SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY

SEQUOYAH FUELS CORPORATION RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION GROUND WATER CORRECTIVE ACTION PLAN REVIEW

Prepared By:

Sequoyah Fuels Corporation
P.O. Box 610
Gore, Oklahoma 74435

December 2005

SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY

RE: 0556-N

December 16, 2005

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
Request for Additional Information – Groundwater Corrective Action Plan (TAC L52528)

Dear Mike,

Enclosed, please find 3 copies of Sequoyah Fuels Corporation's response to your request for additional information dated September 28, 2005. The request concerned the Groundwater Corrective Action Plan submitted March 14, 2005, as amended.

If you have any questions, please call me at (918) 489-5511, ext. 14.

Sincerely,

Craig L. Harlin
Vice President

XC: Rita Ware, EPA
Jeannine Hale, Cherokee Nation
J. Trevor Hammons, OK AG
Al Gutterman, Morgan Lewis & Bockius
Toby Wright, MFG

HIGHWAY 10 & I-40 PO BOX 610, GORE, OKLAHOMA 74435 (918) 489-5511 FAX: (918) 489-2291

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Groundwater Corrective Action Plan Review
Request for Additional Information

Introduction

The overall protection of public health and safety and protection of the environment will be accomplished through source remediation of the surface soils and institutional controls for access to the affected surface areas and ground water system, combined with corrective action to reduce ground water concentrations and potential contaminant exposures to as low as reasonably achievable. The surface cleanup standards and the long-term stability standards set forth in 10 CFR 40 Appendix A will be met through active surface reclamation and stabilization of contaminated materials in an approved waste repository as described in the Reclamation Plan (RP). Groundwater standards will be met through corrective actions implemented in the Corrective Action Plan (CAP) to reduce any potential contaminant exposures from existing releases to the environment while the surface sources are being removed and stabilized.

The ground water and surface water systems are currently protective. The ground water system, which has several constituents that are elevated above MCLs or background concentrations, does not support use as a drinking water, irrigation or livestock watering supply due to poor ambient water quality, insufficient yield and access control through ownership by SFC and the Army Corp of Engineers. Though existing data indicates that contaminant concentrations in seeps and pools of the site ephemeral surface water drainages periodically exceed MCLs or background concentrations, these seeps and pools are transient and do not result in significant potential for exposure or risk to ecological receptors.

The contaminant transport to the Kerr Reservoir through ground water and surface water discharges do not create unacceptable loading conditions or un-protective exposure concentrations for human or ecological receptors. The ground water corrective actions are intended to reduce the mass loading to the Kerr Reservoir via ephemeral drainages, seeps, pools and reduce the exposure potential in the ephemeral drainages.

The corrective actions rely on remediation of the contaminant sources through surface reclamation and interception and treatment of contaminated ground water flow along specific primary flow paths where the greatest potential for ecological exposures may occur. The observational approach will be applied whereby data developed by continued monitoring and operation of the corrective actions, as well as source term remediation, will be continuously evaluated and the corrective action program modified and/or supplemented as needed.

Based on discussions with NRC staff at the SFC site on December 6, 2005, the responses to these RAIs are submitted in sufficient detail to fulfill the stated NRC CAP review objectives. Consequently, the CAP will not be revised and resubmitted.

CAP2 Site Characterization

A. SFC should identify ground-water users within 2 miles of the site boundary and surface water users within 2 miles downstream of the site. This information is necessary to allow NRC staff to assess impacts of proposed remediation strategies on potential ground-water and surface water users. NRC staff will also use this information to determine if the proposed strategies will be protective of human health, safety, and the environment.

Response:

The primary flow paths of groundwater containing constituents of concern is westward from the site to the Kerr Reservoir, where discharge from shale 1 through 4 occurs. Shales 1 through 4 were truncated at the banks of the reservoir or beneath the water surface by the erosional processes that formed the river system prior to reservoir construction. No site derived constituents have been detected in Shale 5 and no future contamination is expected. There are, therefore, no water wells within two miles that are connected to the site aquifer system

SFC provided information regarding groundwater users to NRC in a Request For Additional Information Concerning Environmental Review of Decommissioning dated April 30, 2001. The response to Question 14 describes off-site water wells near the Sequoyah Facility and the status of the wells. The following is a clip from that response:

> A total of twenty-three (23) off-site water wells were sampled either by the Oklahoma State Department of Health (OSDH) on September 6, 1990 (7 wells) or by SFC on May 9 and 10, 1991 (18 wells sampled; included 2 from the OSDH September 6, 1990 sampling). [FEI, Section 7.3.13, page 190]
>
> A follow-up check done by SFC in April 2001 indicated that there are four wells within the 2-mile radius of the facility that are used for home, stock, and/or garden use. None are downgradient of the site.
>
> One of the wells, OR-23, previously covered in the FEI is outside the 2-mile radius, and was not checked.
>
> SFC could not determine the current use of three wells, OR-6, OR-19, and OR-20. OR-6 was previously listed in the FEI as not in use (NIU).
>
> The remaining wells are currently not in use. A summary table of the recent survey is included as Attachment CAP2A-1.

SFC contacted the Oklahoma Water Resources Board (OWRB) to obtain information regarding surface water users within 2 miles downstream from the site.

OWRB found two permitted stream water diversions within 2 miles downstream of the Facility. Both are used for irrigation purposes. A copy of the response from OWRB and a map showing the location of the two permitted stream diversions are included in Attachment CAP2A-1.

B. Figures 2-8 through 2-13 contain geologic cross-sections; however, these also need to include the potentiometric surface of the uppermost aquifer and the locations and screen depths of ground-water monitoring wells used to measure the potentiometric surface. This information is necessary to examine the relationship between the potentiometric surface, site structures or features, and underlying geologic units. This information will allow NRC staff to evaluate whether extraction wells and trenches are placed in effective locations for capturing ground-water contamination.

Response:

The figures identified were developed from the EVS geologic terrain model and are not amenable to depicting these fine scale and detailed features. Also, these cross sections do not coincide with the majority of wells monitoring the water levels; wells would have to be projected on to these sections and may not accurately depict the elevation of the individual hydrostratigraphic units displayed in the sections.

CAP Figures 2-14 through 2-18 illustrate the measured potentiometric surface for the alluvium as well as Shale units 1, 2, 3, and 4 and the lateral extent of these units. Additional figures are attached to this response as Attachment CAP2B illustrating the modeled particle flow paths related to the corrective actions to illustrate the capture zones of each interception trench or recovery well. In addition, in response to Question CAP3B, a figure is included showing the entire industrial area with all site features, topography, remediation facilities (including corrective action trenches and dewatering wells), and color coded potentiometric lines for all saturated zones (Shale 1 through Shale 4). This figure is a composite of CAP Figures 2-14 through 2-18.

C. The CAP should include detailed hydrogeologic information for each aquifer defined at the site. Information should include hydraulic conductivity, storativity, specific yield, transmissivity, effective and total porosity, hydraulic gradients, variations in hydraulic gradient, and water balance computations. SFC should present the most recently estimated values. Background ground-water quality should also be discussed in the CAP. This information is necessary to allow NRC staff to evaluate whether the corrective action system is sufficiently designed to contain and remediate contaminated ground water.

Response:

The CAP identifies the detailed information identified in the question via reference (see Section 4.0, general reference to HGSCR).

Overall, the site ground water flow modeling uses the Equivalent Porous Media method (described in more detail in the HGSCR, Section 8.4.3). This method replaces primary and secondary hydraulic properties with lumped parameters which are then calibrated to best match the observed data. The most recent data identified by the NRC has been summarized from the appropriate references identified in the following paragraphs and included as Attachments CAP2C-1 through CAP2C-5.

The available hydraulic conductivity data are limited (only slug test performed, no pumping tests, see Attachment CAP2C-1) due to the low permeability of shale units. Older test data are presented in the SCR Sections 3.4.3 and 3.4.4 (hydraulic Conductivity Testing). More recent data is presented in the HGSCR (2002) Section 4.2. These data were collected as part of the 2001 field investigation and as part of a supplemental data collection effort in 2002. Appendix J in the HGSCR presents the hydraulic conductivity data collected in 2001 while Appendix B presents supplemental hydraulic conductivity data collected in 2002. Included with these responses from the HGSCR are Figure 4-2, which shows the location of wells tested, Table 4-1 (borehole to well crosswalk) and Tables 4-8 and 4-9 (Slug Test Results). The results of these tests were incorporated in to the re-calibration of the ground water flow and contaminant transport model submitted in March, 2005 with the first round of RAI responses.

Storativity (storage coefficient) values calculated form selected pumping tests analyzed using the methods of Cooper et al. (1967), range from 2.94×10^{-2} to 1.0×10^{-12}. These results are presented in the HGSCR Appendix J, Figures 2 through 21 and in Appendix B, Table 1, which are included in Attachment CAP2C-1 to these responses. Specific yield values have not been directly measured or calculated. Similarly, porosity has not been directly measured. The HGSCR presents the effective porosity values developed from the calibrated transport model (Section 8.5.4). Effective porosity was estimated to be 25 percent for the alluvial units and 10 percent for the shale units based on inspection of lithologic samples and model calibration. Estimates of effective porosity were also obtained using the inverse modeling program PEST (Doherty, 1994, 1995, 2000 and 2001). Effective porosity for each model layer was allowed to vary over two orders of magnitude. The PEST estimates of effective porosity exhibited less than five percent difference than those estimated from manual model calibration.

Transmissivity ranges from 23 ft^2/day to 0.057 ft^2/day and are presented in Table 2 of HGSCR (2002) Appendix J, which has been copied and included with these responses in Attachment CAP2C-2. However, due to the highly variable stratigraphic thickness and saturated thickness of the shale units, these values provide little insight into the overall flow and transport characteristics of the site or in evaluating whether the corrective action systems are sufficiently designed to contain and remediate contaminated ground water.

The hydraulic gradients for individual hydrostratigraphic units are identified graphically in CAP (2003) Figures 2-14 through 2-18 (Attachment CAP2C-3); the northings, eastings as well as measured and computed heads in specific wells are also provided in HGSCR (2002) in Table 8-3, which have been copied and included with these responses in Attachment CAP2C-4. From these figures and data, specific gradients of interest can be easily calculated.

Appendix I of the HGSCR presents a vegetation water balance used to support ground water recharge estimates and ground water flow model calibration. The calibrated flow model presented in the HGSCR Section 8.0 is the principal tool for evaluating the overall water balance at the site.

Percolating meteoric water is the primary source of groundwater recharge. Historically, significant groundwater recharge was supplied by the leaking fire suppression system but this system has been inactive for about four years. Some groundwater recharge occurs from surface water from the storm water pond, but this source is not significant.

Groundwater discharges include evapotranspiration and discharge to the streams and the Kerr Reservoir. The installed drains also remove a significant amount of groundwater from the aquifer system. Recovery wells remove a small amount of groundwater from the system.

Table A summarizes the water balance of the groundwater model. The table units are in cubic feet per day.

Table A

IN:		OUT:	
STORAGE	0	STORAGE	0
CONSTANT HEAD	9.53E+07	CONSTANT HEAD	2.27E+08
WELLS	0	WELLS	235
DRAINS	0	DRAINS	1.01E+07
RECHARGE	4.47E+08	RECHARGE	0
ET	0	ET	2.34E+08
STREAM LEAKAGE	2.02E+06	STREAM LEAKAGE	6.96E+07
TOTAL IN	5.45E+08	TOTAL OUT	5.41E+08
IN - OUT	3.93E+06		
PERCENT DISCREPANCY	0.72		

The background ground water quality data for the site has been presented in the Ground Water Monitoring Plan, Section 5.1.1 and in the associated Appendix B (Attachment CAP2C-5). In general, six wells were selected to characterize background ground water quality conditions (wells MW007, MW007A, MW007B,

MW070, MW073, MW110A). Data from these wells from the period between 1991 and 2003 were analyzed for arsenic, uranium, nitrate and fluoride, outliers as well as high minimum detection limit values removed from the data set. The data are plotted in time versus concentration plots and descriptive statistics were developed for the data sets. Data from Well MW007 exhibit upward trending nitrate concentrations which appear similar to those concentration trends observed in wells MW008A and MW021A, which have been impacted by site operations. The upper confidence levels (UCL) for the 95% confidence interval have been calculated for these well data and are included in the attached Table 4. These UCL values are proposed as representing background ground water concentrations for these key constituents.

D. SFC should also present a discussion of the contouring method used to create potentiometric surface maps and should also present a contoured map of residuals. Discussions of the contouring method will allow NRC to evaluate the validity of the mapping procedure (not model validity). A residuals map will allow NRC staff to determine if data for certain areas of the site exhibits a high degree of uncertainty and whether such a condition would impact the selection of remedial alternatives.

Response:

The data used to develop the potentiometric contours are posted in Figures 2-14 through 2-18 (Attachment CAP2C-3). Due to limited data and boundary effects associated with computer contouring, these contours were generated by hand based on professional judgment by a qualified hydrogeologist. There are no residuals (difference between measured head and contoured head) to be mapped since the precise measured heads were used to generate the contours. The residuals for the calibrated flow and transport model are presented in Table 1 of the March 7, 2005 Technical Memorandum regarding revisions to the ground water model submitted to the NRC on March 14, 2005 as part of the first round of responses to RAI's on the Ground Water Corrective Action Plan.

E. The CAP should include more information regarding contaminant transport, such as dispersivity (longitudinal, vertical, horizontal), retardation factors, and areal recharge rates. Discussions of the geochemical investigations and attenuation mechanisms should also be included in the CAP. SFC should present the most recently estimated values. This information is necessary for evaluating whether the contaminants at SFC would be amenable to the type of remedial actions proposed by SFC.

Response:

It is not the intent or purpose of the CAP to reproduce all the details of the flow and transport model originally presented in the HGSCR (2002) and most recently revised in the March 14, 2005 submittal of responses to the first round of RAI's. The CAP references these materials in Section 4.0. Information regarding

contaminant transport and geochemical testing and analyses are presented in detail in the HGSCR (Section 5.0 and Section 8.5). The following discussions are intended to provide the requested information. Selected information referenced in this response is attached to this submittal in Attachment CAP2E-1 through CAP2E-3.

The longitudinal dispersivity in all layers was initially estimated based on an empirical, scale dependent equation from Xu and Eckstien (1995). The transverse dispersivity and vertical dispersivity were estimated to 10 percent and 1 percent of the longitudinal dispersivity, respectively (Fetter, 1999). Estimated values of longitudinal, transverse, and vertical dispersivity using Xu and Eckstien are 50 feet, 5 feet, and 0.5 feet, respectively. Longitudinal dispersivity values were further evaluated using the Ogata-Banks advection dispersion equation (ADE) solution (HGSCR, Section 8.5.3) and were found to range from 1 foot to 20 feet as illustrated in HGSCR Figures 8-32 through 8-36 (dispersivity = α, Attachment CAP2E-1).

The geochemical testing and analysis performed for the site constituents of concern are presented in Chapter 5 of the HGSCR. Section 4 of the CAP references the transport modeling (HGSCR, Section 8), which contain all the appropriate retardation factors used in the model calibration and contaminant transport predictions. During the development of the transport model, several methods were used to determine appropriate partitioning coefficient (K_d) values that could be used to reasonably model arsenic, nitrate and uranium transport at the Facility. Sections 5.3.2 and 5.3.3 of the HGSCR discuss the methodology used during these studies to evaluate laboratory derived K_d values. Uranium K_d values determined during the studies were generally higher than those initially determined in the batch desorption experiments. In addition, while the K_d values for arsenic from the batch adsorption tests were somewhat lower than those obtained in the desorption studies, they still did not adequately predict the migration of arsenic observed in the field. Nitrate was determined to behave essentially as a conservative solute with a K_d value of 0. In the end it became evident that describing the transport of the constituents of concern as ionic species with a laboratory derived K_d was difficult, if not impossible. Thus, a more appropriate method to describe the transport of arsenic and uranium for a site as complex as the SFC Facility is via a model-derived transport factor, which incorporates numerous geochemical and hydrodynamic processes.

This alternative to experimental determination of K_d values was accomplished by using the transport model to derive a K_d by fitting model predicted migration of various constituents to historical data. Because the values for K_d arrived at via laboratory experimentation were not completely satisfactory for describing the transport of constituents as observed in the field, this approach was ultimately used to develop a "modeled K_d parameter." It should be noted that, while these model-derived values are often referred to as a K_d, it is more appropriate to label them as a transport parameter (TP).

The partition coefficient is by definition the ratio of the contaminant concentration associated with the solid to the contaminant concentration in the aqueous phase when the system is at equilibrium. Laboratory methods for determining constant K_d values describe the partitioning of a molecule between the solid and aqueous phases due to reversible sorptive reactions. Fitting field data does not provide an equivalent parameter. The subsurface processes, which account for changes in analyte concentration in the field, are not well defined and the systems are unlikely to be in equilibrium. Thus, the modeled K_d ($K_{d\text{-}mod}$), arrived at via model fitting, is essentially a bulk transport parameter that incorporates numerous geochemical reactions such as reversible and irreversible sorption/desorption, precipitation/ dissolution, co-precipitation, sequestration within organic phases and oxidation/ reduction. In addition, hydrogeological parameters not accounted for in the initial model design, such as flow through fractured media, are incorporated into $K_{d\text{-}mod}$.

Values determined for $K_{d\text{-}mod}$ and used in the transport model to describe the migration of arsenic and uranium range between 0.1 to 1.5 mL/g and 0.25 to 0.6 mL/g respectively. A complete description of how these were determined with the model is discussed in HGSCR Section 8.5.4 (Transport Model Calibration). Table 8-4 of the HGSCR summarizes the calibrated uranium $K_{d\text{-}mod}$ values for uranium (Attachment CAP2E-2). The Calibrated K_d for Arsenic was 0.1 for all layers. The transport of nitrate was modeled as a conservative solute with no retardation or decay term.

Arial recharge resulting from the infiltration of precipitation was modeled based on an estimated 5 percent, or 2.2 inches per year (5.0×10^{-4} feet per day) percentage of average annual rainfall measured in the nearby town of Sallisaw, Oklahoma, which is 42 inches per year. The recharge rate was increased in the valley bottoms and Oak woodland areas. During precipitation events, valley bottoms collect large amounts of runoff from higher elevations, which result in localized areas of higher infiltration. The dense vegetation in the woodland areas restricts runoff, which creates a greater percentage of precipitation available for recharge. Recharge rates in the valley bottoms and Oak woodland were estimated during model calibration to be 7.9 inches per year (1.8×10^{-3} feet per day). Irrigation water plus the natural recharge in the Agland area is equal to an average annual rate of 7.9 inches per year (1.8×10^{-3} feet per day). The leaky fire water system in the Process Area also increases the recharge to the subsurface. Accurate leakage rates to the groundwater system for the Process Area are not available, but the total recharge rate in the Process Area was originally estimated to be 3.8 inches per year (8.7×10^{-4} feet per day) during model calibration. However, this recharge rate was reevaluated after the submittal of the HGSCR. The model was recalibrated and minor changes to the recharge rates around the fertilizer ponds to the east and the Process Area as presented in the Revised Transport Model included in the March 7, 2005 responses to the first round of RAIs. The process area recharge rate was increased to 3.26 x10-3 ft/day during the recalibration of the model (see Attachment

CAP2E-3 for Figure 6 from the Revised Transport Model memorandum date March 7, 2005).

F. The CAP should include more detailed discussions of the onsite and adjacent surface water bodies and seeps. Information should include flow rates, hazardous constituent concentrations, and surface water body dimensions, if applicable. SFC should also provide a current estimate of pollutant loads entering the Kerr Reservoir. This information is necessary to gauge quantitatively the impact that the current site pollution is having on the reservoir. This is particularly of interest for nitrates and arsenic. Nitrates migrate relatively quickly through ground water, and arsenic is a toxic metal.

Regarding corrective actions performed to date, SFC should provide ground-water extraction rates for its trenches and an estimate of the mass of hazardous constituents recovered to date. Understanding the amount of material recovered by the current system allows NRC staff to assess its effectiveness. For example, if the recovered quantity is relatively small compared to the initial load, then another remediation strategy may be appropriate. SFC should provide the most recently estimated extraction rates and recovered masses.

Response:

The hydrologic characterizations from the RFI and HGSCR, which included discussions of the seeps and drainages, were referenced in Section 2.4 of the CAP. The following text is intended to supplement existing descriptions of the seeps, drainages and Kerr Reservoir and to direct the reader to additional data or narrative. Additional information regarding constituent loading to the Kerr Reservoir are provided in the response to RAI CAP3C.

<u>Drainages and Seeps</u>
The seeps and site drainage surface flows occur seasonally within and along the four primary ephemeral drainages of the site (001, 005, 007 and 008) as identified in the HGSCR. Figure 2-5 from the HGSCR illustrates the locations of the site drainages. Table 2-2 (Attachment CAP2F-1) summarizes the drainage areas and the calculated mean annual flow rates for each site drainage. However, it should be recognized that these drainages run only in direct response to moderate to intense precipitation events and are dry more often than not. Section 2.3.2 of the HGSCR presents the method used to estimate the average annual flow rates for these drainages. Table 2-3 (Attachment CAP2F-1), describes the location and dimensions of the seeps at the time the HGSCR was prepared. Attachment CAP2F-1 also presents seep water quality data for the seeps discussed below.

The 007 drainage seep is a transient pool of water which only occurs after specific precipitation and runoff events. Historical water quality data indicate concentrations of uranium have ranged from 16.9 µg/L to 1.07 µg/L, but have remained below the

drinking water standard of 30 µg/L since 2002. Historical arsenic data have ranged from a high of 17 µg/L to below the lowest analytical detection limit of 4 µg/L. All samples since March 2004 have been below the analytical detection limit. Historical nitrate data have ranged from a high of 8.5 mg/L to below the 1 mg/L detection limit. All samples since January 2002 have been below the drinking water limit of 10 mg/L.

The 005 seep (005 drainage at MW100B) historically occurs as a transient pool. This transient pool perched in a depression on top of the unit 4 sandstone (Sand 4) and is not fed by upwelling of ground water from below or from up stream surface flows but rather through minor lateral ground water discharge from Shale 4 on the lateral margins of the drainage at this location in response to precipitation events. Historical water quality data indicated concentrations of uranium have ranged from 1450 µg/L to 18.8 µg/L. Uranium concentrations have been trending downward since 2001 and have been below 70 µg/L over the past year. Historical arsenic data have ranged from a high of 52 µg/L to below the lowest analytical detection limit of 4 µg/L. All samples since January 2004 have been below the analytical detection limit. Historical nitrate data have ranged from a high of 262 mg/L to below the 1 mg/L detection limit. All samples since April 2004 have been below the drinking water limit of 10 mg/L.

However, as discussed later in this response, the 005 collection trench is intercepting up gradient ground water flow, which has decreased upstream ground water discharge to the drainage. The rate of water pumping from the 005 collection trench has decreased from an average of approximately 7,000 gallons per day (approximately 5 gallons per minute at start up) to approximately 140 gallons per day (approximately 0.1 gallons per minute) (See Attachment CAP2F-8; Figure titled Pumping Rate). In addition, the 005 monitoring trench can no longer be sampled due to lack of water, indicating that the 005 collection trench is effectively eliminating ground water flow past the trench. Therefore, the 005 collection trench has effectively eliminated up gradient ground water discharges to the 005 drainage, the only remaining discharge to the drainage is from ephemeral surface runoff in response to precipitation event and minimal ground water seepage from the near lateral banks along the lower portion of the drainage. As indicated by the description above, the one transient seep identified from this source does not present a significant pathway or hazard to human or ecological receptors.

The 008 drainage seep (Port Road Bridge Seep) historically occurred as a perennial shallow pool or seep. After implementation of pumping from the MW95A collection trench, this seep has dried up indicating that MW-95A trench is effectively removing ground water up gradient of the seep. Historical water quality data indicated concentrations of uranium have ranged from 6.38 µg/L to 1.19 µg/L, but have remained below the drinking water standard of 30 µg/L. Historical arsenic data have ranged from a high of 74 µg/L to below the 4 µg/L detection limit. All arsenic samples since November 2004 have been below the analytical detection limit. Historical nitrate data have ranged from a high of 990 mg/L to 10.5 mg/L. In

response to RAI 6 submitted on December 30, 2004, water quality data for the Port Road Bridge Seep (008 Seep) were presented which indicate that concentrations at the seep decreased after the MW095A extraction trench was installed, arsenic concentrations decreased to below 5 ug/L before the seep dried up. Though it is expected that this seep would re-emerge once the MW095A collection trench pumping is discontinued, the inflowing ground water at that time (when the trench had met its corrective action objectives) will be of sufficient water quality to be protective at the seep. It should be noted that this past year has been unseasonably dry, which may also have had an overall impact on the emergence of the seep.

Section 8.5.6.1 through 8.5.6.3 of the HGSCR present additional information regarding predicted contaminant loading and surface water concentrations in the drainages, without the corrective actions. Though the ground water flow and transport model has been re-calibrated, the impacts of the model changes on the predicted loading of contaminants to the drainages and rivers are minor and within than the accuracy of the original estimate. Therefore, re-modeling of the stream and river loading estimates presented in the HGSCR have not been performed.

Kerr Reservoir

The SFC facility is located on the east bank of the Illinois River tributary of the Robert S. Kerr Reservoir. Southwest of the Facility the Illinois River joins with the Arkansas River tributary of the Robert S. Kerr Reservoir. Across from the SFC facility the Illinois River arm of the Robert S. Kerr Reservoir is approximately 1,000 feet wide. Flow in the Illinois River arm of the Robert S. Kerr Reservoir is regulated by releases from the Tenkiller Ferry Reservoir, which is located on the Illinois River approximately seven miles upstream from the Facility. Table 2-1 of the HGSCR (Attachment CAP2F-2) summarizes the annual flow of the Illinois River at the gauging station between the Tenkiller Reservoir and the Facility. The average annual flow at this station is estimated to be 1,610 cubic feet per second (cfs). Based on historic data from the gauging station, the estimated average daily flow for the upstream reach of the Illinois River is 998.5 million gallons per day (Mgpd, approximately 133,480,000 cubic feet per day) while the seven day average low flow (7Q2 flow) is approximately 60.2 Mgpd (approximately 8,035,000 cubic feet per day). As a point of comparison, the entire modeled ground water flux from the SFC site to the Kerr Reservoir is 0.057Mgpd (approximately 7,680 cubic feet per day). Based on these flows of the Illinois River arm of the Kerr Reservoir, the discharging ground water represents on average 0.006 percent of the daily flow in that arm of the Reservoir and only 0.095 percent of the flow during a 7 day low flow event.

Historical background sampling of the branch of the Kerr Reservoir adjacent to the site are summarized in Attachment CAP2F-3 of this submittal. Significant differences occur in water quality between the Illinois and Arkansas Rivers. The Illinois River flows through a rugged, rocky watershed throughout much of its course in northeastern Oklahoma and is fed largely by releases from Lake Tenkiller

Ferry Reservoir and from steep, spring-fed streams. This results in relatively clear waters. In contrast, the Arkansas River, which acquires sediment from farming areas along its course in Colorado, Kansas, and Oklahoma, resulting in relatively turbid waters. Nitrate values typically range below 3 mg/L though data from upstream of the site have been as high as 3.5 to 4 mg/L. Uranium is typically below the 1 µg/L detection limit and all values, both upstream and down stream of the site, have been below 10 µg/L for the past decade. Downstream samples in the Illinois arm of the Kerr Reservoir show no increase in uranium water concentrations relative to the upstream samples since 1999. Arsenic values upstream of the site have ranged from 130 µg/L (possibly higher, but uncertain due to high detection limits from matrix interference on laboratory analyses) to as low as 7 µg/L. Downstream samples in the Illinois arm of the Kerr Reservoir show no increase in arsenic water concentrations relative to the upstream samples.

Section 9.1 of the HGSCR described appropriate protective values for the protection of human and ecological health for the SFC site. Specifically, Section 9.1 addresses protective aquatic standards (Table 9-3, see Attachment CAP2F-4). Both Federal and Oklahoma State water standards relevant to human and aquatic biota surface water exposure were reviewed (HGSCR Table 9-3). Applicable Federal standards for humans are the MCL values promulgated under the Safe Drinking Water Act and the National Recommended Water Quality Criteria (NRWQC), promulgated under Section 304(a) of the Clean Water Act (40 CFR 131), for protection of aquatic biota. Oklahoma water regulations are outlined in Title 785 Chapter 45 of the Oklahoma Administrative Code.

As listed in the Oklahoma State Regulations, the Arkansas River near the site has designated uses of: 1) Emergency Water supply, 2) Warm Water Aquatic Community water, and 3) Primary Body Contact recreational water. The Illinois River has designations of: 1) Public and Private Water Supply, 2) Trout Fishery, 3) a Class I irrigation water, 4) Primary Body Contact recreational water, and 5) a High Quality Water. Waters designated as Public or Private Water Supply must meet Raw Water Numerical Criteria (785:45-5-10) and water column criteria to protect for the consumption of fish flesh and water. All waters with a designated use as fish and wildlife propagation must achieve protective values for toxic substances (785:45-5-12). These criteria are to be met at all times outside of the regulatory mixing zone as defined in 785:45-5-26.

By comparing the maximum predicted ground water discharge concentrations to the appropriate protective water quality standard (HGSCR Table 9-3) it is possible to identify the maximum amount of dilution required for the discharge to meet the protective standard. The maximum predicted ground water concentrations of nitrate at any of the model observation points used for model predictions is approximately 315 mg/L in observation point number 4 (OBS4, HGSCR Figure 8-52 for location, Figure 8-60 for peak concentration, see Attachment CAP2F-5) at approximately 15 years from the start of the model run. The average peak ground water nitrate concentration (the peak total mass of nitrate entering the river [10,048 Kg/day from

GW Vistas model] at year 15 divided by the total flux per day of ground water to the river [7,682 cubic feet per day from GW Vistas model]) is 46.19 mg/L. In order to meet the protective standard of 10 mg/L in the river a dilution of up to 31.5 to 1 would be required for the maximum point concentration and 4.6 to 1 for the average ground water discharge concentration.

Viewed another way, at the average daily flow of 998.5 Mgpd or seven day low flow of 60.2 Mgpd and with a background nitrate concentration in the Reservoir of 3 mg/L, the background nitrate load in the Illinois River arm of the Reservoir would range between 11,340,460 Kg/day and 682,563 Kg/day. By comparison the peak nitrate loading is predicted to be 10,048 Kg/day. This peak, which would only occur for a relatively short period, represents between 0.9 percent and 1.5 percent of the background nitrate load in the Illinois branch or the reservoir for the average and 7Q2 low flows, respectively.

The maximum predicted ground water concentrations of arsenic at any of the model observation points used for model predictions (see HGSCR Figure 8-63 for location, Figure 8-71 for peak concentration included in Attachment CAP2F-6) is approximately 240 ug/L in observation point number 4 in model Layer 5 at about 7 years after the start of the model run. In order to meet the protective aquatic standard of 150 ug/L in the river (HGSCR Table 9.3), a dilution of up to 1.6 to 1 would be required for the maximum point concentration, the dilution needed for the average ground water discharge concentration would be much less.

The maximum predicted ground water concentrations of uranium at any of the model observation points used for model predictions is approximately 135 ug/L in observation point number 4 in model Layer 6 (OBS4, HGSCR Figure 8-80 for location, Figure 8-81 for peak concentration, see Attachment CAP2F-7) at about 500 years after the start of the model run. This peak point concentration is approximately 13 percent of the protective aquatic standard of 1,000 ug/L in the river (HGSCR Table 9.3), no dilution would be required to meet this protective level. As demonstrated by the Reservoir sampling data presented in Attachment CAP2F-3, there is no observable increase in uranium or arsenic concentrations down stream from the site and nitrate concentrations are below the drinking water standard.

<u>Collection System Performance</u>
Estimates of the current collection trench extraction rates, concentration of extracted waters and estimates of the mass of constituents recovered to date is included in Attachment CAP2F-8.

The 005 Collection System, installed in late 2003, began pumping at rates between 867 gallons per day (gpd) to 1,450 gpd (or approximately 0.6 gpm to 1 gpm). The amount of water intercepted began to decrease starting in February 2005 to the current rate of approximately 220 gpd to 140 gpd (or approximately 0.15 gpm to 0.1 gpm). In general, this decrease in measured pumping rates has corresponded to

decrease in the mass of nitrate recovered from the system. In addition, concentrations in the 005 Monitor Trench down gradient decreased dramatically before the trench dried up and sampling could not continue. This demonstrates a high degree of effectiveness for the 005 collection trench system.

The MW 95A Collection System, began pumping at rates of approximately 270 gpd (or approximately 0.19 gpm). The amount of water intercepted appears to fluctuate seasonally with the annual precipitation cycle. Nitrate mass removal appears to fluctuate around a value of approximately 60 Kg/month while arsenic mass recovery rates appear to fluctuate between 1.5 g/month and 3 g/month. The 95A Monitor Pit, located directly down gradient of the collection trench consistently exhibits lower constituent concentrations than the trench indicating effective recovery by the trench system.

The MW10 Collection System began pumping at rates of approximately 1,500 gpd (or approximately 1 gpm) and appears to have increased to approximately 3,000 gpd or 2 gpm. Nitrate mass is relatively low as nitrate concentrations are below the drinking water standard of 10 mg/L. Uranium mass removal fluctuates between 10 g/month and 30 g/month as the trench concentrations vary in the 40 µg/L to 60 µg/L range. Arsenic mass removal is around 2 g/month though the trench concentrations are typically less than the analytical detection limit of approximately 4 µg/L.

CAP3 Corrective Actions

A. SFC's March 14, 2005, response to NRC's December 6, 2004, RAI provides information regarding the installation of proposed extraction wells in the northwest portion of the site, as part of the CAP. Locations and descriptions of these wells should be included in the main CAP text, so the complete remediation is described in the main document. In addition to the well locations, effects of pumping on the terrace ground-water system potentiometric surface, estimates of the capture zone, and expected pollutant yields should be provided in the CAP. Understanding these aspects of the extraction wells will allow NRC staff to evaluate whether or not the wells will remediate ground water effectively.

Response:

The proposed wells are located as shown in Figure 2 of the revised Transport Modeling Memo dated March 7, 2005 and submitted with the responses to the first round of RAIs. These two wells were proposed to accelerate collection of ground water contaminants uranium in the northwest portion of the site as illustrated in Figure 2. These wells would each consist of 8 inch diameter schedule 80 PVC with 0.010 inch machine slotted screens and appropriate clean silicate sand filter pack and surface seal and screened in Shale unit 4. The wells would be pumped with a low volume pump or with a small submersible pump. Based on the estimated

hydrologic characteristics of the Shale unit in that area and a maximum drawdown of approximately 67 percent of the saturated thickness, the maximum effective radius of each well would be expected to be approximately 60 feet to 75 feet at an average pumping rate of approximately 0.3 gpm per well. Based on an existing ground water contaminant concentration of 250 μg/L uranium, this would result in an initial mass removal rate of approximately 12g/month. The estimated capture zone of these wells is illustrated in the figures included in Attachment CAP2B-1.

B. The CAP should include on one map the entire industrial area with all site features, topography, remediation facilities (including trench dewatering wells), and colorcoded potentiometric lines for all saturated zones (Shale 1 through Shale 4). Such a map is needed to gauge the spatial relationship between the areas of contamination, ground-water flow directions, and locations of remedial action structures.

Response:

A new map has been generated which illustrates the entire industrial area with all site features, topography, the potentiometric lines for shale units 1 through 4 (composited and colorcoded from the CAP Figures 2-14 through 2-18) as discussed with NRC on December 6, 2005. In addition, this new map illustrates the locations of the corrective action trenches and proposed recovery wells.

C. According to the March 14, 2005, response to NRC's request for additional information, the proposed remedial action appears to allow elevated nitrate and arsenic concentrations to enter the Kerr Reservoir. Nitrates tend to impact water quality by promoting algal and protozoa growth, which, in-turn, decreases dissolved oxygen levels endangering aquatic habitats. Elevated nitrate levels also impact water quality for domestic use. Arsenic is a toxic metal that can stress aquatic fauna at low concentrations, depending on the species. Please provide justification for allowing elevated nitrate and arsenic levels to enter the surface water system.

Response:

Section 8.5.6.4 of the HGSCR presents estimated current and predicted loading of site derived COCs to the Kerr Reservoir. Section 9.1 of the HGSCR described appropriate protective values for the protection of human and ecological health for the SFC site. Specifically, Section 9.1 addresses protective aquatic standards (Table 9-3, Attachment CAP2F-4).

River loading of the three COCs was calculated in the HGSCR by multiplying the modeled flux into the constant head nodes representing the Illinois and Arkansas Rivers by the concentration of the aquifer material, without considering the effects the corrective actions. This calculation was performed using the Groundwater Vistas program as discussed in Section 8.5.6.4 of the HGSCR. The resulting

nitrate mass loading rate, reported in units of mg/L * ft^3/day was converted to mg/day by multiplying by 28.32 L/ft^3. Arsenic and uranium concentrations were reported as µg/L * ft^3/day and were converted similarly.

Nitrate

The maximum predicted ground water concentrations of nitrate at any of the model observation points used for model predictions (see Figure 8-52) is approximately 315 mg/L in observation point number 4 in multiple layers (OBS4, Figure 8-52) at approximately 15 years from the start of the model run. Current site characterization data indicate that the only current discharge of nitrate to the river is through ephemeral stream flows. The modeled peak current concentration of nitrate to the river through stream drainage discharge is below the MCL of 10 mg/L (HGSCR Figure 8-83) though the nitrate concentrations in the seeps is higher (see response to RAI CAP2F).

Calculated nitrate mass loading to the river over time is presented in HGSCR Figure 8-88 (Attachment CAP2F-5). The loading occurs as a sharp-fronted pulse that has a maximum loading rate of 10.4 kg/day at 15.8 years. The loading rate then quickly decreases to less than 2.0 kg/day at 50 years. At 100 years, the calculated loading rate is less than 0.4kg/day.

Arsenic

The principal discharges of arsenic in groundwater to the Arkansas and Illinois Rivers occur between the 001 and 005 drainages. The maximum predicted ground water concentrations of arsenic at any of the model observation points used for model predictions (see Figure 8-63 for location, Attachment CAP2F-6) is approximately 240 ug/L in observation point number 4 in model Layer 5 (OBS4, see Figure 8-71 for concentration, Attachment CAP2F-6) at about 7 years after the start of the model run.

Calculated arsenic mass loading to the river over time is presented in Figure 8-89 (Attachment CAP2F-6). The loading occurs as a sharp fronted pulse that has a maximum loading rate of 0.0028 kg/day at 15 years. The loading rate then quickly decreases to less than 0.0005 kg/day at 50 years. At 100 years, the calculated loading rate is less than 0.00015 kg/day.

Uranium

The maximum predicted ground water concentrations of uranium at any of the model observation points used for model predictions (see HGSCR Figure 8-80) is approximately 135 ug/L in observation point number 4 in model Layer 6 (OBS4, Figure 8-63) at about 500 years after the start of the model run. Note that the observation points used for each constituent are located in different places due to the different configurations and flow paths of the individual contaminant plumes.

The model results indicate that uranium in groundwater discharges to the Arkansas and Illinois Rivers in the areas near the 001, 005, and 007 streams. HGSCR Figure 8-90 presents calculated groundwater concentration discharging to the river versus time in Unit 5 Shale (Layer 6) near the 001, 005, and 007 streams. Groundwater discharge to the river near streams 005 and 007 both have maximum concentrations slightly higher than the MCL of 30 µg/L, 36.3 µg/L and 41.7 µg/L, respectively. The calculated concentration discharging to the river near the 001 Stream appears to reach a maximum of 3.6 µg/L at 1,000 years. Calculated uranium mass loading to the river over time is presented in HGSCR Figure 8-91 (attachment CAP2F-7). The calculated groundwater loading occurs in two distinct pulses. The initial pulse enters the river at approximately 250 years in response to the discharging of mass from the 007 stream. Peak loading during the initial pulse is calculated to be 0.355 g/day. The second pulse results from mass in the 005 Stream entering the river. This pulse peaks at 0.514 g/day at 550 years. At 1,000 years, the calculated uranium mass loading to the river is 0.103 g/day.

D. SFC dismissed phytoremediation as a potential remediation technology for this site because it could only be used in areas where ground water expressed itself at the seeps. Discuss the possibility of using phytoremediation near source areas before nitrates and arsenic have entered deeper bedrock units, in addition to areas of seeps. Furthermore, discuss the possibility of using other technologies, such as bioremediation, in selected areas of the deeper bedrock aquifers to fix or remove nitrates or arsenic reducing overall pollutant loads to the reservoir. SFC should again review the remediation technologies presented in the GWCAP to determine if other strategies could be used at strategic points to minimize pollutant loads to the reservoir. Strategic remediation could increase the overall performance of the proposed remediation system instead of solely relying on ground-water contamination flowing to extraction structures at certain points, which may not occur exactly as predicted.

Response:

The CAP identified phytoremediation as a viable technology with an overall technical rating of 9 out of 10. However it was noted that it will only be effective in shallow soils and not in the deeper shale units. Therefore, it was deemed less effective than the selected technology as a sole remedy. It is recognized that phytoremediation may be effective in selected source and discharge areas as a supplemental technology to accomplish ground water clean up goals. As a source control technology, phytoremediation would only be applicable in the central portion of the Process Area in the shallow alluvial soils. These soils are contaminated by radionuclides and non radionuclide contaminants and will be remediated through the surface reclamation action. It remains unclear at this time what source contamination will remain for this technology to be applied towards once surface reclamation is completed. Phytoremediation will be reconsidered on a location specific basis in the Process Area once surface reclamation is complete.

The application of bioremediation technologies was discussed as Cometabolic Precipitation. However, thought proven technology that can be safely implemented, experience has shown that in these low permeability and small pore sized environments, introduction and dissemination of nutrients can be problematic resulting in biofouling of injection structures and limited impact on a broad or persistent scale. Using the observational approach with the ongoing monitoring and operation of the CAP systems, the CAP system will be continuously re-evaluated for effectiveness and all reasonable corrective action technologies and approaches will be considered for potential future application.

E. Ground-water potentiometric surface maps provided in the CAP do not appear to reflect the effects of ground-water extraction from the trenches to date or expected effects of pumping from the proposed extraction wells. Such effects should be presented in the report to allow NRC staff to gauge the effectiveness of these remediation structures.

Response:

Figures showing the predicted influence of the corrective actions are attached (Attachment CAP2B-1). These figures, using particle flow traces from the Ground Water Vista flow and transport model, show that the 005 collection system and two proposed wells in the northwest area capture the vast majority of the uranium and nitrate in ground water from the northern Process Area. In addition, the 95A collection system effectively captures the arsenic and nitrate in ground water from the area southwest of Pond 2. The MW010 collection system with MWRW2 effectively mitigate uranium in ground water from migrating to the south from the process area. Combined with proposed surface reclamation actions, the ground water corrective actions will continue to reduce contaminant concentrations to as low as reasonably achievable below protective levels at the points of exposure.

F. SFC should provide in the CAP a discussion of concentrations and loads of constituents of concern that are currently and will continue to enter the Kerr Reservoir. NRC staff note that such information is contained in Appendix B of the Reclamation Plan (Hydrogeological and Geochemical Site Characterization Report, October 2002); however, this information should be incorporated in its entirety or by reference with a summary in the CAP. Furthermore, because the contaminant transport model has evolved since the date of the characterization report, reservoir constituent loads and concentrations should reflect the most recent updated model. This information will allow NRC staff to assess whether the corrective actions are protective of human health, safety, and the environment.

Response:

The loading of ground water contaminants is discussed in HGSCR 8.5.6.4, and Appendix B, as noted by the NRC. In addition, responses to RAI CAP2F present

flow and sampling data that demonstrate that the volumetric addition of ground water and the associated contaminants is a minute fraction of the background flow and loads. Further, the responses demonstrate that constituent concentrations down stream from the site in the reservoir are either below the drinking water standards (nitrate) or there are no observable differences in contaminant concentrations down stream of the site with respect to contemporaneous upstream samples (uranium and arsenic). As discussed with NRC on December 6, 2005, the existing contaminant loading analyses will not be incorporated in to a revised CAP Report and the responses to these RAIs are intended be sufficient to meet the NRC's review objectives. Though the ground water flow and transport model has been re-calibrated since the loading calculations were performed, the minimal impacts of the model changes on the predicted loading of contaminants to the drainages and rivers are minor and within the accuracy of the original estimate. Therefore, re-modeling of the stream and river loading estimates presented in the HGSCR have not been performed.

G. Section 6.5 of the CAP states that SFC will treat extracted ground water to land application standards presented in the existing source materials license (SUA-1010). However, the only standards described in the license are the ground-water protection standards listed under license condition 49. If SFC intends to treat extracted ground water to the ground-water protection standards, then it should revise Section 6.5 to that effect. SFC should also present the actual ground-water protection standards in the CAP. If SFC intends to treat extracted ground-water to a different set of standards, it should present those standards in the CAP and describe any potential environmental impacts that might result from discharging water treated to a different set of standards.

Response:

The standards referred to in the CAP are contained in the license application for SUB-1010 at Section 1.8, Exemptions and Special Authorizations. These requirements are incorporated into the license by reference in license condition 9.1. SFC has been land applying process by-products under these requirements for over 20 years. In addition to the requirements contained in SUB-1010, SFC has been issued a Waste Water Discharge Permit from the State of Oklahoma to land apply waste water in compliance with the Mass Land Application Loading Limitations specified in OPDES OK0000191. SFC will implement waste water disposal from the water treatment plan in compliance with this permit, which ensures protection of public health, safety and the environment. The principle portions of the OPDES Permit are attached in Attachment CAP3G. The following table summarizes the numerical limits which will be met when land applying any waste water generated as a result of the CAP:

Table B Mass Land Application Loading Limitations
(Units are lbs/acre/y unless otherwise specified)

Wastewater Constituent	Draft Permit
	Maximum Annual
Nitrogen, PAN	423**
Arsenic, Total*	1.79
Cadmium, Total*	1.69
Chromium, Total*	134
Copper, Total	67
Nickel, Total*	18.75
Lead, Total*	13.39
Selenium, Total*	4.46
Mercury, Total*	0.76
Zinc, Total*	125
Radium 226 (pCi/l)	2.0**
Uranium (mg/l)	0.1**

* Annual Mass Loading limit allowed by 40 CFR Part 503, "Standards for the Use or Disposal of Sewage Sludge"

** Limits established by the NUCLEAR Regulatory Commission (NRC) license SUB-1010

ATTACHMENT CAP2A-1

Attachment 1
Well Survey April 2001

Well No.	Previous Use (FEI)	Current Use	Notes
OR-1	Domestic	NIU	
OR-2	Domestic	NIU	
OR-3	NIU	NIU	
OR-4	NIU	NIU	
OR-5	Domestic	**Home**	
OR-6	NIU	Unknown	
OR-7	Domestic	NIU	Second well in this area, also NIU
OR-8	NIU	NIU	
OR-9	UK	NIU	
OR-10	Domestic	NIU	
OR-11	Domestic	NIU	
OR-12	Domestic	NIU	
OR-13	Domestic	**Home, Garden, Stock**	
OR-14	NIU	NIU	Second well north of OR-14, also NIU
OR-15	Domestic	NIU	
OR-16	NIU	NIU	
OR-17	Domestic	**Home**	
OR-18	NIU	NIU	
OR-19	Not Stated	Unknown	
OR-20	Not Stated	Unknown	
OR-21	Not Stated	NIU	Second well in this area, also NIU
OR-22	Not Stated	**Garden**	Three wells in this area, one used for garden, other two NIU.
OR-23	Not Stated	Not Checked	Outside 2 mile radius.

OKLAHOMA WATER RESOURCES BOARD

FACSIMILE TRANSMITTAL SHEET

TO: Scott Munson	**FROM:** Bob Sandbo
COMPANY: Sequoyah Fuels	**DATE:** 11/28/05
FAX NUMBER: 918-489-2291	**TOTAL NO. OF PAGES INCLUDING COVER:** 1
PHONE NUMBER: 918-489-5511x20	**SENDER'S PHONE NUMBER:** 405-530-8800
RE: Stream water diversions	**SENDER'S FAX NUMBER:** 405-530-8900

☐ URGENT ☒ FOR REVIEW ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE RECYCLE

NOTES/COMMENTS:

I have done a search from the GPS location you gave me (35 deg 30 min, 95 deg 5 min) and found the following two permitted stream water diversions within 2 miles downstream:

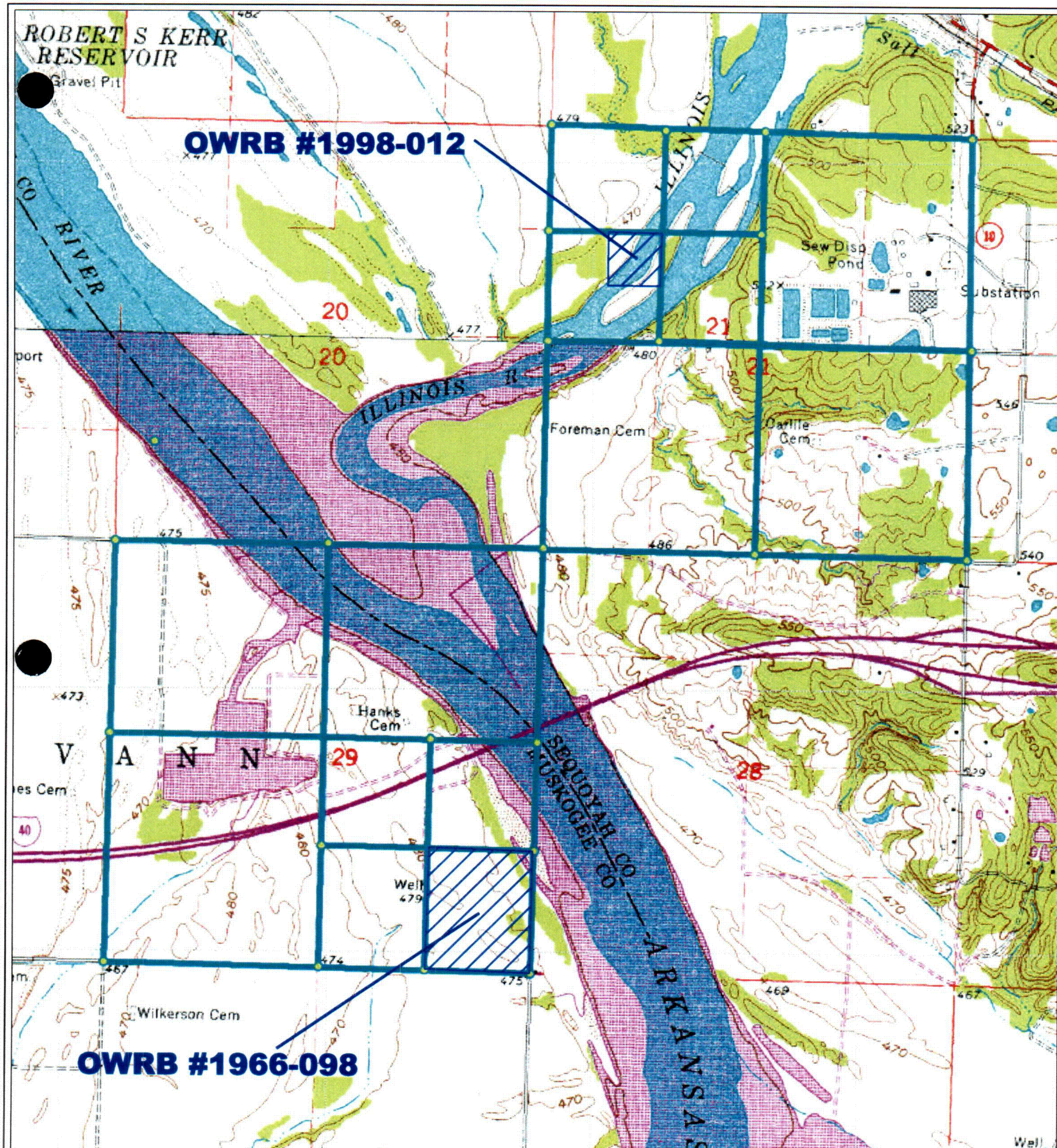
#1998-012 John Synar for 222 acre-feet per year to irrigate 370 acres of land from one diversion point on the Illinois River located in the NE/4 SW/4 NW/4 of Section 21, T12N-R21EIM &

#1966-098 Wayne Sloan for 180 acre-feet per year to irrigate 100 acres of land from one diversion point located on the Arkansas River in the SE/4 SE/4 of Section 29, T12N-R21EIM

These are the only two permitted users of surface water within 2 miles downstream from the site assessment area.

If you have any questions, please feel free to contact me at the number above.

OKLAHOMA WATER RESOURCES BOARD
3800 NORTH CLASSEN BLVD.
OKLAHOMA CITY, OK 73118
WWW.OWRB.STATE.OK.US

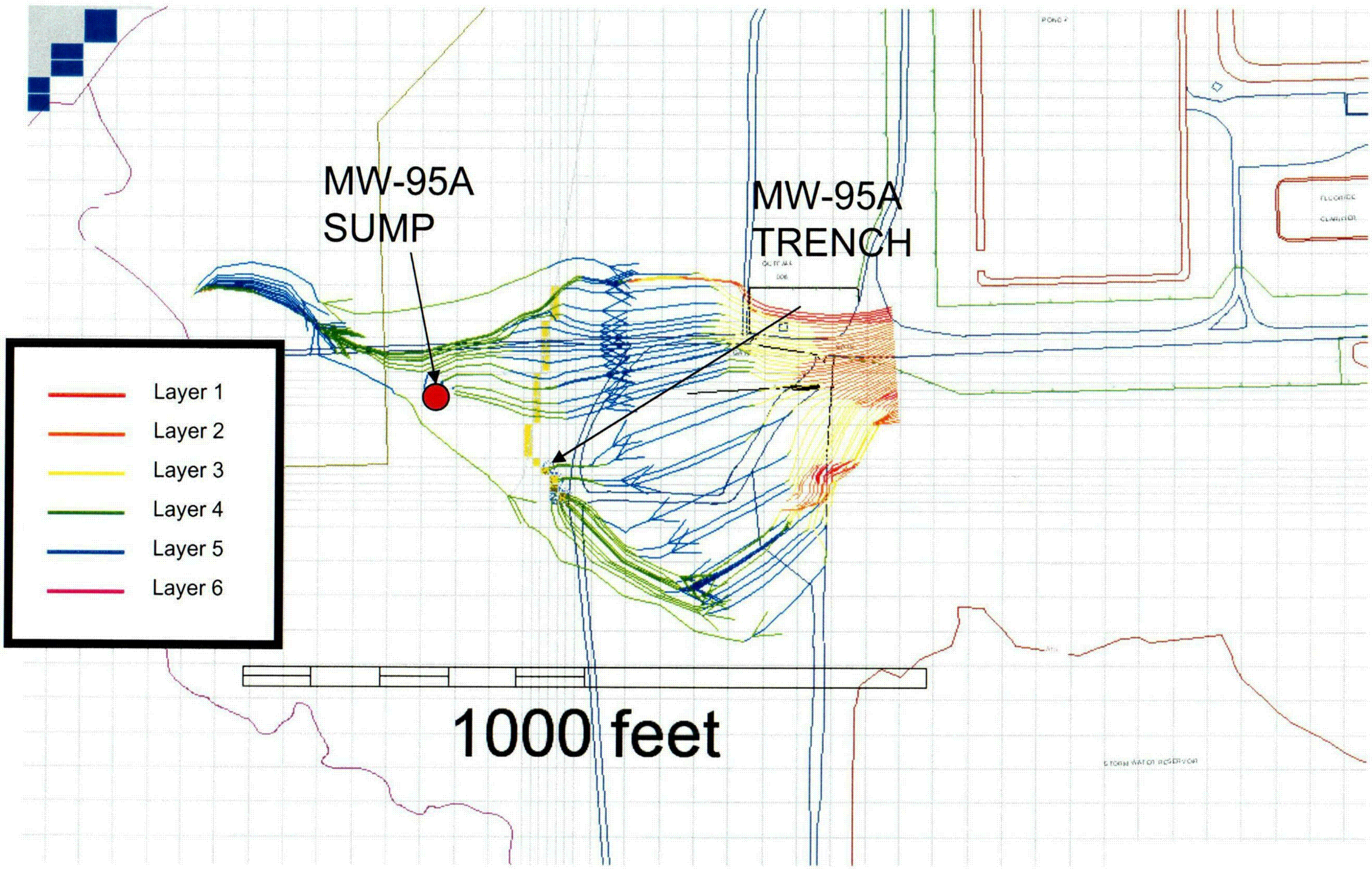


SEQUOYAH FUELS CORPORATION
Groundwater Corrective Action Plan

TITLE:	*Surface Water Users* *Permitted Stream Water Diversions*		
PREPARED BY:	SCM	FILENAME:	SurfWtrUsers.dwg
REVIEWED BY:	CLH	FIGURE NO. 1	
DATE:	29 Nov 2005		

C01

ATTACHMENT CAP2B

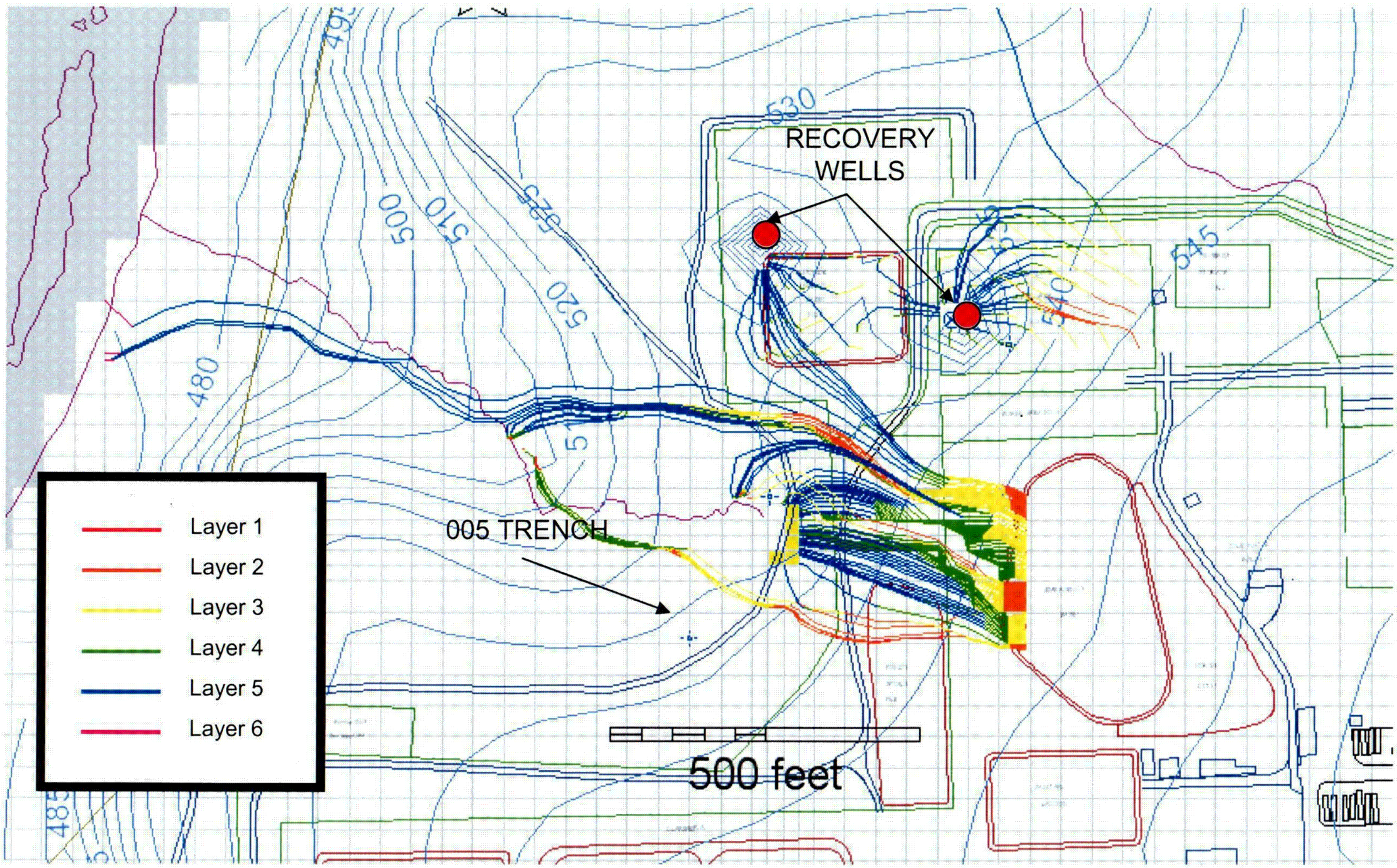


MFG, Inc.
consulting scientists and engineers

MW-95A SUMP AND TRENCH

Date:	DECEMBER 2005
Project:	P:\100734/92805 GWCAPR
File:	CAP PARTICLE TRACK.ppt

C02

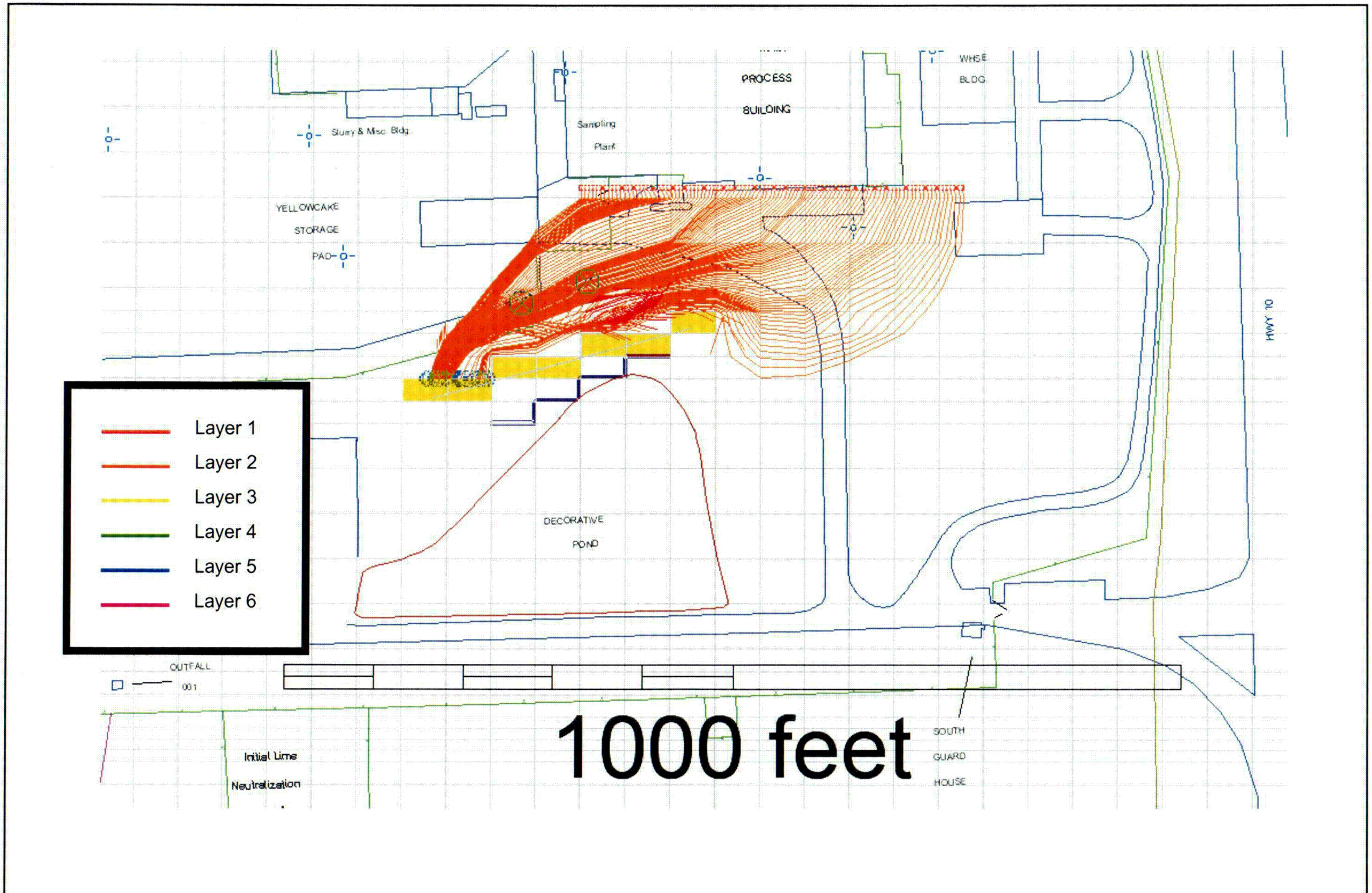


MFG, Inc.
consulting scientists and engineers

005 TRENCH AND RECOVERY WELLS

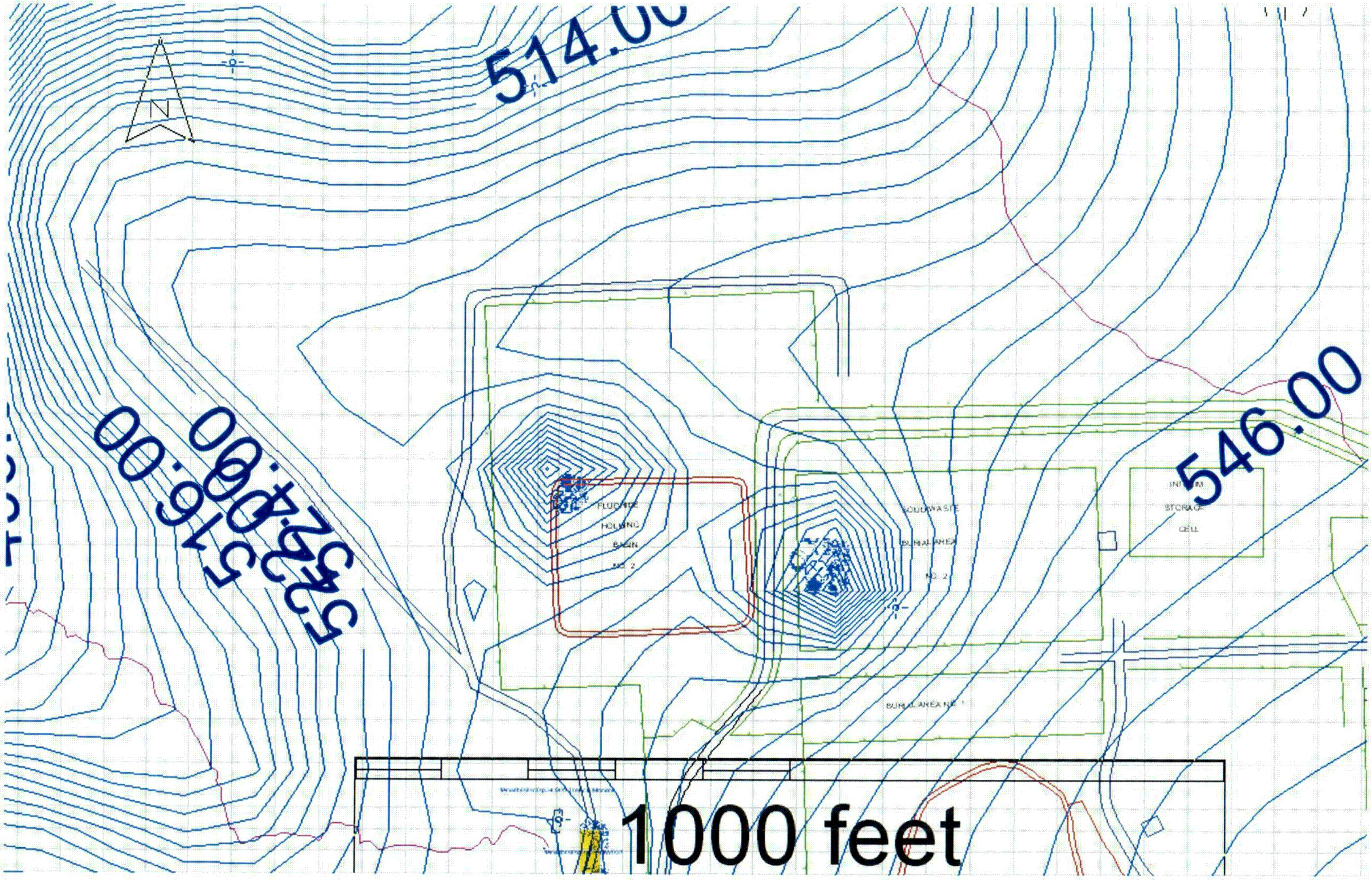
Date:	DECEMBER 2005
Project:	P:\100734/92805 GWCAPR
File:	CAP PARTICLE TRACK.ppt

C03



MFG, Inc. *consulting scientists and engineers*	MW-10 TRENCH AND CLAY WALL	Date: DECEMBER 2005 Project: P:\100734/92805 GWCAPR File: CAP PARTICLE TRACK.ppt

C04



MFG, Inc. *consulting scientists and engineers*	MODELED DRAWDOWN FOR PROPOSED CAP WELLS

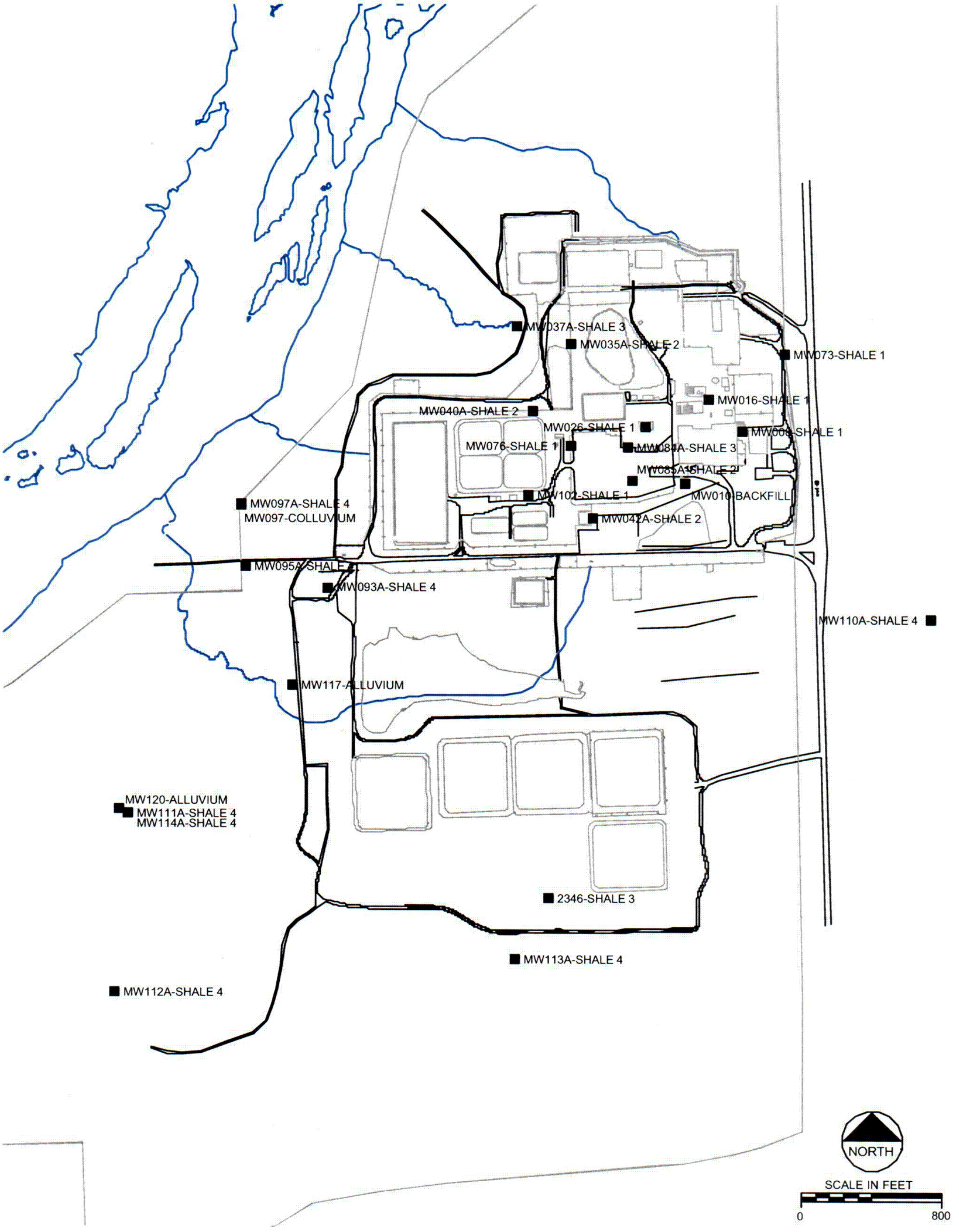
Date: DECEMBER 2005

Project: P:\100734/92805 GWCAPR

File: CAP PARTICLE TRACK.ppt

C05

ATTACHMENT CAP2C-1



consulting scientists and engineers

FIGURE 4-2
SLUG TEST LOCATIONS

Date:	OCTOBER 2002
Project:	100734
File:	SLUGTEST.DWG

C06

Table 4-1 Location Summary

Location	Borehole	Monitoring Well
1	NA	MW-118
2	BH-328	MW-111A, MW-114A, MW-120
3	BH-330	
4	BH-327	MW-110A
5	BH-331	MW-113A
6	BH-329	MW-112A
7	BH-333 BH-334	
8	BH-339 BH-340	
9	SAME AS LOCATION 3	
10	BH-332	
11	BH-335	MW-115A
12	BH-338	MW-117
13	BH-337	MW-119A
14	BH-336	MW-116A

Table 4-8 Slug Test Results

Well	Date	Hydro-stratigraphic Unit	Horizontal Hydraulic Conductivity (ft/day)	Analytical Method
MW010	02012/02	Gravel Backfill	23.79	Bouwer-Rice, 1976 (Unconfined)
MW117	06/12/01	Alluvium	0.0223	Bouwer-Rice, 1976 (Unconfined)
MW120	06/16/01	Alluvium	5.01	Bouwer-Rice, 1976 (Unconfined)
MW097	02012/02	Colluvium	19.86	Bouwer-Rice, 1976 (Unconfined)
MW008	12/04/90	Terrace/Shale 1	0.0156	Bouwer-Rice, 1976 (Unconfined)
	06/15/01	Terrace/Shale 1	0.0134	Bouwer-Rice, 1976 (Unconfined)
MW012	12/06/90	Terrace/Shale 1	0.00556	Bouwer-Rice, 1976 (Unconfined)
MW013	12/06/90	Terrace/Shale 1	0.0110	Bouwer-Rice, 1976 (Unconfined)
MW016	12/06/90	Terrace/Shale 1	0.0382	Bouwer-Rice, 1976 (Unconfined)
	12/09/90	Terrace/Shale 1	0.0480	Bouwer-Rice, 1976 (Unconfined)
	06/15/01	Terrace/Shale 1	0.0129	Bouwer-Rice, 1976 (Unconfined)
MW017	12/06/90	Terrace/Shale 1	0.0311	Bouwer-Rice, 1976 (Unconfined)
	12/06/90	Terrace/Shale 1	0.126	Bouwer-Rice, 1976 (Unconfined)
MW026	06/15/01	Terrace/Shale 1	0.0310	Bouwer-Rice, 1976 (Unconfined)
MW073	06/13/01	Terrace/Shale 1	0.261	Bouwer-Rice, 1976 (Unconfined)
MW076	06/15/01	Terrace/Shale 1	0.00416	Bouwer-Rice, 1976 (Unconfined)
MW102	06/14/01	Terrace/Shale 1	0.0297	CBP, 1967 (Confined)
MW035A	06/13/01	Shale 2	1.35	CBP, 1967 (Confined)
MW040A	06/13/01	Shale 2	0.327	CBP, 1967 (Confined)
MW042A	06/13/01	Shale 2	0.0318	CBP, 1967 (Confined)
MW085A	06/15/01	Shale 2	0.0700	CBP, 1967 (Confined)
2346	06/12/01	Shale 3	0.489	CBP, 1967 (Confined)
MW037A	06/13/01	Shale 3	0.0103	Bouwer-Rice, 1976 (Unconfined)

Table 4-8 Slug Test Results (continued)

Well	Date	Hydro-stratigraphic Unit	Horizontal Hydraulic Conductivity (ft/day)	Analytical Method
MW084A	06/14/01	Shale 3	0.0217	CBP, 1967 (Confined)
MW093A	02/12/02	Shale 4	0.94	Bouwer-Rice, 1976 (Unconfined)
MW095A	02/12/02	Shale 4	1.88	Bouwer-Rice, 1976 (Unconfined)
MW097A	02/12/02	Shale 4	0.35	Bouwer-Rice, 1976 (Unconfined)
MW110A	06/13/01	Shale 4	0.0343	CBP, 1967 (Confined)
MW111A	06/15/01	Shale 4	0.0482	Bouwer-Rice, 1976 (Unconfined)
MW112A	06/12/01	Shale 4	1.30	Bouwer-Rice, 1976 (Unconfined)
MW113A	06/12/01	Shale 4	0.00730	CBP, 1967 (Confined)
MW114A	06/16/01	Shale 4	0.00466	Bouwer-Rice, 1976 (Unconfined)

Note: CBP = Cooper, Bredehoeft & Papadopulos

Table 4-9 Average, Maximum, and Minimum Values of Hydraulic Conductivity

Hydrologic Unit	Average Hydraulic Conductivity (ft/day)	Maximum Hydraulic Conductivity (ft/day)	Minimum Hydraulic Conductivity (ft/day)
Alluvium/Colluvium	8.30	19.9	0.0223
Shale 1/Terrace	0.0521	0.261	0.00416
Shale 2	0.445	1.35	0.0318
Shale 3	0.174	0.489	0.0103
Shale 4	0.571	1.88	0.00466

Table 1 Calculated Hydraulic Conductivity Tests

Well Location	Hydrologic Unit	d_c (ft)	d_b (ft)	Screen Length (ft)	Saturated Thickness (ft)	Hydraulic Conductivity (ft/day)	Storage Coefficient	Analysis Method
MW010	Gravel Backfill	0.352	0.615	~3	~3	23.79	na	Bouwer and Rice (1976)
MW010A	2SH/3SH	0.167	0.500	13.50	14.00	0.169	6.25E-03	Cooper, et. al. (1967)
MW059A	3SH/4SH	0.286	0.500	4.71	5.43	8.60	na	Bouwer and Rice (1976)
MW093A	4SH	0.352	0.615	16.57	17.09	0.94	na	Bouwer and Rice (1976)
MW095A	4SH	0.352	0.615	5.50	5.50	1.88	na	Bouwer and Rice (1976)
MW097	Colluvium	0.352	0.615	0.90	1.55	19.86	na	Bouwer and Rice (1976)
MW097A	4SH	0.352	0.615	17.00	17.00	0.35	na	Bouwer and Rice (1976)

d_c – effective diameter of well where water level is changing
d_b – borehole diameter
na – data not derived from this test

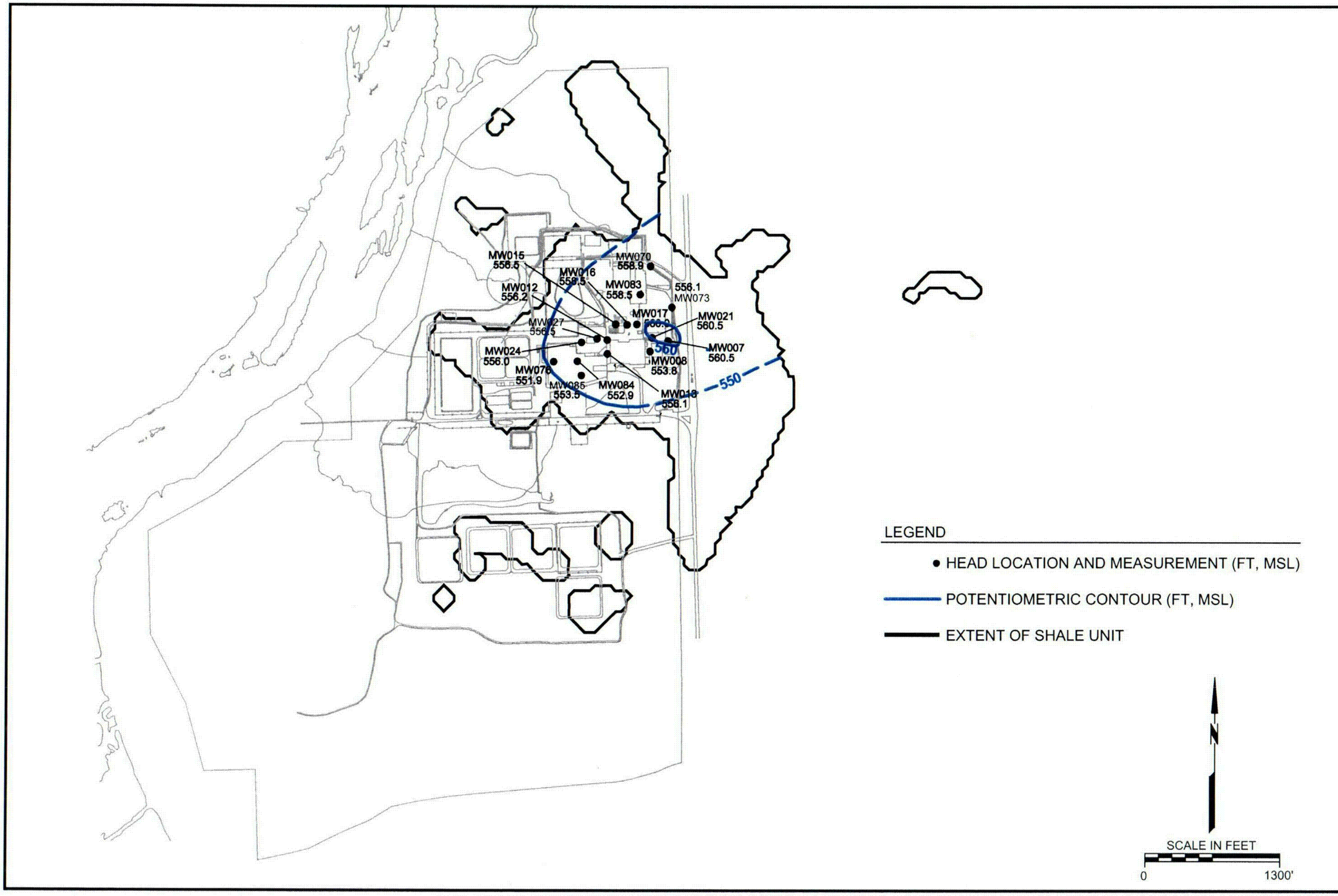
ATTACHMENT CAP2C-2

Table 2 Slug Test Results

WELL	DATE	HYDROLOGIC UNIT	SATURATED THICKNESS (FT)	HYDRAULIC CONDUCTIVITY (FT/DAY)	TRANSMISSIVITY (FT2/DAY)	METHOD
MW117	06/12/01	ALLUVIUM	3.9	0.0223	0.0870	BOUWER-RICE, 1976 (UNCONFINED)
MW120	06/16/01	ALLUVIUM	17.9	5.01	89.7	BOUWER-RICE, 1976 (UNCONFINED)
MW008	06/15/01	SHALE 1	6.8	0.0134	0.0900	BOUWER-RICE, 1976 (UNCONFINED)
MW016	06/15/01	SHALE 1	11.8	0.0129	0.150	BOUWER-RICE, 1976 (UNCONFINED)
MW026	06/15/01	SHALE 1	10.7	0.0310	0.330	BOUWER-RICE, 1976 (UNCONFINED)
MW073	06/13/01	SHALE 1	7.4	0.261	1.90	BOUWER-RICE, 1976 (UNCONFINED)
MW076	06/15/01	SHALE 1	15.9	0.00416	0.0660	BOUWER-RICE, 1976 (UNCONFINED)
MW102	06/14/01	SHALE 1	11.5	0.0297	0.342	CBP, 1967 (CONFINED)
MW035A	06/13/01	SHALE 2	3.0	1.35	4.05	CBP, 1967 (CONFINED)
MW040A	06/13/01	SHALE 2	8.6	0.327	2.81	CBP, 1967 (CONFINED)
MW042A	06/13/01	SHALE 2	6.0	0.0318	0.191	CBP, 1967 (CONFINED)
MW085A	06/15/01	SHALE 2	3.5*	0.0700	0.245	CBP, 1967 (CONFINED)
2346	06/12/01	SHALE 3	2.5	0.489	1.22	CBP, 1967 (CONFINED)
MW037A	06/13/01	SHALE 3	12.9	0.0103	0.130	BOUWER-RICE, 1976 (UNCONFINED)
MW084A	06/14/01	SHALE 3	3.5*	0.0217	0.0759	CBP, 1967 (CONFINED)
MW110	06/13/01	SHALE 4	16.4	0.0343	0.562	CBP, 1967 (CONFINED)
MW111	06/15/01	SHALE 4	12.3	0.0482	0.600	BOUWER-RICE, 1976 (UNCONFINED)
MW112	06/12/01	SHALE 4	17.8	1.30	23.0	BOUWER-RICE, 1976 (UNCONFINED)
MW113	06/12/01	SHALE 4	22.0	0.0073	0.161	CBP, 1967 (CONFINED)
MW114	06/16/01	SHALE 4	12.3	0.00466	0.0570	BOUWER-RICE, 1976 (UNCONFINED)

*estimated

ATTACHMENT CAP2C-3

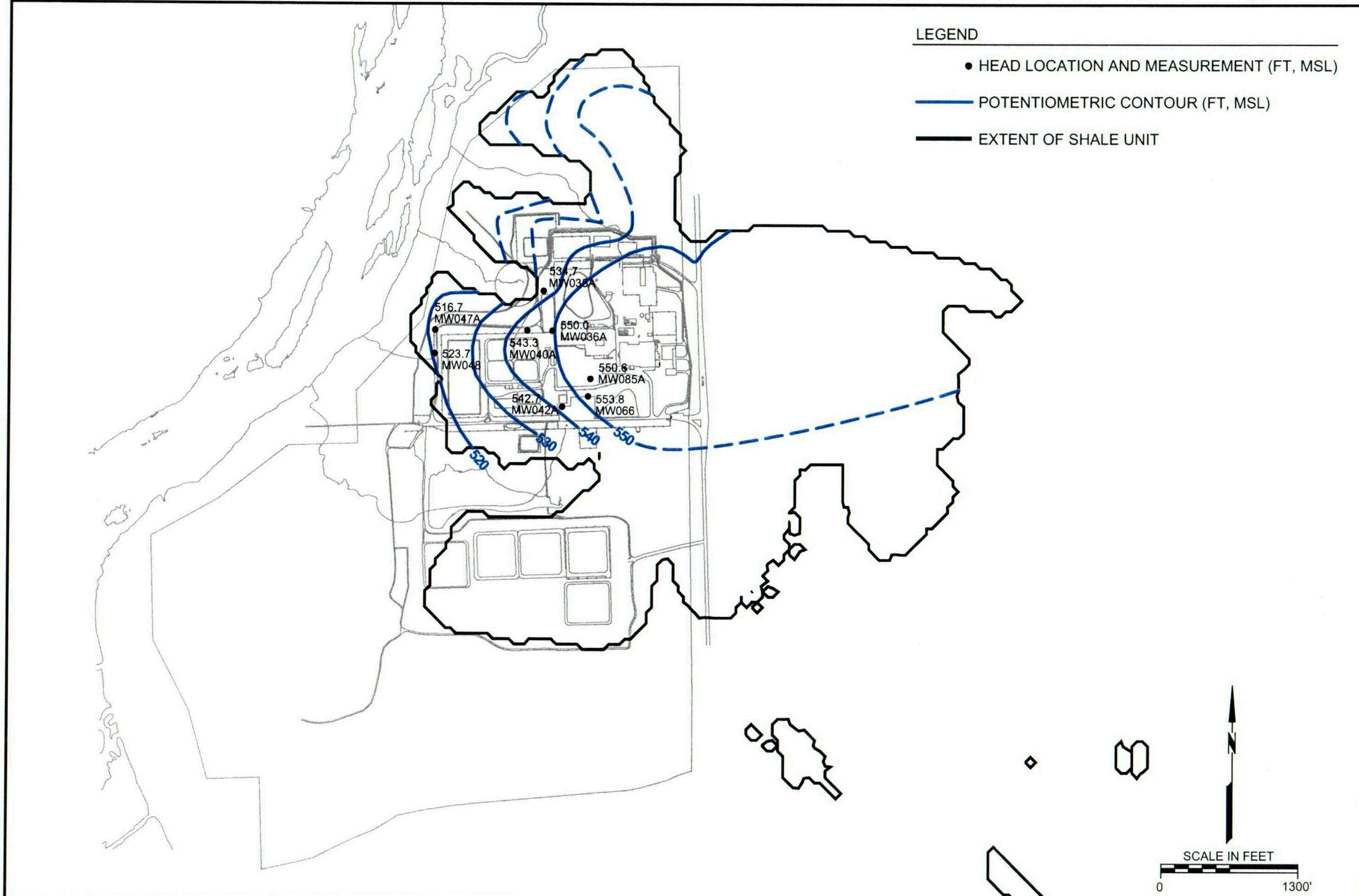


consulting scientists and engineers

FIGURE 2-14
POTENTIOMETRIC SURFACE SHALE 1
JUNE 2001

Date:	JUNE 2003
Project:	100734/CAP Figures
File:	SHALE.dwg

C07

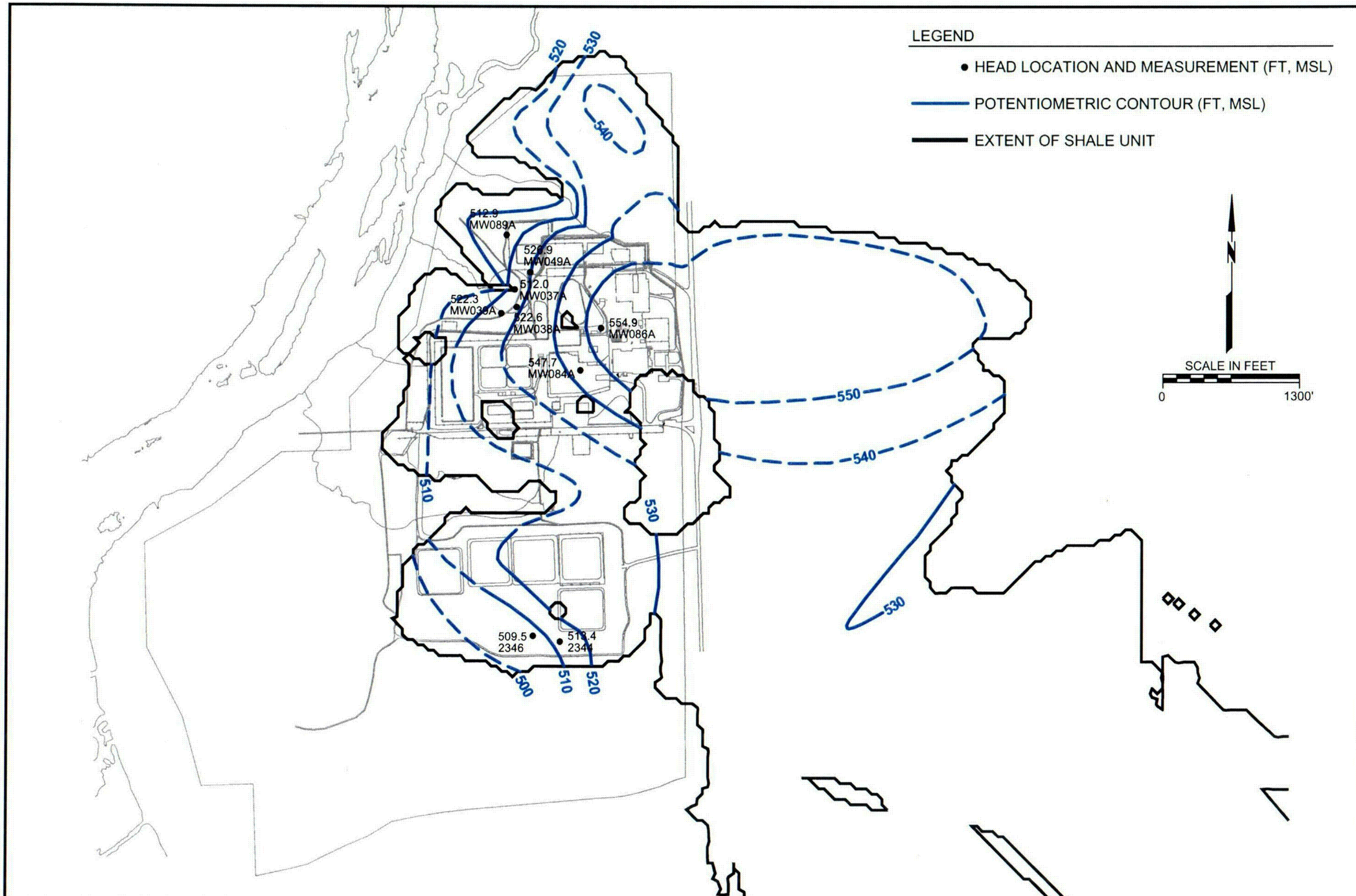


consulting scientists and engineers

FIGURE 2-15
POTENTIOMETRIC SURFACE SHALE 2
JUNE 2001

Date:	JUNE 2003
Project:	100734/CAP Figures
File:	SHALE.dwg

C09

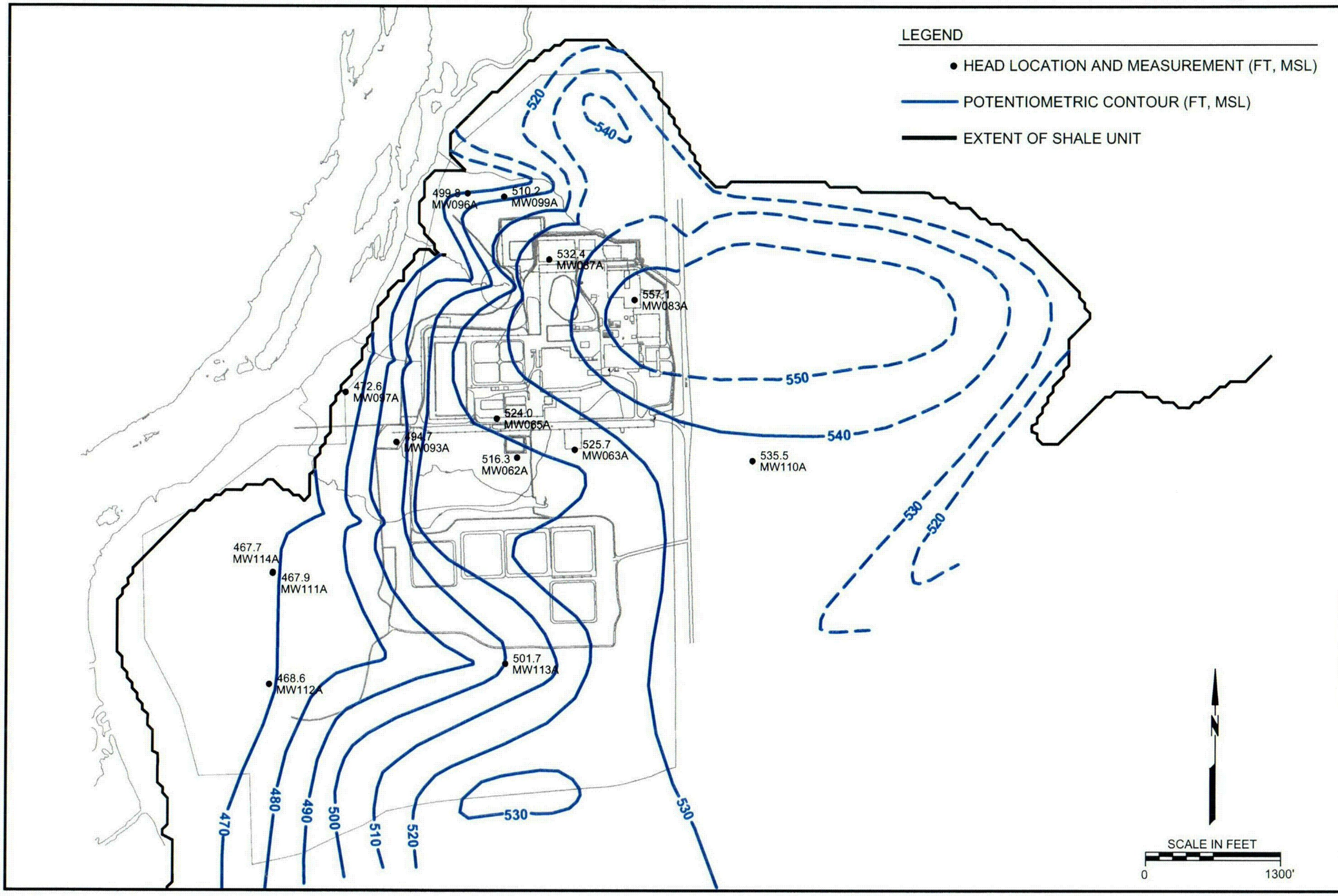


consulting scientists and engineers

FIGURE 2-16
POTENTIOMETRIC SURFACE SHALE 3
JUNE 2001

Date:	JUNE 2003
Project:	100734/CAP Figures
File:	SHALE.dwg

C09

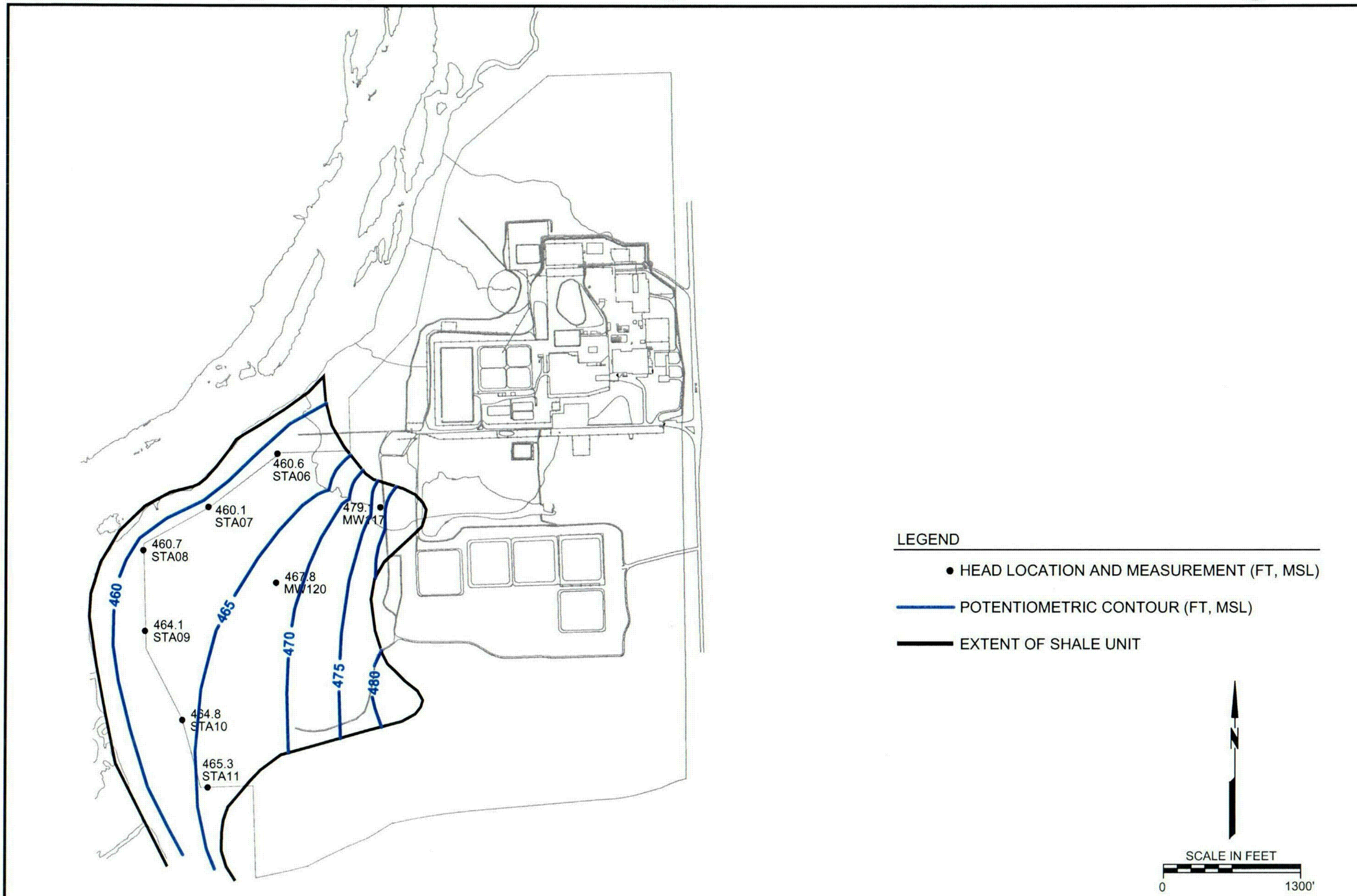


consulting scientists and engineers

FIGURE 2-17
POTENTIOMETRIC SURFACE SHALE 4
JUNE 2001

Date:	JUNE 2003
Project:	100734/CAP Figures
File:	SHALE.dwg

C10



consulting scientists and engineers

FIGURE 2-18
POTENTIOMETRIC SURFACE ALLUVIUM
5 JUNE 2001

Date:	JUNE 2003
Project:	100734/CAP Figures
File:	SHALE.dwg

C11

ATTACHMENT CAP2C-4

Table 8-3 Computed versus Observed Heads

Name	Easting (feet)	Northing (feet)	Layer	Observed Head (feet amsl)	Computed Head (feet amsl)	Residual (feet)	Absolute Residual Error (feet/feet)
MW-111	2833814	193663	1	465.03	466.57	-1.54	0.012
MW-117	2834811	194372	1	475.97	487.82	-11.85	0.096
MW-120	2833825	193669	1	465.18	466.65	-1.47	0.012
MW003	2837304	195568	2	556.76	555.17	1.58	0.013
MW007	2837565	195863	2	560.27	561.91	-1.64	0.013
MW008	2837391	195763	2	558.54	558.90	-0.36	0.003
MW012	2836975	195867	2	555.89	556.17	-0.28	0.002
MW013	2836982	195739	2	555.43	554.46	0.97	0.008
MW015	2837060	196022	2	556.64	556.31	0.33	0.003
MW016	2837172	196018	2	555.22	557.02	-1.80	0.015
MW017	2837260	196022	2	559.36	558.23	1.13	0.009
MW021	2837412	195894	2	557.99	560.63	-2.64	0.021
MW022	2837199	195623	2	558.05	554.21	3.84	0.031
MW023	2837150	195888	2	557.70	557.16	0.54	0.004
MW025	2836808	195940	2	555.51	553.12	2.39	0.019
MW026	2836827	195817	2	555.60	553.82	1.78	0.014
MW027	2836883	195883	2	555.43	555.22	0.21	0.002
MW052	2835998	196764	2	527.98	532.00	-4.02	0.032
MW070	2837395	196575	2	558.55	559.36	-0.80	0.006
MW073	2837602	196183	2	560.22	562.36	-2.14	0.017
MW076	2836469	195664	2	553.26	549.90	3.36	0.027
MW079	2837013	196198	2	556.05	556.92	-0.87	0.007
MW083	2837296	196305	2	558.35	558.96	-0.61	0.005
MW084	2836695	195669	2	552.71	548.51	4.20	0.034
MW085	2836734	195536	2	551.58	550.56	1.02	0.008
MW102	2836152	195463	2	550.08	547.25	2.82	0.023
MW036A	2836362	195976	3	548.87	548.52	0.34	0.003
MW040A	2836127	195981	3	542.27	544.46	-2.19	0.018
MW042A	2836461	195264	3	542.50	540.98	1.52	0.012
MW045A	2835681	195996	3	528.75	536.27	-7.52	0.061
MW046	2835463	196002	3	526.24	529.14	-2.90	0.023
MW048	2835245	195761	3	523.59	524.50	-0.91	0.007
MW085A	2836727	195526	3	549.91	549.38	0.52	0.004
2344	2836515	193110	4	513.84	514.16	-0.32	0.003
2346	2836267	193164	4	513.27	510.22	3.05	0.025
MW035A	2836289	196354	4	534.32	534.99	-0.67	0.005
MW047A	2835260	195981	4	516.61	522.73	-6.12	0.049
MW084A	2836702	195669	4	547.99	548.61	-0.62	0.005
MW086A	2836882	196067	4	552.91	551.14	1.77	0.014
270-1	2839203	195930	5	552.45	559.39	-6.94	0.056
270-2	2839849	194334	5	530.81	535.87	-5.05	0.041
270-3	2841138	195318	5	516.43	514.59	1.83	0.015

Table 8-3 Computed versus Observed Heads (continued)

Name	Easting (feet)	Northing (feet)	Layer	Observed Head (feet amsl)	Computed Head (feet amsl)	Residual (feet)	Absolute Residual Error (feet/feet)
FTP-2B	2835812	193434	5	504.84	507.95	-3.11	0.025
MW037A	2836077	196436	5	512.00	526.92	-14.92	0.121
MW039A	2835948	196208	5	521.68	529.27	-7.59	0.061
MW062A	2836178	194789	5	516.94	523.78	-6.83	0.055
MW063A	2836724	194863	5	526.15	532.02	-5.87	0.047
MW083A	2837302	196290	5	557.16	553.92	3.25	0.026
MW087A	2836464	196681	5	533.24	535.74	-2.50	0.020
MW093A	2835012	194930	5	495.41	503.78	-8.37	0.068
MW095A	2834525	195116	5	478.59	476.64	1.95	0.016
MW096A	2835695	197304	5	502.65	507.18	-4.54	0.037
MW097A	2834512	195412	5	473.48	472.57	0.91	0.007
MW099A	2836045	197278	5	510.55	512.81	-2.26	0.018
MW110	2838430	194760	5	533.19	546.40	-13.21	0.107
MW112	2833800	192631	5	465.77	470.36	-4.59	0.037
MW113	2836075	192811	5	498.80	499.60	-0.80	0.006
MW114A	2833831	193680	5	465.03	466.77	-1.74	0.014
MW007B	2837559	195868	6	532.01	532.49	-0.49	0.004
MW012B	2836966	195878	6	505.06	525.88	-20.82	0.168
MW050B	2836143	196938	6	510.47	499.08	11.38	0.092
MW059B	2835347	195048	6	501.98	495.12	6.86	0.055
MW062B	2836191	194790	6	511.34	511.65	-0.31	0.003
MW072B	2837569	196445	6	538.40	528.74	9.65	0.078
MW090B	2834977	194201	6	487.68	489.05	-1.37	0.011
MW098B	2834822	195723	6	476.13	476.93	-0.80	0.006
MW100B	2835549	196687	6	485.18	484.30	0.88	0.007
MW104B	2836343	193537	6	507.41	511.39	-3.98	0.032
MW105B	2834997	193754	6	484.70	489.69	-5.00	0.040
Mean Residual (MR)						-1.51	
Mean Absolute Residual (MAR)						3.48	
Standard Deviation (SD)						5.00	
Sum of Squares						1884	
Minimum Residual						-20.82	
Maximum Residual						11.38	
Range						123.74	
MAR/Range						0.028	
SD/Range						0.040	

ATTACHMENT CAP2C-5

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

C12

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

C13

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

C14

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

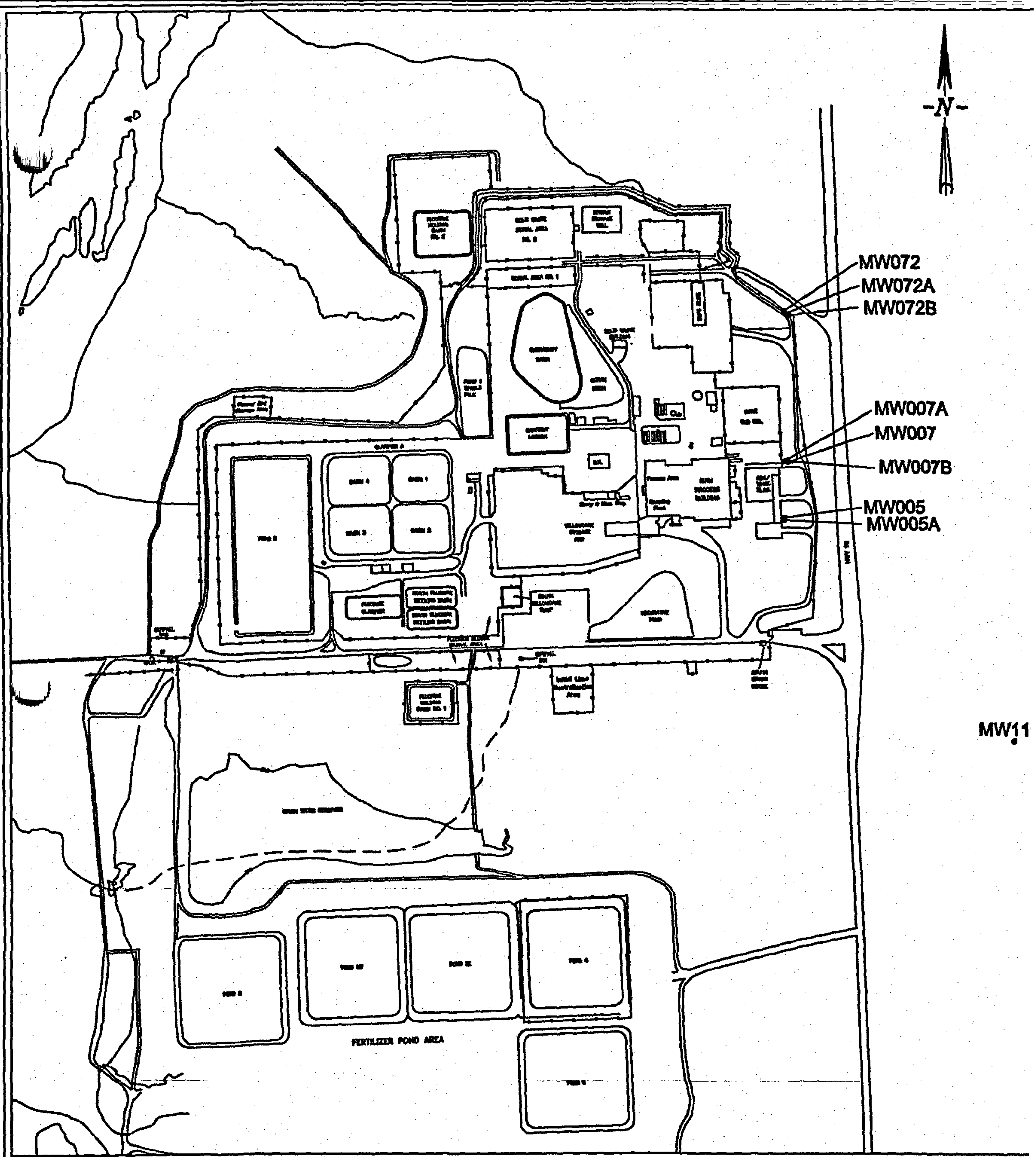
Total Measurements	14
Total Non-Detects	12 (85.7143%)
Background Mean	1.14643
Background Std Dev	0.556578

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 Evaluati

TITLE: *Background Monitoring Well Locations*

PREPARED BY: SCM	FILENAME: Figure1.dwg
REVIEWED BY: SCM	FIGURE NO. 1
DATE: 18 Oct 2004	

Figure 2
Arsenic - Box Plot

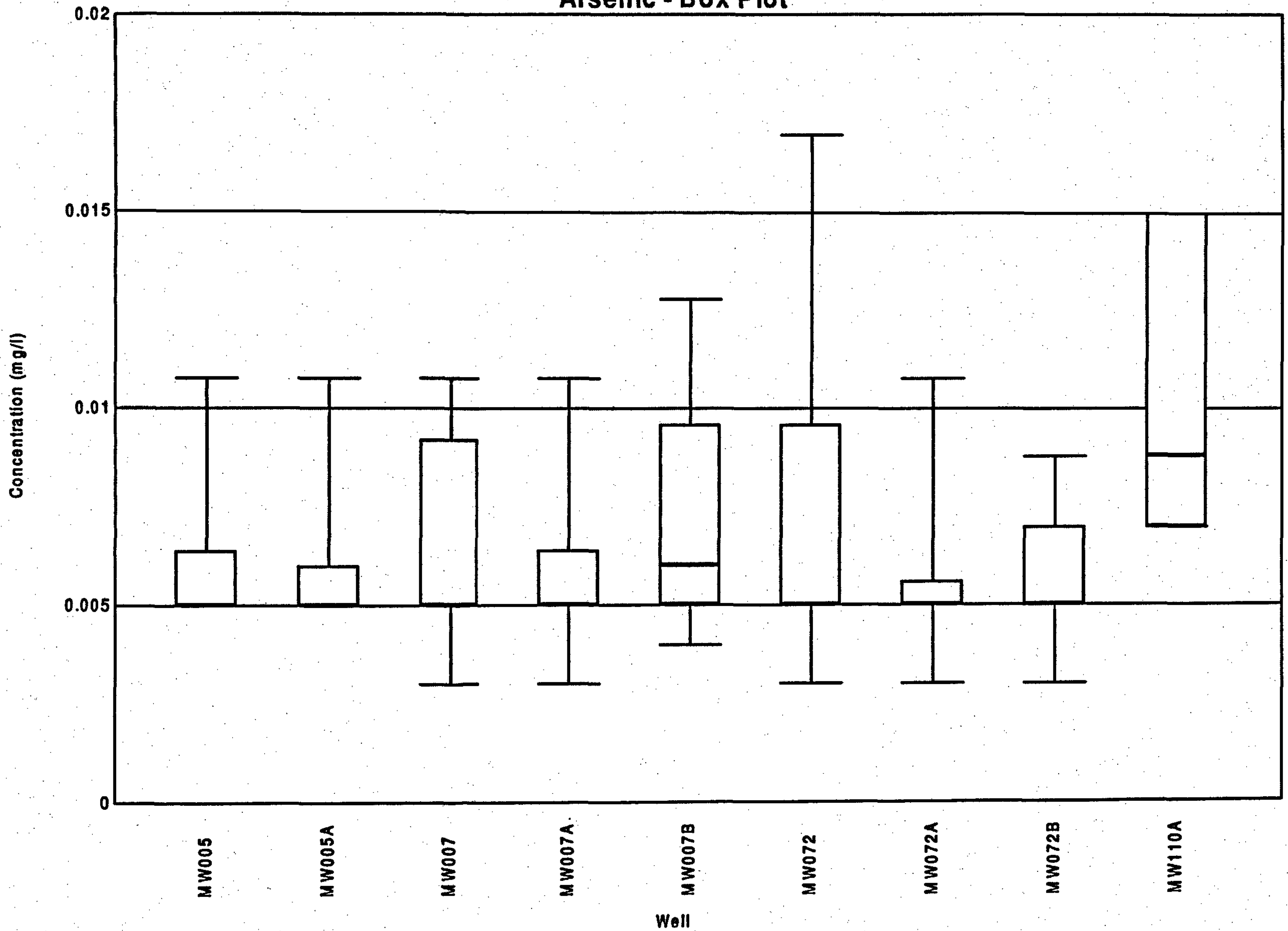


Figure 3
Fluoride - Box Plot

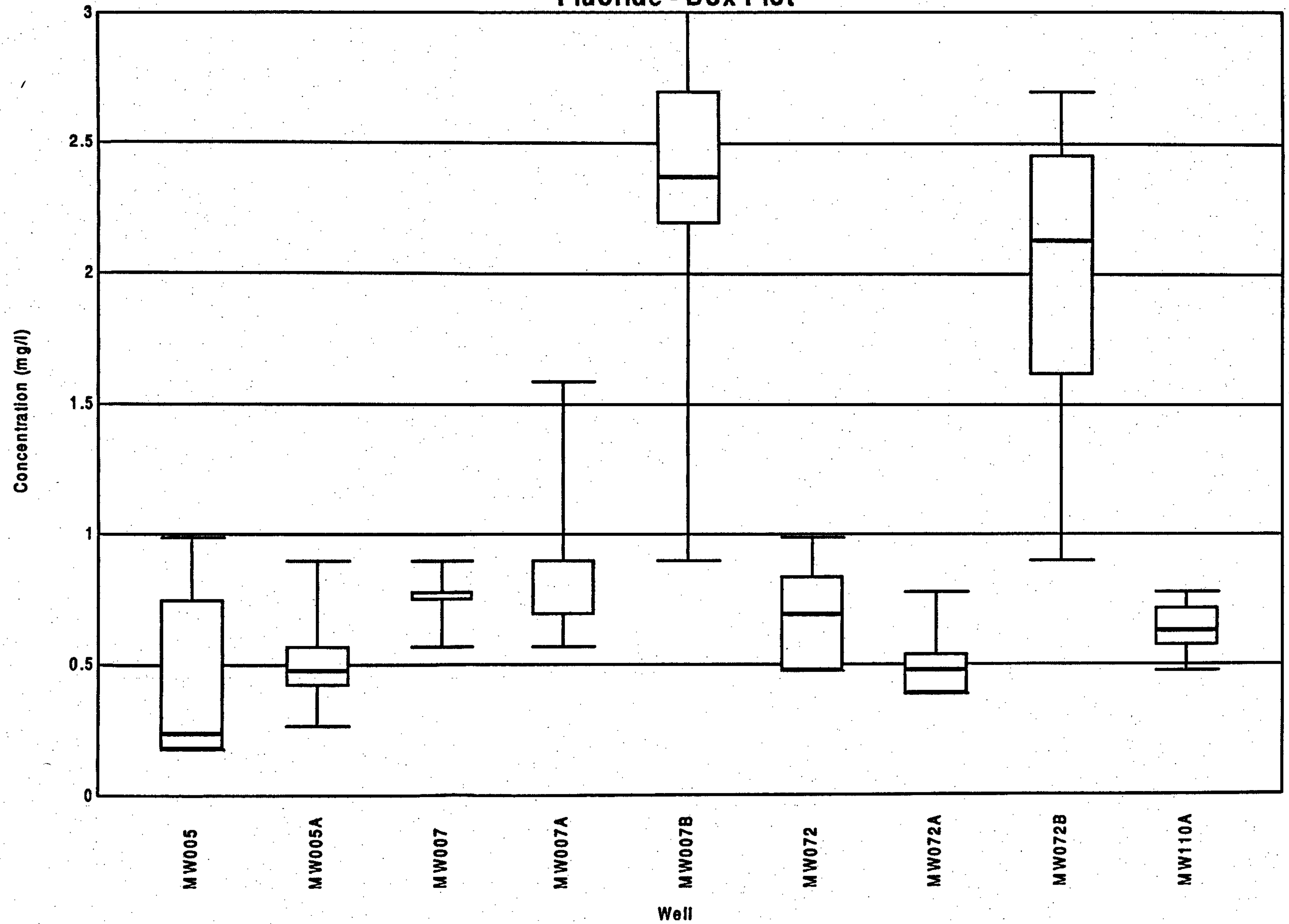


Figure 4
Nitrate - Box Plot

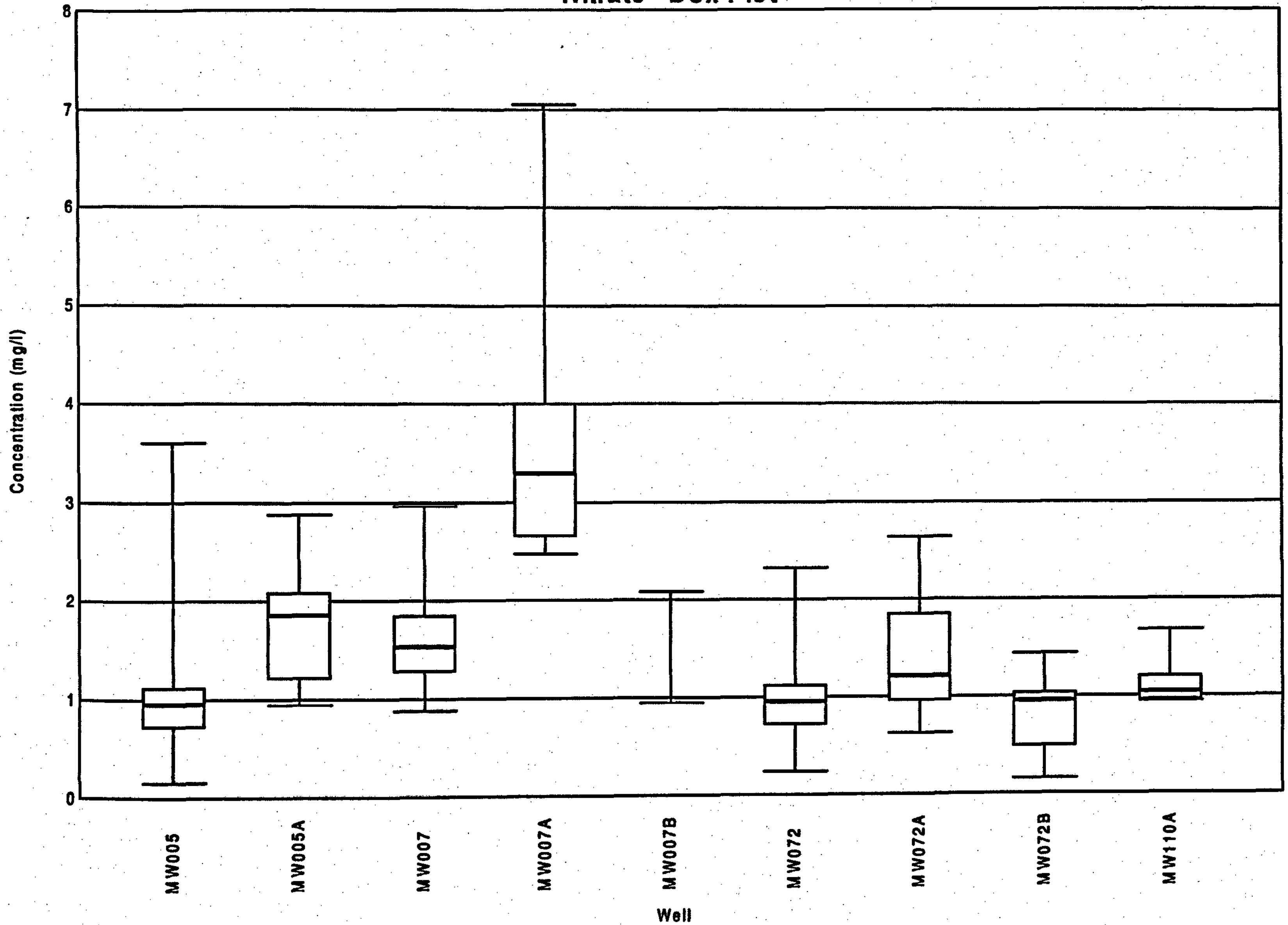


Figure 5
Uranium - Box Plot

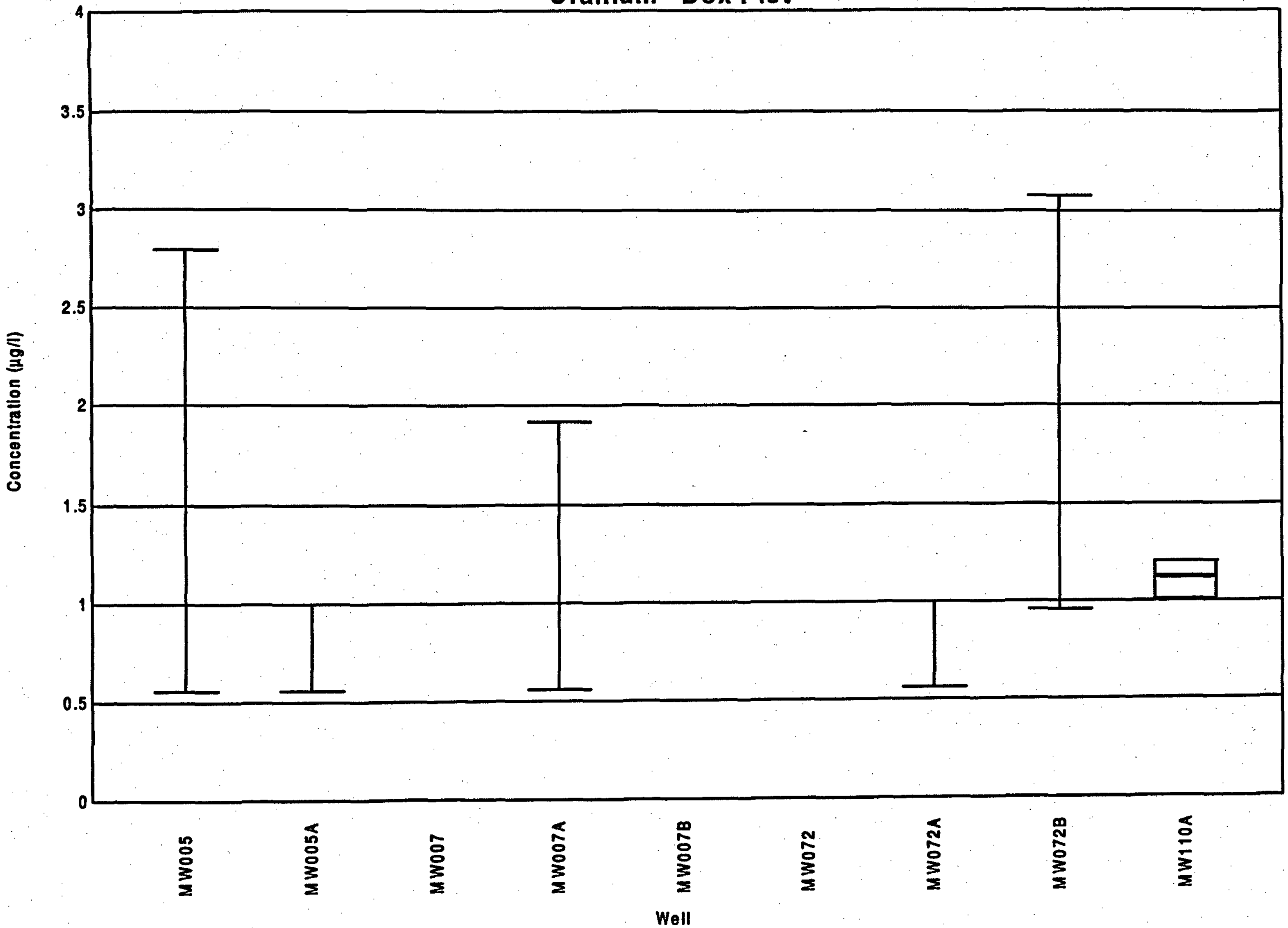
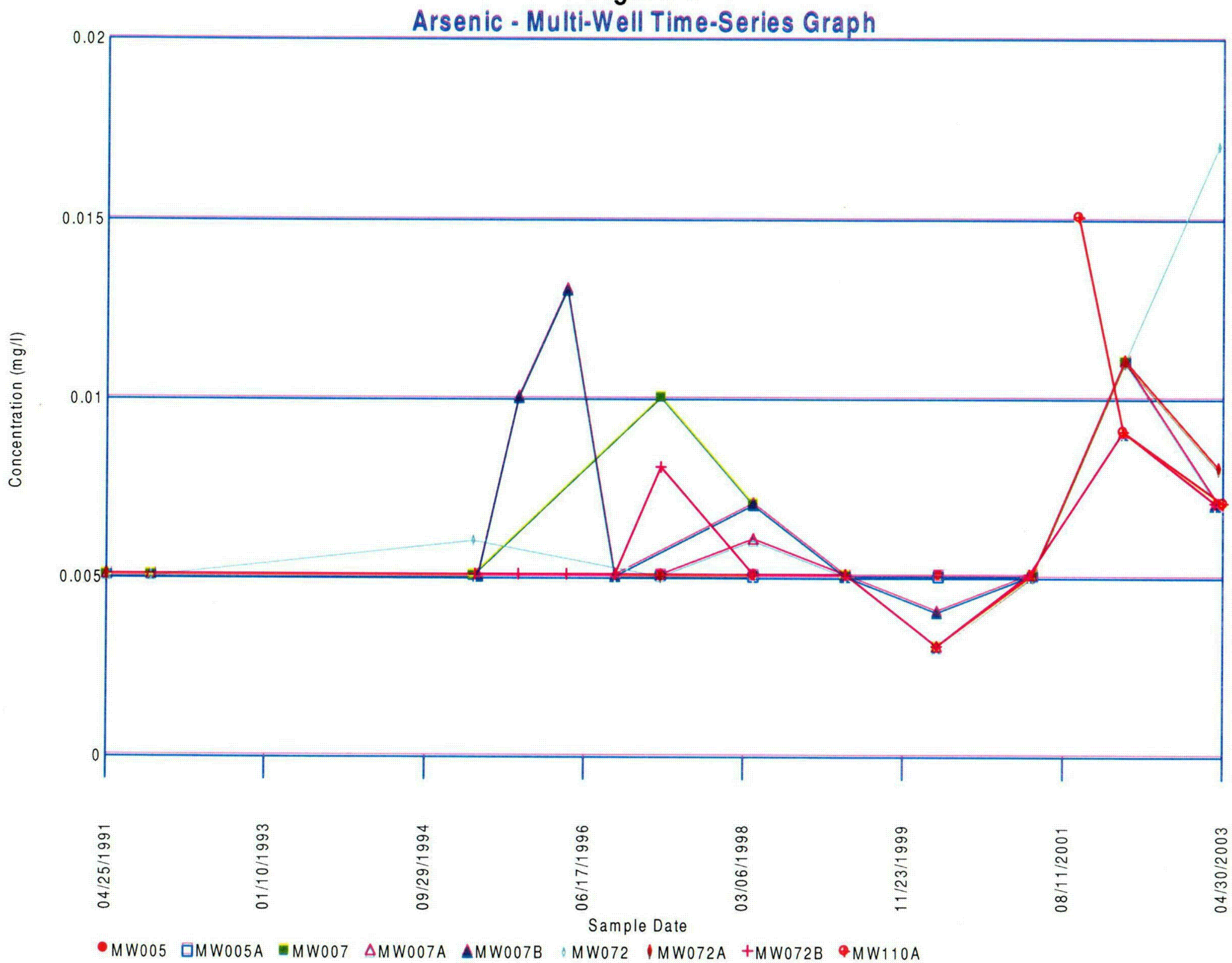
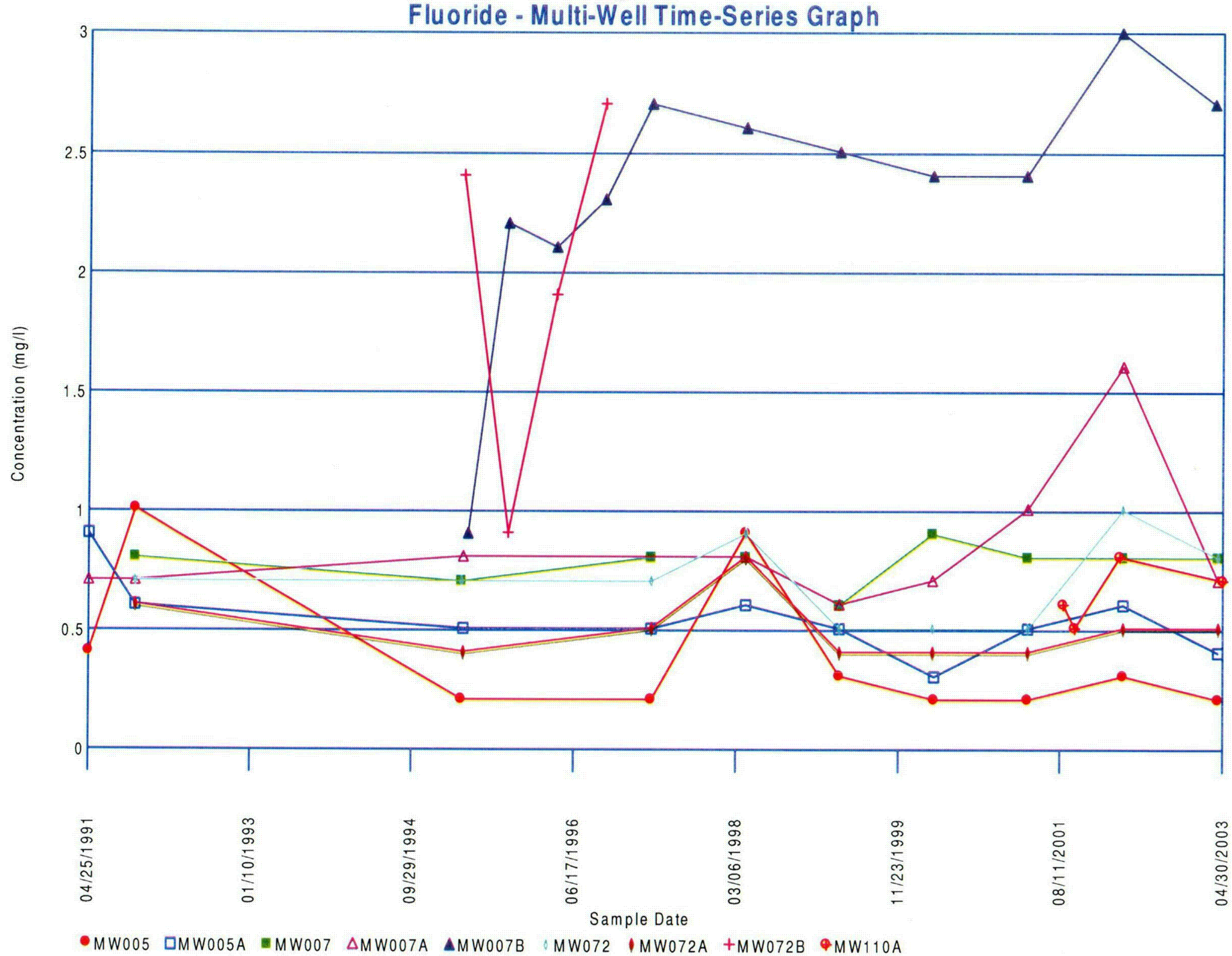


Figure 6


Arsenic - Multi-Well Time-Series Graph
Concentration (mg/l)
0.02
0.015
0.01
0.005
0
04/25/1991
01/10/1993
09/29/1994
06/17/1996
03/06/1998
11/23/1999
08/11/2001
04/30/2003
Sample Date
MW005
MW005A
MW007
MW007A
MW007B
MW072
MW072A
MW072B
MW110A

C15

Figure 7



Fluoride - Multi-Well Time-Series Graph
Concentration (mg/l)
3
2.5
2
1.5
1
0.5
0
04/25/1991
01/10/1993
09/29/1994
06/17/1996
03/06/1998
11/23/1999
08/11/2001
04/30/2003
Sample Date
MW005
MW005A
MW007
MW007A
MW007B
MW072
MW072A
MW072B
MW110A

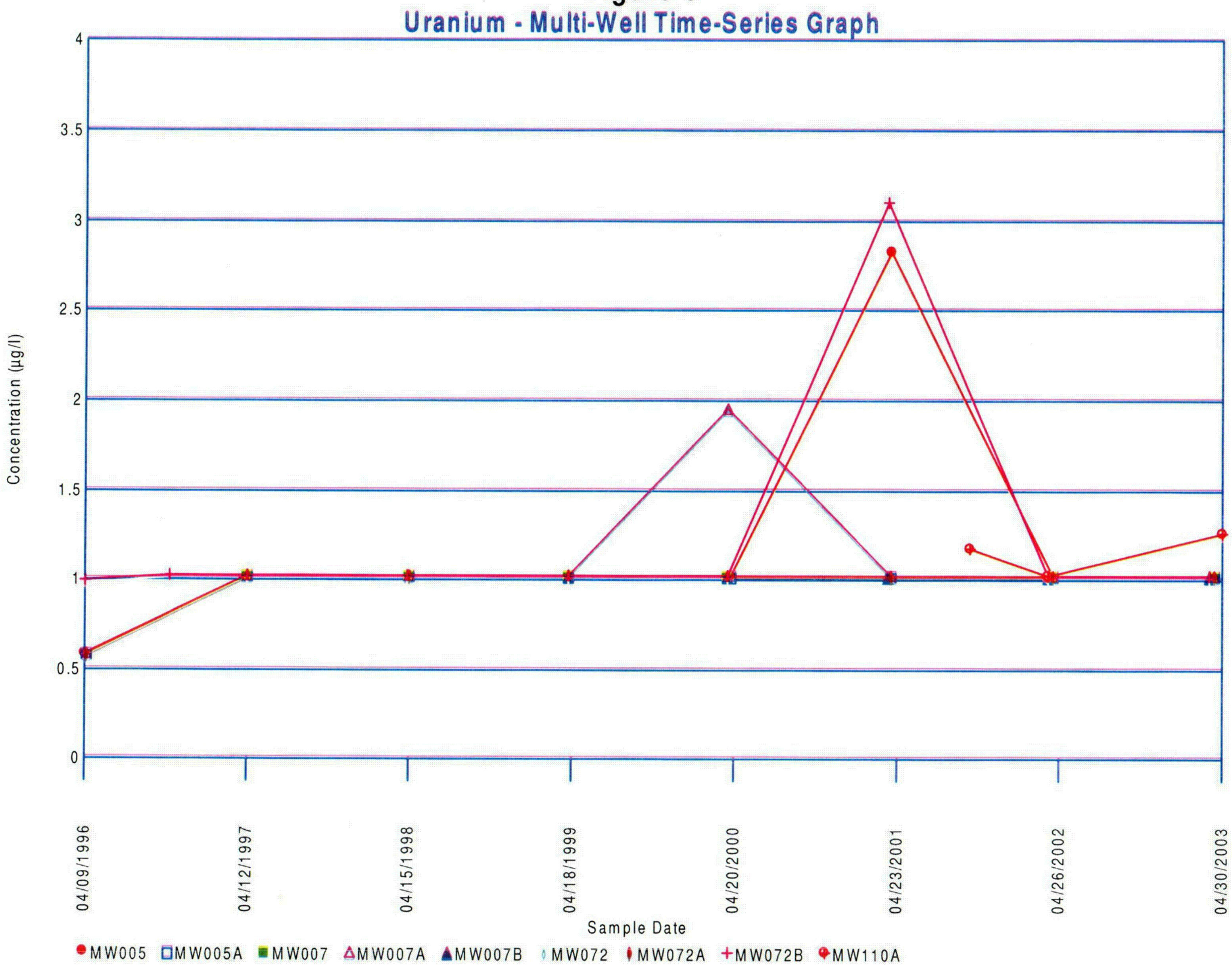
C16

Figure 8

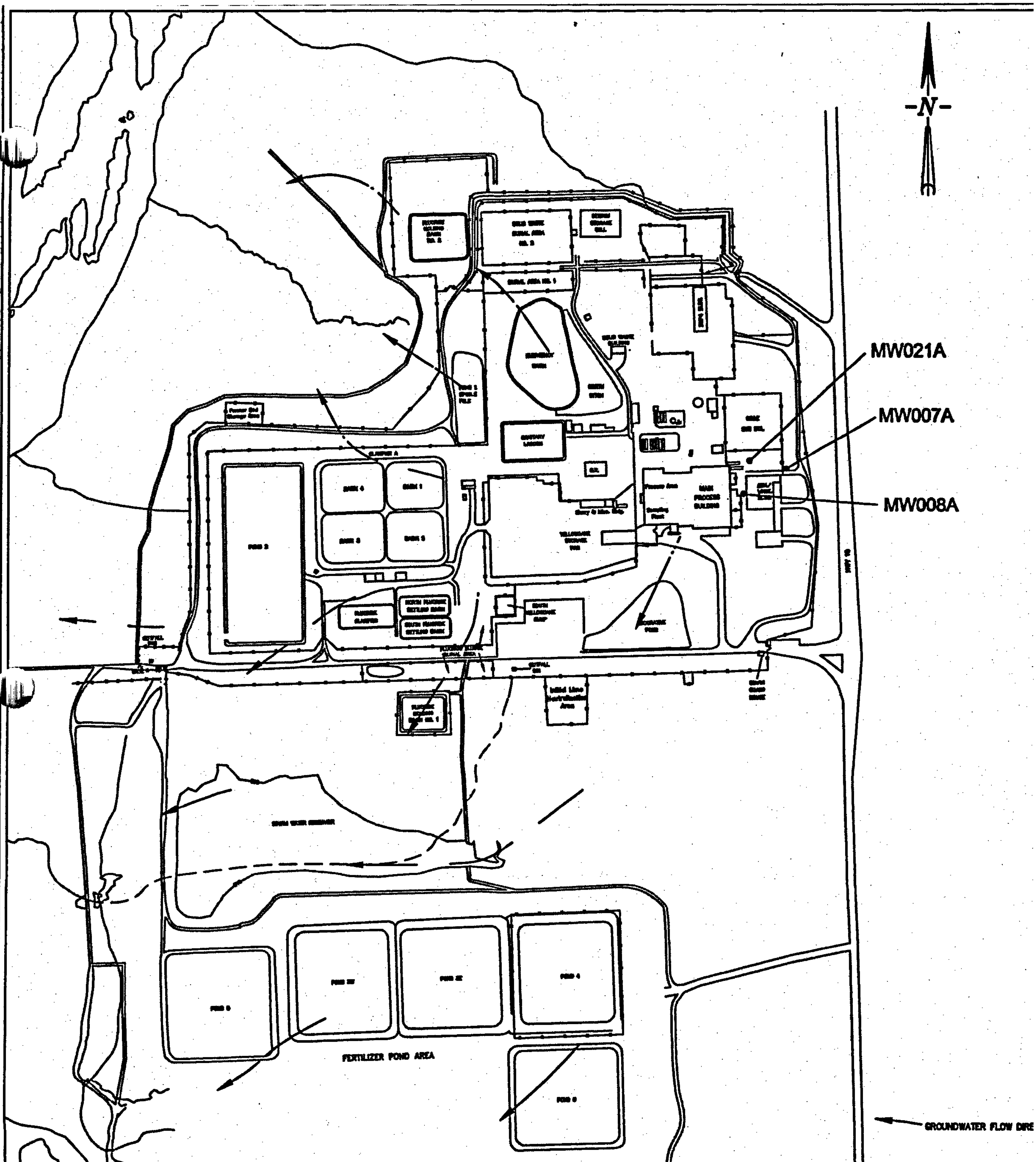
Nitrate - Multi-Well Time-Series Graph
Concentration (mg/l)
0
1
2
3
4
5
6
7
8
04/25/1991
01/10/1993
09/29/1994
06/17/1996
03/06/1998
11/23/1999
08/11/2001
04/30/2003
Sample Date
MW005
MW005A
MW007
MW007A
MW007B
MW072
MW072A
MW072B
MW110A

C17

Figure 9


Uranium - Multi-Well Time-Series Graph
4
3.5
3
2.5
2
1.5
1
0.5
0
Concentration (µg/l)
04/09/1996
04/12/1997
04/15/1998
04/18/1999
04/20/2000
04/23/2001
04/26/2002
04/30/2003
Sample Date
MW005
MW005A
MW007
MW007A
MW007B
MW072
MW072A
MW072B
MW110A

C18



SEQUOYAH FUELS CORPORATION

Background Groundwater Monitoring Well Evaluatic

TITLE: Location of MW007A, MW008A & MW021A	
PREPARED BY: SCM	FILENAME: Figure1.dwg
REVIEWED BY: SCM	FIGURE NO. 1(
DATE: 26 Oct 2004	

Figure 11

C19

ATTACHMENT CAP2E-1

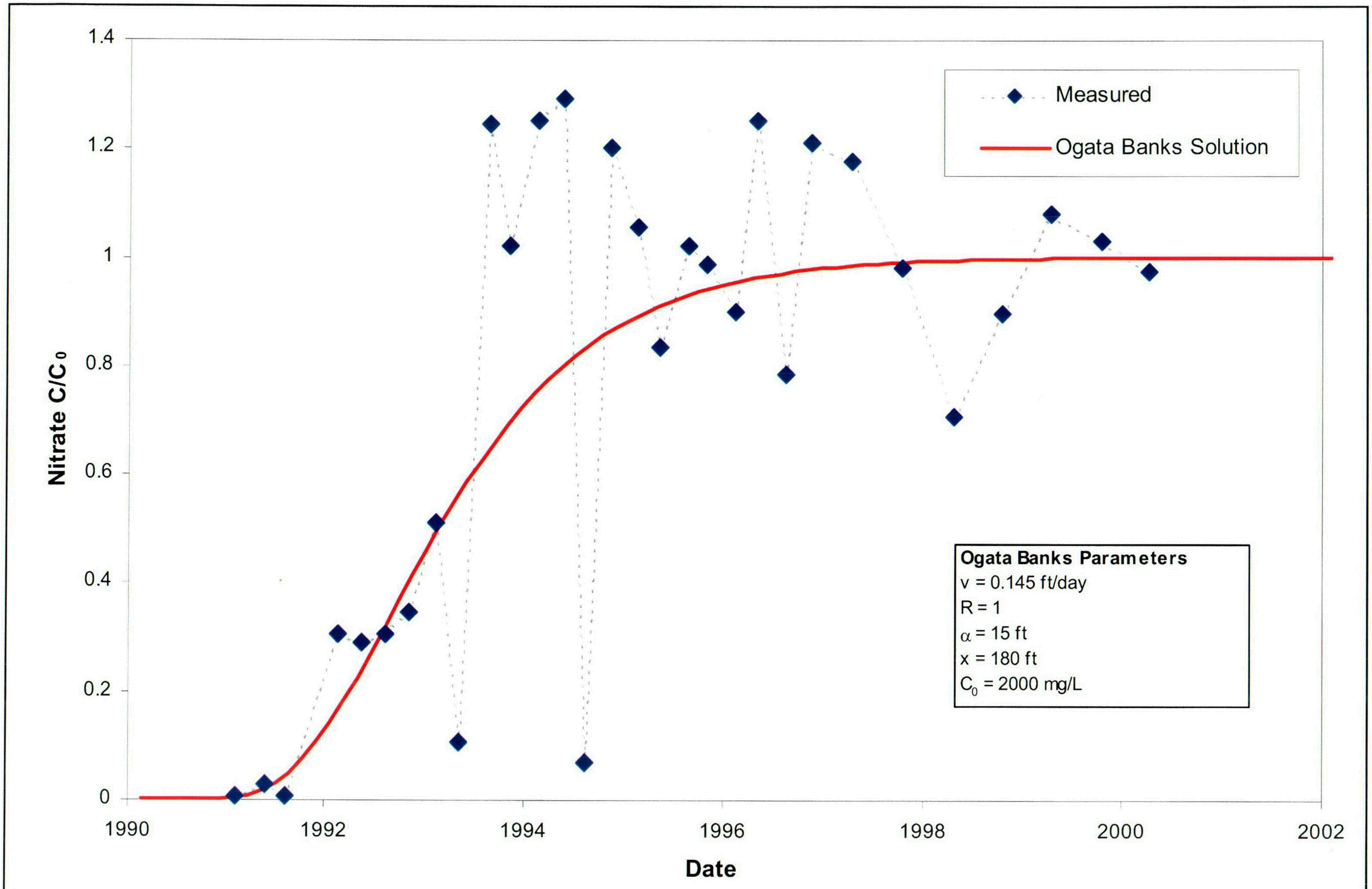


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FIGURE 8-32
ONE DIMENSIONAL TRANSPORT ANALYSIS, 2322A

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Project:	P:\100734-2\REV CHAR RPT
File:	1D TRANSPORT.ppt

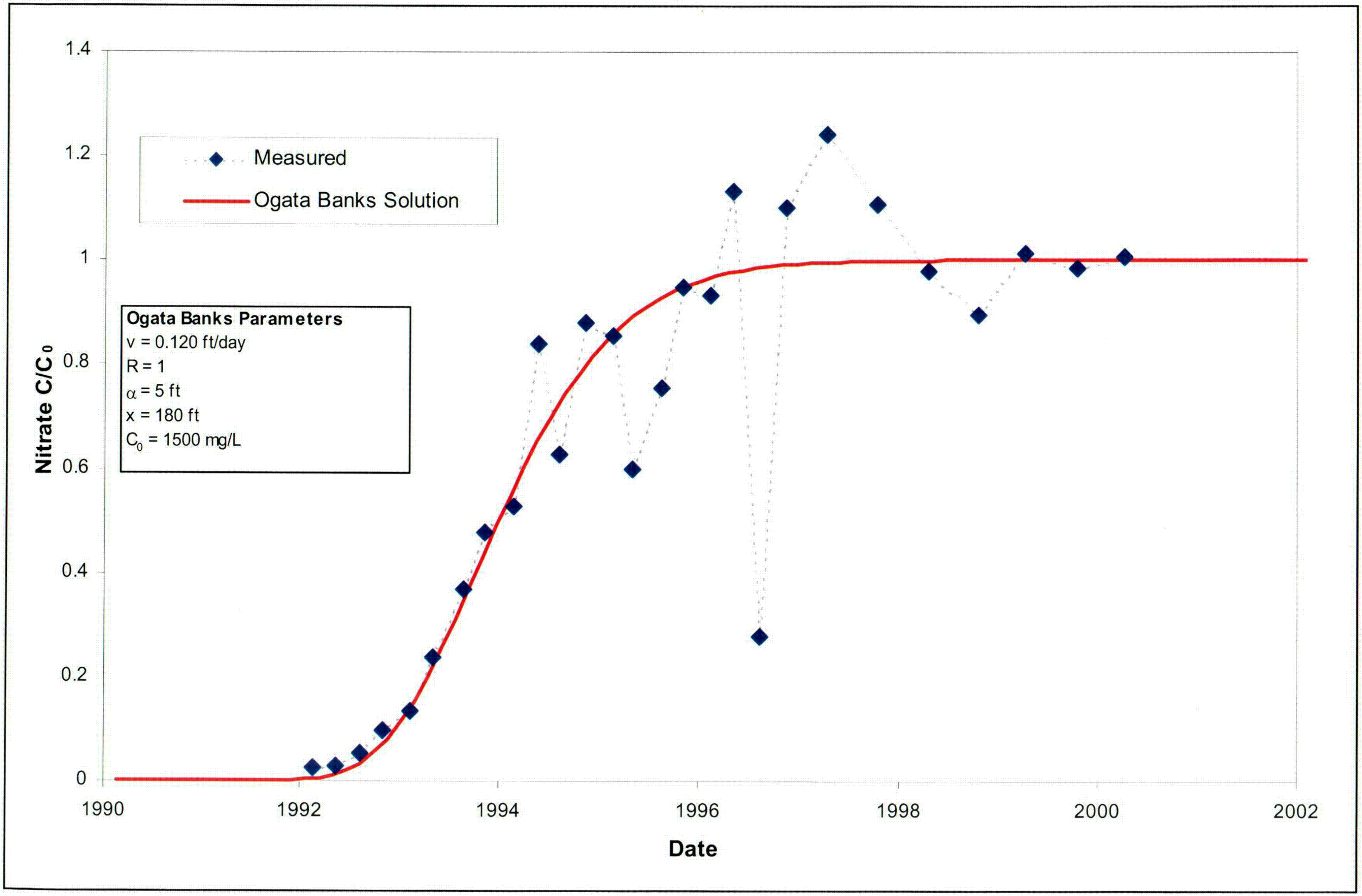

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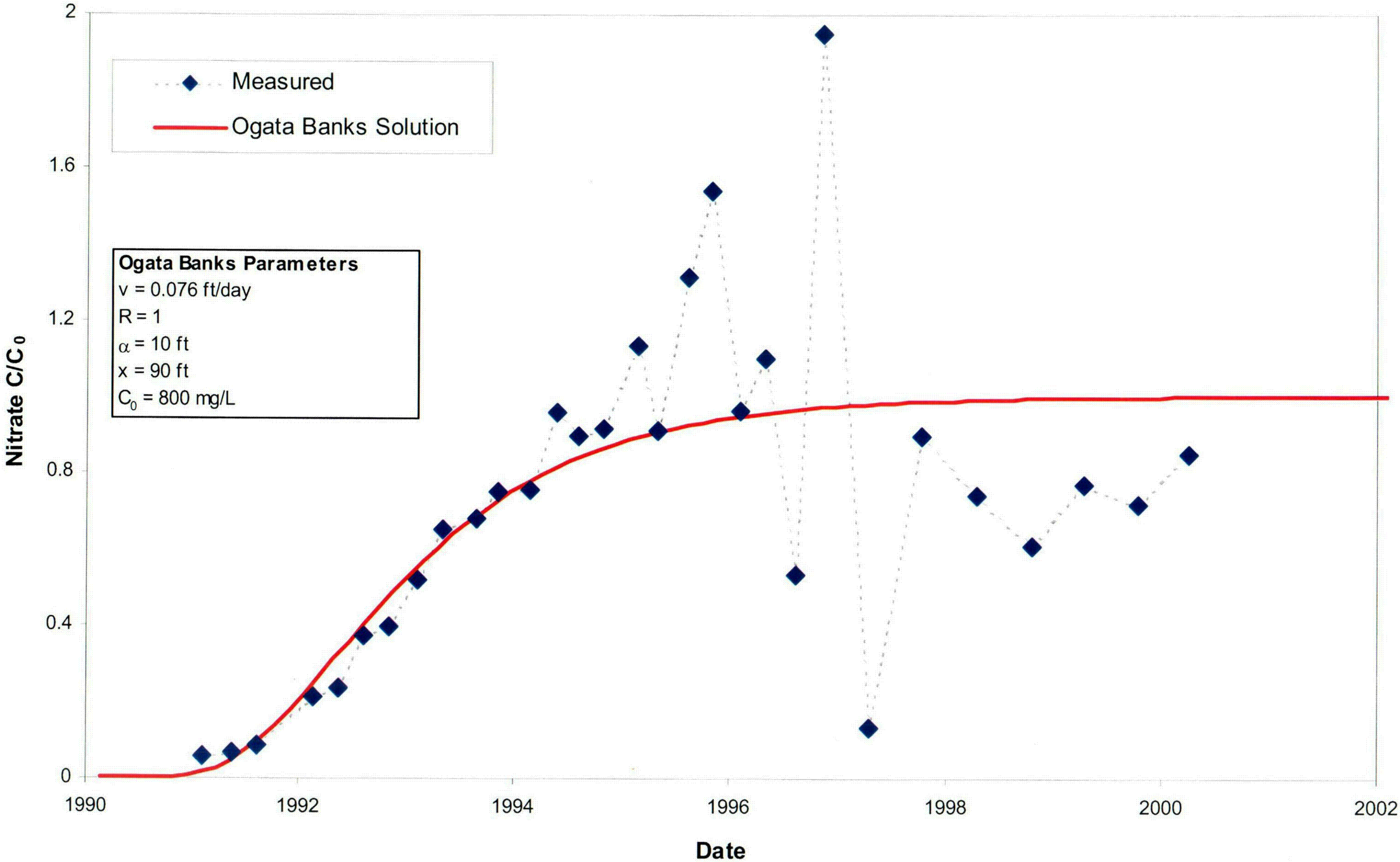
FIGURE 8-33
ONE DIMENSIONAL TRANSPORT ANALYSIS, 2341

Date:	OCTOBER 2002
Project:	P:\100734-2\REV CHAR RPT
File:	1D TRANSPORT.ppt



consulting scientists and engineers

FIGURE 8-34
ONE DIMENSIONAL TRANSPORT ANALYSIS, 2354

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Project:	P:\100734-2\REV CHAR RPT
File:	1D TRANSPORT.ppt

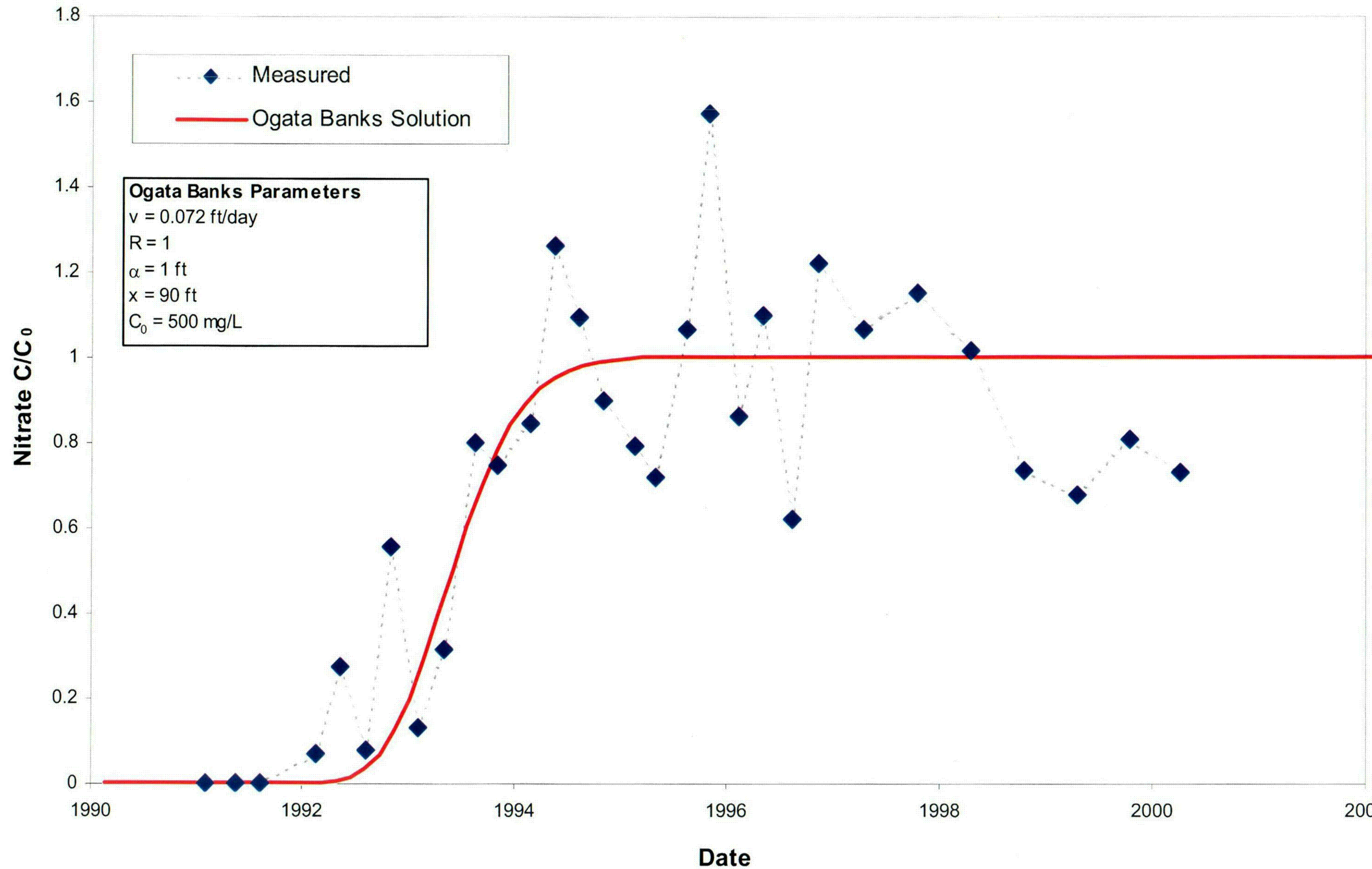

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FIGURE 8-35
ONE DIMENSIONAL TRANSPORT ANALYSIS, 2356

Date:	OCTOBER 2002
Project:	P:\100734-2\REV CHAR RPT
File:	1D TRANSPORT.ppt

C-23

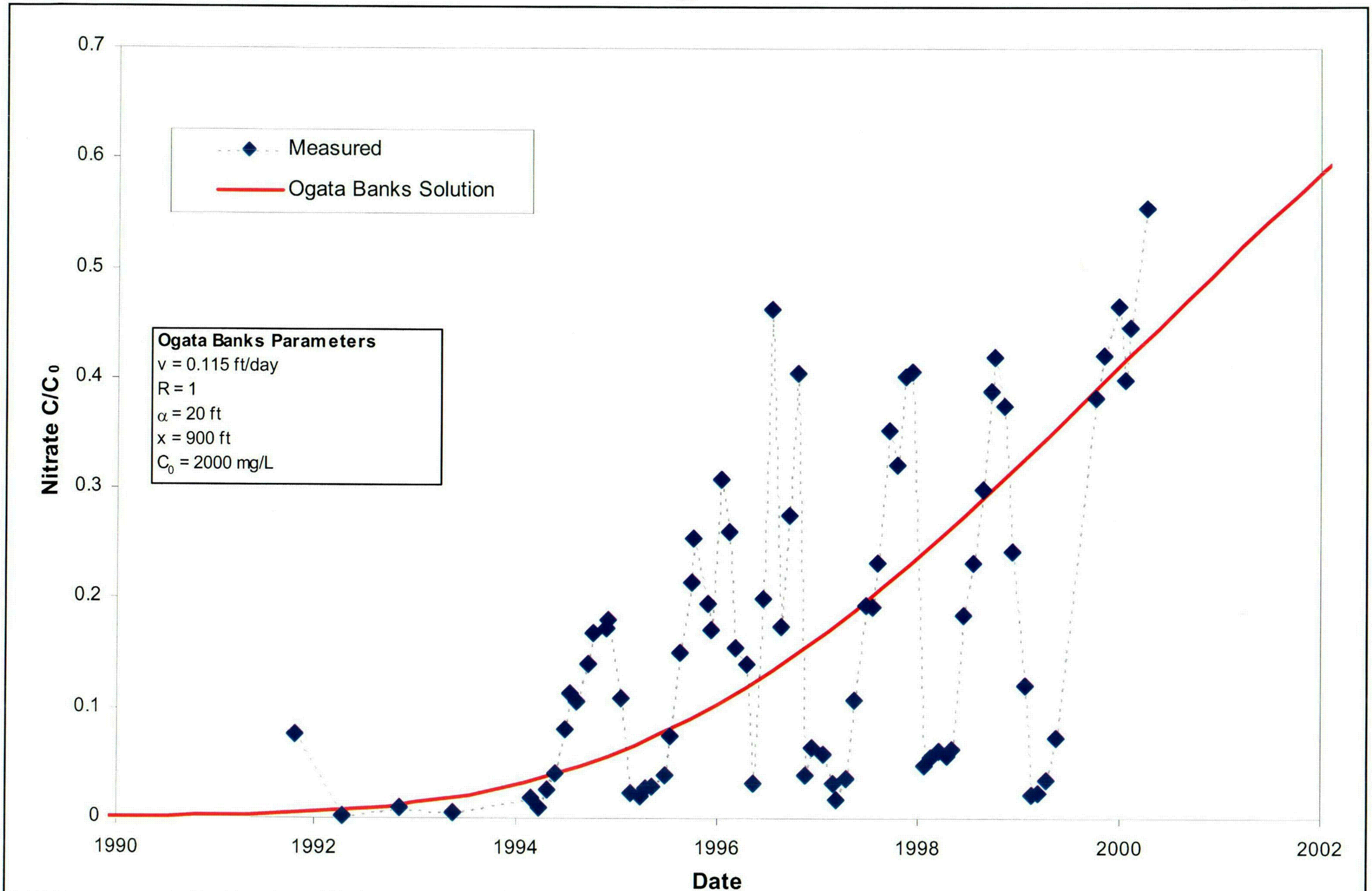

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FIGURE 8-36
ONE DIMENSIONAL TRANSPORT ANALYSIS, MW095A

Date:	OCTOBER 2002
Project:	P:\100734-2\REV CHAR RPT
File:	1D TRANSPORT.ppt

ATTACHMENT CAP2E-2

Table 8-4 Calibrated Uranium $K_{d\text{-}mod}$

Unit	New $K_{d\text{-}mod}$
Surf deposit	0.92
SH1	0.33
SH2	0.16
SH3	0.33
SH4/5	0.23

ATTACHMENT CAP2E-3

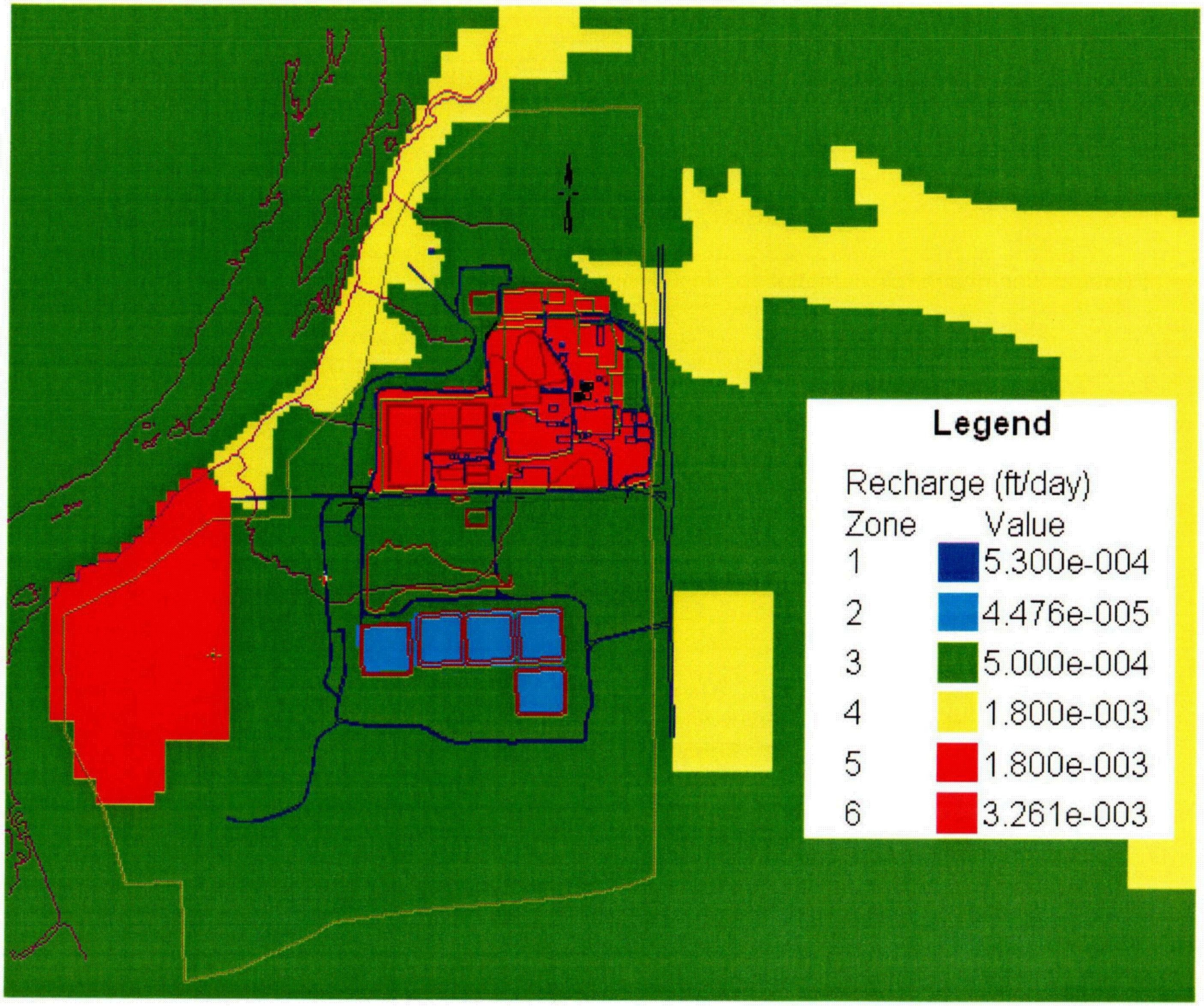

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FIGURE 6
CALIBRATED HYDRAULIC CONDUCTIVITY

Date:	MARCH 2005
Project:	E:\100734\FIG-2005MAR
File:	Flow model-calibration.ppt

C25

ATTACHMENT CAP2F-1

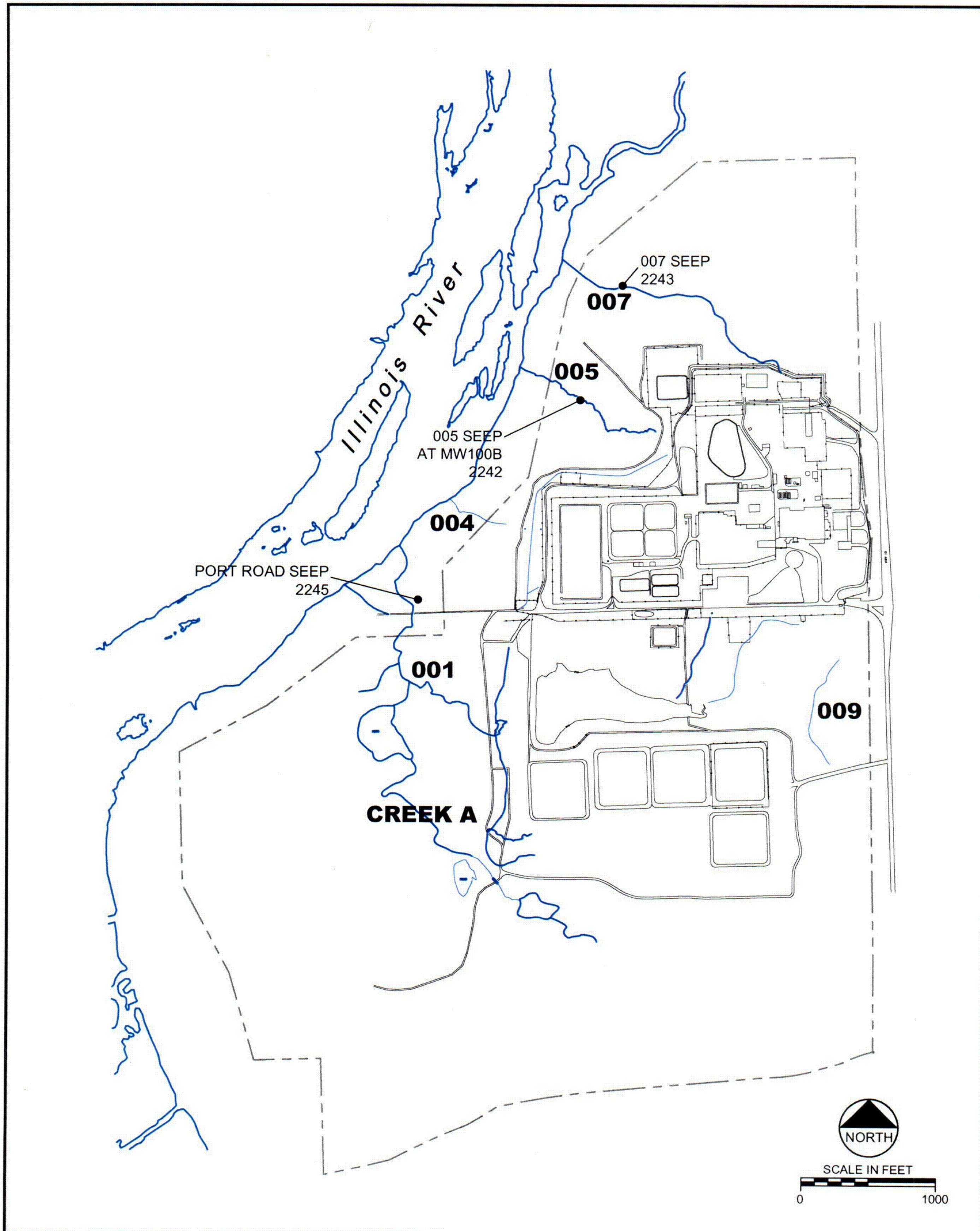

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FIGURE 2-5
LOCATIONS OF FACILITY DRAINAGES AND SEEPS

Date:	DECEMBER 2005
Project:	180735
File:	SECT-2-PORT.DWG

C26

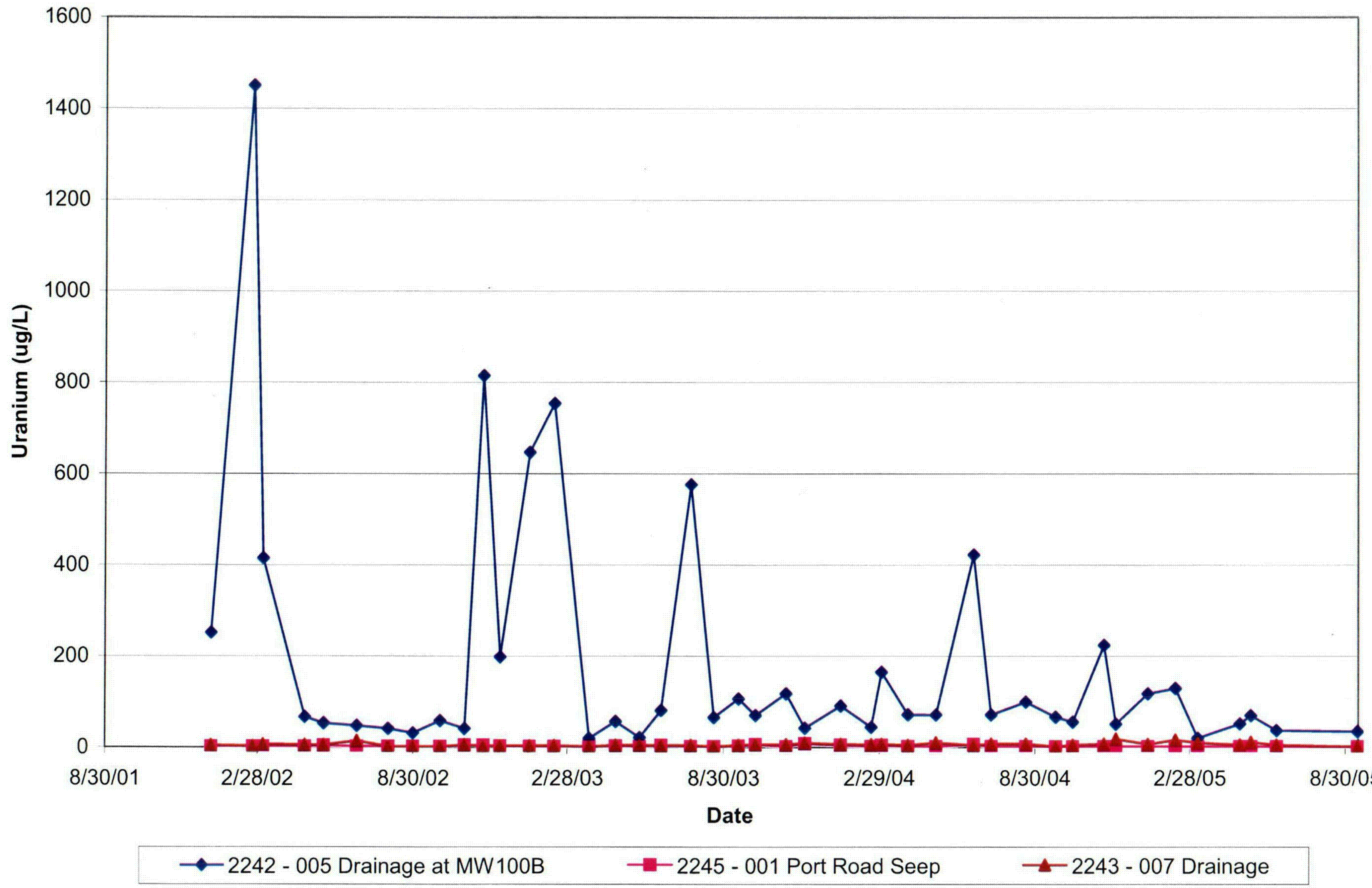
Sequoyah Fuels Corporation
Drainage Sample Results

Date	2242 - 005 Drainage at MW100B			2243 - 007 Drainage			2245 - 001 Port Road Seep		
	Uranium µg/l	Nitrate mg/l	Arsenic mg/l	Uranium µg/l	Nitrate mg/l	Arsenic mg/l	Uranium µg/l	Nitrate mg/l	Arsenic mg/l
8/30/2001	251	< 1							
10/9/2001	1450								
11/1/2001	414	1.2							
11/9/2001	66.4	43.7							
12/3/2001	52.5	30.4							
1/4/2002	46.8	15.8	< 0.009	2.92	1.2	< 0.009	< 1	388	0.027
2/22/2002	40.1	8	< 0.009	1.07	< 1	< 0.009	< 1	13.9	0.015
3/6/2002	30.4	262	< 0.009	5.16	< 1	< 0.009	< 1	97.3	< 0.009
4/24/2002	57.5	5.3	< 0.011	3.74	< 1	< 0.011	< 1	< 1	< 0.011
5/16/2002	40.4	8.9	0.01	3.9	< 1	< 0.005	2.58	97.2	0.023
6/24/2002	814	< 1	0.014	12.4	< 1	0.011	< 1	288	< 0.005
7/31/2002	197	9.6	0.052	Dry	Dry	Dry	< 1	715	0.074
8/29/2002	646	< 1	0.011	Dry	Dry	Dry	Dry	Dry	Dry
9/30/2002	753	< 1	0.022	Dry	Dry	Dry	Dry	Dry	Dry
10/29/2002	18.8	10.5	< 0.005	4.14	8.5	< 0.005	2.68	990	< 0.005
11/20/2002	56	64	0.014	Dry	Dry	Dry	2.47	616	0.058
12/10/2002	20.6	67.3	0.028	1.56	4.1	< 0.005	1.31	437	0.029
1/14/2003	79.7	29.9	< 0.005	1.68	1.8	< 0.005	< 1	560	0.039
2/12/2003	575	45	0.012	2.36	2.1	< 0.005	< 1	581	0.048
3/25/2003	64.4	11.9	< 0.007	< 1	2.1	< 0.007	< 1	513	0.040
4/25/2003	105	21.6	0.011	2.85	< 1	< 0.007	1.19	484	0.045
5/23/2003	68.9	3.6	< 0.006	3.66	< 1	< 0.006	< 1	433	0.026
6/17/2003	117	< 1	0.015	2.14	< 1	< 0.006	2.54	374	0.028
7/22/2003	41.3	5.1	0.017	3.01	3.2	< 0.006	< 1	573	0.053
8/18/2003	89.5	1.1	0.013	Dry	Dry	Dry	Dry	Dry	Dry
9/16/2003	43.3	13.1	0.016	2.68	< 1	0.017	1.28	455	0.039
10/6/2003	164	< 1	< 0.006	4.34	1.2	< 0.006	4.12	377	0.016
11/11/2003	71	21.3	0.014	4.76	< 1	0.013	< 1	384	0.018
12/3/2003	70.1	11.5	0.01	7.83	< 1	< 0.007	6.38	409	0.07
1/14/2004	421	18.5	< 0.010	5.34	1.1	< 0.010	2.84	281	0.017
2/19/2004	70.2	12.1	< 0.010	4.28	1.3	0.011	< 1	302	0.025
3/2/2004	98.5	13	< 0.005	5.34	< 1	< 0.005	2.02	211	< 0.005
4/2/2004	65.8	5.6	< 0.005	2.77	< 1	< 0.005	< 1	184	< 0.005
5/5/2004	54.9	3.9	< 0.005	8.6	< 1	< 0.005	< 1	115	0.009
6/18/2004	223	< 1	< 0.005	3.12	< 1	< 0.005	4.53	67.8	0.005
7/9/2004	49.8	2.3	< 0.004	5.99	< 1	< 0.004	< 1	86.6	< 0.004
8/19/2004	117	< 1	< 0.004	5.52	< 1	< 0.004	Dry	Dry	Dry
9/23/2004	128	< 1	< 0.004	Dry	Dry	Dry	Dry	Dry	Dry
10/13/2004	19.4	< 1	< 0.004	3.24	< 1	< 0.004	< 1	63.4	0.008
11/19/2004	50.8	7.3	< 0.004	5.63	1.5	< 0.004	< 1	28.4	< 0.004
12/3/2004	69	5.9	< 0.004	16.9	< 1	< 0.004	< 1	34.8	0.004
1/10/2005	36	5.3	< 0.004	5.26	2.0	< 0.004	< 1	23.9	< 0.004
2/11/2005	34	5.4	< 0.004	15.1	1.2	< 0.004	< 1	24.3	< 0.004
3/9/2005	54.7	9.0	< 0.004	8.8	< 1	< 0.004	< 1	25.4	< 0.004
4/27/2005	38.1	1.6	< 0.005	4.05	< 1	< 0.005	< 1	31.5	< 0.005
5/10/2005	51.4	2.1	< 0.005	9.96	< 1	< 0.005	< 1	26.8	< 0.005

Sequoyah Fuels Corporation
Drainage Sample Results

Date	2242 - 005 Drainage at MW100B			2243 - 007 Drainage			2245 - 001 Port Road Seep		
	Uranium µg/l	Nitrate mg/l	Arsenic mg/l	Uranium µg/l	Nitrate mg/l	Arsenic mg/l	Uranium µg/l	Nitrate mg/l	Arsenic mg/l
6/9/2005	49	< 1	< 0.005	3.38	< 1	< 0.005	< 1	10.5	< 0.005
9/13/2005	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Max	1450	262	0.052	16.9	8.5	0.017	6.38	990	0.074
Min	18.8	1.1	0.01	1.07	1.1	0.011	1.19	10.5	0.004
Avg	139.1	22.1	0.0	5.2	2.4	0.0	2.8	286.2	0.0

Note: The nitrate analyses for samples collected on April 25, 2003 form 2245 and 2246 were likely switched. Discussions with laboratory and field personnel could not confirm this but the results



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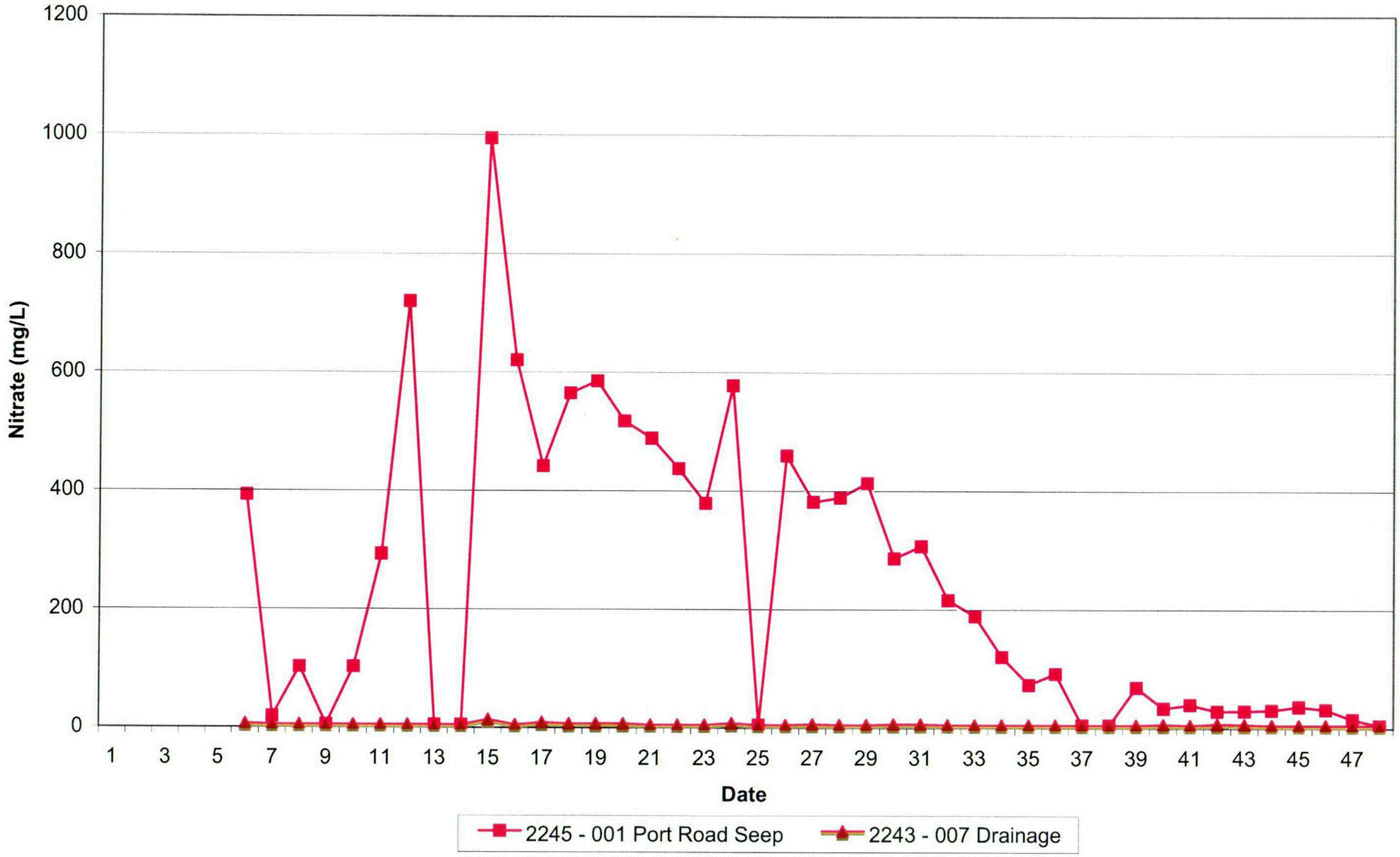

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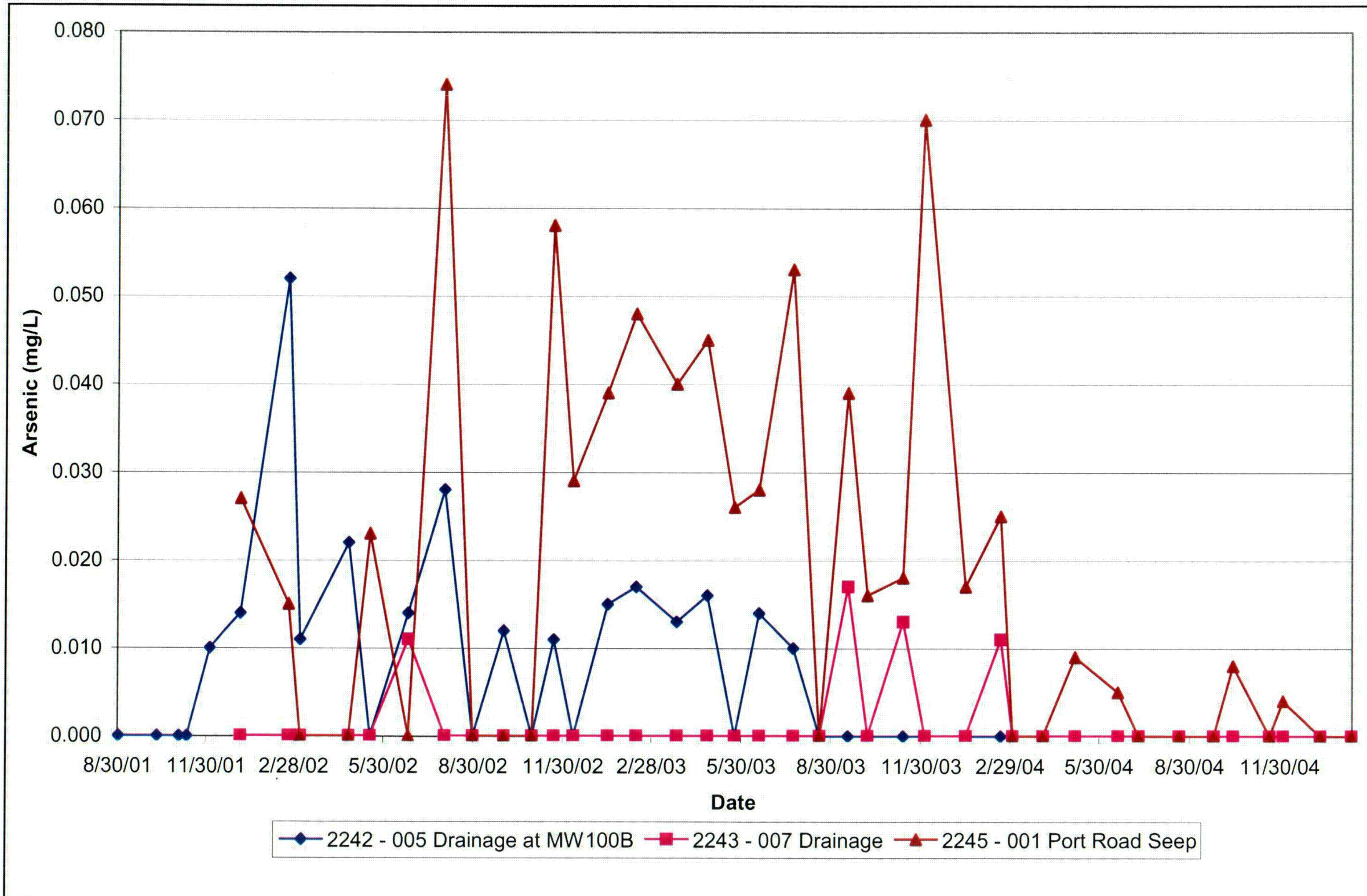

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C29

Table 2-2 Stream Flow Calculations

Stream	Drainage Area (mi^2)	Calculated Mean Annual Flow (cfs)
001	0.063	0.056
004	0.019	0.017
005	0.031	0.027
007	0.069	0.061

Table 2-3 Location and Description of Seeps and Pools

Seep and Pool	Northing	Easting	Description	Comments
007 Outfall Pool	197483.5	2835845.3	about 4½' Long X 4' Wide X 2" Deep	Located on top of sandstone No significant algae or bug life present
005 Outfall Seep and Pool	Located about 40 feet southwest of MW-100B		about 12' Long X 7' Wide X 5" Deep	Significant algae and bug life present in pool Located on top of sandstone
008 Outfall Seep and Pool	195156.8	2834289	1' X 3' X 2" Deep	Some flow observed but very slight Located on top of sandstone

ATTACHMENT CAP2F-2

Table 2-1 Annual Average Flow

Year	Annual Average Flow (cfs)	Year	Annual Average Flow (cfs)
1939	543.3	1970	2164.6
1940	623.4	1971	1150.0
1941	2006.7	1972	1153.8
1942	2293.9	1973	3999.0
1943	1821.7	1974	2717.0
1944	1532.1	1975	2266.3
1945	3811.9	1976	1402.9
1946	2250.9	1977	434.5
1947	1210.1	1978	1524.3
1948	1815.8	1979	955.1
1949	2226.1	1980	445.5
1950	2513.5	1981	593.4
1951	1595.6	1982	1213.5
1952	918.1	1983	1011.6
1953	185.6	1984	1585.9
1954	695.0	1985	2542.9
1955	778.9	1986	2639.0
1956	337.9	1987	1746.5
1957	2816.8	1988	1548.8
1958	1695.3	1989	1493.4
1959	1363.7	1990	2977.2
1960	1546.4	1991	1957.0
1961	2258.7	1992	1909.4
1962	1205.9	1993	3203.4
1963	351.3	1994	1738.5
1964	365.0	1995	1964.5
1965	872.3	1996	1590.7
1966	937.0	1997	1385.0
1967	359.6	1998	1822.5
1968	1939.2	1999	1921.1
1969	1829.8	2000	2066.2
Total annual average flow			1610.0

Flow data from Tenkiller Dam Gauging Station

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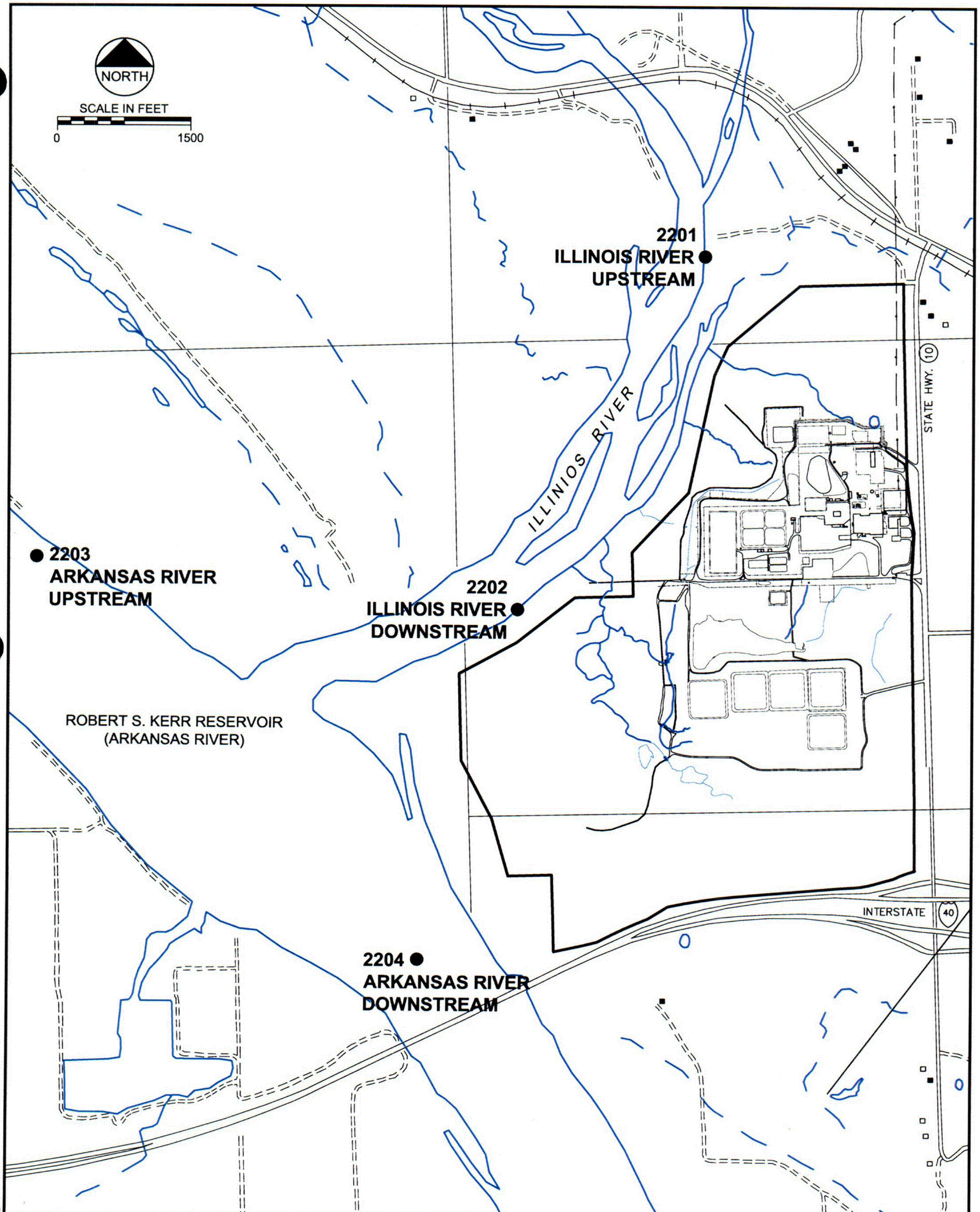

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		Project: 180735
		File: SAMPLE-01.DWG

C30

Surface Water Analyses
Upstream and Downstream Sampling in Illinois and Arkansas Rivers
Illinois Upstream (2201)

Sample Date	Nitrate mg/l	Uranium µg/l	Arsenic mg/L	Sample Date	Nitrate mg/l	Uranium µg/l	Arsenic mg/L
1/23/1991	0.60	<5.0		5/5/1994	<1.00	<5.0	<0.05
2/13/1991	0.70	<5.0		6/22/1994	1.10	<5.0	
3/26/1991	0.80	<5.0		7/27/1994	1.10	<5.0	
4/24/1991	0.90	<5.0		8/24/1994	1.00	<5.0	
5/22/1991	1.30	<5.0		9/21/1994	1.00	<5.0	
6/19/1991	0.50	<5.0		10/26/1994	<1.00	<5.0	
7/17/1991	1.00	<5.0		12/21/1994	<1.00	<5.0	
8/14/1991	1.00	<5.0		1/26/1995	<1.00	<5.0	
9/20/1991	1.00	<5.0		2/22/1995	1.00	<5.0	
10/9/1991	1.40	<5.0		2/23/1995			<2.0
11/13/1991	1.80	<5.0		3/17/1995	1.30	6.4	
12/11/1991	1.00	<5.0		4/28/1995	1.00	<5.0	
1/22/1992	1.40	<5.0		5/24/1995	1.10	12.6	
3/4/1992	1.90	14.0		6/28/1995	1.10	<5.0	
3/10/1992	1.50	<5.0		7/27/1995	1.10	<5.0	
4/29/1992	1.80	<5.0		8/30/1995	<1.00	<5.0	
5/22/1992	1.80	<5.0		9/26/1995	<1.00	<5.0	
6/30/1992	1.10	<5.0		9/26/1995	<1.00	<5.0	
7/29/1992	1.20	<5.0		10/26/1995	<1.00	<5.0	
8/26/1992	0.90	<5.0		11/28/1995	<1.00	<5.0	
9/29/1992	0.70	<5.0		12/13/1995	<1.00	<5.0	
10/28/1992	0.80	<5.0		1/19/1996	<1.00	<1.0	
11/30/1992	1.30	<5.0		2/23/1996	<1.00	<1.0	
12/9/1992	1.00	<5.0	<0.100	3/15/1996	<1.00	<0.6	
1/20/1993	1.70	<5.0		4/30/1996	<1.00	3.0	
2/24/1993	2.10	<5.0		5/29/1996	<1.00	2.0	
3/24/1993	1.30	<5.0		7/8/1996	<1.00	4.5	
4/29/1993	1.40	<5.0		7/26/1996	2.40	<1.0	
5/19/1993	1.40	<5.0		8/28/1996	3.40	<1.0	
6/16/1993	1.50	<5.0		9/19/1996	<1.00	<1.0	
7/28/1993	1.20	<5.0		10/30/1996	1.30	1.0	
8/25/1993	1.00	6.7		11/15/1996	1.70	<1.0	
9/22/1993	0.80	<5.0	0.130	6/25/1997		<1.0	
10/29/1993	1.00	<5.0		6/29/1998		1.1	
11/17/1993	1.00	<5.0		6/9/1999		<1.0	
12/8/1993	1.20	<5.0		6/29/2000		1.4	
1/26/1994	1.20	<5.0		7/30/2002	1.30	<1.0	<.005
2/16/1994	<1.00	<5.0		7/30/2003		<1.0	
3/30/1994	1.00	<5.0		6/25/2004	1.60	<1.0	.010
4/15/1994	1.10	<5.0		6/29/2005		<1.0	
Maximum					3.40	14.0	
Minimum					0.50	0.6	
Average					1.19	4.4	

Surface Water Analyses
Upstream and Downstream Sampling in Illinois and Arkansas Rivers
Illinois Downstream (2202)

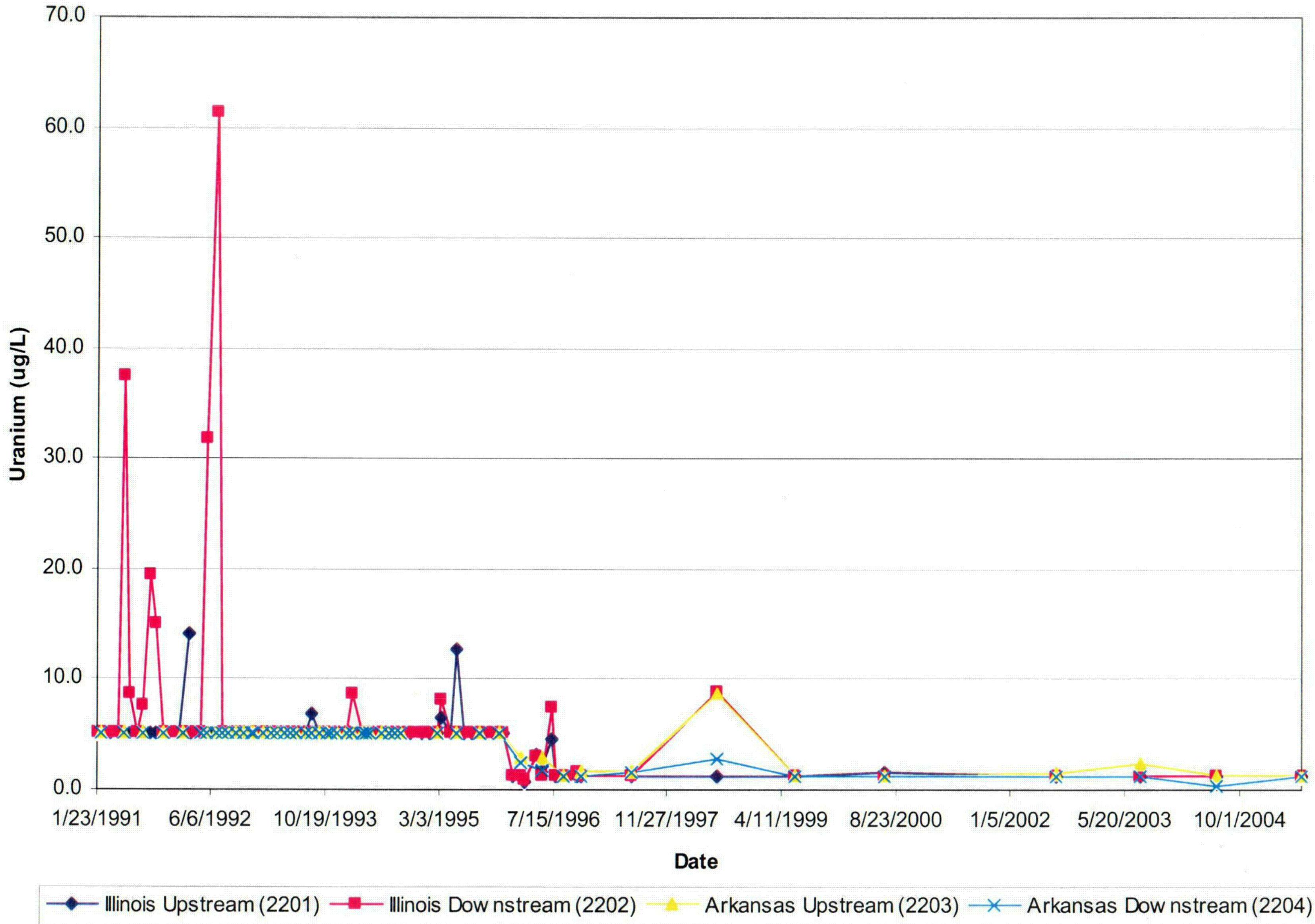
Sample Date	Nitrate mg/l	Uranium µg/l	Arsenic mg/l	Sample Date	Nitrate mg/l	Uranium µg/l	Arsenic mg/l
1/23/1991	0.80	<5.0		5/5/1994	1.00	<5.0	<0.05
2/13/1991	0.80	<5.0		6/22/1994	<1.00	<5.0	
3/26/1991	0.90	<5.0		7/27/1994	<1.00	<5.0	
4/24/1991	0.90	<5.0		8/24/1994	<1.00	<5.0	
5/22/1991	1.20	37.3		9/21/1994	<1.00	<5.0	
6/19/1991	0.30	8.5		10/26/1994	<1.00	<5.0	
7/17/1991	0.30	<5.0		12/21/1994	<1.00	<5.0	
8/14/1991	0.70	7.4		1/26/1995	1.00	<5.0	
9/20/1991	0.90	19.2		2/22/1995	1.00	<5.0	
10/9/1991	1.20	14.8		3/17/1995	1.30	7.9	
11/13/1991	1.80	<5.0		4/28/1995	1.00	<5.0	
12/11/1991	1.00	<5.0		5/24/1995	1.10	<5.0	
1/22/1992	1.50	<5.0		6/28/1995	<1.00	<5.0	
2/5/1992	1.40	<5.0		7/27/1995	1.10	<5.0	
3/10/1992	1.40	<5.0		8/30/1995	<1.00	<5.0	
4/29/1992	1.30	<5.0		9/26/1995	<1.00	<5.0	
5/22/1992	1.80	31.6		9/26/1995	<1.00	<5.0	
6/30/1992	1.40	61.2		10/26/1995	1.00	<5.0	
7/29/1992	1.10	<5.0		11/28/1995	<1.00	<5.0	
8/26/1992	0.80	<5.0		12/13/1995	<1.00	<5.0	
9/29/1992	0.60	<5.0		1/19/1996	<1.00	<1.0	
10/28/1992	0.80	<5.0		2/23/1996	<1.00	<1.0	
11/30/1992	1.30	<5.0		3/15/1996	<1.00	0.6	
12/9/1992	1.00	<5.0		4/30/1996	<1.00	<2.9	
1/20/1993	1.60	<5.0		5/29/1996	<1.00	<1.0	
2/24/1993	2.10	<5.0		7/8/1996	<1.00	7.3	
3/24/1993	1.30	<5.0		7/26/1996	4.10	<1.0	
4/29/1993	1.30	<5.0		8/28/1996	<1.00	<1.0	
5/19/1993	0.90	<5.0		9/19/1996	<1.00	<1.0	
6/16/1993	1.40	<5.0		10/30/1996	1.30	1.5	
7/28/1993	0.90	<5.0		11/15/1996	1.70	<1.0	
8/25/1993	0.80	<5.0		6/25/1997		<1.0	
9/22/1993	0.80	<5.0	0.130	6/29/1998		8.7	
10/29/1993	1.00	<5.0		6/9/1999		<1.0	
11/17/1993	1.00	<5.0		6/29/2000		<1.0	
12/8/1993	1.20	<5.0		7/30/2002	<1.00	<1.0	<0.05
1/26/1994	1.40	<5.0		7/30/2003		<1.0	
2/16/1994	<1.00	8.5		6/25/2004	1.40	<1.0	0.01
3/30/1994	1.00	<5.0		6/29/2005		<1.0	
4/15/1994	1.90	<5.0					
Maximum					4.10	61.2	
Minimum					0.30	0.6	
Average					1.13	6.2	

Surface Water Analyses
Upstream and Downstream Sampling in Illinois and Arkansas Rivers
Arkansas Upstream (2203)

Sample Date	Nitrate mg/l	Uranium µg/l	Arsenic mg/l	Sample Date	Nitrate mg/l	Uranium µg/l	Arsenic mg/l
2/13/1991	0.30	<5.0		2/16/1994	<1.00	<5.0	
5/22/1991	0.30	<5.0		3/30/1994	<1.00	<5.0	
8/14/1991	0.50	<5.0		4/15/1994	<1.00	<5.0	
11/13/1991	1.50	<5.0		5/5/1994	<1.00	<5.0	<0.05
2/5/1992	1.10	<5.0		6/22/1994	<1.00	<5.0	
5/22/1992	0.90	<5.0		7/27/1994	<1.00	<5.0	
6/30/1992	1.10	<5.0		8/24/1994	<1.00	<5.0	
7/29/1992	1.00	<5.0		9/21/1994	<1.00	<5.0	
8/26/1992	0.90	<5.0		2/22/1995	1.10	<5.0	
9/29/1992	0.70	<5.0		2/23/1995			<2.0
10/28/1992	0.90	<5.0		5/24/1995	<1.00	<5.0	
11/30/1992	1.40	<5.0		8/30/1995	<1.00	<5.0	
12/9/1992	1.10	<5.0		11/28/1995	<1.00	<5.0	
1/20/1993	1.60	<5.0		2/23/1996	<1.00	2.7	
2/24/1993	1.60	<5.0		5/29/1996	<1.00	2.7	
3/24/1993	0.90	<5.0		8/28/1996	<1.00	<1.0	
4/29/1993	0.90	<5.0		11/15/1996	3.70	1.4	
5/19/1993	0.80	<5.0		6/25/1997		1.5	
6/16/1993	0.80	<5.0		6/29/1998		8.4	
7/28/1993	0.80	<5.0		6/9/1999		<1.0	
8/25/1993	0.70	<5.0		6/29/2000		<1.0	
9/22/1993	0.90	<5.0	0.13	7/30/2002	<1.00	1.3	.007
10/29/1993	1.00	<5.0		7/30/2003		2.2	
11/17/1993	<1.00	<5.0		6/24/2004	1.30	<1.0	.009
12/8/1993	1.10	<5.0		6/29/2005		<1.0	
1/26/1994	1.20	<5.0					
Maximum					3.70	8.4	
Minimum					0.30	1.0	
Average					1.05	4.3	

Surface Water Analyses
Upstream and Downstream Sampling in Illinois and Arkansas Rivers
Arkansas Downstream (2204)

Sample Date	Nitrate mg/l	Uranium µg/l	Arsenic mg/l	Sample Date	Nitrate mg/l	Uranium µg/l	Arsenic mg/l
2/13/1991	0.30	<5.0		10/29/1993	1.00	<5.0	
5/22/1991	0.20	<5.0		11/17/1993	1.00	<5.0	
8/14/1991	0.40	<5.0		12/8/1993	1.10	<5.0	
11/13/1991	1.60	<5.0		1/26/1994	1.10	<5.0	
2/5/1992	1.20	<5.0		2/16/1994	<1.00	<5.0	
4/29/1992	0.90	<5.0		3/30/1994	<1.00	<5.0	
5/22/1992	0.90	<5.0		4/15/1994	<1.00	<5.0	
5/22/1992	0.80	<5.0		5/5/1994	<1.00	<5.0	0.07
6/30/1992	0.80	<5.0		6/22/1994	<1.00	<5.0	
7/29/1992	0.90	<5.0		7/27/1994	<1.00	<5.0	
8/26/1992	0.90	<5.0		8/24/1994	<1.00	<5.0	
8/26/1992	0.90	<5.0		9/21/1994	<1.00	<5.0	
9/29/1992	0.70	<5.0		2/22/1995	1.00	<5.0	
9/29/1992	0.70	<5.0		5/24/1995	<1.00	5.0	
10/28/1992	0.80	<5.0		8/30/1995	<1.00	<5.0	
10/28/1992	0.80	<5.0		11/28/1995	<1.00	<5.0	
11/30/1992	1.30	<5.0		2/23/1996	<1.00	2.3	
12/9/1992	1.10	<5.0		5/29/1996	<1.00	1.6	
1/20/1993	1.60	<5.0		8/28/1996	<1.00	<1.0	
1/20/1993	1.60	<5.0		11/15/1996	2.40	<1.0	
2/24/1993	1.60	<5.0		6/25/1997		1.5	
3/24/1993	0.90	<5.0		6/29/1998		2.7	
4/29/1993	0.90	<5.0		6/9/1999		<1.0	
5/19/1993	0.80	<5.0		6/29/2000		<1.0	
6/16/1993	1.40	<5.0		7/30/2002	<1.00	<1.0	.009
7/28/1993	0.80	<5.0		7/30/2003		<1.0	
8/25/1993	0.70	<5.0		6/25/2004	1.30	0.1	0.010
9/22/1993	0.90	<5.0	0.130	6/29/2005		<1.0	
Maximum					2.40	5.0	
Minimum					0.20	0.1	
Average					1.01	4.2	



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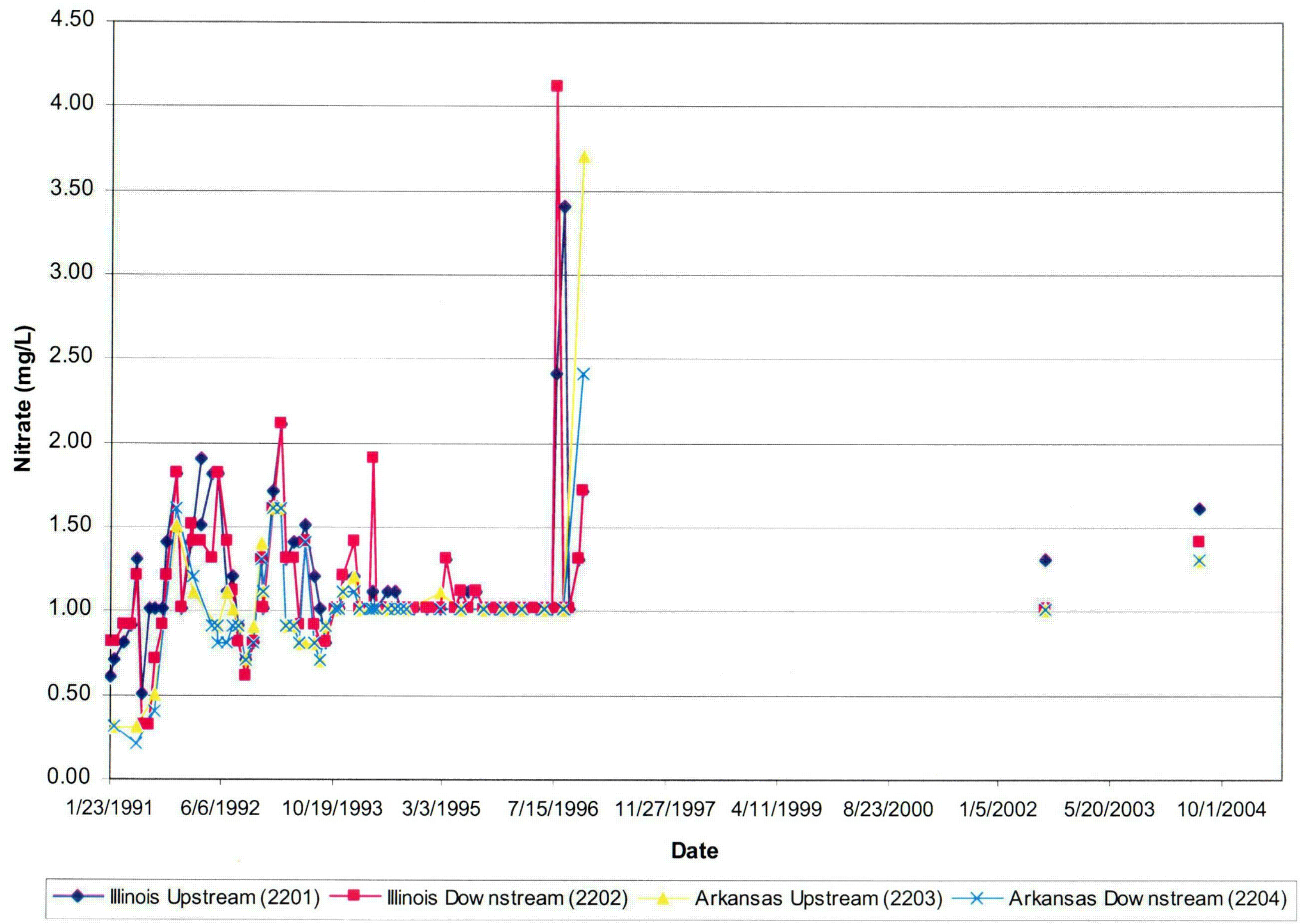

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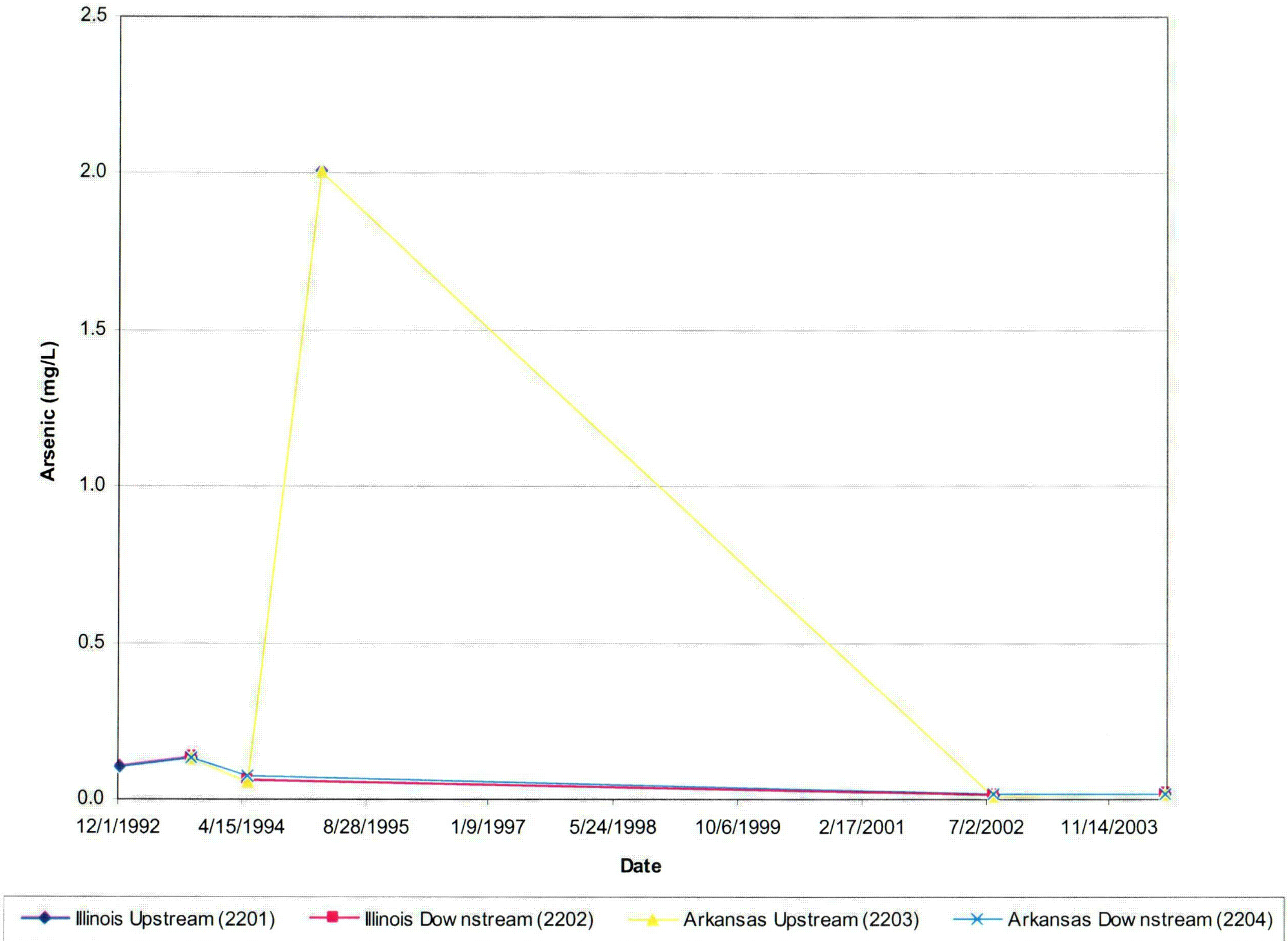

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Date:	DECEMBER 2005
Project:	P:\100734/92805 GWCAPR
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Table 9-3 ARARs and Established Protective Values

	MCL	Acute NRWQ CNR WQC	Chronic NRWQ CNR WQC	OK raw water criteria	OK ANC	OK CNC	Protective criteria for humans	Protective criteria for aquatic biota
Arsenic	10 ppb	340 ppb	150 ppb	40 ppb	340 ppb	150 ppb	10 ppb	150 ppb
Uranium	30 ppb	NA	NA	NA	NA	NA	30 ppb	1000 ppb
Nitrate	10 ppm	NA	NA	10 ppm	NA	NA	10 ppm	10 ppm

ATTACHMENT CAP2F-5

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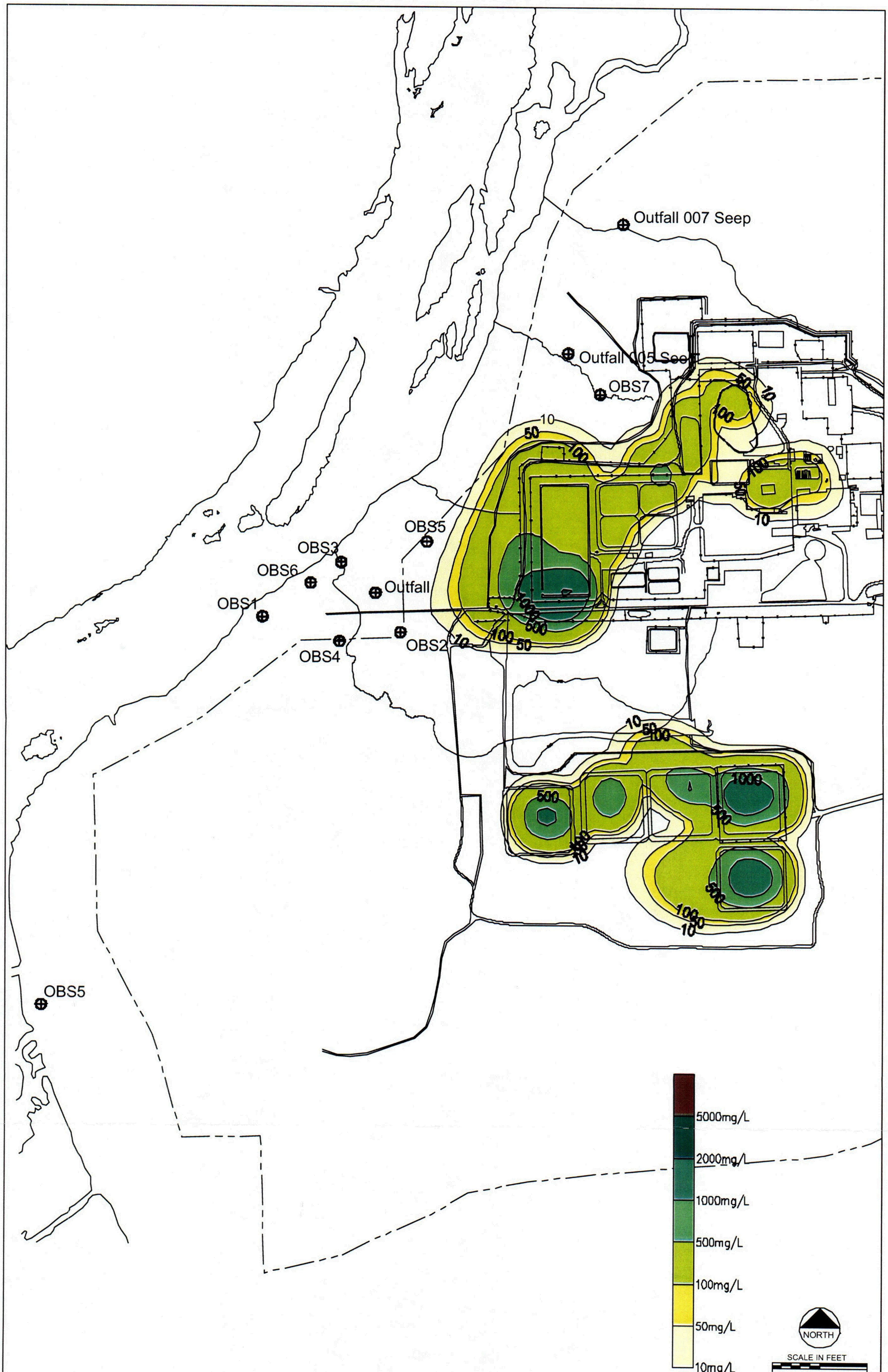

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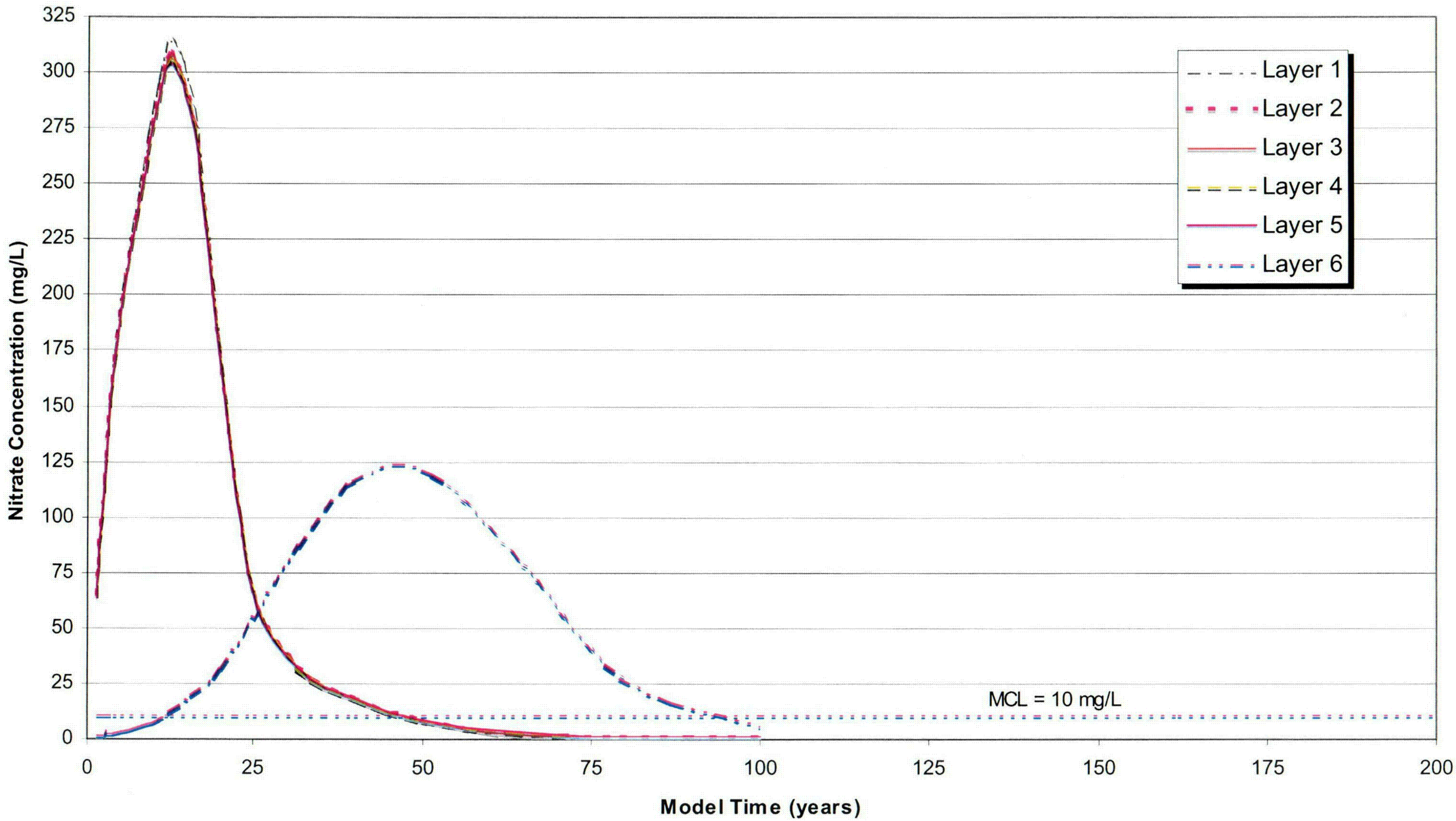
FIGURE 8-52
MODELED NITRATE MAXIMUM INITIAL CONCENTRATIONS

Date:	OCTOBER 2002
Project:	100734\REVISED-20*\
File:	YEARS-NIT.DWG

C34

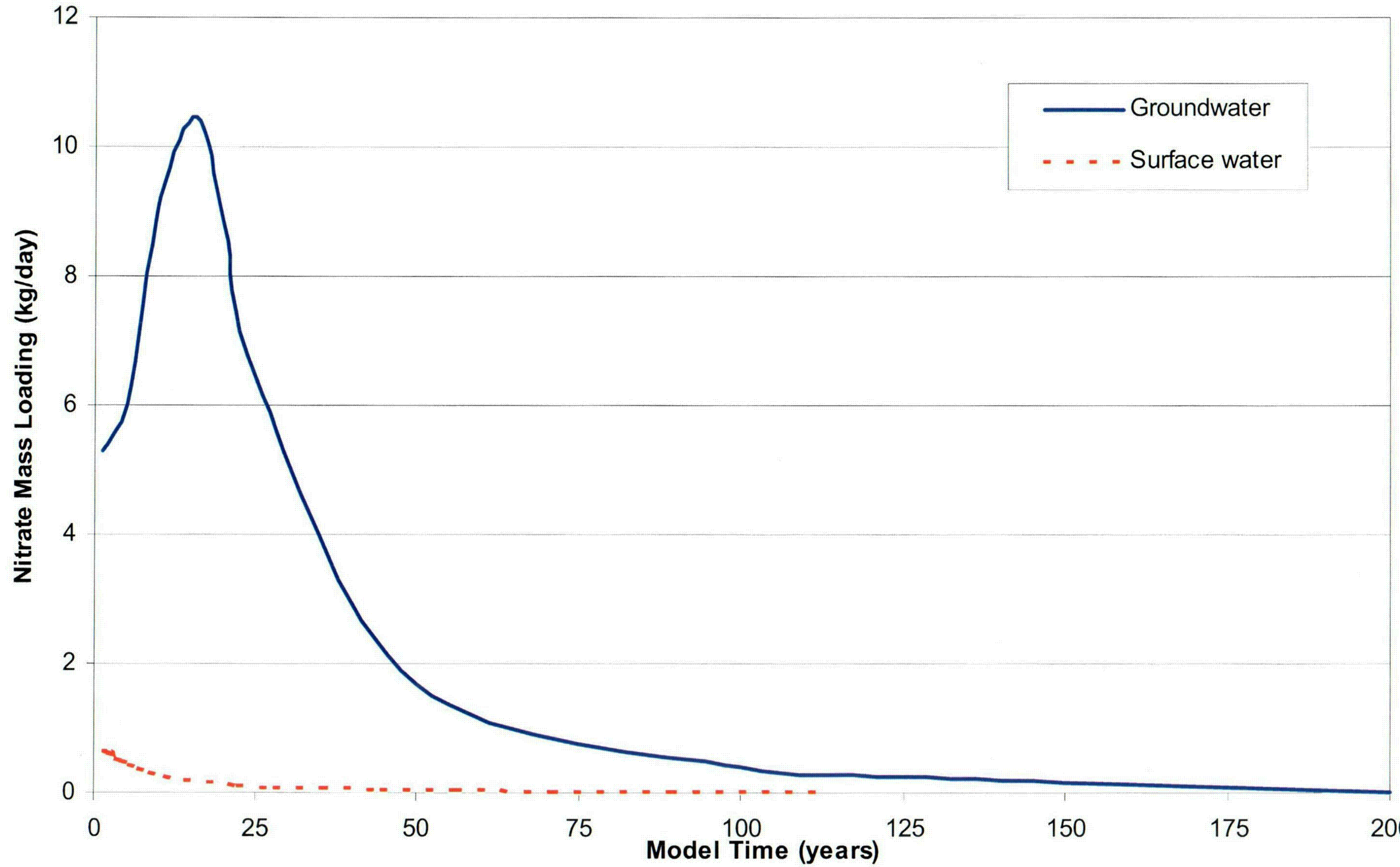


consulting scientists and engineers

FIGURE 8-60
NITRATE CONCENTRATIONS AT OBSERVATION POINT 4

Date:	OCTOBER 2002
Project:	P:100734-2\REV CHAR RPT
File:	NIT CONC.ppt

635



consulting scientists and engineers

FIGURE 8-88
NITRATE MASS LOADING TO RIVER

Date:	OCTOBER 2002
Project:	P:\100734-2\REV CHAR RPT
File:	MASS LOADING.ppt

ATTACHMENT CAP2F-6

Filename: E:\...734\REVISED-2002-AUG\years-as.dwg
Date: 09/30/2002
Time: 16:24:23.32

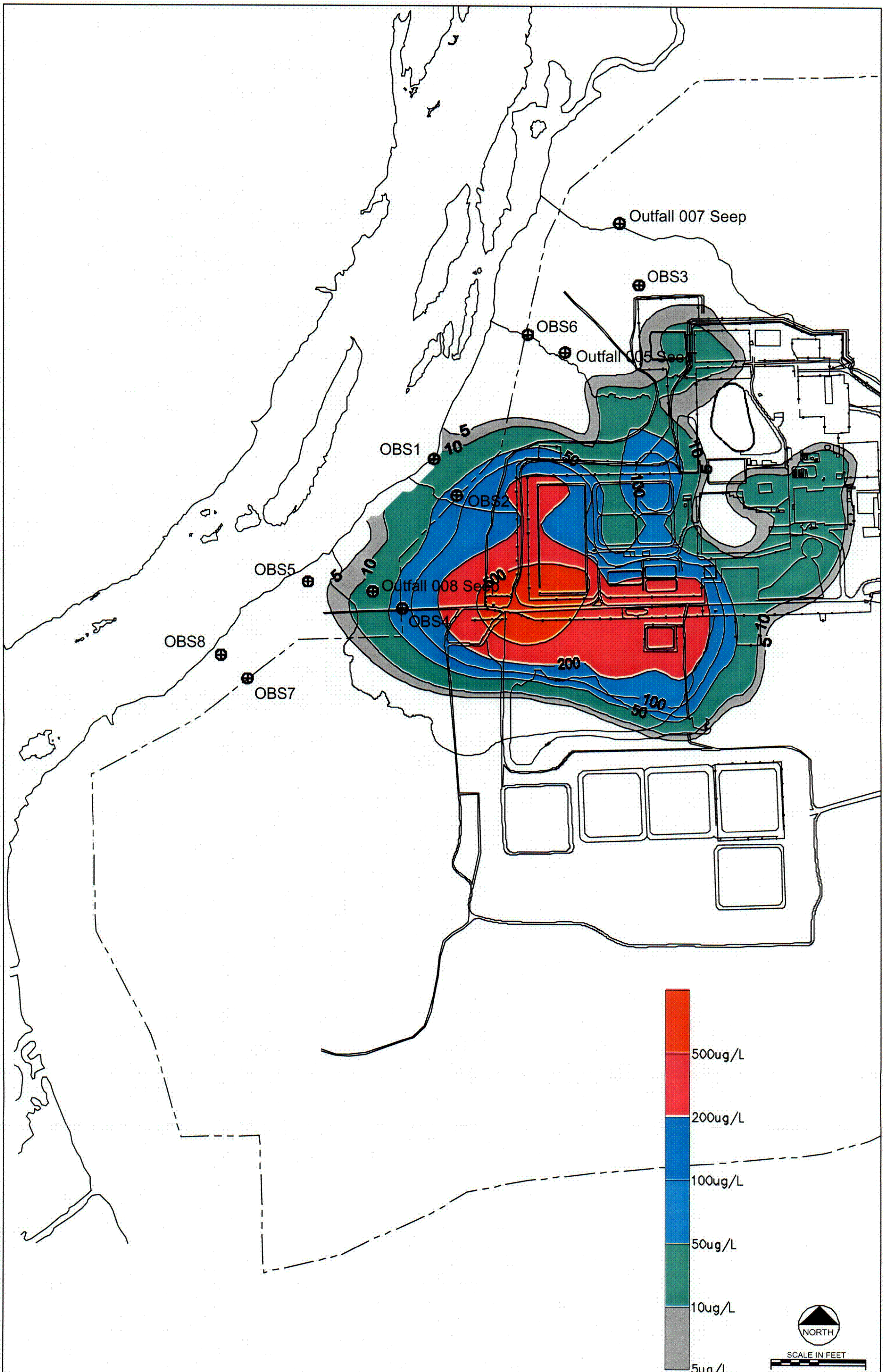


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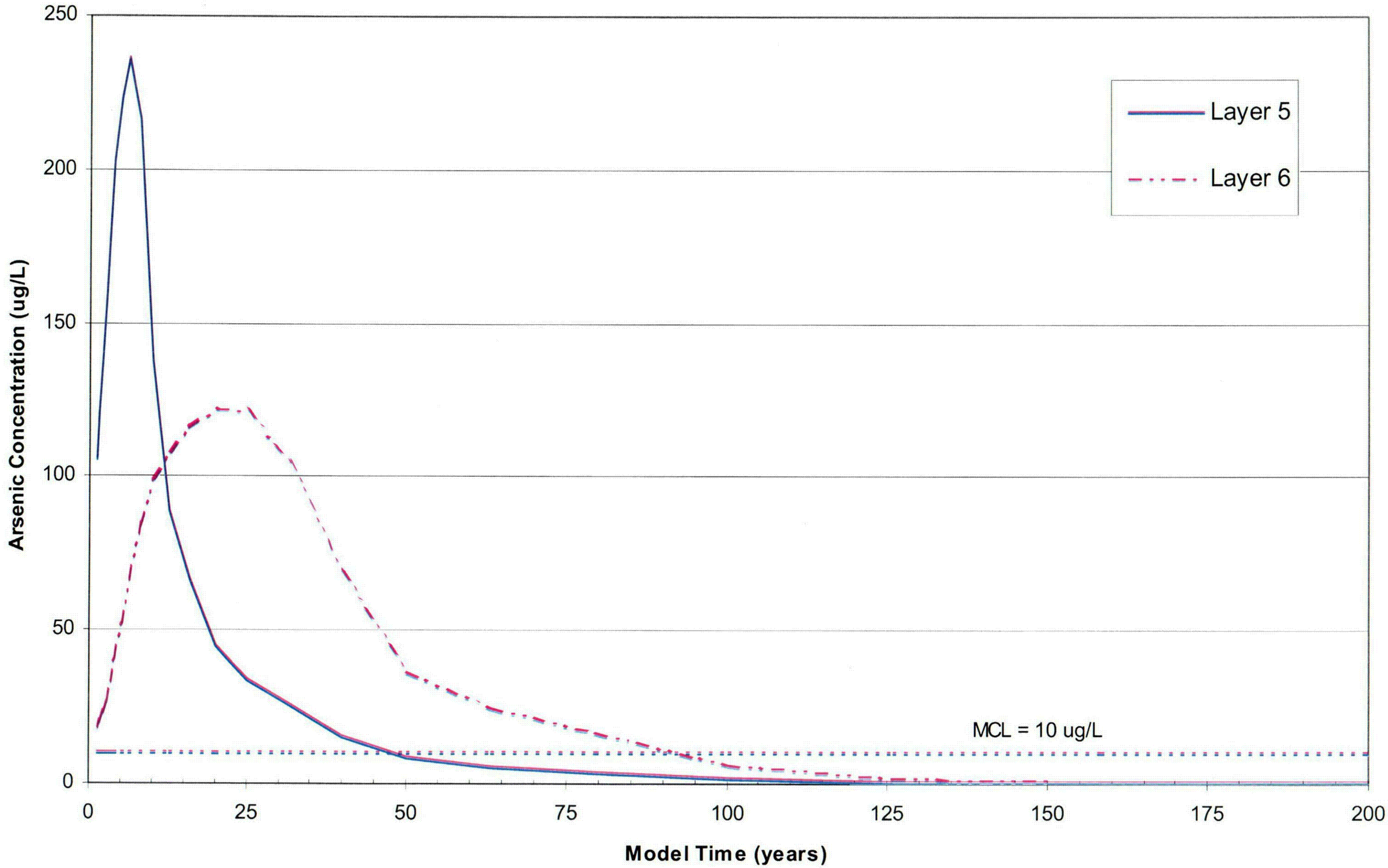
FIGURE 8-63
MODELED ARSENIC MAXIMUM INITIAL CONCENTRATIONS

Date:	OCTOBER 2002
Project:	100734\REVISED-20*\
File:	YEARS-AS.DWG

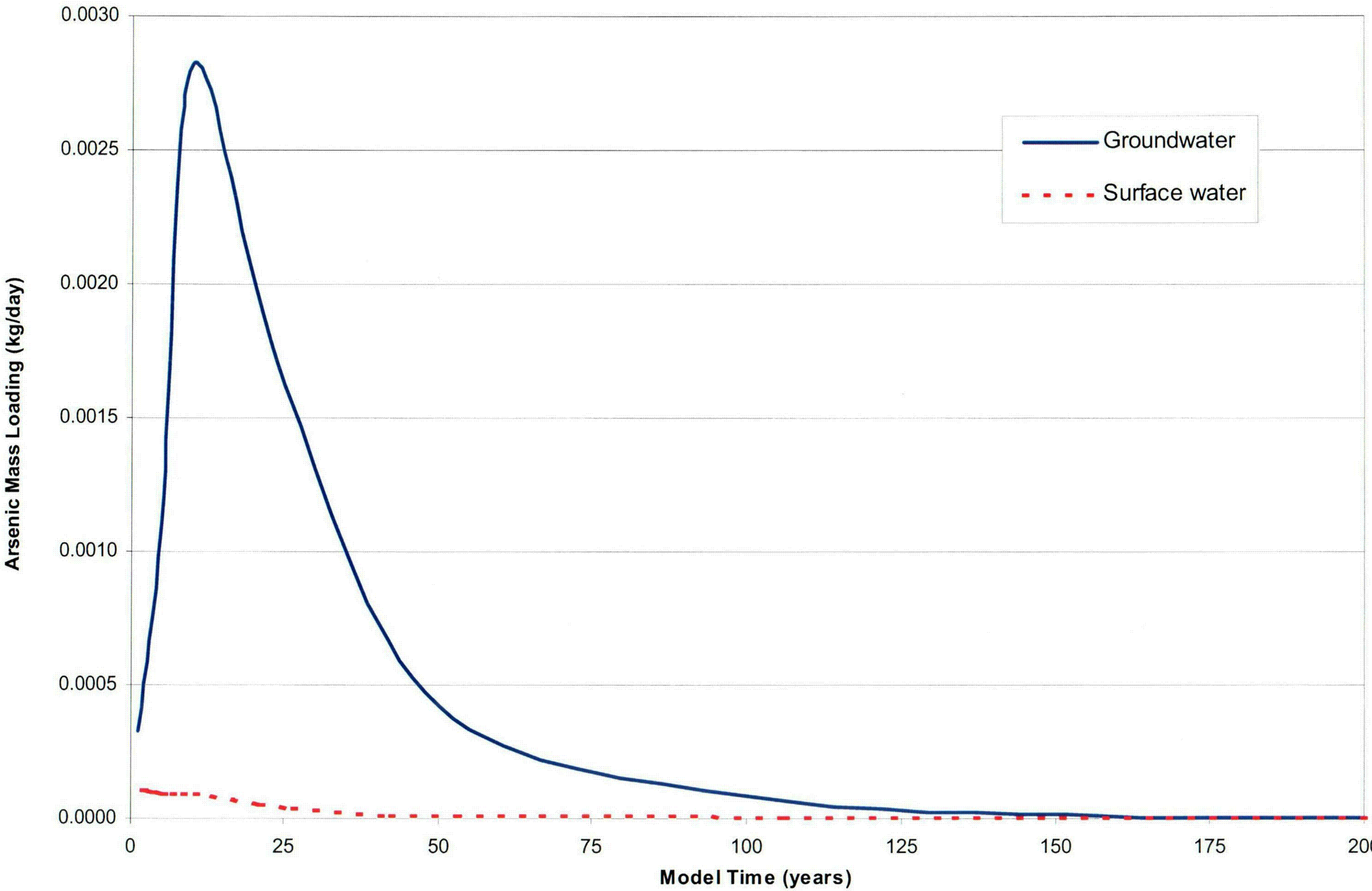
C37



consulting scientists and engineers

FIGURE 8-71
MODELED ARSENIC CONCENTRATION AT OBSERVATION POINT 4

Date:	OCTOBER 2002
Project:	P:\100734-2\REV CHAR RPT
File:	OBS ARSENIC.ppt



consulting scientists and engineers

FIGURE 8-89
ARSENIC MASS LOADING TO RIVER

Date:	OCTOBER 2002
Project:	P:\100734-2\REV CHAR RPT
File:	MASS LOADING.ppt

ATTACHMENT CAP2F-7

Filename: E:\ 734\REVISED-2002-AUG\years-U.dwg
Date: 09/30/2002
Time: 15:26:48.55

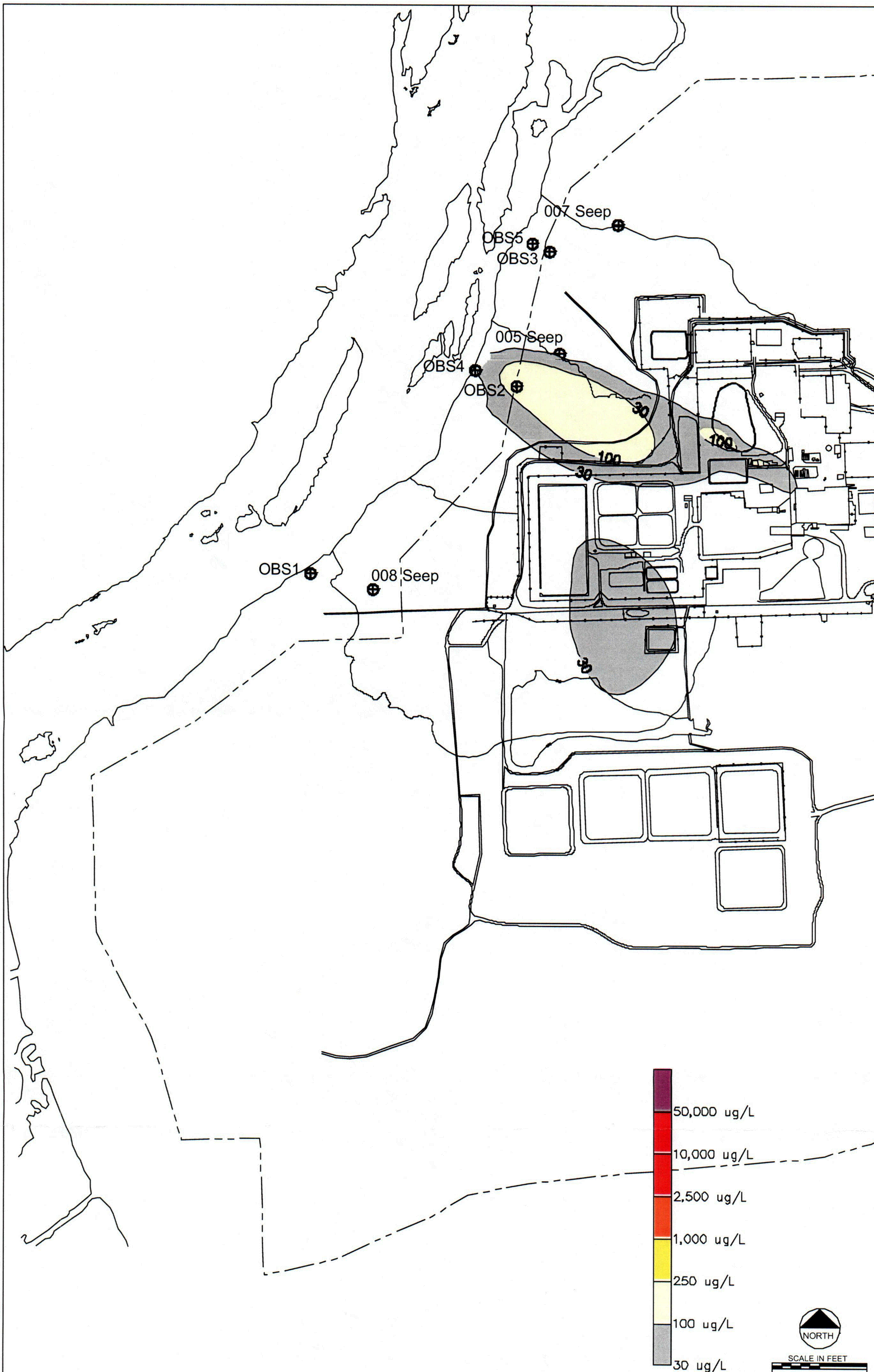


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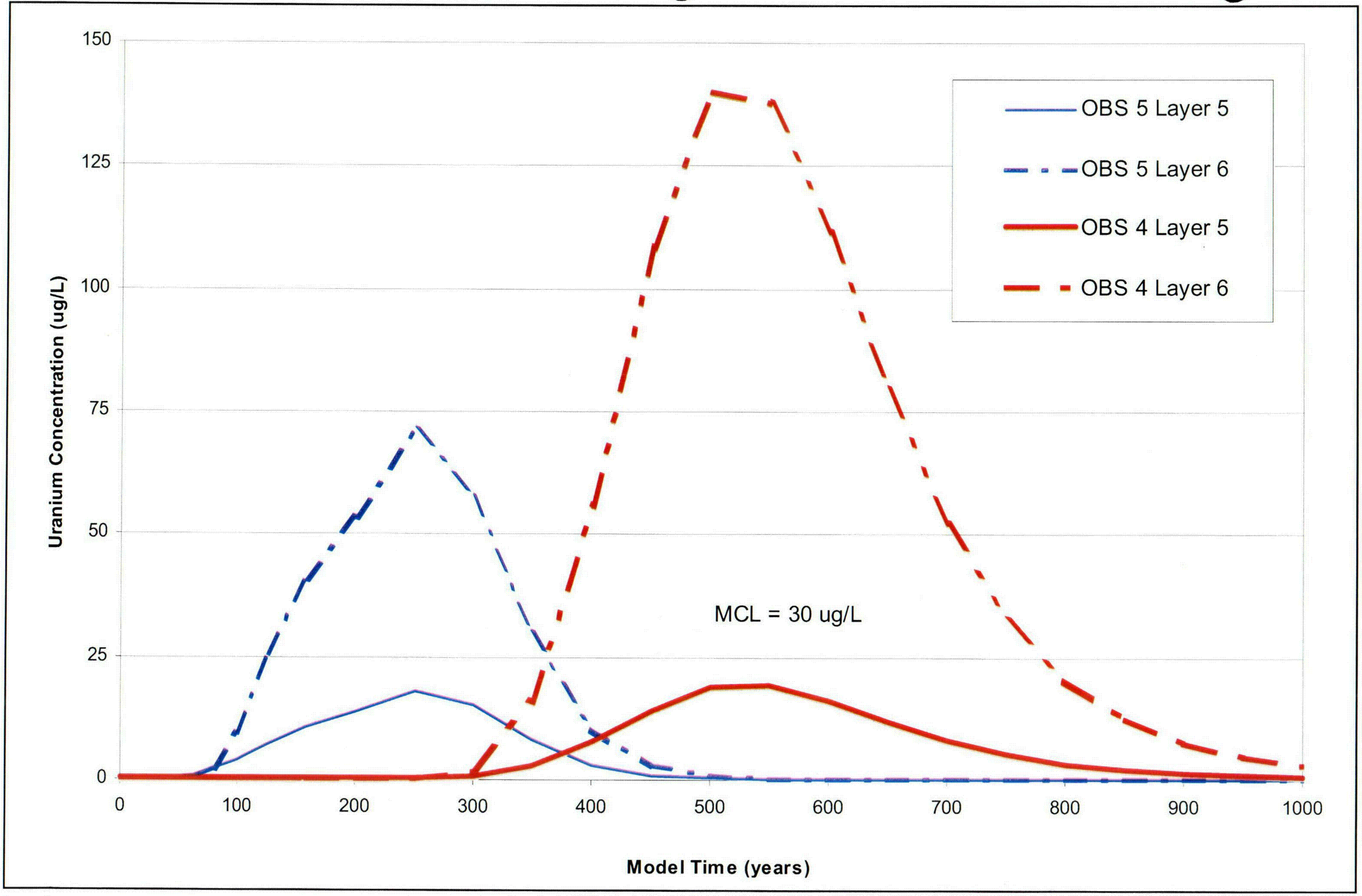
FIGURE 8-80
MODELED URANIUM MAXIMUM CONCENTRATIONS 500 YEARS

Date:	OCTOBER 2002
Project:	100734\REVISED-20*\
File:	YEARS-U.DWG

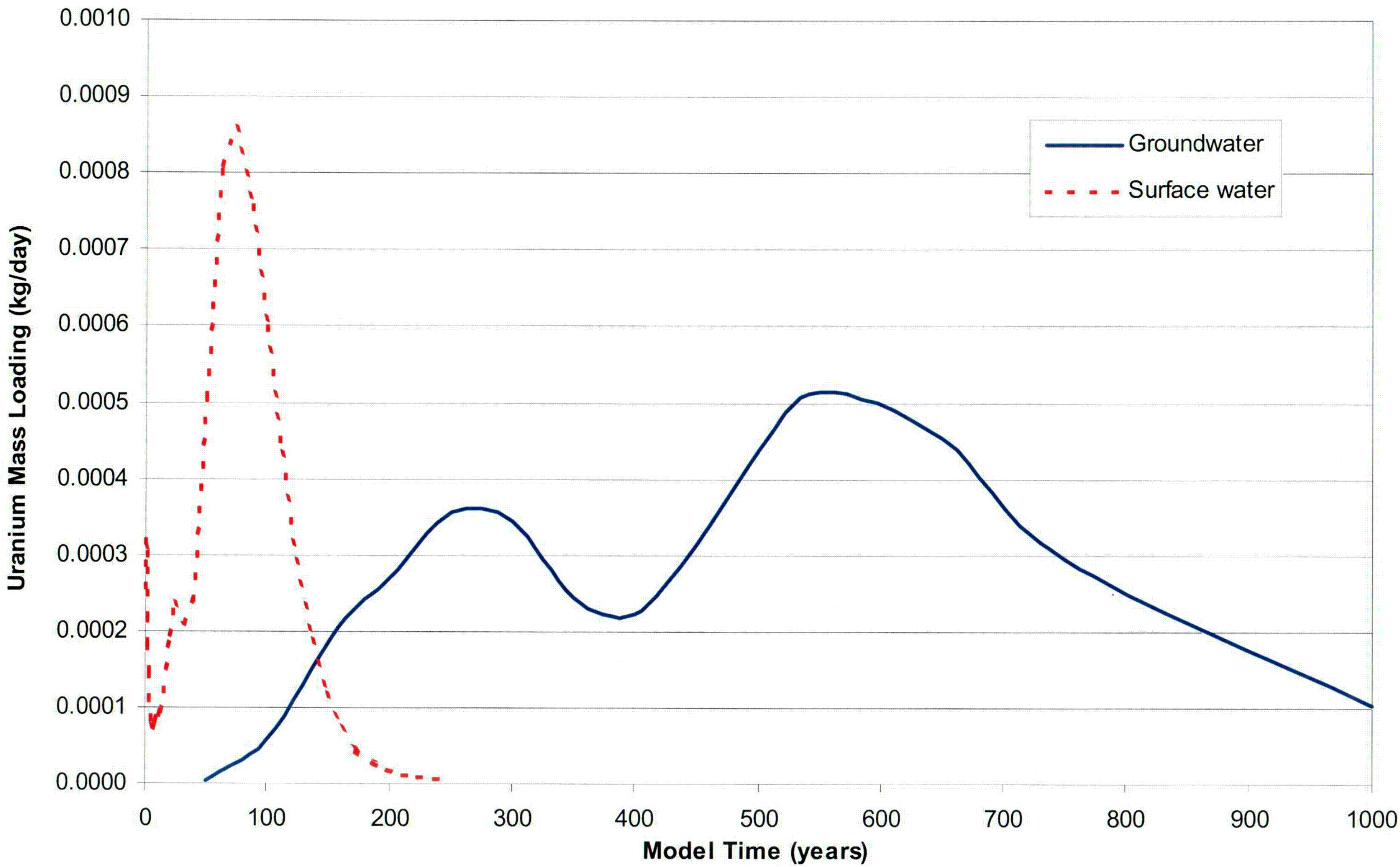
C40



MFG consulting scientists and engineers

FIGURE 8-81
URANIUM CONCENTRATIONS AT OBSERVATION POINTS 4 AND 5

Date:	OCTOBER 2002
Project:	P:\100734-2\REV CHAR RPT
File:	U CONC.ppt



MFG consulting scientists and engineers

FIGURE 8-91
URANIUM MASS LOADING TO RIVER

Date:	OCTOBER 2002
Project:	P:\100734-2\REV CHAR RPT
File:	MASS LOADING.ppt

ATTACHMENT CAP2F-8

Mass Recovered

	005 Trench			10 Trench			MWRW2			95A Trench			95A Pit		
	U (g)	NO3 (g)	As (g)	U (g)	NO3 (g)	As (g)	U (g)	NO3 (g)	As (g)	U (g)	NO3 (g)	As (g)	U (g)	NO3 (g)	As (g)
Jan-04	11.4	17772.7	2.3	10.9	352.3		223.5	208.6		0.2	42987.6	2.7		27660.0	3.0
Feb-04	34.4	35434.2	2.8	9.1	768.1		418.6	371.0		0.1	57199.3	1.9		23823.0	1.8
Mar-04	47.2	28020.4		13.5	212.6		277.1	253.8		0.1	41054.9	8.8		20630.7	3.8
Apr-04	19.4	24476.3	1.4	22.1	916.0		405.6	373.2		0.1	77259.2	4.4		17731.0	2.7
May-04	24.6	19783.4	0.9	11.6	381.7	1.6	441.6	278.1		0.1	40193.5	1.1		20410.5	1.5
Jun-04	4.8	18026.2	1.4	0.9	408.9	9.0	50.2	35.5		0.1	102888.7	2.7		25351.7	0.4
Jul-04	43.1	44826.7		4.9	1692.9		123.7	376.9		0.1	122258.1	2.9	0.2	39374.2	1.0
Aug-04	36.4	81168.4	3.9	10.0	408.9		550.0	470.0		0.1	59204.3	5.0		27404.3	0.7
Sep-04	29.2	117607.1	11.0	10.3	269.9	1.2	184.4	200.0	1.0	0.0	52297.3	1.1		28200.4	0.8
Oct-04	22.0	60213.4	3.5	11.5	327.1	1.9	159.6	184.6	0.3	0.1	55351.7	2.1	0.1	11608.2	0.4
Nov-04	38.2	29514.6		10.7	981.4	2.6	401.4	261.4		0.0	58618.8	1.1	0.1	9881.5	0.2
Dec-04	80.1	55141.2	4.4	15.1	553.4	3.2	513.3	278.1	1.0	0.0	39113.7	0.9		19746.7	0.8
Jan-05	37.5	15550.9		7.0	2529.8		571.3	293.6	0.6		35549.1	0.7		3706.0	0.2
Feb-05	37.2	41450.4		24.1	1397.1		586.5	51935.1						25769.9	
Mar-05	30.2	48009.7		29.7	687.0	2.0	394.5	383.6		0.2	90547.8	1.6		31989.7	2.1
Apr-05	28.5	87181.3	6.2	12.0	772.8	1.7	564.3	669.7			69665.7	3.2		37069.5	2.2
May-05	21.7	51770.7	1.9				372.9	661.6		0.1	78956.6	1.7		29700.5	
Jun-05	8.9	31444.9	1.7				671.2	531.0		0.1	49295.3	2.5	1.2	16245.0	0.4
Jul-05	6.8	21600.7	2.0	21.3			476.0	441.6		0.1	44556.9	1.9		6747.1	0.2
Aug-05	3.2	10952.3	1.1	30.8	956.9	8.0	304.3	243.2		0.2	58858.3	3.2	0.0	5201.8	0.3
Sep-05	2.6	469.8	0.7	9.6	343.5	1.5	389.3	364.0		0.1	55847.5	1.5	0.0	1830.9	0.1
max	80.09	117,607	11.03	30.8	2530	9.00	671	51,935	1.04	0.17	122,258	8.80	1.18	39,374	3.80
min	2.64	470	0.71	0.88	213	1.23	50	35	0.31	0.03	35,549	0.73	0.02	1,831	0.07
avg	27.02	40,020	3.01	14.0	776	3.27	385	2,801	0.74	0.10	61,585	2.55	0.26	20,480	1.18

Pumping Rates

	005 Trench		10 Trench		MWRW2		95A Trench		95A Pit	
	Vol (gals)	Rate (gal/d)	Vol (gals)	Rate (gal/d)	Vol (gals)	Rate (gal/d)	Vol (gals)	Rate (gal/d)	Vol (gals)	Rate (gal/d)
Jan-04	20,060		42,300		19,680		6,881		6,139	
Feb	40,690	1,453	44,100	1,575	21,300	761	7,516	268	6,050	216
Mar	33,336	1,191	43,200	1,543	13,680	489	6,777	242	6,727	240
Apr	30,350	867	86,400	2,469	18,600	531	12,146	347	10,071	288
May	30,556	1,091	72,000	2,571	22,260	795	6,984	249	12,364	442
Jun	15,358	549	72,000	2,571	13,380	478	14,080	503	9,662	345
Jul	55,584	1,544	82,800	2,300	33,180	922	17,549	487	17,716	492
Aug	78,240	2,898	72,000	2,667	21,780	807	11,846	439	11,674	432
Sep	80,890	2,889	64,800	2,314	9,780	349	9,592	343	9,218	329
Oct	48,046	1,716	72,000	2,571	7,500	268	9,137	326	3,956	141
Nov	71,516	2,043	86,400	2,469	17,700	506	10,119	289	3,425	98
Dec	115,584	3,986	104,400	3,600	22,260	768	6,887	237	7,164	247
Jan-05	78,084	2,297	104,400	3,071	32,310	950	6,177	182	8,662	255
Feb	66,754	2,384	147,600	5,271	27,270	974	*		24,395	871
Mar	58,704	2,097	129,600	4,629	18,090	646	19,132	683	18,610	665
Apr	77,790	2,778	75,600	2,700	26,010	929	15,593	557	18,974	678
May	45,578	1,302	*		31,770	908	17,378	497	19,086	545
Jun	28,442	1,016	*		26,460	945	11,836	423	8,513	304
Jul	17,030	608	79,200	2,829	21,600	771	9,973	356	4,294	153
Aug	7,776	222	140,400	4,011	16,470	471	11,601	331	2,637	75
Sep	4,682	142	64,800	1,964	19,620	595	9,395	285	810	25
Oct	3,306	144	97,200	4,226	4,050	176	8,037	349	183	8

005 Data

Date	005 Collection Trench			005 Monitor Trench			005 Drainage at MW100B		
	Uranium µg/l	Nitrate mg/l	As mg/l	Uranium µg/l	Nitrate mg/l	As mg/l	Uranium µg/l	Nitrate mg/l	As mg/l
Jan-04	150	234	0.030	347	40.6	< 0.010	421	18.5	< 0.001
Feb-04	223	230	0.018	445	47.1	0.015	70.2	12.1	< 0.001
Mar-04	374	222	<0.005	463	48	<0.005	98.5	13	<0.005
Apr-04	169	213	0.012	354	34.3	<0.005	65.8	5.6	<0.005
May-04	213	171	0.008	579	38.1	0.039	54.9	3.9	<0.005
Jun-04	82	310	0.024	638	14.8	0.029	223	< 1	<0.005
Jul-04	205	213	<0.004	396	28.5	<0.004	49.8	2.3	<0.004
Aug-04	123	274	0.013				117	<1	<0.004
Sep-04	95.2	384	0.036				128	<1	<0.004
Oct-04	121	331	0.019	507	9.2	<0.004	19.4	<1	<0.004
Nov-04	141	109	<0.004	201	1.2	<0.004	50.8	7.3	<0.004
Dec-04	183	126	0.01	337	2.7	0.01	65.2	5.1	0.004
Jan-05	127	52.6	<0.004	143	22		36	5.3	<0.004
Feb-05	147	164	<0.004	240	5.8	<0.004	34	5.4	<0.004
Mar-05	136	216	<0.004				24.7	9	<0.004
Apr-05	96.7	296	0.021				38.1	1.6	<0.005
May-05	126	300	0.011				51.4	2.1	<0.005
Jun-05	82.2	292	0.016				49	<1	<0.005
Jul-05	105	335	0.031						
Aug-05	108	372	0.038						
Sep-05	149	26.5	0.04						

dry

not sampled/analyzed

C43

95A Collection Data

Date	95A Collection Trench			95A Collection Pit			Port Road Seep		
	Uranium mg/l	Nitrate mg/l	Arsenic mg/l	Uranium mg/l	Nitrate mg/l	Arsenic mg/l	Uranium mg/l	Nitrate mg/l	Arsenic mg/l
Jan-04	6.36	1650	0.104	< 1	1190	0.128	2.84	281	0.017
Feb-04	3.06	2010	0.068	< 1	1040	0.079	< 1	302	0.025
Mar-04	4.44	1600	0.343	< 1	810	0.149	2.02	211	<0.005
Apr-04	2.19	1680	0.095	< 1	465	0.071	< 1	184	<0.005
May-04	2.92	1520	0.04	< 1	436	0.031	< 1	115	0.009
Jun-04	2.38	1930	0.05	< 1	693	0.011	4.53	67.8	0.005
Jul-04	1.99	1840	0.044	2.82	587	0.015	< 1	86.6	<0.004
Aug-04	2.14	1320	0.111	<1	620	0.015			
Sep-04	1.37	1440	0.03	<1	808	0.024			
Oct-04	1.76	1600	0.06	3.58	775	0.026	< 1	63.4	0.008
Nov-04	1.08	1530	0.03	4	762	0.015	< 1	28.4	<0.004
Dec-04	1.16	1500	0.034	<1	728	0.029	< 1	34.8	0.004
Jan-05	<1	1520	0.031	<1	113	0.006	< 1	23.9	<0.004
Feb-05	<1	832	<0.004	<1	279	<0.004	<1	24.3	<0.004
Mar-05	2.26	1250	0.022	<1	454	0.03	<1	25.4	0.004
Apr-05	<1	1180	0.055	<1	516	0.03	<1	31.5	<0.005
May-05	1.84	1200	0.026	<1	411	<0.005	<1	26.8	<0.005
Jun-05	1.78	1100	0.056	36.7	504	0.012	<1	10.5	<0.005
Jul-05	2.34	1180	0.051	<1	415	0.011			
Aug-05	3.66	1340	0.072	3.27	521	0.026			
Sep-05	3.26	1570	0.041	7.54	597	0.023			

dry (grey)
not sampled/analyzed (blue)

C44

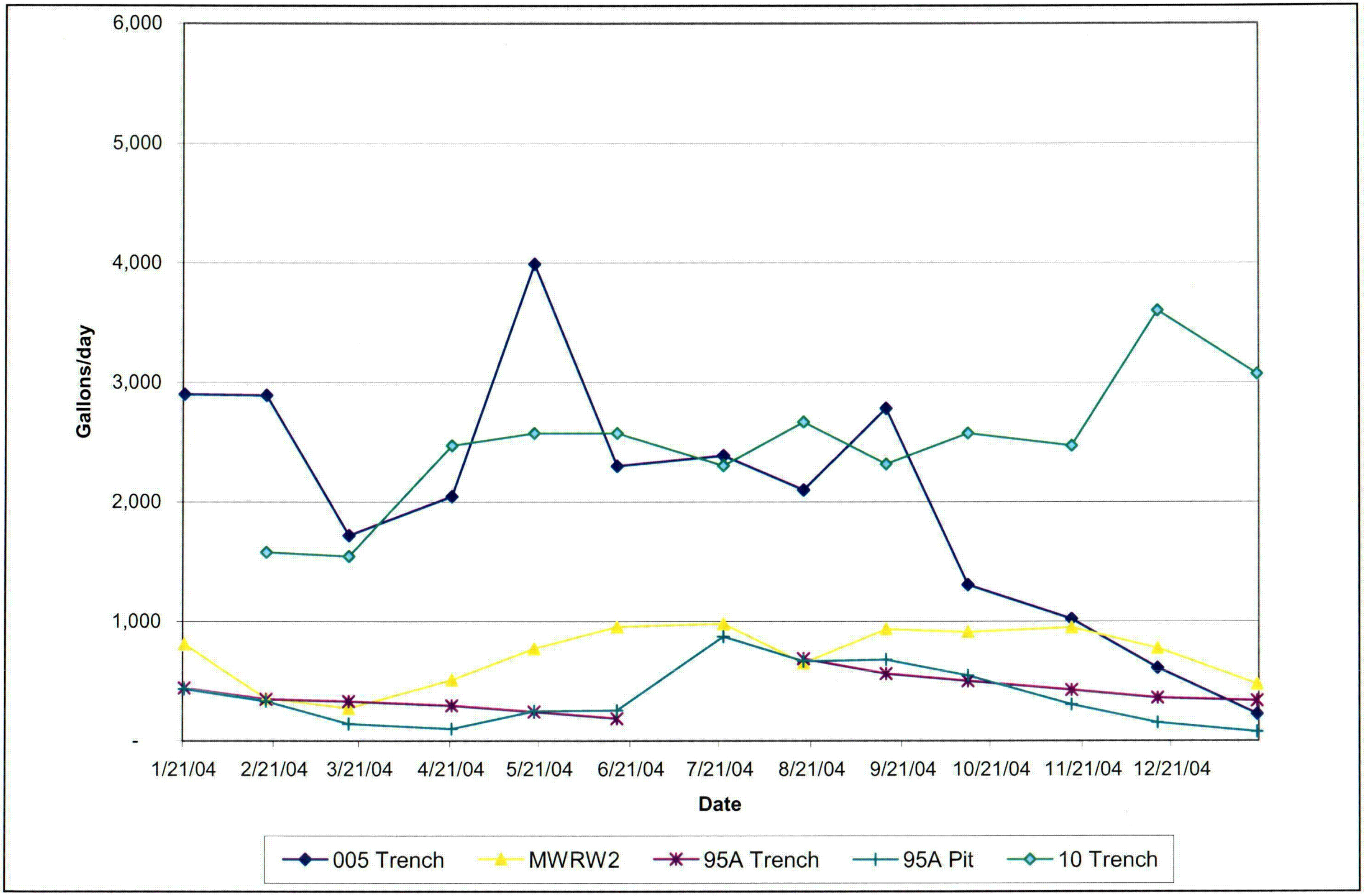
MW010 Collection Data

	MW010 Collection Trench			MWRW2		
Date	Uranium µg/l	Nitrate mg/l	Arsenic mg/l	Uranium µg/l	Nitrate mg/l	Arsenic mg/l
Jan-04	67.8	2.2	<0.010	3000	2.8	
Feb-04	54.7	4.6	<0.010	5190	4.6	
Mar-04	82.7	1.3	< 0.005	5350	4.9	
Apr-04	67.6	2.8	< 0.005	5760	5.3	< 0.005
May-04	42.6	1.4	0.006	5240	3.3	
Jun-04	3.21	1.5	0.033	990	0.7	
Jul-04	15.6	5.4	<0.004	985	3	
Aug-04	36.7	1.5	<0.004	6670	5.7	
Sep-04	41.9	1.1	0.005	4980	5.4	0.028
Oct-04	42.1	1.2	0.007	5620	6.5	0.011
Nov-04	32.7	3	0.008	5990	3.9	
Dec-04	38.2	1.4	0.008	6090	3.3	0.012
Jan-05	17.7	6.4	<0.004	4670	2.4	0.005
Feb-05	43.1	2.5	<0.004	5680	503	
Mar-05	60.5	1.4	0.004	5760	5.6	<0.004
Apr-05	41.9	2.7	0.006	5730	6.8	
May-05	46	2.5	<0.005	3100	5.5	
Jun-05	32.8	1.8	<0.005	6700	5.3	
Jul-05	71.1	<1	<0.005	5820	5.4	
Aug-05	58	1.8	0.015	4880	3.9	
Sep-05	39.1	1.4	0.006	5240	4.9	

dry

not sampled/analyzed

C45



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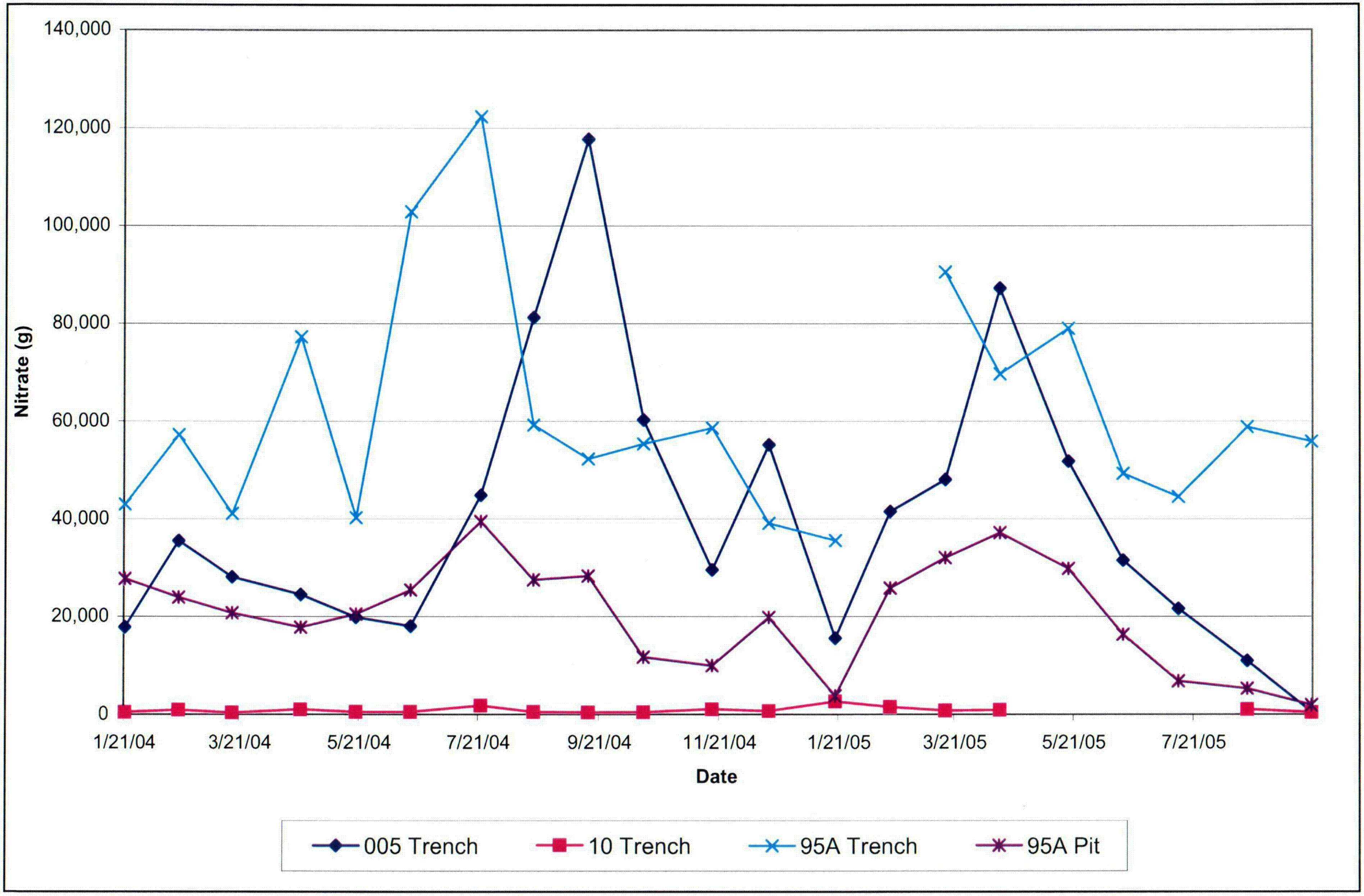
PUMPING RATE

Date:	DECEMBER 2005
Project:	P:\100734/92805 GWCAPR
File:	RAI TRENCH FIGURES.ppt

C46



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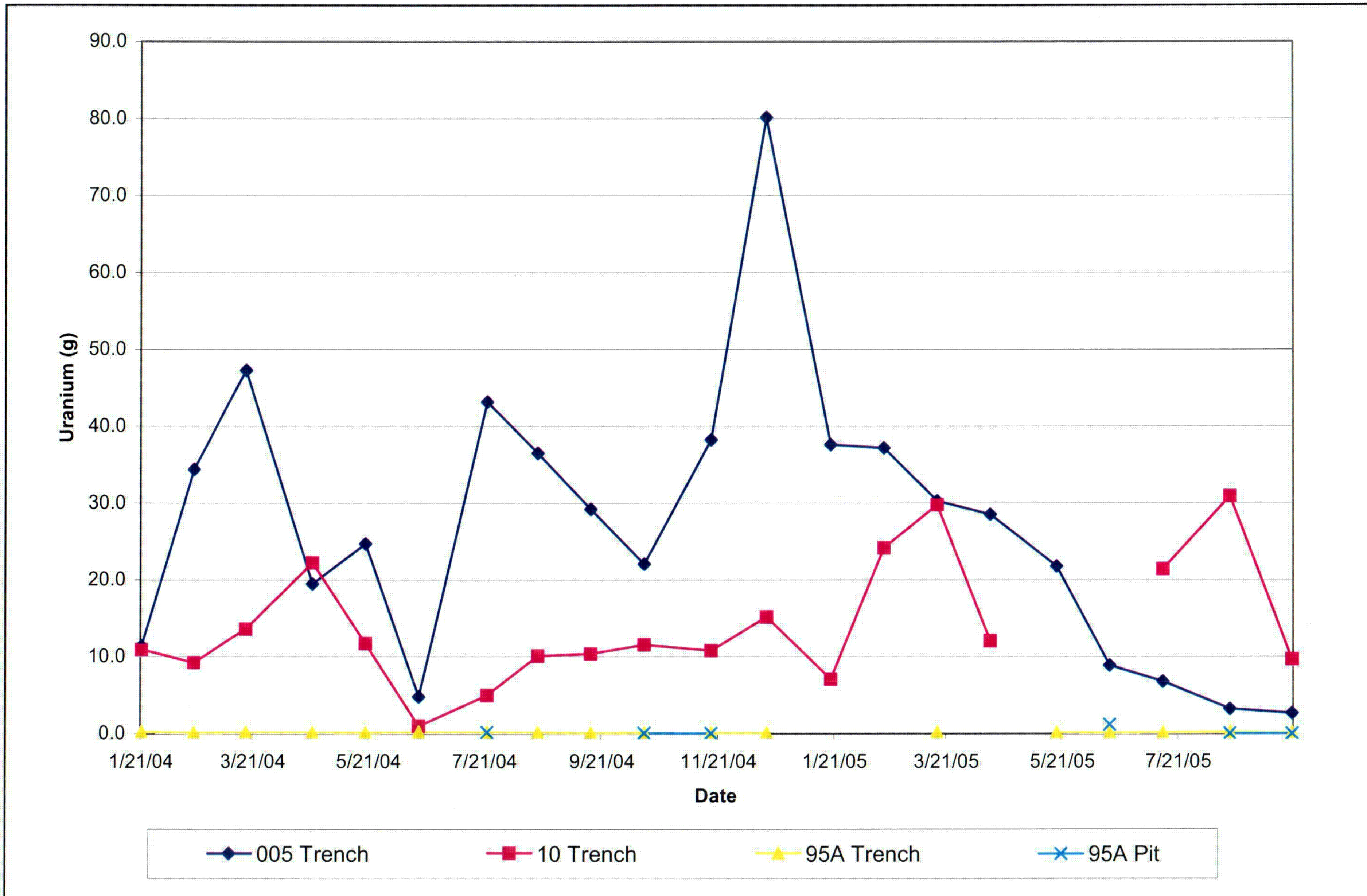
NITRATE MASS REMOVED

Date:	DECEMBER 2005
Project:	P:\100734/92805 GWCAPR
File:	RAI TRENCH FIGURES.ppt

C47



MFG, Inc.
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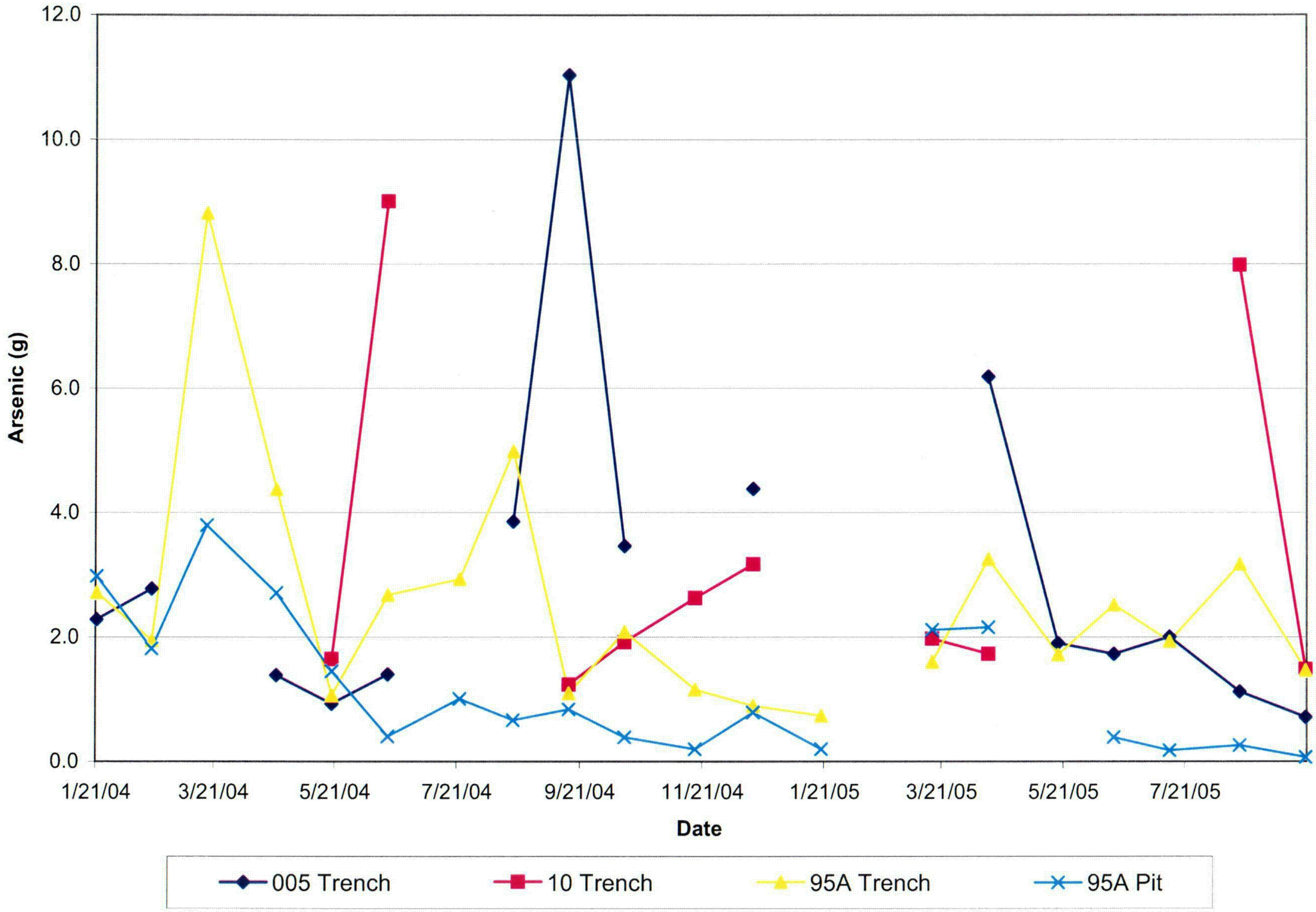
URANIUM MASS REMOVED

Date:	DECEMBER 2005
Project:	P:\100734/92805 GWCAPR
File:	RAI TRENCH FIGURES.ppt

C48



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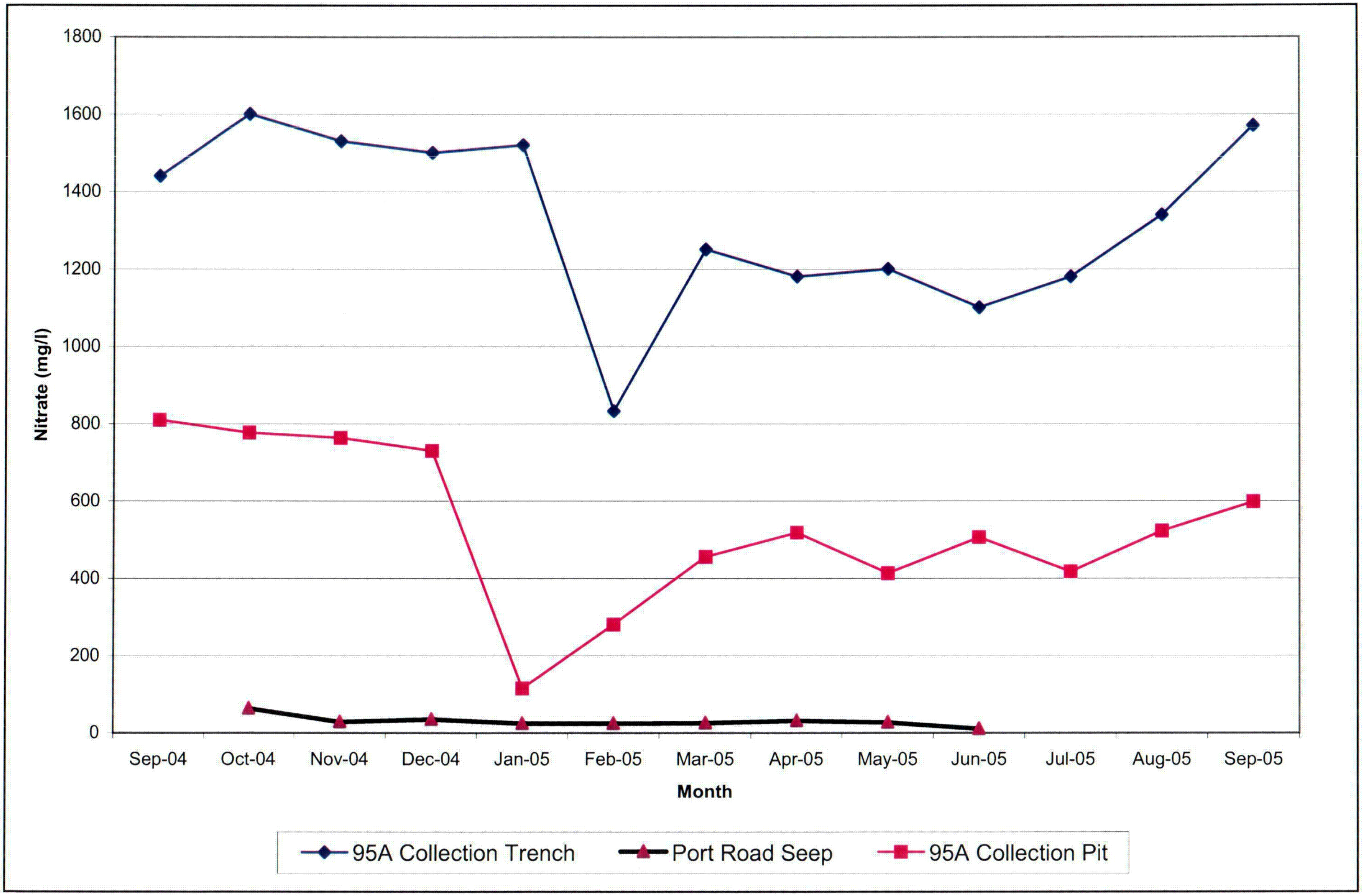
ARSENIC MASS REMOVED

Date: DECEMBER 2005

Project: P:\100734/92805 GWCAPR

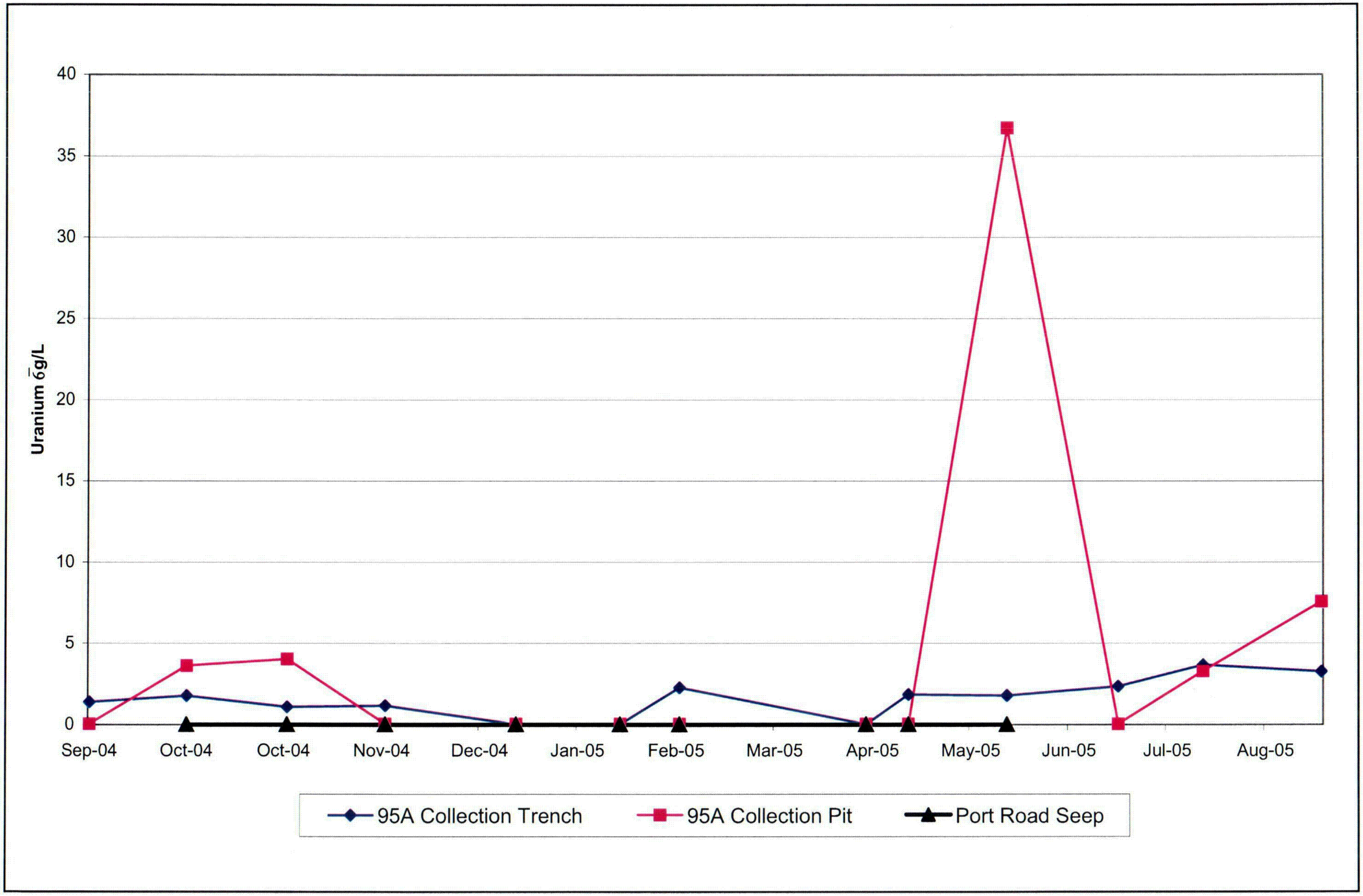
File: RAI TRENCH FIGURES.ppt

C49



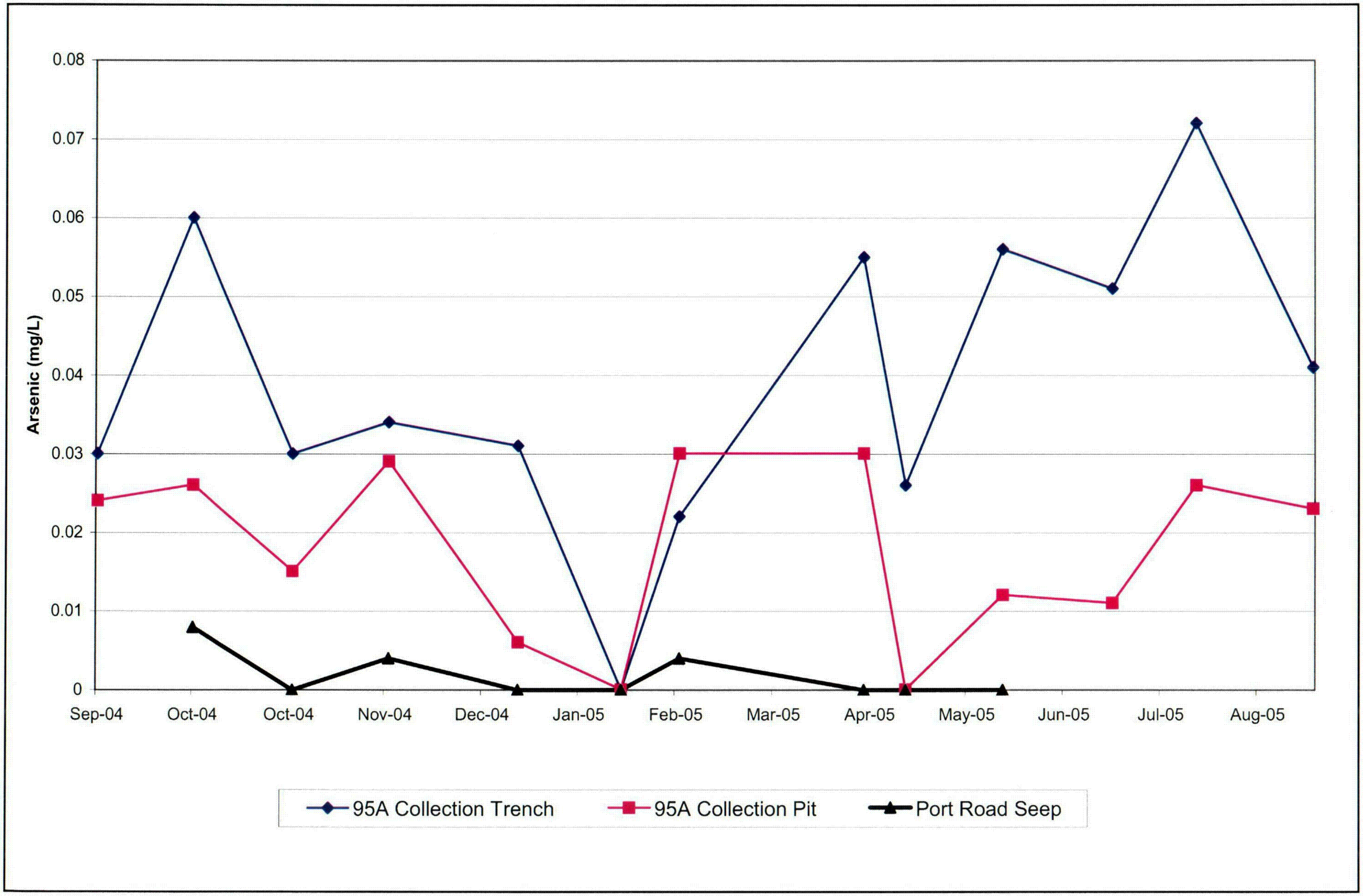
MFG, Inc. *consulting scientists and engineers*	95A COLLECTION SYSTEM NITRATE CONCENTRATIONS	Date: DECEMBER 2005 Project: P:\100734/92805 GWCAPR File: RAI TRENCH FIGURES.ppt

C50



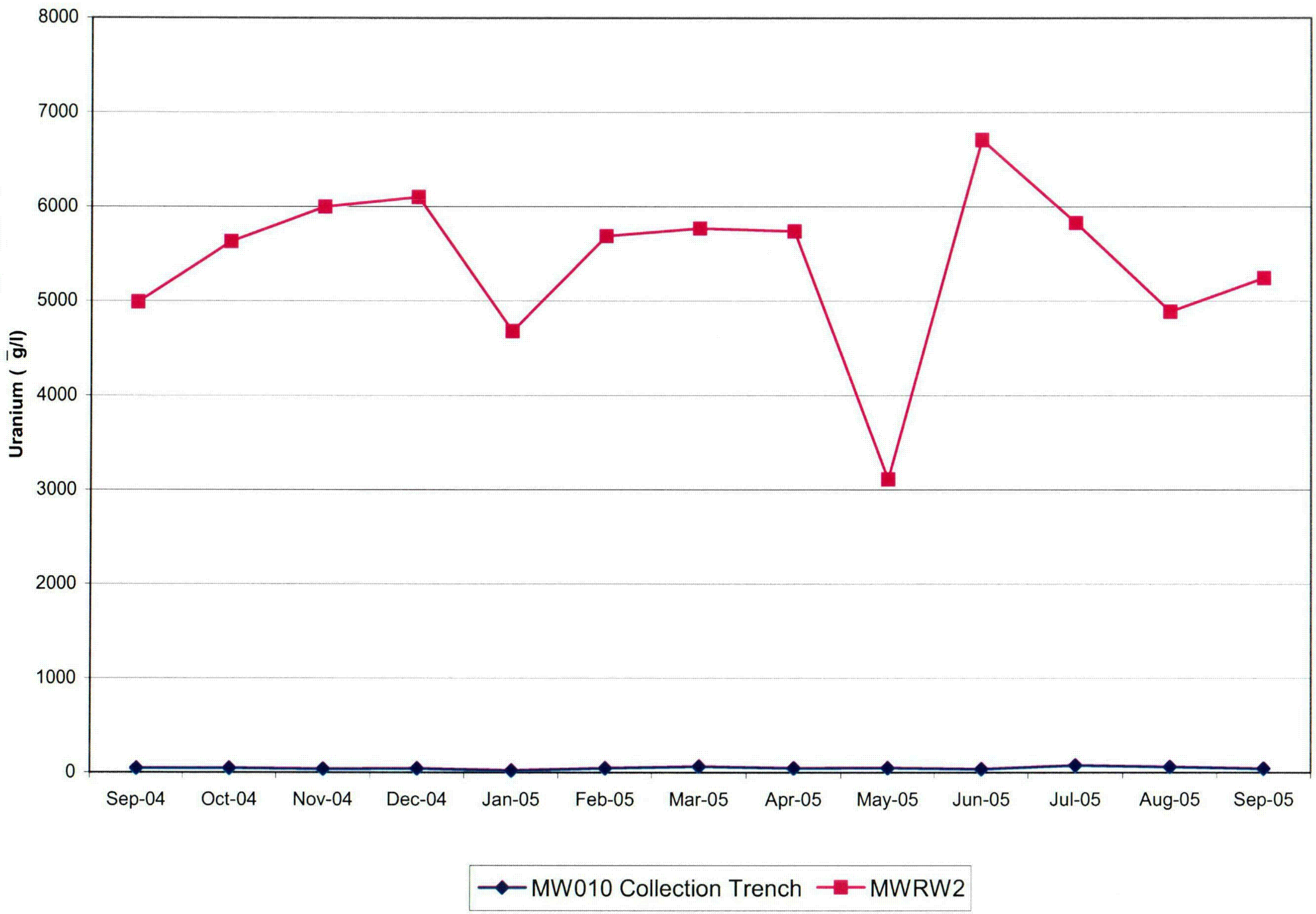
MFG, Inc. *consulting scientists and engineers*	95A COLLECTION SYSTEM URANIUM CONCENTRATIONS	Date: DECEMBER 2005 Project: P:\100734/92805 GWCAPR File: RAI TRENCH FIGURES.ppt

C51



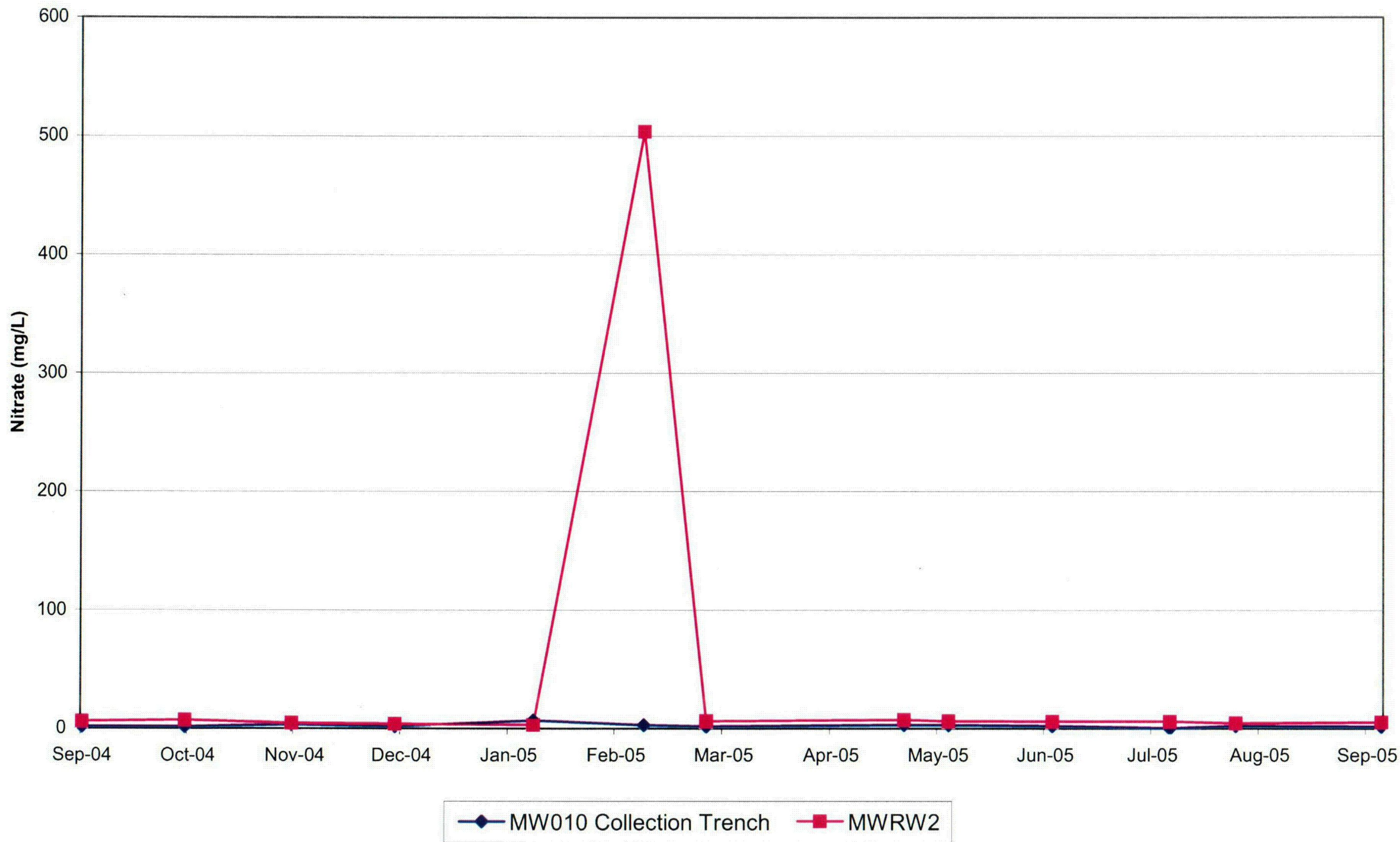
MFG, Inc. *consulting scientists and engineers*	95A COLLECTION SYSTEM ARSENIC CONCENTRATIONS	Date: DECEMBER 2005 Project: P:\100734/92805 GWCAPR File: RAI TRENCH FIGURES.ppt

C52



MFG, Inc. *consulting scientists and engineers*	MW010 COLLECTION SYSTEM URANIUM CONCENTRATIONS	Date: DECEMBER 2005 Project: P:\100734/92805 GWCAPR File: RAI TRENCH FIGURES.ppt

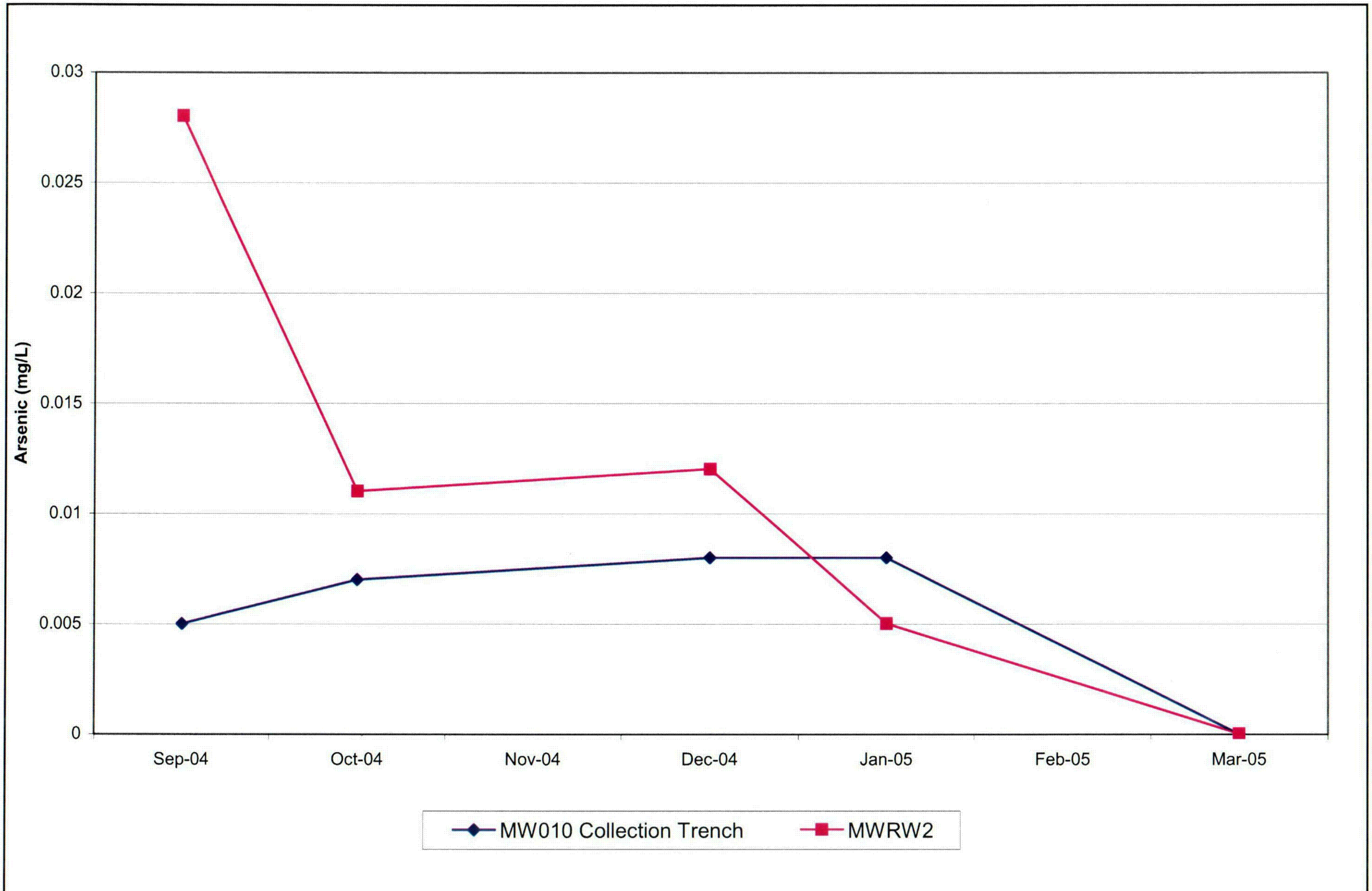
C53



MFG, Inc. *consulting scientists and engineers*	MW010 COLLECTION SYSTEM NITRATE CONCENTRATIONS

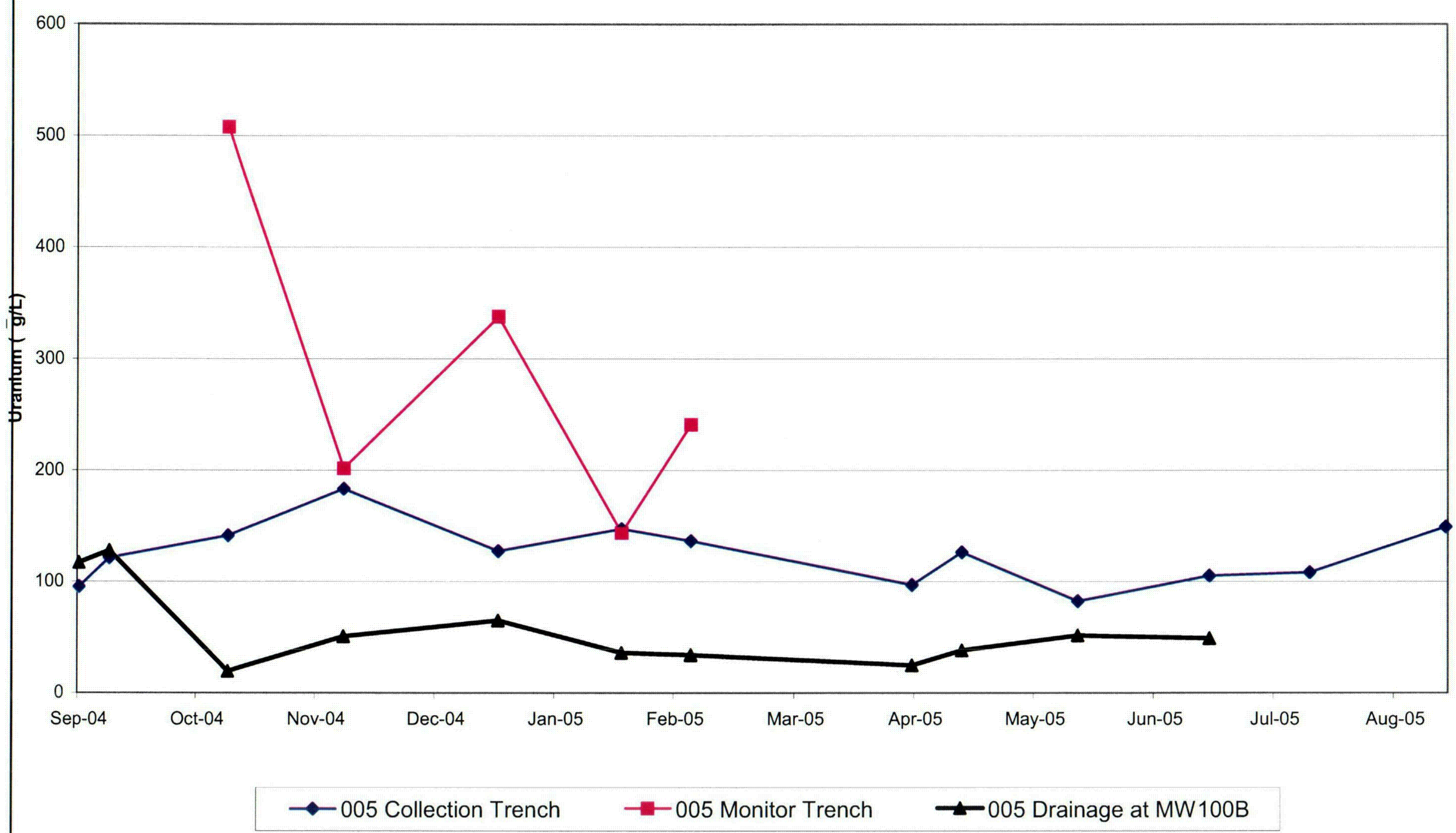
Date: DECEMBER 2005
Project: P:\100734/92805 GWCAPR
File: RAI TRENCH FIGURES.ppt

C54



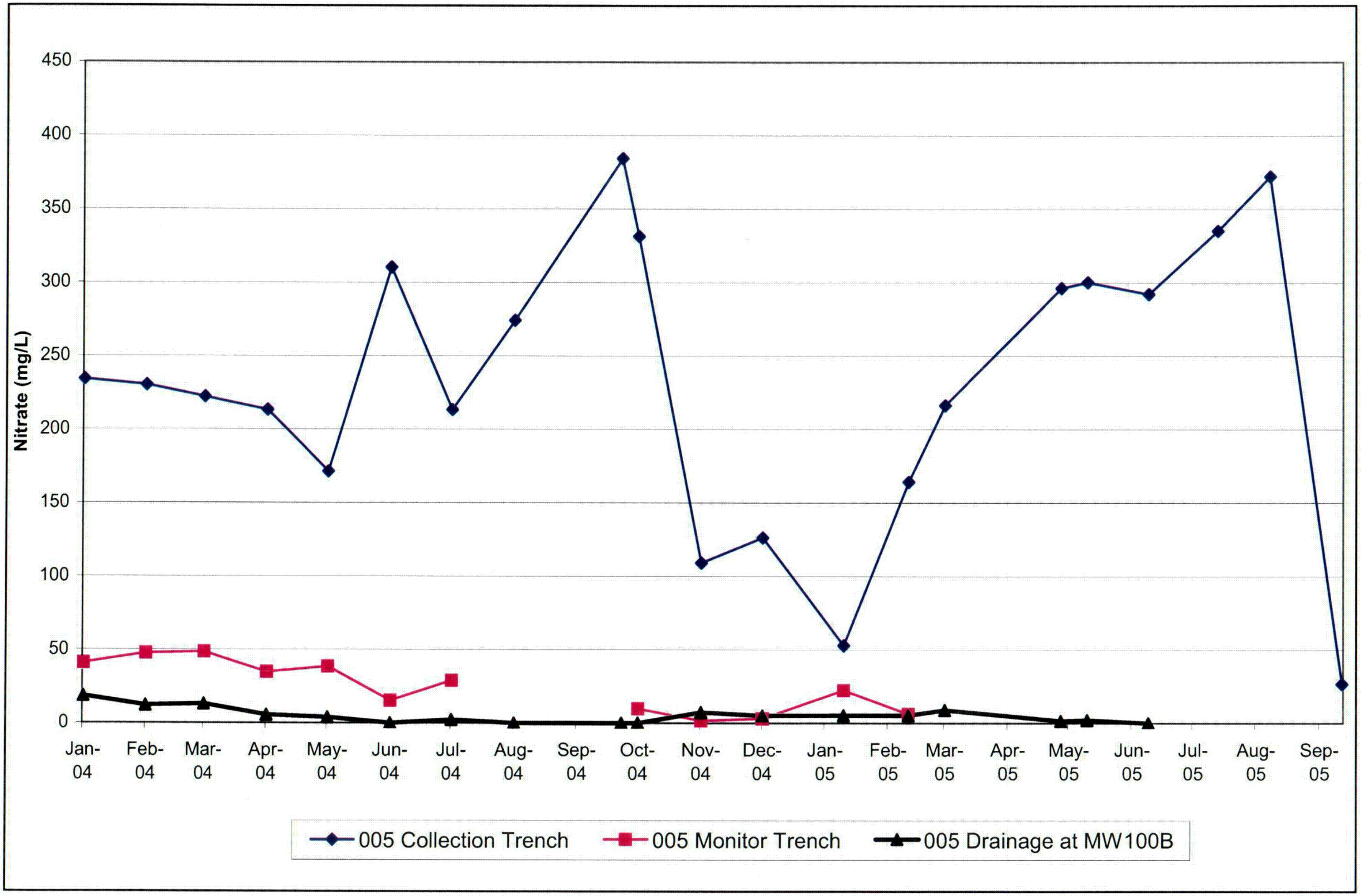
MFG, Inc. *consulting scientists and engineers*	MW010 COLLECTION SYSTEM ARSENIC CONCENTRATIONS	Date: DECEMBER 2005 Project: P:\100734/92805 GWCAPR File: RAI TRENCH FIGURES.ppt

C55



MFG, Inc. *consulting scientists and engineers*	005 TRENCH COLLECTION SYSTEM URANIUM CONCENTRATIONS	Date: DECEMBER 2005 Project: P:\100734/92805 GWCAPR File: RAI TRENCH FIGURES.ppt

C56



MFG, Inc.
consulting scientists and engineers

005 TRENCH COLLECTION SYSTEM NITRATE CONCENTRATIONS

Date: DECEMBER 2005
Project: P:\100734/92805 GWCAPR
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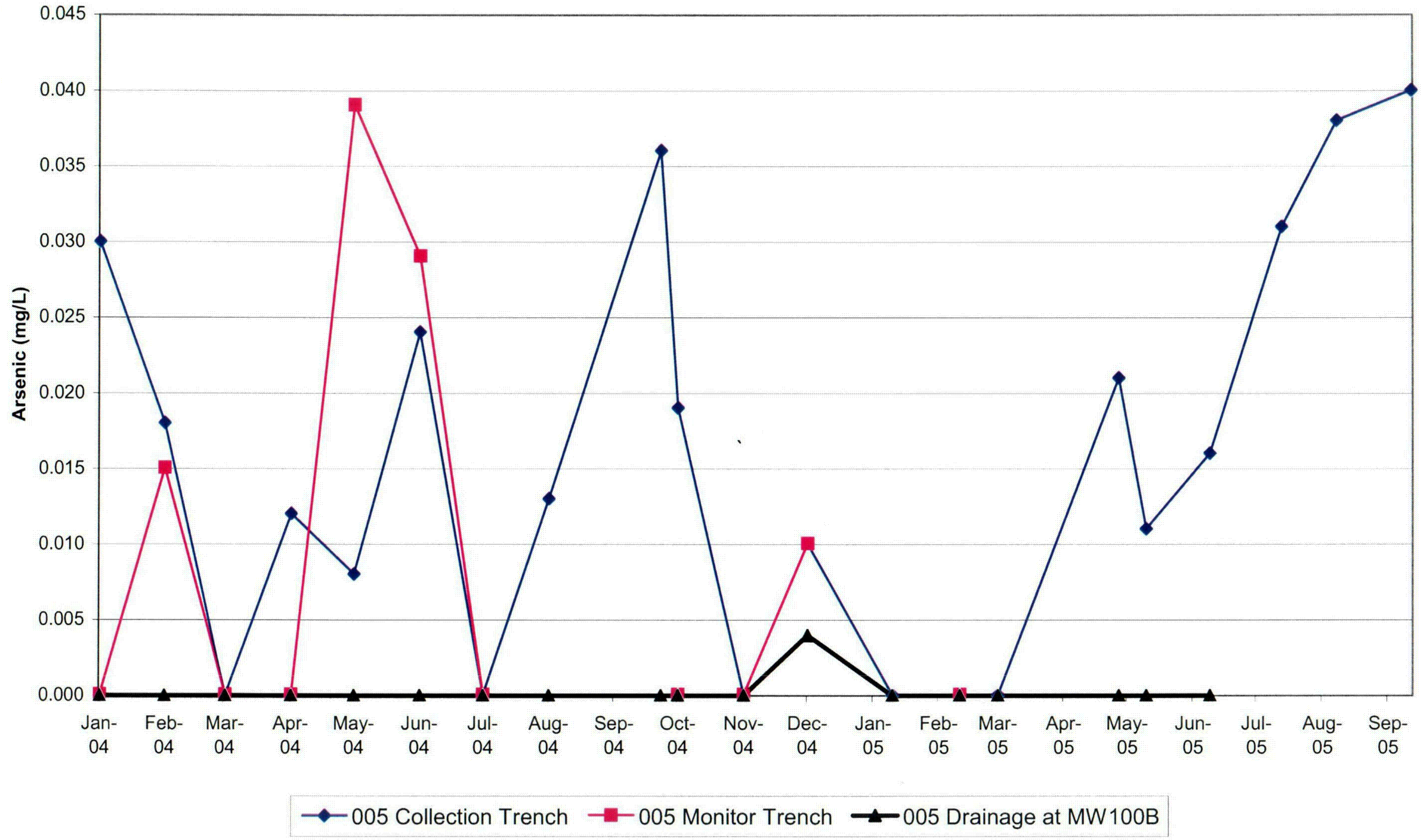

MFG, Inc. *consulting scientists and engineers*	005 TRENCH COLLECTION SYSTEM ARSENIC CONCENTRATIONS	Date: DECEMBER 2005 Project: P:\100734/92805 GWCAPR File: RAI TRENCH FIGURES.ppt

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ATTACHMENT CAP3B-1

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ATTACHMENT CAP3G-1

I. LAND APPLICATION

1. Specific Requirements for Land Application of Wastewater and Sludge

   a. The hydraulic loading at land application sites L01-L11 (consisting of 320.2 acres of Sequoyah Fuels owned land as described in Appendix 2) shall be maintained to prevent surface runoff of applied wastewater and to prevent persistent flooding (persistent flooding is defined as soil which remains saturated for more than 24 hours). The annual Nitrogen Loading rate shall not exceed a total of 700 lbs/acre/yr of which 423 lbs/acre/yr is Plant Available Nitrogen (PAN).

   b. Additional limited parameters include Radium-226 of 2 pCi/l and Uranium limits of 0.1 mg/l and annual metals loading limits as defined in OAC 252:606 which adopts by reference 40 CFR Part 503, "Standards for the Use or Disposal of Sewage Sludge" as described in the table below.

   c. The nitrogen loading at land application sites L01-L11 shall be maintained to minimize the formation and infiltration of nitrates and nitrate-producing compounds in concentrations that may impact the groundwater.

   d. Land application of wastewater shall not occur during periods of precipitation, when the soil is frozen or while the soil is saturated. The wastewater must be stored in the surface impoundments T01 and T04 until the soil is capable of receiving wastewater without persistent flooding or surface water runoff.

   e. Land application of wastewater shall not cause permanent vegetative damage or otherwise prevent growth after cessation of application of wastewater.

   f. Land application sites L01-L11 shall be managed to prevent site conditions that have the potential to impact aesthetics, including but not limited to, odors, waste piles, and sludges.

   g. The land application of wastewater shall not occur within 250 feet of a well used for potable water.

   h. The land application of wastewater shall not occur within 100 feet of a stream or body of water and shall not occur within two feet of the highest seasonal water level on a site.

   i. A 10 foot buffer zone is required between the land application site and the adjacent property boundary. A buffer is not required between adjacent sites.

   j. The permit may be reopened to implement and/or require land application modifications, additions, extensions, cessation and/or operational changes; additional monitoring and reporting (including but not limited to soil sampling); reclassification of wastes, sludge management plans; best management practices; land application site closure and/or closure plans; remediation and/or remediation plans; monitoring wells and/or subsurface monitoring plans; and/or other appropriate actions.

The following table summarizes the Land Application loading limits:

Mass Land Application Loading Limitations
(Units are Lbs/Acre/Year unless otherwise specified)

Wastewater Constituent	Draft Permit Maximum Annual
Nitrogen, PAN	423**
Arsenic, Total*	1.79
Cadmium, Total*	1.69
Chromium, Total*	134
Copper, Total	67
Nickel, Total*	18.75
Lead, Total*	13.39
Selenium, Total*	4.46
Mercury, Total*	0.76
Zinc, Total*	125
Radium 226 (pCi/l)	2.0**
Uranium (mg/l)	0.1**

* Annual Mass Loading limit allowed by 40 CFR Part 503, "Standards for the Use or Disposal of Sewage Sludge".
** Limits established by the Nuclear Regulatory Commission (NRC) and included in the facilities NRC license.

k. Wastewater Monitoring Requirements

(1) Each waste stream that contributes wastewater to be land applied shall be tested annually. The Permittee shall collect representative samples of each waste stream and have them analyzed for the following constituents: soil pH and the nutrients – Total Kjeldahl Nitrogen (TKN), nitrogen (N), ammonia (NH_4)-N, nitrate (NO_3)-N, potassium (K) and phosphorus (P) and the metals included in 40 CFR Part 503, "Standards for the Use or Disposal of Sewage Sludge".

(2). Based on the results of the tests, the annual nitrogen loading rate may be adjusted to insure the plant uptake is not exceeded.

l. Soil Monitoring Requirements

(1) Soil sampling

Soil samples shall consist of a composite sample taken from sites proposed or used for the land application of sludge and wastewater. Soil testing procedures applicable for use in the local area in accordance with Oklahoma State University soil testing guidance or the local NRCS may be used. Sampling of proposed land application sites is required to determine the background concentration of constituents to be land applied for disposal.

(2) Soil monitoring.

Each land application site that receives solids, sludge or wastewater shall be tested annually to determine the residual nitrogen content. The Permittee shall collect representative soil samples form each land application site that received waste or wastewater and have them analyzed for the following constituents: soil pH and the

nutrients – Total Kjeldahl Nitrogen (TKN), nitrogen (N), ammonia (NH_4)-N, nitrate (NO_3)-N, potassium (K) and phosphorus (P) and the metals included in 40 CFR Part 503, "Standards for the Use or Disposal of Sewage Sludge".

(3). Based on the results of the soil tests, the annual nitrogen loading rate may be adjusted to insure the plant uptake is not exceeded.

m. Record keeping and Reporting Requirements

(1). Records. Maintain the following land application records:
(a) location, day and hour land application began and ended, and the method of application;
(b) analytical data, volume and source(s) of wastewater applied;
(c) loading rates;
(d) weather conditions during the application period;
(e) type of crop, grass or vegetation grown on site;
(f) pH of wastewater at beginning of application, or weekly if application exceeds seven consecutive days; and
(g) monitoring records, including the date, time and exact place of the sampling or measurement, the name of the sampler, when analysis began, the name of the certified laboratory and the analytical results.

(2) Reporting requirements:

(a) The owner or operator shall submit reports of monitoring and land application records by month on a quarterly basis unless otherwise specified.
(b) The quarterly reports will be due on or before the last working day of the month following the close of each quarter (i.e., April, July, October and January).
(c) Monitoring information shall be submitted to the DEQ on self-monitoring report (SMR) forms or other forms provided or approved by the DEQ.
(d) The owner or operator shall submit copies of the Ammonium Nitrate Fertilizer Application Program annual completion report required by the Facility NRC license SUB-10; Docket 40-8027 to the DEQ at the same time the report is submitted to the NRC.