Woodward-Clyde

Engineering & science applied to the earth & its environment

June 19, 1996

RECEIVED JUN 19 1996

HAND DELIVERED

Mr. Jerry Delavan, P.G.
Arkansas Department of Pollution
Control and Ecology
Water Division
PO Box 8913
Little Rock, AR 72219-8913

Re: Phase II Groundwater Investigation at El Dorado Chemical Company - Final Report
WC File No.: 95B165/REPT-2

Dear Mr. Delavan:

Enclosed please find the above-referenced report. Please contact either of the undersigned at 223-2582 if you have any questions or comments. We appreciate the Department's cooperation during the course of this project.

Sincerely,

Ray A. Quick, P.G.
Branch Office Manager

Mary D. Beck, C.I.H.
Project Scientist

cc: Mr. John Carver, EDC

C:/WORD/EDC-CORRES/DELAVAN.L-2/6-19-96/RAQ

Woodward-Clyde Consultants • A subsidiary of Woodward-Clyde Group, Inc.
Three Financial Centre • 900 S. Shackleford, Suite 412 • Little Rock, Arkansas 72211
501-223-2582 • Fax 501-223-2996

FINAL REPORT

PHASE II GROUNDWATER INVESTIGATION

June, 1996

Prepared for
El Dorado Chemical Company
El Dorado, Arkansas

Woodward-Clyde

Three Financial Centre
900 S. Shackleford, Suite 412
Little Rock, AR 72211

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

1.0 INTRODUCTION

In compliance with the terms of Paragraph 18 of Consent Administrative Order (CAO) LIS 95-070, El Dorado Chemical Company (EDC) submits this report summarizing the results of a Phase II groundwater investigation. The Phase II investigation was conducted subsequent to the findings of a Phase I groundwater investigation, as summarized in Woodward-Clyde's Phase I Groundwater Investigation summary report dated January 9, 1996. The report recommended a second phase of investigation, to include installation and sampling of a groundwater monitoring network, which was approved by the Water Division of the Arkansas Department of Pollution Control and Ecology (ADPC&E) on January 18, 1996.

The Phase II investigation was conducted to further quantify groundwater quality and flow direction around areas of potential concern identified during Phase I activities. The areas of potential concern (APCs), as outlined in the CAO, include:

- Process Wastewater Treatment System (PWTS), including:
  1. Lake Lee
  2. Lake Kildeer
  3. Plant Drain System
- Nitric Acid Concentrator Area
- Product Loading and Unloading Areas

As stated in the CAO, these areas are suspected to be potential sources of release for one or more of the following parameters:

- Nitrate
- Sulfate
- Lead
- Chromium

As proposed in Woodward-Clyde's approved work plan, definition of the groundwater quality beneath the EDC site was conducted through a phased approach. Phase I consisted of the preliminary delineation of shallow groundwater quality at 35 locations throughout the facility using direct-push technology and subsequent groundwater sampling and analysis. Phase II activities included the installation and sampling of eighteen new groundwater monitoring wells, sampling of four existing groundwater monitoring wells, and abandonment of eighteen existing piezometers/monitoring wells installed during previous site investigations.

This report has been divided into the following sections:

- Section 2.0 provides a summary of the site environmental setting and the areas of potential environmental concern at the EDC site, as identified in the CAO;
- Section 3.0 provides a brief summary of the Phase I groundwater investigation results;
- Section 4.0 details the activities conducted during the Phase II groundwater investigation, and provides a description of the methods used in monitoring well installation, sampling and abandonment during this phase of investigation;
- Section 5.0 presents the results of the Phase II groundwater investigation relative to groundwater flow direction and quality beneath the EDC site;
- Section 6.0 provides a summary of the mitigating actions taken by EDC to preclude future releases of sulfates and nitrates to the groundwater beneath the EDC site; and,
- Section 7.0 presents a summary of additional assessment activities which are proposed for the EDC site, as well as a proposed timeframe for implementation.

2.0
FACILITY DESCRIPTION

2.1 FACILITY LOCATION

The EDC facility is located at 4500 North West Avenue in the city of El Dorado, Union County, Arkansas. The EDC property consists of approximately 1,340 acres, of which about 150 acres are utilized for plant operations (i.e., production and support areas). The approximate center of the Production Area is located at Latitude 33° 15′ 53″ North, Longitude 94° 41′ 16″ West and is generally contained in the southeast 1/4 of Section 6 and the northeast 1/4 of Section 7, Township 17 South, Range 15 West. A site location plan of the EDC facility is presented in Figure 1.

2.2 FACILITY DESCRIPTION AND HISTORY

EDC is a manufacturer of basic agricultural chemicals, including sulfuric acid, nitric acid, ammonium nitrate fertilizers and industrial grade ammonium nitrate. Ammonia used in the manufacture of nitric acid and ammonium nitrate is received at the plant site through an underground pipeline owned and operated by Koch. Elemental sulfur used in the manufacture of sulfuric acid is received via truck shipment. The other principal raw materials used in the production processes at EDC are water and natural gas. Water is supplied through five on-site operating production wells, owned by EDC and ranging in depth from 530 feet to 670 feet below ground surface. Natural gas is supplied to the plant through an underground pipeline owned and operated by Arkansas-Louisiana Gas Company.

The EDC facility is currently owned by El Dorado Chemical Company, a wholly owned subsidiary of LSB Industries of Oklahoma City, Oklahoma. EDC purchased the plant in July, 1983 from Monsanto Chemical Company, which had occupied the site since 1955. Previous site occupants included the Lion Oil Company (1949-1955) and the Lion Chemical Corporation (1943-1949). Based on information provided by EDC, the plant property was undeveloped prior to 1943. Since 1943, site operations have generally been limited to production of ammonia-related products and sulfuric acid.

2.3 REGIONAL GEOLOGIC AND HYDROGEOLOGIC SETTING

The EDC facility lies within the Gulf Coastal Plain Province in southern Arkansas. Heath (1988) has broadly characterized this province as a relatively undissected low-lying plain underlain by complexly interbedded sands, silts, and clays which thicken progressively toward the coast and toward the Mississippi River. Sediments within the sequence are, for the most part, unconsolidated or non-lithified. The sediments range in age from Quaternary (youngest) to Triassic. The sediments occur as continuous, distinguishable units across most of the Gulf Coastal Plain Province.

Structurally, depositional dip was basinward in a generally southern to southeasterly direction. Growth fault development at depth enhances the basinward dip of the sediment accumulations across the region. A graben structure (a down-thrown faulted block of sediments) is located approximately seven miles south of the facility. The fault planes which form the graben strike northwest-southeast.

Table 1 shows the age relationships of the various formations found in the subsurface of the region. Also shown are the approximate thickness of each formation and description of the hydrogeologic character of the sediments.

2.4 AREAS OF POTENTIAL CONCERN

In September, 1992, the Superfund Branch of the Hazardous Waste Division of the ADPC&E conducted a preliminary assessment of the environmental conditions at the EDC facility. The investigation was completed under the authority of the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Superfund Amendments Reauthorization Act (SARA) with the overall objective of determining if additional CERCLA/SARA actions at the facility were warranted.

An on-site and off-site reconnaissance was completed by the ADPC&E on September 9-10, 1992. A report of the preliminary assessment was issued by the ADPC&E on September 30, 1992 and later revised on October 27, 1992. Based on the findings of the preliminary assessment, the ADPC&E identified the plant's wastewater treatment system and Lake Lee as areas of potential concern (APCs).

In March of 1994, a multi-media inspection (MMI) of the EDC facility was conducted by the ADPC&E. As part of the MMI, personnel from the Water Division of the ADPC&E conducted an inspection of the process wastewater treatment system, and the EDC facility in general. The inspection included a groundwater monitoring data review which revealed that nitrate in groundwater had been detected at concentrations in excess of the United States Environmental Protection Agency's (USEPA's) Maximum Contaminant Level (MCL) for nitrate (10 mg/L, EPA 1993). In addition, sulfate had been detected at concentrations above the USEPA's proposed secondary MCL (SMCL) for sulfate (500 mg/L, EPA 1995).

On March 29, 1994, Water Division personnel reported the findings of the inspection and recommendations for actions to be taken by EDC. This information was detailed in a memorandum to the enforcement coordinator (Mr. Harry Elliott) of the MMI task force.

Based on the findings of the September, 1992 preliminary assessment and the March, 1994 MMI, a Consent Administrative Order (CAO) was negotiated between EDC and the ADPC&E and became effective on June 6, 1995. Paragraph 18 of the CAO specifically cited the following areas to be of potential concern with respect to groundwater quality:

- Process Wastewater Treatment System (PWTS), including:
  1. Lake Lee
  2. Lake Kildeer
  3. Plant Drainage System
- Nitric Acid Concentrator Area
- Product Loading and Unloading areas

The locations of the APCs are presented in Figure 2.

The APCs addressed in the CAO are suspected to be potential sources of release for nitrate and sulfate. Lead and chromium were also identified as targeted parameters in the CAO due to the inadvertent disposal of a sludge containing lead and chromium in EDC's Class III Landfill. The four targeted parameters for the Phase I and Phase II Groundwater Investigation are summarized below:

Nitrate: Process wastewater from the nitric acid manufacturing process is likely to contain a significant concentration of nitrogen-related compounds, including nitrate. The current USEPA MCL for nitrate is 10 mg/L.

Sulfate: Process wastewater from the sulfuric acid/concentrated nitric acid manufacturing processes and water treatment is likely to contain a significant concentration of sulfate. Although sulfate occurs in almost all natural water, the naturally occurring concentrations vary considerably depending on geochemical conditions. The current proposed USEPA MCL for sulfate is 500 mg/L (USEPA, May 1995).

Lead and Chromium: In accordance with solid waste permit 0177-SR-1, solid sulfur sludge from the facility's nitric acid concentrator tanks was periodically disposed of in the Solid Sulfur Disposal Cell (SSDC) of EDC's Class III Landfill. In May 1993, sludge characterized by a blue-green appearance was observed during disposal operations. The sludge was removed and placed into drums for characterization, whereby elevated levels of leachable lead and chromium were quantified in grab samples. EDC attributed the elevated levels of lead and chromium to corrosion of the Lewmet dip tube and certain lead lined components of the nitric acid concentrator unit. Approximately 218 tons of sludge and soil were excavated, removed, and transported off-site to a RCRA-permitted hazardous waste landfill. From August through October 1995, waste material remaining in the SSDC was stabilized and covered with a low permeability clay cap, and the Class III landfill was closed in accordance with EDC's approved *Consolidated Plan for Closure of the Class III Solid Waste Landfill and Corrective Action Plan for the Solid Sulfur Disposal Cell* (June 1995). The current federal action level for lead in drinking water is 0.015 mg/L, while the USEPA MCL for chromium is 0.1 mg/L.

The following discussion gives a brief overview and description of the areas of potential concern (APCs) identified in the CAO.

2.4.1 Process Wastewater Treatment System (PWTS)

The PWTS receives flows from the following equipment within the EDC facility's production area:

- Three weak nitric acid plants
- Two ammonium nitrate plants
- One sulfuric acid plant
- One natural gas fired boiler
- One nitric acid concentrator
- One strong nitric acid plant with associated oxygen plant

Process wastewater from these areas is subsequently discharged to three associated APCs, namely Lake Lee, Lake Kildeer, and the plant drainage system.

2.4.1.1 <u>Lake Lee</u>

Lake Lee is a one-acre pond equipped with an aerator. Under high rainfall conditions, wastewater mixed with stormwater from the acid manufacturing area can bypass the neutralization pit and flow directly to Lake Lee. Lake Lee also receives direct flow from the ammonium nitrate plants, boiler blowdown, and zeolite regeneration backwash. These three sources are mixed by the aerator in Lake Lee. From Lake Lee, flow is directed through a pipe to Lake Kildeer in the south-central portion of the EDC property.

Under normal conditions, all stormwater flows are treated with the process wastewater. However, when stormwater volumes exceed the capacity of the pipe from Lake Lee to Lake Kildeer, the excess flow is directed through an overflow pipe from Lake Lee and is discharged through Outfall 002 into the tributary of Haynes Creek. This overflow pipe is necessary for levee protection for Lake Lee.

2.4.1.2 Lake Kildeer

Lake Kildeer is a fifty-acre (±) finishing treatment pond which allows retention time for natural biological treatment. Discharge from Lake Kildeer is via Outfall 001 to an unnamed tributary of Haynes Creek.

2.4.1.3 Plant Drainage System

The plant drainage system is comprised of four components:

- Discharges from the PWTS through NPDES Outfall 001
- Discharges of stormwater/wastewater under heavy rainfall conditions through NPDES Outfall 002
- Discharges of effluent from the sanitary sewer collection and treatment system through NPDES Outfall 003
- Discharges of stormwater collected around the ammonium nitrate manufacturing and loading/unloading areas through NPDES Outfall 004

A schematic showing the arrangement of the plant drainage and discharge (including the PWTS) is presented in Figure 3. Figure 3 also shows the relative locations of the sanitary sewer treatment system and the NPDES regulated stormwater discharge outfalls.

NPDES Outfall 001 discharges the processed wastewater and stormwater from EDC's acid manufacturing and ammonium nitrate manufacturing operations. Inlets to the system receive flows released continuously from cooling towers, boiler blowdowns, and manufacturing areas where there is potential for spills (both indoor and outdoor). Flows enter the process sewer system and flow by gravity to a pumping station located on the south side of the acid manufacturing area. At this point, the wastewater is pumped from a stainless steel collection basin into a limestone ($CaCO_3$) neutralization basin. Flow from the neutralization basin is via gravity into Lake Lee, which is also referred to as the "day pond".

Sanitary wastewater is collected and treated by a separate system at the EDC facility. The wastewater is collected and transferred via gravity flow to an Imhoff sanitary treatment plant located approximately ¼ mile south of the manufacturing area. After treatment, effluent is discharged to the unnamed tributary of Haynes Creek at a location downstream of the other outfalls.

2.4.2 Nitric Acid Concentrator Area

Within the EDC facility's production area, flow from one nitric acid concentrator, three weak nitric acid plants, and one strong nitric acid plant with associated oxygen plant is directed to the PWTS. Flow from cooling towers, boiler blowdowns, and manufacturing areas enter the process sewer system and flow by gravity to a pumping station located on the south side of the acid manufacturing area. The wastewater is then pumped from the stainless steel collection basin into a limestone ($CaCO_3$) neutralization basin prior to gravity discharge to Lake Lee.

2.4.3 Product Loading and Unloading Areas

Stormwater which falls in the vicinity of the ammonium nitrate manufacturing area and the product loading/unloading areas is collected in storm sewers and is directed to an 18" diameter polyethylene sewer pipe which carries the flow along the western and southern sides of the production area. Discharge from this pipe is directly to Lake Lee, where the water is aerated prior to discharge to Lake Kildeer. When runoff exceeds the capacity of this system, overflow is directed through Outfall 004 into the unnamed tributary of Haynes Creek.

2.4.4 Class III Landfill

For the purpose of the Phase II groundwater investigation, the Class III Landfill has been designated an area of potential concern although it is not specifically cited in Paragraph 18 of the CAO. As mentioned previously, closure activities at the Class III Landfill were completed in October, 1995, as documented in Woodward-Clyde's *Closure Certification and Report* dated December, 1995. Mr. Rodger Payne of the ADPC&E Solid Waste Division approved the closure of the Class III landfill in his letter dated March 4, 1996. The letter also stated that the post-closure care period had begun on the date of his site inspection (February 28, 1996). A subsequent conversation between Mr. Ray Quick of Woodward-Clyde and Mr. Payne (March, 1996) confirmed that the post-closure care period commenced on February 28, 1996. EDC personnel have been performing routine inspections of the landfill cap and surface, and conducting any necessary maintenance (e.g., filling and grading of any eroded areas, spot seeding).

3.0 PHASE I GROUNDWATER INVESTIGATION

3.1 WELL POINT PROGRAM

The ADPC&E-approved Groundwater Monitoring Work Plan, prepared by Woodward-Clyde and dated September 19, 1995, outlined a phased approach for investigating groundwater quality beneath various portions of the EDC site. The first phase of investigation utilized a Hydropunch direct-push sampling device to install temporary well points at thirty-five (35) locations around the EDC site. The principal objectives of the well point program were to obtain preliminary groundwater elevation and quality data from a number of locations around each APC in order to provide a broad indication of the groundwater flow direction and groundwater quality.

3.1.1 Well Point Locations

The well point locations were selected based on their proximity to the APCs described in the CAO, most of the which are relatively close to one another (i.e., PWTS, nitric acid concentrator units, loading and unloading areas, and portions of the plant drainage system). As these areas occupy a relatively small portion of the EDC facility (known as the Production Area), their areas of influence may actually overlap one another.

A listing of each well point location and its associated APC is presented below:

Well Point No.	Area of Potential Concern Targeted
1, 2, 3, 4	Background; along north property boundary
9, 11, 21, 35	Lake Kildeer Downstream Area
5, 6, 7, 19, 22	Lake Lee/Lake Kildeer Buffer Area
23, 24, 25, 26	Lake Lee Area
8, 10, 12, 13, 14, 15, 16, 17, 18	Lake Kildeer Area
20, 27, 28, 29	Nitrate truck and train loading areas
30, 31, 32, 33, 34	Acid concentrator units, acid loading areas

The approximate well point locations relative to existing site structures are presented in Figure 4.

The Phase I groundwater investigation encountered groundwater at each of the 35 well point locations. Although groundwater was not immediately present upon installation of several well points, the static groundwater level rose to near ground surface after several hours. The results of the water level survey indicate that the shallow groundwater observed during the Phase I investigation may exist under confined or semi-confined conditions at several of the well point locations, and under unconfined conditions at the other locations. The results of the Phase I water level survey are summarized in Table 2.

3.1.2 Groundwater Flow Direction

Using the approximate groundwater elevations obtained during the Phase I water level survey, the general direction of groundwater flow beneath the EDC site was identified to the east-southeast, which is consistent with findings from previous site investigations and Woodward-Clyde's Phase II groundwater investigation. The Phase I data indicated that groundwater flow directions may vary locally with ground surface topography, as well as in the vicinities of Lake Lee and Lake Kildeer.

3.1.3 Analytical Results

The Phase I analytical results indicated the presence of lead and chromium in groundwater at relatively similar concentrations throughout the EDC site. In addition, several well point locations were found to exhibit elevated concentrations of nitrate and sulfate. The four locations installed along the northern property line (WP-1 through WP-4) are upgradient from plant activities (Figure 6) and, therefore, presumably unaffected by potential site releases. The groundwater data obtained from these four upgradient locations indicates that lead and chromium concentrations are consistent with concentrations found throughout much of the EDC site.

Many of the elevated metal (i.e., lead and chromium) results were believed to be attributed to the turbid state of the groundwater samples obtained during the well point sampling program. A Phase II groundwater investigation was recommended to further quantify groundwater quality in these areas where elevated levels of the constituents of concern were detected. In order to more accurately quantify metal concentrations in groundwater beneath the EDC site, the proposed Phase II activities included installation of a network of 4-inch diameter PVC monitoring wells, well development to reduce sample turbidity, field filtration of groundwater samples for analysis of dissolved lead and chromium, and total lead and chromium analyses for comparison to the dissolved metals data.

The results of the Phase I groundwater data are summarized in Table 3. A more complete discussion of the Phase I results is presented in Woodward-Clyde's Phase I Groundwater Investigation Summary Report dated January 8, 1995.

4.0
PHASE II GROUNDWATER INVESTIGATION

4.1 MONITORING WELL INSTALLATION

Based on the data obtained during the Phase I well point investigation, a total of eighteen (18) groundwater monitoring wells were strategically located and installed at various points around APCs at the EDC facility during the Phase II groundwater investigation. The monitoring wells were constructed in accordance with USEPA guidance for well construction in overburden (unconsolidated) formations, and were installed approximately ten (10) feet into the uppermost saturated unit, resulting in well depths ranging from 17.0 to 34.7 feet.

Figure 5 presents the well locations relative to site structures and features.

4.1.1 Monitoring Well Construction

The groundwater monitoring wells were drilled with a truck mounted drilling rig using hollow stem augers. Drilling activities were conducted by Anderson Engineering Consultants, Inc. of Little Rock, Arkansas under the observation of a Woodward-Clyde field scientist. Anderson Engineering Consultants, Inc. is a licensed water well drilling contractor in the state of Arkansas.

Each monitoring well was screened in the uppermost saturated zone utilizing ten feet of 4-inch diameter, 0.010-inch slotted polyvinyl chloride (PVC) well screen. The well was constructed with 4-inch diameter PVC casing. The annular space around the well screen was filled using No. 00 grade clean sand pack to a height of two feet above the top of the screen. A two foot thick seal of dry bentonite pellets was placed above the sand pack, and hydrated with potable water. The remaining annular space was filled with a bentonite-cement grout mixture to a height of approximately 6-inches below grade. A steel protective casing was placed around each well and secured in concrete to a height of approximately three feet above ground surface. Table 4 provides a summary of the monitoring well construction details. Completion diagrams for each monitoring well are presented in Appendix A.

4.1.2 Soil Sampling

During well drilling procedures, soil samples were collected using stainless-steel split spoon samplers for the purpose of determining subsurface lithology and depth of well screen placement. Soil samples were obtained at five foot intervals at each well location, and logged according to the Unified Soil Classification System. Boring logs for each monitoring well location are provided in Appendix B.

Two undisturbed soil samples were collected during the drilling of MW-EDC-8, and submitted to Woodward-Clyde's Geotechnical Testing Laboratory in Baton Rouge, Louisiana for geotechnical analyses. The two samples, collected from 9 ft. to 11 ft. and 14 ft. to 16 ft., were classified in the "CH" group, indicative of clays with a high liquid limit, and medium to high plasticity. Copies of the geotechnical test reports for each sample are provided in Appendix C. These samples correlate with the boring log for this well (Appendix B).

4.1.3 Decontamination

All downhole drilling equipment (e.g., drill bits, augers) were decontaminated between each location by high pressure washing. Downhole sampling equipment (e.g., split-spoon samplers, water level probe) were decontaminated using a solution of non-phosphate detergent in potable water, followed by a rinse with clean, potable water. Wash water resultant from decontamination procedures was containerized for characterization and proper disposal by EDC.

4.1.4 Well Development

After allowing the well materials to set for at least 24 hours, each monitoring well was developed by surge-blocking and bailing until field parameters (i.e., pH, conductivity, temperature) stabilized and the well produced a clear discharge. Development water resultant from the field program was contained in 55-gallon DOT drums for characterization and proper disposal by EDC.

4.2 MONITORING WELL SURVEY

Following installation, each monitoring well was surveyed for location and elevation by Ball and Paulus, Inc. of El Dorado, Arkansas, an Arkansas Registered Professional Land Surveyor. Elevation measurements were conducted to the nearest 0.01 feet above mean sea level (MSL) at the top of casing (TOC) at each well.

4.3 GROUNDWATER SAMPLING

4.3.1 Groundwater Elevations

Groundwater samples were collected from each of the newly installed wells approximately two weeks after well development. Prior to sample collection, depth to water measurements were obtained at each well location using an electronic water level indicator. To minimize the potential for cross-contamination, the water level indicator was decontaminated between sample locations as described in Section 4.1.3. Depth to water measurements were referenced to the respective TOC elevations, and static groundwater elevations were calculated for each well location.

Table 5 summarizes the groundwater elevation data at each monitoring well as measured on May 14, 1996. An interpretive groundwater elevation contour was prepared using the May 14, 1996 elevation data, and is presented in Figure 6. The contour indicates an east-southeasterly groundwater flow direction, as observed during previous site investigations.

4.3.2 Sample Collection

Following water level measurements, the volume of water within each well was calculated using the following formula:

[Total Well Depth (ft.) - Depth to Water (ft.)] x 0.653 = Gallons of water in casing

Prior to sampling, a minimum of three times the volume of standing water in the well was purged using a centrifugal pump. Dedicated, one-inch diameter polyethylene tubing was used in each well to minimize the potential of cross-contamination between wells. Purge water was containerized for characterization and proper disposal. After purging, each well was allowed to recharge to at least 80% of its original static water level, or for two hours, whichever occurred sooner.

Upon allowing each well to recharge, groundwater samples were collected utilizing laboratory-cleaned, dedicated, disposable polyethylene bailers. Samples were transferred into laboratory-supplied clean glassware, with laboratory-prepared preservatives, as appropriate. Samples submitted for dissolved lead and chromium analyses were filtered in the field using a QED portable filtration apparatus with 0.45 micron high-pressure filters. To minimize the potential for cross-contamination between well locations, dedicated filters were utilized and the filter housing was washed and triple rinsed with distilled water between each sample location.

SAMPLES FILTERED

Field meters were used to record pH, conductivity, temperature, and turbidity at each monitoring well during the sampling program. A summary of the field parameters recorded at each well during the Phase II groundwater sampling program is provided in Table 6.

4.3.3 Laboratory Analysis

Groundwater samples were analyzed by Southwest Laboratories of Oklahoma, Inc., an Arkansas-certified analytical laboratory.

Groundwater samples from each well were analyzed for lead (total and dissolved), chromium (total and dissolved), nitrate and sulfate, using the following analytical methods:

Parameter	Method
Lead (total)	SW-846 / EPA 7421
Lead (dissolved)	SW-846 / EPA 7421
Chromium (total)	SW-846 / EPA 6010
Chromium (dissolved)	SW-846 / EPA 6010
Nitrate	SW-846 / EPA 9056
Sulfate	SW-846 / EPA 9056

Field quality assurance/quality control (QA/QC) samples included one field blank per day of sampling, and one blind duplicate sample for the sampling event. The field blank was collected to confirm that contaminants have not been introduced into the groundwater samples by the sampling method. The field blank was collected by pouring laboratory-supplied analyte-free water through a sampling bailer and into laboratory-supplied sample containers. Field blank samples submitted for dissolved lead and chromium analyses were collected by field filtering analyte-free water through the filter apparatus in the same manner as actual groundwater samples, as described in Section 4.3.2.

The blind duplicate sample is a duplicate of a groundwater sample collected at a specific well, and submitted to the laboratory without designating the sample origin. The results of the blind duplicate sample can be compared to the results of the original groundwater sample to provide an indication of the reproducibility of the laboratory's analytical and reporting procedures. The field blank and blind duplicate samples were analyzed for each of the parameters in the above table.

Waste characterization samples were collected from the drums of decontamination water, well purging water, and drummed drill cuttings. Sample volume was collected from at least one drum per well, and composited to form one characterization sample per APC. Composite samples were submitted for analysis of lead, chromium, nitrate and sulfate, as appropriate.

4.3.4 Sampling at Class III Landfill Wells

At the request of Mr. Gerald Delevan of the ADPC&E Water Division, the ADPC&E-approved groundwater monitoring well network surrounding the Class III Landfill (i.e., existing monitoring wells MW-BA, MW-1, MW-2, and MW-3) was sampled on April 4, 1996. Prior to sampling, the wells were purged of at least three times the standing volume of water within the well casing using a centrifugal pump and dedicated polyethylene tubing. Purge water was containerized for characterization and proper disposal by EDC. Sampling protocol was consistent with the groundwater sampling conducted at the eighteen newly installed wells, as described in Section 4.3.2.

Groundwater samples from the Class III Landfill wells were analyzed in accordance with the analysis protocol presented in Section 4.3.3.

4.4 MONITORING WELL/PIEZOMETER DECOMMISSIONING

During Phase II site work, the drilling contractor properly abandoned eighteen existing monitoring wells and piezometers which had been installed during previous site investigations. The wells included eleven locations around Lake Kildeer (identified as Piezometers B through F, and monitoring wells 1, 2, 2A, 3, 4, and 5), four locations around Lake Lee (identified as L-1 through L-4), and three locations in the vicinity of the Class III Landfill (identified as MW-B-1, B-C-1, and B-C-2). The wells and piezometers were abandoned by removing the well screen and casing, and filling the borehole with a bentonite-cement grout, in accordance with Arkansas Water Well Commission guidelines for well abandonment.

5.0
PHASE II RESULTS

5.1 GROUNDWATER ELEVATION AND FLOW DIRECTION

Static groundwater levels in the twenty-two Phase II monitoring wells locations ranged from approximately 2 feet above ground surface (artesian conditions) at MW-2 in the northern portion of the EDC site, to approximately 27 feet below grade at MW-17 in the southern portion of the site. In general, groundwater flow beneath the site is to the east-southeast, with the exception of areas locally influenced by ground surface topography and the presence of Lake Kildeer. Based on field observations and the Phase II groundwater data, it is believed that groundwater may exist under confined or semi-confined conditions at several locations around the EDC site and under unconfined conditions at other locations.

5.2 GROUNDWATER QUALITY

The Phase II groundwater data generally indicate lower concentrations and lower frequency of detection of lead and chromium than the Phase I data. As a number of the elevated metal (i.e., lead and chromium) results from the Phase I investigation were attributed to high turbidity in the well point samples, the reduction in Phase II sample concentrations is likely associated with the decrease in turbidity of the groundwater samples obtained from the Phase II monitoring wells. Nitrate concentrations and frequency of detection are similar for the Phase I and II data. Sulfate concentrations are generally similar for the Phase I and Phase II data, but the maximum concentrations found are lower for the Phase II samples.

The pH and conductivity values for the Phase II groundwater samples are included in Table 6. pH values ranged from 4.6 at MW-EDC-14 to 11.1 at MW-EDC-11. Four of the wells (MW-EDC-1, MW-EDC-2, MW-EDC-9 and MW-EDC-11) had pH values above 8.5, indicating possible minor influence from alkaline chemicals. Two other wells (MW-EDC-14 and MW-EDC-17) had pH values slightly below 5.0, indicating possible minor influence of acidic chemicals. Conductivity values ranged from 130 micromhos at MW-EDC-11 to 3,900 micromhos at MW-EDC-2. The pH and conductivity values do not suggest any spatial trend of decreasing or increasing values across the site.

The Phase II groundwater quality data for lead, chromium, nitrate and sulfate are summarized in Table 7 and presented in Figure 7. Copies of the laboratory reports for the groundwater sampling program are provided in Appendix D.

5.2.1 Lead

Total lead was quantified in groundwater samples from fifteen monitoring wells at the EDC site, at concentrations ranging from 2.5 ug/L (MW-EDC-4) to 33.7 ug/L (MW-BA). Total lead was not quantified above the laboratory method detection limit (<2.0 ug/L) at seven well locations. Dissolved lead was quantified in only five of the filtered groundwater sample locations. Three of these locations were quantified with concentrations below the federal drinking water action level of 15 ug/L, including MW-EDC-16 (3.4 ug/L), MW-EDC-10 (3.9 ug/L), and MW-BA (7.0 ug/L). Monitoring wells MW-EDC-7 and MW-EDC-8 contained dissolved lead concentrations slightly above the action level, at 18.5 ug/L and 23.8 ug/L, respectively. Detectable lead concentrations are attributed to naturally occurring lead in the soils at the facility. This is further confirmed by the presence of lead in upgradient wells (MW-EDC-2 and MW-BA).

The Phase II results indicate substantially lower concentrations and frequency of occurrence of total lead in shallow groundwater beneath the EDC site relative to the Phase I data, in which lead was detected at each of the 35 well point locations. It is assumed that the widespread presence of total lead in the Phase I well point data was attributable to the high sample turbidity associated with the well point samples. The decrease in turbidity of the Phase II monitoring well samples resulted in lower overall lead levels, with dissolved lead concentrations below the federal action level at 20 of the 22 well locations.

5.2.2 Chromium

Total chromium was not quantified above the laboratory method detection limit (<5.0 ug/L) at sixteen well locations during the Phase II investigation. Total chromium was quantified in six groundwater samples, at concentrations ranging from 7.8 ug/L (MW-EDC-7) to 82.4 ug/L (MW-1). Dissolved chromium was quantified in only one of the filtered groundwater samples, MW-BA, at a concentration of 5.4 ug/L. MW-BA is an upgradient monitoring well for the facility. All of the groundwater samples submitted for total and dissolved chromium were below the USEPA MCL of 100 ug/L for chromium.

Similar to the lead results, the Phase II chromium results indicate a significant reduction in the presence of chromium in groundwater relative to the Phase I data. The presence of total chromium at 20 Phase I well point locations is attributable to the high sample turbidity associated with the well point samples. Therefore, the detected chromium concentrations are attributed to naturally occurring chromium in the soils at the facility and are below the USEPA MCL. This is further confirmed by the presence of chromium in upgradient wells (MW-EDC-2 and MW-BA). The decrease in turbidity of the Phase II monitoring well samples resulted in lower overall chromium levels, with total and dissolved concentrations below the USEPA MCL at all 22 well locations.

5.2.3 Nitrate

Nitrate concentrations in excess of the USEPA MCL of 10 mg/L were observed at ten out of the twenty-two monitoring well locations tested during the Phase II investigation. The elevated nitrate concentrations ranged from 11.9 mg/L (MW-EDC-14) to 1,010 mg/L (MW-EDC-8). The wells with elevated nitrate levels are concentrated in two distinct areas at the EDC site: the north side of the acid and nitrate process areas known as the Production Area (wells MW-EDC-6 through MW-EDC-11), and the vicinity of Lake Kildeer (MW-EDC-14 through MW-EDC-17). Based on nitrate concentrations in excess of the USEPA MCL at ten monitoring well locations, nitrate in groundwater remains a potential concern at these two areas.

5.2.4 Sulfate

Sulfate concentrations in excess of the proposed USEPA SMCL of 500 mg/L were observed at five of the twenty-two monitoring well locations tested during the Phase II investigation. The elevated sulfate concentrations ranged from 578 mg/L (MW-EDC-11) to 809 mg/L (MW-EDC-13). Monitoring wells MW-EDC-11, MW-EDC-9 (621 mg/L) and MW-EDC-4 (728 mg/L) are all located to the north of the Production Area. Monitoring well MW-2 (777 mg/L) is located southeast of the Class III Landfill, while MW-EDC-13 is located south of the Production Area, about midway between the Production Area and Lake Kildeer. Based on sulfate concentrations in excess of the USEPA MCL at five monitoring well locations, sulfate in groundwater remains a potential concern at these three areas.

6.0 MITIGATING ACTIVITIES CONDUCTED AT THE EDC FACILITY

The following repairs and upgrades have been implemented at the EDC facility in order to reduce the potential for nitrate and sulfate to enter the groundwater beneath the EDC site:

- Upgrade of the Boiler Feed System: A $216,000 upgrade and expansion of the EDC facility's Boiler Feed System was recently completed, which should reduce the amount of sulfate introduced to the groundwater beneath the EDC site.

- New Sewer Pipe: A new sewer pipe was recently installed to transport collected stormwater drainage from the ammonium nitrate plant for transportation to the Lake Lee neutralization pond. The sewer pipe should reduce the amount of nitrate introduced to the groundwater beneath the EDC site.

- Remelt Basin Discontinued: Repairs are underway to the ammonium nitrate remelt basin located in the nitrate process area. The area is currently not being used for storage of ammonium nitrate until these repairs are completed. The repairs are expected to be completed by the end of 1996, and should reduce the amount of nitrate introduced to groundwater beneath the EDC site.

- Third Street Sewer Upgrade: The Third Street clay tile sewer was recently repaired, which included the installation of double-walled polyethylene sewer pipe to transfer wastewater and stormwater from the DMW acid plant to the Third Street sewer. This $36,000 sewer upgrade will significantly reduce the potential for acidic wastewater and stormwater to impact groundwater beneath the EDC site by directing such wastes into the plant sewer system for pre-treatment prior to discharge to the plant drainage system.

7.0 RECOMMENDATIONS FOR ADDITIONAL ASSESSMENT ACTIVITIES

Based on the results of the Phase II groundwater investigation, nitrate and sulfate concentrations in groundwater beneath the EDC site remain a potential concern relative to USEPA Maximum Contaminant Levels for drinking water quality. In an effort to identify whether or not the concentrations of nitrate and sulfate in the groundwater beneath the EDC site pose a threat to human health and the environment, and whether or not remediation may be necessary to mitigate a potential health risk or risk to the environment, a risk assessment program is proposed for shallow groundwater at the EDC site.

7.1 RISK ASSESSMENT

The protection of human health and the environment is the primary goal of regulatory requirements for cleanup and corrective action. A risk assessment can contribute significantly to strategy development, risk management, and evaluation of corrective action needs. To that end, a risk assessment is proposed for the EDC site. Initially, an impact assessment will identify preliminary exposure pathways, media and chemicals of potential concern at the site. As a follow-up to the impact assessment, a human health risk assessment is proposed to develop target monitoring levels (TMLs) for each constituent of concern (COC) at the EDC site. The risk assessment will evaluate the constituents of concern. However, nitrate appears to be the only COC. TMLs are concentrations of a COC below which adverse effects to the exposed receptor are not expected to occur based on site-specific inputs. Therefore, a TML represents a concentration of a COC below which additional actions are not necessary from a health risk standpoint. In addition to the human health risk assessment, potential ecological receptors will be identified and the potential for exposure to constituents from the site will be evaluated.

A work plan for the risk assessment will be prepared to outline the objectives of the program, the process through which it will be carried out, and the exposure assumptions and toxicity parameters which will be incorporated into the risk assessment. The primary objective of the risk assessment will be to evaluate the potential for exposure to the identified media by receptor populations of concern to the site. The risk assessment will include the calculation of site-specific TMLs in groundwater based on the historical information available from the site, present site conditions, and the potential for future exposure.

Environmental fate and transport modeling will be conducted as a part of the risk assessment to determine the potential for the identified COCs to reach the target exposure population(s) at the exposure point(s) via groundwater and will provide information indicating COC-specific monitoring zones for the calculated TMLs, if appropriate. In addition, fate and transport modeling will be used to estimate if on-site groundwater concentrations could contribute to future exceedences of groundwater TMLs for the identified COCs at the exposure points.

The results of the risk assessment will provide information to support risk management decision-making for the site.

7.2 SCHEDULE FOR IMPLEMENTATION

A risk assessment work plan can be submitted to the ADPC&E within sixty days of approval of this proposal. Woodward-Clyde proposes to commence work on a risk assessment for the EDC site immediately upon approval of the work plan from the ADPC&E. It is anticipated that a report summarizing the risk assessment can be prepared and submitted to the ADPC&E within 120 days of receiving approval of the work plan from the ADPC&E.

TABLES

TABLE 1

DESCRIPTION OF HYDROGEOLOGIC UNITS IN THE STUDY AREA

System	Series	Group	Formation	Hydrogeologic Unit	Hydrogeologic Properties
Quaternary	Holocene and Pleistocene		Alluvial and terrace deposits		Clay, silt, sand, and gravel. Present only in bottomlands of most streams. Generally not used. As much as 100 feet thick.
Tertiary	Eocene	Claiborne	Cockfield Formation	Cockfield aquifer	Lignitic sand with interbedded clay. Principal aquifer for rural domestic supply. Water withdrawls approximately 0.5 million gallons per day. Approximately 200 feet thick where present.
			Cook Mountain Formation	Cook Mountain confining unit	Clay with interbedded fine sand. Not an aquifer. Thickness ranges from 50 to 200 feet.
			Sparta Sand	Greensand aquifer	Thinly bedded fine glauconitic sand with interbedded clay. Source of municipal and industrial water supply principally in southeast part of county. Water withdrawals approximately 0.5 million gallons per day. Approximately 200 feet thick.
				Middle confining unit	Clay and silt. Not an aquifer. Thickness ranges from 40 to 160 feet.
				El Dorado aquifer	Thickly bedded medium to coarse sand. Source of municipal and industrial water supply throughout the county. Water withdrawals approximately 14 million gallons per day. Approximately 300 feet thick.
			Cane River Formation	Cane River confining unit	Clay and silty clay. Not an aquifer. Approximately 300 feet thick.

From Leidy and Taylor, 1992

Table 2
Summary of Well Point Elevation Data
Phase I Groundwater Investigation
El Dorado Chemical Company
El Dorado, Arkansas
November 1995

Well Point Number	Total Depth (ft.)	Depth to Water (ft.)	Ground Elevation (ft. MSL)	Groundwater Elevation (ft. MSL)
WP-1	34.5	15.2	206.7	191.5
WP-2	27.0	4.7	190.6	185.9
WP-3	24.0	1.7	181.9	180.2
WP-4	27.5	3.5	210.8	207.3
WP-5	32.0	1.5	200.9	199.4
WP-6	23.0	17.3	201.8	184.5
WP-7	27.0	2.4	171.2	168.8
WP-8	30.5	13.0	182.3	169.3
WP-9	21.0	14.7	168.5	153.8
WP-10	18.0	14.5	174.8	160.3
WP-11	19.5	12.3	176.7	164.4
WP-12	12.0	4.5	173.1	168.6
WP-13	12.0	4.2	175.2	171.0
WP-14	12.0	0.5	172.9	172.4
WP-15	12.0	3.5	175.4	171.9
WP-16	12.0	5.5	178.4	172.9
WP-17	12.0	7.7	176.0	168.3
WP-18	12.0	7.6	173.9	166.3
WP-19	27.0	21.6	212.1	190.5
WP-20	20.0	7.1	172.6	165.5
WP-21	24.0	4.9	149.7	144.8
WP-22	22.0	11.2	166.4	155.2
WP-23	21.0	6.1	163.2	157.1
WP-24	21.0	7.9	161.8	153.9
WP-25	21.0	11.2	163.9	152.7
WP-26	21.0	6.6	182.0	175.4
WP-27	26.0	3.0	199.9	196.9
WP-28	23.0	14.7	202.8	188.1
WP-29	25.0	8.9	196.3	187.4
WP-30	24.0	10.5	194.5	184.0
WP-31	22.0	4.8	188.2	183.4
WP-32	30.0	17.2	195.8	178.6
WP-33	24.0	7.9	198.0	190.1
WP-34	15.0	17.0	199.0	182.0
WP-35	12.0	0.5	162.2	161.7

Table 3
Summary of Well Point Groundwater Quality Data
Phase I Groundwater Investigation
El Dorado Chemical Company
El Dorado, Arkansas
November 1995

Well Point No.	Lead (ug/L)	Chromium (ug/L)	Nitrate (mg/L)	Sulfate (mg/L)
1	21	<80	0.1	21
2	11	<80	<0.1	79
3	1230	2030	0.98	<50
4	63	260	0.79	<50
5	301	610	0.24	353
6	62	160	9.6	363
7	44	100	<0.1	49
8	35	<80	<0.1	15
9	30	<80	19.2	172
10	30	<80	220	9
11	25	120	4.15	335
12	11	<80	1.26	176
13	46	150	1.9	20
14	30	170	1.8	12
15	38	<80	94	6
16	2	<80	56	8
17	10	<80	224	15
18	98	180	0.1	32
19	52	<80	0.18	<2
20	50	160	1.32	159
21	310	790	<0.1	163
22	12	<80	<0.1	7
23	40	110	0.22	267
24	16	<80	0.28	216
25	2	<80	0.2	208
26	490	540	0.47	139
27	90	210	0.73	145
28	36	120	220	357
29	44	180	3.4	1070
30	192	350	1000	89
31	82	230	266	6
32	196	750	0.68	3540
33	40	<80	<0.1	54
34	58	120	5.4	470
35	28	<80	1.12	14
Action Level	15[A]	100[B]	10.0[B]	500[C]

Notes: [A] - USEPA action level for lead.
[B] - USEPA MCL.
[C] - Proposed USEPA MCL.

Table 4
Summary Matrix of Monitoring Well Construction Details
Phase II Groundwater Investigation
El Dorado Chemical Company
El Dorado, Arkansas
March 1996

Monitoring Well No.	Method of Drilling	Well Completion Date	Well Diameter (inches)	Total Well Depth (A)	Riser Length (feet)	Screen Size (inches)	Screened Interval (A)	Well Elevation (B)
MW-EDC-1	HSA	2/14/96	4"	22.1	12.1	0.010"	12.1 to 22.1	213.28
MW-EDC-2	HSA	2/14/96	4"	20.2	10.2	0.010"	10.2 to 20.2	196.25
MW-EDC-3	HSA	2/15/95	4"	27.1	17.1	0.010"	17.1 to 27.1	192.11
MW-EDC-4	HSA	2/15/95	4"	22.1	12.1	0.010"	12.1 to 22.1	194.84
MW-EDC-5	HSA	2/21/96	4"	17.7	7.7	0.010"	7.7 to 17.7	182.69
MW-EDC-6	HSA	2/21/96	4"	22.0	12.0	0.010"	12.0 to 22.0	191.87
MW-EDC-7	HSA	2/20/96	4"	23.9	13.9	0.010"	13.9 to 23.9	195.88
MW-EDC-8	HSA	2/20/96	4"	29.9	19.9	0.010"	19.9 to 29.9	197.34
MW-EDC-9	HSA	2/15/95	4"	30.0	20.0	0.010"	20.0 to 30.0	198.39
MW-EDC-10	HSA	2/19/96	4"	22.6	12.6	0.010"	12.6 to 22.6	205.75
MW-EDC-11	HSA	2/19/96	4"	19.8	9.8	0.010"	9.8 to 19.8	201.65
MW-EDC-12	HSA	2/19/96	4"	19.9	9.9	0.010"	9.9 to 19.9	184.97
MW-EDC-13	HSA	2/14/96	4"	19.8	9.8	0.010"	9.8 to 19.8	177.26
MW-EDC-14	HSA	2/13/96	4"	18.2	8.2	0.010"	8.2 to 18.2	178.48
MW-EDC-15	HSA	2/13/96	4"	17.0	7.0	0.010"	7.0 to 17.0	180.84
MW-EDC-16	HSA	2/12/96	4"	19.3	9.3	0.010"	9.3 to 19.3	180.14
MW-EDC-17	HSA	2/13/96	4"	34.7	24.7	0.010"	24.7 to 34.7	185.40
MW-EDC-18	HSA	2/22/96	4"	17.2	7.2	0.010"	7.2 to 17.2	155.46

Notes:
HSA - Hollow Stem Auger.
(A) - Feet below grade from top of PVC casing.
(B) - Feet above mean sea level (MSL); reference point is top of PVC casing.

Table 5
Groundwater Elevation Data
Phase II Groundwater Investigation
El Dorado Chemical Company
El Dorado, Arkansas
May 14, 1996

Monitoring Well Number	Well Elevation (ft. above MSL)	Depth to Groundwater (ft. from top of casing)	Groundwater Elevation (ft. above MSL)
MW-EDC-1	213.28	10.07	203.21
MW-EDC-2	196.25	0.45	195.80
MW-EDC-3	192.11	9.31	182.80
MW-EDC-4	194.84	7.64	187.20
MW-EDC-5	182.69	5.22	177.47
MW-EDC-6	191.87	4.79	187.08
MW-EDC-7	195.88	7.81	188.07
MW-EDC-8	197.34	8.06	189.28
MW-EDC-9	198.39	9.11	189.28
MW-EDC-10	205.75	13.18	192.57
MW-EDC-11	201.65	10.65	191.00
MW-EDC-12	184.97	6.70	178.27
MW-EDC-13	177.26	10.30	166.96
MW-EDC-14	178.48	8.23	170.25
MW-EDC-15	180.84	5.13	175.71
MW-EDC-16	180.14	5.60	174.54
MW-EDC-17	185.40	26.92	158.48
MW-EDC-18	155.46	5.41	150.05
MW-BA	214.49	11.65	202.84
MW-1	203.13	13.71	189.42
MW-2	197.85	9.63	188.22
MW-3	194.87	8.62	186.25

Table 6
Summary of Groundwater Field Sampling Parameters
Phase II Groundwater Investigation
El Dorado Chemical Company
El Dorado, Arkansas
March - April 1996

Monitoring Well	Sampling Date	pH (Std. units)	Conductivity (micromhos)	Temperature (degrees F)	Turbidity (NTUs)
MW-EDC-1	3/14/96	9.7	720	69.8	65
MW-EDC-2	3/14/96	9.0	780	63.6	>200
MW-EDC-3	3/14/96	8.0	700	65.3	25
MW-EDC-4	3/14/96	8.1	760	62.6	26
MW-EDC-5	3/13/96	5.8	790	65.5	32
MW-EDC-6	3/13/96	7.7	700	65.6	48
MW-EDC-7	3/13/96	8.1	700	65.3	78
MW-EDC-8	3/13/96	7.9	710	64.5	32
MW-EDC-9	3/14/96	9.0	320	65.3	140
MW-EDC-10	3/13/96	7.7	410	67.0	109
MW-EDC-11	3/13/96	11.1	130	67.2	127
MW-EDC-12	3/13/96	6.1	930	68.4	61
MW-EDC-13	3/13/96	5.6	160	64.2	22
MW-EDC-14	3/13/96	4.6	650	69.5	86
MW-EDC-15	3/13/96	6.4	266	64.6	8.9
MW-EDC-16	3/13/96	5.7	890	67.1	15
MW-EDC-17	3/13/96	4.9	730	72.7	40
MW-EDC-18	3/14/96	6.6	680	66.7	76
MW-BA	4/17/96	5.0	850	82.0	>200
MW-1	4/17/96	5.2	1300	79.0	139
MW-2	4/17/96	5.0	3900	79.0	>200
MW-3	4/17/96	5.4	2300	78.0	156

Woodward-Clyde

Table 7
Summary of Monitoring Well Data
Phase II Groundwater Investigation
El Dorado Chemical Company
El Dorado, Arkansas
March - April 1996

Monitoring Well	Nitrate (mg/L)	Sulfate (mg/L)	Total Chromium (ug/L)	Total Lead (ug/L)	Dissolved Chromium (ug/L)	Dissolved Lead (ug/L)
MW-EDC-1	1.7	4.1	<5	3.7	<5	<2
MW-EDC-2	<0.2	17.0	34.2	18.0	<5	<2
MW-EDC-3	<0.2	10.0	<5	2.7	<5	<2
MW-EDC-4	1.3	728	<5	2.5	<5	<2
MW-EDC-5	4.4	441	<5	<2	<5	<2
MW-EDC-6	51.1	24.0	<5	2.6	<5	<2
MW-EDC-7	282	380	7.8	22.1	<5	18.5
MW-EDC-8	1010	68.3	<5	23,4	<5	23.8
MW-EDC-9	37.3	621	<5	4.0	<5	<2
MW-EDC-10	257	89.0	<5	5.2	<5	3.9
MW-EDC-11	22.1	578	<5	<2	<5	<2
MW-EDC-12	<0.2	9.6	<5	<2	<5	<2
MW-EDC-13	0.2	809	<5	<2	<5	<2
MW-EDC-14	11.9	139	<5	<2	<5	<2
MW-EDC-15	34.5	4.4	<5	<2	<5	<2
MW-EDC-16	137	4.6	<5	3.6	<5	3.4
MW-EDC-17	45.0	145	<5	<2	<5	<2
MW-EDC-18	0.4	3.3	19.4	17.0	<5	<2
MW-BA	1.4	125	55.9	33.7	5.4	7.0
MW-1	4.8	349	82.4	32.8	<5	<2
MW-2	<0.2	777	19.8	10.0	<5	<2
MW-3	<0.2	211	<5	2.8	<5	<2
Action Level	10	500	100	15	100	15