SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY

RE: 0448-N

October 29, 2004

Certified Mail – Return Receipt Requested
Receipt # 7003 0500 0001 2470 0658

U.S. Nuclear Regulatory Commission
ATTN: Mr. Myron Fliegel, Senior Project Manager
Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety
And Safeguards, NMSS
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

Subject: Sequoyah Fuels Corporation, Docket – 40-8027
Response to Second Request For Additional Information – Ground Water Monitoring Plan (TAC L52529)

Dear Mike,

By letter dated 9/17/04, SFC committed to provide a response to items 3, 4, and 5 of your second request for additional information (RAI) on our Ground Water Monitoring Plan Amendment Request by October 29, 2004. This letter provides SFC's response to items 3, 4, and 5 in your RAI.

Items 1, 2 and 6 will be addressed by 12/31/2004. If you have any questions, don't hesitate to call me at (918) 489-5511, ext. 13.

Sincerely,

John H. Ellis

John H. Ellis
President

XC: Bill Von Till, NRC
Rita Ware, EPA
Jim Harris, USACE
William Andrews, USGS
Jeannine Hale, CN
Kelly Burch, OAG
Alvin Gutterman, MLB

Recd 11/9/04
[illegible]

NMSS01

GROUNDWATER SAMPLING PLAN

Sequoyah Fuels Corporation

Sequoyah Facility

October 29, 2004

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GROUNDWATER SAMPLING PLAN

1.0 PURPOSE

This plan presents the procedures to be followed for groundwater monitoring well sampling, sample management, and sample custody control.

2.0 SAMPLING PROCEDURES

Activities which will occur during groundwater sampling are summarized as follows:

- pre-arrangement of sample analytical requests with analytical testing laboratory
- assembly and preparation of sampling equipment and supplies
- determine statistically significant number of groundwater samples for specific tasks
- groundwater sampling
    - determine sample type (i.e. composite or grab), frequency and number of samples, and proper sampling containers
    - inspection of well
    - water-level measurements
    - well depth measurement
    - measurement of any floating product in well
    - visual inspection of borehole water
    - calculation of purge volume
    - well bore evacuation
    - sampling
- sample preservation and shipment
    - sample preparation
    - on-site measurement of parameters
    - sample labeling including date, time, location, sampler's initials, analyses, and tracking number
- completion of sample records (field log book)
- completion of chain-of-custody records
- sample shipment

Detailed sampling procedures are presented in the following sections.

2.1 Equipment Assembly and Preparation

Prior to the sampling event, all equipment to be used (listed in Table 1) will be assembled, and its operating condition verified, calibrated (if required), and properly cleaned (if required). In addition, all record-keeping materials will be prepared.

2.1.1 Equipment Check

This activity includes the verification that all equipment is in proper operating condition. Also, arrangements for repair or replacement of any equipment which is inoperative are made.

2.1.2 Equipment Calibration

Where appropriate, equipment will be calibrated according to the manufacturer's specifications prior to field use. Equipment for making on-site measurements are pH, specific conductance, and temperature of water.

2.1.3 Equipment Cleaning (Decontamination)

All portions of sampling and test equipment which will contact the interior well casing will be thoroughly cleaned before use. This includes water-level tapes or probes, pumps, tubing, bailers, lifting line, test equipment for on-site use, and other equipment or portions thereof which are to be immersed. The procedure for initial equipment cleaning is as follows:

- clean with tap water and phosphate-free laboratory grade detergent, brush if necessary;
- rinse thoroughly with tap water;
- rinse thoroughly with distilled water;
- equipment cleaned prior to field use will be recleaned after transfer to the sampling site unless carefully wrapped for transport.

Non-dedicated equipment (such as water level or interface probes) which contacts the interior well casing before evacuation of the casing water will be rinsed thoroughly with distilled water (or hexane rinse if organics are noted) between wells. Dedicated bailers will be rinsed thoroughly with distilled water between sampling events. All other equipment which contacts the interior well casing during or after evacuation of the well casing water should be cleaned between well sampling use in accordance with the above detailed procedures.

Any necessary deviation from these procedures will be documented in the permanent record of the sampling episode.

Laboratory-supplied sample containers will be cleaned and sealed by the laboratory before shipping. Pre-cleaned sample containers may be purchased instead of using laboratory supplied containers that require cleaning by Facility personnel.

2.2 Groundwater Sampling Procedures

Special care will be exercised to prevent contamination of the groundwater and extracted samples during the sampling activities. The two primary ways in which such contamination can occur are:

- contamination of a sample through contact with improperly cleaned equipment; or
- cross-contamination of the groundwater through insufficient cleaning of equipment between wells. This could occur if non-dedicated sampling equipment is used.

To prevent such contamination, all sampling equipment will be thoroughly cleaned before each use at different sampling locations in accordance with Section 2.1.3. In addition to the use of properly cleaned equipment, three further precautions will be followed:

- a clean pair of new, disposable latex (or similar) gloves will be worn each time a different well is sampled; and
- sample collection activities will proceed progressively from background area to the downgradient area or from wells which are least affected by contaminants progressively to wells most affected by contaminants.

The following paragraphs present procedures for the several activities which comprise groundwater sample acquisitions. These activities will be performed in the same order as presented below. Exceptions to this procedure will be noted in the permanent sampling record.

2.2.1 Groundwater Level and Well Depth Measurement

Prior to the water-level and well depth measurements, each well will be inspected thoroughly for signs of damage. Any damage to or repairs needed on the well must be noted in the field log book.

Using a pre-cleaned water level meter, the groundwater surface will be measured from the casing datum to the nearest 1/8 inch (0.01 foot). The datum, usually the top of the inner well casing, is described in monitor well records. A permanent mark or scribe will be visible on inspection of the inner casing. The depth to the bottom of the well must also be measured and referenced to the same datum as the water-level measurement. These measurements will be recorded in the field log book. The date and time of the water-level measurements must also be recorded.

2.2.2 Visual Inspection of Well Water

Prior to well evacuation, but after water level and well depth measurements, a small quantity of water will be removed with a bailer in a manner which will not totally immerse the bailer. The recovered sample is representative of the top of the water column in the well casing. This technique can determine the presence of immiscible contaminants that accumulate at the top of the water column. The water will be inspected for the presence of a floating film or other indications of contamination. Any distinct sample color or odors will be noted. The thickness of any floating immiscible or dense phase products will be measured and recorded in the field log book. All observations regarding odor or visual evidence of contamination will also be recorded in the field log book.

2.2.3 Well Casing Evacuation

The water standing in a well prior to sampling may not be representative of in-situ groundwater quality. Therefore, the standing water in the well and sand filter pack must be removed so that formation water can replace the stagnant water. Using the depth-to-water, well depth, and filter pack interval (assume a porosity of 30%) calculate the volume of groundwater to remove from each well. Three casing volumes (including filter pack porewater) must be removed before sampling. The following equations should be used to calculate the volume of groundwater to be removed prior to sampling:

(1) $v_c = \pi r_c^2 h_c \times 7.48 \times 3$

v_c = Three (3) volumes of water in casing storage, gallons

r_c = radius of casing, feet

h_c = length of water column in casing, feet

7.48 = conversion factor from cubic feet to gallons

3 = casing volumes, and

(2) $v_s = (\pi r_s^2 h_s - \pi r_c^2 h_{cs}) \times 7.48 \times 3 \times 0.30$

where: v_s = Three (3) volumes of water in sand pack interval, gallons

r_s = radius of drilled borehole, feet

h_s = length of sand pack interval, feet

r_c = radius of casing, feet

h_{cs} = length of casing/screen in sand pack interval, feet

0.30 = estimated porosity of sand pack

Adding the 3 casing groundwater volumes to the 3 sand porewater volumes equals the amount of water that must be purged from the well prior to sampling. After the first casing volume is purged, pH, conductivity, and temperature measurements will be taken and recorded. An additional set of pH, conductivity, and temperature measurements will be taken after the final casing volume is purged to insure that the water quality in the well has stabilized. If these measurements indicate water quality has not stabilized, then additional casing/sand pack pore water volumes will be removed until stable readings are obtained. All purged groundwater will be collected and managed in accordance with state and federal regulations.

If a well is incapable of yielding 3 casing volumes, then the well will be evacuated to dryness and allowed to recover until the next day prior to sampling. Water levels prior to purging, after purging and prior to sampling will be recorded in the field log book. The purged water will be tested for pH, temperature, and conductivity and compared to the groundwater sample to insure that the water quality in the well had stabilized. If the pH, temperature, or conductivity have not stabilized then additional purging of the well will be required.

The wells can be purged using clean stainless steel or teflon bottom discharge bailers. A clean monofilament nylon line will be used to lower the bailer into the well. Special care will be taken to insure that the bailer or bailer line does not contact the ground. Alternatively, a properly cleaned non-aerating pump system can be used for purging such as a bladder and/or peristaltic pump. Another method which may be used is a Brainard-Kilman hand pump system.

During groundwater collection, no equipment or lifting lines will be allowed to contact the ground. If equipment or lifting lines contacts the ground, they will be replaced or recleaned prior to use.

2.2.4 Sample Extraction

A bailer constructed of stainless steel or teflon will be used to extract water samples from the well. It is much preferable that bailers be dedicated to specific wells. A bailer must be recleaned in accordance with Section 2.1.3 if it was previously used to collect an immiscible phase sample or used to sample more than one (1) well. A new, clean monofilament nylon line should be used during each sampling event. Care must be taken to prevent either the bailer or lifting line from contacting the ground surface and becoming potentially contaminated during sampling. Care will be taken during insertion of sampling equipment to prevent undue disturbance of water in the well. The bailer will be lowered into the water gently to prevent splashing and extracted gently to prevent creation of excessive turbulence in the well. The sample will be poured directly into appropriate containers. While pouring water from a bailer, the water will be carefully poured down the inside of the sample bottle to prevent significant aeration of the sample.

If a significant immiscible layer remains in the well following purging, then care must be taken to avoid sample bias by sampling directly from the top of the water column. A sample of the immiscible layer should have previously been taken.

Excess water collected during sampling will be placed in a container for proper disposal as described in Section 2.2.4.

2.2.5 On-Site Parameter Measurement

Certain chemical and physical parameters in water can change significantly within a short time of sample acquisition. These parameters cannot be accurately measured in a laboratory located more than a few hours from the Site, and therefore will be measured on-site with portable equipment. Examples of these parameters are:

- pH;
- specific conductance;
- temperature;

Measurement of these parameters will be obtained from unfiltered, unpreserved, "fresh" water collected by the same technique as the samples taken for laboratory analyses. The measurements will be made in a clean glass container separate from those intended for laboratory analysis. The measured sample will be disposed of as described in Section 2.2.4. The measured values will be recorded in the field log book.

2.3 Sample Preservation

Water samples will be properly prepared for transportation to the laboratory under refrigeration and chemical preservation, if necessary. The laboratory providing sample containers will have added any necessary chemical preservatives to the sealed containers provided. While in the field, all collected samples must be placed in ice filled chests. Table 2 is a list showing appropriate sample containers, preservatives, and holding/extraction times for several parameters. The preservatives; sample containers, and holding times listed in Table 2 will be followed during groundwater sample collection.

2.4 Container and Labels

Containers and appropriate container lids will be provided by the analytical testing laboratory. The containers will be filled and container lids will be tightly closed. The following information will be legibly and indelibly written on the label:

- sample identification,
- sampling date,
- sampling time,
- sample collector's initials, and
- preservatives used.

Complete the chain-of-custody form, include sample collectors name, facility name, laboratory name, sample identification, sampling date, sampling time, description of sample, parameters, and any special instructions.

2.5 Sample Shipment

Typically, the concentration, volume shipped, and type of compounds present in the groundwater from the Facility are considered by the U.S. Department of Transportation (D.O.T.) to be non-hazardous. Thus, the following packaging and labeling requirements for the sample materials are usually appropriate for shipping the sample to the testing laboratory:

- preserve samples with ice and cool to 4°C,
- package sample so that is does not leak, spill, or vaporize from its packaging;
- attach chain-of-custody forms inside sample shipment container;
- label package; and
- complete shipping papers.

Under certain circumstances, such as elevated concentrations of uranium, the D.O.T. has an action limit. Radioactive material is defined as any material having a specific activity greater than 0.002 microcuries per gram. Radioactive materials have additional shipping requirements that will be followed.

2.6 Chain-of-Custody Control

After samples have been obtained, chain-of-custody procedures will be followed to establish a written record concerning sample movement between the sampling site and the testing laboratory. Each shipping container will have a chain-of- custody form completed by the site sampling personnel packing the samples. The chain-of-custody form for each container will be completed in triplicate. One copy of this form will be maintained at the site, and the other two copies will be shipped with the samples to the laboratory. One of the laboratory copies will become a part of the permanent record for the sample and will be returned with the sample analyses.

A copy of a sample chain of custody form is shown in Appendix F.

2.7 Sampling Records

To provide complete documentation of sampling, detailed records will be maintained. These records will include the information listed below:

- sample location (facility name);
- sample identification (well number and/or sample number);
- sample location map or detailed sketch;
- date and time of sampling;
- sampling analysis and method;
- field observations of
  - sample appearance,
  - sample odor
- weather conditions;
- sampler's identification; and
- any other information which is significant.

Groundwater sampling information will be recorded in the field log book.

3.0 ANALYTICAL METHODS

Groundwater samples will be analyzed using the appropriate, EPA approved methodology in accordance with methods outlined in SW846, "Test Methods for Evaluating Solid Waste", published by the EPA or a similar EPA approved method. Water samples collected from monitoring wells also include one (1) replicate per day. The decision of which sample to split will be made by sampling personnel. The split or replicate sample will be given a designation which will not be confused with other samples to be tested. A trip blank sample of reagent grade water will be shipped from the laboratory to the Site and will be returned to the laboratory for analysis. The blank will not be opened in the field. The trip blank will be used when volatile organic analyses are conducted. One equipment blank sample will be prepared in the field each sampling day. Equipment blank (rinse) samples will be obtained by pouring distilled water into a cleaned sampling bailer and then filling a sample container in the same manner that would be used for a groundwater sample. This is done in the field at the time of sample collection.

The laboratory performing the analyses will have a QA/QC program which specifies procedures and references to be used. As a minimum, the program will contain:

1. Laboratory instrument calibration procedures and schedules.
2. Specification of adherence to accepted test methods.
3. Equipment inspection and servicing schedules.
4. The regular use of standard or spiked sample analyses.
5. Operator or analyst training procedures and schedules.
6. A program of continuous review of results, procedures, and compliance with the QA/QC program.
7. Documentation of compliance with the program.

Project Plan for Plugging Abandoned Wells

Sequoyah Fuels Corporation

Sequoyah Facility

October 29, 2004

Project Plan for Plugging Abandoned Wells

Introduction

SFC has characterized the groundwater conditions at the Facility, and has developed a site-specific model from this characterization data to use as a management tool for groundwater remediation. Monitoring well completion records have been reviewed against the predictive model to evaluate the need for existing groundwater monitoring wells. This review is described in Section 5 of the Ground Water Monitoring Plan (GWMP). Existing wells that are no longer needed to monitor changes in groundwater quality will be plugged and abandoned in accordance with the procedure outlined below.

Regulatory Requirements

Historically, SFC has utilized well plugging techniques and guidance suggested in the EPA guidance document entitled, "Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells" (600/4-89/034, 1989). SFC committed through the GWMP to utilize the EPA guidance for well plugging techniques (Section 8, GWMP). State regulations pertaining to well plugging are contained within Oklahoma Water Resources Board Rules and Regulations, Subchapter 11, Plugging and Capping Requirements for Wells and Test Holes. The above cited Oklahoma regulations are similar to EPA's and will be followed.

Well Plugging Procedure

If the top of the screen is less than 20 feet below land surface, or the well does not meet current construction standards:

1. The casing will be removed or drilled out by over-drilling of the casing. The same size auger used to drill the borehole will be used to drill out the casing.
2. Cement grout will be placed from the bottom of the well to an elevation four (4) feet below land surface.
3. The remaining four (4) feet to land surface will be backfilled with compacted uncontaminated soil.

If the top of the well screen is 20 feet or more below land surface, and the well meets current minimum construction standards, then the casing need not be removed:

1. Cement grout will be placed in the well through a tremie pipe and filled or pumped from the bottom upward to within four (4) feet of land surface or to land surface.

2. The remaining four (4) feet to land surface will be backfilled with compacted uncontaminated soil.

Documentation

Proper documentation of each plugged well will be recorded and maintained by the Environmental Dept. Copies of the field logs will be included in the progress reports to the EPA. All material removed from the hole will be managed in compliance with all state and federal regulations and Facility procedures.

A plugging report will be completed and filed with the Oklahoma Water Resources Board within sixty days after the date of plugging. The form titled "Plugging Report for Groundwater and Monitoring Wells", copy attached, will be used.

PLUGGING REPORT FOR
Groundwater and Monitoring Wells

Oklahoma Water Resources Board
3800 North Classen Boulevard
Oklahoma City, OK 73118
Telephone (405) 530-8800

Do Not Write In This Space
Well Record ID Number ______

Legal Location of Water Well or Boring

North

One Mile
Each square is 10-acres
Please Plot Well Location

Section ______
Township ______ ☐ North ☐ South Range ______ ☐ WIM ☐ EIM ☐ ECM

*** After August 1, 2003 a measured latitude and longitude may be substituted for the Legal Description**
Latitude ______ Longitude ______

Date collected (latitude and longitude), if different from date the well was drilled: ______
Method latitude and longitude was collected: ☐ GPS-uncorrected data,
☐ GPS-corrected data (WASS), ☐ GPS-corrected data (DGPS), ☐ GPS-corrected to base station

County ______ Variance Request No. (if applicable) ______

WELL OWNER – NAME AND ADDRESS
Well Owner ______ Phone ______
Address/City/State ______ Zip ______

TYPE OF WELL OR BORING BEING PLUGGED
☐ Groundwater Test Hole ☐ Groundwater well ☐ Geothermal/Heat Pump ☐ Geotechnical Boring ☐ Monitoring well

USE OF WELL BEFORE PLUGGING *Indicate the use of the well being plugged, to the best of your knowledge,.
Use of well: ______

PLUGGING INFORMATION
Date Well or Boring Was Plugged: ______ Total depth of well being plugged (feet): ______

Was the well contaminated or was it plugged as though it was contaminated? ☐ Yes ☐ No

If the well or boring was plugged as if it was contaminated, was the casing removed or perforated? ☐ Yes ☐ No

Backfilled with:
☐ Native Materials, ☐ Clean Washed Sand, ☐ Other Describe: ______
Backfilled from ______ feet to ______ feet

Grouted with:
☐ Cement Grout, ☐ Cement Grout/Bentonite, ☐ H.S. Bentonite Grout, ☐ Bentonite Pellets, ☐ Bentonite Granules/Chips
Grouted From ______ feet to ______ feet Was Grout Tremied? ☐ Yes ☐ No

Grouted with:
☐ Cement Grout, ☐ Cement Grout/Bentonite, ☐ H.S. Bentonite Grout, ☐ Bentonite Pellets, ☐ Bentonite Granules/Chips
Grouted From ______ feet to ______ feet

CERTIFICATION

The work described above was done under my supervision. This report is correct to the best of my knowledge.

Firm Name ______ D/PC No. ______
Operator Name ______ OP No. ______
______ Date ______
Signature

Evaluation of Background Groundwater Monitoring Data

Sequoyah Fuels Corporation

Sequoyah Facility

October 29, 2004

Evaluation of Background Groundwater Monitoring Data
Sequoyah Fuels Corporation

Introduction

Sequoyah Fuels Corporation (SFC) has evaluated the data collected at background groundwater monitoring wells located up-gradient of Facility operations. Since baseline groundwater monitoring was not conducted prior to construction of the Facility, the up-gradient data analyses has been used as proxies for onsite baseline samples. Sample collection and analysis for most of the background monitoring wells began in 1991. Two additional background wells were added during 1995 and one other during 2001. A total of nine background wells will be used for the statistical evaluations.

Constituents of concern that have been routinely analyzed for in the background wells have been arsenic, fluoride, nitrate and uranium. Analysis for additional constituents has been very limited and is not of sufficient quantity to perform statistical evaluations. This statistical evaluation will therefore only consider arsenic, fluoride, nitrate and uranium. Data used for this evaluation was collected between 1991 and 2003.

Groundwater monitoring data has been compiled in dBase, the primary database management software package used for maintaining environmental sampling information by SFC. The data is typically transferred to Excel for sorting and formatting for inclusion in various reports. Some basic statistical evaluations and plotting of analyses have also been completed using Excel. ChemStat[1], an application for the statistical analysis of groundwater monitoring data was used for most of the statistical analysis provided in this evaluation.

Description of Background Monitoring Well System

A map of the site showing locations of the background groundwater monitoring wells is provided as Figure 1. Monitoring wells are typically found as clusters at each location. Each well in a cluster is completed at different depths to monitor separate groundwater systems. Facility hydrogeology is described in the Groundwater Monitoring Plan[2] and in other documents presented with the Reclamation Plan[3]. Wells monitoring the Terrace Groundwater System are identified as "MWXXX" (e.g. MW072). Well identifications that end with an "A" (e.g. MW072A), monitor the Shallow Bedrock Groundwater System and well identifications ending with a "B" (e.g. MW072B) designation monitor the Deep

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[1] ChemStat, Environmental Data Statistical Analysis for Windows, Starpoint Software.

[2] Groundwater Monitoring Plan, Sequoyah Fuels Corporation, May 2003.

[3] Reclamation Plan, Sequoyah Fuels Corporation, January, 2003.

Bedrock Groundwater System. The Terrace Groundwater System includes the terrace deposits and Unit 1 Shale, the Shallow Bedrock System includes Units 2, 3 or 4 Shale, and the Deep Bedrock System includes Unit 5 Shale. Well completion logs for each of the nine background wells are included in Attachment A. Well completion summary information is included in Table 1.

Table 1
Background Well Completion Summary Information

Well ID	Total Depth, ft	Top Sand ft	Screen Bottom, ft	Ground Elev.	Case Top Elev.
MW005	10.9	3.3	10.7	560.7	562.98
MW005A	32.1	15.7	31.6	560.5	563.09
MW007	18.2	7.0	17.8	569.9	572.01
MW007A	35.0	22.0	34.8	570.2	572.63
MW007B	82.8	72.0	82.1	570.3	572.89
MW072	19.2	7.4	18.5	574.2	577.10
MW072A	48.0	21.2	47.4	575.1	577.73
MW072B	90.1	78.1	89.5	574.6	577.23
MW110A	45.0	32.0	44.7	552.6	554.93

Sampling methods and quality control practices are described in the Groundwater Monitoring Plan.

Preliminary Data Analysis

The preliminary data analysis consisted of a review of tabulated analyses and plotted graphical visual aids for evaluating the quality and quantity of background data. The complete set of arsenic, fluoride, nitrate and uranium analyses from 1991 through 2003 for the background groundwater monitoring well locations are included in Table 2. Time series graphs and box plots were constructed from this data. Some of the data was determined to be not representative of background water quality. This data was not included with the data set used to represent background groundwater quality.

A review of the Table 2 and associated time series graphs and box plots identified the following concerns:

1. The minimum detection limit for uranium decreased from 5 µg/l to about 1 µg/l after 1995. The arsenic minimum detection limit was typically reported as 0.005

mg/l but during a few sampling events increased to values between 0.03 and 0.053 mg/l.

2. Some of the analyses clearly appear to be outliers based on a visual inspection of the plotted results. The analyses are well above typical values reported.

3. Following installation of a few of the wells, analyses obtained during the first few sampling events appear to be elevated but decreased with time. This indicates impacts from well construction that is not representative of groundwater quality for these well.

4. Recent analyses of nitrate at MW005 and MW007A were higher than historical values. A review of April 2004 monitoring results indicate that in both instances the analyses have decreased.

Data Analysis

Based on the above concerns some analyses have been removed from the background groundwater data set. High minimum detection limits for uranium (5 µg/l) and arsenic (between 0.03 and 0.53 mg/l) were removed. These high minimum detection limits are not representative of the current laboratory capability and will bias the background water quality. The analyses that are obvious outliers from a visual inspection of the plotted results were considered for removal. These outliers were evaluated using Dixon's test, confirmed to be outliers and removed from the data set. A description of Dixon's statistical test is included in Attachment B. Initial analyses that were impacted following installation of a new well have also been removed from the data set.

Analyses that have been removed from the background data set are highlighted in Table 2. Color shading has been used to indicate the reason for removal of each analysis. A revised set of box plots and time series graphs are presented as Figures 2 - 9. The revised data set will be used to represent background groundwater quality at the Facility.

The box plots and time series graphs (Figures 2 - 9) were reviewed and two significant observations made. The fluoride concentration in the Deep Bedrock Groundwater System is significantly higher than in the Terrace and Shallow Bedrock Groundwater Systems. Analyses of samples collected from wells in the Deep Bedrock system appear to be fairly consistent and support the observation. A natural occurring constituent in this geological formation appears to be causing these elevated concentrations of fluoride. The second observation is that the nitrate concentration in Monitoring Well MW007A is significantly higher than in the other wells. Nitrate analyses in monitoring wells downgradient of MW007A in the Shallow Bedrock Groundwater System were evaluated to determine if these wells also have elevated nitrate concentrations. MW008A and MW021A are located immediately downgradient of MW007A and show very similar results for nitrate. The locations of MW007A, MW008A and MW021A are shown in Figure 10. In addition, concentrations of nitrates plotted on a time series graph appear to have similar trends; see Figure 11.

Descriptive Statistics of Background Monitoring Wells and Groundwater Systems

Basic statistics for the background monitoring wells are presented in Table 3 for arsenic, fluoride, nitrate and uranium. For each groundwater system the total number of measurements, total non-detects, mean and standard deviation are listed. Non-detects have been replaced with the minimum detection limit. Individual monitoring well statistics are also provided. A review of the data indicates that the fluoride concentration in the Deep Bedrock Groundwater System is higher than in the other systems and the nitrate levels appear to be elevated in groundwater sampled from MW007A. These observation are consistent with the graphical analysis.

Upper confidence levels were determined using the guidance in "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites," USEPA OSWER 9285.6-10, December 2002. The Chebyshev Inequality UCL Method is a non-parametric test for calculation of upper confidence limits from measured sample concentrations. This method was used to calculate a 95% upper confidence limit for each parameter and each groundwater system. Table 4 contains the results of the UCL calculations.

Conclusion

An evaluation of background concentrations of arsenic, fluoride, nitrate and uranium has been completed for the Terrace, Shallow Bedrock and Deep Bedrock Groundwater Systems for data collected between 1991 and 2003. This evaluation has established a framework by which statistical evaluations of the background monitoring data will be completed at the Sequoyah Facility.

Table 2
Background Monitor Well Sample Analyses Removed

Location	Sample Date	Arsenic mg/l	Fluoride mg/l	Nitrate mg/l	Uranium µg/l
MW005	04/25/1991	< 0.005	0.4	0.2	< 5.0
MW005	10/24/1991	< 0.005	1.0	0.9	< 5.0
MW005	04/01/1992			0.7	18.7
MW005	04/14/1993			0.5	< 5.0
MW005	04/19/1994	< 0.050		< 1.0	< 5.0
MW005	10/14/1994	< 0.053			
MW005	04/11/1995	< 0.005	0.2	< 1.0	< 5.0
MW005	04/09/1996			1.1	< 0.6
MW005	04/15/1997	< 0.005	< 0.2	< 1.0	< 1.0
MW005	04/15/1998	< 0.005	0.9	< 1.0	< 1.0
MW005	04/13/1999	< 0.005	0.3	1.2	< 1.0
MW005	04/14/2000	< 0.005	0.2	1.1	< 1.0
MW005	04/12/2001	< 0.005	< 0.2	< 1.0	2.8
MW005	04/11/2002	< 0.011	0.3	2.0	< 1.0
MW005	04/15/2003	< 0.007	< 0.2	3.6	< 1.0
MW005A	04/25/1991	< 0.005	0.9	2.1	< 5.0
MW005A	10/23/1991	< 0.005	0.6	2.0	< 5.0
MW005A	04/21/1992			2.0	< 5.0
MW005A	05/26/1993			1.7	< 5.0
MW005A	04/27/1994	< 0.050		1.8	< 5.0
MW005A	10/14/1994	< 0.053			
MW005A	04/18/1995		0.5	1.1	< 5.0
MW005A	04/16/1996			1.5	< 0.6
MW005A	04/15/1997	< 0.005	0.5	1.0	< 1.0
MW005A	04/15/1998	< 0.005	0.6	1.6	< 1.0
MW005A	04/13/1999	< 0.005	0.5	2.9	< 1.0
MW005A	04/14/2000	< 0.005	0.3	2.0	< 1.0
MW005A	04/12/2001	< 0.005	0.5	< 1.0	< 1.0
MW005A	04/11/2002	< 0.011	0.6	2.1	< 1.0
MW005A	04/15/2003	< 0.007	0.4	2.2	< 1.0
MW007	05/01/1991	< 0.005	1.9	0.9	< 5.0
MW007	10/23/1991	< 0.005	0.8	1.7	< 5.0
MW007	04/01/1992			1.6	25.7
MW007	07/14/1992				< 5.0
MW007	04/14/1993			1.3	< 5.0
MW007	04/19/1994	< 0.050		1.5	< 5.0
MW007	10/13/1994	< 0.053			< 5.0
MW007	04/11/1995	< 0.005	0.7	1.3	< 5.0
MW007	04/09/1996			1.8	< 5.7
MW007	04/15/1997	0.010	0.8	3.0	< 1.0
MW007	04/15/1998	0.007	0.8	1.9	< 1.0
MW007	04/13/1999	< 0.005	0.6	1.5	< 1.0
MW007	04/06/2000	< 0.003	0.9	1.5	< 1.0
MW007	04/12/2001	< 0.005	0.8	< 1.0	12.4
MW007	04/11/2002	< 0.011	0.8	1.6	< 1.0
MW007	04/15/2003	0.007	0.8	2.3	< 1.0

Table 2
Background Monitor Well Sample Analyses Removed

Location	Sample Date	Arsenic mg/l	Fluoride mg/l	Nitrate mg/l	Uranium µg/l
MW007A	05/01/1991	< 0.005	0.7	2.7	< 5.0
MW007A	10/23/1991	< 0.005	0.7	2.5	< 5.0
MW007A	04/21/1992			2.7	< 5.0
MW007A	05/25/1993			2.5	< 5.0
MW007A	04/27/1994	< 0.050		2.7	< 5.0
MW007A	10/13/1994	< 0.053			< 5.0
MW007A	04/18/1995		0.8	2.7	< 5.0
MW007A	04/16/1996			3.1	< 0.6
MW007A	04/15/1997	< 0.005	4.9	3.9	< 1.0
MW007A	04/15/1998	0.006	0.8	4.1	< 1.0
MW007A	04/13/1999	< 0.005	0.6	3.7	< 1.0
MW007A	04/06/2000	< 0.003	0.7	3.6	1.9
MW007A	04/12/2001	< 0.005	1.0	3.5	< 1.0
MW007A	04/11/2002	< 0.011	1.6	5.5	< 1.0
MW007A	04/15/2003	< 0.007	0.7	7.1	< 1.0
MW007B	05/05/1995	< 0.005	0.9	1.7	< 5.0
MW007B	10/10/1995	0.010	2.2	3.5	10.0
MW007B	04/12/1996	0.013	2.1	2.8	6.8
MW007B	10/22/1996	< 0.005	2.3	< 1.0	4.0
MW007B	04/15/1997	0.021	2.7	< 1.0	2.0
MW007B	04/14/1998	0.007	2.6	2.1	2.0
MW007B	04/13/1999	< 0.005	2.5	1.1	< 1.0
MW007B	04/06/2000	0.004	2.4	< 1.0	< 1.0
MW007B	04/03/2001	< 0.005	2.4	< 1.0	< 1.0
MW007B	04/03/2002	< 0.009	3.0	< 1.0	< 1.0
MW007B	04/02/2003	0.007	2.7	< 1.0	< 1.0
MW072	05/09/1991	< 0.005			
MW072	10/23/1991	< 0.005	0.7	1.0	< 5.0
MW072	04/01/1992			1.2	< 5.0
MW072	04/16/1993			2.4	
MW072	04/19/1994	< 0.050		1.3	
MW072	10/14/1994	< 0.053			
MW072	04/12/1995	0.006	0.7	< 1.0	< 5.0
MW072	04/09/1996			1.1	< 5.7
MW072	04/15/1997	0.005	0.7	< 1.0	< 1.0
MW072	04/15/1998	< 0.005	0.9	< 1.0	< 1.0
MW072	04/13/1999	< 0.005	0.5	0.4	< 1.0
MW072	04/06/2000	< 0.003	0.5	0.3	< 1.0
MW072	04/12/2001	< 0.005	0.5	1.2	< 1.0
MW072	04/11/2002	< 0.011	1.0	0.5	< 1.0
MW072	04/15/2003	0.017	0.8	< 1.0	< 1.0

Table 2
Background Monitor Well Sample Analyses Removed

Location	Sample Date	Arsenic mg/l	Fluoride mg/l	Nitrate mg/l	Uranium µg/l
MW072A	05/01/1991	< 0.005	1.7	2.7	< 5.0
MW072A	10/23/1991		0.6	1.1	< 5.0
MW072A	04/15/1992			1.4	< 5.0
MW072A	05/25/1993			1.4	< 5.0
MW072A	04/26/1994	< 0.050		2.2	< 5.0
MW072A	10/14/1994	< 0.053			
MW072A	04/18/1995		0.4	< 1.0	< 5.0
MW072A	04/16/1996			1.3	< 0.6
MW072A	04/15/1997	< 0.005	0.5	< 1.0	< 1.0
MW072A	04/15/1998	< 0.005	0.8	2.0	< 1.0
MW072A	04/13/1999	< 0.005	0.4	0.7	< 1.0
MW072A	04/06/2000	< 0.003	0.4	0.8	< 1.0
MW072A	04/12/2001	< 0.005	0.4	1.6	< 1.0
MW072A	04/11/2002	< 0.011	0.5	1.2	< 1.0
MW072A	04/15/2003	0.008	0.5	< 1.0	< 1.0
MW072B	04/18/1995	< 0.005	2.4	< 1.0	< 5.0
MW072B	10/10/1995	< 0.005	0.9	1.2	< 5.0
MW072B	04/12/1996	< 0.005	1.9	1.1	1.0
MW072B	10/22/1996	< 0.005	2.7	< 1.0	< 1.0
MW072B	04/15/1997	0.008		< 1.0	< 1.0
MW072B	04/14/1998	< 0.005		1.5	< 1.0
MW072B	04/13/1999	< 0.005		0.2	< 1.0
MW072B	04/06/2000	< 0.003		0.6	< 1.0
MW072B	04/03/2001	< 0.005		0.5	3.1
MW072B	04/03/2002	< 0.009		< 0.2	< 1.0
MW072B	04/02/2003	< 0.007		0.7	< 1.0
MW110A	08/23/2001	< 0.030	0.6	< 1.0	3.1
MW110A	10/09/2001	< 0.015	0.5	1.7	1.2
MW110A	04/02/2002	< 0.009	0.8	< 1.0	< 1.0
MW110A	04/30/2003	< 0.007	0.7	1.1	1.2

Key:

☐ - Removed due to high minimum detection limit report by laboratory

▨ - Determined to be a statistical outlier and removed

☐ - Determined to be impacted from well completion and removed

Table 3
Basic Statistics for Background Monitoring Wells for Groundwater Systems - Arsenic

Terrace Groundwater System

Non-Detects Replaced with Detection Limit	
Total Measurements	30
Total Non-Detects	24 (80%)
Background Mean	0.00626667
Background Std Dev	0.00293532

There are 3 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005	10	10	100	0.0058	0.00193218
MW007	10	7	70	0.0063	0.00249666
MW072	10	7	70	0.0067	0.00416467

Shallow Bedrock Groundwater System

Non-Detects Replaced with Detection Limit	
Total Measurements	29
Total Non-Detects	27 (93.1034%)
Background Mean	0.00631034
Background Std Dev	0.00270057

There are 4 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005A	9	9	100	0.00588889	0.00202759
MW007A	9	8	88.8889	0.00577778	0.00222361
MW072A	8	7	87.5	0.005875	0.00247487
MW110A	3	3	100	0.0103333	0.00416333

Deep Bedrock Groundwater System

Non-Detects Replaced with Detection Limit	
Total Measurements	21
Total Non-Detects	15 (71.4286%)
Background Mean	0.00628571
Background Std Dev	0.00236945

There are 2 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW007B	10	5	50	0.007	0.00286744
MW072B	11	10	90.9091	0.00563636	0.00168954

Table 3
Basic Statistics for Background Monitoring Wells for Groundwater Systems - Fluoride

Terrace Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	28
Total Non-Detects	3 (10.7143%)
Background Mean	0.614286
Background Std Dev	0.269037

There are 3 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005	10	3	30	0.39	0.303498
MW007	9	0	0	0.777778	0.0833333
MW072	9	0	0	0.7	0.180278

Shallow Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	32
Total Non-Detects	0 (0%)
Background Mean	0.628125
Background Std Dev	0.241279

There are 4 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005A	10	0	0	0.54	0.157762
MW007A	9	0	0	0.844444	0.304594
MW072A	9	0	0	0.5	0.132288
MW110A	4	0	0	0.65	0.129099

Deep Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	15
Total Non-Detects	0 (0%)
Background Meas.	15
Background Mean	2.24667
Background Std Dev	0.610464

There are 2 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW007B	11	0	0	2.34545	0.542888
MW072B	4	0	0	1.975	0.788987

Table 3
Basic Statistics for Background Monitoring Wells for Groundwater Systems - Nitrate

Terrace Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	41
Total Non-Detects	10 (24.3902%)
Background Mean	1.28293
Background Std Dev	0.671901

There are 3 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005	14	5	35.7143	1.16429	0.805373
MW007	14	1	7.14286	1.63571	0.528579
MW072	13	4	30.7692	1.03077	0.518627

Shallow Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	46
Total Non-Detects	6 (13.0435%)
Background Mean	2.16304
Background Std Dev	1.2739

There are 4 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005A	14	1	7.14286	1.78571	0.524562
MW007A	14	0	0	3.59286	1.3047
MW072A	14	3	21.4286	1.38571	0.568205
MW110A	4	2	50	1.2	0.33665

Deep Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	19
Total Non-Detects	10 (52.6316%)
Background Mean	0.957895
Background Std Dev	0.425984

There are 2 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW007B	8	6	75	1.15	0.38545
MW072B	11	4	36.3636	0.818182	0.41429

Table 3
Basic Statistics for Background Monitoring Wells for Groundwater Systems - Uranium

Terrace Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	21
Total Non-Detects	20 (95.2381%)
Background Mean	1.06571
Background Std Dev	0.410507

There are 3 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005	8	7	87.5	1.1725	0.678544
MW007	6	6	100	1	0
MW072	7	7	100	1	0

Shallow Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	27
Total Non-Detects	24 (88.8889%)
Background Mean	1.00111
Background Std Dev	0.240166

There are 4 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005A	8	8	100	0.94625	0.152028
MW007A	8	7	87.5	1.0625	0.381454
MW072A	8	8	100	0.94625	0.152028
MW110A	3	1	33.3333	1.13	0.121244

Deep Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

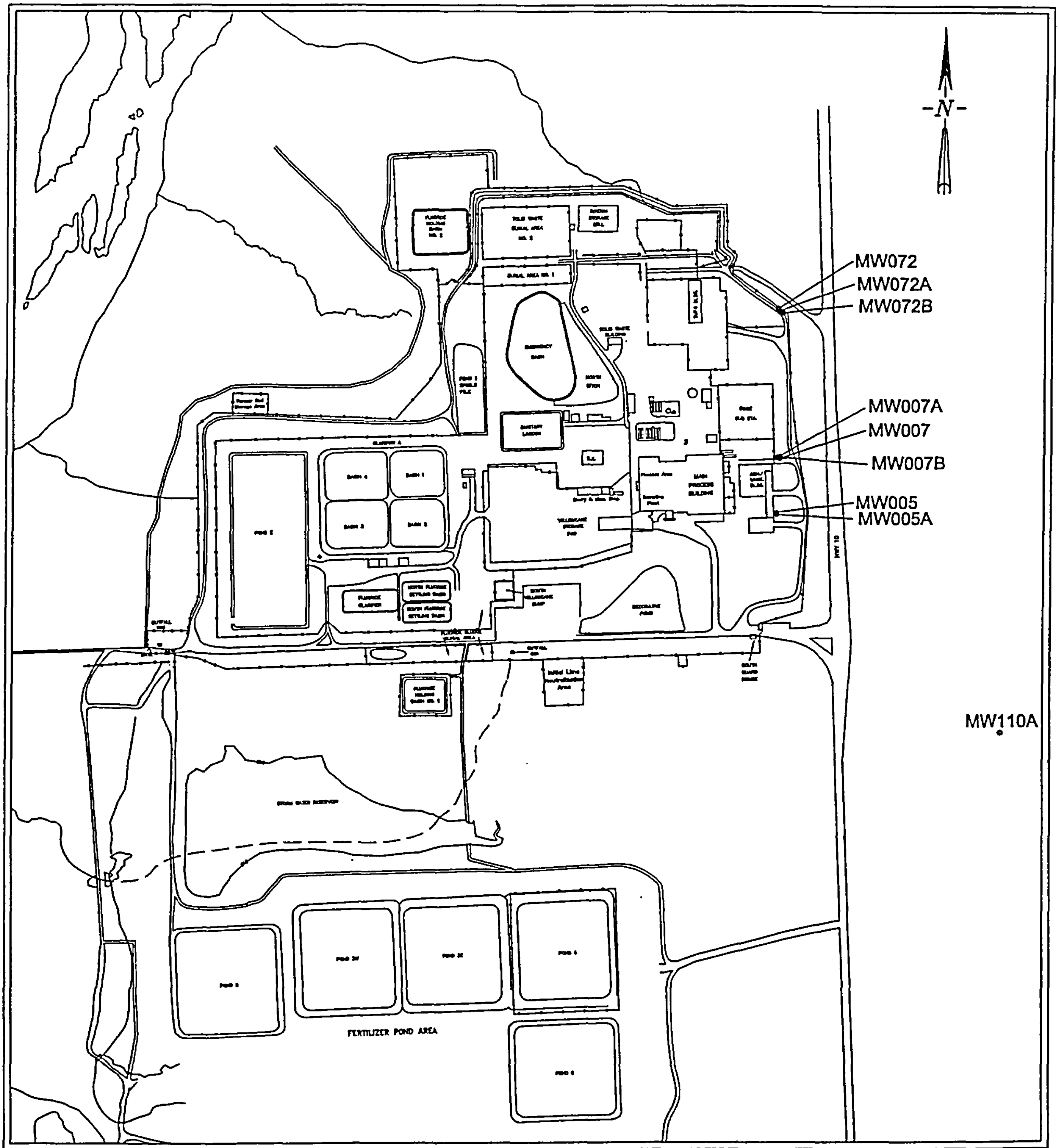
Total Measurements	14
Total Non-Detects	12 (85.7143%)
Background Mean	1.14643
Background Std Dev	0.556578

There are 2 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW007B	5	5	100	1	0
MW072B	9	7	77.7778	1.22778	0.694654

Table 4
Upper Confidence Levels (95%) of Background Water Quality for Groundwater Systems

	Number Meas.	S. Dev.	Mean	UCL
Terrace				
Arsenic, mg/l	30	0.003	0.006	0.009
Fluoride, mg/l	28	0.3	0.6	0.8
Nitrate, mg/l	41	0.7	1.3	1.7
Uranium, μg/l	21	0.4	1.1	1.5
Shallow Bedrock				
Arsenic, mg/l	29	0.003	0.006	0.008
Fluoride, mg/l	32	0.2	0.6	0.8
Nitrate, mg/l	46	1.3	2.2	3.0
Uranium, μg/l	27	0.2	1.0	1.2
Deep Bedrock				
Arsenic, mg/l	21	0.002	0.006	0.009
Fluoride, mg/l	15	0.6	2.2	2.9
Nitrate, mg/l	19	0.4	1.0	1.4
Uranium, μg/l	14	0.6	1.1	1.8



SEQUOYAH FUELS CORPORATION
Background Groundwater Monitoring Well Evaluation

TITLE: *Background Monitoring Well Locations*

PREPARED BY: *SCM*

FILENAME: *Figure1.dwg*

REVIEWED BY: *SCM*

DATE: *18 Oct 2004*

FIGURE NO. 1

Figure 2

Arsenic - Box Plot

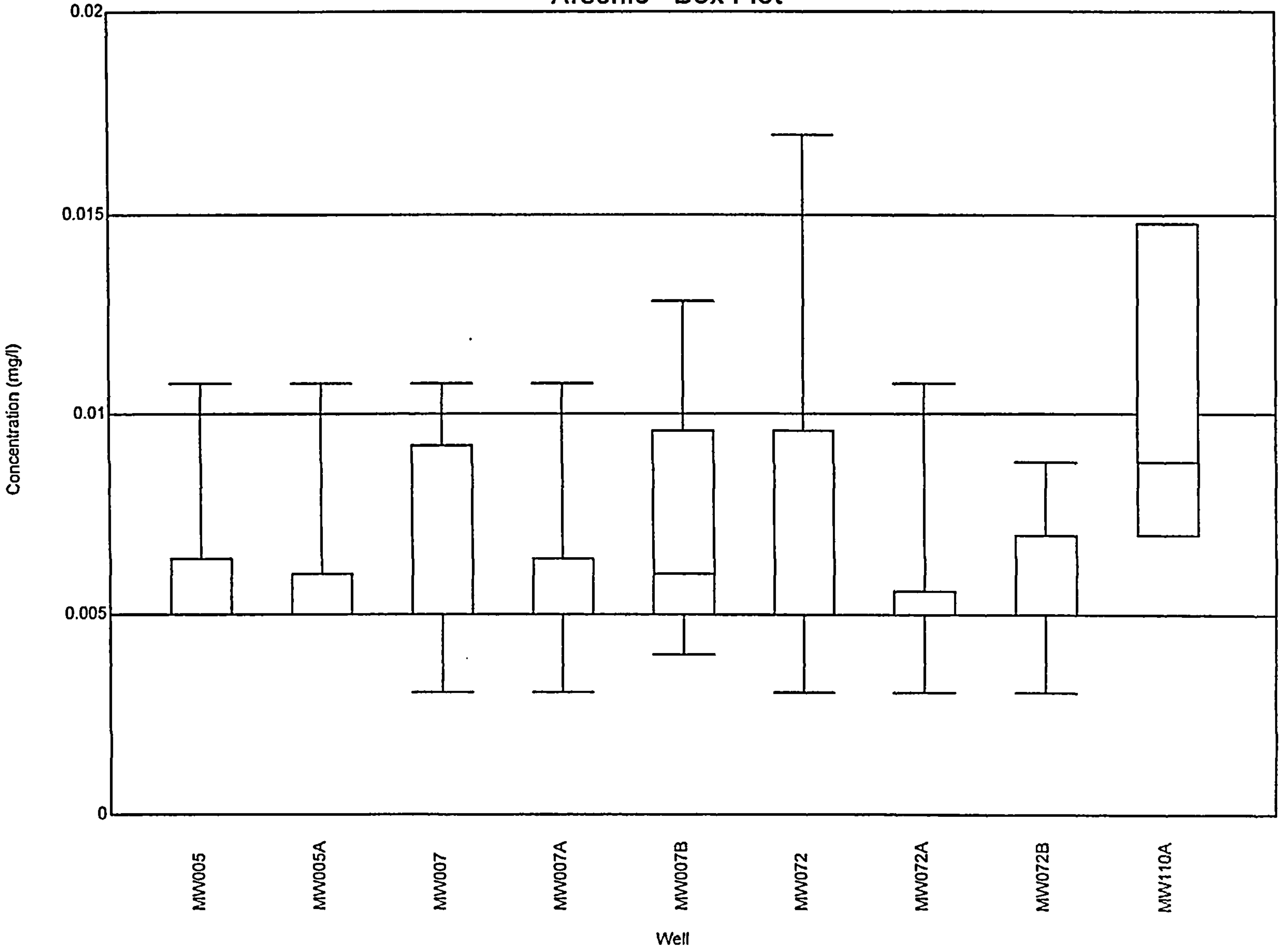


Figure 3

Fluoride - Box Plot

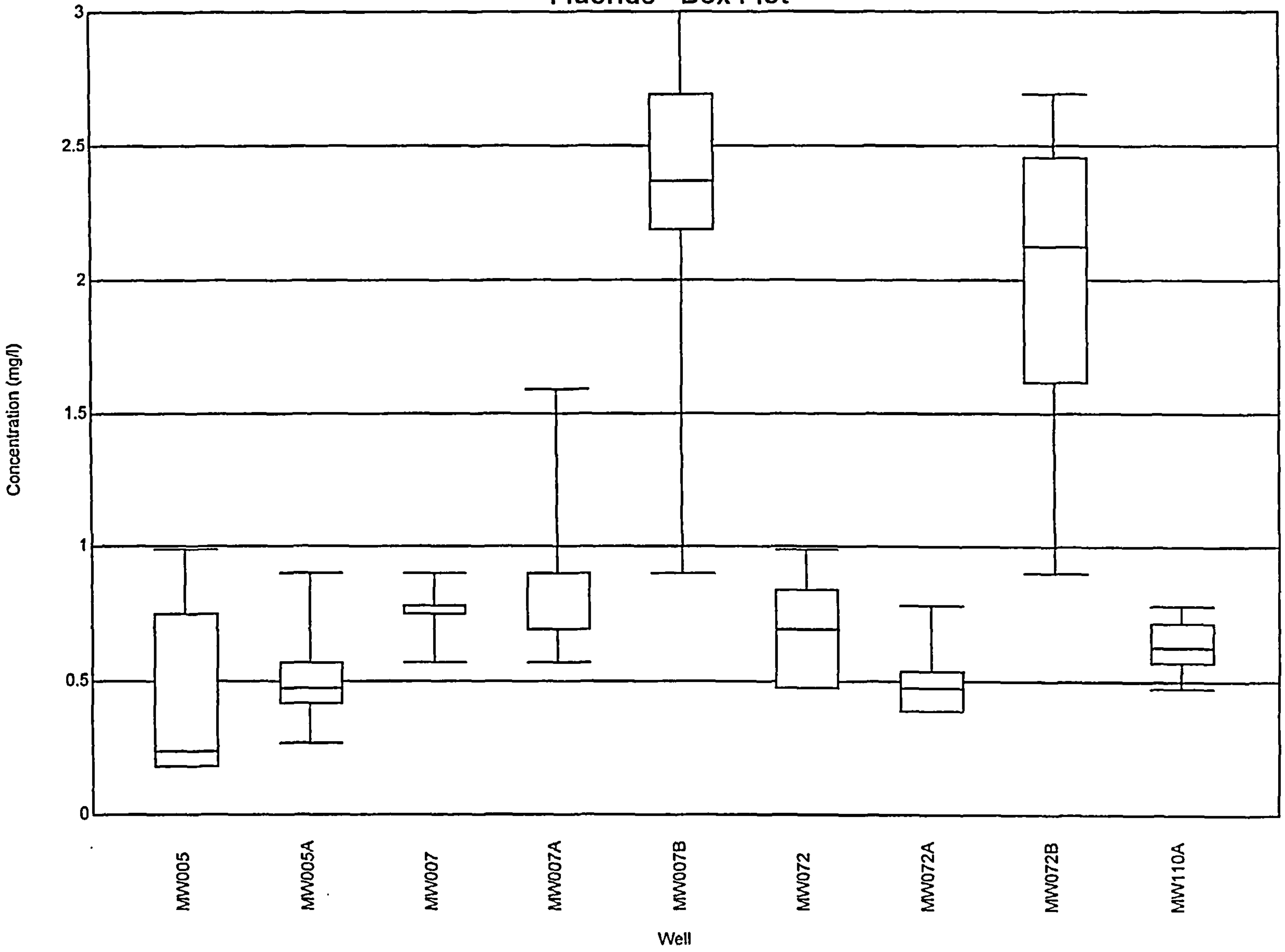


Figure 4

Nitrate - Box Plot

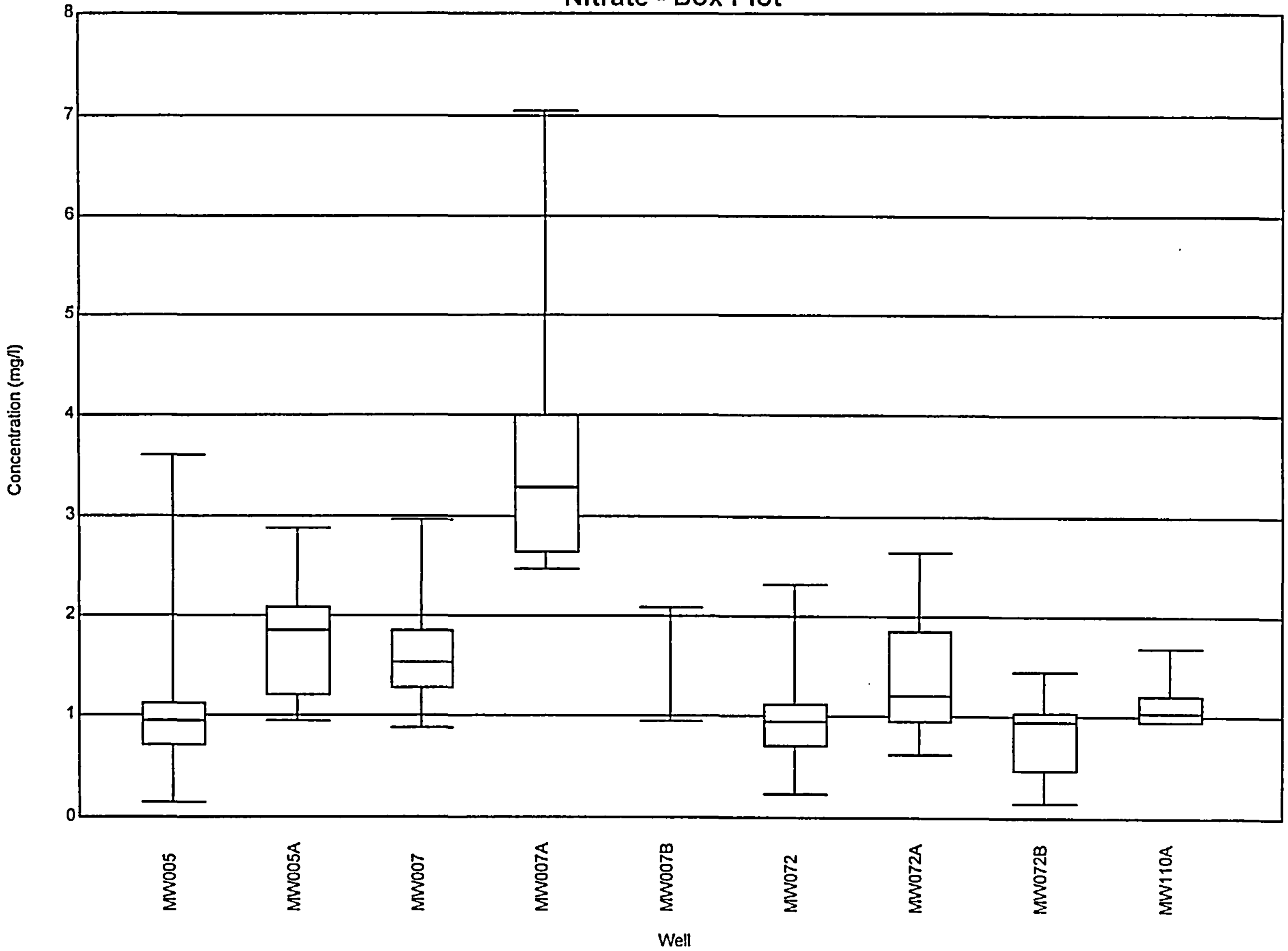


Figure 5

Uranium - Box Plot

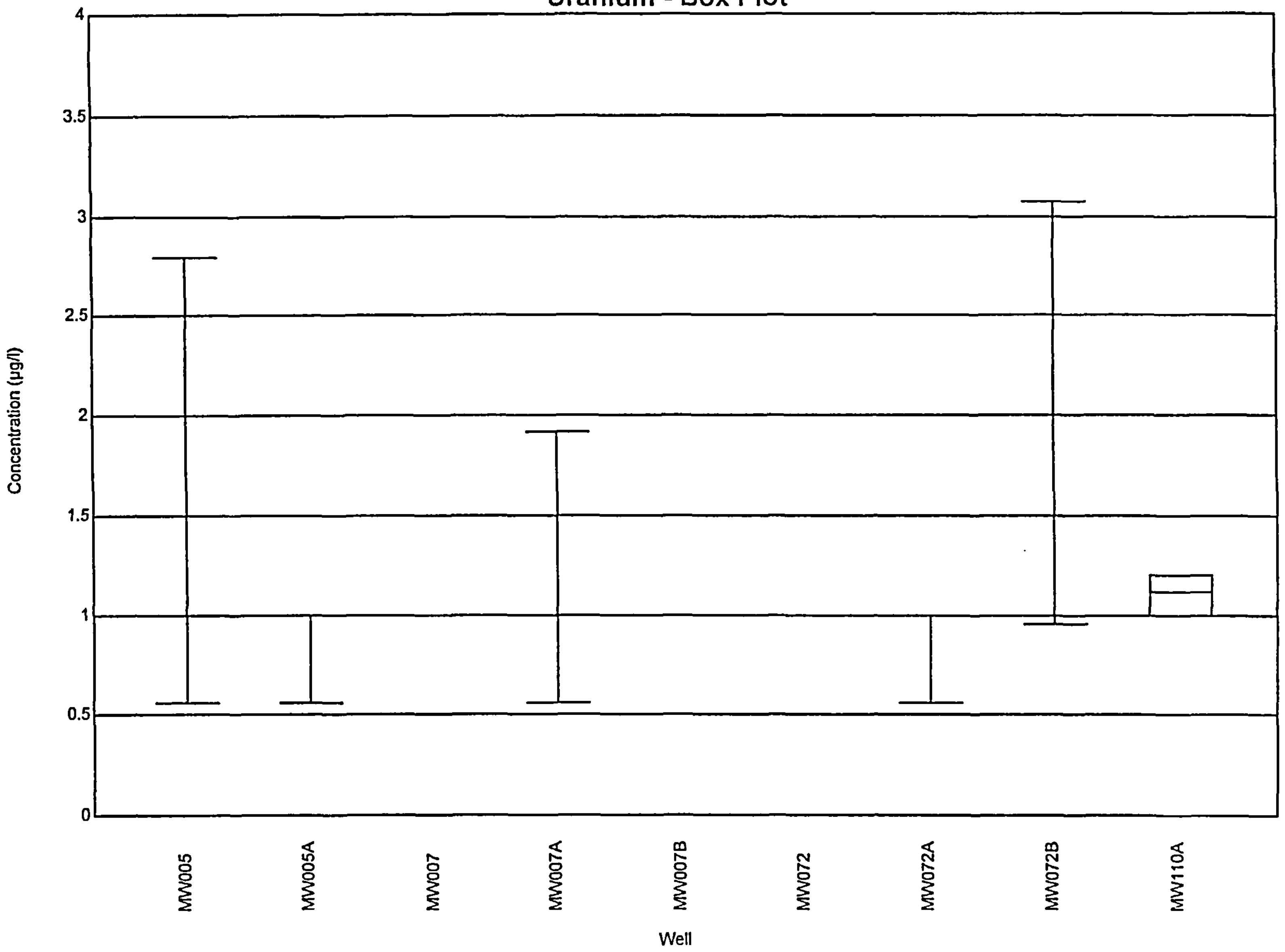


Figure 6

Arsenic - Multi-Well Time-Series Graph

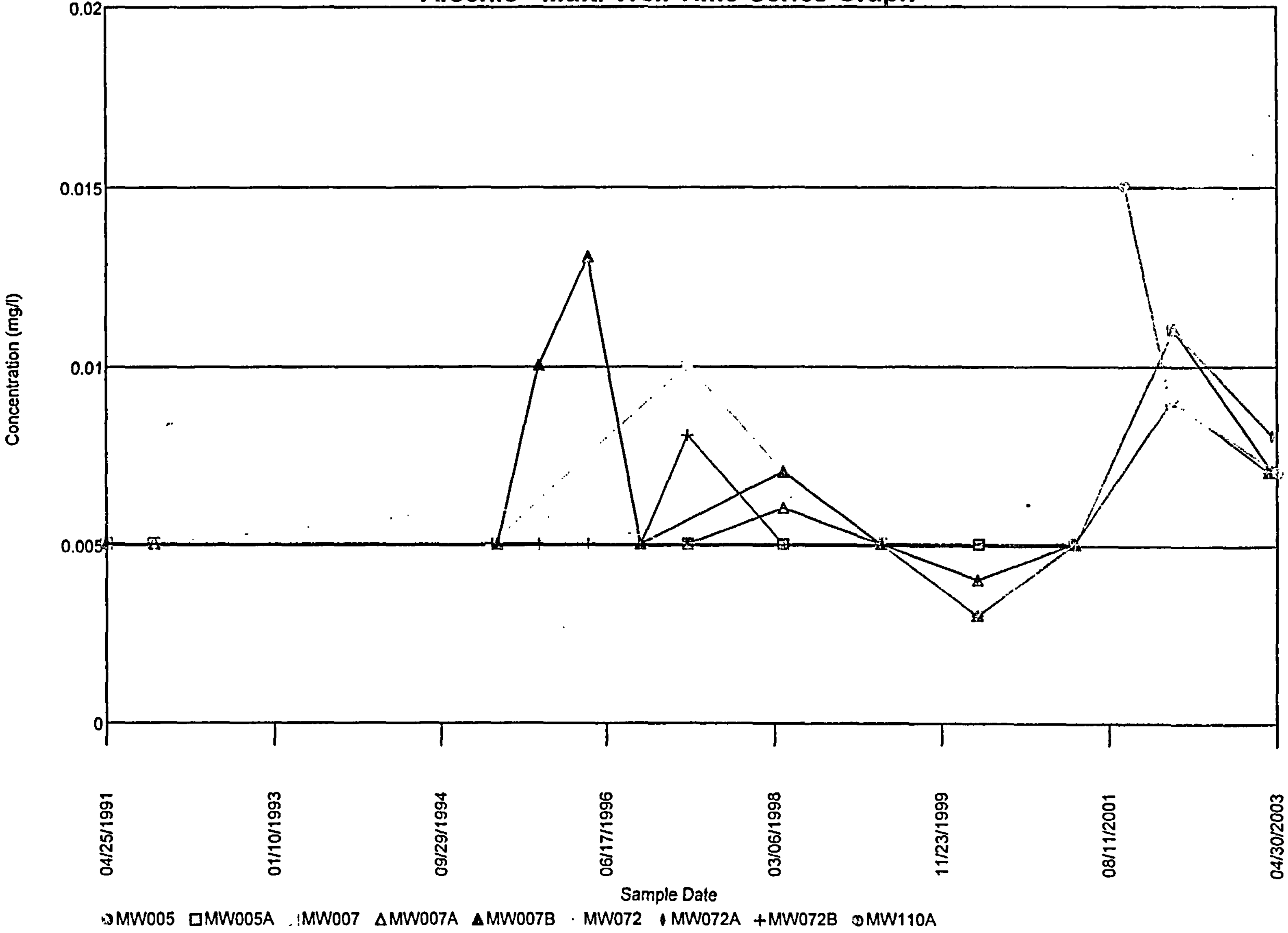


Figure 7

Fluoride - Multi-Well Time-Series Graph

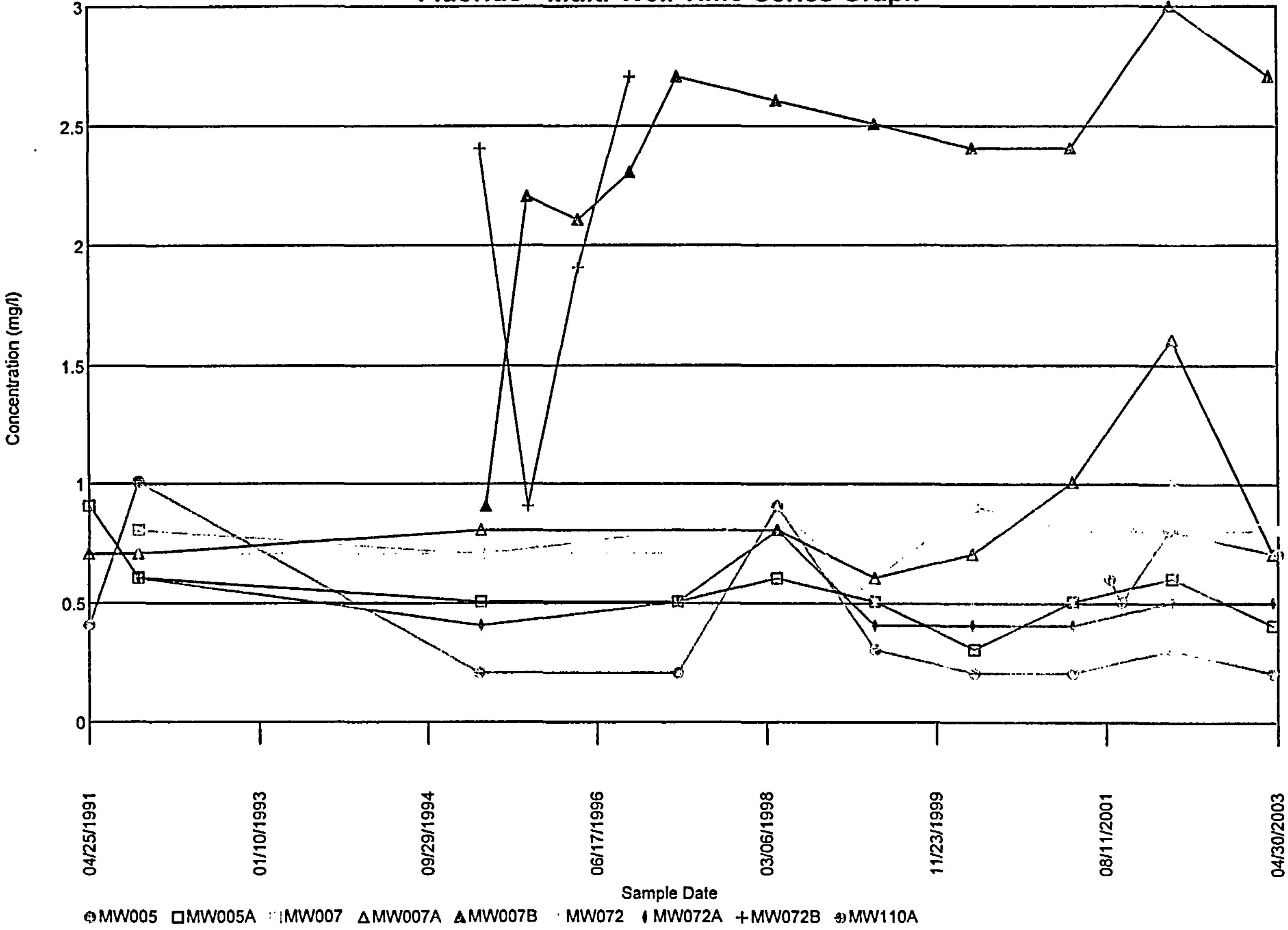


Figure 8

Nitrate - Multi-Well Time-Series Graph

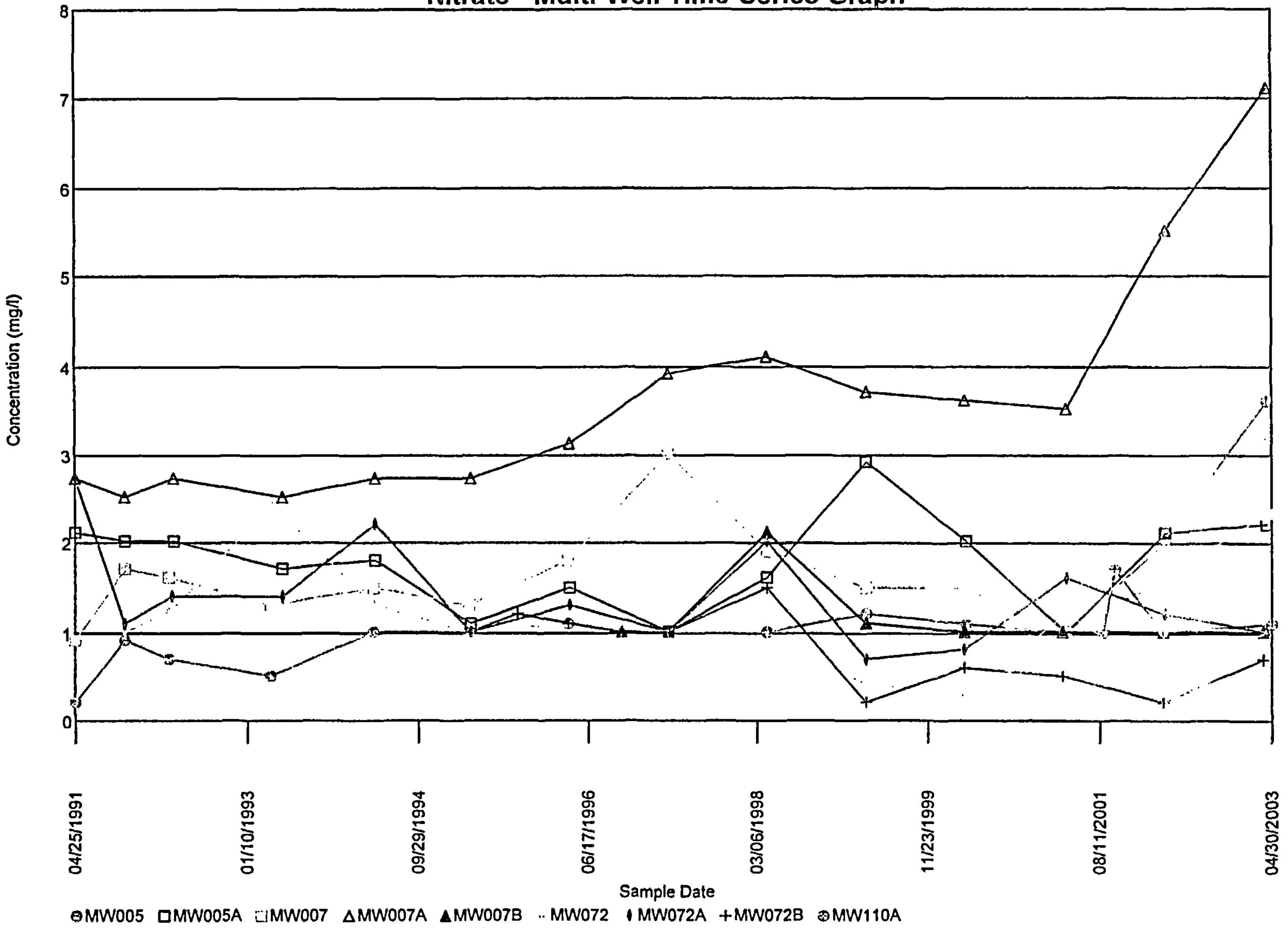
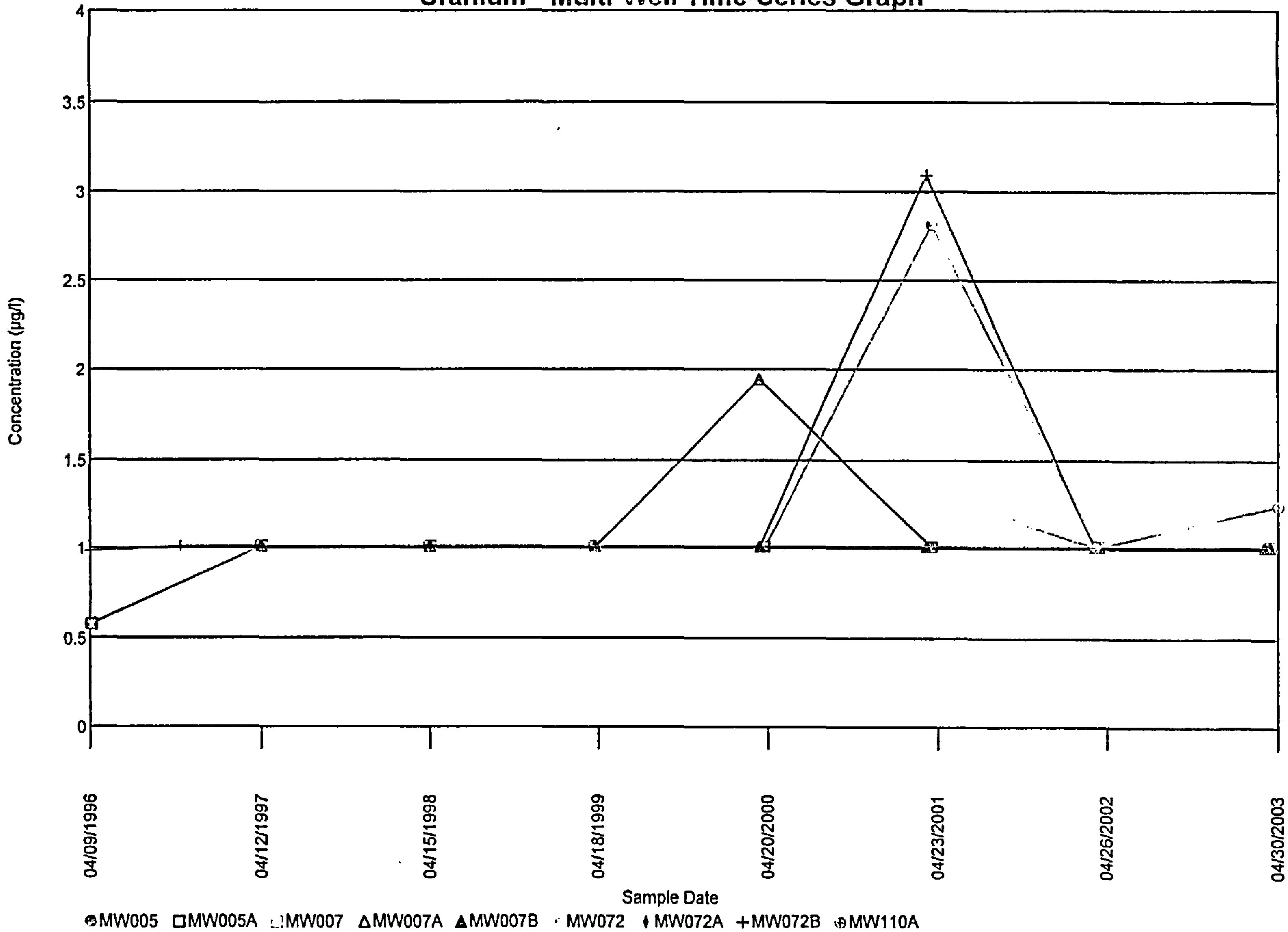
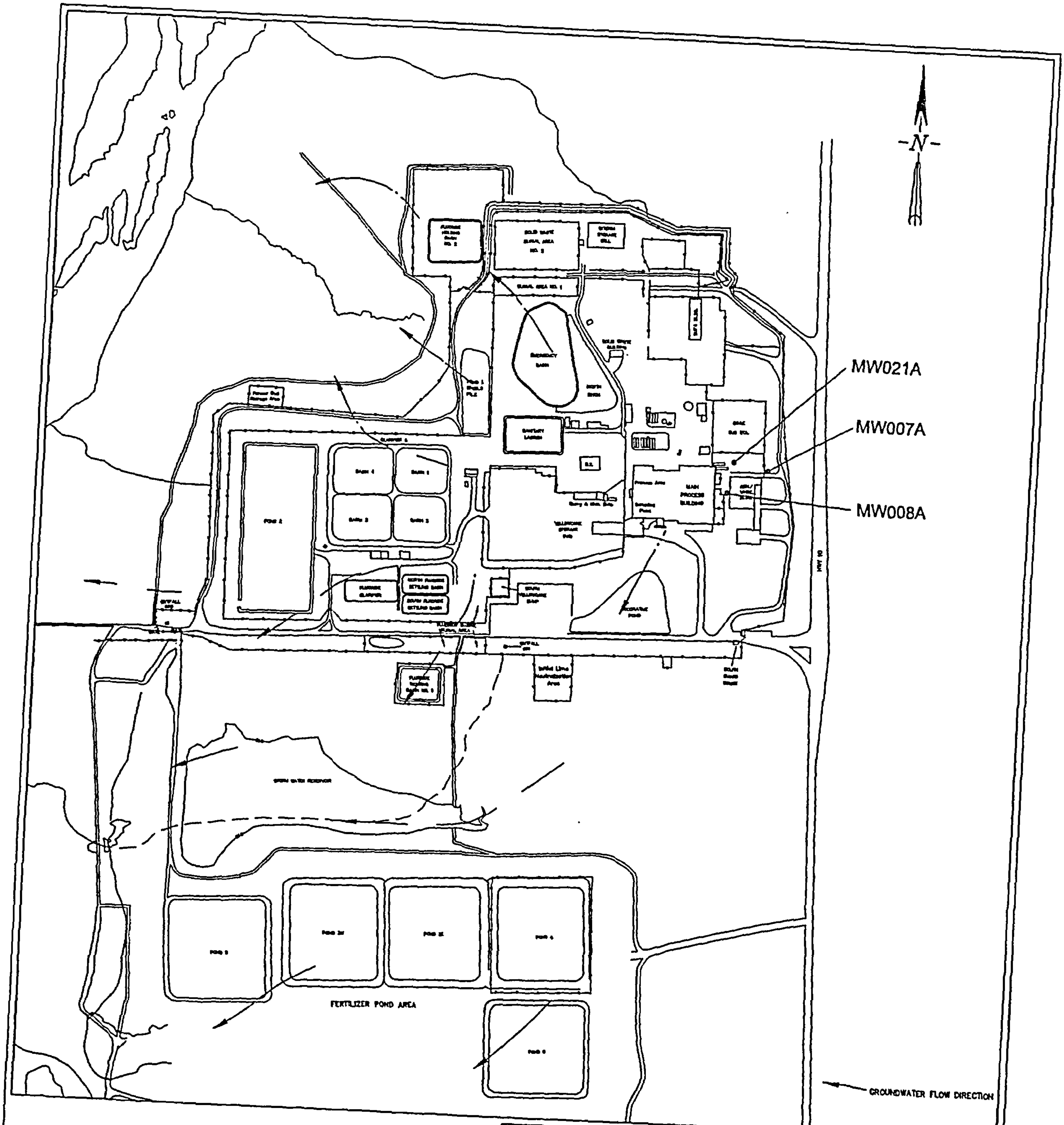


Figure 9

Uranium - Multi-Well Time-Series Graph



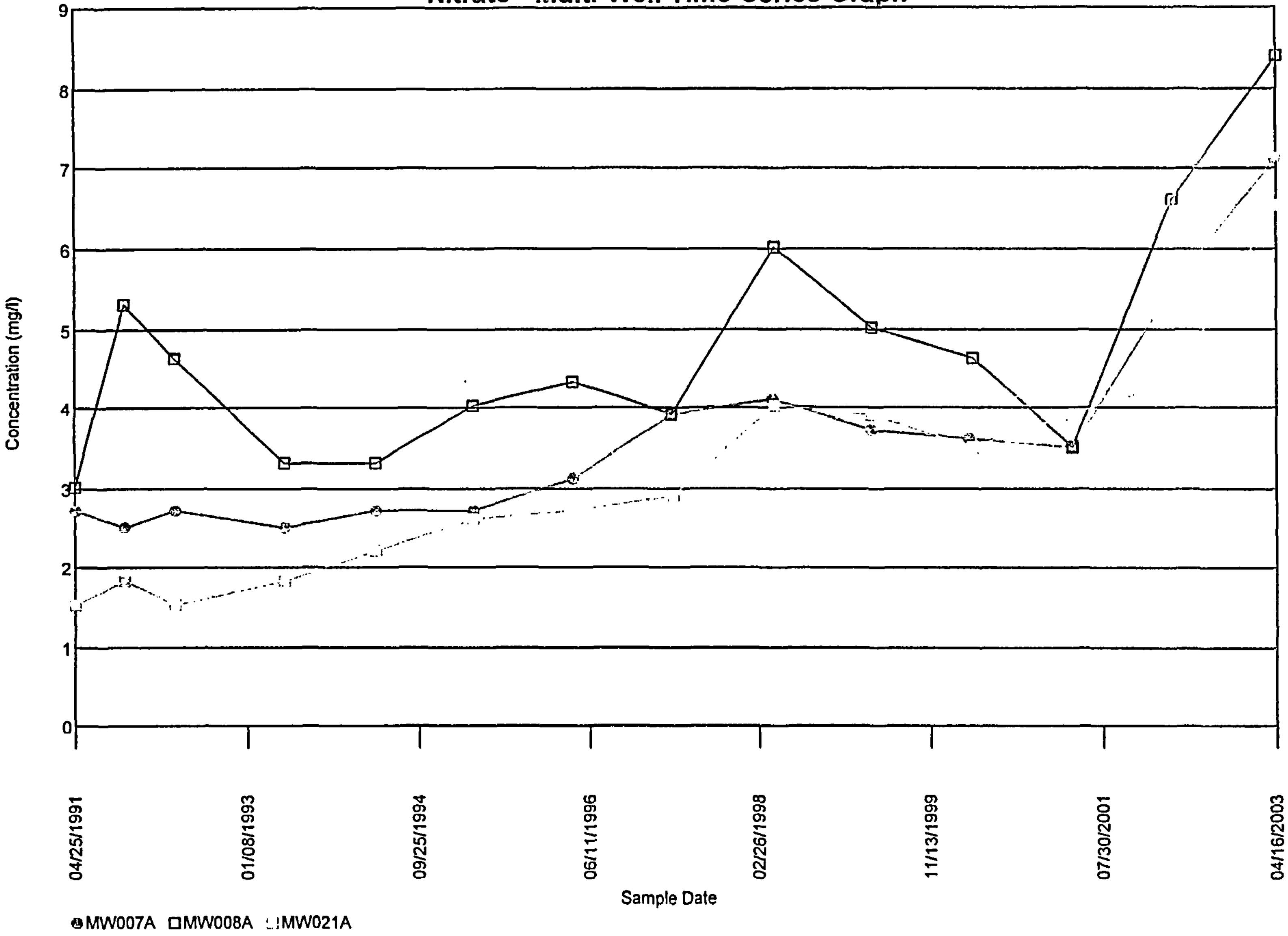


SEQUOYAH FUELS CORPORATION
Background Groundwater Monitoring Well Evaluation

TITLE: Location of MW007A, MW008A & MW021A	
PREPARED BY: SCM	FILENAME: Figure1.dwg
REVIEWED BY: SCM	FIGURE NO. 10
DATE: 26 Oct 2004	

Figure 11

Nitrate - Multi-Well Time-Series Graph



Attachment A

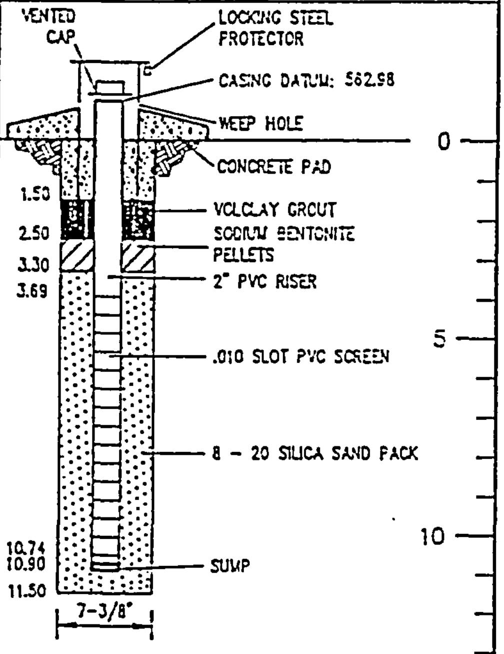
WELL COMPLETION RECORD

Start: 8:40
Stop: 9:15

GROUND SURFACE: 560.70

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE	INTERVAL	"N" VALUE
	0	CLAYEY SANDY SILT: 10 YR 4/2, DARK GRAYISH BROWN, ROOTLETS TO 2.0', TRACE OF GRAVEL, CLAYEY LENSE AT 0.9–1.0', GRADATIONAL LOWER BOUNDARY (0.6'), 60% SILT, 20% CLAY, 20% SAND	OL		1	4.5	
	2.0	SILTY CLAY: 2.5 Y 6/4, LIGHT YELLOWISH BROWN, MOTTLED 2.5 YR 4/8, RED, LOW PLAST., FIRM, SLIGHTLY MOIST, 65% CLAY, 35% SILT, GRAVEL LENSE AT 5.0–6.0'	CL		2 NR 3	 4.0	
	6.0	SHALE: 10 YR 5/8, YELLOWISH BROWN AND 10 YR 3/1, VERY DARK GRAY, FRACTURED AND HIGHLY WEATHERED, CLAY LENSES 2.5 Y 5/6, LIGHT OLIVE BROWN WITH 2.5 Y 7/0, LIGHT GRAY ELIPTICAL LENSES, THICK CLAY SHOWS AT 12.0–12.5'	SHALE		4 NR NR	 0.0	
	12.5	T.D. 12.5' NOTE: SANDSTONE AT 12.5'					

WELL COMPLETION DETAIL



NOTE: WELL INSTALLED IN SEPARATE BOREHOLE APPROXIMATELY 5 FEET FROM LITHOLOGICAL BOREHOLE. WELL BOREHOLE DRILLED TO 11.50 FEET.

▭ CME CONTINUOUS AUGER SAMPLER
☒ STANDARD PENETRATION TEST
▭ UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *SEQUOYAH\ 90067*
BORING NUMBER *MW–5 (BH–10)*

DATE DRILLED 9/27/90
DRILLING METHOD HSA
DRILLED BY PSI/SE
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR
PAGE 1 OF 1

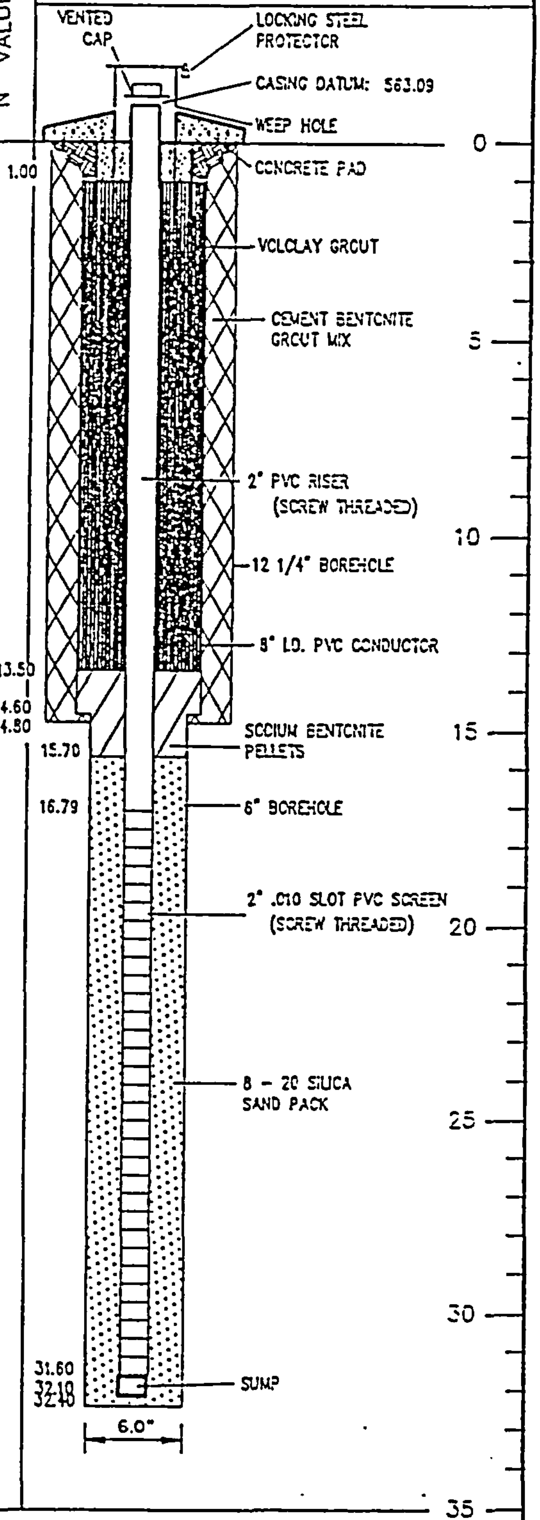
ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GROUND SURFACE: 560.50

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE	INTERVAL
	0	CLAYEY SANDY SILT: 10 YR 4/2, DARK GRAYISH BROWN, ROOTLETS TO 2.0', TRACE OF GRAVEL, CLAYEY LENSE AT 0.9-1.0', GRADATIONAL LOWER BOUNDARY (0.6'), 60% SILT, 20% CLAY, 20% SAND	CL	1	4.5
	2.0	SILTY CLAY: 2.5 Y 6/4, LIGHT YELLOWISH BROWN, MOTTLED 2.5 YR 4/8, RED, LOW PLAST., FIRM, SLIGHTLY MOIST, 65% CLAY, 35% SILT, GRAVEL LENSE AT 5.0-6.0'	CL	2 NR 3	 4.0
9/27/90 9.0'	6.0	SHALE: 10 YR 5/8, YELLOWISH BROWN AND 10 YR 3/1, VERY DARK GRAY, FRACTURED AND HIGHLY WEATHERED, CLAY LENSE 2.5 Y 5/6, LIGHT OLIVE BROWN WITH 2.5 Y 7/0, LIGHT GRAY ELIPTICAL LENSES	SHALE	4 NR 5	 2.5
	12.5	SANDSTONE: VERY FINE GRAIN SAND, 10 YR 5/3, BROWN, HARD	SANDSTONE	NS NS 1	
10/5/90 17.4	17.0	SANDY SHALE: VERY FINE GRAIN SAND, 10% SAND 10 YR 4/1, DARK GRAY, SLIGHTLY MOIST, HARD	SANDY SHALE	2	
	18.5	7.5 YR 2/0, BLACK, SLIGHTLY MOIST, HARD	SHALE	3 NS	
	21.0	SANDSTONE: VERY FINE GRAIN, 2.5 Y 4/0, VERY HARD	SANDSTONE	4 5	
	26.0	SANDY SHALE: VERY FINE GRAIN SAND, 2.5 Y 3/0, VERY DARK GRAY, HARD, VERY MOIST	SHALE	6	
	28.0	SILTY SAND: VERY FINE GRAIN SAND, 2.5 Y 3/0, VERY DARK GRAY, VERY HARD	SILTY SAND	7	
	30	SANDY SHALE: VERY FINE GRAIN SAND, 10% SAND, 2.5 Y 3/0, VERY DARK GRAY, HARD, SATURATED	SANDY SHALE	8 9	
	32.4	T.D. 32.4'			
	35				

WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *SEQUOYAH\ 90067*

BORING NUMBER *MW-5A (BH-10 & BH-10A)*

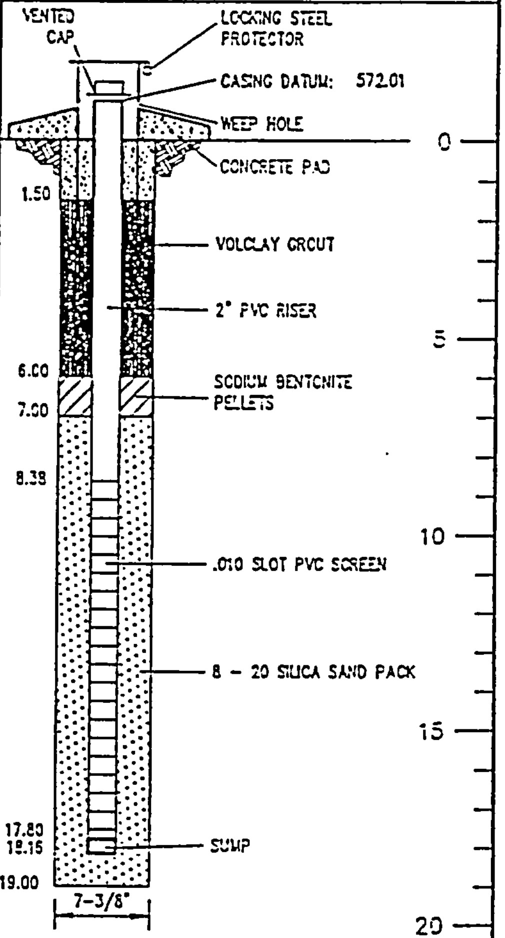
DATE DRILLED 10/5/90
DRILLING METHOD AIR ROTARY
DRILLED BY POOL
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR PAGE 1 OF 1

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE INTERVAL		"N" VALUE
		GROUND SURFACE: 569.90				
	0	CLAYEY SANDY SILT: 10 YR 4/2, DARK GRAYISH BROWN, ROOTLETS, GRASS, 65% SILT, 20% CLAY, 15% SAND	CL	1	3.0	
	1.5	CLAYEY SILTY GRAVEL: 5 YR 5/8, YELLOWISH RED, SLIGHTLY MOIST, 50% GRAVEL, 30% CLAY, 20% SILT	GC	2		
	3.0	SILTY CLAY: 2.5 Y 6/4, LIGHT YELLOWISH BROWN, LOW PLAST., SLIGHTLY MOIST, GRAVEL LENSES 5.0–6.0'	CL	NR 3 NR	 0.8	
	8.0	SHALE: 2.5 Y 5/4, LIGHT OLIVE BROWN INTERBEDDED WITH 2.5 Y 3/0, VERY DARK GRAY, HIGHLY WEATHERED, FRACTURED, OXIDATION ALONG BEDDING PLANES AT 9.0' TO TD.	SHALE	4 NR 5 NR	0.5 0.5	
	20	T.D. 20.0' NOTE: SANDSTONE AT 20.0'				

WELL COMPLETION DETAIL



NOTE: WELL INSTALLED IN SEPARATE BOREHOLE APPROXIMATELY 5 FEET FROM LITHOLOGICAL BOREHOLE. WELL BOREHOLE DRILLED TO 19.00 FEET.

▱ CME CONTINUOUS AUGER SAMPLER	─ ─ WATER TABLE (TIME OF BORING)
☒ STANDARD PENETRATION TEST	L LABORATORY TEST LOCATION
☐ UNDISTURBED SAMPLE	+ PENETROMETER (TONS/SQ. FT.)
═ WATER TABLE (24 HOURS)	

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ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

JOB NAME/NUMBER *SEQUOYAH\ 90067*

BORING NUMBER *MW-7 (BH-14)*

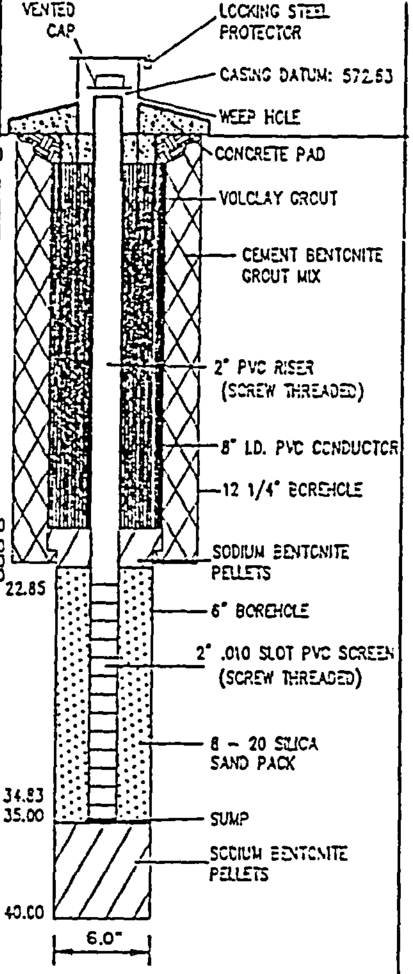
DATE DRILLED 9/27/90
DRILLING METHOD HSA
DRILLED BY PS/SE
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR PAGE 1 OF 1

WELL COMPLETION RECORD

GROUND SURFACE: 570.20

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE	INTERVAL	"N" VALUE
	0	CLAYEY SANDY SILT: 10 YR 4/2, DARK GRAYISH BROWN, ROOTLETS, GRAVEL, 65% SILT, 20% CLAY, 15% SAND	OL	1	3.0	
	1.5	CLAYEY SILTY GRAVEL: 5 YR 5/8, YELLOWISH RED, SLIGHTLY MOIST, 50% GRAVEL, 30% CLAY, 20% SILT	GC	2		
	3.0	SILTY CLAY: 2.5 Y 6/4, LIGHT YELLOWISH BROWN, LOW PLAST., GRAVEL LENSE AT 5.0–6.0', SLIGHTL MOIST	CL	NR 3 NR	 0.9 	
10/5/90 ▽ 15.2'	8.0	SHALE: 2.5 Y 5/4, LIGHT OLIVE BROWN, INTERBEDDED 2.5 Y 3/0, VERY DARK GRAY, HIGHLY WEATHERED, FRACTURED, OXIDIZED ZONES, GROUNDWATER AT 15.2–15.4', OXIDATION ALONG BEDDING PLANES AT 9.0 TO T.D.	SHALE	4 NR 5 NR	0.5 0.5	
	20	SANDSTONE: 10 YR 5/3, BROWN, VERY FINE GRAIN VERY HARD	SANDSTONE	NS		
	20.5	SHALE: 7.5 YR 4/0, DARK GRAY, VERY HARD, SLIGHTLY MOIST, MINOR VERY FINE GRAIN SAND, INCREASES WITH DEPTH	SHALE	1		
	24.0	SILTY SANDSTONE: VERY FINE GRAIN SAND, 40% SILT, 7.5 YR 4/0, DARK GRAY, SLIGHTLY MOIST, HARD	SILTY SANDSTONE	2 NS		
	29.0	SANDSTONE: VERY FINE GRAIN, 7.5 YR 3/0, VERY DARK GRAY, VERY HARD, SLIGHTLY MOIST	SANDSTONE	3		
	32.0	SANDY SHALE: 20% VERY FINE GRAIN SAND, 7.5 YR 4/0, DARK GRAY, SLIGHTLY MOIST, HARD	SANDY-SHALE	NS 4 NS		
	40	T.D. 40.0' WATER LEVEL 33.7' AFTER DRILLING				

WELL COMPLETION DETAIL



▱	CME CONTINUOUS AUGER SAMPLER
☒	STANDARD PENETRATION TEST
☐	UNDISTURBED SAMPLE
▽	WATER TABLE (24 HOURS)
▽	WATER TABLE (TIME OF BORING)
L	LABORATORY TEST LOCATION
+	PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *SEQUOYAH\ 90067*

BORING NUMBER *MW-7A (BH-14 & BH-14A)*

DATE DRILLED 10/5/90
DRILLING METHOD AIR ROTARY
DRILLED BY PCOL
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR PAGE 1 OF 1

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ENVIRONMENTAL CONSULTANTS
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NORMAN, OKLAHOMA 73072
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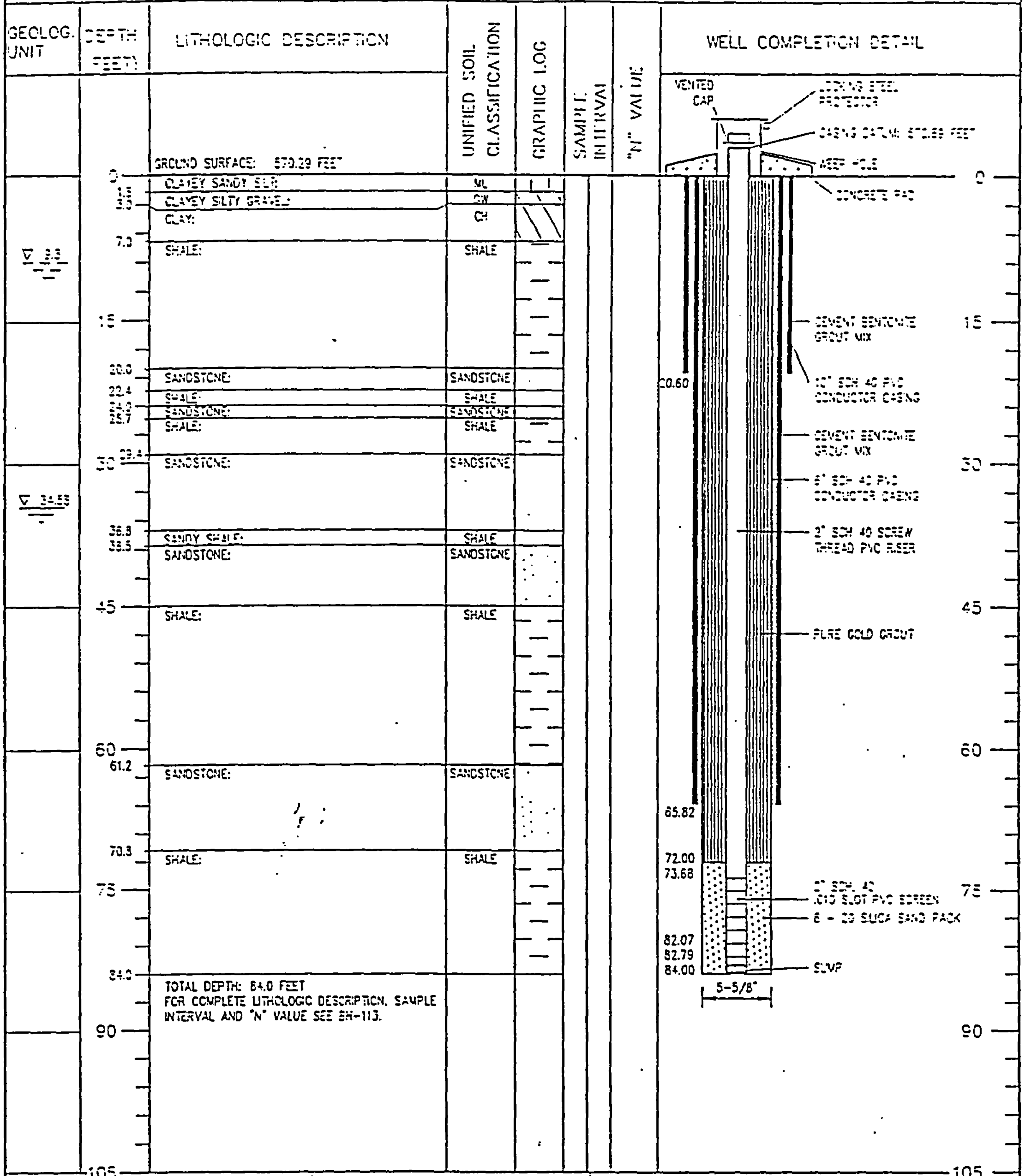
WELL COMPLETION RECORD



GROUND SURFACE: 570.29 FEET

Depth (feet)	Lithologic Description	Unified Soil Classification
0	CLAYEY SANDY SILT:	ML
1.5	CLAYEY SILTY GRAVEL:	GW
3.5	CLAY:	CH
7.0	SHALE:	SHALE
20.0	SANDSTONE:	SANDSTONE
22.4	SHALE:	SHALE
24.0	SANDSTONE:	SANDSTONE
25.7	SHALE:	SHALE
29.4	SANDSTONE:	SANDSTONE
36.8	SANDY SHALE:	SHALE
38.5	SANDSTONE:	SANDSTONE
45	SHALE:	SHALE
61.2	SANDSTONE:	SANDSTONE
70.3	SHALE:	SHALE
84.0	TOTAL DEPTH: 84.0 FEET FOR COMPLETE LITHOLOGIC DESCRIPTION, SAMPLE INTERVAL AND "N" VALUE SEE BH-113.	

▨	CME CONTINUOUS AUGER SAMPLER
☒	STANDARD PENETRATION TEST
☐	UNDISTURBED SAMPLE
═	WATER TABLE (24 HOURS)
∇	WATER TABLE (TIME OF BORING)
L	LABORATORY TEST LOCATION
+	PENETROMETER (TONS/SQ. FT.)
NR:	NO RECOVERY

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NORMAN, OKLAHOMA 73072
(405) 321-3895

JOB NAME/NUMBER *SEQUOYAH FUELS 93092.11*

BORING NUMBER *MW-7B (BH-113)*

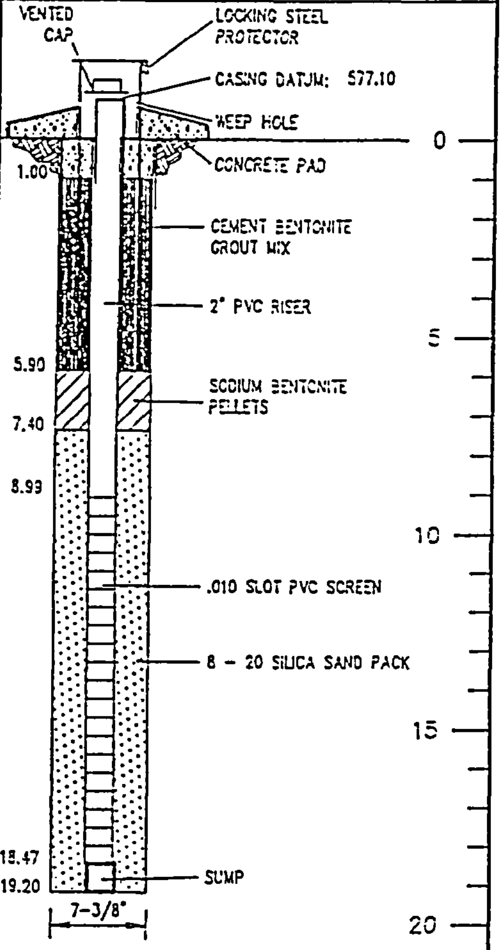
DATE DRILLED 2/7/95. 2/27-3/3/95
DRILLING METHOD HSA/AIR ROTARY
DRILLED BY LWC
LOGGED BY MJL
CHECKED BY BJS
DRAWING NO. 93092.11 B01
DRAWN BY: RML
PAGE 1 OF 1

WELL COMPLETION RECORD

GROUND SURFACE: 574.22

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE	INTERVAL	"N" VALUE
	0	TOPSOIL:		1	2.3	
	0.6	GRAVELLY SANDY CLAYEY SILT: BACKFILL, WET, SOFT, MED-LOW PLAST., NON-STRAT., 7.5 YR 4/4 TO 5/8, BROWN TO STRONG BROWN, 10% GRAVEL, 15% SAND, VERY FINE-FINE GRAIN, RND-SUBRND,M 15% CLAY, 60% SILT	ML	NR 2	2.5	
	5	GRAVELLY SILTY CLAY: BACKFILL 7.5 YR 4/6, STRONG BROWN, MOIST, NON-STRAT., 15% GRAVEL, 15% SILT, 70% CLAY	CH	3 NR		
	9.1	CLAY: 7.5 YR 7/8 TO 7/0, REDDISH YELLOW TO LIGHT GRAY, MOIST, FIRM, MOTTLED, FINE LAMINATIONS, MED PLAST.	CL	4 5	5.0	
	11.4	WEATHERED SHALE: 7.5 YR 7/8 TO 3/0 TO 7/0, REDDISH YELLOW TO VERY DARK GRAY TO LIGHT GRAY, MOIST, VERY THIN LAMINATIONS 16.7-16.8', REDUCTED FE ZONE, GRADES TO 7/8 TO 3/0 WITH NO 7/0 BY 14.0'	SHALE	6 7 8 NR 9	3.5 1.5	
	20.5	T.D. 20.5'				

WELL COMPLETION DETAIL



NOTE: WELL INSTALLED IN SEPARATE BOREHOLE APPROXIMATELY 5 FEET FROM LITHOLOGIC BOREHOLE. WELL BOREHOLE DRILLED TO 19.20 FEET.

▱	CME CONTINUOUS AUGER SAMPLER
☒	STANDARD PENETRATION TEST
▭	UNDISTURBED SAMPLE
≡	WATER TABLE (24 HOURS)
≡	WATER TABLE (TIME OF BORING)
L	LABORATORY TEST LOCATION
+	PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER SEQUOYAH\ 90067

BORING NUMBER MW-72 (BH-82)

DATE DRILLED 12/10/90
DRILLING METHOD HSA
DRILLED BY FSI
LOGGED BY TPG
CHECKED BY BJS
DRAWN BY: SAR PAGE 1 OF 1

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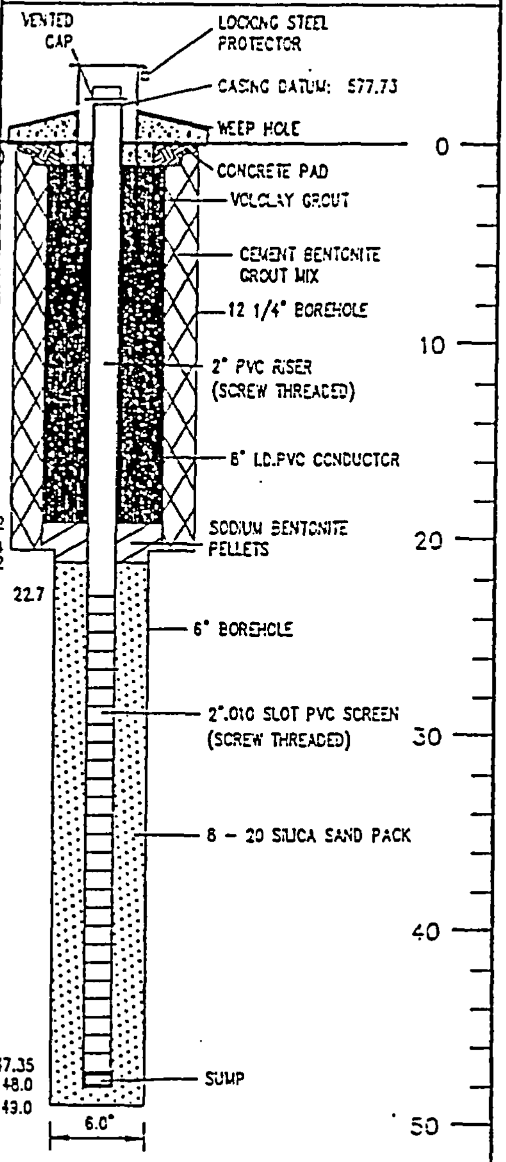
WELL COMPLETION RECORD

GROUND SURFACE: 575.10

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE INTERVAL
	0.6	TOPSOIL:		
	5.0	GRAVELLY SANDY CLAYEY SILT: BACKFILL, WET, SOFT, MED-LOW PLAST., NON-STRAT., 7.5 YR 4/4 TO 5/8, BROWN TO STRONG BROWN, 10% GRAVEL, 15% SAND, VERY FINE-FINE GRAIN, RND-SUBRND, 15% CLAY, 60% SILT	ML	1 2.3 NR 2 2.5
	9.1	GRAVELLY SILTY CLAY: BACKFILL, 7.5 YR 4/6, STRONG BROWN, MOIST, NON-STRAT., 15% GRAVEL 15% SILT, 70% CLAY	CH	NR
	11.4	CLAY: 7.5 YR 7/8 TO 7/0, REDDISH YELLOW TO LIGHT GRAY, MOIST, FIRM, MOTTLED, FINE LAMINATIONS, MED-PLAST.	CL	4 5.0
	19.2	WEATHERED SHALE: 7.5 YR 7/8 TO 3/0 TO 7/0, REDDISH YELLOW TO VERY DARK GRAY TO LIGHT GRAY, MOIST, VERY THIN LAMINATIONS 16.7-16.8', REDUCED FE ZONE, GRADES TO 7/8 TO 3/0 WITH NO 7/0 BY 14.0'	SHALE	5 6 7 3.5 8 NR
		WEATHERED SHALE:	SHALE	9 1.5
	20.4	CONDUCTOR CASING	SHALE	NS
		SHALE: 2.5 Y 5/4, LIGHT OLIVE BROWN, SOFT, MOIST TO WET, WEATHERED		1 2 3 4
▽ 29.0'	29.0	SHALE: 2.5 Y 2/0, BLACK, SOFT, WET, FISSILE, ORGANIC	SHALE	
		SANDSTONE: 2.5 Y 6/0, GRAY, HARD, SLIGHTLY MOIST, FINE GRAIN. CHANGED COLOR TO 2.5 Y 4/0, DARK GRAY AT 37.5', MODERATELY HARD BECOMES 2.5 Y 2/0, BLACK AND SHALEY AT 43.0'	SANDSTONE	5 6 7 8 9 10 11 12
	22.8	SHALE: 2.5 Y 2/0, BLACK, SOFT, WET, FISSILE, ORGANIC	SHALE	13
	24.5	T.D. 49.0'		



▨	CME CONTINUOUS AUGER SAMPLER
☒	STANDARD PENETRATION TEST
☐	UNDISTURBED SAMPLE
▽	WATER TABLE (24 HOURS)
▽	WATER TABLE (TIME OF BORING)
L	LABORATORY TEST LOCATION
+	PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *SEQUOYAH\90067*

BORING NUMBER *MW-72A (BH-82)*

DATE DRILLED 1/14/91
DRILLING METHOD AIR ROTARY
DRILLED BY PCOL
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR PAGE 1 OF 1

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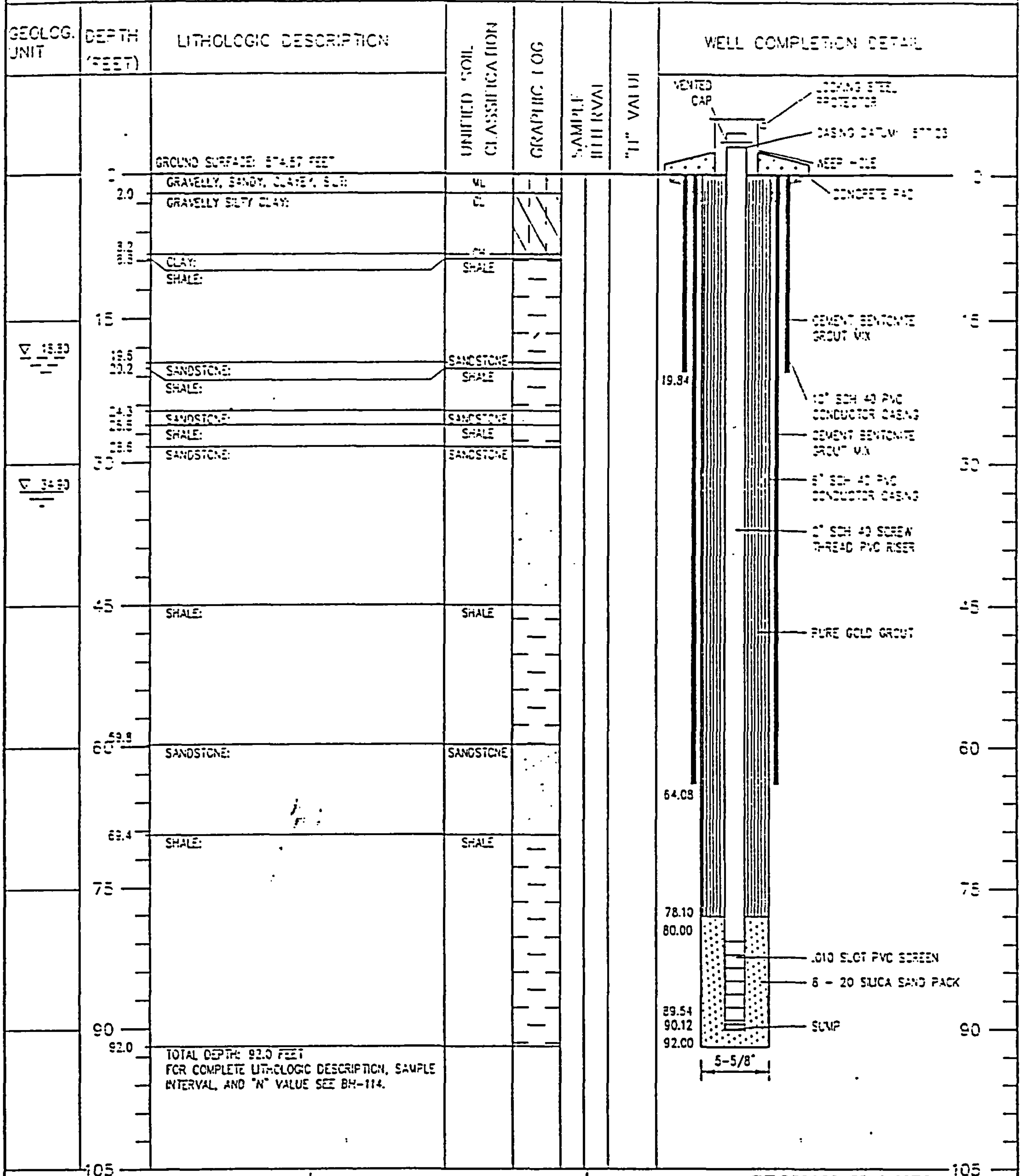
WELL COMPLETION RECORD



CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

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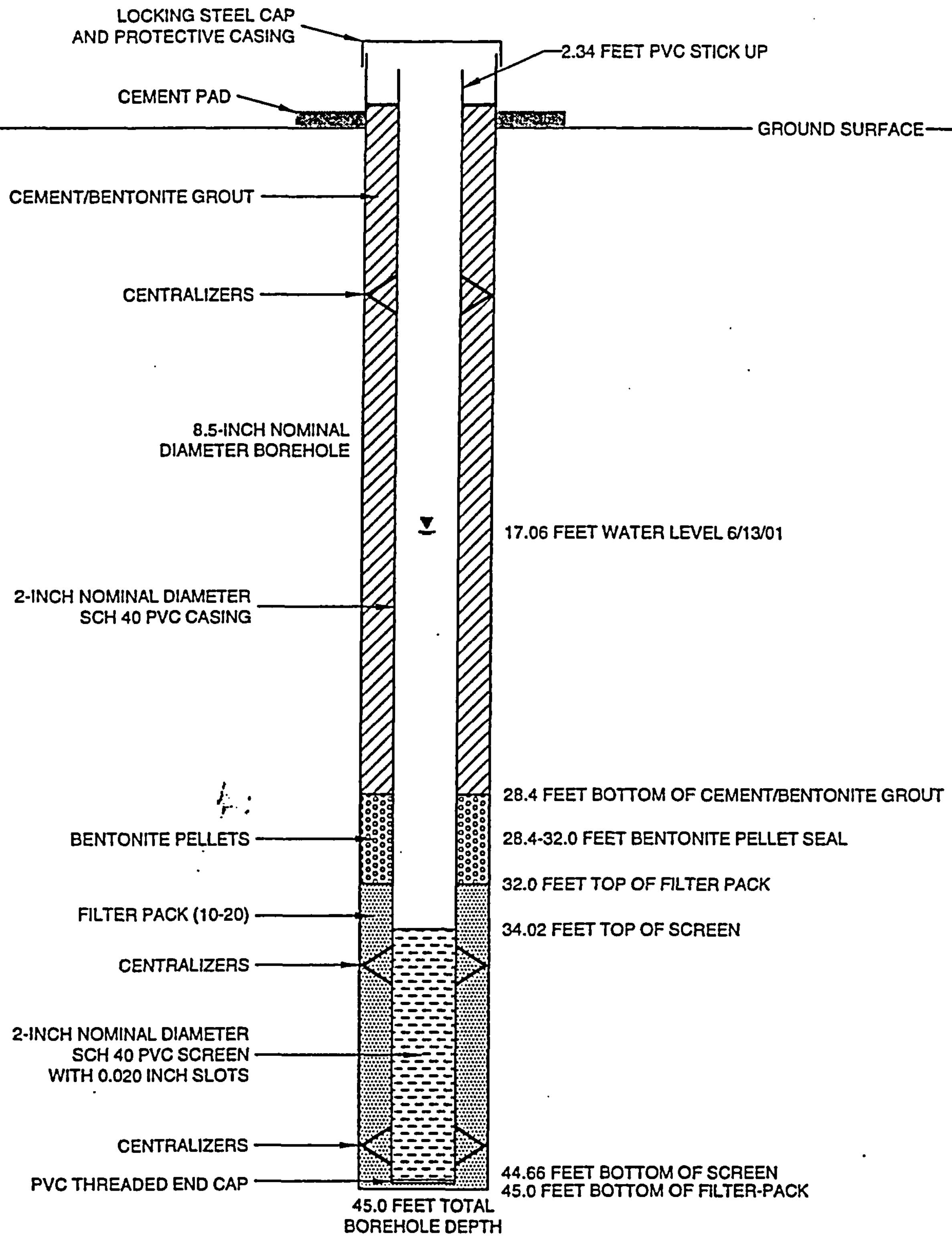
JOB NAME/NUMBER *SEQUOYAH FUELS 93092.11*

BORING NUMBER *MW-72B (BH-114)*

DATE DRILLED 2/8/95, 2/17/95, 2/20-24/95
DRILLING METHOD HSA/AIR ROTARY
DRILLED BY LWC
LOGGED BY MJL
CHECKED BY BJS
DRAWING NO. 93092502
DRAWN BY: RML
PAGE 1 OF 1



NOTE:
NOT TO SCALE
ALL DEPTHS ARE BELOW GROUND SURFACE

SHEPHERD MILLER
INCORPORATED

MW-110A

Date:	JUNE 2001
Project:	100734
File:	WC-MW

BORING LOG

SHEPHERD MILLER
INCORPORATED

BORING NO.
BH327 (mw116A)

PROJECT: SEQUOYAH FUELS
PAGE: 1 of 2
PROJECT NO.: 100734
DATE: 5/15/01
NORTHING: 194737.5
EASTING: 2838430.0
GROUND ELEVATION: 549.5
DRILLING COMPANY: PETERSON
DRILLING METHOD: HSA SPLIT SPOON -CORE
DRILLER: TROY LUCAS
LOGGED BY: E. MULLER

DEPTH (FT)	GEOLOGY UNIT	TIME	(FT) RECOVERY	LITHOLOGY GRAPHIC	DESCRIPTION / NOTES
0	COLLUVIUM	10:45	0		BLIND DRILED -NO RECOVERY.
2		11:00	2		SC-SM CLAYEY, SILTY SAND WITH 50 % VERY FINE SAND, 5 % MED. TO COARSE SAND, AND 45 % SILT AND CLAY. SAND SUBRND. TO RND. QTZ. INTERVAL SLIGHTLY COHESIVE, DRY TO SLIGHTLY MOIST, VERY PALE BROWN (10YR, 8/3). ROOTS ABUNDANT THROUGHOUT.
4 5		11:10	2.5		SC - CLAYEY SAND WITH 70 % VERY FINE SAND, 30 % CLAY, AND AN OCCASIONAL FINE TO MEDIUM GRAVEL. SAND SUBRND. TO RND. QTZ., GRAVEL SUBRND. SS. INTERVAL DRY TO SLIGHTLY MOIST, SLIGHTLY COHESIVE, VERY PALE BROWN (10YR, 8/3).
6		11:20	2.0		MC - SANDY CLAY WITH ABOUT 80 % CLAY AND 20 % VERY FINE, RND. TO SUBRND. QTZ. SAND. INTERVAL SLIGHTLY MOIST, MEDIUM PLASTIC, VERY PALE BROWN (10YR, 8/3) WITH ABUNDANT YELLOWISH BROWN IRON OXIDE STAINING.
7.5 8	1 SH	11:31	1.8		SHALE - COMPLETELLY WEATHERED. VERY FINE SILT WITH WEAK, SUBPARALLEL, THIN (0.1MM) PARTINGS. INTERVAL SOFT, DRY, FRIABLE, VERY PALE BROWN TO YELLOWISH BROWN (10YR, 8/3) TO (10YR, 5/6).
10	1 SS				SAME AS 7.5'-8'. REFUSAL AT 10'.
					SANDSTONE - VERY HARD, MASSIVE, CONSISTS OF VERY FINE TO FINE, SUBRND. TO RND. QTZ., SUCROSIC. PALE YELLOWISH BROWN (10YR, 6/2) FROM 10.0' TO 10.4' WITH ABUNDANT IRON OXIDE MINERALS. LIGHT GRAY (N7) WITH MEDIUM DARK GRAY (N4) MOTTLING FROM 10.4' TO 14.8'. REACTS SLIGHTLY IN HCL.
14.8 15	2 SH	13:00	10.2		SHALE - SANDY SHALE WITH ABOUT 20 % VERY FINE RND. QTZ. SAND. INTERVAL VERY THINNLY LAMINATED, VERY SOFT, CRUMBLES EASILY, DARK GRAY (N3) TO GRAYISH BLACK (N2).
15.7	2 SS				SANDSTONE - MED. HARD, CONSISTING OF VERY FINE, RND. TO SUBRND. QTZ. LIGHT GRAY (N7) WITH MED. DARK GRAY (N4) MOTTLING. REACTS SLIGHTLY IN HCL.
16.7	3 SH				SHALE - SOFT, VERY THINNLY LAMINATED, GRAYISH BLACK (N2). CRUMBLY FROM 16.7' TO 17.1'.
18.9	3 SS				SANDSTONE - MED. HARD, LIGHT GRAY (N7) WITH MED. DARK GRAY (N4) MOTTLING. CONSISTS OF VERY FINE TO FINE, RND. QTZ.
20		17:20	9.9		SANDSTONE - HARD, MED. DARK GRAY (N4), MASSIVE, CONSISTS OF FINE GRAINED, RND. QTZ.
24.2 25	4 SH				SHALE - BLACK (N1), VERY SOFT, FISSILE.
30					SEE ABOVE.

BORING LOG

SHEPHERD MILLER
INCORPORATED

BORING NO.
BH327

PROJECT: SEQUOYAH FUELS PAGE: 2 of 2
PROJECT NO.: 100734 DATE: 5/15/01
NORTHING: 194737.5 EASTING: 2838430.0 GROUND ELEVATION: 549.5
DRILLING COMPANY: PETERSON DRILLING METHOD: HSA SPLIT SPOON -CORE
DRILLER: TROY LUCAS LOGGED BY: E. MULLER

DEPTH (FT)	GEOLOGY UNIT	TIME	(FT) RECOVERY	LITHOLOGY GRAPHIC	DESCRIPTION / NOTES
30				▥	SHALE - SEE ABOVE.
35	4 SH	18:30	10.0	▥	
40				▥	
40.6				░	SANDSTONE - SHALEY SANDSTONE, SLIGHTLY HARD, BLACK (N1) FROM 40.6' TO 42.3', GRADING TO HARD, MED. LIGHT GRAY (N6) SANDSTONE WITH DARK GRAY (N4), MM THICK PLANAR LAMINATIONS FROM 47.2' TO 47.8'. CONSISTS OF V. FINE, RND. TO SUBRND. QTZ. REACTS SLIGHTLY IN HCL.
45	4 SS	8:55 5/16/01	8.1	░	
50					TD
55					
60					

Attachment B

Dixon's Test for Outliers

For 3 to 25 Samples

Description:

Dixon's test provides a method of screening for outlier concentrations for data sets with 25 or fewer measurements. The method is iterative. In each iteration of the test, the highest or lowest outlier value is revealed. The next iteration is performed on the remaining values. Iterations continue until no data are shown to be outliers.

In each iteration, the highest and lowest critical values are calculated using a formula selected based on the number of data not yet shown to be outliers. These formulas are provided by Gibbons (1994). The critical value is then compared to tabulated comparison values based on the number of measurements now yet shown to be outliers, and the level of significance.

In ChemStat's implementation, Dixon's test can be performed on all wells, all compliance wells, all background wells, or the selected well. This option is available from the right-click menu accessed over the Dixon's test window. Remember that the total number of measurements screened can not exceed 25. Use Rosner's test for greater than 25 measurements.

ChemStat performs Dixon's test at either the 1% or 5% levels of significance. This option is selected from the right-click menu accessed over the Dixon's test window.

Use:

As a method of screening for outlier concentrations for data sets with 25 or fewer measurements.