-2	MW-3	MW-4	MW-6	S1	S2	S3	S4	S5	Trip Blank												
Acetone	6/20/94	61	120	U	UJ	10	UJ	10	UJ	25	U	10	UJ	10	UJ	10	UJ	10	U	700	-			
4-methyl-2-pentanone	6/20/94	24	120	U	U	10	U	U	U	25	U	10	U	U	U	6	J	10	U	10	U	U	-	
1,1,2,2-Tetrachloroethane	6/20/94	2	J	120	UJ	10	UJ	10	UJ	25	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	-
Ethylbenzene	6/20/94	10	120	U	U	10	U	U	U	25	U	10	U	U	U	6	J	10	U	10	U	10	U	700
Xylene (total)	6/20/94	69	120	U	U	10	U	U	U	25	U	10	U	U	20	U	U	10	U	10	U	10	U	10000
Toluene	6/20/94	2	J	120	U	10	U	U	U	25	U	10	U	U	7	J	10	U	10	U	10	U	1000	1000

Notes:
 NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
 MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
 U Denotes Not Detected above the CRQL (CLP - SOW Organics Only)
 J Denotes an estimated value
 CRQL Contract Required Quantification Limit.
 - Denotes Not Available or Not Sampled
 Shading denotes parameter results that meet or exceed U.S. EPA Maximum Contaminant Levels.
 NOTE: 1) Well MW-5 was dry for the 6/20-23/94 event.
 2) CLP analytical methods utilize relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method, in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0.

Watauga County Landfill
 Watauga County, North Carolina
 Upgradient Well: MW-1
 11/01/94

Table 3B
 Detected Non-Target Organic Compound Analytical Results
 Boundary Groundwater Monitoring Wells
 Low Level Risk Assessment (LLRA) Analytical Method

Parameter	Event	Results ug/L (ppb)														MCL (ug/L)		
		MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16	MW-17	MW-18	Trip Blank	NCS (ug/L)			
1,2,3-Trichlorobenzene	6/20/94	U	J	U	J	U	J	0.32	J	0.47	J	U	J	U	J	U	J	-
1,3,5-Trimethylbenzene	6/20/94	U	J	U	J	U	J	U	J	U	J	U	J	U	J	U	J	-
Isopropylbenzene	6/20/94	U	JB	U	JB	U	JB	1.06	JB	U	JB	U	JB	U	JB	0.50	JB	-
n-Propylbenzene	6/20/94	U	J	U	J	U	J	0.33	J	U	J	U	J	U	J	U	J	-
Trichlorofluoromethane	6/20/94	U	J	U	J	U	J	U	J	U	J	U	J	U	J	U	J	2,100
Styrene	6/20/94	U	J	U	J	U	J	0.65	J	U	J	U	J	U	J	U	J	100
Napthylene	6/20/94	0.33	J	U	J	U	J	0.74	J	7.07	J	U	J	U	J	U	J	-
o-Xylene	6/20/94	0.83	J	U	J	U	J	U	J	U	J	U	J	U	J	U	J	530
t-bb + tmb + s-bb	6/20/94	44.97	J	U	J	U	J	0.83	J	U	J	U	J	U	J	U	J	-
trans-1,2-Dichloroethene	6/20/94	1.53	J	U	J	U	J	1.47	J	U	J	U	J	U	J	1.31	J	70

Notes:
 NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
 MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
 U Denotes not detected above LOQ for Organics (LLRA Methods Only)
 J Denotes an estimated value
 B Denotes present in blank
 - Denotes Not Available or Not Sampled
 Missing: Denotes Parameter results that meet or exceed U.S. EPA Maximum Contaminant Levels
 t-bb + tmb + s-bb: tert-Butylbenzene + 1,2,4-Trimethylbenzene + sec-Butylbenzene
 NOTE: 1) Well MW-5 was dry for the 6/20-23/94 event.
 2) LLRA analytical methods utilize EPA SW-846 Method #8021

Watauga County Landfill
 Watauga County, North Carolina
 Upgradient Well: MW-1

TABLE 4A
 GROUNDWATER LEVEL DATA
 CORE WELLS

REFERENCE ELEVATION					
	MW-1	MW-2	MW-3	MW-4	MW-6
GROUND	3339.03	3151.24	3182.25	3150.06	3262.55
MEASURING POINT	3341.80	3152.94	3183.12	3152.52	3266.04

STATIC WATER LEVEL			
DATE			
6/20/94	38.00	7.88	18.43
			13.48
			44.12

GROUNDWATER ELEVATION			
DATE			
6/20/94	3303.80	3145.06	3164.69
			3139.04
			3221.92

- 1) ALL MEASUREMENTS IN FEET.
- 2) ALL ELEVATIONS REFERENCE MEAN SEA LEVEL.
- 3) MEASURING POINT (M.P.) IS FROM THE TOP OF WELL CASING.

Watauga County Landfill
 Watauga County, North Carolina
 Upgradient Well: MW-1

TABLE 4B
 GROUNDWATER LEVEL DATA
 BOUNDARY WELLS
 REFERENCE ELEVATION

	MW-5	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16	MW-17	MW-18
GROUND	3263.81	3270.56	3235.39	3356.65	3202.18	3156.44	3156.82	3117.39	3117	3117.15	3141.42	3181.14	3117.12
MEASURING POINT	3267.69	3273.53	3239.77	3359.23	3203.87	3159.6	3159.15	3119.72	3120	3120.65	3142.72	3183.62	3119.63

STATIC WATER LEVEL	
DATE	
6/20/94	DRY
	23.03
	17.68
	59.35
	8.18
	13.35
	11.04
	19.66
	7.94
	11.92
	5.32
	17.93
	17.93

GROUNDWATER ELEVATION	
DATE	
6/20/94	DRY
	3250.50
	3222.09
	3299.88
	3195.69
	3146.25
	3148.11
	3100.06
	3112.06
	3108.73
	3137.40
	3165.69
	3101.70

- 1) ALL MEASUREMENTS IN FEET.
- 2) ALL ELEVATIONS REFERENCE MEAN SEA LEVEL.
- 3) MEASURING POINT (M.P.) IS FROM THE TOP OF WELL CASING.

Watauga County Landfill
 Watauga County, North Carolina
 Upgradient Well: MW-1

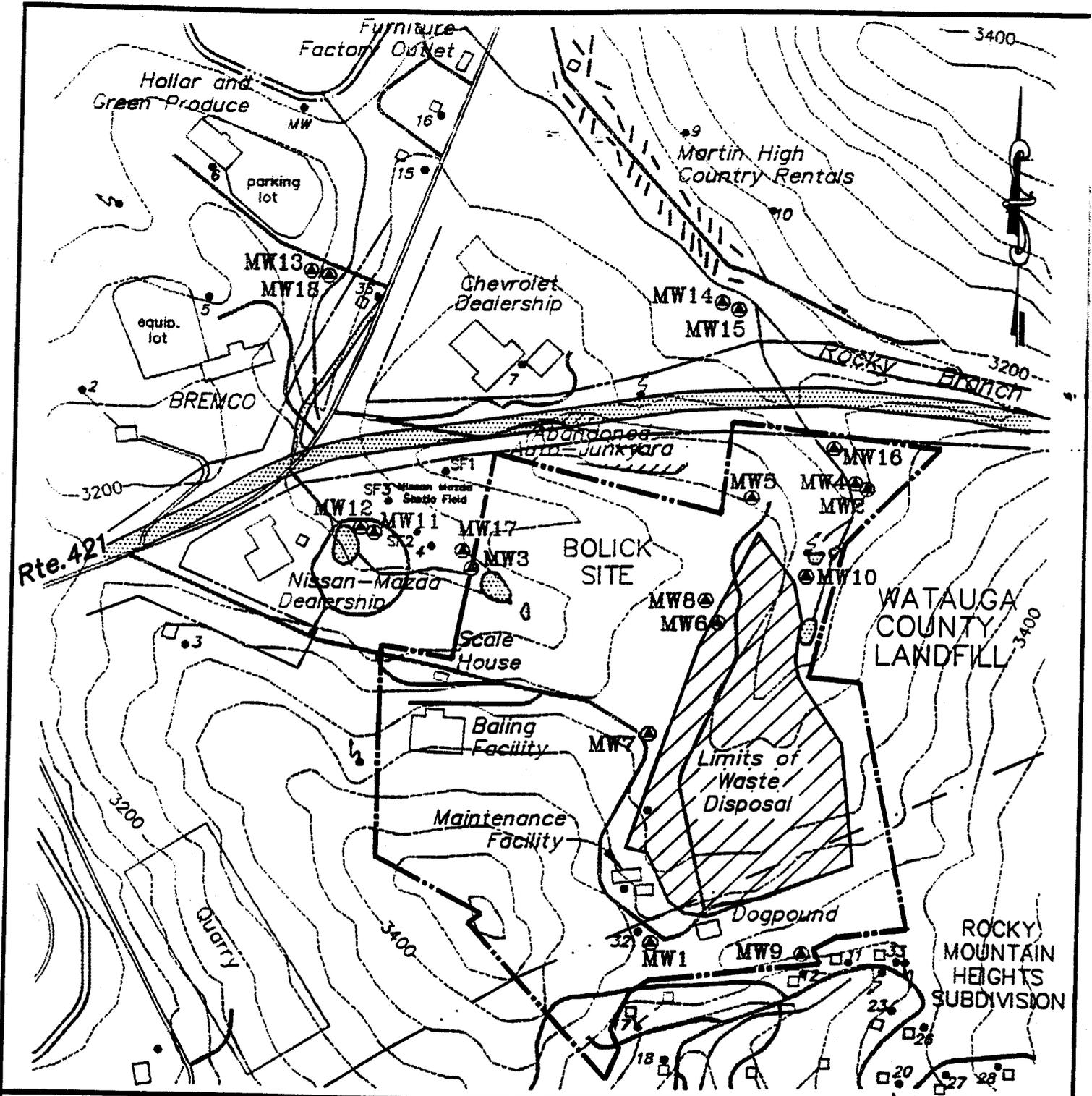
TABLE 4C
 GROUNDWATER LEVEL DATA

REFERENCE ELEVATION							
	PZ-13	PZ-14	PZ-17	PZ-18	PZ-18A	PZ-22	PZ-23
GROUND	3195.05	3214.80	3217.62	3233.60	3233.95	3205.6	3221.74
MEASURING POINT	3198.33	3217.80	3220.79	3236.02	3236.86	3208.84	3225.27

STATIC WATER LEVEL			
DATE			
6/20/94	12.75	17.26	14.47
		16.80	17.3
			14.29
			24.68

GROUNDWATER ELEVATION			
DATE			
6/20/94	3185.58	3200.54	3206.32
		3219.22	3219.56
			3194.55
			3200.59

- 1) ALL MEASUREMENTS IN FEET.
- 2) ALL ELEVATIONS REFERENCE MEAN SEA LEVEL.
- 3) MEASURING POINT (M.P.) IS FROM THE TOP OF WELL CASING.



3200 — Existing Ground
 Proposed Right-of-Way
 Proposed Road Improvements

PROPOSED ROUTE 421 BYPASS MAP



Draper Aden Associates
CONSULTING ENGINEERS
 Blacksburg, Va. - Richmond, Va. - Nashville, Tenn.

JOB No.
 6520-14

DATE:
 10 JUN 94

SCALE:
 1"=600'±

FIGURE
 2

APPENDIX II
FIELD NOTES

FIGURE 1

STANDARD FIELD PROTOCOL - INITIAL ACTIVITIES

Project Watauga County Landfill Permit #95-02 Date 6/20-23/94
Sampling Sequence _____ Weather/Temperature SUNNY 85°F
Samplers CSA / JSP SHOWERS
Static Water Level measurement equipment PORTABLE SLOPE INDICATOR
procedure IMMERSION

Well evacuation equipment DEDICATED PUMPS
procedure ACCEPTABLE FLOW RATES - GROUND DISCHARGE

Sample withdrawal equipment SAME AS ABOVE
procedure <1 GPM

Sample filtration equipment NONE
procedure _____

Types of sample containers and method of preservation used for required analysis (in order of sequence of filling containers)

- CLP VOA - 40 ML CLEAR, PRESERVED (PRE) HCl
- CLP METALS - 1L PLASTIC, PRESERVED HNO₃
- BOZ VOA - 40 ML AMBER, PRESERVED, HCl
- _____
- _____

Internal temperature of shipping containers at outset of sampling

ROOM TEMP

Temperature equipment CORNING CHECKMATE 90
calibration procedure INTERNAL
measurement procedure IMMERSION

pH equipment C.C. 90
calibration procedure 7 & 10 BUFFERS
measurement procedure IMMERSION

Conductivity equipment C.C. 90
calibration procedure AIR - 1413 μ S 0.01 M NaCl
measurement procedure IMMERSION

Conductivity calibration measurements/time 0.00 - 1413 μ S

Sampler signatures (date/time) Chris Allen

FIGURE 2A - EXISTING MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-1 date 6.20.94 time 1550

Condition of well GOOD

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 38.00 (in feet)
 Total depth of well = TD = 79.00 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) =$ 41.00 (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.653 \text{ gal/ft.}$
 = 26.8

Volume of water in filter pack = $V_f(\text{gal.}) =$
 $= [L_c(\text{ft.}), \text{ Not to exceed } 37 \text{ feet }] * 0.522 \text{ gal/ft.}$
 = 19.3

Unit Well Volume = V_w (Gallons) = $(V_c + V_f)$ = 46.1
 Minimum Purge Volume (Gallons) = $3 * V_w$ = 138 GALS

Description of water before purging CLEAR

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate	
1 4:12	16.2°C	6.79	158.9 $\mu\text{S/cm}$	6 GPM	4:15 DRY (30)
2 4:35	14.9°C	6.68	136.5 $\mu\text{S/cm}$	2 GPM	
3 4:48	15.9°C	6.62	127.8 $\mu\text{S/cm}$	2 GPM	
4 5:06	15.8°C	6.42	139.8 $\mu\text{S/cm}$	2 GPM	

Total volume of water purged 140 Gal
 Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.10

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time
1.	16.2 16.2°C	6.79 6.40	157.0 $\mu\text{S/cm}$	1730
2.	15.4°C	6.54	134.2 $\mu\text{S/cm}$	1733
3.	15.1°C	6.64	124.6 $\mu\text{S/cm}$	1735
4.	15.4°C	6.63	121.4 $\mu\text{S/cm}$	1737

Misc. Field Observations _____

Sampler signatures (date/time) [Signature] 6-20-94 1745

FIGURE 2B - EXISTING MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-2

date 6-23-94

time ~~12:45~~

Condition of well GOOD

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 7.88' (in feet)
 Total depth of well = TD = +183.00 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD - DTW) =$ 175.12 (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 28.54 gal

Volume of water in filter pack = $V_f(\text{gal.}) =$
 $= [L_c(\text{ft.}), \text{ Not to exceed } 17.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$
 = 8.87 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f)$ = 37.41 gal

Minimum Purge Volume (Gallons) = $3 * V_w$ = 112.2 gal

Description of water before purging Clear

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate
1. 1050	15.3°C	9.90	272.0 uS	2.5 gpm
2. 1105	15.0°C	9.56	275.0 uS	3 gpm
3. 1120	15.9°C	9.22	268.0 uS	3 gpm
4. 1130	15.9°C	9.00	269.0 uS	3 gpm
5. 1135	15.7°C	8.91	270.1 uS	3 gpm

Total volume of water purged + 163 gal

Description of water after purging clear

15 min

6. 1140 15.2°C 8.82 3 gpm

Measurements collected after purging:

pH Calibration: 7.0 and 10.0

7. 1145 8.74

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time
1.	16.6°C	8.64	271.1 uS	1208
2.	15.8°C	8.63	269.8 uS	1202
3.	15.3°C	8.66	270.0 uS	1203
4.	15.2°C	8.63	271.8 uS	1205

Misc. Field Observations _____

Sampler signatures (date/time) J. Bah 6-23-94 1208

FIGURE 2C - EXISTING MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-3 date 6-22-94 time 1902

Condition of well Good

Reference Point - Top of Well Casing:
 Total Depth to water = DTW = 18.43' (in feet)
 Total depth of well = TD = 38.70 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) =$ 20.27' (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 3.30 gal

Volume of water in filter pack = $V_f(\text{gal.}) =$
 = [$L_c(\text{ft.})$, Not to exceed 12.0 ft.] * 0.522 gal/ft.
 = 6.26 gal

Unit Well Volume = V_w (Gallons) = ($V_c + V_f$) = 9.56 gal
 Minimum Purge Volume (Gallons) = $3 * V_w$ = 28.7 gal

Description of water before purging water silty (very)

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate
1. <u>1910</u>	<u>15.0°C</u>	<u>7.28</u>	<u>183.5 μS</u>	<u>1 gpm</u>
2. <u>1916</u>	<u>14.0°C</u>	<u>7.00</u>	<u>172.6 μS</u>	<u>1 gpm</u>
3. <u>1919</u>	<u>14.0°C</u>	<u>6.63</u>	<u>199.1 μS</u>	<u>1 gpm</u>
4. <u>1924</u>	<u>14.2°C</u>	<u>6.58</u>	<u>205.0 μS</u>	<u>1 gpm</u>
5. <u>1938</u>	<u>15.2°C</u>	<u>6.64</u>	<u>188.8 μS</u>	<u>1 gpm</u>

Total volume of water purged ~ 30 gal
 Description of water after purging very silty

Measurements collected after purging:

pH Calibration: 9.0 and 10.0

Final four (4) replicate measurements of:

Temperature	pH	Conductivity	Time
1. <u>16.6°C</u>	<u>6.55</u>	<u>207.1 $\mu\text{S/cm}$</u>	<u>1945</u>
2. <u>16.5°C</u>	<u>6.48</u>	<u>176.7 $\mu\text{S/cm}$</u>	<u>1950</u>
3. <u>15.8°C</u>	<u>6.38</u>	<u>195.2 $\mu\text{S/cm}$</u>	<u>1953</u>
4. <u>16.2°C</u>	<u>6.36</u>	<u>175.6 $\mu\text{S/cm}$</u>	<u>1957</u>

Misc. Field Observations _____

Sampler signatures (date/time) Chad Allen 6-22-94 2003

FIGURE 2D - EXISTING MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-4 date 6-23-94 time 0818

Condition of well GOOD

Reference Point - Top of Well Casing:
 Total Depth to water = DTW = 13.28' (in feet)
 Total depth of well = TD = 32.50 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) =$ 19.22' (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 3.13 gal

Volume of water in filter pack = $V_f(\text{gal.}) =$
 = [$L_c(\text{ft.})$, Not to exceed 11.0 ft.] * 0.522 gal/ft.
 = 5.74 gal

Unit Well Volume = V_w (Gallons) = ($V_c + V_f$) = 8.87 gal
 Minimum Purge Volume (Gallons) = $3 * V_w$ = 26.6 gal

Description of water before purging clear

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate
1. 0824	13.1°C	9.54	65.6 μS	1 gpm
2. 0833	12.4°C	8.78	53.3 μS	1 gpm
3. 0842	12.9°C	8.36	53.0 μS	1 gpm
5 min 4. 0851	14.7°C	8.40	53.5 μS	1 gpm

Total volume of water purged 427 gal
 Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.0 and 10.0

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time
1.	14.7°C	8.14	56.6 μS	0900
2.	15.6°C	8.09	52.2 μS	0902
3.	15.8°C	8.07	52.7 μS	0904
4.	15.9°C	8.28	53.1 μS	0906

Misc. Field Observations _____

Sampler signatures (date/time) J. Reed 6-23-94 0908

FIGURE 2E - EXISTING MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-5 date 6.21.94 time _____

Condition of well DRY

Reference Point - Top of Well Casing:
 Total Depth to water = DTW = _____ (in feet)
 Total depth of well = TD = _____ (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) =$ _____ (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = _____

Volume of water in filter pack = $V_f(\text{gal.}) =$
 $= [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.624 \text{ gal/ft.}$
 = _____

Unit Well Volume = V_w (Gallons) = $(V_c + V_f)$ = _____
 Minimum Purge Volume (Gallons) = $3 * V_w$ = _____

Description of water before purging _____

Measurements collected during purging:

<u>Time</u>	<u>Temperature</u>	<u>pH</u>	<u>Conductivity</u>	<u>Pumping Rate</u>
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____

Total volume of water purged _____
 Description of water after purging _____

Measurements collected after purging:

pH Calibration: _____

Final four (4) replicate measurements of:

<u>Temperature</u>	<u>pH</u>	<u>Conductivity</u>	<u>Time</u>
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____

Misc. Field Observations _____

Sampler signatures (date/time) Chad Allen 6.21.94

FIGURE 2F - EXISTING MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-6 date 6-21-94 time 0820

Condition of well GOOD

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 44.12' (in feet)
 estimate Total depth of well = TD = 65.00' (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) =$ 20.88' (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 3.40' gallons

Volume of water in filter pack = $V_f(\text{gal.}) =$
 = [$L_c(\text{ft.})$, Not to exceed 12.0 ft.] * 0.624 gal/ft.
 = 7.50 ~~to~~ gallons

Unit Well Volume = V_w (Gallons) = ($V_c + V_f$) = 10.90' gallons
 Minimum Purge Volume (Gallons) = $3 * V_w$ = 32.7 gallons

Description of water before purging slightly silty

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate	
1. 0840	16.5 °C	6.26	478 μ S	2 gpm	} DRY WELL dry after 1 min. dry after 7 min.
2. 0853	16.3 °C	6.21	422 μ S	0.3 gpm	
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	

Total volume of water purged approx 5 gallons
 Description of water after purging CLEAR

Measurements collected after purging:

pH Calibration: 7.0 and 10.0

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time
1.	18.4 °C	6.16	419 μ S	0908
2.	18.3 °C	6.12	420 μ S	0911
3.	18.1 °C	6.12	377 μ S	0915
4.	17.8 °C	6.09	381 μ S	0918

Misc. Field Observations water clear

Sampler signatures (date/time) J. Mack 6/21/94 0920

FIGURE 2G - EXISTING MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-7

date 6.20.94

time 1525

Condition of well GOOD - EXCAVATION IN AREA

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 23.03 (in feet)

Total depth of well = TD = 52.03 (in feet)

Water column length = $L_c(\text{ft.}) = (TD - DTW) =$ 29.0 (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
= 4.73

Volume of water in filter pack = $V_f(\text{gal.}) =$
= [$L_c(\text{ft.})$, Not to exceed 12.0 ft.] * 0.624 gal/ft.
= 7.49

Unit Well Volume = V_w (Gallons) = ($V_c + V_f$) = 12.21

Minimum Purge Volume (Gallons) = $3 * V_w =$ 37 GALS

Description of water before purging CLEAR

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate
1. <u>15:30</u>	<u>17.8 °C</u>	<u>7.42</u>	<u>1012 $\mu\text{S/cm}$</u>	<u>1 BNL</u>
2.				
3.				
4.				

DR 4.5 BNL

Total volume of water purged 1 GAL

Description of water after purging CLEAR

Measurements collected after purging:

pH Calibration: 7.10

Final four (4) replicate measurements of:

21.94 SAMPLED

Temperature	pH	Conductivity	Time
1. <u>14.6 °C</u>	<u>7.81</u>	<u>615 $\mu\text{S/cm}$</u>	<u>0730</u>
2. <u>14.7 °C</u>	<u>7.68</u>	<u>608 $\mu\text{S/cm}$</u>	<u>0740</u>
3. <u>16.4 °C</u>	<u>7.34</u>	<u>613 $\mu\text{S/cm}$</u>	<u>0743</u>
4. <u>16.0 °C</u>	<u>7.25</u>	<u>614 $\mu\text{S/cm}$</u>	<u>0747</u>

Misc. Field Observations DUSTY; EXCAVATION FOR LF CAP

Sampler signatures (date/time) Chad Allen 6.20.94 15:40

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-8 date 6-21-94 time 1200

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 17.68' (in feet)
 Total depth of well = TD = 67.00 (in feet)
 Water column length = $L_{c(ft.)} = (TD-DTW) =$ 49.32' (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163 \text{ gal/ft.}$
 = 8.04 gal

Volume of water in filter pack = $V_{f(gal.)} =$
 = [$L_{c(ft.)}$, Not to exceed 12.0 ft.] * 0.522 gal/ft.
 = 6.26 gal

Unit Well Volume = V_w (Gallons) = ($V_c + V_f$) = 14.3 gal
 Minimum Purge Volume (Gallons) = $3 * V_w =$ 42.9 gal

Description of water before purging clear

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate
1. <u>1205</u>	<u>19.0°C</u>	<u>8.89</u>	<u>1124 μS</u>	<u>.75 gpm</u>
2. <u>1213</u>	<u>16.0°C</u>	<u>7.92</u>	<u>670 μS</u>	<u>.75 gpm</u>
3. <u>1222</u>	<u>16.0°C</u>	<u>7.74</u>	<u>666 μS</u>	<u>.75 gpm</u>
4. <u>1227</u>	<u>17.2°C</u>	<u>7.49</u>	<u>703 μS</u>	<u>dry</u>

Well dry at 12:27

Total volume of water purged ~ 17 gal -> dry
 Description of water after purging clear - slightly silty

Measurements collected after purging:

pH Calibration: 7.0 and 10.0

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time	Date
1.	<u>20.1°C</u>	<u>7.64</u>	<u>625 μS</u>	<u>1125</u>	<u>6/22</u>
2.	<u>20.3°C</u>	<u>7.55</u>	<u>674 μS</u>	<u>1127</u>	
3.	<u>17.8°C</u>	<u>7.26</u>	<u>691 μS</u>	<u>1130</u>	
4.	<u>17.4°C</u>	<u>7.07</u>	<u>692 μS</u>	<u>1132</u>	

Misc. Field Observations Rain last night

Sampler signatures (date/time) J. Black 6-22-94 1145

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-9 date 6-22-94 time 1010

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 59.35' (in feet)

Total depth of well = TD = 86.40 (in feet)

Water column length = $L_{c(ft.)} = (TD-DTW) = \underline{27.05'}$ (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163 \text{ gal/ft.}$
 = 4.41 gal

Volume of water in filter pack = $V_{f(gal.)} =$
 = [$L_{c(ft.)}$, Not to exceed 12.0 ft.] * 0.522 gal/ft.
 = 6.26 gal

Unit Well Volume = V_w (Gallons) = ($V_c + V_f$) = 10.67 gal

Minimum Purge Volume (Gallons) = $3 * V_w = \underline{32.0 gal}$

Description of water before purging CLEAR

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate	
1. <u>1020</u>	<u>17.8°C</u>	<u>8.64</u>	<u>477 µS</u>	<u>1.5 gpm</u>	
2. <u>1027</u>	<u>15.4°C</u>	<u>7.01</u>	<u>428 µS</u>	<u>1.5 gpm</u>	
3. <u>1034</u>	<u>15.2°C</u>	<u>6.56</u>	<u>413 µS</u>	<u>1.5 gpm</u>	1035 well dry
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	

min

Total volume of water purged 21 GALS

Description of water after purging SILTY (PUMPED DRY)

Measurements collected after purging:

pH Calibration: 7 or 10

Final four (4) replicate measurements of:

1050

Temperature	pH	Conductivity	Time	
1. <u>18.5°C</u>	<u>6.50</u>	<u>493 µS/cm</u>	<u>1050</u>	SILTY
2. <u>17.7°C</u>	<u>6.24</u>	<u>529 µS/cm</u>	<u>1053</u>	SILTY
3. <u>17.0°C</u>	<u>6.12</u>	<u>482 µS/cm</u>	<u>1056</u>	CLEAR
4. <u>16.3°C</u>	<u>6.05</u>	<u>487 µS/cm</u>	<u>1059</u>	CLEAR

Misc. Field Observations -

Sampler signatures (date/time) Phil Allen 6.22.94 1100

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-10 date 6-22-94 time 1155

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 8.18' (in feet)
 Total depth of well = TD = 70.03 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) = \underline{61.85'}$ (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 10.08 gal

Volume of water in filter pack = $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$
 = 6.26 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) = \underline{16.34 \text{ gal}}$
 Minimum Purge Volume (Gallons) = $3 * V_w = \underline{49.02 \text{ gal}}$

Description of water before purging Clear

Measurements collected during purging:

	<u>Time</u>	<u>Temperature</u>	<u>pH</u>	<u>Conductivity</u>	<u>Pumping Rate</u>
1.	<u>1200</u>	<u>16.8°C</u>	<u>8.23</u>	<u>164.5 uS</u>	<u>1.5 gpm</u>
2.	<u>1205</u>	<u>15.7°C</u>	<u>8.54</u>	<u>165.4 uS</u>	<u>1.75 gpm</u>
3.	<u>1210</u>	<u>15.8°C</u>	<u>8.38</u>	<u>160.1 uS</u>	<u>1.5 gpm</u>
4.	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>

+ 15 min well dry at 1213

Total volume of water purged ≈ 10 gallons
 Description of water after purging clear

Measurements collected after purging: -

pH Calibration: 40.0 and 7.0

Final four (4) replicate measurements of:

	<u>Temperature</u>	<u>pH</u>	<u>Conductivity</u>	<u>Time</u>
1.	<u>18.4°C</u>	<u>7.69</u>	<u>312 uS/cm</u>	<u>1615</u>
2.	<u>17.1°C</u>	<u>7.17</u>	<u>283 uS/cm</u>	<u>1620</u>
3.	<u>18.0°C</u>	<u>7.20</u>	<u>223 uS/cm</u>	<u>1626</u>
4.	<u>17.5°C</u>	<u>7.16</u>	<u>222 uS/cm</u>	<u>1630</u>

Misc. Field Observations _____

Sampler signatures (date/time) Chad Allen 6-22-94 1631

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-11 date 6-23-94 time 0920

Condition of well GOOD

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 13.35 (in feet)
 Total depth of well = TD = 25.80 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) = \underline{12.45}$ (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 2.03

Volume of water in filter pack = $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 1.045 \text{ gal/ft.}$
 = 12.54

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) = \underline{14.57}$
 Minimum Purge Volume (Gallons) = $3 * V_w = \underline{44 \text{ WALS}}$

Description of water before purging CLEAR

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate
1. <u>0926</u>	<u>15.4°C</u>	<u>6.69</u>	<u>91.7 uS</u>	<u>1.5 gpm</u>
2. <u>0936</u>	<u>14.8°C</u>	<u>6.84</u>	<u>81.3 uS</u>	<u>1.5 gpm</u>
3. <u>0946</u>	<u>15.3°C</u>	<u>6.41</u>	<u>85.0 uS</u>	<u>1.5 gpm</u>
4. <u>0956</u>	<u>15.7°C</u>	<u>6.32</u>	<u>120.8 uS</u>	<u>1.5 gpm</u>
5. <u>1000</u>	<u>14.8°C</u>	<u>—</u>	<u>129.8 uS</u>	<u>1.5 gpm</u>

Total volume of water purged + 60 gal
 Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.0 and 10.0
6, 1002 14.5°C — 121.1 uS 1.5 gpm
 Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time
1.	<u>16.4°C</u>	<u>6.34</u>	<u>92.4 uS</u>	<u>1010</u>
2.	<u>15.8°C</u>	<u>6.22</u>	<u>85.9 uS</u>	<u>1012</u>
3.	<u>16.9°C</u>	<u>6.20</u>	<u>84.8 uS</u>	<u>1014</u>
4.	<u>16.8°C</u>	<u>6.19</u>	<u>84.1 uS</u>	<u>1016</u>

Misc. Field Observations _____

Sampler signatures (date/time) Jeff Baer 6-23-94 1020

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-12 date 6-22-94 time 0710

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 10.04' (in feet)
 Total depth of well = TD = 72.75 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) = \underline{61.71'}$ (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 10.06 gal

Volume of water in filter pack = $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$
 = 6.26 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) = \underline{16.32 \text{ gal}}$
 Minimum Purge Volume (Gallons) = $3 * V_w = \underline{49.0 \text{ gal}}$

Description of water before purging CLEAR

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate
1. <u>0730</u>	<u>13.2°C</u>	<u>9.91</u>	<u>211 µS</u>	<u>2 gpm</u>
2. <u>0738</u>	<u>13.5°C</u>	<u>8.43</u>	<u>179.2 µS</u>	<u>2 gpm</u>
3. <u>0746</u>	<u>13.6°C</u>	<u>7.51</u>	<u>176.4 µS</u>	<u>2 gpm</u>
4. <u>0755</u>	<u>14.4°C</u>	<u>7.47</u>	<u>169.5 µS</u>	<u>2 gpm</u>
5. <u>0803</u>	<u>14.7°C</u>	<u>7.37</u>	<u>180.0 µS</u>	<u>2 gpm</u>

+18 min

Total volume of water purged approx 70 gal.
 Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.10

Final four (4) replicate measurements of:

Temperature	pH	Conductivity	Time
1. <u>16.3°C</u>	<u>7.34</u>	<u>170.7 µS/cm</u>	<u>0815</u>
2. <u>15.8°C</u>	<u>7.05</u>	<u>171.6 µS/cm</u>	<u>0819</u>
3. <u>15.8°C</u>	<u>5.69</u>	<u>177.9 µS/cm</u>	<u>0823</u>
4. <u>15.9°C</u>	<u>5.69</u>	<u>175.3 µS/cm</u>	<u>0827</u>

Misc. Field Observations RAIN LAST NIGHT; GROUND WET

Sampler signatures (date/time) J. [Signature] 6/22/94 0830

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-13 date 6-22-94 time 1230

Condition of well Good

Reference Point - Top of Well Casing:
 Total Depth to water = DTW = 19.66' (in feet)
 Total depth of well = TD = 31.65 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) =$ 11.99' (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 1.95 gal

Volume of water in filter pack = $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 1.045 \text{ gal/ft.}$
 = 12.53 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) =$ 14.48
 Minimum Purge Volume (Gallons) = $3 * V_w =$ 43.44 gal

Description of water before purging silty

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate
1. <u>1238</u>	<u>16.3°C</u>	<u>9.87</u>	<u>41.3 uS</u>	<u>0.5 gpm</u>
2. <u>1244</u>	<u>16.2°C</u>	<u>9.59</u>	<u>34.7 uS</u>	<u>0.5 gpm</u>
3. <u>1247</u>	<u>14.6°C</u>	<u>8.51</u>	<u>30.6 uS</u>	<u>0.5 gpm</u>
4. <u>1251</u>	<u>14.8°C</u>	<u>7.80</u>	<u>27.9 uS</u>	<u>0.5 gpm</u>

dry after 1 min.

Total volume of water purged 20 gal
 Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.0 and 10.0

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time
1.	<u>17.1°C</u>	<u>7.76</u>	<u>27.6 uS</u>	<u>1310</u>
2.	<u>17.4°C</u>	<u>7.45</u>	<u>30.5 uS</u>	<u>1312</u>
3.	<u>16.6°C</u>	<u>7.39</u>	<u>28.1 uS</u>	<u>1314</u>
4.	<u>16.1°C</u>	<u>7.28</u>	<u>28.5 uS</u>	<u>1316</u>

Misc. Field Observations _____

Sampler signatures (date/time) J. [Signature] 6-22-94 1325

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-14

date 6-21-94

time 0935

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 7.94' (in feet)

Total depth of well = TD = 71.00 (in feet)

Water column length = $L_c(\text{ft.}) = (TD-DTW) = \underline{63.06'}$ (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 10.28 gal

Volume of water in filter pack = $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 1.567 \text{ gal/ft.}$
 = ~~18.80 gal~~ 98.82 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) = \underline{29.08}$

Minimum Purge Volume (Gallons) = $3 * V_w = \underline{87.24}$

Description of water before purging Clear

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate
1. <u>0945</u>	<u>14.9°C</u>	<u>7.19</u>	<u>85.1 uS</u>	<u>1.5 gpm</u>
2. <u>1000</u>	<u>15.9°C</u>	<u>7.35</u>	<u>89.8 uS</u>	<u>2 gpm</u>
3. <u>1016</u>	<u>15.2°C</u>	<u>7.40</u>	<u>68.2 uS</u>	<u>2 gpm</u>
4. <u>1033</u>	<u>15.3°C</u>	<u>7.41</u>	<u>86.4 uS</u>	<u>2 gpm</u>

(+ 18 min)

Total volume of water purged 130 gallons

Description of water after purging CLEAR

Measurements collected after purging:

pH Calibration: 7.0 and 10.0

Final four (4) replicate measurements of:

Sampling time	Temperature	pH	Conductivity	Time
1. <u>1055</u>	<u>17.5°C</u>	<u>7.29</u>	<u>82.8 uS</u>	<u>1055</u>
2. <u>1058</u>	<u>17.0°C</u>	<u>7.24</u>	<u>84.7 uS</u>	<u>1058</u>
3. <u>1102</u>	<u>16.8°C</u>	<u>7.22</u>	<u>65.6 uS</u>	<u>1102</u>
4. <u>1105</u>	<u>16.6°C</u>	<u>7.21</u>	<u>65.9 uS</u>	<u>1105</u>

Misc. Field Observations water clear

Sampler signatures (date/time) J. [Signature] 6/21/94 1105

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-15 date 6-22-92 time 1700

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 11.92' (in feet)
 Total depth of well = TD = 178.00' (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) = \underline{166.08'}$ (in feet)

Volume of water in well casing = $V_{c(\text{gal.})} = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 27.07 gal

Volume of water in filter pack = $V_{f(\text{gal.})} = [L_c(\text{ft.}), \text{ Not to exceed } 13.0 \text{ ft.}] * 1.522 \text{ gal/ft.}$
 = 19.79 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) = \underline{46.86 \text{ gal}}$
 Minimum Purge Volume (Gallons) = $3 * V_w = \underline{140.58 \text{ gal}}$

Description of water before purging clear

Measurements collected during purging:

	<u>Time</u>	<u>Temperature</u>	<u>pH</u>	<u>Conductivity</u>	<u>Pumping Rate</u>	
	1. <u>1705</u>	<u>15.9°C</u>	<u>10.1</u>	<u>202.45</u>	<u>3 gpm</u>	
	2. <u>1720</u>	<u>17.8°C</u>	<u>9.71</u>	<u>163.845</u>	<u>2 gpm</u>	well dry
	3. <u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	
	4. <u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	
<u>+15 min</u> <u>to sample</u>						

Total volume of water purged ≈ 55 gal
 Description of water after purging clear

Measurements collected after purging:

pH Calibration: 10.0 and 7.0

Final four (4) replicate measurements of:

	<u>Temperature</u>	<u>pH</u>	<u>Conductivity</u>	<u>Time</u>
1.	<u>25.0°C</u>	<u>8.87</u>	<u>123.045</u>	<u>1746</u>
2.	<u>25.0°C</u>	<u>8.83</u>	<u>123.845</u>	<u>1748</u>
3.	<u>16.6°C</u>	<u>8.89</u>	<u>181.645</u>	<u>1752</u>
4.	<u>16.4°C</u>	<u>8.89</u>	<u>187.145</u>	<u>1755</u>

Misc. Field Observations _____

Sampler signatures (date/time) J. Pol 6-22-92 1800

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-16 date 6-22-94 time 1810

Condition of well Good

Reference Point - Top of Well Casing:
 Total Depth to water = DTW = 5.32' (in feet)
 Total depth of well = TD = 26.80 (in feet)
 Water column length = $L_{c(ft.)} = (TD-DTW) =$ 21.48' (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163 \text{ gal/ft.}$
 = 3.50 gal

Volume of water in filter pack = $V_{f(gal.)} =$
 $= [L_{c(ft.)}, \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$
 = 6.26 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) =$ 9.76 gal
 Minimum Purge Volume (Gallons) = $3 * V_w =$ 29.28 gal

Description of water before purging clear

Measurements collected during purging:

	<u>Time</u>	<u>Temperature</u>	<u>pH</u>	<u>Conductivity</u>	<u>Pumping Rate</u>
	<u>1. 1814</u>	<u>14.4°C</u>	<u>10.57</u>	<u>156.9 µS</u>	<u>1.5 gpm</u>
	<u>2. 1820</u>	<u>13.9°C</u>	<u>8.46</u>	<u>178.1 µS</u>	<u>1.5 gpm</u>
	<u>3. 1825</u>	<u>12.8°C</u>	<u>8.09</u>	<u>166.7 µS</u>	<u>1.5 gpm</u>
<u>+ 6 min</u>	<u>4. 1830</u>	<u>13.2°C</u>	<u>8.29</u>	<u>183.9 µS</u>	<u>1.5 gpm</u>

Total volume of water purged
 Description of water after purging _____

Measurements collected after purging:

pH Calibration: 7.0 and 10.0

Final four (4) replicate measurements of:

	<u>Temperature</u>	<u>pH</u>	<u>Conductivity</u>	<u>Time</u>
1.	<u>15.9°C</u>	<u>8.45</u>	<u>195.6 µS</u>	<u>1845</u>
2.	<u>16.0°C</u>	<u>8.34</u>	<u>196.0 µS</u>	<u>1847</u>
3.	<u>16.5°C</u>	<u>8.28</u>	<u>189.3 µS</u>	<u>1849</u>
4.	<u>°C</u>	<u>8.18</u>	<u>189.6 µS</u>	<u>1851</u>

Misc. Field Observations LEACHATE ODDOR NEAR MW-16

Sampler signatures (date/time) J. Mack 6-22-94 1900

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-17 date 6-22-94 time 0835

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 17.93' (in feet)
 Total depth of well = TD = 94.54' (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) = \underline{76.61'}$ (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 12.49 gal

Volume of water in filter pack = $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$
 = 6.26 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) = \underline{18.75 \text{ gal}}$
 Minimum Purge Volume (Gallons) = $3 * V_w = \underline{56.3 \text{ gal}}$

Description of water before purging _____

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate	
1. <u>0845</u>	<u>15.5 °C</u>	<u>9.20</u>	<u>537 uS</u>	<u>1.0 gpm</u>	
2. <u>0854</u>	<u>15.0 °C</u>	<u>9.04</u>	<u>378 uS</u>	<u>1.0 gpm</u>	
3. <u>0920</u>	<u>15.1 °C</u>	<u>8.26</u>	<u>309 uS</u>	<u>1.5 gpm</u>	
4. <u>0942</u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	well dry @ 0902 well dry @ 0942

Total volume of water purged ≈ 28 gal
 Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7 and 10

Final four (4) replicate measurements of: purge rate < 1 gpm

Temperature	pH	Conductivity	Time
1. <u>17.2 °C</u>	<u>8.36</u>	<u>426 uS</u>	<u>0936</u>
2. <u>16.8 °C</u>	<u>8.23</u>	<u>430 uS</u>	<u>0938</u>
3. <u>15.0 °C</u>	<u>7.98</u>	<u>329 uS</u>	<u>0940</u>
4. <u>15.7 °C</u>	<u>7.92</u>	<u>331 uS</u>	<u>0942</u>

Misc. Field Observations Rain last night - wet soil

Sampler signatures (date/time) J. Paul 6-22-94 0946

ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit #95-02

Well # MW-18

date 6-23-94

time 0630

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 17.93' (in feet)
 Total depth of well = TD = 73.20 (in feet)
 Water column length = $L_c(\text{ft.}) = (TD-DTW) =$ 55.27' (in feet)

Volume of water in well casing = $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$
 = 9.00 gal

Volume of water in filter pack = $V_f(\text{gal.}) =$
 = [$L_c(\text{ft.})$, Not to exceed 12.0 ft.] * 0.522 gal/ft.
 = 6.26 gal

Unit Well Volume = V_w (Gallons) = $(V_c + V_f) =$ 15.26
 Minimum Purge Volume (Gallons) = $3 * V_w =$ 46.0 gal

Description of water before purging Clear

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate
1. <u>0647</u>	<u>13.5°C</u>	<u>10.35</u>	<u>88.1 uS</u>	<u>1.5 gpm</u>
2. <u>0657</u>	<u>13.4°C</u>	<u>9.92</u>	<u>81.0 uS</u>	<u>1.5 gpm</u>
3. <u>0707</u>	<u>13.4°C</u>	<u>9.92</u>	<u>82.8 uS</u>	<u>1.5 gpm</u>
4. <u>0717</u>	<u>13.5°C</u>	<u>8.81</u>	<u>79.8 uS</u>	<u>1.5 gpm</u>
5. <u>0727</u>	<u>13.8°C</u>	<u>8.56</u>	<u>79.7 uS</u>	<u>1.5 gpm</u>

+14 min

Total volume of water purged 77 gal
 Description of water after purging clear

Measurements collected after purging:

6.0730 13.8°C 8.49 80.2 uS 1.5 gpm
 pH Calibration: 7.0 and 10.0

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time
1.	<u>15.8°C</u>	<u>7.97</u>	<u>82.7 uS</u>	<u>0750</u>
2.	<u>15.5°C</u>	<u>7.94</u>	<u>80.0 uS</u>	<u>0753</u>
3.	<u>15.5°C</u>	<u>7.89</u>	<u>80.2 uS</u>	<u>0754</u>
4.	<u>15.7°C</u>	<u>7.83</u>	<u>81.7 uS</u>	<u>0756</u>

Misc. Field Observations _____

Sampler signatures (date/time) _____

J. Park 6-23-94 0804

STANDARD FIELD PROTOCOL - FINAL ACTIVITIES

Project: Watauga County Landfill Permit #95-02 Date: 6/20-23/94

Internal temperature of shipping containers at completion of sampling:
< 4°C

Sample destination COMPUCHEM, NC TRIANGLE, OH

Method of transportation FED-EX OVERNITE

Sampler signatures (date/time) Chad Allen 6/29/94

11 ADDITIONAL
WATER LEVELS

PZ-13

PZ-14

PZ-17

PZ-18

PZ-18A

PZ-22

PZ-23

Production well located across the access
road from MW-7 (will have to clear
insulation away after removing concrete top)

3 Nissan-Mazda septic monitoring wells (1-3)
get key from Jim Matto, Gen. Mgr.
Boone Nissan-Mazda
(704) 264-7726

note: MW-5 now be do

DATE	TIME	LOCATION	ACTIVITY
7-20-94	7:00	Madison Sp., NC	LF
7-20-94	7:15	Quarter Assessment	Environmental Sampling
7-20-94	7:30	SSP/ESA	and humid
7-20-94	7:45	Survey	and humid
7-20-94	8:00	arrived on site	
7-20-94	8:15	collected to	
7-20-94	8:30	containing box	
7-20-94	8:45	secretary started to ppt	
7-20-94	9:00	2 weeks, no thunderstorms	
7-20-94	9:15	looked at site of 1000	
7-20-94	9:30	and perimeter of fall area	
7-20-94	9:45	potholes, evidence of precipitation	
7-20-94	10:00	as 5' pit	
7-20-94	10:15	evidence of higher elevations also	
7-20-94	10:30	overall ppt in recent past despite stable	
7-20-94	10:45	performance. Air smells unusually fresh	
7-20-94	11:00	in the vicinity.	
7-20-94	11:15	attempted to get this leaves at old production	
7-20-94	11:30	well - could not remove well cap due to	
7-20-94	11:45	compression.	
7-20-94	12:00	collected site on well tick	
7-20-94	12:15	arrived on site	
7-20-94	12:30	collected samples	
7-20-94	12:45	returned to site	
7-20-94	1:00	started off	
7-20-94	1:15	site walkover	
7-20-94	1:30	below 2000 ft - stream fields discharges	
7-20-94	1:45	at 1000 ft - FeD3 discharge	
7-20-94	2:00	stream / well	
7-20-94	2:15	well	
7-20-94	2:30	total depth: 58.95'	
7-20-94	2:45	water level: 16.90'	

begin sampling at well
completed sampling at well
750 left site

[Handwritten signature]
6-22-04

1472 PZ18A total depth: 27.07'
 s. water level: 17.30'

1444 PZ22 total depth: 19.29'
 s. water level: 12.75' (no lock)

1450 PZ13
 1452 PZ23
 1501 PZ14
 1506 PZ17
 1520 MW7

s.w.l. 24.68'
 s.w.l. 17.26'
 s.w.l. 14.47'
 s.w.l. 23.03'
 t.d. 52.03'

bailed well - 4 1/2 bailes - dry
 rechecked pH & conductivity
 (calibrated meter w/ buffers and conductivity sol'n)
 pH 7.42
 cond. 1012 uS

1610 MW1 began purging 6 gpm - dry after 4 min.
 purged 24 gal. - decreased to 2 gpm
 took readings after each 18 min
 interval

- VOA sample bottles: lot# S/A

MW1	B 3228020	A 1036794
MW1	B 3228020	A 1037001
MW1 MS	B 3228020	A 1037002
MW1 MSD	B 3228020	A 1036994

- total water bottles

MW1	C 4070010	C 389127
MW1 - MS/SD	C 4070010	C 389195

1200

began purging MW8
 Calibrated meter w/ new 7.0 & 10.0 buffer
 and conductivity sol'n.
 sampled MW8 (dry at 1227)
 total metals

1240

lot # C 4070010
 SN C 389190
 lot # C 4070011
 SN C 389176

No VOA #'s
 SZ

pH 7.05 @ 17.8°C

conductivity 893 µs

water for readings collected
 approx. 5 ft. downstream from
 3 pipes, water clear, no organic/
 petroleum odor, strong pet. chunk
 odor, no ppt in the last week.
 Water flow has increased since
 silica/glass material removed from
 here.

1300

sampled SZ

VOA lot # B3228020, B3228170

SN A1036653, A1037000

for metab lot # C4070010

SU C389151

1340

SU

pH 7.83 @ 17.2°C
 cond. 834 µs
 water slightly cloudy / yellowish
 no ppt in 1 week
 no ppt in 1 week
 still looking for odor
 no ppt in 1 week

1345

sampled S

total metals lot # C4070010

NOA #1 SN C389168

NOA #1 lot B3228020

NOA #2 SN A1036913

NOA #2 lot B3228020

NOA #2 SN A1037003

1350

SZ

pH 7.60 @ 19.7°C

conductivity 554 µs

water cloudy
 still looking for odor
 no ppt in 1 week

sampled S3

total metals

VOA #1 lot # C4070010

VOA #2 SN C389192

VOA #2 lot # B3228020

VOA #2 SN A1037452

VOA #2 lot # B3228020

VOA #2 SN A1037003

1400

undersampling - re-sampled

total metals lot # C4070010

VOA #1 SN C389192

VOA #2 lot # B3228020

VOA #2 SN A1037452

VOA #2 lot # B3228020

VOA #2 SN A1037003

WATAUGA CO. LE
 LEA ASSESSMENT (QUALITY)
 DSP/EEA
 Community 70°F and partly cloudy

0625 arrived on site
 calibrated meter w/ 10 and 10.0
 buffers (pH) and
 10.03 mV
 10.03 mV
 10.03 mV
 began purging MW3 - 1.5 gpm
 total metal lot # C4070010
 VOA lot # C38915
 lot # B3228020

0643 began purging MW3
 total metal lot # C4070010
 VOA lot # C38915
 lot # B3228020

0734 pump for 30 minutes lot # C4070010
 0750 purged MW3 @ 1 gpm
 0800 began purging MW3
 total metal lot # C4070010
 VOA lot # C38915
 lot # B3228020

0852 VOA 1 lot # B3228020
 VOA 2 lot # A1036962
 VOA 3 lot # B3228020
 VOA 4 lot # A1036962
 VOA 5 lot # B3228020
 VOA 6 lot # A1036962
 VOA 7 lot # B3228020
 VOA 8 lot # A1036962
 VOA 9 lot # B3228020
 VOA 10 lot # A1036962

0920 sample collection
 0924 sample MW3
 began purging MW3
 1.5 gpm
 total metal lot # C4070010
 VOA lot # C38915
 lot # B3228020

1004 produce flow to
 1010 sample MW3
 total metal lot # C4070010
 VOA lot # C38915
 lot # B3228020

1902 arrived at MW3
 1910 began purging
 - 1 gpm
 - sample purged rate < 1 gpm
 1950 sampled MW3
 total metal
 VOA 1 lot # B3228020
 VOA 2 lot # A1036962
 VOA MS lot # B3228020
 VOA MSL lot # A1036962
 2015 sampled 34
 total metal lot # C4070010
 VOA 1 lot # B3228020
 VOA 2 lot # A1036962
 VOA 3 lot # B3228020
 VOA 4 lot # A1036962
 VOA 5 lot # B3228020
 VOA 6 lot # A1036962
 VOA 7 lot # B3228020
 VOA 8 lot # A1036962
 VOA 9 lot # B3228020
 VOA 10 lot # A1036962

-water clear, no
 no leachate
 pH 7.19
 Cond 175.2

11/15/15

1050 began purging MWZ

- 2.5 gpm
total metered

lot # C9070010

SN C 389170

Vol 1

lot # B 3228010

SN A 1036966

Vol 2

lot # D 3228020

SN A 1036397

1055

increased flow rate to 3 gpm

1145

reduced flow to < .1 gpm

total purged: 163 gal

1200

sampled MWZ

purge rate during sampling < .1 gpm

1220

checked for leakage around power pile, on upper side of landfill.

~~J. J. Paul~~

APPENDIX III

**Previous Landfill Groundwater Organic Analysis
Summary Table and Data Evaluation**

ORGANIC CONSTITUENTS DETECTED

December 11, 1990, November 16-18, 1992 and March 3, 1993 SAMPLING EVENTS

Analyte	Date Sampled	Analytical Method	MDL	MW-1	MW-2	MW-3	MW-4	PZ-24	NCS	MCL	TRIP
Trichloroethene (TCE)	December 11, 1990	SW846 Method 8240	5			9		---	2.8	5	
	November 16-18, 1992	SW846 Method 8010	1			23		110	2.8	5	
	March 5, 1993	EPA Method 502.2	0.2	0.4	2.4	18.1	0.7		2.8	5	
1,1,1-Trichloroethane (1,1,1-TCA)	March 5, 1993	SW846 Method 8021	0.2		2.1	15.7	0.8	79.5	2.8	5	
	December 11, 1990	SW846 Method 8240	5		394	102			200	200	
	November 16-18, 1992	SW846 Method 8010	1		980	68	6		200	200	
Tetrachloroethene (PCE)	March 5, 1993	EPA Method 502.2	0.4		1646	19.0	10.5		200	200	
	March 5, 1993	SW846 Method 8021	0.4		1212	19.0	22.5	1.4	200	200	
	December 11, 1990	SW846 Method 8240	5		7	25			0.7	5	
1,1-Dichloroethene (1,1-DCA)	November 16-18, 1992	SW846 Method 8010	1		5	39		4	0.7	5	
	March 5, 1993	EPA Method 502.2	0.5	0.5	11.2		1.6		0.7	5	
	March 5, 1993	SW846 Method 8021	0.5		11.8	24.9	1.6	12.5	0.7	5	
1,1-Dichloroethene (1,1-DCE)	December 11, 1990	SW846 Method 8240	5		52	178			700'	---	
	November 16-18, 1992	SW846 Method 8010	1		41	250		81	700'	---	
	March 5, 1993	EPA Method 502.2	0.7		96	173.3	1.2	77	700'	---	
cis-1,2-Dichloroethene (cis-1,2-DCE)	March 5, 1993	SW846 Method 8021	0.7		82	161	1.1	43.7	700'	---	
	December 11, 1990	SW846 Method 8240	5		80	7			7	7	
	November 16-18, 1992	SW846 Method 8010	1		110	14			7	7	
cis-1,2-Dichloroethene (cis-1,2-DCE)	March 5, 1993	EPA Method 502.2	0.7		232	10.3	5.1	0.9	7	7	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.7 *(0.3)		143.6	9	4.5	*	7	7	
	March 5, 1993	EPA Method 502.2	0.7	0.7	1.4	36.4		225	70	70	
March 5, 1993	SW846 Method 8021 and *(8240)	0.7 *(0.7)		1	26.6	*	87.8	70	70		

Note: All Concentrations are in ppb (ug/L) (other footnotes located on page 4)

WALDOGA COUNTY LANDFILL GROUNDWATER

ORGANIC CONSTITUENTS DETECTED

DECEMBER 11, 1990, NOVEMBER 16-18, 1992 AND MARCH 5, 1993 SAMPLING EVENTS

Analyte	Date Sampled	Analytical Method	MDL	MW-1	MW-2	MW-3	MW-4	PZ-24	NCS	MCL	TRIP
Methylene Chloride	December 11, 1990	SW846 Method 8240	5			23		---	5	5	
	November 16-18, 1992	SW846 Method 8010	1			16		15	5	5	
	March 5, 1993	EPA Method 502.2	0.6		4.2	9.4			5	5	
	March 5, 1993	SW846 Method 8021	0.6						5	5	
Vinyl Chloride	December 11, 1990	SW846 Method 8240	10					---	.015	2	
	November 16-18, 1992	SW846 Method 8010	1			3		12	.015	2	
	March 5, 1993	EPA Method 502.2	0.4			3.4		18.3	.015	2	2.6
Dichlorodifluoromethane	March 5, 1993	SW846 Method 8021 and *(8240)	0.4 *(1.0)			*		*	.015	2	
	December 11, 1990	SW846 8240	5			21		---	0.19	---	
	November 16-18, 1992	SW846 Method 8010	1						0.19	---	
	March 5, 1993	EPA Method 502.2	0.8			11.8		6.9	0.19	---	
Chloroethane	March 5, 1993	SW846 Method 8021 and *(8240)	0.8 *(0.8)			*			0.19	---	
	December 11, 1990	SW846 Method 8240	10					---	---	---	
	November 16-18, 1992	SW846 8010	1			5		8	---	---	
	March 5, 1993	EPA Method 502.2	1.4		2.6				---	---	
Trans-1,3-Dichloropropene	March 5, 1993	SW846 method 8021 and *(8240)	1.4 *(10)			*		*	---	---	
	December 11, 1990	SW846 Method 8240	5			9-J		---	70	100	
	November 16-18, 1992	SW846 Method 8010	1					3	70	100	
	March 5, 1993	EPA Method 502.2	0.7			0.9		5.5	70	100	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.7 *(0.7)			*			70	100	

Note: All Concentrations are in ppb (ug/L) (other footnotes located on page 4)

ORGANIC CONSTITUENTS DETECTED

DECEMBER 11, 1990, NOVEMBER 16-18, 1992 AND MARCH 5, 1993 SAMPLING EVENTS

Analyte	Date Sampled	Analytical Method	MDL	MW-1	MW-2	MW-3	MW-4	PZ-24	NCS	MCL	TRIP
Benzene	December 11, 1990	SW846 Method 8240	5					---	1.0	5	
	March 5, 1993	EPA Method 502.2	0.1			1.5	0.5	6.3	1.0	5	
	March 5, 1993	SW846 Method 8021	0.1			1.3		6.3	1.0	5	
1,4-Dichlorobenzene	November 15-18, 1992	SW846 Method 8010	0.3			0.5			0.19	75	
	March 5, 1993	EPA Method 502.2	0.5		0.8				1.8	75	
Chloroform	March 5, 1993	SW846 Method 8021	0.5						1.8	75	
	December 11, 1990	SW846 Method 8240	5					---	0.19	100	
	November 16-18, 1992	SW846 Method 8010	1				2	1	0.19	100	3
1,2-Dichloropropane	March 5, 1993	EPA Method 502.2	0.3						0.19	100	
	March 5, 1993	SW846 Method 8021	0.3			0.5			0.19	100	
	December 11, 1990	SW846 Method 8240	5					---	0.56	5	
2,2-Dichloropropane	November 16-18, 1992	SW846 Method 8010	1						0.56	5	
	March 5, 1993	EPA Method 502.2	0.3		0.3	0.3			0.56	5	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.3 *(0.3)			*	*	*	0.56	5	
1,1-Dichloropropene	March 5, 1993	EPA Method 502.2	0.7	0.7	1.4				---	---	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.7 *(0.7)		*	*	*	*	---	---	
Bis(2-ethylhexyl)phthalate	March 5, 1993	SW846 Method 8240	0.5	3.8					---	---	
	March 5, 1993	SW846 Method 8270	2		20				---	---	
Xylenes, Total	March 5, 1993	SW846 Method 8021	0.4						---	---	
	March 5, 1993	SW846 Method 8080	0.1					0.1	0.4	10	

Note: All Concentrations are in ppb (ug/L) (other footnotes located on page 4)

WATAUGA COUNTY LANDFILL GROUNDWATER

ORGANIC CONSTITUENTS DETECTED

DECEMBER 11, 1990, NOVEMBER 16-18, 1992 AND MARCH 5, 1993 SAMPLING EVENTS

Analyte	Date Sampled	Analytical Method	MDL	MW-1	MW-2	MW-3	MW-4	PZ-24	NCS	MCL	TRIP
Bromodichloromethane	December 11, 1990	SW846 Method 8240	5					---	---	100	
	November 16-18, 1992	SW846 Method 8010	1						---	100	
	March 5, 1993	EPA Method 502.2	0.3		0.6				---	100	
Carbon Tetrachloride	December 11, 1990	SW846 Method 8240	5					---	0.3	5	
	November 16-18, 1992	SW846 Method 8010	1						0.3	5	
	March 5, 1993	EPA Method 502.2	0.1			0.2	0.2	0.3	0.3	5	
1,2-Dichloroethane	March 5, 1993	SW846 Method 8021	0.1						0.3	5	
	March 5, 1993	SW846 Method 8021	0.3						0.38	5	
	December 11, 1990	SW846 Method 8240	5					---	0.38	5	
	November 16-18, 1992	SW846 Method 8010	1						0.38	5	
	March 5, 1993	EPA Method 502.2	0.3		0.3				0.38	5	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.3		*	*		*	0.38	5	

EPA SW-846 Methods 8011, 8030, 8040, 8090, 8120, 8150, and 8310 were Also Performed on Samples Collected on March 5, 1993, Resulting in No Analytes Detected.

- DL Analytical Method Detection Limit
- NCS North Carolina Water Quality Standard (DEHNR: 15A NCAC 2L .0202)
- CL EPA Primary Drinking Water Standard Maximum Contaminant Level

December 11, 1990 Sampling Event - Conducted by Engineering Tectonics and split-sampled with the NCDEHNR Solid Waste Section - Analysis performed by the North Carolina State Laboratory of Public Health.
 November 16-18, 1993 and March 5, 1993 Sampling Event - Conducted by Draper Aden Associates - Analysis performed by Central Virginia Laboratories and Consultants, Inc. (CVLC).

EPA Metho 502.2 Co-elutes compounds cis-1,2-Dichloroethene and 2,2-Dichloropropane

denotes estimated result
 denotes proposed NCS
 denotes *(method) utilized and analyte not detected

Note: All Concentrations are in ppb (µg/L)

Data Evaluation

The organic compounds detected in the groundwater at Watauga County Landfill are primarily dense Chlorinated solvents. The solvents have little affinity for soils and are seldom a problem in surface water because of their volatility. (EPA/600/8-83/019. May 1983). Metals concentrations detected in the groundwater are generally low or are below the analytical method detection limit, although several metals, Cadmium and Iron in particular, have been observed at levels above those established by the EPA MCL and the Secondary MCL, respectively.

Metal concentrations observed during the Assessment monitoring program will be evaluated to determine if groundwater resources are being adversely impacted by sources not directly related to the aquifer medium. The Groundwater and Surface Water Monitoring Program (SAP - Appendix I) included as an attachment to the Watauga County Assessment Plan describes the metal analysis to be conducted as part of the Assessment Plan. Cadmium, Iron, Barium, and Mercury will comprise the initial metal target analyte list for the first year of Assessment monitoring. Subsequent to complete annual Appendix II analyses conducted on the 'core' assessment monitoring well network, appropriate revisions to the target analyte list will be made.

The Groundwater and Surface Water Monitoring Program, Appendix I of the Assessment Plan, also describes the organic analysis to be conducted as part of the Assessment Plan. The following twelve "primary detected organic compounds" will initially be included in the target analyte list for the first year of Assessment monitoring. Analytical results of additional organic analytes provided by the necessary methods will also be provided. Subsequent to the complete annual Appendix II analyses conducted on the 'core' assessment monitoring well network, appropriate revisions to the target analyte list will be made.

A descriptive summary of constituents detected as a result of prior sampling and analysis is contained in the Evaluation of Existing Data contained in Section II of the Assessment Plan. Tables presenting data summaries of landfill well groundwater, potable well water, stream, and leachate analyses are also contained within Section II of the Assessment Plan. The following data evaluation explores in greater detail the organic constituents detected at the site.

Primary Detected Organic Compounds

The organic compounds detected at significant levels in three (3) previously existing downgradient groundwater monitoring wells (i.e. MW-2, MW-3, and MW-6), listed by order of decreasing occurrence and concentration are:

<i>Parameters detected at significant levels in virtually all downgradient monitoring wells</i>	Highest concentration reported (ppb)	NCS/MCL (ppb, ug/L)	Location of highest concentration
1,1,1-Trichloroethane (1,1,1-TCA)	1646	200/200	MW-2
1,1-Dichloroethene, <i>1,1-Dichloroethylene</i> (1,1-DCE)	232	7/7	MW-2
1,1-Dichloroethane (1,1-DCA)	250	700 (proposed)/--	MW-3
cis-1,2-Dichloroethene, <i>cis-1,2-Dichloroethylene</i> (cis-1,2-DCE)	225	70/70	MW-6
Tetrachloroethene, <i>tetrachloroethylene</i> , <i>perchloroethylene</i> (PCE)	39	0.7/5	MW-3
Trichloroethene, <i>trichloroethylene</i> (TCE)	110	2.8/5	MW-6

All of the constituents listed above were detected above associated EPA Maximum Contaminant Levels (MCL) and the North Carolina Groundwater Quality Standards (NCS) in one or more site groundwater monitoring wells (except for 1,1-DCA which does not have an established MCL or NCS).

All of the compounds listed above were also detected in three (3) of the potable water wells neighboring the site (i.e.: Nissan-Mazda, BREMCO and Carroll residence wells). PCE and TCE were detected above associated MCLs and NCSs in the Nissan-Mazda and Carroll residence wells. In the BREMCO potable well, all (6) compounds were observed only at unquantifiable levels below 1 ppb or at the detection limit of 1 ppb (1,1-DCE).

Five (5) of these compounds (i.e. 1,1,1-TCA, 1,1-DCE, 1,1-DCA, PCE, and TCE) were additionally detected at lower concentrations in five (5) other potable water wells neighboring the site (i.e.: Bolick rental, Greer, Shared Well #2, Ward, and Simko residences). All five (5) of these compounds were not detected in each potable water well and were mostly detected close to the method detection limit for each compound. The presence or source of these trace level compounds in these five (5) potable water wells can not be confirmed at this time.

A summary of the landfill groundwater analysis results for organic compounds listed above can be found on page 1 of the attached detected organic constituent summary table. Page 1 of the summary table presents all the groundwater analysis results for these six chlorinated volatile organics collected to date for the Watauga County Landfill monitoring wells, MW-1, MW-2, MW-3, MW-4, and MW-6. A summary of residential and business potable well analysis results can be found on Table 2.

The organic compounds detected at significant levels primarily in previously existing downgradient groundwater monitoring points located along the Bolick site (i.e.: MW-3 and MW-6), listed by order of decreasing occurrence and concentration are:

<i>Parameters detected at significant levels primarily in downgradient monitoring points located along the Bolick Site</i>	Highest concentrations reported (ppb)	NCS/MCL (ppb; ug/L)	Location of highest concentration
Methylene Chloride, <i>dichloromethane</i> (DCM)	23	5/5	MW-3
Dichlorodifluoromethane	21	0.19/---	MW3
Vinyl Chloride	18	0.015/2	MW-6
Benzene	6	1/5	MW-6
Trans-1,3-Dichloropropene	9	70/100	MW-3
Chloroethane	8	---/---	MW-6

Methylene Chloride and Vinyl Chloride were detected above associated MCLs and NCSs in both groundwater wells, MW-3 and MW-6. Methylene chloride was found just below the MCL at MW-2. It was found recently at the Carroll's residence at 138.2 ppb, well above the MCL of 5 ppb.

Dichlorodifluoromethane was also detected above the NCS in both MW-3 and MW-6 but does not have an established MCL.

Benzene was also detected above the MCL and NCS in MW-6 but only above the NCS in MW-3.

Trans-1,3-Dichloropropene was detected twice in MW-3 and MW-6, although well below the established NCS and MCL.

Chloroethane, although analyzed in four (4) sampling events, was only detected in MW-3 and MW-6 on one (1) event and additionally detected in MW-2 on a different sampling event. Chloroethane does not have an established MCL or NCS.

Methylene Chloride was detected in the Carroll residence well water in two out of three sampling events and Vinyl Chloride was detected in the Carroll residence well water in only one out of three sampling events. Although detected on different sampling events the two compounds have also been detected in the accompanying trip blank. The concentrations of Methylene Chloride and Vinyl Chloride detected in the Carroll residence well were above the established NCS and MCL for Methylene Chloride, and above and approaching, respectively, the established NCS and MCL for Vinyl Chloride. Methylene Chloride was detected at 138.2 ppb in the June 23, 1993 sampling of the Carroll residence well water, well above the MCL of 5 ppb.

Methylene Chloride has also been detected at various levels in three (3) other domestic wells within the Rocky Mountain Heights Subdivision. Methylene Chloride was possibly detected in the Perry residence well water although the analytical result was an estimated result denoted by the analytical lab only as <0.06. Methylene Chloride was detected at significant levels in the initial sampling of two other residential wells (Shared well # 1 and the Ward well). Resampling of the Perry residence well, the Shared Well #1 and the Ward residence well resulted in the absence (non-detection) of Methylene Chloride, suggesting a laboratory contaminant source.

Dichlorodifluoromethane was detected above the established NCS in three of the potable water wells neighboring the site (i.e.: Nissan-Mazda, Carroll, and Perry residences). Again, Dichlorodifluoromethane does not have an associated MCL.

Benzene was detected above the established NCS on all three sampling events of the Carroll residence well but below the established MCL. Benzene was not detected in any other potable water well neighboring the site.

Trans-1,3-Dichloropropene was not detected in any of the sampled potable water wells neighboring the site.

Chloroethane was detected in the Carroll residence well water at concentrations greater than twenty (20) times the concentrations observed in any of the groundwater monitoring wells at the landfill. Chloroethane was also detected in the Nissan-Mazda well water greater than twice the concentrations observed in any of the groundwater monitoring wells at the landfill. Chloroethane does not have an established MCL or NCS.

In summary, parameters detected in the landfill wells and also detected in potable wells above applicable MCLs are Methylene Chloride (Carroll), TCE (Carroll/Nissan) and PCE (Carroll/Nissan).

A summary of analysis results for the organic compounds discussed above can be found in pages 2 and 3 of the attached detected organic constituent summary table. Page 2 of the summary table lists Chlorinated volatile organics detected primarily in groundwater monitoring points located along the Bolick site and page 3 lists detected Benzene and Propane derivatives.

Questionable Detected Organic Compounds

Other organic compounds identified by landfill groundwater sampling and analysis were:

- 1) Detected at trace levels approaching or at analytical minimum detection limits,
- 2) Previously known as common laboratory contaminants,
- 3) Detected only once and at only one monitoring point, and/or
- 4) Also detected in the Trip Blank.

These compounds are listed with appropriate detection addendums as referenced above are:

Chloroform	1,3,4
Bromodichloromethane	1,2
Carbon Tetrachloride	1
1,2-Dichloroethane	1
1,4-Dichlorobenzene	1
1,2-Dichloropropane	1
2,2-Dichloropropene	1
1,1-Dichloropropene	2
Bis(2-ethylhexyl)phthalate	2,4
Xylenes, Total	1,2
4,4'-DDD	1,2

2,2-Dichloropropane additionally co-elutes with cis-1,2-Dichloroethene when utilizing EPA Method 502.2. Related data sets utilizing different analytical methods suggests 2,2-Dichloropropane detection was likely the result of the presence of cis-1,2-Dichloroethane.

A summary of analysis results for the organic compounds discussed above can be found on pages 3 and 4 of the attached detected organic constituent summary table. These compounds will continue to be analyzed in Full Appendix II monitoring scheduled for "core" assessment wells.

Organic Compounds Only Detected in Potable Water Wells

Organic compounds detected in the residential and business potable water wells neighboring the site but not detected in the monitoring well network at the landfill, listed by order of decreasing occurrence and concentration are:

Parameters detected only at potable water wells	Highest concentration (ppb)	NCS/MCL (ppb; ug/L)	Location Detected
Chloromethane	1.48/<0.9	---/---	Carroll/Perry
Trichlorofluoromethane	37.1/0.4	2100/---	Carroll/Nissan
Styrene	2.8	0.014/100	Carroll/Greer
tert-Butylbenzene	1.1	---/---	Carroll/Bolick
Ethylbenzene	trace	29/700	Greer
Isopropylbenzene	0.7/0.6	---/---	Bolick rental
1,3,5-Trimethylbenzene	0.7	---/---	Bolick rental
Napthalene	0.7	---/---	BREMCO/Perry
Toluene	0.6 ^T /0.8 ^T	1000/1000	Carroll/Nissan/Greer
4-Isopropyltoluene	0.2	---/---	Carroll
alpha-Chlordane	0.4	0.027/2	Shared Well #1
gamma-Chlordane	0.3	0.027/2	Shared Well #1
sec-Butylbenzene	0.2	---/---	Shared Well #1
Tert-Butyl Methyl Ether	2.4	200/---	Carroll
Methyl Ethyl Ketone	trace	170/---	Bolick rental

The fifteen (15) organic compounds listed above are contaminants that have previously been associated with private water well systems (Sorg, Thomas, 1986). Eight (8) of the compounds only detected in the residential and business potable water wells are BTEX components and are often found as the result of activities immediately around the private well heads and/or components of the well systems. Eight (8) of the compounds were detected in the Carroll residence well with three (3) of these same compounds were also detected in the Nissan-Mazda well.

The two (2) Chlordane compounds are commonly used in Termite extermination. The chlordane compounds were detected in only one (1) well, and their occurrence is likely a result of improper application. A resampling of the chlordane contaminated well resulted in no detection of any organic compounds.

A presentation of analytical results for the fifteen (15) organic compounds discussed above can be found in the summary table for the volatile and semi-volatile constituents detected in the residential and business potable water well testing.

APPENDIX IV

Potable Well Organic Analysis Summary Table

POTABLE WELL TESTING - WATAUGA COUNTY, NC
RESULTS OF VOLATILE AND SEMI-VOLATILE ANALYSIS

CONSTITUENT	MARCH 5, 1993*	MARCH 16, 1993*	MARCH 24, 1993*	JUNE 23, 1993**	JULY 13, 1994**	NCS	MCL
Carroll Residence (12)							
Benzene	2.1	1.7		1.9		1.0	5
Chloroethane	173.4	74.5		ND			
Chloromethane	ND	14.8		ND			
Dichlorodifluoromethane	30.6	ND		ND		0.19	
1,1-Dichloroethane	20.9	17.4		ND		700	
1,1-Dichloroethene	4.1	1.5		ND		7	70
cis-1,2-Dichloroethane#	1.2	0.9		<1.0		70	
2,2-Dichloropropane#	1.2	0.9		ND	NS		
4-Isopropyltoluene	ND	0.2	NS	ND			
Isopropylbenzene	0.6	ND		ND			
Methylene Chloride	ND	43.0(XT)		ND			
Styrene	2.8	0.5		138.2		5	5
Tert-Butyl Methyl Ether	ND	ND		ND		0.014	100
Tetrachloroethene	5.4(X)	4.7		2.4		200	
Toluene	ND	0.6(T)		4.2		0.7	5
1,1,1-Trichloroethane	19.7	15.7		ND		1000	1000
Trichloroethene	7.0(X)	5.5(X)		29.4		200	200
Trichlorofluoromethane	37.1	20.2		7.0		2.8	5
Vinyl Chloride	1.7(T)	ND		ND		2100	
p and m-Xylene	ND	ND		ND		0.015	2
o-Xylene	ND	3.4		<1.0		400	10,000
Nissan-Mazda Dealership (4)							
Benzene	ND					1.0	5
Carbon Tetrachloride	0.2		ND		trace	0.3	5
Chloroethane	19.1		ND		ND		
Dichlorodifluoromethane	8.2		ND		ND		
1,1-Dichloroethane	98.5		8.7		ND	0.19	
1,2-Dichloroethane	ND		63.1		104.3	700	
1,1-Dichloroethene	5.4		0.5		ND	0.38	
cis-1,2-Dichloroethene#	22.2		3.7		4.7	7	7
1,2-Dichloropropane	0.5		13.0		23.7	70	70
2,2-Dichloropropane#	22.2		0.3		ND	0.56	5
Methylene Chloride	ND	NS	13.0	NS	ND		
Tetrachloroethene	21.8(X)		ND		ND		
Toluene	ND		28.1(X)		4.5	5	5
1,1,1-Trichloroethane	14.7		0.8(T)		30.9	0.7	5
Trichloroethene	11.2(X)		19.3		ND	1000	1000
Trichlorofluoromethane	0.4		9.1(X)		22.9	200	200
o-Xylene	0.4		ND		12.8	2.8	5
			0.5(T)		ND	2100	
					ND	400	10,000

NOTE: All Concentrations are in ppb (ug/L).

(Other footnotes located on page 4)

POTABLE WELL TESTING - WATAUGA COUNTY, NC
RESULTS OF VOLATILE AND SEMI-VOLATILE ANALYSIS

CONSTITUENT	3/5/93*	3/18/93*	5/11/93**	6/23/93**	3/30/94**	4/6/94**	8/2/94**	NCS	MCL
Blue Ridge Electric Membership Company - (BREMCO) (5)									
1,1-Dichloroethane	0.7					<1.0	1.4	700	---
Naphthalene	0.6					NA	NA	---	---
1,1,1-Trichloroethane	0.2					<1.0	<1.0	200	200
Trichloroethene	0.5	NS	NS		NS	<1.0	<1.0	2.8	5
1,1-Dichloroethene	ND					1.0	1.9	7	7
cis-1,2-Trichloroethene	ND					<1.0	ND	70	70
Tetrachloroethene	ND					<1.0	<1.0	0.7	5
Bollek rental resident (2)									
tert-Butylbenzene	1.1					ND		---	---
isopropylbenzene	0.7					ND		---	---
Trichloroethene	0.5					ND		---	---
1,3,5-Trimethylbenzene	0.7	NS	NS		NS	ND		2.8	5
1,1-Dichloroethane	ND					trace	NS	700	---
1,1-Dichloroethene	ND					trace		7	7
Methyl Ethyl Ketone	ND					trace		170	---
Perry Residence (11)									
Dichlorodifluoromethane	2.5					ND		0.19	---
Naphthalene	0.7					ND		---	---
Chloromethane	<9	NS	NS			NS	NS	---	---
Methylene Chloride	<0.6					ND		5	5
Chloroform						<1.0		0.19	5
Greer residence (15)									
Benzene						<1.0		1.0	5
Toluene						6.4		1000	1000
Tetrachloroethene	NS	ND	NS		NS	trace		0.7	5
Ethylbenzene						trace	NS	29	700
p and m - Xylene						<1.0		400	10,000
Styrene						trace		0.14	100
Ward residence (24)									
Methylene Chloride			3.2	ND	ND			5	5
1,1,1-Trichloroethane		<1.0	<1.0	<1.0	<1.0			200	200
Trichloroethene		trace	trace	trace	<1.0			2.8	5
Tetrachloroethene		NS	NS	NS	NS		ND	0.7	5
Carbon Tetrachloride			ND	ND	<1.0			0.3	5
1,1-Dichloroethane			ND	ND	<1.0			700	---
Chloroform			ND	ND	trace			0.19	5

NOTE: All Concentrations are in ppb (ug/L).

(Other footnotes located on page 4)

POTABLE WELL TESTING - WATAUGA COUNTY, NC
RESULTS OF VOLATILE AND SEMI-VOLATILE ANALYSIS

CONSTITUENT	3/18/93*	3/23/93**	5/11/93**	6/23/93**	8/3/93**	8/9/93**	9/21/93	10/20/93**	3/30/94**	9/21/94**	NCS	MCL
Shared Well #1 (8 Houses) (13)												
sec-Butylbenzene	0.2											---
Carbon Tetrachloride	0.1										0.3	5
Methylene Chloride	1.5	NS	ND	NS	NS	NS	ND	NS	NS		5	5
alpha-Chlordane	0.4										0.27	2
gamma-Chlordane	0.3										0.27	2
Shared Well #2 (4 Houses) (14)												
1,4-Dichlorobenzene	0.5											---
1,1-Dichloroethene	ND								ND		7	7
1,1,1-Trichloroethane	ND	NS	NS	NS	NS	NS	NS	NS	<1.0		200	200
Chloroform	ND								<1.0		0.19	5
Slimko residence (20)												
Chloroform	NS	<1.0	NS	NS	NS	NS	NS	NS	NS		0.19	5
1,1,1-Trichloroethane		trace										200
Johnson residence (32)												
Chloroform	NS	NS	trace	NS	NS	NS	NS	NS	NS		0.19	5
McLean residence (26)												
Chloroform	NS	NS	<1.0	NS	NS	NS	NS	NS	NS		1.0	5
Yates residence (30)												
Chloroform	NS	NS	NS	NS	<1.0	NS	NS	NS	NS		0.19	5
McCintock residence (33)												
1,2-Dichloroethane	NS	NS	NS	NS	NS	<1.0	NS	NS	NS		0.19	5
Chloroform	NS	NS	NS	NS	NS	NS	NS	<1.0	NS	NS	700	---
Welch residence; Meadowview condominiums (38)												
Chloroform	NS	NS	NS	NS	NS	<1.0	NS	<1.0	NS	ND	0.19	5
Chloroform	NS	NS	NS	NS	NS	NS	NS	<1.0	NS		0.19	5

NOTE: All Concentrations are in ppb (ub/L)

(Other footnotes located on page 4)

**POTABLE WELL TESTING - WATAUGA COUNTY, NC
WELLS SHOWING NO DETECTED ORGANIC COMPOUNDS**

SAMPLING LOCATION	SAMPLING DATES
Colene Bolick residence (1)	March 5, 1993*
Roten residence (3)	March 5, 1993* and July 3, 1994**
Hollar and Green Produce (6)	March 5, 1993*
Chevrolet Dealership (7)	March 5, 1993*
Vannoy residence (8)	March 5, 1993*
Martin High Country Rentals #1 (9)	March 5, 1993*
Martin High Country Rentals #2 (10)	March 5, 1993*
Williamson residence (16)	March 18, 1993*
Suddreth residence (17)	March 18, 1993*, September 21, 1993**, and July 3, 1994**
Taylor residence (18)	March 18, 1993*
Hodges residence (19)	March 18, 1993*
Findt residence (21)	March 18, 1993*
Rusher residence (22)	March 23, 1993**
Younce residence (25)	May 11, 1993**
Medlin residence (27)	June 23, 1993**
Rector residence (28)	June 23, 1993**
Robinson residence (29)	June 23, 1993**
Cook residence (31)	August 3, 1993**
Animal Control Office (32)	August 3, 1993**
Green residence (34)	October 20, 1993**
Shared well #3 (35)	October 20, 1993**
BREMCO residence (36)	September 21, 1993**
Brook Hollow Trailer Park (37)	October 11, 1993**

TABLE 5A AND 5B NOTES:

The sampled well reference number as presented on the Vicinity Map (Figure 3) is denoted in parentheses following the sampling locations name

* Laboratory analysis performed by Central Virginia Laboratories and Consultants (CVLC) utilizing EPA Methods 502.2 (Volatiles) and 525.1 (Semi-Volatiles)

**Laboratory Analysis performed by NCDEHNR Division of Laboratory Services utilizing EPA Method 502.2 (Volatiles)

denotes compound co-elutes

ND denotes no compounds detected for entire analytical scan

NS denotes not sampled on that date

NA denotes compound not analyzed on that date

(T) denotes found in Trip Blank

(E) denotes estimated result

(X) denotes above MCL

NSC-North Carolina Water Quality Standard (DEHNR-15A NCAC 2L.0202)

MCL-EPA Primary Drinking Water Standard Maximum Contaminant Level