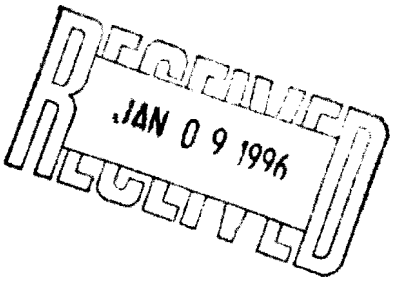
Woodward-Clyde

Engineering & science applied to the earth & its environment



HAND DELIVERED

January 8, 1996

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

Re: Phase I Groundwater Investigation Report
El Dorado Chemical Company
WC Project No. 95B165/REPT-1

Dear Mr. Delevan:

Enclosed please find a copy of the summary report for the recent Phase I Groundwater Investigation recently conducted at the El Dorado Chemical Company in El Dorado, Arkansas.

Please contact either of the undersigned at (501)223-2582 with any questions or comments.

Very truly yours,
WOODWARD-CLYDE CONSULTANTS

Ray A. Quick, P.G.
Office Manager

Eric J. Fox
Assistant Project Scientist

Encl.

cc: Mr. John Carver, El Dorado Chemical Company

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 I GROUNDWATER INVESTIGATION

Prepared for
El Dorado Chemical Company
El Dorado, Arkansas

January 1996

Woodward-Clyde

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

TABLE OF CONTENTS

Section			Page
1.0	INTRODUCTION		1-1
2.0	FACILITY DESCRIPTION		2-1
	2.1	FACILITY LOCATION	2-1
	2.2	FACILITY DESCRIPTION AND HISTORY	2-1
	2.3	REGIONAL GEOLOGIC AND HYDROGEOLOGIC SETTING	2-1
		2.3.1 Cockfield Aquifer	2-2
		2.3.2 Cook Mountain Formation	2-3
		2.3.3 Sparta Formation	2-4
		2.3.3.1 Greensand Aquifer	2-4
		2.3.3.2 Sparta Sand Confining Bed	2-5
		2.3.3.3 El Dorado Aquifer	2-5
	2.4	PREVIOUS ON-SITE INVESTIGATIONS	2-5
		2.4.1 McClelland Engineers - 1980 Investigation	2-5
		2.4.2 McClelland Engineers - 1981(a) Investigation	2-7
		2.4.3 McClelland Engineers - 1981(b) Investigation	2-9
		2.4.4 MCI Consulting Engineers - 1985 Investigation	2-10
		2.4.5 Grubbs, Garner & Hoskyn - 1992 Investigation	2-10
	2.5	AREAS OF POTENTIAL CONCERN	2-12
		2.5.1 Process Wastewater Treatment System (PWTS)	2-14
		2.5.1.1 Lake Lee	2-15
		2.5.1.2 Lake Kildeer	2-15
		2.5.1.3 Plant Drainage System	2-15
		2.5.2 Nitric Acid Concentrator Area	2-16
		2.5.3 Product Loading and Unloading Areas	2-16
3.0	METHODS OF INVESTIGATION		3-1
	3.1	WELL POINT PROGRAM	3-1
		3.1.1 Well Point Installation	3-1
		3.1.2 Well Point Locations and Depths	3-2
		3.1.3 Groundwater Level Measurements and Sample Collection	3-2
	3.2	LABORATORY ANALYSES	3-3
	3.3	MONITORING NETWORK SURVEY	3-4
	3.4	BOREHOLE ABANDONMENT	3-4

TABLE OF CONTENTS

Section			Page
4.0	RESULTS		4-1
	4.1	GROUNDWATER ELEVATIONS AND FLOW DIRECTION	4-1
	4.2	ANALYTICAL RESULTS	4-1
		4.2.1 Lead	4-2
		4.2.2 Chromium	4-2
		4.2.3 Nitrate	4-2
		4.2.4 Sulfate	4-3
5.0	CONCLUSIONS		5-1
	5.1	GROUNDWATER ELEVATION AND FLOW DIRECTION	5-1
	5.2	GROUNDWATER QUALITY	5-1
		5.2.1 Lead	5-2
		5.2.2 Chromium	5-2
		5.2.3 Nitrate	5-2
		5.2.4 Sulfate	5-2
	5.3	PROPOSED AREAS FOR ADDITIONAL INVESTIGATION	5-2
6.0	RECOMMENDATIONS FOR ADDITIONAL INVESTIGATION		6-1
	6.1	MONITORING WELL INSTALLATION	6-1
		6.1.1 Monitoring Well Construction	6-1
		6.1.2 Soil Sampling	6-2
		6.1.3 Decontamination	6-2
		6.1.4 Well Development	6-2
	6.2	MONITORING WELL SURVEY	6-2
	6.3	GROUNDWATER SAMPLING	6-3
		6.3.1 Groundwater Elevations	6-3
		6.3.2 Sample Collection	6-3
		6.3.3 Laboratory Analysis	6-4
	6.4	MONITORING WELL/PIEZOMETER DECOMMISSIONING	6-5
	6.5	SUMMARY REPORT	6-5
7.0	SCHEDULE		7-1
8.0	REFERENCES		8-1

TABLE OF CONTENTS

LIST OF TABLES

TABLE 1	Description of Hydrogeologic Units in the Study Area
TABLE 2	Summary of Well Point Data
TABLE 3	Summary of Groundwater Quality Data
TABLE 4	Summary of Proposed Analytical Program

LIST OF FIGURES

FIGURE 1	Site Location Map
FIGURE 2	Hydrogeologic Section Through the Center of Union County, Arkansas
FIGURE 3	Areas of Potential Concern and Well Point Location Map
FIGURE 4	Plant Drainage and Discharge Diagram
FIGURE 5	Groundwater Elevation Contour
FIGURE 6	Proposed Monitoring Well Locations
FIGURE 7	Typical Monitoring Well Construction Schematic

LIST OF APPENDICES

APPENDIX A	Analytical Results

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 concentrated Phase I Groundwater Investigation. The Phase I investigation was conducted in accordance with a Groundwater Monitoring Work Plan (GMWP) dated September 19, 1995, and approved by the Water Division of the Arkansas Department of Pollution Control and Ecology (ADPC&E) on October 12, 1995.

This Phase I investigation addressed the following areas of potential concern (APCs) at the EDC facility:

- 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 the approved GMWP, definition of the groundwater quality beneath the EDC site is being 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 groundwater sampling and analysis. A proposed scope of work for the second phase of investigation has been developed based on the Phase I results and is provided in Section 6.0 of this report.

This report has been divided into the following sections:

- Section 2.0 provides a summary of the site environmental setting and the results of relevant previous environmental investigations conducted at the EDC facility
- Section 3.0 details the methodologies employed in the Phase I groundwater investigation, including the installation and sampling of temporary well points at 35 locations throughout the EDC facility
- Section 4.0 provides a summary of the preliminary groundwater elevation and quality data obtained during this initial phase of investigation
- Section 5.0 presents the conclusions based on the Phase I data
- Section 6.0 provides the recommendations for additional investigation, including a proposed scope of work for a Phase II groundwater investigation involving installation of a network of groundwater monitoring wells
- Section 7.0 details a schedule for implementation of the proposed Phase II groundwater investigation.

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 Lone Star Industries. Elemental sulfur used in the manufacture of sulfuric acid is received via rail car 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 formations and descriptions of the hydrogeologic character of the sediments.

Broom, et. al. (1984) have characterized the regional hydrogeology in a study of salt water contamination of groundwater in Union County, Arkansas. The regional hydrogeologic description presented here is based largely on their work. Additionally, two studies (Fitzpatrick, et. al., 1990 and McWreath, et. al., 1991) which simulated the response to pumping stresses in the Sparta aquifer are also cited in description of the regional hydrogeologic setting. The major regional aquifers and confining units of the region are presented in Figure 2. The following discussions are limited to the principal aquifers used for potable water supplies within the immediate vicinity of the EDC site: the Cockfield aquifer, the Greensand aquifer, and the El Dorado aquifer. The Greensand aquifer and the El Dorado aquifer are commonly referred to as the Sparta aquifer.

2.3.1 Cockfield Aquifer

The Tertiary-aged Cockfield Formation (part of the Claiborne Group) crops out over most of Union County. This formation consists predominantly of sands, silts, and carbonaceous (calcitic) clays with minor amounts of interbedded lignite and gypsum. The formation can contain lenticular beds of lignitic sands in some areas. The formation thickness is approximately 200 feet in most of the county. A thin veneer of Quaternary-aged alluvial sediments overlay the Cockfield Formation along the Ouachita River and its tributaries.

Recharge to the Cockfield aquifer is local. Groundwater occurs under water table, or unconfined, conditions; however, locally semi-confined conditions have been demonstrated to exist in areas where the clay content of the overlying sediments is high. Water table configuration within the aquifer generally exhibits a subdued reflection of the local

topography with flow toward surface drainages (i.e., the valleys of the principal streams). Water levels in wells range in depth from near land surface in low-lying areas to as much as 50 feet deep on the tallest hills and ridges.

Falling head tests on undisturbed samples collected from the Cockfield Formation revealed coefficient of vertical permeability values ranging from 1.0×10^{-3} cm/sec for sandy materials to 5.0×10^{-8} cm/sec for the more clayey sediments. This wide range of permeability values is the result of the variable lithologic character of the sediments. Lithologic investigations have shown that the Cockfield Formation is highly variable in clay content with some areas being predominantly clay and other areas being predominantly sand. The horizontal hydraulic conductivity of the aquifer, when considered as a whole, is generally greater than the aquifer's vertical hydraulic conductivity. Areas of high clay content tend to perch groundwater on a local scale. Further, clay horizons can generate semi-confined conditions when the clayey material overlies more permeable zones and hydrostatic head is driven by recharge areas at higher elevations.

Domestic use of groundwater from the Cockfield aquifer has decreased considerably in recent years. Prior to the 1920s, the Cockfield aquifer was the primary source of groundwater for both domestic and industrial use. Rural water supply systems developed in the late 1960s greatly reduced the number of wells producing from the Cockfield aquifer (Broom, et. al., 1984).

2.3.2 Cook Mountain Formation

The Cook Mountain Formation underlies the Cockfield Formation in all areas of the region except where the younger Cockfield sediments have been removed by erosion and the Cook Mountain Formation is exposed at the surface. The Cook Mountain Formation consists of low permeability clays and silty clays with lesser amounts of very fine sands. The formation acts as a lower confining unit (aquitard) for the Cockfield aquifer and an upper confining unit for the underlying ~~Sparta~~ aquifer.

Thickness of the confining unit is variable, ranging from approximately 50 feet to 200 feet across the region. Based on Woodward-Clyde's review of boring logs for area production wells, the thickness of the confining unit is estimated at approximately 200 feet in the vicinity of the EDC facility.

Vertical hydraulic conductivity of the confining unit was estimated by Fitzpatrick, et. al. (1990) to range from 1×10^{-7} cm/sec to 1×10^{-10} cm/sec. The estimates are based on the results of their calibrated regional finite-difference model. Horizontal hydraulic conductivity

of the Cook Mountain confining unit was established by the calibrated model to be 3.18 x 10^{-9} cm/sec. Therefore, both the vertical and horizontal hydrologic flow components are retarded by this formation.

2.3.3 Sparta Formation

The Tertiary-aged Sparta Formation is the main source of municipal and industrial water supplies throughout the region. Heavy pumping stresses placed on the aquifer in the past decades have created large cones of depression within the potentiometric surface surrounding the pumping centers. One such cone of depression is centered around the city of El Dorado. Large quantities of groundwater withdrawn from the aquifer have altered, and in some cases reversed, flow directions in the aquifer (McWreath, et. al., 1991).

In Union County, the Sparta Formation is hydrostratigraphically separated into three zones based on lithologic character and water production capacities. These zones, in descending order, are the Greensand aquifer, the Sparta Formation confining bed, and the El Dorado aquifer. The El Dorado aquifer is the most heavily used portion of this hydrostratigraphic sequence.

2.3.3.1 Greensand Aquifer

The Greensand aquifer occupies the upper portion of the Sparta Formation. The aquifer consists of fine-grained to very fine-grained glauconitic sands with lesser amounts of silts and clays. Groundwater within the aquifer is under confined conditions. The Greensand aquifer is located below the Cook Mountain confining unit, and above a clay-rich horizon of the Sparta Sand which acts as a lower confining unit.

The structural top of the aquifer in the vicinity of El Dorado ranges from mean sea level (msl) to 50 feet below msl, yet the potentiometric surface in tightly cased wells can rise as high as 100 feet above msl in some areas. The Greensand aquifer thickness in the Union County area is approximately 200 feet (Leidy and Taylor, 1992). The regional flow direction within the aquifer is south-southeast (Broom, et. al., 1984).

The Greensand aquifer is used as a potable water supply, but less extensively than the deeper, more productive El Dorado aquifer. Recharge to the Greensand aquifer is via precipitation and from streams flowing across outcrop areas. To a lesser extent, the aquifer can receive recharge from leakage across confining beds when the vertical hydraulic gradient is toward the aquifer.

2.3.3.2 Sparta Sand Confining Bed

In separate investigations by Fitzpatrick, et. al (1990) and McWreath, et. al. (1991), the Sparta Formation has been treated as a single aquifer for the purposes of finite-difference modeling of the effects of pumping stresses. However, as stated by Broom, et. al. (1984), sufficient evidence exists to support the conceptualization that in Union County, Arkansas a predominantly marine clay horizon in the middle portion of the Sparta Formation serves as a confining unit. Hydraulic conductivity, both horizontal and vertical, is low in comparison to the overlying and underlying sediments. This zone serves as a confining bed between the upper and lower portions of the Sparta Formation and allows them to function separately as individual aquifers. McWreath, Nelson, and Fitzpatrick (1991) support the designation of this clay horizon as a confining unit on a local scale. The confining bed is between 50 and 150 feet thick in the Union County area (McWreath, et. al., 1991).

2.3.3.3 El Dorado Aquifer

The El Dorado aquifer is more productive and, thus, more heavily targeted for placement of high yield wells. The City of El Dorado and local industries have production and/or supply wells completed in this aquifer.

The structural top of the aquifer in the vicinity of the EDC facility is estimated to be approximately 350 feet below msl. Thickness of the aquifer in this area is approximately 200 feet (Broom, et. al., 1984).

2.4 PREVIOUS ON-SITE INVESTIGATIONS

Five previous hydrogeologic investigations have been completed which have focused on shallow groundwater conditions at four locations at the EDC facility. Generally, these investigations confirm the information regarding shallow groundwater as given in the preceding discussion of regional geologic and hydrogeologic settings. The investigations are summarized below.

2.4.1 McClelland Engineers - 1980 Investigation

McClelland Engineers completed an investigation in the west-central portion of the EDC property in December, 1980 (McClelland Engineers, 1980). The stated investigation objectives were to:

- Determine general soil stratigraphy at the site in relation to groundwater characteristics
- Establish the thickness and character of the existing soil strata
- Establish the permeability of significant strata
- Install wells for long-term monitoring of groundwater quality

The study concluded that the west-central portion of the site was underlain by deposits of the Claiborne Group. At the site, the "upper approximately 10 to 15 feet consists of reworked alluvial deposits; whereas the underlying beds are relatively unaltered from the original depositional character." Cover soil in the area was found to range from 2 to 2.5 feet in thickness in four borings. The cover soil was reported to consist predominantly of gray and tan sandy clay with the percentage of sand varying from 6 to 37 percent.

At the site, "moderately variable stratigraphy and cross-bedding should be anticipated." In four widely spaced borings around the area of the site currently occupied by the Class III landfill, McClelland noted significant variation in strata. The borings for monitoring well installations were advanced by a combination of dry auger and wash-rotary drilling methods and were completed to depths ranging from 20 to 40 feet. The Plan of Borings (Plate 1 of the McClelland report) indicates that four borings, (i.e., B-A, B-B, B-C and B-D) were completed as groundwater monitoring wells. However, the text indicates that two additional borings, C-1 and C-2, were completed in the vicinity of boring B-C, although borings logs were not provided for these locations. In addition, there are no monitoring well installation diagrams or other information to indicate at what depth well screens have been placed at these wells.

Groundwater was reportedly encountered in the borings at depths ranging from 7.5 to 21 feet below grade. In each boring, the water level was observed to rise rapidly. The recorded amount of rise ranged from 3.5 feet in Boring C-2 (completed to 10 feet total depth) to 16.5 feet in Boring B-C (completed to 40 feet total depth). McClelland interpreted the water level information to represent, "a 'perched' condition rather than a major groundwater aquifer."

The water levels in B-C (completed at 40 feet total depth) and C-2 (completed at 10 feet total depth) both rose to 4.5 feet below grade. However, the water level in Boring C-1 (completed to 20 feet total depth) rose only to 14 feet below grade. McClelland reported vertical permeability values for the cover in the area ranging from 1.0×10^{-6} to 1.0×10^{-7} cm/sec. The vertical permeability of the natural clays which are assumed to underlie the cover are reported to range from 5.0 to 10^{-7} to 1.0 to 10^{-8} cm/sec.

Woodward-Clyde infers from the McClelland report and general geologic conditions of the region that the clay layers may not be continuous across the entire area; the overall vertical permeability value for the area as a whole should not exceed approximately 1×10^{-7} to 5×10^{-7} cm/sec. In areas where sand interbedding is prevalent, the overall horizontal permeability value may locally approach 1.0×10^{-5} to 1.0×10^{-4} cm/sec.

2.4.2 McClelland Engineers - 1981(a) Investigation

McClelland Engineers completed an investigation in the Lake Kildeer Area in June, 1981 (1981(a)). The studies were conducted to provide the following:

- General subsurface stratigraphy and definition of the first aquifer
- Determination of the degree of contamination, if any, of the first aquifer and soils resulting from seepage losses from the impoundment
- An estimation of the seepage losses based on groundwater seepage analysis and a water balance for existing and proposed reservoir levels

The study concluded that the site was underlain by deposits of the Claiborne Group. A total of 12 borings were completed with depths ranging from 18 to 100 feet below grade using a combination of dry auger and wash-rotary methods. Casagrande-type piezometers were installed in six of the borings (Borings A through F). These were reported to consist of 2-inch diameter closed-end PVC casing with a slotted screen tip approximately 3 to 4 feet in length. The annulus around the well screen was backfilled with a graded, free-draining sand. A layer of bentonite pellets was placed above the sand pack, and the annulus was sealed with grout to prevent infiltration of surface water.

Six monitoring wells were also installed, at Borings 1, 2, 2A, 3, 4 and 5. The monitoring wells were reportedly installed in a similar manner as the Casagrande piezometers. However, the wells incorporated 4-inch diameter casings, 5-foot slotted screen lengths and 2-foot sand traps. A plan of the borings, boring location coordinates, boring ground surface elevations and Boring Logs are presented in the McClelland report. Information on screen placement is indicated on the Boring Logs. According to the Plan of Borings:

- Piezometer F and Monitoring Well 1 (MW-1) were completed in a former borrow area located adjacent to the north end of the lake
- Piezometer A was completed near the northeast corner of the lake
- Piezometer E was completed north of the northern end of the dam
- Piezometer D and MW-2, MW-2A, and MW-5 were completed east and downstream of the dam

- Piezometer C was completed south of the southern end of the dam
- MW-3 was completed east of the accessory dike on the southern side of the lake
- MW-4 was completed near the end of the western end of the accessory dike on the southern side of the lake
- Piezometer B was completed near the western end of the accessory dike on the southern side of the lake

McClelland divided the deposits encountered in these borings into three strata as follows:

> "STRATUM I: Stiff to very stiff tan and gray sandy clay (CL) was encountered at or near the ground surface over a portion of the site to depths of up to approximately 15 ft. The permeability of this stratum is estimated to be in the order of 1.0×10^{-7} centimeters per second.
>
> STRATUM II: Medium dense to dense gray clayey sand and silty sand (SC and SM) was encountered beneath Stratum I or at the ground surface over most of the site to depths of up to approximately 50 ft. The thickness of this stratum is greatest on the south side of the Impoundment Pond and beneath the embankment (approximately 30 to 50 ft.) and least on the north and west sides of the pond (approximately 0 to 20 ft). Measured permeability values were found to vary widely over the range of 1.3×10^{-4} to 5.8×10^{-7} centimeters per second.
>
> STRATUM III: Laminated stiff to very stiff gray silty clay (CL and CH) and light gray fine sand (SM was encountered as the basal unit beneath Strata I and II). This stratum was encountered generally below EL 160 to 170 on the northwest sides of the impoundment, below EL 130 on the south side and below EL 90 to 100 in the valley bottom below the dam. Measured permeabilities range from 9.5×10^{-5} to 7.0×10^{-9} centimeters per second. Vertical permeabilities are substantially less than horizontal permeabilities in this laminated zone."

It is not clear from the report whether the strata described above should be treated as one or more water bearing zones. The wells and piezometers have their screens set in Stratum II (MW-1, MW-3, MW-4 and MW-5 and Piezometers B, C and D) and in Stratum III (MW-2 and Piezometers A, E and F). MW-2A is apparently screened in shallow fill material. McClelland concluded that regional groundwater flow in the uppermost aquifer was from the north-northwest to the south-southeast. Based on chemical analytical data from the investigation, McClelland concluded that "little if any contamination of either the soil or groundwater was evidenced in the chemical analyses."

Based on seepage analyses and a water balance, McClelland estimated that underseepage losses from Lake Kildeer range from 300 gallons per day (gpd) with a lake surface elevation of 165 feet above mean sea level (msl) to 700 gpd with a lake water surface elevation of 175 feet above msl. Details of the seepage loss estimates are not provided in the report but it is noted that, "considerably higher or lower seepage quantities could actually be experienced."

2.4.3 McClelland Engineers - 1981(b) Investigation

McClelland Engineers completed an investigation of the Lake Lee area in November, 1981 (1981(b)) to address potential contamination of the "uppermost aquifer" due to construction of the collection pond. Four borings were completed to depths ranging from 40 to 60 feet using a combination of dry auger and wash-rotary methods. The boring locations were selected to provide three downgradient (Borings 1, 2 and 3) and one upgradient (Boring 4) locations. The report does not indicate that monitoring wells were installed. Monsanto Company representatives collected water samples immediately on the first encounter of water in each boring. These water samples were tested for pH, sulfate, nitrate-nitrogen and ammonia-nitrogen. A variable head aquifer test was also performed on Boring 3.

The report concluded that Lake Lee was underlain at depth by deposits of the Claiborne Group. These were encountered at elevations below 162 to 164 feet above msl within the pond area and below 147 feet above msl downgradient of the pond. Fill or alluvium was encountered above the Claiborne deposits. McClelland divided the deposits encountered in these borings into four strata as follows:

> "Stratum I: Fill consisting of very stiff to firm tan gray and brown sandy clay (CL) with some gravel encountered at the ground surface to depths of 5 to 17 feet (generally to EL 166 to 170 within the pond area). The mass permeability of this stratum is in the order of 7×10^{-7} to 5×10^{-8} cm/sec.
>
> Stratum II: Soft to stiff gray with tan sandy clay (CL) was encountered beneath the fill to depths of approximately 15 to 20 ft. This stratum contains some silty sand pockets and seams and consequently possesses a horizontal permeability in the order of 5.0×10^{-6} to 1×10^{-5} cm/sec. This stratum represents geologically recent alluvial deposition.
>
> Stratum III: Very stiff brown and dark gray clay (CL to CH) with light gray silt and fine sand partings and seams was encountered beneath the alluvial zone to the completion depths of 40 ft. in Borings 1, 2 and 4 and to a depth of 49 ft. in Boring 3.

Numerous sand seams and layers were encountered below depths of 35 ft. in Boring 3 and 32.5 ft. in Boring 4. The mass vertical permeability of this stratum is in the order of 5 x 10^{-8} to 1 x 10^{-7} cm/sec. In the deeper zone more frequent sand seams are encountered and the mass vertical permeability could approach 1 x 10^{-5} and 1 x 10^{-4} cm/sec.

Stratum IV: Dense light find sand (SN to SP) with occasional clayey seams was encountered beneath Stratum III in Boring 3 at a depth of 49 ft. The coefficient of permeability is estimated to be 1.0 x 10^{-3} cm per second for this sand stratum."

Static groundwater levels in the four borings ranged from 4 feet below grade in Boring 3 to 24.5 feet below grade in Boring 1. The groundwater flow direction roughly paralleled the ground surface and sloped downward towards the southeast. McClelland concluded that the water bearing zone encountered did not represent the uppermost aquifer. The uppermost aquifer was interpreted as being in the Stratum IV sands encountered below 115 msl.

2.4.4 MCI Consulting Engineers - 1985 Investigation

A second investigation was completed in the Lake Lee area in 1985 by MCI Consulting Engineers, Inc. (MCI). This investigation was undertaken in support of EDC's RCRA Part B Permit Application, which was subsequently withdrawn. A formal report of this second Lake Lee investigation was not prepared, although it was summarized and referenced in the Groundwater Protection section of the Part B Permit Application (EDC, 1986).

The investigation involved installation of four borings and piezometers around Lake Lee, identified as L-1 through L-4. Well installation diagrams indicate that each monitoring well was constructed of 2-inch diameter threaded PVC riser pipe and five feet of 0.010-inch slot PVC well screen. Downgradient wells L-2, L-3 and L-4 were installed to a depth of 20 feet, while upgradient well L-1 was installed to 25 feet. The annular space between the screen and soil is backfilled with sand, and a bentonite pellet seal was placed above the sand pack. The remainder of the boring was grouted with bentonite/cement grout. A potentiometric map which accompanies the logs and well installation diagrams indicates the groundwater flow direction is towards the northeast, which contradicts the information presented in the McClelland (1981b) report.

2.4.5 Grubbs, Garner & Hoskyn - 1992 Investigation

Grubbs, Garner & Hoskyn (GGH)(1992) completed an investigation of the existing Class III Landfill in September, 1992. The objectives of this study were to define site stratigraphy,

and to determine groundwater depth and movement. Three borings were completed to depths ranging from 20 to 25 feet below grade using dry auger methods. Monitoring wells were installed in each of the three borings. Monitoring wells were constructed of 2-inch diameter PVC risers and 0.010-inch slot PVC well screen. The annulus between the screen and soil was backfilled with a 10/20 sand pack, and a bentonite pellet seal was placed on top of the sand pack. The remaining annular space was then filled to near the ground surface with cement/bentonite grout. Well completion details are shown on the boring logs provided in the report.

EDC personnel have stated that the GGH Report has the designations for Monitoring Well 1 and Monitoring Well 3 reversed from EDC's understanding of the monitoring well designations. Therefore, this section of this report follows the monitoring well designation understood by EDC (i.e., Monitoring Well 1 is located east of Landfill Area 1 and Monitoring Well 3 is located south of Landfill Area 5). For excerpts of the report that are in direct quotes, Woodward-Clyde will recite the GGH report as written, but will insert the EDC designations in parentheses.

The Class III Landfill site was found to be underlain by deposits of the Claiborne Group. Based on available mapping, GGH projected that the base of the Cockfield and the top of the Cook Mountain Formation will be encountered at a depth of about 100 feet below grade at the site. GGH estimated the thickness of the Cook Mountain clays at approximately 150 to 200 feet at the EDC site.

GGH summarized the stratigraphy encountered in borings at the site as follows:

> "Stratum I: Loose to medium-dense brown, tan and gray clayey silt and silty fine sand to fine sandy silt was encountered at the ground surface to depths of 2 to 4 ft.
>
> Stratum II: Stiff to very stiff gray and yellowish tan clay and sandy clay with silty sand seams was encountered beneath Stratum I to depths of 13 to 20 ft. The more clayey portions of this stratum were found to possess vertical hydraulic conductivities in the range of 3×10^{-9} to 5×10^{-9} cm/sec. Due to the presence of intermittent sand seams, horizontal hydraulic conductivities are substantially greater than these recorded vertical conductivities.
>
> Stratum III: Medium dense to dense tan and gray silty fine sand was encountered beneath Stratum II in Monitoring Wells 2 and 3 (EDC Well 1) to the boring completion depths. Grain size analyses indicated hydraulic conductivities ranging

from 4 x 10^{-4} to 8 x 10^{-4} cm/sec. Review of this and previous studies indicates that this sand stratum is present over most of the existing and old landfill sites.

Stratum IV: Very stiff, dark brown clay was encountered beneath Stratum III in Monitoring Well 1 (EDC Well 3) to the boring completion depth. A coefficient of permeability of 5 x 10^{-9} cm/sec was obtained. This clay stratum was also encountered in Boring 3 of the previous study. Apparently, this predominantly clay unit is confined to the northeastern portion of the existing landfill."

GGH provided a potentiometric surface map using groundwater elevation data obtained from the three recently installed wells at the existing landfill and groundwater elevation data from the four older wells installed at the old Monsanto Landfill. However, GGH noted that the groundwater elevations in Wells B-A and B-C-2 at the old landfill were considered to represent "perched" conditions in association with near surface sand units at those wells. Thus, groundwater surface elevations from these two wells were excluded in the preparation of the GGH potentiometric surface map.

The potentiometric surface map prepared by GGH indicates that shallow groundwater flow is generally to the southeast beneath the Monsanto Landfill and generally to the south beneath the existing Class III Landfill. Woodward-Clyde notes that this flow direction is toward the valley of the unnamed tributary that crosses the EDC property on the south side of the Production Area.

2.5 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 are warranted.

An on-site and off-site reconnaissance were 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 secondary MCL (SMCL) for sulfate (250 mg/L, EPA 1993).

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

Figure 3 presents the locations of these APCs, as well as each of the temporary well point locations.

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. Nitrate does not typically occur in natural waters at significant concentrations, and its presence would indicate likely wastewater

contamination and/or a lack of oxidizing conditions. The current USEPA MCL for nitrate is 10 mg/L.

Sulfate: Process wastewater from the sulfuric acid manufacturing process is likely to contain a significant concentration of sulfates. Although sulfate occurs in almost all natural water at low concentrations, its presence at high concentrations may pose a human health hazard. The current proposed USEPA MCL for sulfate is 500 mg/L (USEPA, May 1995).

Lead and Chromium: In accordance with 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, impacted 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 state regulatory action level for lead in groundwater 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.

2.5.1 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.

2.5.1.1 Lake Lee

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.

2.5.1.2 Lake Kildeer

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

2.5.1.3 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 4. Figure 4 also shows the location 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 and 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.

2.5.2 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 and into a limestone ($CaCO_3$) neutralization basin prior to gravity discharge to Lake Lee.

2.5.3 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 and into the unnamed tributary of Haynes Creek.

3.0
METHODS OF INVESTIGATION

3.1 WELL POINT PROGRAM

The ADPC&E-approved Groundwater Monitoring Work Plan 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. This data was then utilized for the preparation of Phase II recommendations which are outlined in Section 6.0.

3.1.1 Well Point Installation

The temporary well points were installed by GEO Environmental, Inc. (GEO) using a Hydropunch sampling system, which consists of a direct-push sampling device mounted on a pickup truck. The work was done under the observation of Woodward-Clyde field personnel.

Well point installation was accomplished by attaching an expendable well point to the leading end of a series of one-inch outer diameter stainless steel probe rods, which were hydraulically driven into the ground to the desired depth. The well point was attached to the probe rod using clean, laboratory-grade film to avoid down-hole contamination. Upon achieving the desired depth, perforated 3/8" polyethylene tubing was placed down the inner circumference of the probe rods, and threaded into the expendable well point. With the well point acting as an anchor for the perforated tubing, the probe rods were uncoupled from the expendable well point and hydraulically removed from the ground.

The temporary well points were allowed to stand for a period of one to five days to allow for groundwater recharge. Following this period, groundwater samples were collected with a peristaltic pump as described in Section 3.1.3.

Dedicated polyethylene tubing was used in each well point to minimize the potential for cross-contamination between sampling locations. In addition, the reusable probe rods were decontaminated prior to each use by scrubbing the rods in a solution of potable water and Alconox™ detergent. The rods were rinsed with potable water, followed by a final rinse with distilled water.

3.1.2 Well Point Locations and Depths

Groundwater samples were collected at thirty-five well point locations, as shown in Figure 3. Several of the actual well point locations differ slightly from the proposed locations presented in the Groundwater Monitoring Work Plan, based on accessibility restrictions caused by surface obstructions, subsurface obstructions, steep topography, or heavy vegetation. In addition, the locations of WP-5 and WP-21 have been approximated.

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

Depths of the well point installations ranged from approximately 12 feet below grade (at several locations in the vicinity of Lake Kildeer) to approximately 34 feet below grade (at upgradient location WP-1 along the northern property line). Installation depths were variable around the site based on topographic elevations, evidence of saturated conditions, and boring refusal in the subsurface. A summary of the well point investigation program, including the installation depth of each well point, is presented in Table 2.

3.1.3 Groundwater Level Measurements and Sample Collection

Following installation, each well point was allowed to recharge and equilibrate for a period of one to five days. A pressure manometer was used to determine the approximate depth to the groundwater surface within each well point. The manometer was attached to a section of 5/16″ diameter, dedicated polyethylene tubing which was placed inside the 3/8″ diameter

perforated well point tubing. The manometer registered a significant pressure change when it intercepted the static water level inside the 3/8" tubing. A marking was placed upon the smaller tubing prior to its removal from the well point tubing, and a tape measure was used to measure the approximate distance from the ground surface to the water level interface.

Following water level measurement, dedicated 5/16" polyethylene tubing ("extraction tubing") was placed inside the well point tubing for groundwater withdrawal. A piece of dedicated, flexible silicon tubing was placed on the end of the extraction tubing, and attached to a variable speed peristaltic pump for groundwater extraction. A volume of at least 40 milliliters (mLs) was purged from each well point prior to sample collection. At those locations where groundwater yield was sufficient, greater volumes were purged prior to sample collection. In general, increased purging resulted in a reduction in sample turbidity at these locations. However, a majority of the samples contained significant amounts of sediment in the sample bottles.

Samples were collected from the dedicated extraction tubing directly into laboratory-supplied sample containers. Samples for metals analysis were collected in bottles containing laboratory-supplied preservative (HNO_3). The sample bottles were labeled, and packed in dry ice in a sample cooler. Samples were transported to the laboratory at the end of each day of sampling under chain-of-custody procedures.

Two blind duplicate samples and two field equipment rinsate samples were collected during the sampling program. Blind duplicate No. 1 was collected at upgradient location WP-2, while Blind Duplicate No. 2 was obtained at location WP-12, adjacent to Lake Kildeer. The field equipment rinsate samples were collected by pouring laboratory-supplied distilled water over and through decontaminated probe rods, and into laboratory-supplied sample containers. The field rinsate samples were collected following installation of well points WP-26 and WP-35, respectively.

3.2 LABORATORY ANALYSES

Groundwater samples, blind duplicates and field equipment rinsate samples were analyzed by Arkansas Analytical, Inc. for the target parameters nitrate, sulfate, total lead, and total chromium, in accordance with the following table:

Parameter	Method	Container	Preservative	Holding Time
Nitrate	EPA 9200	125 mL Plastic	4°C	2 days
Sulfate	EPA 9038	125 mL Plastic	4°C	28 days
Lead	EPA 7421	125 mL Plastic	$HN0_3$ & 4°C	6 months
Chromium	EPA 7190	125 mL Plastic	$HN0_3$ & 4°C	6 months

Arkansas Analytical, Inc. is a state certified analytical testing laboratory. Laboratory results are discussed in Section 4.2, and the analytical data reports are presented in Appendix A.

3.3 MONITORING NETWORK SURVEY

Following completion of the well point installations, a survey was conducted to establish horizontal and vertical locations of the sampling points. The survey was conducted by Ball & Paulus, Inc., an Arkansas Registered Professional Land Surveyor. Well locations are shown in Figure 3, and surveyed elevations are presented in Table 2.

The well point survey provided horizontal definition of the sampling points with respect to an established plant coordinate system, and vertical definition of the ground surface elevation (with respect to mean sea level) at each sampling location.

3.4 BOREHOLE ABANDONMENT

Upon groundwater sampling and following completion of the well point survey, all temporary well points were abandoned by removing the perforated well point tubing and backfilling the one-inch diameter borehole to grade level with bentonite pellets. The bentonite pellets were hydrated with potable water to effectuate a thorough seal of the borehole.

4.0 RESULTS

4.1 GROUNDWATER ELEVATIONS AND FLOW DIRECTION

The Phase I groundwater investigation confirmed the presence of 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 groundwater observed during the Phase I investigation may exist under confined or semi-confined conditions at many of the well point locations. The results of the water level survey are summarized in Table 2. As pressure manometer measurements may be considered somewhat less accurate than more conventional methods for water level determination (e.g., electronic water level indicators used within a monitoring well), groundwater elevation data has been rounded to the nearest 0.1 feet.

Using the approximate groundwater elevations obtained during the water level survey, a contour map depicting a generalized groundwater flow direction was developed and is presented in Figure 5. The groundwater contour map identifies the general direction of groundwater flow over most of the EDC site to the east-southeast. Groundwater flow appears to be locally affected by ground surface topography, especially in the northeast portion of the site, where local groundwater flow direction appears to be toward the southwest. In addition, Lake Lee and Lake Kildeer locally affect groundwater flow direction in their respective vicinities.

4.2 ANALYTICAL RESULTS

The analytical results indicate that lead and chromium are present in the 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) were expected to be upgradient from plant activities 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.

The results of the laboratory analytical program are discussed below and summarized in Table 3.

4.2.1 Lead

Lead was quantified in each of the groundwater samples obtained from the 35 well points, at concentrations ranging from 0.002 mg/L (WP-16 and WP-25) to 1.23 mg/L (WP-3). The average (mean) concentration was calculated at 0.109 mg/L, while the median concentration was calculated at 0.040 mg/L. Twenty-nine groundwater samples were quantified above the regulatory action level of 0.015 mg/L. In addition, three of the four upgradient (i.e., "background") well point locations were quantified with lead concentrations in excess of the regulatory action level. Concentrations in the background well points ranged from 0.011 mg/L at WP-2 to 1.23 mg/L at WP-3.

4.2.2 Chromium

Chromium was quantified in 20 of the 35 groundwater samples obtained during the well point investigation. Detected chromium concentrations ranged from 0.1 mg/L at WP-7 to 2.03 mg/L at WP-3. The average (mean) concentration was calculated at 0.259 mg/L, while the median concentration was calculated at 0.120 mg/L. Nineteen of the 35 groundwater samples were quantified at concentrations in excess of the USEPA MCL of 0.10 mg/L for chromium in drinking water. In addition, two of the four upgradient (i.e., background) well point locations were quantified with chromium concentrations in excess of the MCL. Concentrations in the background well points were 0.26 mg/L at WP-4 and 2.03 mg/L at WP-3.

4.2.3 Nitrate

Nitrate was quantified in 29 of the 35 groundwater samples, with detected concentrations ranging from 0.1 mg/L at WP-1 and WP-18, to 1,000 mg/L at WP-30. The average (mean) concentration was calculated at 62.8 mg/L, while the median concentration was calculated at 1.1 mg/L. Eight locations were quantified at concentrations in excess of the USEPA MCL of 10.0 mg/L for nitrate in drinking water. These locations included WP-9 (19.1 mg/L), WP-15 (94 mg/L), WP-16 (56 mg/L), WP-10 (220 mg/L), WP-28 (220 mg/L), WP-17 (224 mg/L), WP-31 (266 mg/L), and WP-30. Nitrate was not detected above the laboratory's Practical Quantification Limit (PQL) in upgradient WP-2, while the remaining upgradient locations were quantified at concentrations below 1.0 mg/L.

4.2.4 Sulfate

Sulfate was quantified in 32 of the 35 groundwater samples, at concentrations ranging from 6 mg/L in WP-15 and WP-31, to 3,540 mg/L at WP-32. The average (mean) concentration was calculated at 248 mg/L, while the median concentration was calculated at 79 mg/L. Well points WP-29 (1,070 mg/L) and WP-32 were quantified at concentrations in excess of the proposed USEPA MCL of 500 mg/L for sulfate in drinking water. Sulfate was not detected above the laboratory PQL at upgradient locations WP-3 and WP-4, while upgradient locations WP-1 and WP-2 were quantified at 21 mg/L and 79 mg/L, respectively.

5.0 CONCLUSIONS

5.1 GROUNDWATER ELEVATION AND FLOW DIRECTION

Based on the results of the preliminary Phase I groundwater investigation, groundwater was encountered beneath the EDC site at depths ranging from near ground surface in many low-lying areas of the site, to approximately 22 feet below grade at the extreme northeast portion of the site. In general, groundwater flow beneath the site is to the east-southeast, with the exception of several areas locally influenced by ground surface topography and the presence of surface water bodies (i.e., Lake Lee and Lake Kildeer).

Several well points did not provide evidence of significant moisture immediately after installation. Groundwater was later observed near the ground surface in some of these locations. Therefore, is it believed that groundwater may exist under confined or semi-confined conditions at several locations around the EDC site.

5.2 GROUNDWATER QUALITY

As previously stated, a majority of the groundwater samples were turbid, and contained a significant layer of sediment upon settling. The sample turbidity could contribute to sample matrix interferences for total metals and/or increased total metals results. The average concentrations in soil for lead and chromium in the eastern United States are 17 mg/Kg and 52 mg/Kg, respectively (USGS, 1984). As the samples for total metals analysis were preserved with nitric acid to a pH of less than 2, the naturally occurring lead and chromium in soil would be leached over time from the soil into the acidic groundwater sample solution.

During the laboratory sample preparation, a representative aliquot of the sample is digested by adding more acid reagents to the sample and heating to aid in the process. Any sediments contained in the representative groundwater aliquot could contribute to the total lead and total chromium results. It should be noted that one of the samples with elevated total chromium and total lead contained approximately one-fourth sediment. This sample (WP-26) corresponded with elevated levels of 0.49 mg/L lead and 0.54 mg/L chromium.

For the next phase of the groundwater investigation, both filtered and unfiltered groundwater samples are proposed to be collected for analysis of dissolved and total metals, respectively.

5.2.1 Lead

Lead was quantified in each of the groundwater samples obtained during the Phase I investigation, including each of the four upgradient well points. No significant trend can be observed from the data produced during the Phase I investigation regarding the impact of site operations on lead concentrations in groundwater beneath the EDC site. It is anticipated that once groundwater monitoring wells are installed during Phase II activities, the lead concentrations will decrease due to decreased turbidity.

5.2.2 Chromium

Chromium was quantified in most of the groundwater samples obtained during the Phase I investigation. Similar to lead, the highest recorded chromium concentration was detected at an upgradient well point location. No significant trend can be observed from the data produced during the Phase I investigation regarding the impact of site operations on chromium concentrations in groundwater beneath the EDC site. Again, it is anticipated that once groundwater monitoring wells are installed during the Phase II activities, the chromium concentrations will decrease due to decreased turbidity.

5.2.3 Nitrate

Elevated nitrate concentrations were observed in the vicinity of Lake Kildeer and the acid and nitrate process areas. Based on nitrate concentrations in excess of the USEPA MCL at eight well point locations, nitrate in groundwater remains a potential concern at these areas.

5.2.4 Sulfate

Sulfate concentrations were relatively low and consistent throughout the EDC site, with the exception of one location near the acid process area (WP-32) and one location near the nitrate process area (WP-29). For the most part, sulfate is not considered a significant concern throughout the majority of the EDC site. However, its presence at elevated concentrations above the proposed USEPA MCL in the vicinity of the acid and nitrate process areas remains a potential concern.

5.3 PROPOSED AREAS FOR ADDITIONAL INVESTIGATION

The Phase I investigation identified six general vicinities which, based on elevated concentrations of one or more of the targeted parameters, warrant additional investigation. The six areas include:

- The northern portion of the EDC site in the vicinity of well point WP-3, which was quantified with elevated concentrations of lead and chromium.

- The area to the northwest and north of the EDC Production Area, in the vicinity of the Nitrate Truck and Train Loading Areas and the Acid Train Loading Area. This area is of concern based on the presence of elevated concentrations of lead (WP-27, WP-30, WP-31, WP-32), chromium (WP-32), nitrate (WP-28, WP-30, WP-31) and sulfate (WP-29, WP-32).

- The area north of Lake Lee, in the vicinity of well point WP-26, based on the presence of lead and chromium at elevated concentrations.

- The low-lying area along the dirt roadway leading to Lake Kildeer, in the vicinity of well point WP-5, based on the presence of lead and chromium at elevated concentrations.

- The area to the northwest of Lake Kildeer, based on the presence of elevated concentrations of nitrate (WP-15, WP-16, WP-17) and lead (WP-18).

- The area to the east-southeast of Lake Kildeer, based on the presence of nitrate (WP-10) and lead and chromium (WP-21) at elevated levels.

In order to address groundwater quality and flow direction in these areas, installation of groundwater monitoring wells in the uppermost saturated zone is recommended, as described in Section 6.0.

6.0 RECOMMENDATIONS FOR ADDITIONAL INVESTIGATION

In order to further address groundwater quality and flow direction at several areas of potential concern at the EDC site, installation and sampling of groundwater monitoring wells are proposed, as described below.

6.1 MONITORING WELL INSTALLATION

A total of eighteen (18) groundwater monitoring wells are proposed to be installed during the Phase II groundwater investigation. The monitoring wells will be installed to a depth of approximately 10 feet into the uppermost saturated unit, or to the top of a confining layer, whichever is encountered first. Based on field observations from the Phase I investigation and from previous investigations, it is assumed that the maximum well depth will not exceed 40 feet below grade.

The proposed monitoring well locations are presented in Figure 6.

6.1.1 Monitoring Well Construction

The groundwater monitoring wells will be constructed in accordance with USEPA guidance for well construction in overburden (unconsolidated) formations. It is anticipated that the monitoring wells will be drilled with a truck mounted drilling rig utilizing hollow stem augers.

The monitoring wells will be screened across the uppermost saturated zone utilizing ten feet of 4-inch diameter, 0.010-inch slotted polyvinyl chloride (PVC) well screen. The well casing will be constructed with 4-inch diameter PVC. The annular space around the well screen will be filled using No. 10/20 clean sand pack to a height of two feet above the top of the screen. A two foot thick seal of dry bentonite pellets will be placed above the sand pack, and hydrated with potable water. The remaining annular space will be filled with a bentonite-cement grout mixture to a height of approximately 6-inches below grade. A schematic for a typical monitoring well construction is presented in Figure 7.

Each monitoring well will be secured with a water-tight locking cap and padlock. The monitoring wells will be finished within a steel protective manhole finished flush-to-grade, or within a steel protective casing finished approximately three feet above grade, depending on surrounding conditions. Each protective manhole and casing will be set in concrete.

6.1.2 Soil Sampling

Soil samples will be collected at various intervals at each location for the purpose of determining subsurface lithology and depth of well screen placement. Samples will either be collected at 5-foot intervals using stainless-steel split spoon samplers, or continuously using a CME 5-foot core barrel. All soil samples will be logged according to the Unified Soil Classification System, and selected samples may be retained for laboratory geotechnical analyses, as appropriate based on field observations. Woodward-Clyde field personnel will perform visual screening of each sample collected and record observations relating to sample recovery, color, density, moisture content, homogeneity, presence of odor or staining, and blow counts. Observations will be recorded in a bound field log book.

6.1.3 Decontamination

All downhole drilling equipment (e.g., drill bits, augers) will be decontaminated between each location by high pressure washing. Downhole sampling equipment (e.g., split-spoon samplers, Shelby tubes, CME core barrel, water level probes) will be 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 will be containerized for characterization and proper disposal by EDC.

6.1.4 Well Development

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

6.2 MONITORING WELL SURVEY

Following installation, each monitoring well will be surveyed for location and elevation by an Arkansas Registered Professional Land Surveyor. Elevation measurements will be conducted to the nearest 0.1 feet above msl at the base of each monitoring well, and to the nearest 0.01 feet above msl at the top of casing (TOC) at each well. A permanent marking will be inscribed at the location of each TOC measurement for future reference. A surveyed plot plan will be prepared presenting the location of each well relative to the monitoring well network and to relevant site structures (e.g., lakes, production and loading areas, etc.)

6.3 GROUNDWATER SAMPLING

6.3.1 Groundwater Elevations

Groundwater samples will be collected from each well at least two weeks after well development. Prior to sample collection, depth to water measurements will be obtained at each well location using an electronic water level indicator. The depth to water will be measured from the TOC and recorded to the nearest 0.01 feet. Depth to water measurements will be referenced to the respective TOC elevations, and static groundwater elevations will be calculated for each well location. To minimize the potential for cross-contamination, the water level indicator will be decontaminated between sample locations as described in Section 6.1.3.

6.3.2 Sample Collection

Following water level measurements, the volume of water within each well will be 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 will be purged by hand bailing or pumping. Purge water will be containerized for characterization and proper disposal. After purging, each well will be allowed to recharge to at least 80% of its original static water level, or for two hours, whichever occurs sooner.

Upon allowing each well to recharge, groundwater samples will be collected utilizing laboratory-cleaned, dedicated, disposable polyethylene bailers. Samples will be transferred into laboratory-supplied clean glassware, with laboratory-prepared preservatives, as appropriate. Field meters will be used to record pH, conductivity, temperature, and turbidity at each monitoring well during the sampling program.

Information such as sampling times, purge volumes, weather conditions, and field parameter concentrations will be recorded in the field during sampling on Woodward-Clyde's Groundwater Sampling Record Sheets.

6.3.3 Laboratory Analysis

Samples will be analyzed by an Arkansas-certified analytical laboratory, in accordance with the analytical program outlined in Table 4.

Proposed analytical methods for each of the parameters are shown on the following table:

Parameter	Method
Lead (total)	SW-846 / EPA 7421
Lead (dissolved)	SW-846 / EPA 7421
Chromium (total)	SW-846 / EPA 6010 or 7190
Chromium (dissolved)	SW-846 / EPA 6010 or 7190
Nitrate	SW-846 / EPA 9200 or 9056
Sulfate	SW-846 / EPA 9038 or 9056

Field quality assurance/quality control (QA/QC) samples will include one field blank per day of sampling, and one blind duplicate sample for the sampling event. The field blank is collected to confirm that contaminants have not been introduced into the groundwater samples by the sampling method. The field blank will be collected by pouring laboratory-supplied analyte-free water through a sampling bailer and into laboratory-supplied sample containers. 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 will be analyzed for each of the parameters in the above table.

Laboratory QA/QC will include reagent blanks, matrix spikes, total recoverables, spiking concentrations, and laboratory quality control samples.

Waste characterization samples will be collected from the drums of decontamination water and well purging water, as well as from the drummed drill cuttings. Composite samples will be submitted for analysis of total lead, total chromium, nitrate and sulfate, as appropriate. Each waste stream will be properly disposed of based on the results of the waste characterization.

6.4 MONITORING WELL/PIEZOMETER DECOMMISSIONING

While the drilling contractor is mobilized at the EDC site, sixteen of the existing monitoring wells and piezometers installed during previous site investigations will be properly abandoned due to the fact that there are no records on how they were installed. The wells to be abandoned include 12 locations around Lake Kildeer (identified as Piezometers A through F, and monitoring wells 1, 2, 2A, 3, 4, and 5), and 4 locations around Lake Lee (identified as L-1 through L-4). The wells and piezometers will be properly abandoned according to Arkansas Water Well Commission guidelines by a licensed water well driller.

The wells and piezometers will be properly abandoned by overdrilling and removing the well screen and casing, and filling the borehole to grade with a bentonite-cement grout. Grout will be applied directly to the bottom of the borehole using a tremie pipe to prevent bridging.

As an alternative, the wells may be cut flush to grade and abandoned in place by filling the well screen and casing with a bentonite-cement grout.

6.5 SUMMARY REPORT

Following installation and sampling of the monitoring well network, a summary report will be developed which presents the results of the Phase II groundwater investigation. The report will include the following:

- Description of field activities relating to monitoring well installation and sampling
- Boring Logs for each borehole
- Well Construction Diagram for each monitoring well
- Groundwater Sampling Record Sheets with results of field measurements
- Analytical results of groundwater sampling program in tabular form
- Analytical data reports from laboratory
- Surveyed plot plan displaying location of monitoring well network relative to site structures
- Groundwater elevation contour map depicting groundwater flow regimes
- Concentration isopleths, as appropriate
- Recommendations for additional study, as warranted

It is anticipated that the Phase II investigation will more accurately define the site conditions with respect to groundwater quality and flow direction.

7.0 SCHEDULE

Woodward-Clyde will commence with field activities within three weeks after ADPC&E approval of this plan. Woodward-Clyde anticipates that a final report can be delivered to the ADPC&E within 120 days after written approval.

8.0
REFERENCES

Broom, M.E., T.F. Kraemer and W.V. Bush (1984). A Reconnaissance Study of Saltwater Contamination in the El Dorado Aquifer, Union County, Arkansas. U.S. Geological Survey, Water-Resources Investigations Report 84-4012. 47 p.

EDC, 1986. El Dorado Chemical Company, Part B Permit Application.

EPA, 1992. RCRA Ground-Water Monitoring: Draft Technical Guidance. U.S. Environmental Protection Agency, Office of Solid Waste. EPA Document PB93-139350.

EPA, 1993. Drinking Water Regulations and Health Advisories. Office of Water, U.S. Environmental Protection Agency. 13 p.

Fitzpatrick, D.J., J.M. Kilpatrick and H. McWreath (1990). Geohydrologic Characteristics and Simulated Response to Pumping Stresses in the Sparta Aquifer in East-Central Arkansas. U.S. Geological Survey, Water-Resources Investigations Report 88-4201. 50 p.

Grubbs, Garner & Hoskyn, Inc. (1992). Hydroeogeologic Evaluation Class III Landfill, El Dorado Chemical Company, El Dorado, Arkansas. 7 p. plus attachments, September, 1992.

Heath, R.C., (1988). "Hydrogeologic settings of regions", in Hydrogeolgy - The Geology of North America. Geologic Society of America, Inc., Boulder, Colorado. pp.15-23.

Leidy, V. A. and R.E. Taylor (1992). Overview of Susceptibility of Aquifers to Contamination Union County, Arkansas. U.S. Geological Survey, Water-Resources Investigations Report 92-4094. 35 p.

McWreath, H.C., J.D. Nelson and D.J. Fitzpatrick (1991). Simulated Response to Pumping Stresses in the Sparta Aquifer, Northern Louisana and Southern Arkansas. U.S. Geological Survey, Water Resources Technical Report No. 51. 51 p.

McClelland Engineers (1980). Subsurface Investigation Well Installation and Water Sampling. Existing Waste Disposal Area, Monsanto Chemical Company, El Dorado, Arkansas, 5 p. plus attachments, December, 1980.

McClelland Engineers (1981a). Ground Work Study Impoundment Pond Area, Monsanto Agricultural Products Company. El Dorado, Arkansas. 10 p. plus attachments, June 1981.

McClelland Engineers, (1981b). Ground Water Study Lake Lee, Monsanto Agricultural Products, El Dorado, Arkansas. 8p. plus attachments, November, 1981.

United States Geological Survey Professional Paper 1270 (1984). Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States.

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 Data
Phase I Hydropunch Investigation
El Dorado Chemical Company
November 1995

Well Point No.	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 Groundwater Quality Data
Phase I Groundwater Investigation
El Dorado Chemical Company
El Dorado, Arkansas
November 1995

Well Point No.	Lead (mg/L)	Chromium (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)
1	0.021	<0.08	0.1	21
2	0.011	<0.08	<0.1	79
3	1.23	2.03	0.98	<50
4	0.063	0.26	0.79	<50
5	0.301	0.61	0.24	353
6	0.062	0.16	9.6	363
7	0.044	0.1	<0.1	49
8	0.035	<0.08	<0.1	15
9	0.03	<0.08	19.2	172
10	0.03	<0.08	220	9
11	0.025	0.12	4.15	335
12	0.011	<0.08	1.26	176
13	0.046	0.15	1.9	20
14	0.03	0.17	1.8	12
15	0.038	<0.08	94	6
16	0.002	<0.08	56	8
17	0.01	<0.08	224	15
18	0.098	0.18	0.1	32
19	0.052	<0.08	0.18	<2
20	0.05	0.16	1.32	159
21	0.31	0.79	<0.1	163
22	0.012	<0.08	<0.1	7
23	0.04	0.11	0.22	267
24	0.016	<0.08	0.28	216
25	0.002	<0.08	0.2	208
26	0.49	0.54	0.47	139
27	0.09	0.21	0.73	145
28	0.036	0.12	220	357
29	0.044	0.18	3.4	1070
30	0.192	0.35	1000	89
31	0.082	0.23	266	6
32	0.196	0.75	0.68	3540
33	0.04	<0.08	<0.1	54
34	0.058	0.12	5.4	470
35	0.028	<0.08	1.12	14
Action Level	0.015[A]	0.100[B]	10.0[B]	500[C]

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

Table 4
Summary of Proposed Analytical Program
Phase II Groundwater Investigation
El Dorado Chemical Company

Monitoring Well No.	Lead[A]	Chromium[B]	Nitrate[C]	Sulfate[D]
MW-EDC-1	X	X		
MW-EDC-2	X	X		
MW-EDC-3	X	X		
MW-EDC-4	X	X	X	X
MW-EDC-5	X	X		X
MW-EDC-6	X	X	X	X
MW-EDC-7	X	X	X	
MW-EDC-8	X	X	X	
MW-EDC-9	X	X		X
MW-EDC-10	X	X	X	
MW-EDC-11	X	X		
MW-EDC-12	X	X		
MW-EDC-13	X	X		
MW-EDC-14	X	X	X	
MW-EDC-15	X	X	X	
MW-EDC-16	X	X	X	
MW-EDC-17	X		X	
MW-EDC-18	X	X		

Notes:

[A] - Total and dissolved lead by Method SW-846/EPA 7421.

[B] - Total and dissolved chromium by Method SW-846/EPA6010 or 7190.

[C] - Nitrate by Method SW-846/EPA 9200 or 9056.

[D] - Sulfate by Method SW-846/EPA 9038 or 9056.

FIGURES

L DORADO CHEMICAL CO.
EL DORADO, ARKANSAS

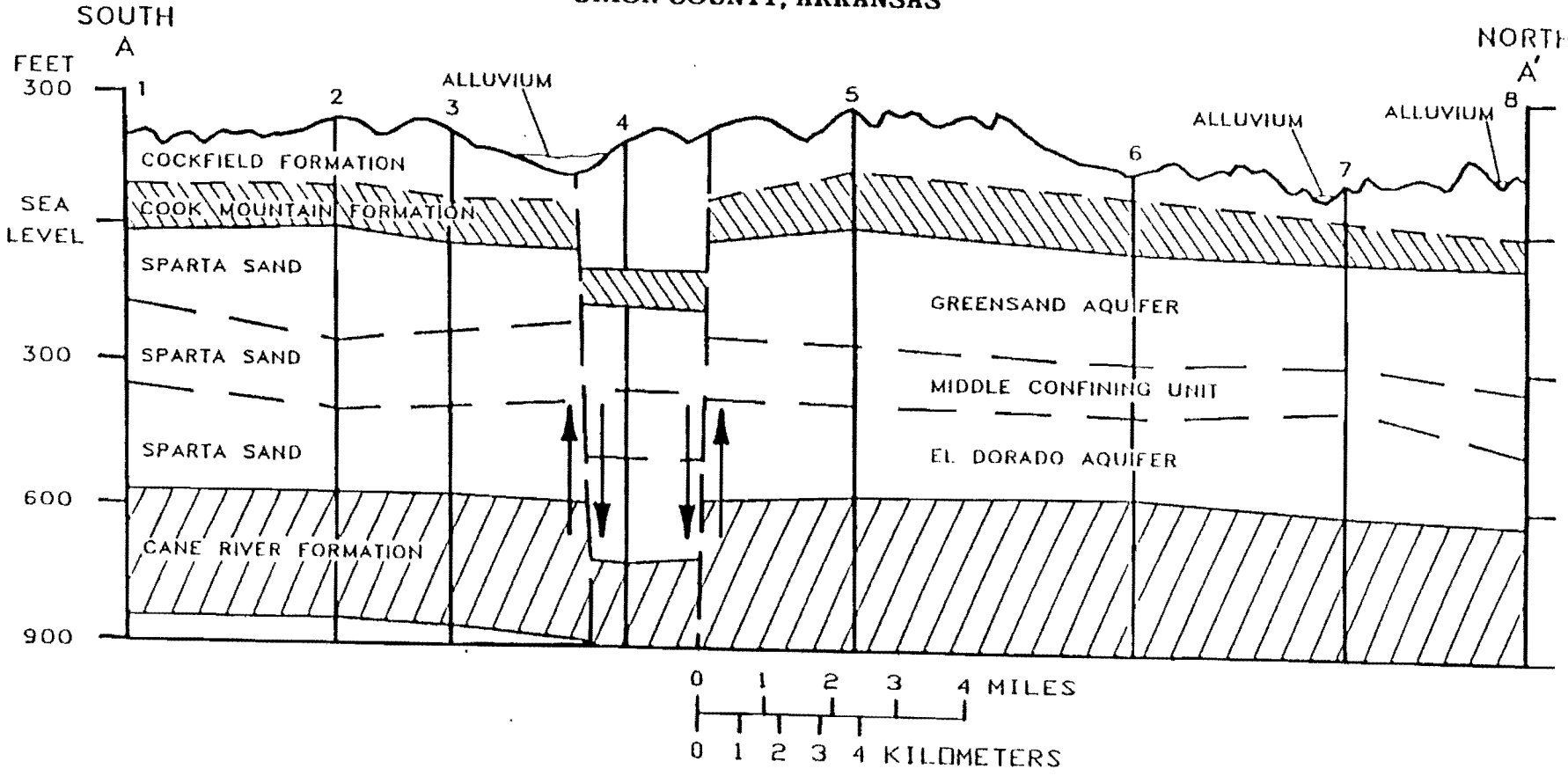
SCALE: AS SHOWN
DRAWN BY: CRS
CHKD. BY: ETF
DATE: 8-23-95
DATE: 1-2-96

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Little Rock, Arkansas

HYDROGEOLOGIC SECTION

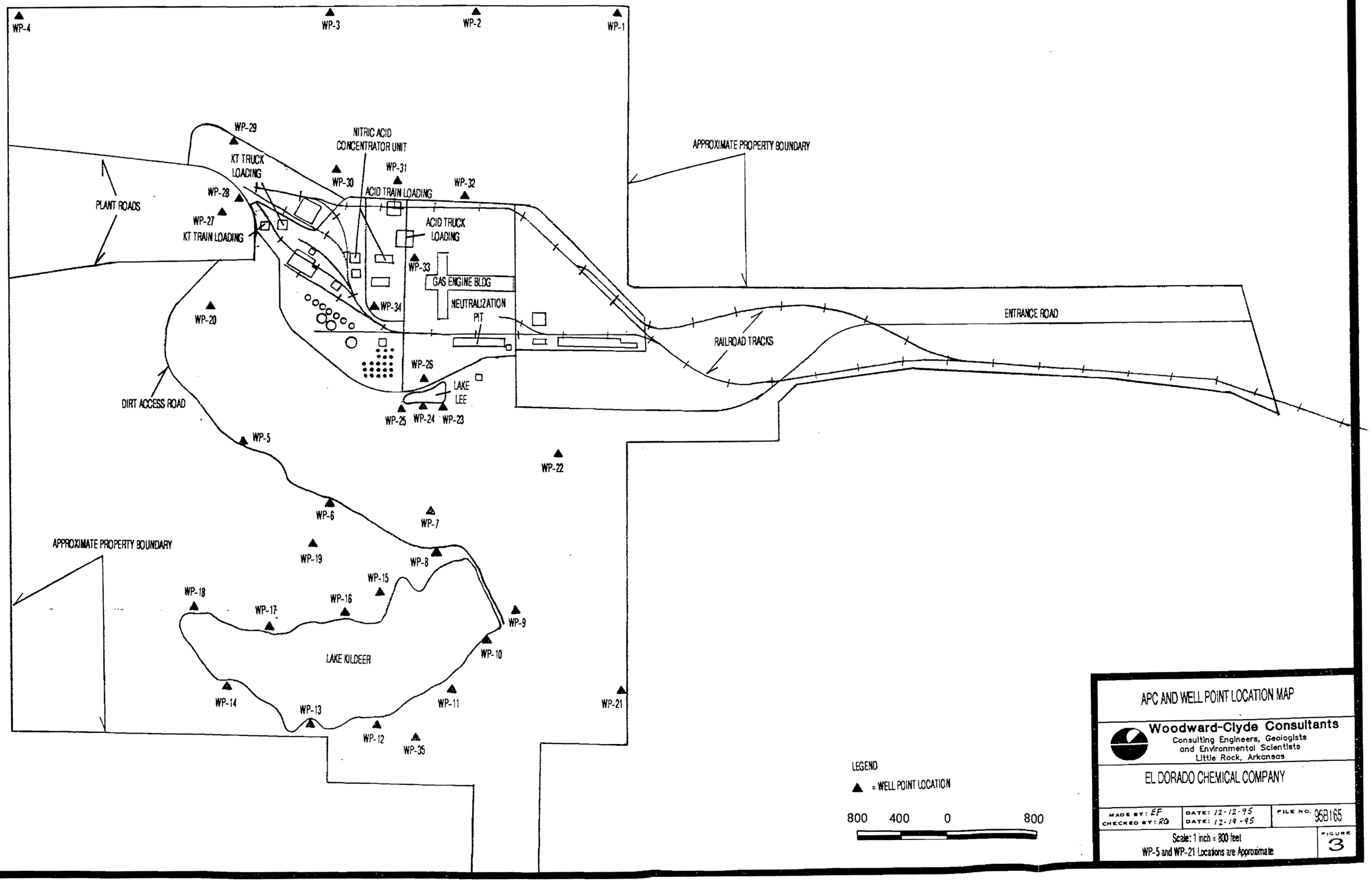
FIG. NO. 2
FILE NO. 95B165

SOUTH–NORTH HYDROGEOLOGIC SECTION THROUGH THE CENTER OF UNION COUNTY, ARKANSAS



VERTICAL EXAGGERATION X35
(TRACE OF SECTION SHOWN ON FIGURE 4.)

From Leidy and Taylor, 1992.



APC AND WELL POINT LOCATION MAP

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Little Rock, Arkansas

EL DORADO CHEMICAL COMPANY

MADE BY: EF CHECKED BY: RG	DATE: 12-12-95 DATE: 12-19-95	FILE NO. 96B165

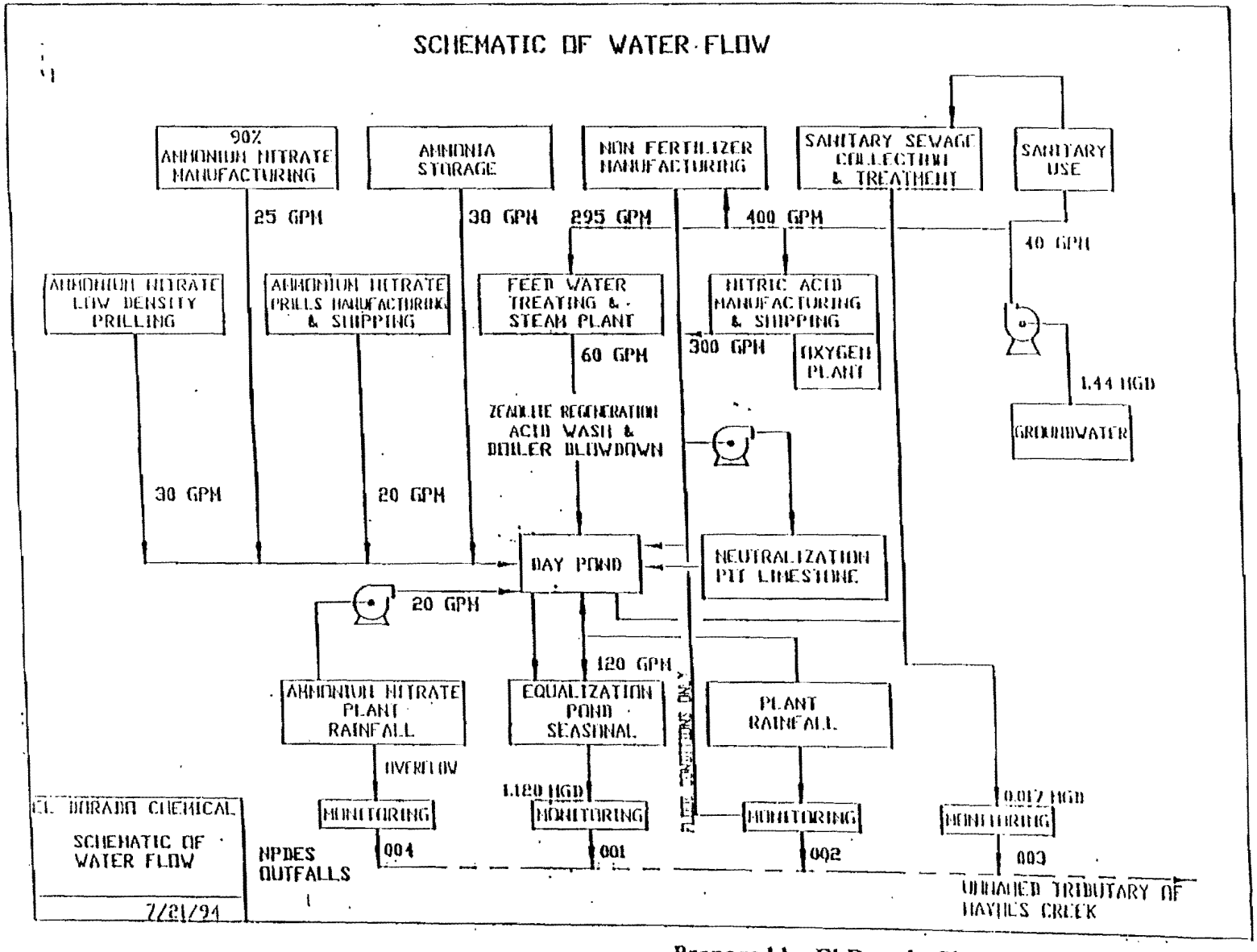
Scale: 1 inch = 800 feet
WP-5 and WP-21 Locations are Approximate

FIGURE 3

EL DORADO CHEMICAL CO.

EL DORADO, ARKANSAS

SCHEMATIC OF WATER FLOW



Prepared by El Dorado Chemical Company

Woodward-Clyde Consultants

Consulting Engineers, Geologists and Environmental Scientists

Baton Rouge, Louisiana

SCALE: N.T.S.

DRAWN BY: CRS

CHKD BY: MPB

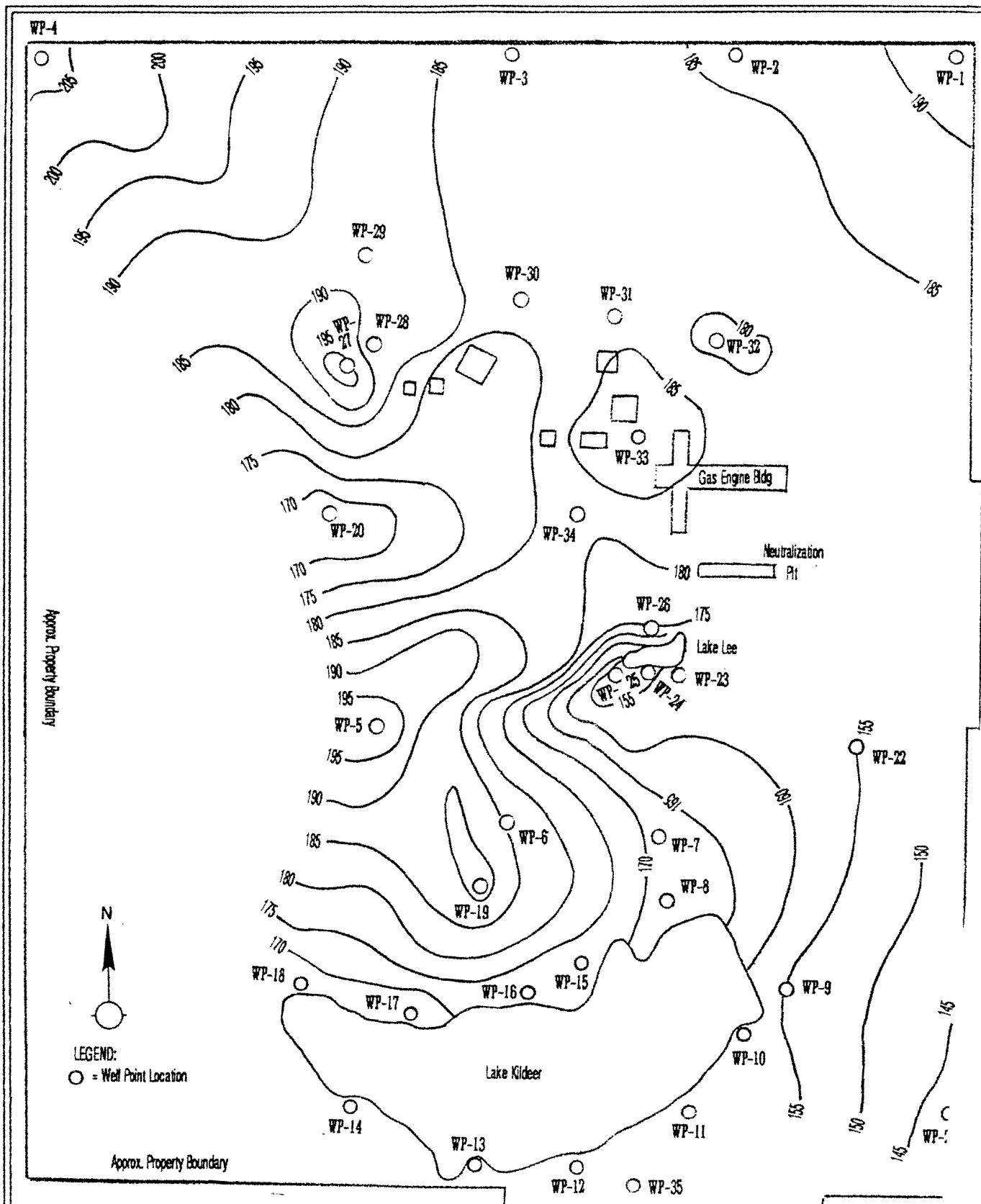
DATE: 8-23-95

DATE: 8-23-95

PLANT DRAINAGE AND DISCHARGE DIAGRAM

FILE NO. 95B165

FIG. NO. 4

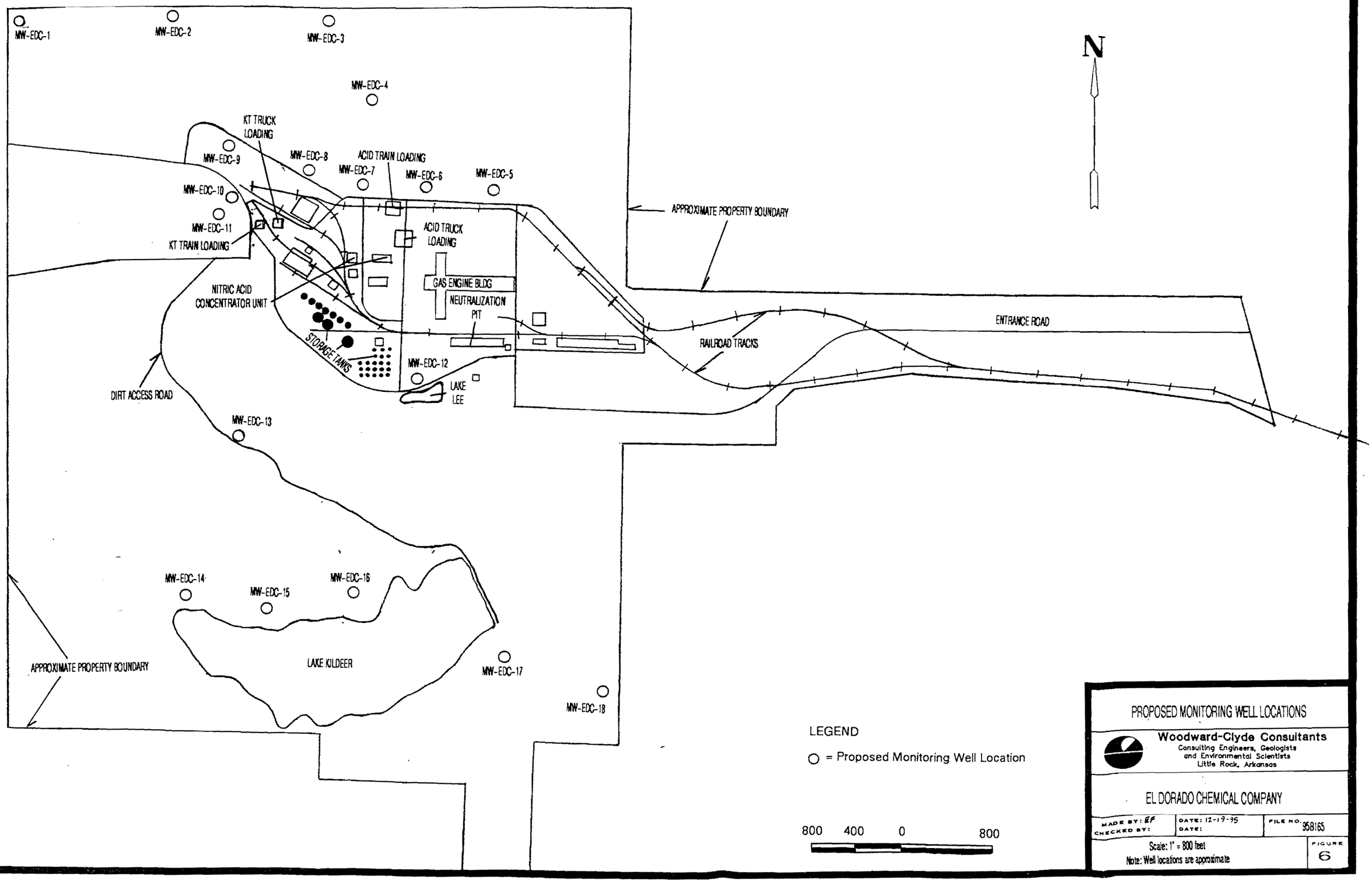


GROUNDWATER ELEVATION CONTOUR

Woodward-Clyde Consultants
Consulting Engineers, Geologists
and Environmental Scientists
Little Rock, Arkansas

SCALE: 1"=800'	DRAWN BY: EJF	DATE: 12-15-9[illegible]
	CHKD. BY: RAO	DATE: 12-19-9[illegible]

Notes:
Contour interval = 5 feet.
Elevations in feet above MSL.
WP-5 and WP-21 locations are approximate.



PROPOSED MONITORING WELL LOCATIONS

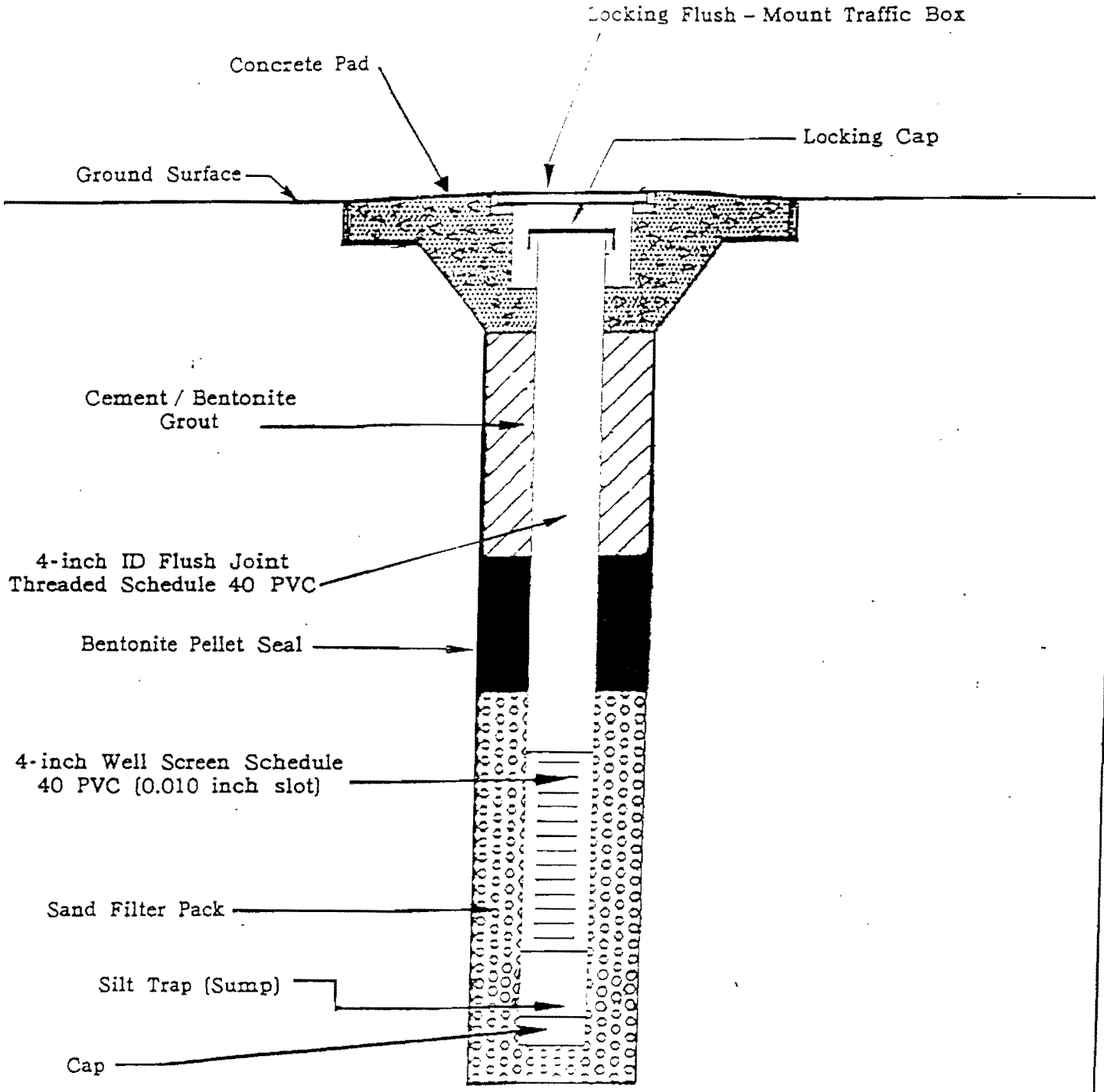
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Little Rock, Arkansas

EL DORADO CHEMICAL COMPANY

MADE BY: EF CHECKED BY:	DATE: 12-19-95 DATE:	FILE NO. 958165

Scale: 1" = 800 feet
Note: Well locations are approximate

FIGURE 6



EL DORADO CHEMICAL COMPANY	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	TYPICAL MONITORING WELL CONSTRUCTION SCHEMATIC	FILE NO. 95B155 FIG. NO. 7
	SCALE: NTS | DRAWN BY: EJF | DATE: 12-21-95 CHKD BY: RAO | DATE: 12-21-95		

APPENDIX A
ANALYTICAL RESULTS

07-Dec-95

Woodward-Clyde Consultants
900 S. Shackleford
Little Rock, Arkansas 72211

Re: El Dorado Chemical
Project: GW INV Phase I
Date Received: 11/16-17/95

Attn: Eric Fox

ANALYTICAL RESULTS

Lab Number	Date Sampled	Sample Type	Sample ID	Lead mg/L	Chromium mg/L	Nitrates mg/L	Sulfates mg/L
952316	11-16-95	water	WP-1	0.021	<0.08	0.1	21
952317	11-16-95	water	WP-2	0.011	<0.08	<0.1	79
952318	11-16-95	water	WP-7	0.044	0.1	<0.1	49
952319	11-16-95	water	WP-8	0.035	<0.08	<0.1	15
952320	11-16-95	water	WP-9	0.03	<0.08	19.2	172
952321	11-16-95	water	WP-11	0.025	0.12	4.15	335
952322	11-16-95	water	WP-12	0.011	<0.08	1.26	176
952308	11-16-95	water	WP-13	0.046	0.15	1.9	20
952323	11-16-95	water	WP-14	0.038	0.17	1.8	12
952324	11-16-95	water	WP-15	0.030	<0.08	94	6
952325	11-16-95	water	WP-16	0.002	<0.08	56	8
952307	11-16-95	water	WP-17	0.01	<0.08	224	15
952306	11-16-95	water	WP-18	na	na	0.1	32
952314	11-16-95	water	WP-27	0.09	0.21	0.73	145
952358	11-17-95	water	WP-21	0.31	0.79	<0.1	163
952359	11-17-95	water	WP-22	0.012	<0.08	<0.1	7
952360	11-17-95	water	WP-23	0.04	0.11	0.22	267
952361	11-17-95	water	WP-24	0.016	<0.08	0.28	216
952362	11-17-95	water	WP-25	0.002	<0.08	0.2	208
952363	11-17-95	water	WP-26	0.49	0.54	0.47	139

Arkansas Analytical, Inc. • 501 North University • Little Rock, AR 72205 • (501) 664-5661 • FAX (501) 664-5891

Arkansas Analytical, Inc. • 501 North University • Little Rock, AR 72205 • (501) 664-5661 • FAX (501) 664-5891

07-Dec-95

Woodward-Clyde Consultants
900 S. Shackleford
Little Rock, Arkansas 72211

Re: El Dorado Chemical
Project: GW INV Phase I
Date Received: 11/16-17/95

Attn: Eric Fox

ANALYTICAL RESULTS

Lab Number	Date Sampled	Sample Type	Sample ID	Lead mg/L	Chromium mg/L	Nitrates mg/L	Sulfates mg/L
952364	11-17-95	water	WP-33	0.04	<0.08	<0.1	54
952365	11-17-95	water	WP-20	0.05	0.16	1.32	159
952366	11-17-95	water	WP-18	0.098	0.18	na	na
952367	11-17-95	water	WP-10	0.03	<0.08	220	9
952368	11-17-95	water	WP-6	0.062	0.16	9.6	363
952369	11-17-95	water	WP-19	0.052	<0.08	0.18	<2
952370	11-17-95	water	WP-5	0.301	0.61	0.24	353
952371	11-17-95	water	WP-34	0.058	0.12	5.4	470
952372	11-17-95	water	WP-3	1.23	2.03	0.98	<50*
952373	11-17-95	water	WP-4	0.063	0.26	0.79	<50*
952313	11-16-95	water	WP-28	0.036	0.12	220	357
952312	11-16-95	water	WP-29	0.044	0.18	3.4	1070
952309	11-16-95	water	WP-30	0.192	0.35	1000	89
952310	11-16-95	water	WP-31	0.082	0.23	266	6
952311	11-16-95	water	WP-32	0.196	0.75	0.68	3540
952327	11-16-95	water	BLIND DUP #1	0.014	<0.08	<0.1	75
952328	11-16-95	water	BLIND DUP #2	0.005	<0.08	1.26	178
952326	11-16-95	water	WP-35	0.028	<0.08	1.12	14
952277	11-15-95	water	Field Blank 1	<0.001	<0.08	<0.1	9
952278	11-15-95	water	Field Blank 2	<0.001	<0.08	<0.1	7

*Elevated detection limit due to dilution required to overcome interference.

Arkansas Analytical, Inc. • 501 North University • Little Rock, AR 72205 • (501) 664-5661 • FAX (501) 664-5891

07-Dec-95

Woodward-Clyde Consultants
900 S. Shackleford
Little Rock, Arkansas 72211

Re: El Dorado Chemical
Project: GW INV Phase I
Date Received: 11/16-17/95

Attn: Eric Fox

QUALITY CONTROL RESULTS

	mg/L Blank	Percent Variance Duplicates	Percent Recovery Matrix Spike/s	Percent Recovery Control Spike/s	EPA SW-846 Method of Analysis
Lead	<0.001	6.8	93.5	97.7	7421
	<0.001	8.2	92.4	96.2	
	<0.001	2.7	90.6	99.3	
Chromium	<0.08	3.5	93.8	89	7190
	<0.08	1.6	94.2	91	
	<0.08	1.2	90.6	95.1	
Nitrates	<0.1	5.3	120	113	9200
		5.3	87.6	113	
	<0.1	9		96.6	
Sulfates	<1	0	79.8	116	9038
	<1	3.8	93.8	106	

Analyzed by: Rodney L. Williams, Liz Potts, Tracy Bounds
Rodney L. Williams, Liz Potts, Tracy Bounds

Reviewed by: Lessie R. Redican (mg) Norma J. James
Lessie R. Redican, Norma J. James

cc: John Carver
El Dorado Chemical Company
P.O. Box 1373
Oklahoma City, Oklahoma 73101

Woodward-Clyde Consultants

CHAIN - OF - CUSTODY RECORD

SAMPLE NO.	MATRIX	YR: 95 DATE MM/DD 11/17	TIME	SAMPLE DEPTH FROM	SAMPLE DEPTH TO	LAB ID STATION LOCATION 95-	TOTAL NO. CONTAINERS	NO_3 + SO_4	Pb + Cr			
WP-21	AQ		750			2359	2	X	X			
WP-22			811			2359	2	X	X			
WP-23			830			2360	2	X	X			
WP-24			842			2361	2	X	X			
WP-25			957			2362	2	X	X			
WP-26			921			2363	2	X	X			
WP-33			948			2364	2	X	X			
WP-20			1007			2365	2	X	X			
WP-18			1028			2366	1		X			
WP-10			1248			2367	2	X	X			
WP-6			1333			2368	2	X	X			
WP-19			1348			2369	2	X	X			
WP-5			1410			2370	2	X	X			
WP-34			1446			2371	2	X	X			
WP-3			1515			2372	2	X	X			
WP-4			1535			2373	2	X	X			

SAMPLE COLLECTION:

PROJECT NO. AND NAME: 958165 | EDC PHASE I GW INVEST.
LOCATION OF SAMPLE: EDC
TEAM LEADER: ERIC FOX TELEPHONE: (501) 223-2582
COMPANY NAME: WOODWARD-CLYDE
ADDRESS: 900 S. SHACKLEFORD #412 LR AR 72211
WITNESS: _____ COMPANY NAME: _____

FIELD INFORMATION:

TYPES OF SAMPLES: LIQUID (LI) FISH (FI) SLUDGE (SL) SOIL (SO)
(MATRIX) WIPE (W) SEDIMENT (SE) OTHER (SPECIFY) _____
FIELD NOTES: _____
TRANSPORTER: HAND DEL. AIRBILL/INVOICE: — DESTINATION: LR

SAMPLE TRANSFER (Original must be retained with sample at all times)

		RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
1	NAME:	Eric Fox	11/17/95	Elizabeth Potts	11/17/95
	COMPANY:	WCC	1545	ARK. Analytical	1545
2	NAME:				
	COMPANY:				
3	NAME:				
	COMPANY:				

TERMINATION OF CHAIN-OF-CUSTODY:

AUTHORIZED BY: _____ DATE: _____ TIME: _____
COMPANY NAME: _____
SAMPLE DISPOSTION: STORAGE _____ DISPOSAL _____ OTHER _____

Woodward-Clyde Consultants

CHAIN - OF - CUSTODY RECORD

SAMPLE NO.	MATRIX	YR: 95 DATE MM/DD	TIME	SAMPLE DEPTH FROM	SAMPLE DEPTH TO	STATION LOCATION	TOTAL NO. CONTAINERS	Pb + Cr	Sulfate + Nitrate	FO#	
WP-1 —	AQ	11/16	945				2	X	X	95	2316
WP-2 —			907				2				2317
WP-7 —			1016				2				2318
WP-8 —			1042				2				2319
WP-9 —			1104				2				2320
WP-11 —			1126				2				2321
WP-12 —			1140				2				2322
WP-13			1151				2				~~2323~~ 2302
WP-14 —			1204				2				~~2324~~ 2323
WP-15 —			1350				2				~~2325~~ 2324
WP-16 —			1401				2				~~2326~~ 2325
WP-17			1412				2				2307
WP-18			1445				1				2306
WP-27 (27) EB	↓	↓	1532				2	↓	↓		2314

SAMPLE COLLECTION:

PROJECT NO. AND NAME: EDC 95B165 EDC GW INV. PHASE I
LOCATION OF SAMPLE: EDC
TEAM LEADER: ERIC FOX TELEPHONE: ( ) 223-2582
COMPANY NAME: WOODWARD CLYDE
ADDRESS: 900 S. SHACKLEFORD #412, LR, AR 72211
WITNESS: _____ COMPANY NAME: _____

FIELD INFORMATION:

TYPES OF SAMPLES: LIQUID (LI) FISH (FI) SLUDGE (SL) SOIL (SO)
(MATRIX) WIPE (WI) SEDIMENT (SE) OTHER (SPECIFY) _____
FIELD NOTES: _____
TRANSPORTER: FED EX AIRBILL/INVOICE: _____ DESTINATION: LR, AR

SAMPLE TRANSFER (Original must be retained with sample at all times)

		RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
1	NAME:	Eric Fox	11/16/95		11-17-95
	COMPANY:	WCC	1740		1115
2	NAME:				
	COMPANY:				
3	NAME:				
	COMPANY:				

TERMINATION OF CHAIN-OF-CUSTODY:

AUTHORIZED BY: _____ DATE: _____ TIME: _____
COMPANY NAME: _____
SAMPLE DISPOSTION: STORAGE _____ DISPOSAL _____ OTHER _____

11:15:95 DEPTAM WOODWARD CLYDE L.R. AR P.02

CHAIN - OF - CUSTODY RECORD

SAMPLE NO.	MATRIX	YR: DATE MM/DD	TIME	SAMPLE DEPTH FROM	SAMPLE DEPTH TO	STATION LOCATION	TOTAL NO. CONTAINERS	Pb + Cr	Sulfate + Nitrate		
WP-28	AQ	11/16	1549				2				952312
WP-29			1601				2				952312
WP-30			1617				2				952309
WP-31			1631				2				2310
WP-32			1647				2				2311
BLIND DUP. #1			—				2				952327
BLIND DUP. #2			—				2				952328
WP-35			1338				2				952326

SAMPLE COLLECTION:

PROJECT NO. AND NAME 95B165 - EDC GW INVEST. PHASE I
LOCATION OF SAMPLE: EDC
TEAM LEADER: ERIC FOX TELEPHONE: ( ) 223-2582
COMPANY NAME: WOODWARD - CLYDE
ADDRESS: 900 S. SHACKLEFORD STE 412 LR, AR 72211
WITNESS: _____ COMPANY NAME: _____

FIELD INFORMATION:

TYPES OF SAMPLES: LIQUID (LI) FISH (FI) SLUDGE (SL) SOIL (SO)
(MATRIX) WIPE (W) SEDIMENT (SE) OTHER (SPECIFY) _____
FIELD NOTES: _____
TRANSPORTER: FED EX AIRBILL/INVOICE: _____ DESTINATION: LR, AR.

SAMPLE TRANSFER (Original must be retained with sample at all times)

		RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
1	NAME:	Eric Fox	11/16/95		11/16/95
	COMPANY:	WCC	1740		1115
2	NAME:				
	COMPANY:				
3	NAME:				
	COMPANY:				

TERMINATION OF CHAIN-OF-CUSTODY:

AUTHORIZED BY: _____ DATE: _____ TIME: _____
COMPANY NAME: _____
SAMPLE DISPOSTION: STORAGE _____ DISPOSAL _____ OTHER _____

Woodward-Clyde Consultants

CHAIN - OF - CUSTODY RECORD

SAMPLE NO.	MATRIX	YR: 1995 DATE MM/DD	TIME	SAMPLE DEPTH FROM	SAMPLE DEPTH TO	STATION LOCATION	TOTAL NO. CONTAINERS	Nitrate, Sulfate	Lead, Chromium			
FIELD BLANK 1	LI	11/15/95	10:45			QC Blank	2	✓	✓	95:2277		
FIELD BLANK 2	LI	11/15/95	16:30			QC Blank	2	✓	✓	95:2275		

SAMPLE COLLECTION:

PROJECT NO. AND NAME: Hydropunch EDC
LOCATION OF SAMPLE: El Dorado, AR
TEAM LEADER: Eric J. Fox TELEPHONE: (501) 223-2582
COMPANY NAME: Woodward-Clyde Consultants
ADDRESS: 900 S. Shackleford, Suite 412
WITNESS: _____ COMPANY NAME: _____

FIELD INFORMATION:

TYPES OF SAMPLES: (MATRIX) LIQUID (LI) WIPE (WI) FISH (FI) SEDIMENT (SE) SLUDGE (SL) OTHER (SPECIFY) SOIL (SO)
FIELD NOTES: _____
TRANSPORTER: _____ AIRBILL/INVOICE: _____ DESTINATION: _____

SAMPLE TRANSFER (Original must be retained with sample at all times)

		RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
1	NAME:	Eric J. Fox	11/16/95	Mary D. Beck	11-16-95
	COMPANY:	Woodward-Clyde	5:50 Am	Woodward-Clyde	5:50 Am
2	NAME:	Mary D. Beck	11/16/95	Rodney L. Wills	11-16-95
	COMPANY:	Woodward-Clyde	8:46 Am	Arkansas Analytical	8:46 am
3	NAME:				
	COMPANY:				

TERMINATION OF CHAIN-OF-CUSTODY:

AUTHORIZED BY: _____ DATE: _____ TIME: _____
COMPANY NAME: _____
SAMPLE DISPOSTION: STORAGE _____ DISPOSAL _____ OTHER _____

APPENDIX D
ANALYTICAL RESULTS

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-1 Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.10 Report: 24948.10

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	1.7	03/15/96	SW 9056
SULFATE		0.2	mg/l	4.1	03/15/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/26/96	SW 6010
LEAD		2.0	ug/l	3.7	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-1-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.20 Report: 24948.20

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/27/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-2 Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.11 Report: 24948.11

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	ND	03/15/96	SW 9056
SULFATE		0.2	mg/l	17.0	03/15/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	34.2	03/26/96	SW 6010
LEAD		2.0	ug/l	18.0	03/25/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-2-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.21 Report: 24948.21

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/27/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-3 Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.12 Report: 24948.12

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	ND	03/15/96	SW 9056
SULFATE		0.2	mg/l	10.0	03/15/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/26/96	SW 6010
LEAD		2.0	ug/l	2.7	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-3-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.22 Report: 24948.22

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/27/96	SW 6010
LEAD		2.0	ug/l	ND	03/22/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
: = UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
NA = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-4 Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.13 Report: 24948.13

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	1.3	03/15/96	SW 9056
SULFATE		2.0	mg/l	728	03/19/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/26/96	SW 6010
LEAD		2.0	ug/l	2.5	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
\ = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-4-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.23 Report: 24948.23

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/27/96	SW 6010
LEAD		2.0	ug/l	ND	03/22/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-5 Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.11 Report: 24931.11

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	4.4	03/14/96	SW 9056
SULFATE		2.0	mg/l	441	03/15/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
\ = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-5-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.27 Report: 24931.27

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
\ = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-6 Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.12 Report: 24931.12

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		2.0	mg/l	51.1	03/15/96	SW 9056
SULFATE		0.2	mg/l	24.0	03/14/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	2.6	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION
SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-6-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.28 Report: 24931.28

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
: = UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
NA = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-7 Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.13 Report: 24931.13

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		2.0	mg/l	282	03/15/96	SW 9056
SULFATE		2.0	mg/l	380	03/15/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	7.8	03/19/96	SW 6010
LEAD		2.0	ug/l	22.1	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-7-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.29 Report: 24931.29

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	18.5	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-8 Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.14 Report: 24931.14

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		20.0	mg/l	1010	03/15/96	SW 9056
SULFATE		0.2	mg/l	68.3	03/14/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	23.4	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-8-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.30 Report: 24931.30

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	23.8	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION
SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-9 Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.07 Report: 24948.07

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	37.3	03/15/96	SW 9056
SULFATE		2.0	mg/l	621	03/19/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/26/96	SW 6010
LEAD		2.0	ug/l	4.0	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION
SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-9 Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.08 MS Report: 24948.08

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	52.7	03/15/96	SW 9056
SULFATE		2.0	mg/l	813	03/19/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	172	03/26/96	SW 6010
LEAD		2.0	ug/l	17.5	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-9 Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.09 MSD Report: 24948.09

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	55.3	03/15/96	SW 9056
SULFATE		2.0	mg/l	807	03/19/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	173	03/26/96	SW 6010
LEAD		2.0	ug/l	19.1	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
: = UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
NA = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-9-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.17 Report: 24948.17

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/26/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-9-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.18 MS Report: 24948.18

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	177	03/26/96	SW 6010
LEAD		2.0	ug/l	18.0	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
: = UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
NA = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-9-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24948.19 MSD Report: 24948.19

Collected: 03/14/1996 Report Date: 03/27/1996 Page: 1
Received: 03/15/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	177	03/26/96	SW 6010
LEAD		2.0	ug/l	19.3	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
NA = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-10 Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.09 Report: 24931.09

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		2.0	mg/l	257	03/15/96	SW 9056
SULFATE		0.2	mg/l	89.0	03/14/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	5.2	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
!A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-10-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.25 Report: 24931.25

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	3.9	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-11 Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.06 Report: 24931.06

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	22.1	03/14/96	SW 9056
SULFATE		2.0	mg/l	578	03/15/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-11 Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.07 MS Report: 24931.07

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	40.5	03/14/96	SW 9056
SULFATE		2.0	mg/l	753	03/15/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	168	03/19/96	SW 6010
LEAD		2.0	ug/l	17.1	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
R = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-11 Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.08 MSD Report: 24931.08

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: 03/27/1996 Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	42.4	03/14/96	SW 9056
SULFATE		2.0	mg/l	731	03/15/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	175	03/19/96	SW 6010
LEAD		2.0	ug/l	17.1	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-11-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.22 Report: 24931.22

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-11-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.23 MS Report: 24931.23

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	189	03/19/96	SW 6010
LEAD		2.0	ug/l	19.5	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-11-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.24 MSD Report: 24931.24

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	193	03/19/96	SW 6010
LEAD		2.0	ug/l	18.5	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-12 Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.10 Report: 24931.10

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	ND	03/14/96	SW 9056
SULFATE		0.2	mg/l	9.6	03/14/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
\ = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-12-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.26 Report: 24931.26

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
\ = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-13 Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.05 Report: 24931.05

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	0.2	03/14/96	SW 9056
SULFATE		2.0	mg/l	809	03/15/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
: = UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
NA = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION
SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-13-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.21 Report: 24931.21

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
\ = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-14 Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.02 Report: 24931.02

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** INORGANICS ***				
NITRATE		0.2	mg/l	11.9	03/14/96	SW 9056
SULFATE		2.0	mg/l	139	03/15/96	SW 9056
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
\ = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. ALBANY SUITE C BROKEN ARROW, OK 74012-1421 (918) 251-2858

Client Name: WOODWARD CLYDE CONSULTANTS-LITTLE ROCK
900 SOUTH SHACKLEFORD
SUITE 412
LITTLE ROCK, AR 72211

Client ID: MW-14-F Project ID: EL DORADO CHEMICAL

SWLO ID: 24931.18 Report: 24931.18

Collected: 03/13/1996 Report Date: 03/27/1996 Page: 1
Received: 03/14/1996 Last Modified: Matrix: Water

TEST	DATE EXTRACTED	DETECTION LIMIT	UNITS	RESULTS	DATE ANALYZED	METHOD REFERENCE
		*** METALS ***				
CHROMIUM		5.0	ug/l	ND	03/19/96	SW 6010
LEAD		2.0	ug/l	ND	03/21/96	SW 7421

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
= UNABLE TO QUANTITATE DUE TO MATRIX INTERFERENCE
A = NOT APPLICABLE
Methodology: SM = STANDARD METHODS, 16th EDITION, 1985
EPA = #EPA600/4-79-020, MARCH 1985

* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
D = SURROGATES DILUTED OUT
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION

SW = EPA METHODOLOGY, "#SW846", THIRD EDITION, NOVEMBER 1986

APPENDIX C
GEOTECHNICAL TEST REPORTS

Woodward-Clyde Consultants

Project Name: El Dorado Chemical

Project Number: 96B165 Task Number: SIO-2

SUMMARY OF TEST RESULTS

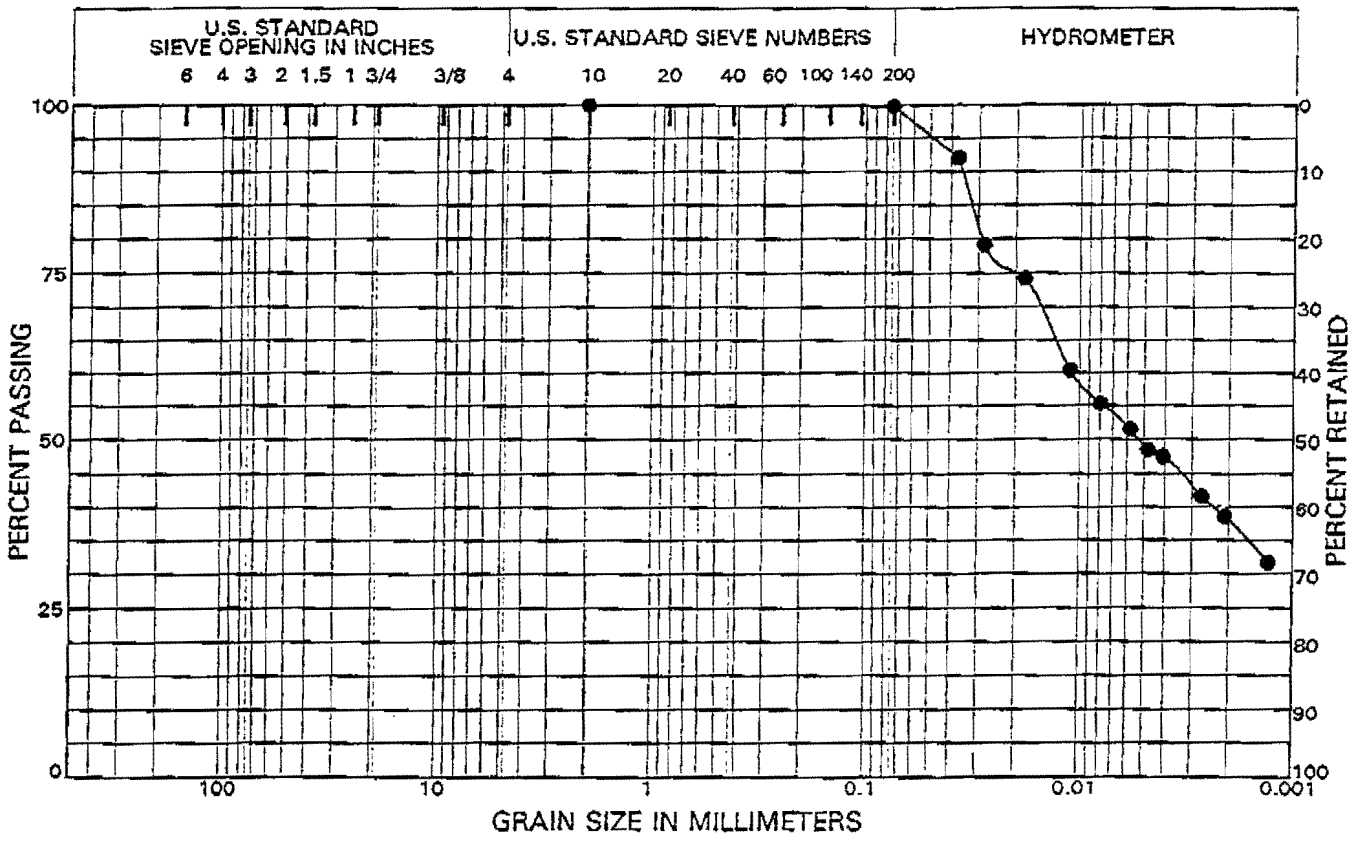
Subject: Index Tests

Sheet No. 1

Test Number	Retest	Location		WCC Lab No.	Lift	In-Place Density Tests							LL	PL	PI	- #200 Sieve (%)	Avg. Oven Water Content (%) As Rec.	Perm. (cm/sec) $K_{20°C}$	Remarks
		North	East			Dry Density (pcf)	Water Content (%)	Curve	Proctor Curve d.d. (pcf)	Proctor Curve m.e. (%)	% Comp. Apprx.	% Satur.							
MW-8				1	9'-11'									(CH)					
							28.5									93.3*	28.5		
MW-8				2	14'-16'	95.0	26.4							(CH)					
													67	26	41	99.8*	26.4		

Remarks:

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Depth (feet)	Symbol	Classification
MW-8	9.0	●	(CH)

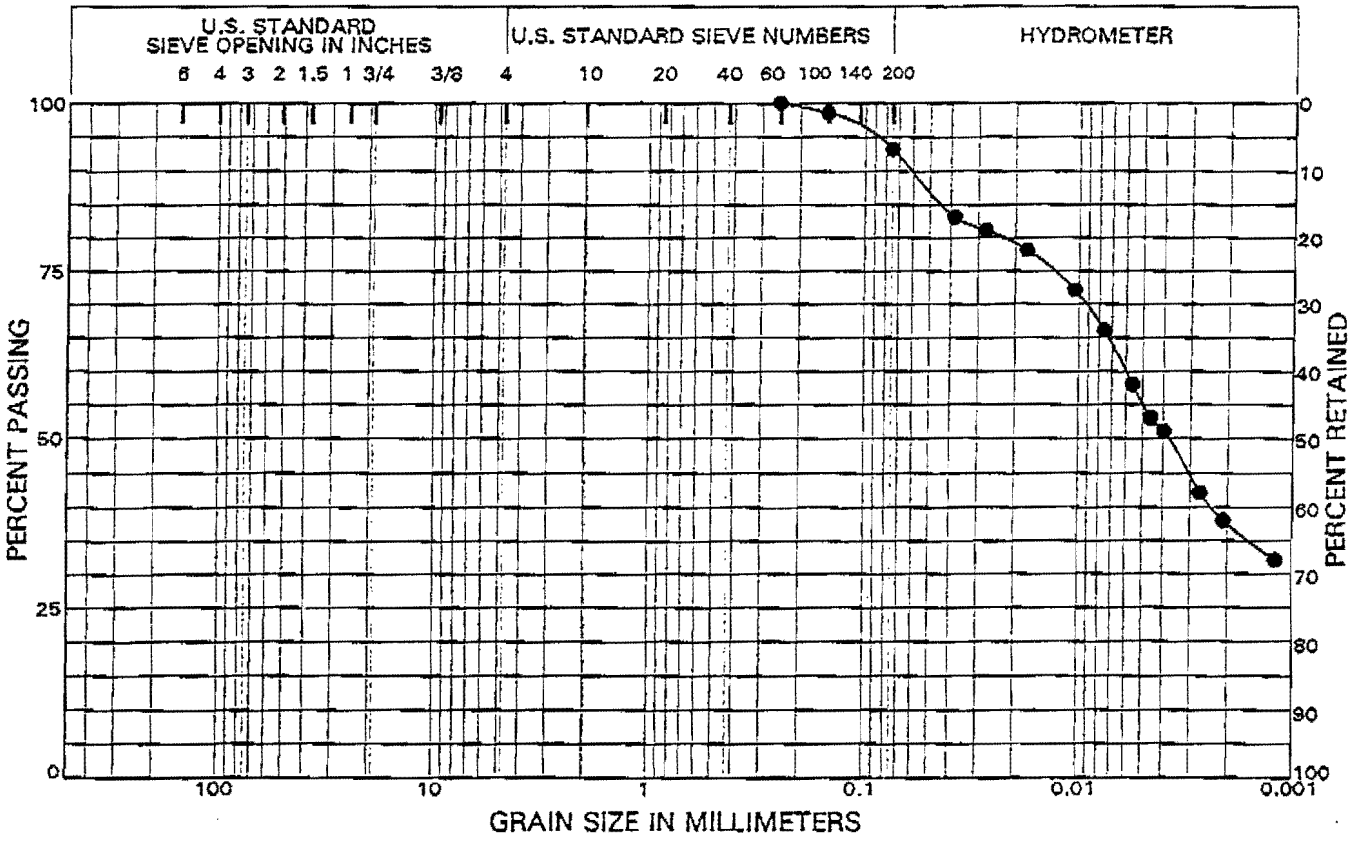
Project: El Dorado Chemical
Project Number: 96B165

GRAIN SIZE DISTRIBUTION CURVES

3/14/96 SVANLS6D 6B165

Woodward-Clyde Consultants

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Depth (feet)	Symbol	Classification
MW-8	14.0	●	(CH)

Project: El Dorado Chemical
Project Number: 96B165

GRAIN SIZE DISTRIBUTION CURVES

3/14/96 SVANLS6D 65165

Woodward-Clyde Consultants

APPENDIX B
BORING LOGS

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-01**
FILE: **95B165**
DATE: **2/14/96**
GEOLOGIST: **EJF**
APPROVED: **EQ**
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0–8				12	Yellow-red and light gray (5YR; 5/8) SILT; medium dense.	(ML)
9–13				16	Light gray (5YR, 7/1) fine Silty SAND; damp to moist.	(ML/SM)
14–18				18	Light gray (10YR, 6/4) and tan Clayey SILT; damp.	(ML)
19				18	Very stiff dark gray (10YR, 4/2) CLAY; wet.	(CL)
20					End of Boring at 20'.	

Woodward-Clyde Consultants

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-02**
FILE: **95B165**
DATE: **2/14/96**
GEOLOGIST: **EJF**
APPROVED: **LQ**
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0				18	Gray to dark gray (7.5YR, 7/2) medium dense Silty CLAY; damp.	(CL)
9				18	Stiff reddish, yellow and gray (7.5YR, 7/8) CLAY; dry.	(CL)
14				18	—stiff gray (7.5YR, 6/0) CLAY; wet.	
17					End of Boring at 17'.	

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-03**
FILE: **95B165**
DATE: **2/15/96**
GEOLOGIST: **EJF**
APPROVED: **RO**
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0–10				18	Light gray (5YR, 7/1) Clayey SILT; damp.	(ML)
10–14				18	Dense gray (5YR, 6/1) Silty CLAY; traces of reddish brown clay.	(CL)
14–20				18	Stiff dark reddish-brown (5YR, 3/2) CLAY.	(CL)
20–24				18	---stiff dark gray (5YR, 4/1) CLAY; wet.	(CL)
24					End of Boring at 24'.	

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-04**
FILE: **95B165**
DATE: **2/15/96**
GEOLOGIST: **EJF**
APPROVED: **RCL**
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0–5				18	Stiff gray (5YR, 6/1) CLAY.	(CL)
5–10				18	—stiff gray (5YR, 6/1) CLAY; damp.	(CL)
10–15				18	Gray (5YR, 6/2) stiff CLAY with light gray plus tan silt lenses; wet.	(CL/ML)
15–20					End of Boring at 20'.	

Woodward-Clyde Consultants

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-05**
FILE: **95B165**
DATE: **2/21/96**
GEOLOGIST: **EJE**
APPROVED: **RCO**
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0				18	Moist light gray and tan (5YR, 7/1) Sandy CLAY.	(CL)
9				18	Wet light gray - gray (5YR, 7/1 + 6/1) fine SAND and fine Silty SAND.	(SM)
15					End of Boring at 15'.	

Woodward-Clyde Consultants

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-06**
FILE: **95B165**
DATE: **2/21/96**
GEOLOGIST: **EJF**
APPROVED:
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0				18	Light gray (5YR, 7/1) Clayey SILT; damp; dense.	(ML)
9				18	Reddish gray (5YR, 5/2) Silty CLAY; dry to damp.	(CL)
14				18	Wet reddish gray (5YR, 5/2) SILT and Silty SAND.	(ML/SM)
19					End of Boring at 19'.	

Woodward-Clyde Consultants

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-07**
FILE: **95B165**
DATE: **2/20/96**
GEOLOGIST: **EJF**
APPROVED: nc
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0–9				18	Reddish yellow (7.5YR, 6/6) Silty SAND with traces of light gray SILT; dry.	(SM)
9–19				18	Stiff reddish gray (5YR, 5/2) CLAY.	(CL)
				18	—very stiff dark gray (10YR, 4/1) CLAY.	(CL)
19–22				18	Wet, loose light gray (5YR, 7/1) SILT and fine Silty SAND.	(ML/SM)
22					End of Boring at 22'.	

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-08**
FILE: **95B165**
DATE: **2/20/96**
GEOLOGIST: **EJF**
APPROVED:
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0–9				18	Fill material consisting of dark brown (5YR, 7/1 + 10YR, 6/3) Sandy CLAY, yellow brown medium SAND, and light gray Silty SAND, loose.	(SC/SP)
9–20				18	Light gray (5YR, 7/1) Silty CLAY; medium dense; damp.	(CH)
				18	Very stiff dark grayish brown (10YR, 4/1) CLAY.	
20–27				4	Light gray (5YR, 7/1) CLAY and light brown fine SAND.	(CL/SM)
					—wet, light gray (5YR, 7/1) fine Silty SAND.	(SM)
27					End of Boring at 27'.	

Woodward-Clyde Consultants

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-09**
FILE: **95B165**
DATE: **2/15/96**
GEOLOGIST: **EJF**
APPROVED:
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0-10				18	White - light gray (5YR, 8/1-7/1) dense Silty CLAY; dry.	(CL)
10				18	Light gray (5YR, 7/1) stiff CLAY; damp; with lenses.	(CL/ML)
14				18	—stiff gray (5YR, 7/1) CLAY; moist.	(CL)
20				18	—dark gray (5YR, 7/1) stiff CLAY with white to light gray SILT; damp.	(CL)
26				18	Wet gray (5YR, 7/1) SILT.	(ML)
28					End of Boring at 28'.	

Woodward-Clyde Consultants

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-10**
FILE: **95B165**
DATE: **2/19/96**
GEOLOGIST: **EJE**
APPROVED:
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0				16	Stiff gray (5YR, 6/1) CLAY; dry.	(CL)
9				18	Stiff reddish gray (5YR, 5/2) Silty CLAY with traces of yellow Silty SAND; dry to damp.	(CL)
14				18	Reddish brown (5YR, 5/2 + 7/1) CLAY with intermittent light brown SILT and yellow fine sand lenses; wet.	(CL/SM)
20					End of Boring at 20'.	

Woodward-Clyde Consultants

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-11**
FILE: **95B165**
DATE: **2/19/96**
GEOLOGIST: **EJF**
APPROVED: **RCA**
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0				18	Loose, damp, light gray (5YR, 7/1) and tan Silty CLAY.	(CL)
9				18	Stiff red-gray (5YR, 5/2) CLAY; with intermittent tan fine sand and light gray silt lenses; damp to moist.	(CL/ML)
14				18	Light gray, tan and reddish brown (10YR, 6/6) fine-medium SAND; wet; with silty sand lenses.	(SM)
19					End of Boring at 19'.	

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-12**
FILE: **95B165**
DATE: **2/19/96**
GEOLOGIST: **EJF**
APPROVED: **RCA**
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0–8				14	Loose, moist gray (10YR, 6/4) CLAY; with light gray and yellow brown sandy clay and traces of small gravel.	(CL)
9–16				18	Wet light gray (5YR, 7/1) and tan Clayey SILT.	(ML)
				18	---wet gray (5YR, 7/1) Clayey SILT with traces of tan fine Silty SAND.	(ML/SM)
17					End of Boring at 17'.	

Woodward-Clyde Consultants

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-13**
FILE: **95B165**
DATE: **2/14/96**
GEOLOGIST: **EJF**
APPROVED: **RCA**
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0 - 9				18	Medium dense Silty CLAY; light pinkish gray to light reddish brown (5YR, 6/2 - 6/3).	(CL)
9 - 14				18	Reddish gray (5YR, 5/2) Clayey SILT with traces of yellow-red fine sand and light gray silt.	(ML)
14 - 18				18	Dark gray to dark reddish brown (7.5YR, 5/0) dense Silty CLAY and Clayey SILT; grading to dark gray fine silty sand; wet.	(ML/SM)
18					End of Boring at 18'.	

Woodward-Clyde Consultants

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-14**
FILE: **95B165**
DATE: **2/13/96**
GEOLOGIST: **EJF**
APPROVED:
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0–9				17	Fine Silty SAND; light gray and tan in color (7.5YR, 7/0).	(SM)
9–13				18	Silty CLAY with traces of silt and fine sand; light to dark gray in color (7.5YR, 5/0); damp.	(CL)
13–17				18	Wet fine SAND, primarily gray with traces of tan and light brown (7.5YR, 6/0-7/0) fine sand.	(ML)
17					End of Boring at 17'.	

Woodward-Clyde Consultants

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-15**
FILE: **95B165**
DATE: **2/13/96**
GEOLOGIST: **EJF**
APPROVED:
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0–8				18	Fine Silty SAND; damp; gray (7.5YR, 7/0); traces of red and gray clay.	(SM)
9–12				18	Light gray to dark gray (7.5YR, 7/0) Clayey SILT, with traces of light brown silty sand; wet; dense.	(ML)
13–14				18	---Clayey SILT with lenses of coarse sand and gravel; wet; dense; gray with dark brown (7.5YR, 7/0).	(ML/GM)
15					End of Boring at 15'.	

Woodward-Clyde Consultants

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-16**
FILE: **95B165**
DATE: **2/12/96**
GEOLOGIST: **EJE**
APPROVED:
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0 – 9				15	Moist fine SAND and Silty SAND; tan - white in color (7.5YR, 7/7).	(SM)
9 – 14				12	Wet Sandy and Silty CLAY; gray in color (7.5YR, 7/0-7/6).	(CL)
14 – 17				20	Wet fine SAND and SILT, stiff; gray in color (7.5YR, 6/0).	(SM)
17					End of Boring at 17'.	

Woodward-Clyde Consultants

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-17**
FILE: **95B165**
DATE: **2/13/96**
GEOLOGIST: **EJF**
APPROVED: MO
PAGE: **1 of 1**

Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0-10				2	Red (10YR,4/6) Sandy CLAY.	(SC)
10				18	Pinkish gray (5YR, 6/2) fine Silty SAND with trace of gray clay.	(SM)
15				12	---light gray (5YR, 6/2) fine Silty SAND; dry; with a trace of tan SAND.	
20				18	---light gray (5YR, 7/1) fine SAND and Silty SAND, with traces of yellow fine sand and dark gray clay.	
25				18	---light gray (5YR-7.5YR, 7/0) fine SAND; damp.	
30				18	---light gray (7.5YR, 7/0) fine SAND and silt; wet.	
34					End of Boring at 34'.	

Woodward-Clyde Consultants

LOG OF BORING

PROJECT: **Monitor Well Installation**
LOCATION: **El Dorado, Arkansas**

CLIENT: **El Dorado Chemical Company**
El Dorado, Arkansas
DRILLER: **Anderson Engineering**

BORING: **MWEDC-18**
FILE: **95B165**
DATE: **2/22/96**
GEOLOGIST: **EJE**
APPROVED:
PAGE: **1 of 1**

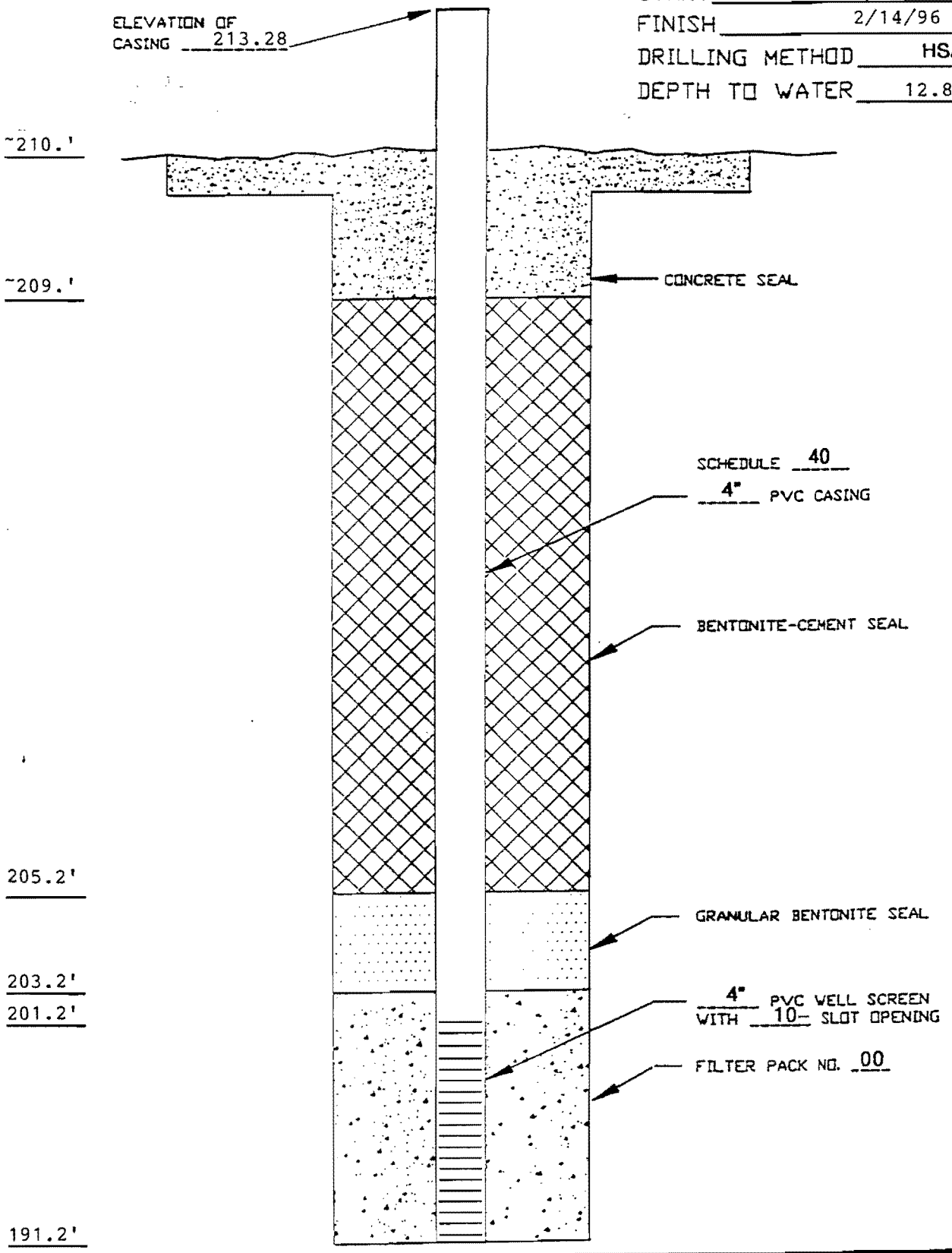
Hollow-stem Augered:

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	Recovery (inch)	Description of Stratum	
0						
1						
2						
3						
4				18	Damp to wet gray (5YR, 5/1) Clayey SILT.	(ML)
5						
6						
7						
8						
9				18	Wet light brown-yellow brown (5YR, 7/1) fine to medium SAND with traces of light gray silty sand.	(SM)
10						
11						
12						
13						
14					End of Boring at 14'.	

Woodward-Clyde Consultants

APPENDIX A
MONITORING WELL COMPLETION DIAGRAMS

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-1
START 2/14/96
FINISH 2/14/96
DRILLING METHOD HSA
DEPTH TO WATER 12.86'



EL DORADO CHEMICAL COMPANY EL DORADO, ARKANSAS	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	MONITORING WELL CONSTRUCTION DIAGRAM	FILE NO 95B165 FIG. NO
SCALE:	DRAWN BY: / DATE:	CHKD. BY: EF / DATE: 5/96	

SITE EL DORADO CHEMICAL CO.

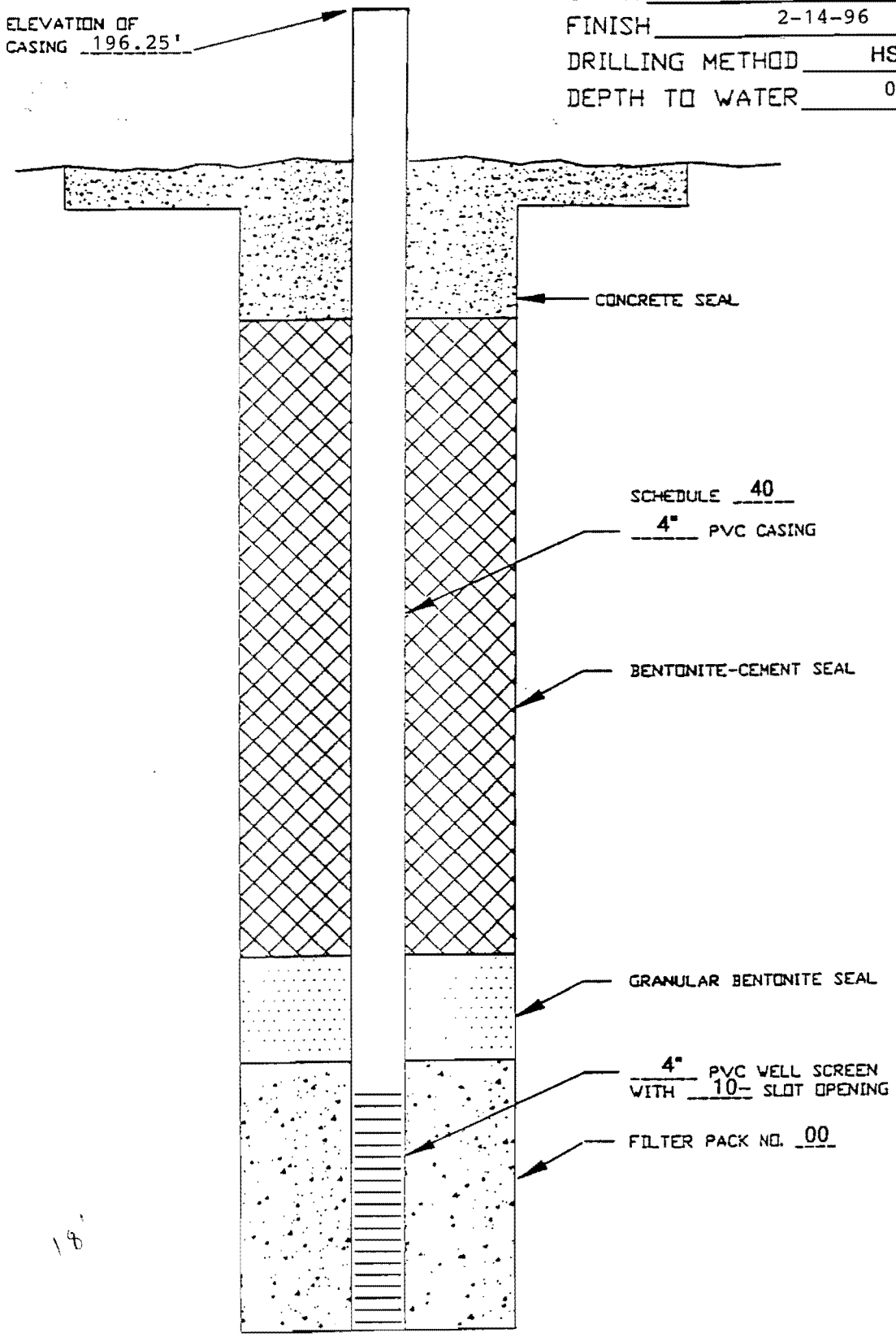
WELL NUMBER MW-EDC-2

START 2-14-96

FINISH 2-14-96

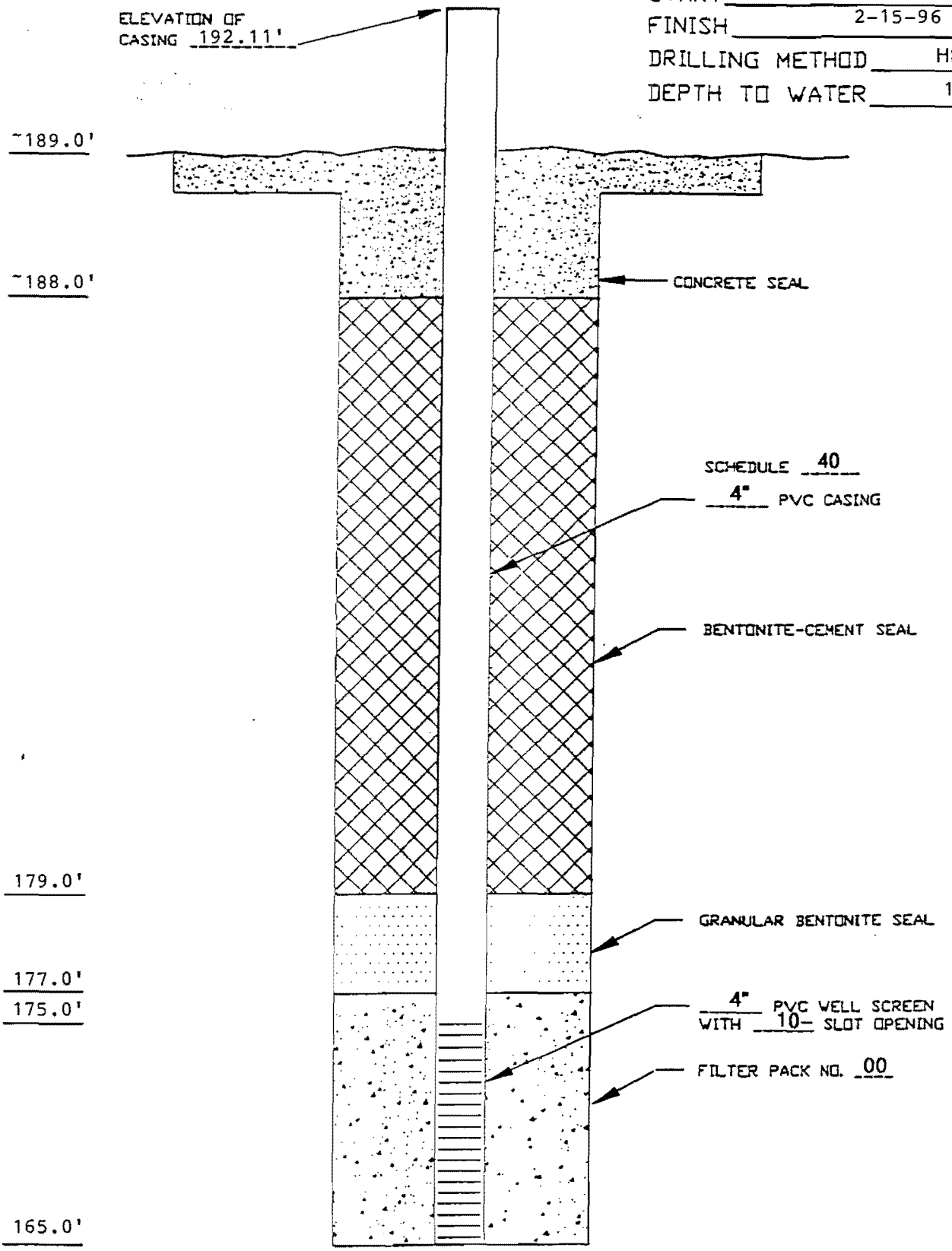
DRILLING METHOD HSA

DEPTH TO WATER 0.84'



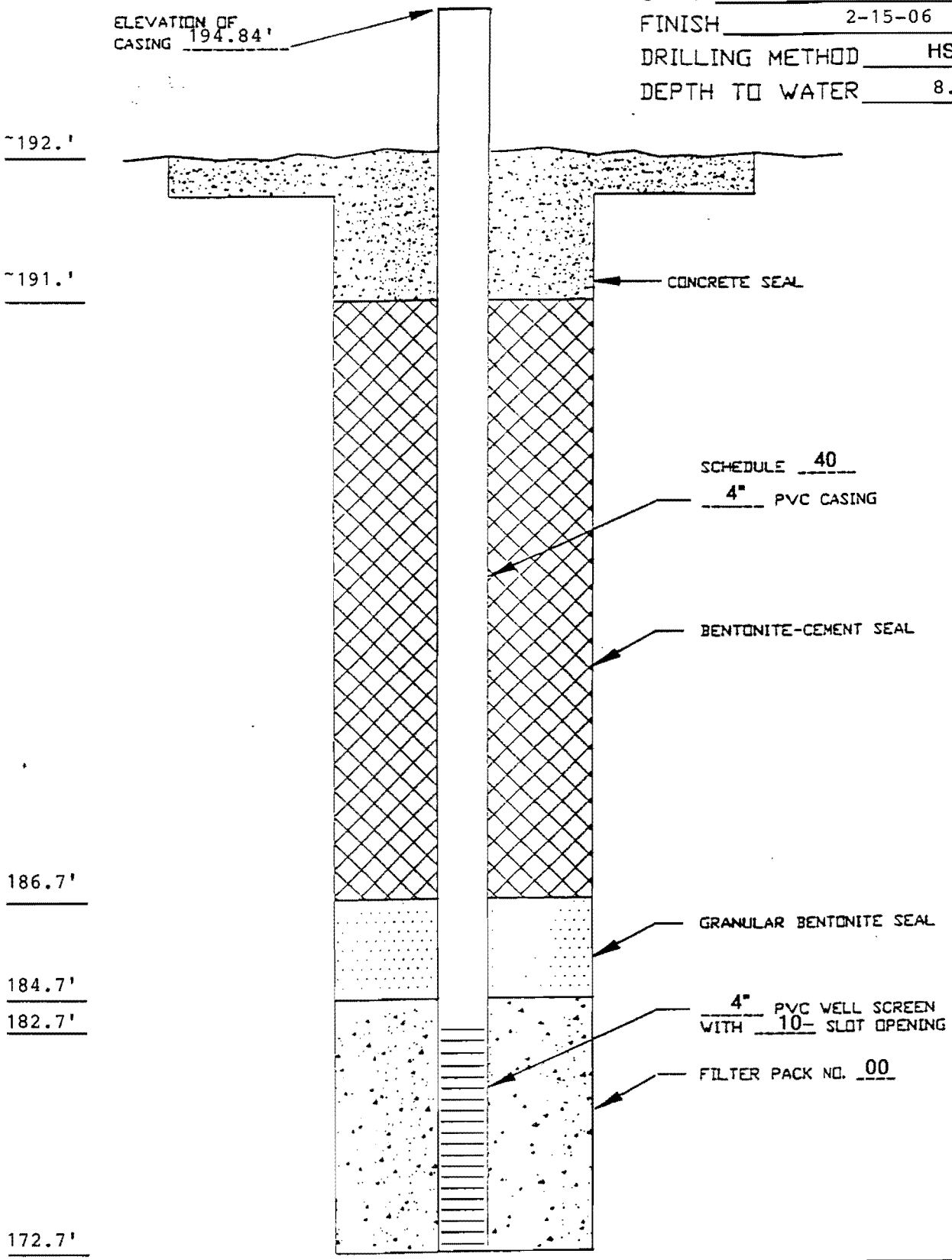
EL DORADO CHEMICAL COMPANY EL DORADO, ARKANSAS	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	MONITORING WELL CONSTRUCTION DIAGRAM	FILE NO 95B165 FIG. NO
	SCALE: DRAWN BY: DATE: CHKD. BY: DATE: 5/96		

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-3
START 2-15-96
FINISH 2-15-96
DRILLING METHOD HSA
DEPTH TO WATER 10.77'



EL DORADO CHEMICAL COMPANY EL DORADO, ARKANSAS	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	MONITORING WELL CONSTRUCTION DIAGRAM	FILE NO 95B165 FIG. NO
	SCALE: DRAWN BY: DATE: CHKD. BY: DATE: 5/96		

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-4
START 2-15-96
FINISH 2-15-06
DRILLING METHOD HSA
DEPTH TO WATER 8.79'



EL DORADO CHEMICAL COMPANY
EL DORADO, ARKANSAS

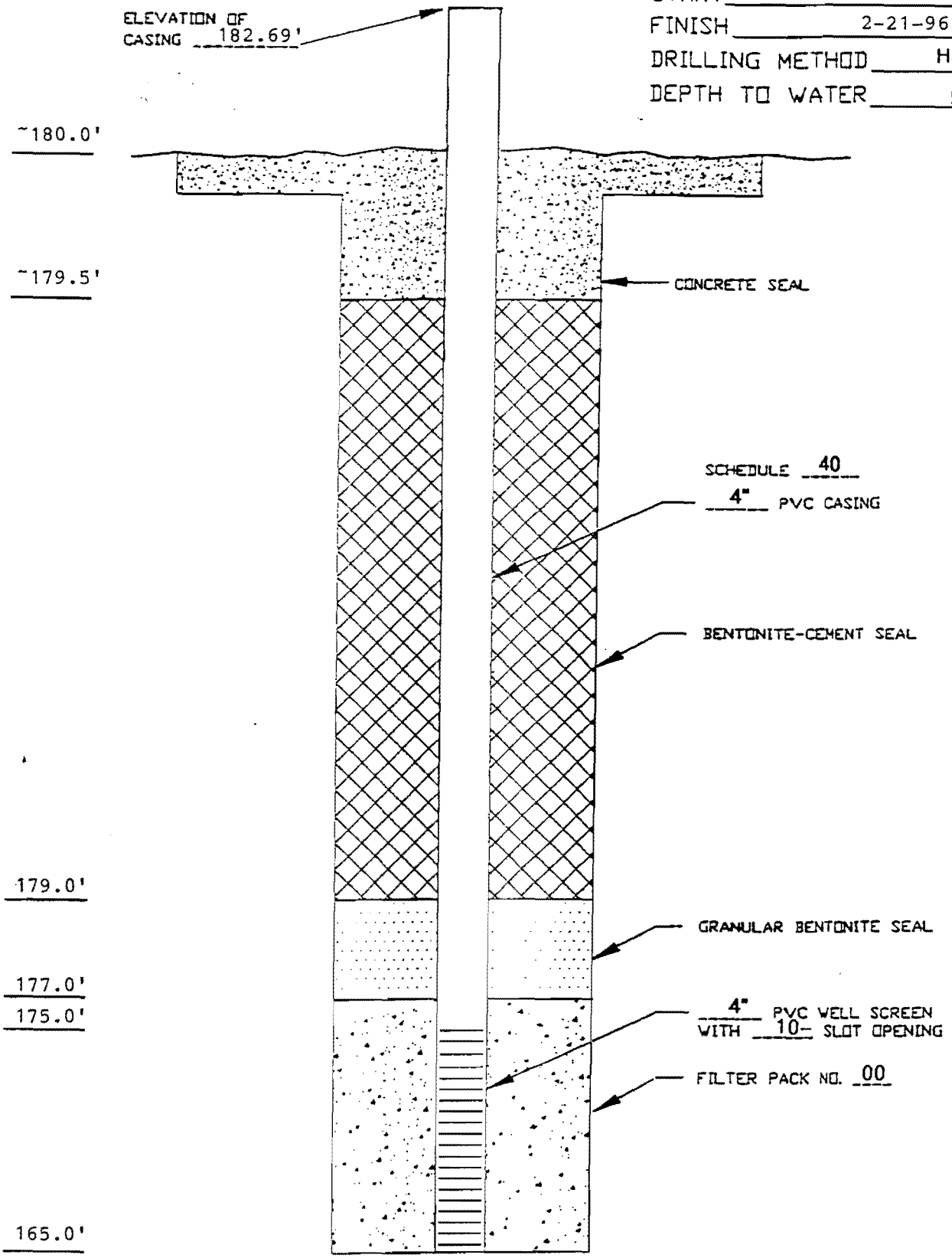
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Little Rock, Arkansas

MONITORING WELL CONSTRUCTION DIAGRAM

FILE NO 95B165
FIG. NO

SCALE:	DRAWN BY:	DATE:
	CHKD. BY: EF	DATE: 5/96

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-5
START 2-21-96
FINISH 2-21-96
DRILLING METHOD HSA
DEPTH TO WATER 5.04'



EL DORADO CHEMICAL COMPANY EL DORADO, ARKANSAS	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	MONITORING WELL CONSTRUCTION DIAGRAM	FILE NO 95B165 FIG. NO
	SCALE: / DRAWN BY: / DATE: / CHKD. BY: / DATE: 5/96		

SITE EL DORADO CHEMICAL CO.

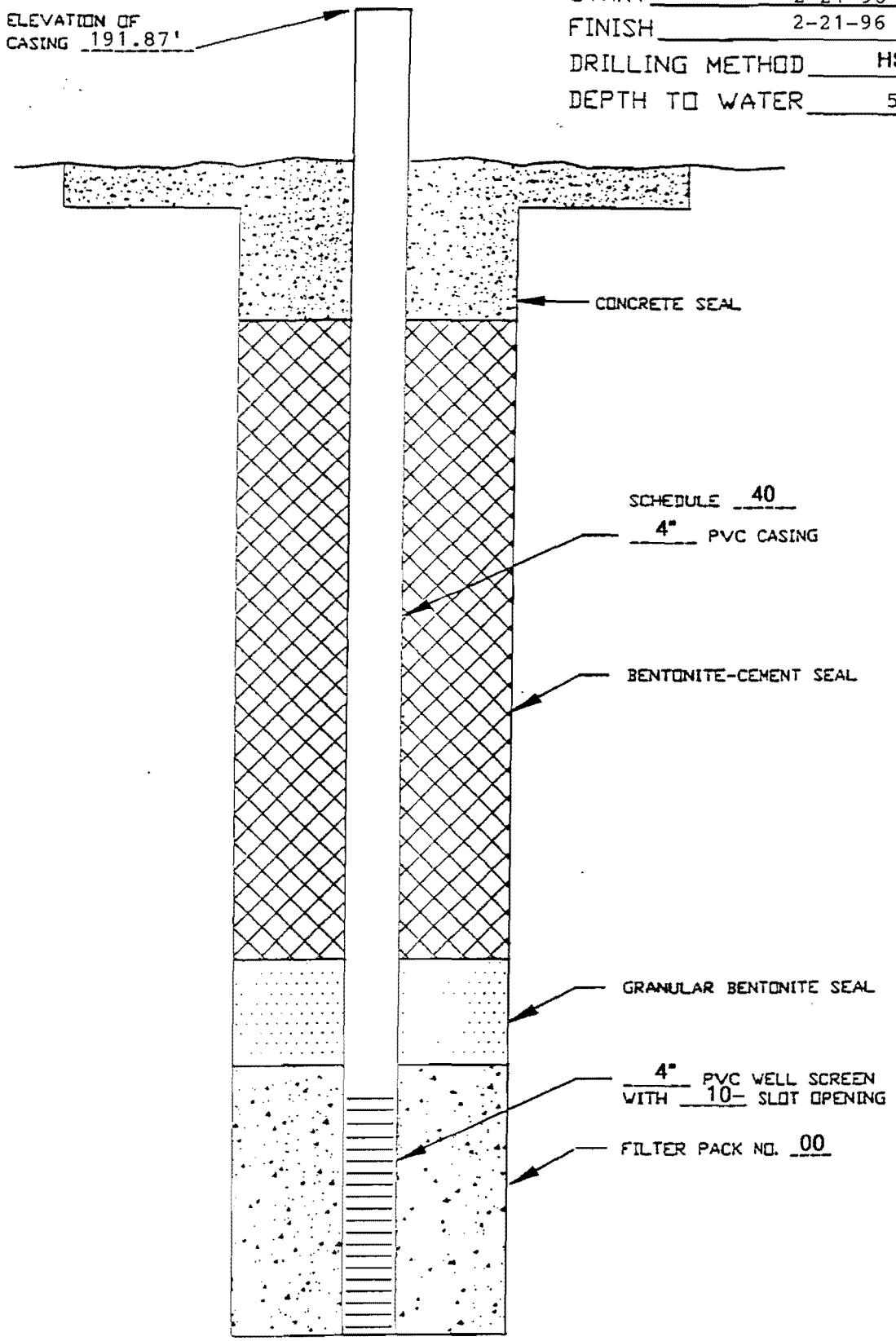
WELL NUMBER MW-EDC-6

START 2-21-96

FINISH 2-21-96

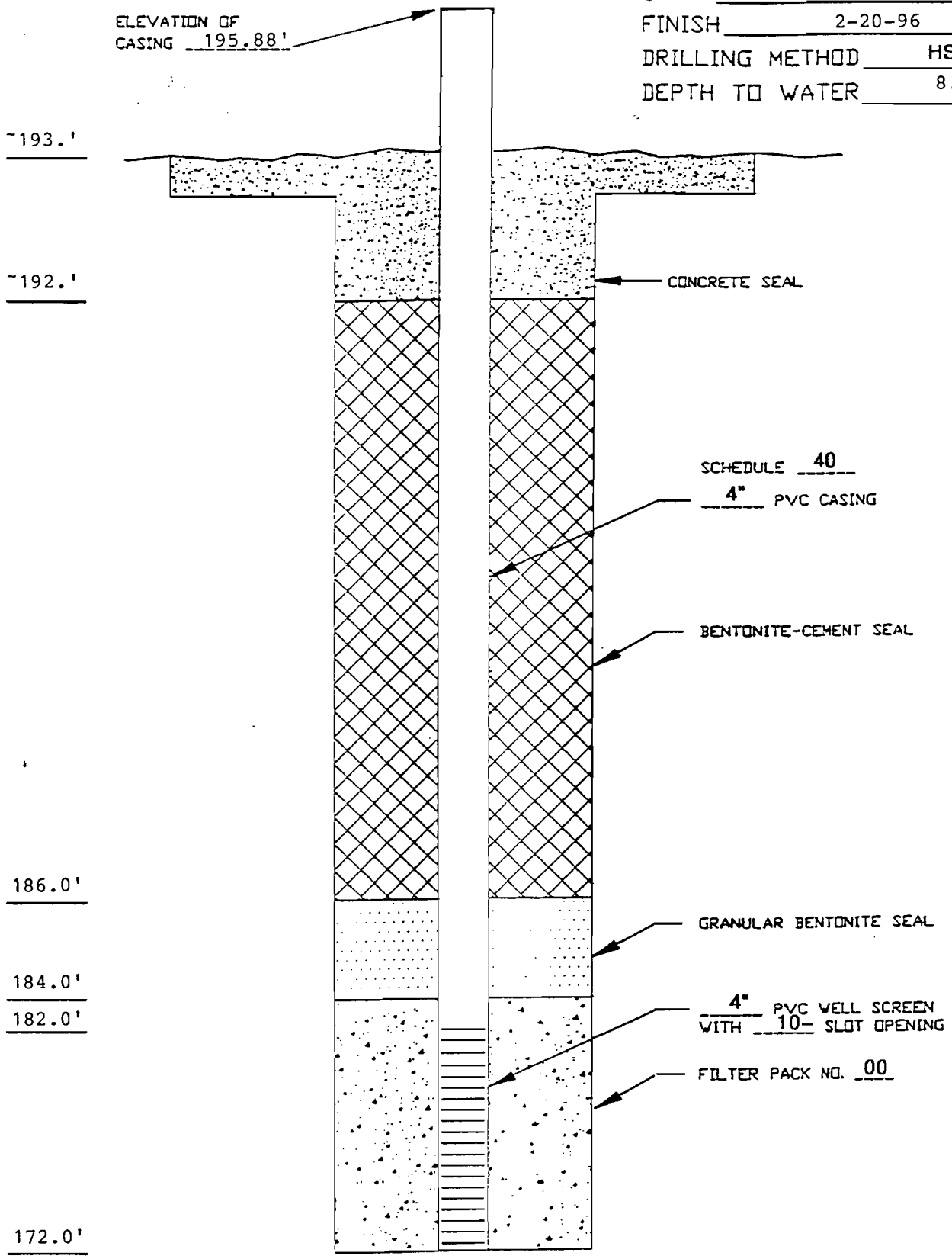
DRILLING METHOD HSA

DEPTH TO WATER 5.73'



EL DORADO CHEMICAL COMPANY EL DORADO, ARKANSAS	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	MONITORING WELL CONSTRUCTION DIAGRAM	FILE NO. 95B165 FIG. NO
SCALE:	DRAWN BY: / DATE:	CHKD. BY: EF / DATE: 5/96	

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-7
START 2-20-96
FINISH 2-20-96
DRILLING METHOD HSA
DEPTH TO WATER 8.45'



EL DORADO CHEMICAL COMPANY EL DORADO, ARKANSAS	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	MONITORING WELL CONSTRUCTION DIAGRAM	FILE NO. 95B165 FIG. NO
	SCALE: DRAWN BY: DATE: CHKD. BY: DATE: 5/96		

SITE EL DORADO CHEMICAL CO.

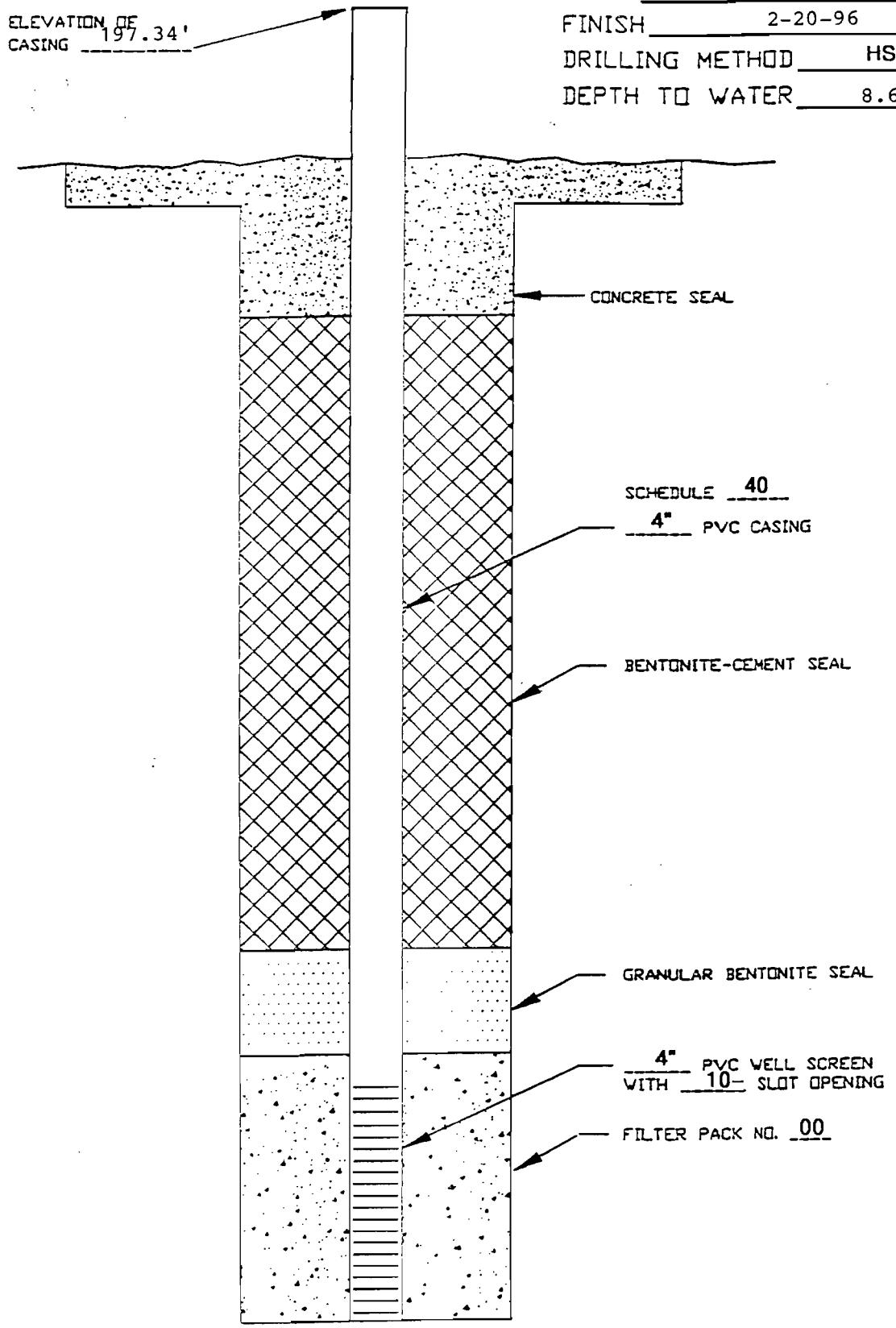
WELL NUMBER MW-EDC-8

START 2-20-96

FINISH 2-20-96

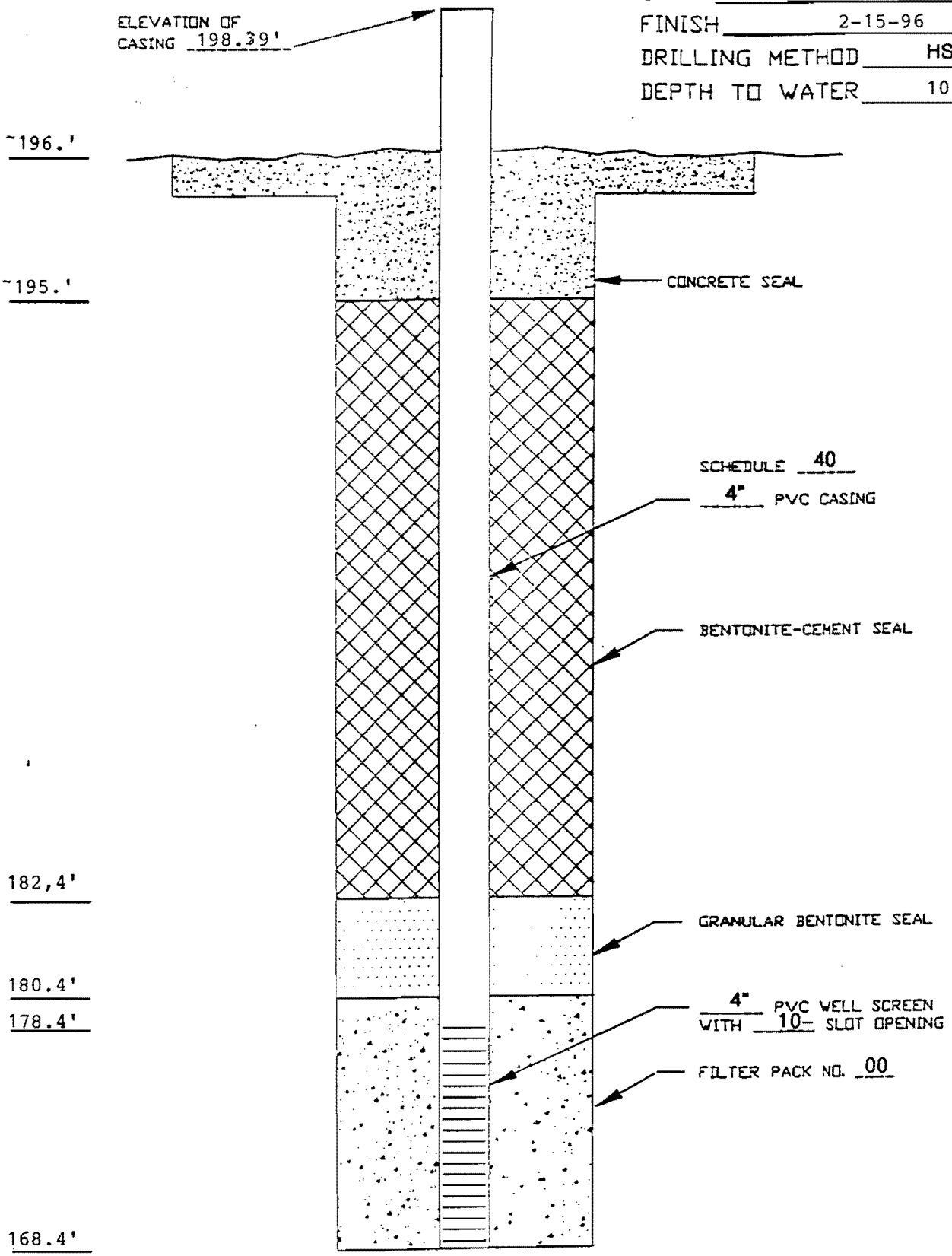
DRILLING METHOD HSA

DEPTH TO WATER 8.69'



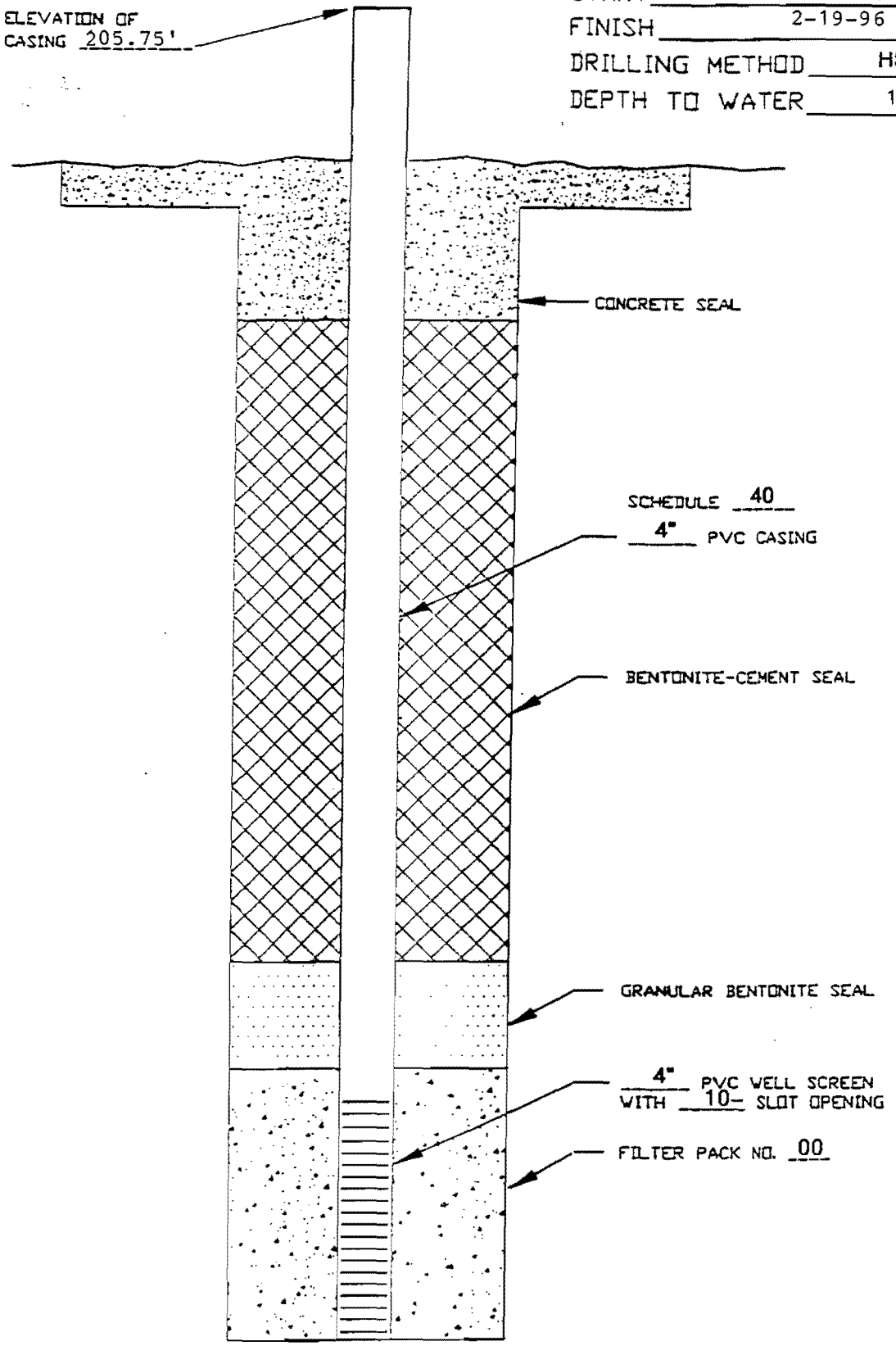
EL DORADO CHEMICAL COMPANY EL DORADO, ARKANSAS	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	MONITORING WELL CONSTRUCTION DIAGRAM	FILE NO 95B165 FIG. NO
	SCALE: / DRAWN BY: / DATE: / CHKD. BY: / DATE: 5/96		

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-9
START 2-15-96
FINISH 2-15-96
DRILLING METHOD HSA
DEPTH TO WATER 10.43'



EL DORADO CHEMICAL COMPANY EL DORADO, ARKANSAS	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	MONITORING WELL CONSTRUCTION DIAGRAM	FILE NO 95B165 FIG. NO
	SCALE: / DRAWN BY: / DATE: / CHKD. BY: EF / DATE: 5/96		

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-10
START 2-19-96
FINISH 2-19-96
DRILLING METHOD HSA
DEPTH TO WATER 14.06'



EL DORADO CHEMICAL COMPANY
EL DORADO, ARKANSAS

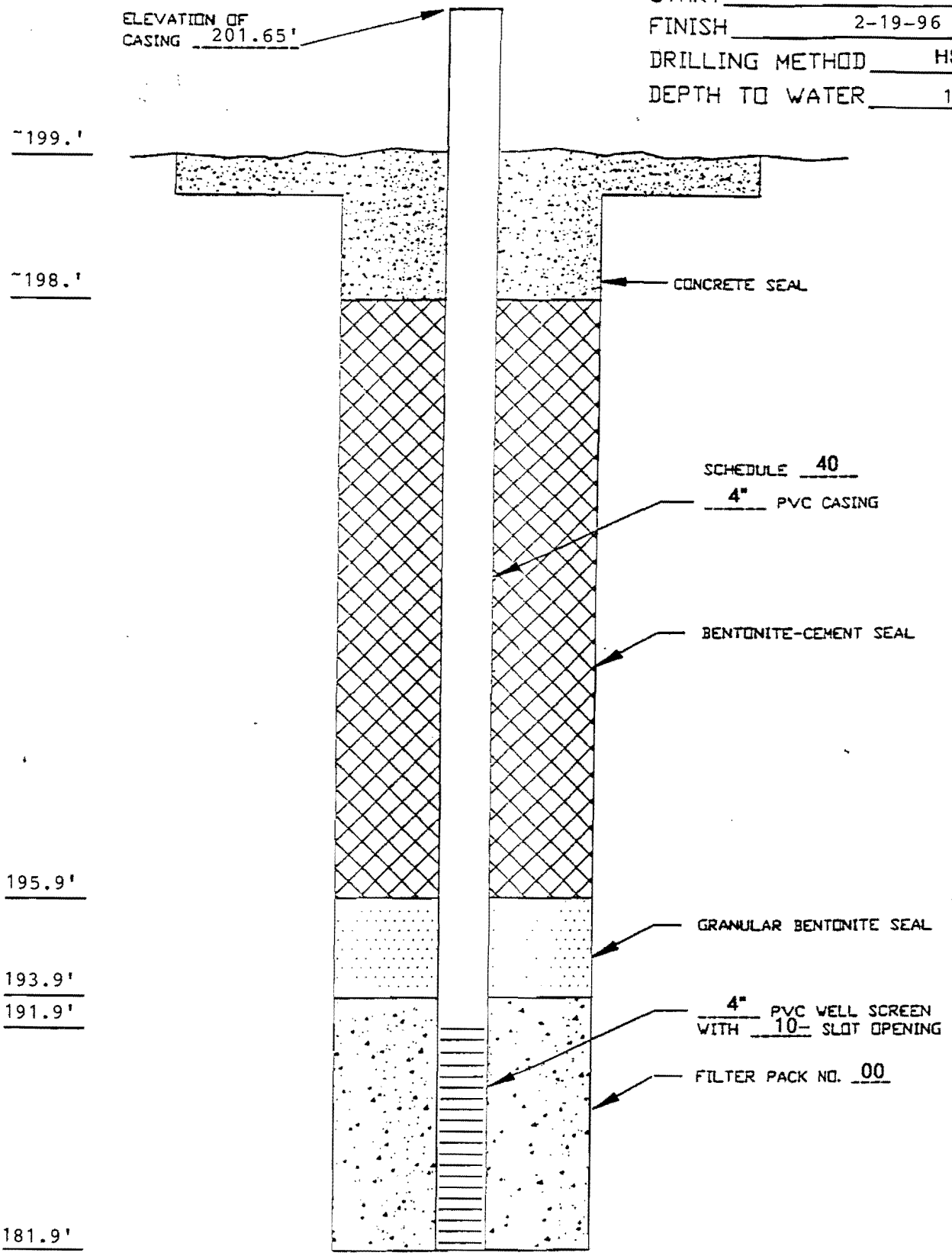
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Little Rock, Arkansas

MONITORING WELL CONSTRUCTION DIAGRAM

FILE NO. 95B165
FIG. NO

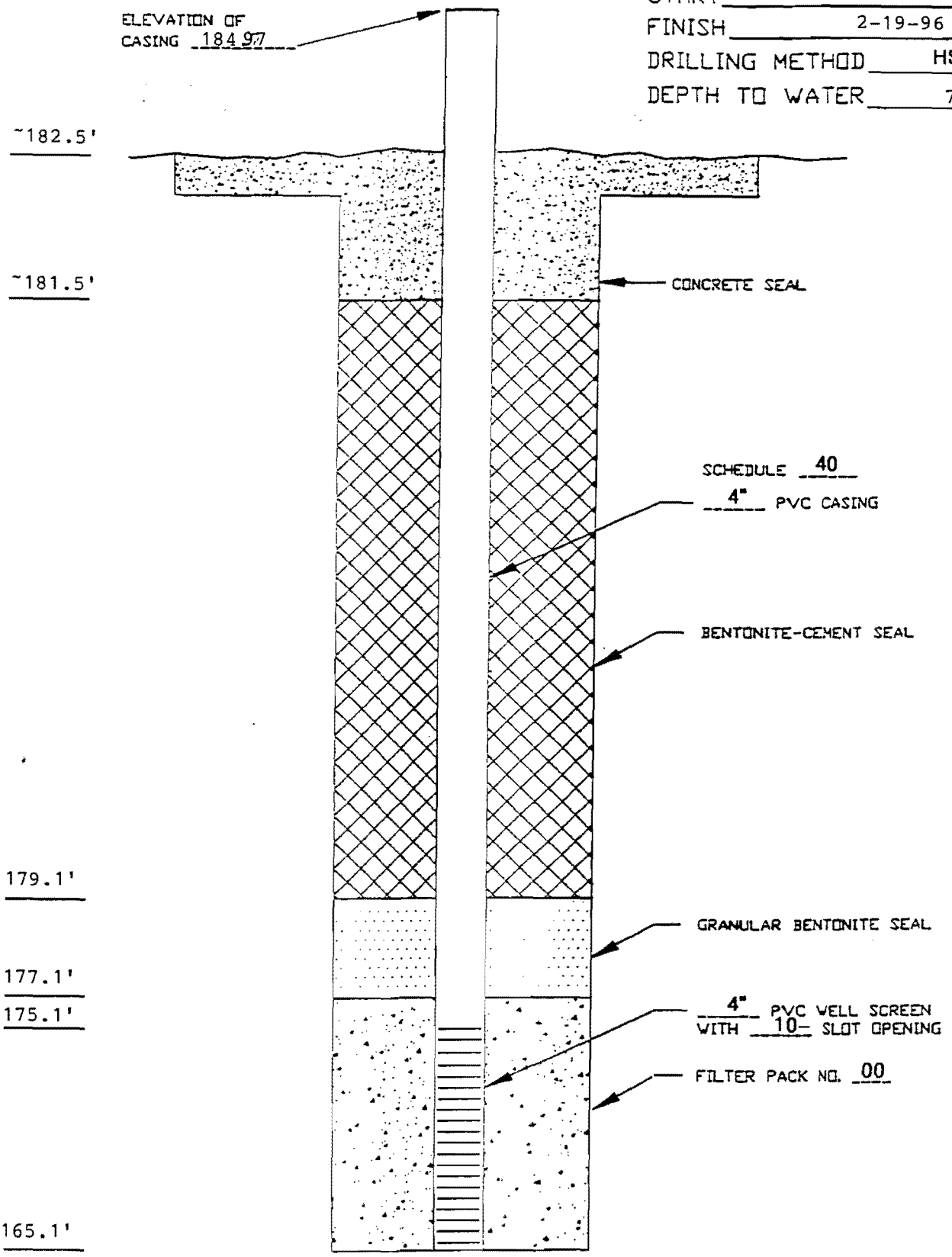
SCALE:	DRAWN BY:	DATE:
	CHKD. BY:	DATE: 5/96

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-11
START 2-19-96
FINISH 2-19-96
DRILLING METHOD HSA
DEPTH TO WATER 11.07'



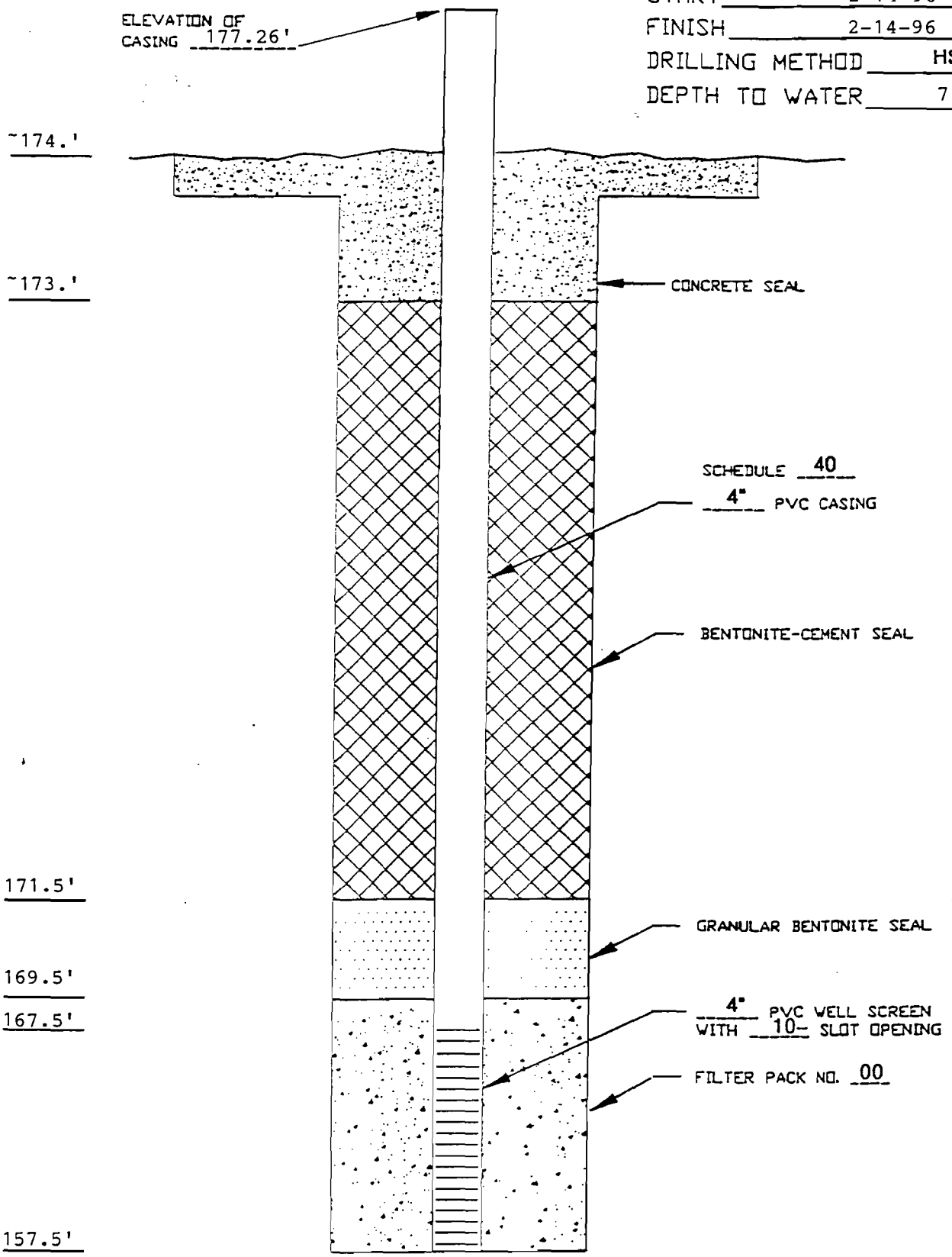
EL DORADO CHEMICAL COMPANY EL DORADO, ARKANSAS	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	MONITORING WELL CONSTRUCTION DIAGRAM	FILE NO 95B165 FIG. NO
	SCALE: / DRAWN BY: / DATE: / CHKD. BY: EE / DATE: 5/96		

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-12
START 2-19-96
FINISH 2-19-96
DRILLING METHOD HSA
DEPTH TO WATER 7.11'



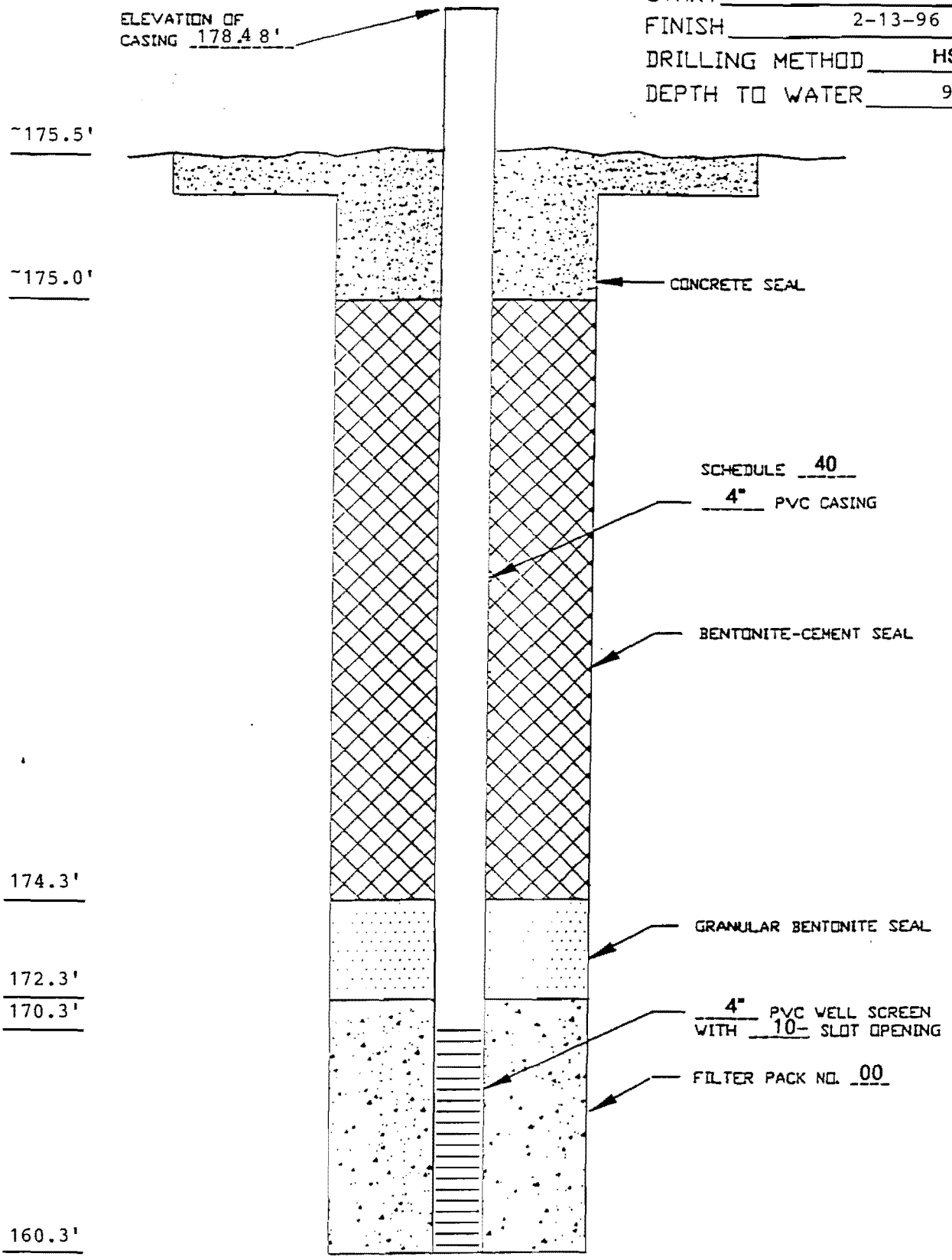
EL DORADO CHEMICAL COMPANY EL DORADO, ARKANSAS	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	MONITORING WELL CONSTRUCTION DIAGRAM	FILE NO 95B165 FIG. NO
	SCALE: / DRAWN BY: / DATE: / CHKD. BY: EF / DATE: 5/96		

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-13
START 2-14-96
FINISH 2-14-96
DRILLING METHOD HSA
DEPTH TO WATER 7.02'



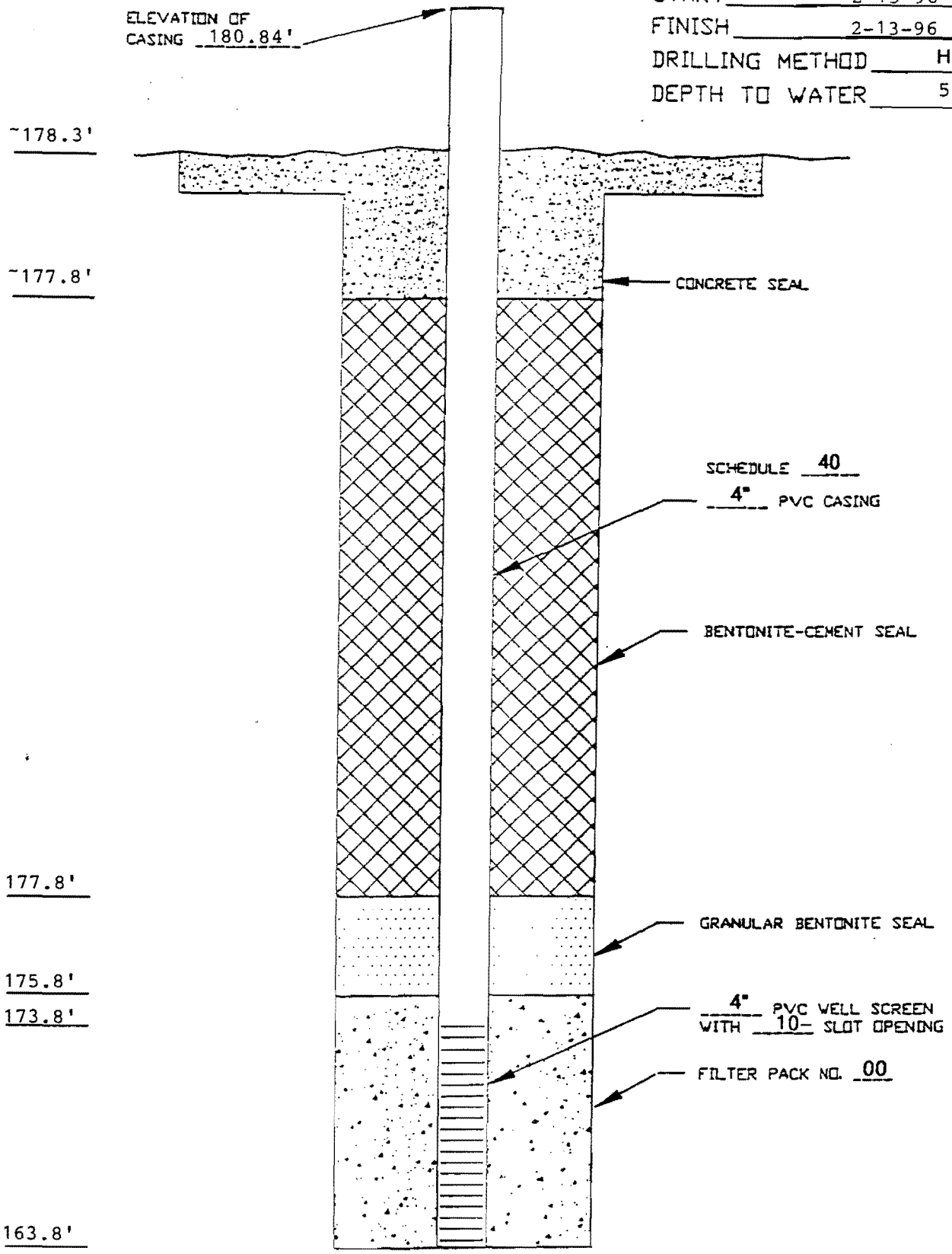
EL DORADO CHEMICAL COMPANY EL DORADO, ARKANSAS	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	MONITORING WELL CONSTRUCTION DIAGRAM	FILE NO. 95B165 FIG. NO
	SCALE: DRAWN BY: DATE: CHKD. BY: EF DATE: 5/96		

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-14
START 2-13-96
FINISH 2-13-96
DRILLING METHOD HSA
DEPTH TO WATER 9.86'



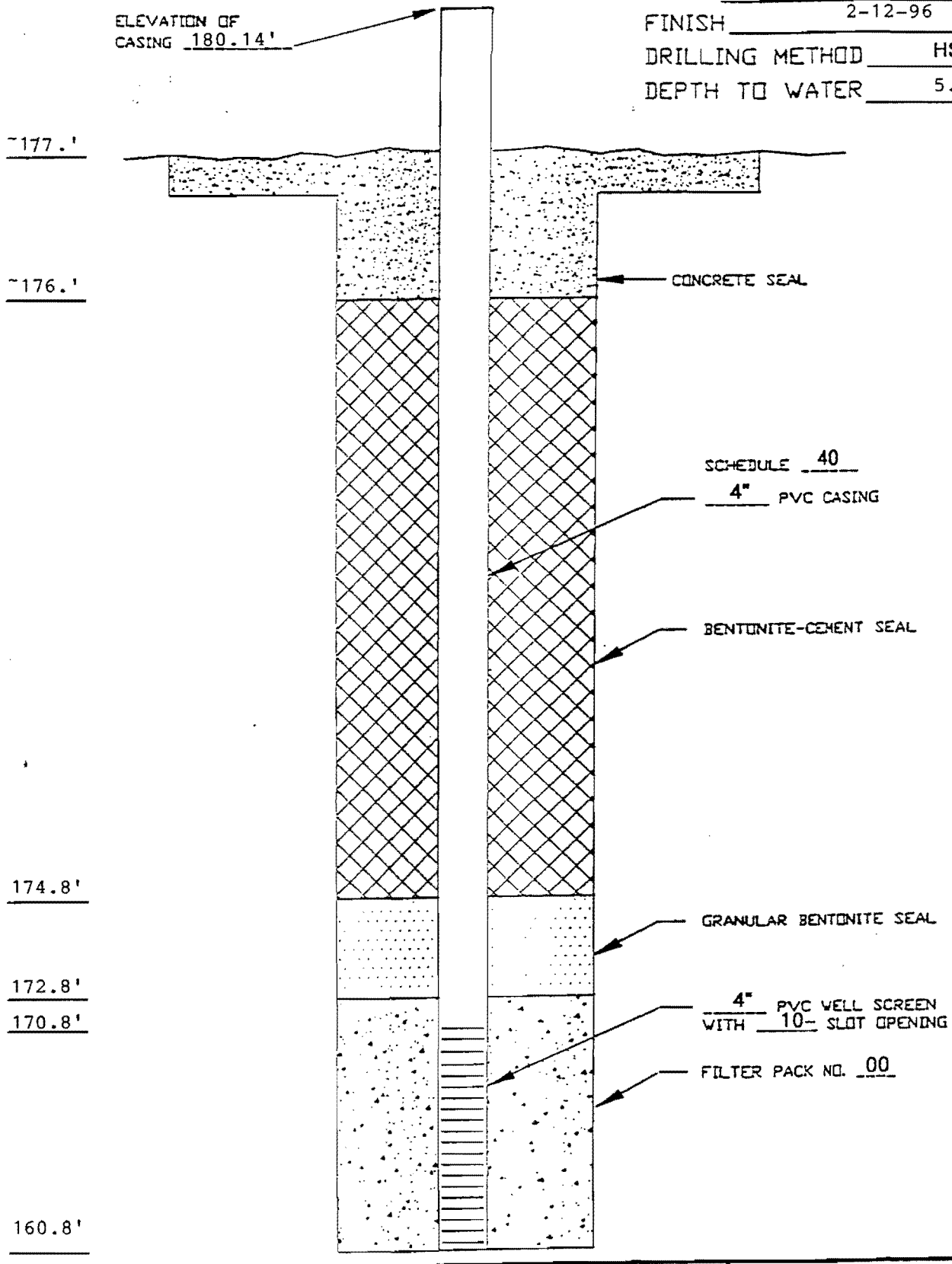
EL DORADO CHEMICAL COMPANY EL DORADO, ARKANSAS	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	MONITORING WELL CONSTRUCTION DIAGRAM	FILE NO 95B165 FIG. NO
SCALE:	DRAWN BY: / DATE:	CHKD. BY: EF / DATE: 5/96	

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-15
START 2-13-96
FINISH 2-13-96
DRILLING METHOD HSA
DEPTH TO WATER 5.81'



EL DORADO CHEMICAL COMPANY EL DORADO, ARKANSAS	Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Little Rock, Arkansas	MONITORING WELL CONSTRUCTION DIAGRAM	FILE NO. 95B165 FIG. NO
	SCALE: / DRAWN BY: / DATE: / CHKD. BY: EF / DATE: 5/96		

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-16
START 2-12-96
FINISH 2-12-96
DRILLING METHOD HSA
DEPTH TO WATER 5.80'



EL DORADO CHEMICAL COMPANY
EL DORADO, ARKANSAS

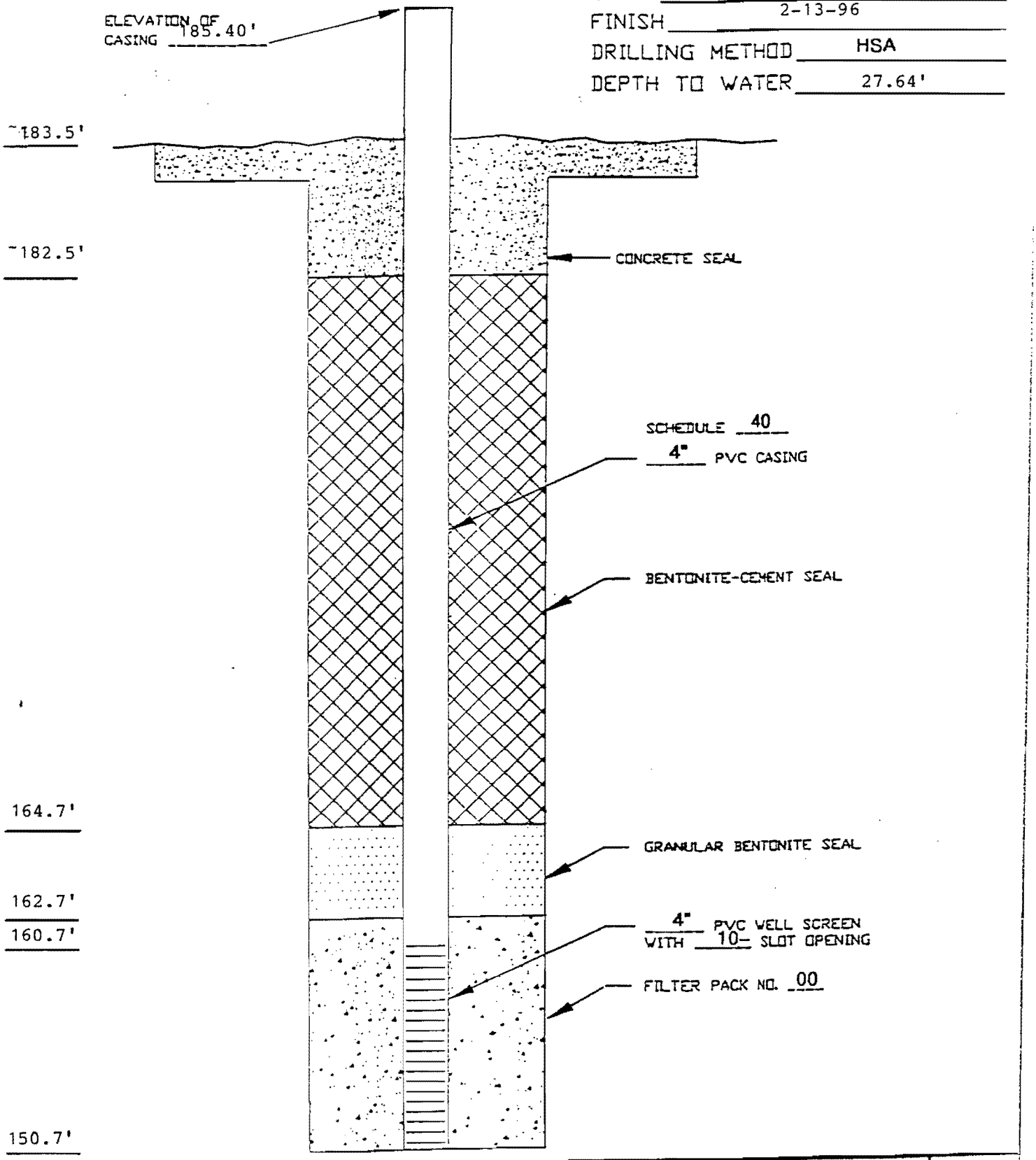
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Little Rock, Arkansas

MONITORING WELL CONSTRUCTION DIAGRAM

FILE NO 95B165
FIG. NO

SCALE:
DRAWN BY:
DATE:
CHKD. BY:
DATE: 3/96

SITE EL DORADO CHEMICAL CO.
WELL NUMBER MW-EDC-17
START 2-13-96
FINISH 2-13-96
DRILLING METHOD HSA
DEPTH TO WATER 27.64'



EL DORADO CHEMICAL COMPANY
EL DORADO, ARKANSAS

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Little Rock, Arkansas

MONITORING WELL CONSTRUCTION DIAGRAM

FILE NO 95B165
FIG. NO

SCALE:
DRAWN BY:
DATE:
CHKD. BY: EF
DATE: 5/96

SITE EL DORADO CHEMICAL CO.

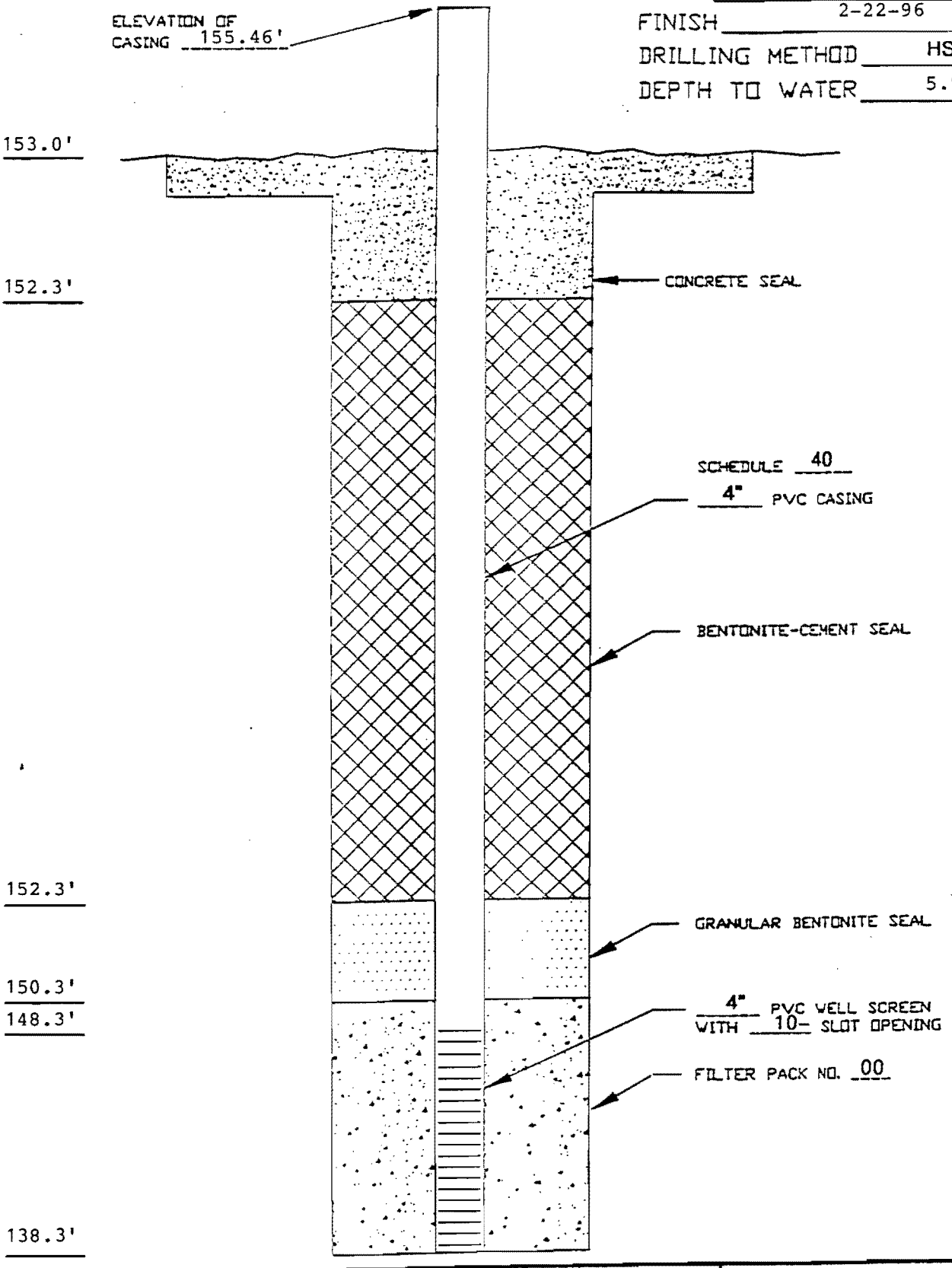
WELL NUMBER MW-EDC-18

START 2-22-96

FINISH 2-22-96

DRILLING METHOD HSA

DEPTH TO WATER 5.90'



EL DORADO CHEMICAL COMPANY

EL DORADO, ARKANSAS

Woodward-Clyde Consultants

Consulting Engineers, Geologists and Environmental Scientists

Little Rock, Arkansas

SCALE:

DRAWN BY:

DATE:

CHKD BY:

DATE: 5/96

MONITORING WELL CONSTRUCTION DIAGRAM

FILE NO 95B165

FIG. NO

EL DORADO CHEMICAL CO.

EL DORADO, ARKANSAS

Woodward-Clyde Consultants

Consulting Engineers, Geologists and Environmental Scientists

Baton Rouge, Louisiana

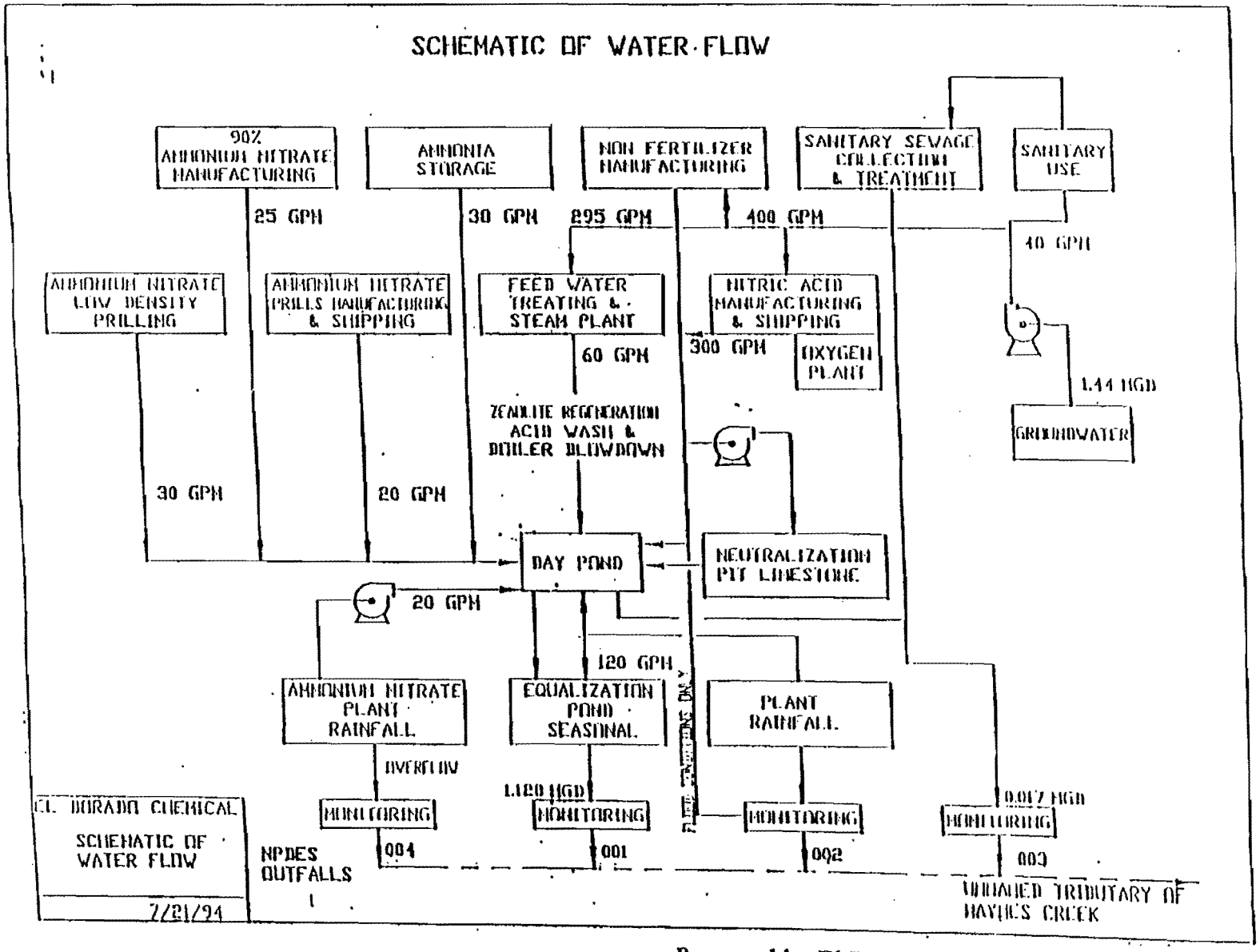
DRAWN BY: CRS

DATE: 8-23-95

PLANT DRAINAGE AND DISCHARGE DIAGRAM

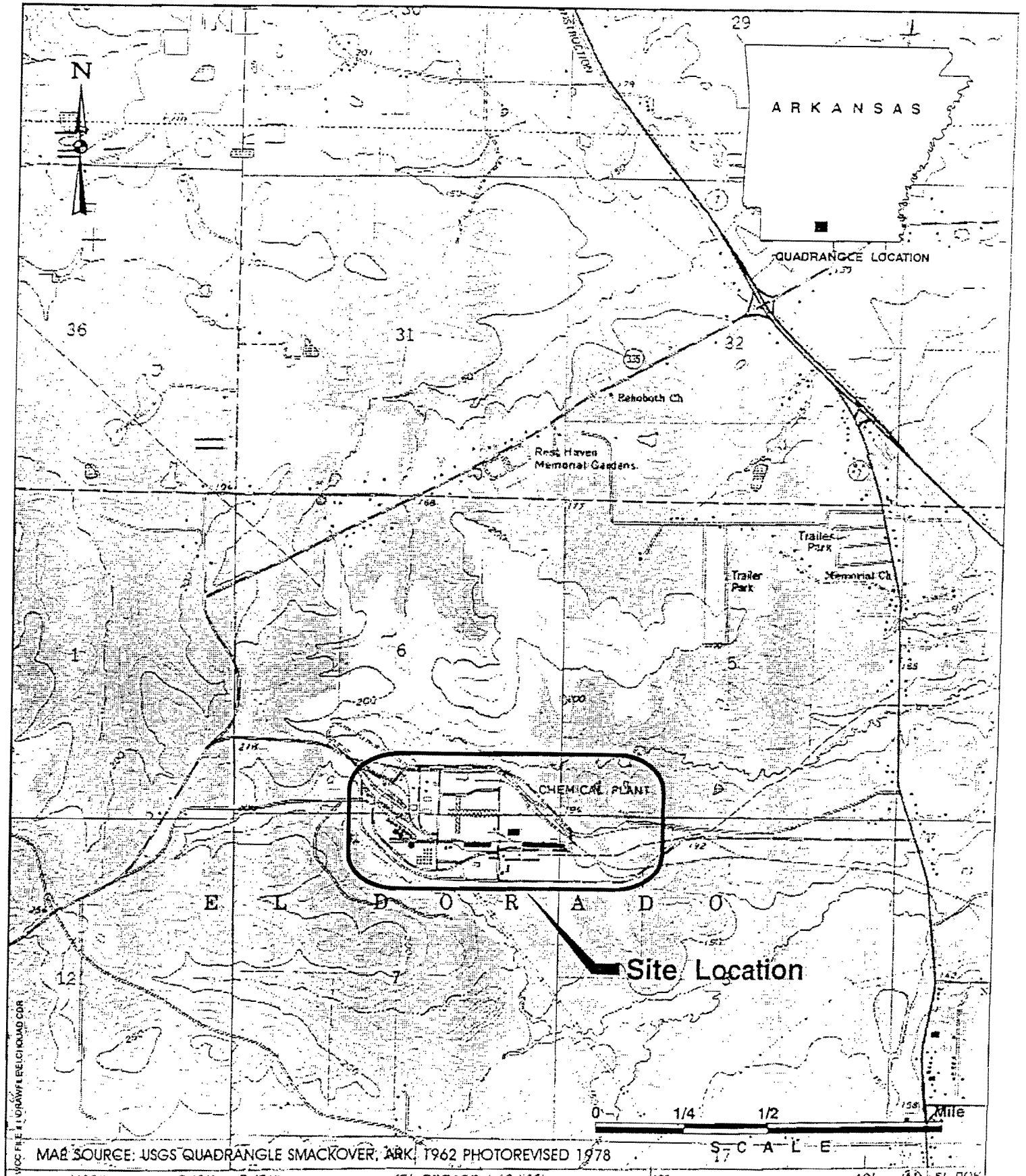
FILE NC 95B165

FIG. NC 3



Prepared by El Dorado Chemical Company

FIGURES



EL DORADO CHEMICAL COMPANY
El Dorado, Arkansas

Woodward-Clyde
Engineering & sciences applied to the earth & its environment
Little Rock, Arkansas

SCALE:	DRAWN BY: D.OLSON	DATE: 05/25/95
AS SHOWN	CHKD. BY: E. FOX	DATE: 05/27/95

EL DORADO CHEMICAL COMPANY
SITE LOCATION MAP

FILE NO. 95B165

FIG. NO. 1

Pb .123

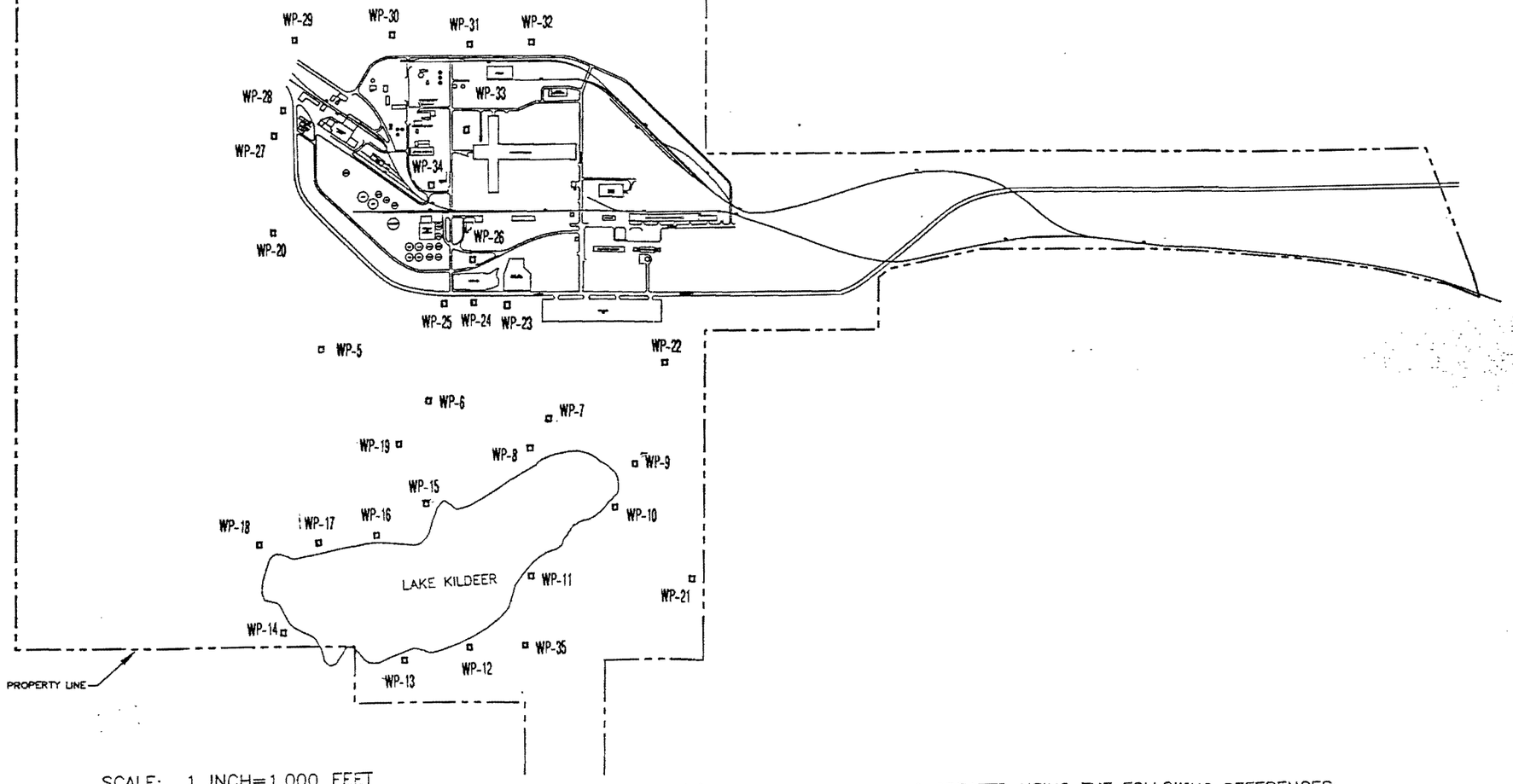
Pb .052

PROPERTY LINE

MCL's -

NITRATE - 10 ppm
SULFATE - 400 mg/L
Pb - 15 ppb
Cr - 100 ppb

N



SCALE: 1 INCH=1,000 FEET

1,000' 0 1,000'

NOTE: THIS DRAWING WAS CREATED USING THE FOLLOWING REFERENCES;
1. EL DORADO CHEMICAL CO. PLOT PLAN, DWG. NO. 7045-1.
2. SMITH-ROBERTS AND ASSOSSIATES TRACT LOCATION MAP (QUAD), SC31,663C DWG. NO. SHT.4.
3. BALL AND PAULUS SURVEYORS, INC. JOB NO. 181F-95, MONITORING WELLS.

REV	DESCRIPTION OF REVISION	BY	DATE
△			

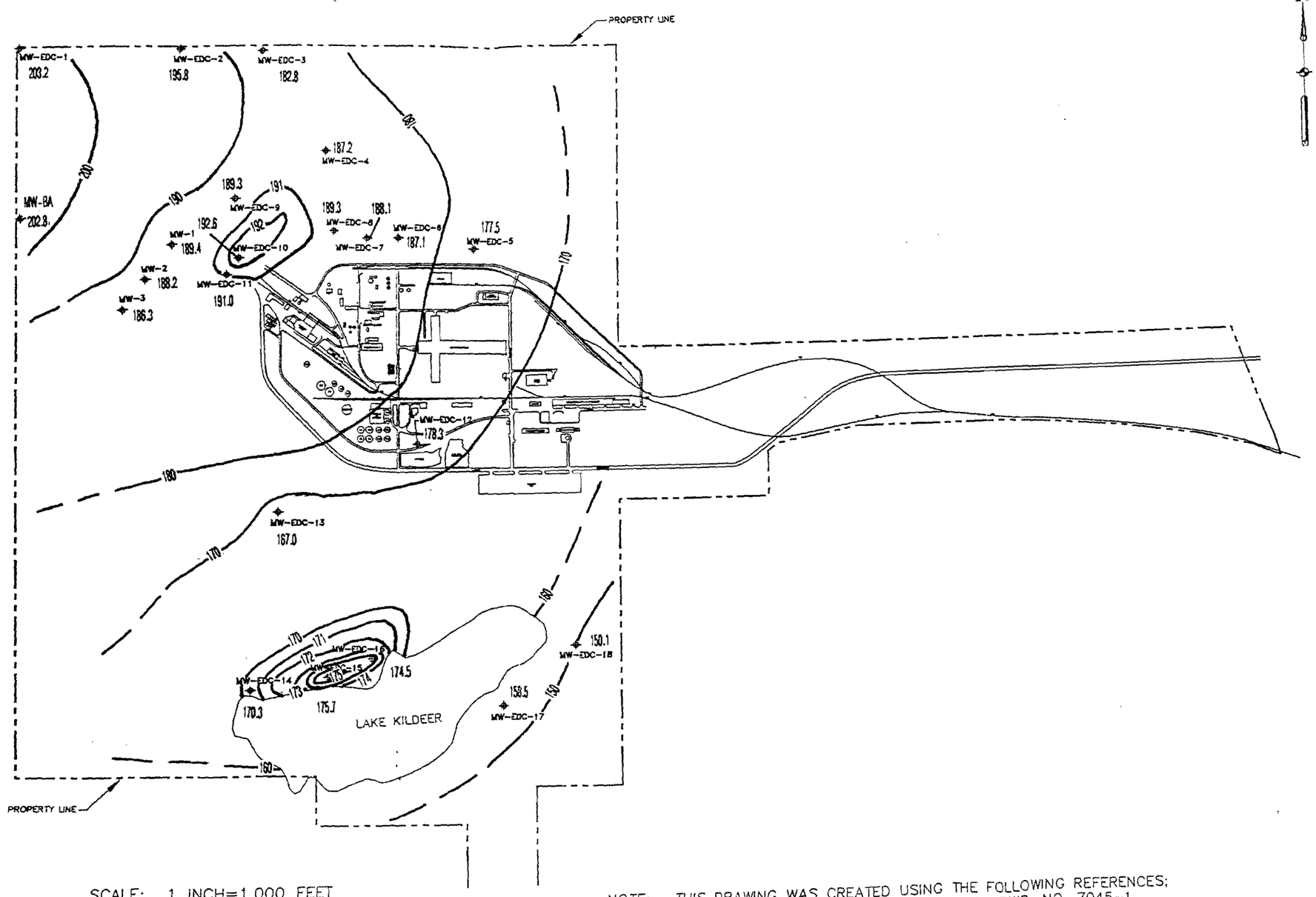
EL DORADO CHEMICAL COMPANY

Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment
900 S. Shackleford, Suite 412
Little Rock, Arkansas 72211

SCALE	1"=1,000'
DESIGNED	
DRAWN	GAT
CHECKED	EF
PEER REVIEWED	
DATE	04/01/96

APPROXIMATE PHASE I WELL POINT LOCATIONS

REVISION	△
PROJECT	95B165
DRAWING	4



SCALE: 1 INCH=1,000 FEET

1,000' 0 1,000'

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (MSL)

NOTE: THIS DRAWING WAS CREATED USING THE FOLLOWING REFERENCES;
1. EL DORADO CHEMICAL CO. PLOT PLAN, DWG. NO. 7045-1.
2. SMITH-ROBERTS AND ASSOSSIATES TRACT LOCATION MAP (QUAD), SC31,663C DWG. NO. SHT.4.
3. BALL AND PAULUS SURVEYORS, INC. JOB NO. 181F-95, MONITORING WELLS.

REV	DESCRIPTION OF REVISION	BY	DATE
△			
△			
△			
△			
△			
△			

EL DORADO CHEMICAL COMPANY

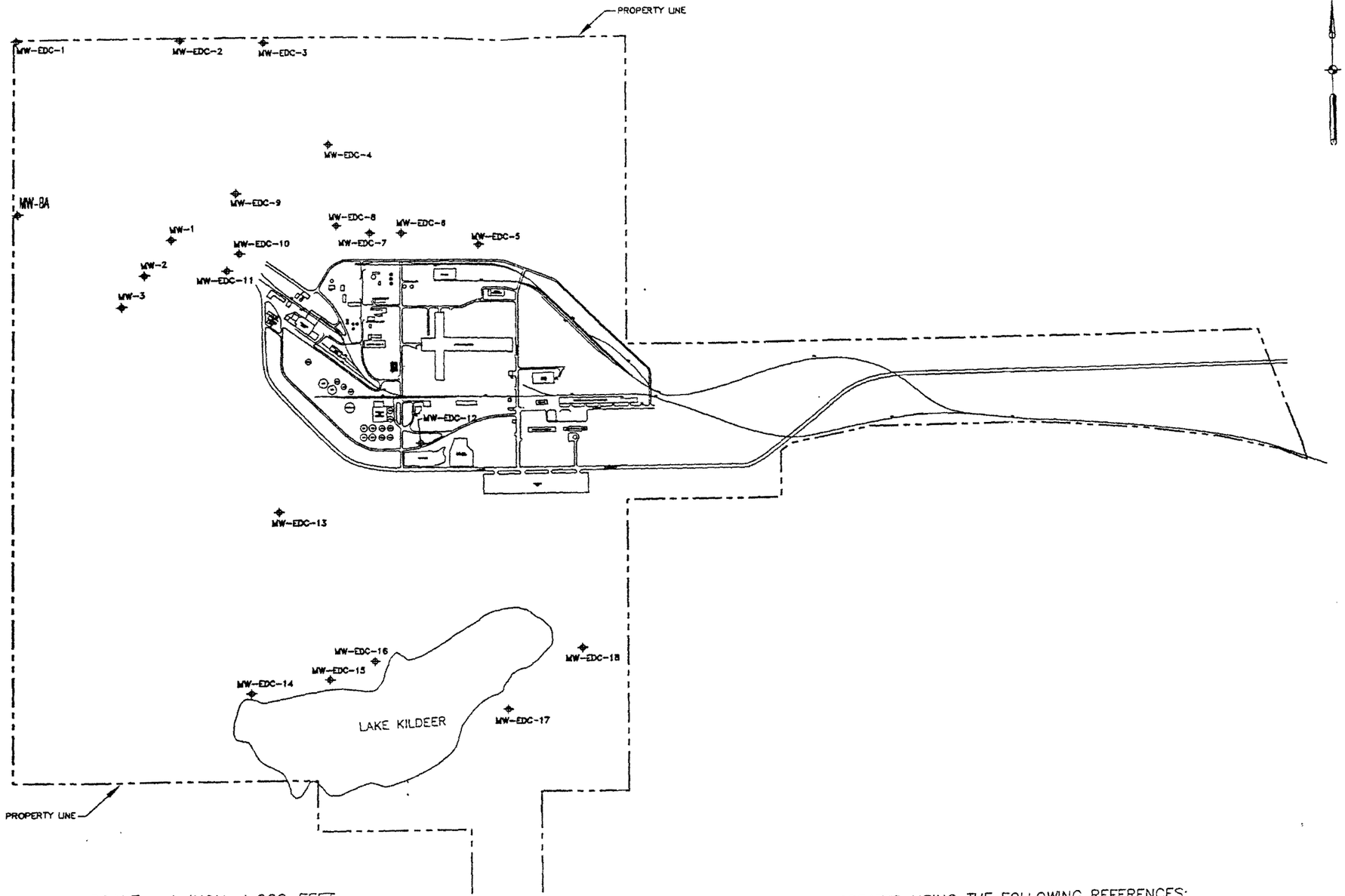
Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment
900 S. Shackleford, Suite 412
Little Rock, Arkansas 72211

SCALE: 1"=1,000'
DESIGNED:
DRAWN: CAT
CHECKED: EF
PEER REVIEW:
DATE: 04/01/96

Contour Interval: 10 feet except where shown.

WATER TABLE MAP

REVISION: △
PROJECT: 958165
DRAWING: 6



SCALE: 1 INCH=1,000 FEET

1,000' 0 1,000'

NOTE: THIS DRAWING WAS CREATED USING THE FOLLOWING REFERENCES;
1. EL DORADO CHEMICAL CO. PLOT PLAN, DWG. NO. 7045-1.
2. SMITH-ROBERTS AND ASSOSSIATES TRACT LOCATION MAP (QUAD), SC31,663C DWG. NO. SHT.4.
3. BALL AND PAULUS SURVEYORS, INC. JOB NO. 181F-95, MONITORING WELLS.

REV	DESCRIPTION OF REVISION	BY	DATE
△			
△			
△			
△			
△			
△			

EL DORADO CHEMICAL COMPANY

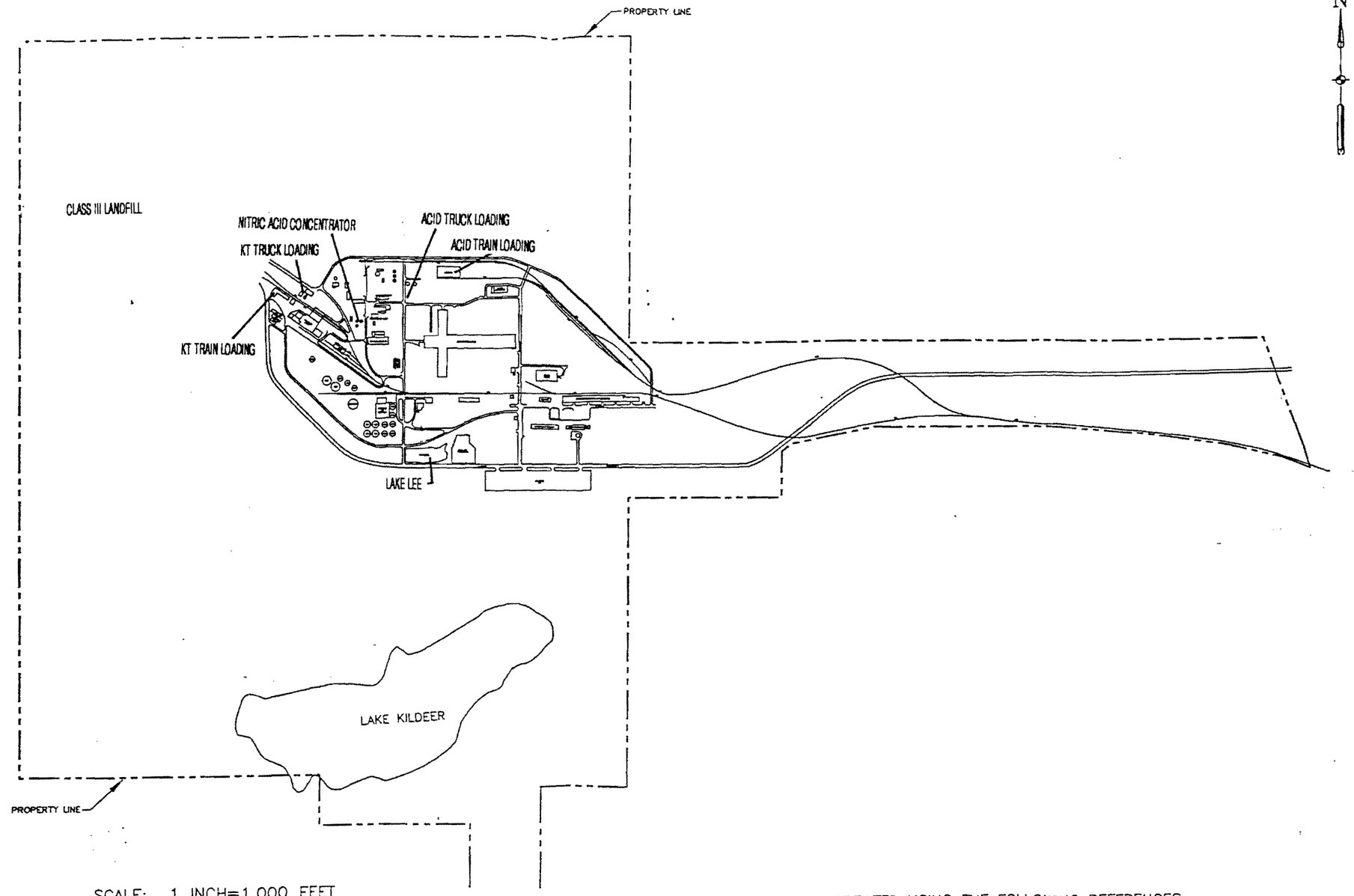
Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment
900 S. Shackleford, Suite 412
Little Rock, Arkansas 72211

SCALE	1"=1,000'
DESIGNED	
DRAWN	GAT
CHECKED	EF
PEER REVIEWED	
DATE	04/01/96

SITE MAP AND MONITORING WELL LOCATIONS

REVISION	△
PROJECT	95B165
DRAWING	5

K:\CAD-GIS\ELDORADO\95B16504 Thu May 02 09:36:02 1996



SCALE: 1 INCH=1,000 FEET

1,000' 0 1,000'

NOTE: THIS DRAWING WAS CREATED USING THE FOLLOWING REFERENCES;
1. EL DORADO CHEMICAL CO. PLOT PLAN, DWG. NO. 7045-1.
2. SMITH-ROBERTS AND ASSOSSIATES TRACT LOCATION MAP (QUAD), SC31,663C DWG. NO. SHT.4.
3. BALL AND PAULUS SURVEYORS, INC. JOB NO. 181F-95, MONITORING WELLS.

REV	DESCRIPTION OF REVISION	BY	DATE
△			
△			
△			
△			
△			
△			

EL DORADO CHEMICAL COMPANY

Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment
900 S. Shackleford, Suite 412
Little Rock, Arkansas 72211

SCALE	1"=1,000'
DESIGNED	
DRAWN	GAT
CHECKED	EF
PEER REVIEWED	
DATE	04/01/96

SITE MAP WITH AREAS OF POTENTIAL CONCERN

REVISION	△
PROJECT	95B165
DRAWING	2

K:\CAD-GIS\ELDORADO\95B16504 Thu May 02 09:36:02 1996