GW - 355

MONITORING REPORTS

DATE:

7/95

TRANSWESTERN PIPELINE COMPANY

Bell Lake Plant
Lea County, New Mexico

FINAL

Monitoring Well Installation and Intrinsic Bioremediation Evaluation Report

July, 1995

TRANSWESTERN PIPELINE COMPANY

BELL LAKE PLANT
LEA COUNTY, NEW MEXICO

FINAL

MONITORING WELL INSTALLATION AND INTRINSIC BIOREMEDIATION EVALUATION REPORT

JULY, 1995

July 17, 1995

Mr. Larry Campbell
Transwestern Pipeline Company
P.O. Box 1717
Roswell, New Mexico 88202-1717

1820-02

Subject: Monitor Well Installation and Intrinsic Bioremediation Evaluation at the Bell Lake Plant, Lea County, New Mexico

Dear Mr. Campbell:

Brown and Caldwell is pleased to submit this letter report to Transwestern Pipeline Company summarizing the results of the monitor well installation and intrinsic bioremediation evaluation conducted at the Bell Lake Plant. The field work was conducted between December 3 and 17, 1994.

Introduction

Brown and Caldwell conducted this project to obtain data on the dissolved phase volatile organic plume down gradient of known impacted areas and to evaluate the feasibility of intrinsic bioremediation and monitoring as a remediation alternative. The Bell Lake Plant is located in Lea County, approximately 25 miles northwest of Jal, New Mexico. Figure 1 is a site location map, identifying the subject property and surrounding area.

Geology

According to the New Mexico Bureau of Mines and Mineral Resources, the site is situated in an area of recent Quaternary alluvial and terrace deposits. The surface materials covering this area of Lea County, New Mexico consist of loosely consolidated sands and gravelly sands. The uppermost stratigraphic unit underlying the site is the Santa Rosa formation. This formation consists of interbedded sandstones and gravels.

The strata encountered to approximately 35 feet below grade during the investigation was loosely consolidated sands and gravelly sands. Below 35 feet, and extending for approximately four feet, is a consolidated sandstone, which is cemented and contains irregular layers of chert. Strata encountered below the cherty sandstone are interbedded siltstones and sandstones to a maximum exploration depth of 100 feet.

Field Activities

During the course of this project, three monitor wells were installed, soil and groundwater samples were collected and the horizontal hydraulic conductivity of the saturated zone was determined using slug tests. One monitor wells was positioned on site and two monitor wells were positioned offsite on adjacent property to the east. Figure 2 depicts the monitor well locations on the adjoining property, as well as previously installed wells on site. Soil borings were drilled using a truck-mounted, air rotary drill rig. Soil samples were collected with a two-foot-long, three-inch-diameter split spoon sampler from a depth of approximately 38 feet, which corresponded to just above a cherty consolidated sandstone, and from just above the groundwater capillary fringe, at typical depth of 90 feet.

Upon removal from the split spoon sampler, half of each sample was placed in a labelled laboratory cleaned jar and placed on ice. The other sample half was placed in a sealable plastic bag. After several minutes, the headspace area in the plastic bag was monitored for organic vapors using an flame ionization detector (FID). The FID readings are shown on the boring logs presented in Appendix A. At the conclusion of sampling, the containerized samples were shipped to Terra Laboratories in League City, Texas for laboratory analysis using chain-of-custody procedures. Upon receipt by the laboratory, the samples were logged in and assigned the numbers shown on the analytical reports presented in Appendix B.

Soil samples from each boring were collected from intervals representative of the aquifer, and submitted for grain size distribution determination to Geotest Engineering, Inc. in Houston, Texas. Additionally, the soil samples from each boring collected from the interval representative of the groundwater capillary fringe were submitted for laboratory counts of total bacteria and bacteria which degrade hydrocarbons. The samples submitted for bacteria counts were placed on ice in laboratory supplied jars, and shipped via common carrier to Advanced Biological Solutions in Deerfield Beach, Florida using chain-of-custody procedures.

Prior to drilling and between each boring, the pilot bit and all other downhole equipment were cleaned with a high pressure steam cleaner. Sampling equipment was cleaned by washing with a laboratory grade detergent solution, rinsing with tap water, and performing a final rinse with distilled water. Soil cuttings derived from drilling activities were placed on plastic sheeting adjacent to each well. Monitor well development and purge water was placed in dehydrator system tanks located at the Bell Lake Plant.

The three monitor wells were installed to a depth of approximately 100 feet. Groundwater was encountered at approximately 90 feet below ground level. The wells were constructed of two-

inch-diameter Schedule 40-PVC with 15 feet of 0.01-inch slotted well screen. The screen was emplaced with the top five feet above groundwater and the lower ten feet of screen in groundwater. Well construction details are included on the boring logs in Appendix A. Monitor wells were developed by manual surging and bailing, with approximately five well volumes of water removed from each well.

The relative elevation of the top of each well casing was determined using a surveying level mounted on a tripod. Prior to sample collection, static water levels were recorded for each monitor well with a dual-interface oil/water probe. All data was recorded to the nearest 0.01 foot. Table 1 presents the top of casing survey elevations, the groundwater depths, and the groundwater elevations. Groundwater elevations are shown on the groundwater gradient map, included as Figure 3. Based on this data, the groundwater beneath the property has a hydraulic gradient of 0.002 feet per foot, to the southeast.

A teflon bailer was used to purge at least three well volumes of groundwater from each well prior to sampling. During purging of monitor wells, at intervals of approximately one well volume, groundwater parameters of temperature, pH, and specific conductance were recorded. When at least three well volumes of water were removed, and two consecutive well volumes yielded measurements for temperature, pH, and specific conductance within 10 percent of each other, the groundwater was considered representative of formation water. A groundwater sample was collected, after water returned to the earlier recorded static level, using a new disposable bailer for each well. Dissolved oxygen, Redox potential and ferrous iron were also measured during groundwater sampling activities. These measurements, along with other groundwater parameters measured during field sampling, are presented on Table 2. The groundwater samples were placed in labelled, laboratory cleaned bottles and placed on ice. At the conclusion of the sampling, the samples were shipped to Terra Laboratories in League City, Texas using chain-of-custody procedures.

On December 17, 1994, hydraulic conductivity tests were performed on two monitor wells, MW-3 and MW-5. Rising head (slug out) tests were performed using a Model SE 1000C Hermit Environmental Data Logger. The slug consisted of a 1.5-inch diameter by 7.5 foot long PVC cylinder attached to a dedicated rope. First, the data logger pressure transducer probe was lowered into the well. Next, the slug was placed in the well and the water level allowed to return to equilibrium. The slug was then removed from the well while simultaneously activating the data logger. The change of height of the water column was recorded at logarithmic time intervals until the well reached equilibrium.

After the data collection process was completed, the saturated hydraulic conductivity of the screened formation was calculated. Graphical solutions and calculations were performed using AQTESOLV, an aquifer test analysis software package.

Analytical Results

Three soil samples from each of the three installed wells were submitted for laboratory analyses during this investigation. A soil sample from above the cherty sandstone layer and a sample from the groundwater capillary fringe were submitted for chemical analyses. Additionally, the groundwater capillary fringe soil sample was submitted for biological analyses. A third soil sample, representative of the aquifer, was submitted for grain size distribution analysis. Submitted soil samples from the groundwater capillary fringe were analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8020, total petroleum hydrocarbons (TPH) by EPA Method 418.1, pH, ammonia nitrogen, total kjeldahl nitrogen (TKN), and total organic carbon (TOC). Submitted soil samples from the cherty sandstone interval were analyzed for TPH by EPA Method 418.1. Biological analyses consisted of utilizing procedures to count heterotrophic (total) and petrophillic (hydrocarbon degrading) bacteria. Samples submitted for grain size distribution were analyzed utilizing ASTM D422.

Soil sample analytical results for chemical and biological analyses are presented on Table 3. Soil analytical results indicate TPH and BTEX concentrations are below laboratory detection limits for all samples submitted. The results of the geotechnical analysis indicate that the grain size of the aquifer is representative of a fine sand or fine sand with silt. The grain size distribution results from sieve analysis are contained on Table 4. The soil laboratory analytical reports are contained in Appendix B. The geotechnical analytical reports are contained in Appendix C.

Groundwater samples were submitted for laboratory analysis from three existing wells and the three wells installed during the investigation. The groundwater samples were analyzed for BTEX utilizing EPA Method 8020, pH, ammonia nitrogen, TKN, TOC, total dissolved solids, ammonia nitrogen, orthophosphate, chemical oxygen demand, sulfate, nitrate-nitrite, soluble carbon oxygen demand, manganese and manganese dioxide. Biological analyses of the groundwater consisted of procedures to count heterotrophic (total) and petrophillic (hydrocarbon degrading) bacteria.

Groundwater chemical analytical results indicate BTEX constituent concentrations above laboratory detection limits for five of the six monitor wells sampled. Figure 4 shows the BTEX constituent concentration results in micrograms per liter (µg/L) of the groundwater samples. Total BTEX concentrations ranged from below laboratory detection limit in MW-3 to less than 0.307 milligrams per liter (mg/L) in MW-1. Of the five monitor wells registering BTEX

concentrations, only MW-6 measured below the laboratory detection limit for benzene. Benzene concentrations in the other four monitor wells ranged from 0.006 mg/L to 0.092 mg/L. Groundwater sample analytical results for chemical and biological analyses are presented on Table 5. Full laboratory reports are presented in Appendix D.

Aquifer Testing Results

Hydraulic conductivity is defined as the capacity of a porous medium to transmit water. The results of the slug tests determined that the hydraulic conductivity of the aquifer behind the screened interval in the upgradient well, MW-3, is approximately 2.2 feet per day (7.76×10^{-4} cm/sec). The hydraulic conductivity measured in MW-5, a well in the downgradient dissolved phase plume, is approximately 1.92 feet per day (6.77×10^{-4} cm/sec). These hydraulic conductivities indicate that the natural aquifer material is a fine sand or silty sand. This is consistent with the grain size analysis. The slug test and AQTESOLV data are included in Appendix E.

Intrinsic Bioremediation Results

The benzene, toluene, ethylbenzene and total xylenes (BTEX) and dissolved oxygen (DO) concentrations measured at the site indicate that intrinsic bioremediation is occurring. Figure 5 shows a graph of BTEX concentrations plotted against DO measured at different monitor wells at the site. The figure shows an inverse relationship between BTEX levels and dissolved oxygen. This relationship is a clear indication of intrinsic aerobic remediation. The complete laboratory report is presented in Appendix F.

There is a lack of a strong inverse relationship between BTEX levels and anaerobic bioremediation electron acceptors such as manganese dioxide, nitrate, ferric hydroxide (monitored ferrous ion produced) and sulfate measured at the site (Figures 6 through 8). Therefore, the site data does not fully demonstrate intrinsic anaerobic bioremediation. However, dissolved methane was not measured at the site. Dissolved methane is an indication of anaerobic biodegradation with carbon dioxide as the electron acceptor (methanogenisis).

Groundwater analysis indicates a fairly significant chemical oxygen demand (COD) and soluble chemical oxygen demand (SCOD). However, the COD/SCOD may or may not be competing with the hydrocarbon-degrading microbes for dissolved oxygen. This can be determined by analyzing groundwater for Biological Oxygen Demand (BOD) and Total Petroleum Hydrocarbons (TPH). If BOD levels are relatively low, it is doubtful that the apparently abiotic processes will significantly compete with biodegradation for available electron acceptors. If TPH and BOD is

relatively high, archived groundwater samples could be analyzed for VOC's and PAH's to determine if other organics present a preferential food source for the site microorganisms.

Using the BTEX concentrations and levels of the electron acceptors measured at the site, the total BTEX assimilative capacity was calculated. The calculation details are presented in Table 6. These calculations show that the assimilative capacity of the site is 8,541 µg/L of BTEX which is much higher than the 307 µg/L, the highest BTEX concentration detected at the site. It is important to note that BTEX assimilative capacity due to dissolved oxygen, 1,939 µg/L, alone exceeds the maximum BTEX level measured, perhaps explaining the lack of anaerobic bioremediation at the site.

Recommendations

The analytical results indicate that intrinsic bioremediation is occurring. The rate of bioremediation should be monitored to verify that the remediation rate is sufficient to obtain the remediation objective. Thus monitoring is a viable risk management tool and a fairly accurate indicator of the progress of intrinsic bioremediation. It is important to note that the concentration of contaminants are low and the contaminated soils in the source area were excavated and shredded back into the excavation along with clean fill and essential nutrients, in the form of fertilizer, in December 1994.

If you have any questions or require additional information, please call me at (713) 759-0999.

Very truly yours,

BROWN AND CALDWELL

Susanne Richard, REM, REP
Project Manager

REFERENCES

1. The New Mexico Bureau of Mines and Minerals, "*Geologic Map of New Mexico*," 1982, United States Geological Survey

TABLES

Groundwater Elevation
Field Screening Results for Groundwater Samples
Analytical Results for Soil Samples
Analytical Results for Sieve Analysis
Analytical Results for Groundwater Samples
Total BTEX Assimilative Capacity Calculation Details

GROUNDWATER ELEVATION

TABLE 1
Groundwater Elevation[1]
December 8, 1994
Transwestern Pipeline Company

Well	TOC	Depth to water	GW Elevation
MW-1	98.15	89.38	8.77
MW-2	97.46	88.15	9.31
MW-3	102.54	93.08	9.46
MW-4	98.53	89.90	8.63
MW-5	97.82	89.33	8.49
MW-6	97.23	88.65	8.58

[1]Top of casing for MW-1, 2, 3 were surveyed to a concrete corner at the south east corner of the concrete berm around the AST's at the north east section of the property.
[2]Top of casing for MW-4, 5, 6 were surveyed relative to the Top of casing for MW-1 and surveyed to close the loop.
[3]The data yields a consistent gradient to the east southeast.
[4]All elevations were measured from the north side of the PVC pipe.

FIELD SCREENING RESULTS FOR GROUNDWATER SAMPLES

Table 2

Field Screening Results for Ground Water Samples
Bell Lake Plant
Transwestern Pipeline Company

Well I.D.	Sample Date	Well Casing Volume (gallons)	Well Volume No.	pH	Conductivity (uohms)	Temperature (Celsius)	Redox (MV)	Dissolved Oxygen (mg/L)	Ferrous Iron (mg/L)
MW-1	12-07-94	4	1	8.56	8,790	68.4			
		4	2	8.92	12,210	70.0			
		4	3	8.99	12,460	70.5			
			sample				-349.7	0.83	0.0
MW-2	12-07-94	5	1	7.27	3,830	68.5			
		5	2	7.16	3,800	69.0			
		5	3	7.11	3,780	69.2			
			sample				-123.6	1.40	2.0
MW-3	12-07-94	3	1	7.31	530	70.4			
		3	2	7.32	518	69.9			
		3	3	7.34	508	69.6			
			sample				356.7	6.06	0.0
MW-4	12-07-94	1.5	1	9.61	9,230	65.8			
		1.5	2	9.78	9,280	67.8			
		1.5	3	9.70	9,270	67.4			
			sample				-385.6	1.30	0.0
MW-5	12-07-94	1.5	1	9.38	16,730	67.7			
		1.5	2	9.28	15,810	68.3			
		1.5	3	9.22	15,280	68.0			
			sample				-336.7	1.90	0.0
MW-6	12-07-94	1.5	1	8.52	9,840	68.2			
		1.5	2	8.51	9,210	67.6			
		1.5	3	8.51	9,490	68.1			
			sample				-200.6	2.15	0.0

NA - not analyzed
ND - not detected
mg/L-milligrams per Liter

ANALYTICAL RESULTS FOR SOIL SAMPLES

Table 3

Analytical Results for Soil Samples

Bell Lake Plant

Transwestern Pipeline Company

Location		MW4	MW4	MW5	MW5	MW6	MW6
Depth (feet)		32 - 34	87 - 89	39 - 41	89 - 91	40 - 41	87 - 89
Chemical Analysis							
Parameter	Units						
TPH	mg/kg	<25	<25	<25	<25	<25	<25
Benzene	mg/kg	NA	<0.005	NA	<0.010	NA	<0.005
Ethylbenzene	mg/kg	NA	<0.005	NA	<0.010	NA	<0.005
Toluene	mg/kg	NA	<0.005	NA	<0.010	NA	<0.005
Xylenes	mg/kg	NA	<0.010	NA	<0.020	NA	<0.010
Total BTEX	mg/kg	NA	<0.025	NA	<0.050	NA	<0.025
Nitrogen - ammonia	mg/kg	NA	19	NA	200	NA	1.1
Nitrogen - Kjeldahl	mg/kg	NA	31	NA	200	NA	<10
pH	s.u.	NA	8.6	NA	8.9	NA	8.5
Total organic carbon	percent	NA	0.02	NA	0.02	NA	0.02

NA-Not Analyzed

ND-Not detected

mg/kg-milligram per kilogram

s.u.-standard units

ANALYTICAL RESULTS FOR SIEVE ANALYSIS

Table 4
Analytical Results for Sieve Analysis
Bell Lake Plant
Transwestern Pipeline Company

Sample I.D.	MW-4	MW-5	MW-6
Depth (ft.)	94-96	95-97	94-96
Sieve Size			
7/8	100	100	100
3/4	100	100	100
1/2	100	100	100
3/8	100	100	100
1/4	100	100	97
4	100	100	96
10	100	98	94
40	99	98	91
100	9	16	25
200	3	9	12
Description	Fine sand	Fine sand with silt	Fine sand with silt

(1) Analysis performed in accordance with ASTM D 422

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

REFERENCES

1. The New Mexico Bureau of Mines and Minerals, "*Geologic Map of New Mexico*," 1982, United States Geological Survey

Table 5

Analytical Results for Groundwater Samples

Bell Lake Plant

Transwestern Pipeline Company

Location		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	TB-1
Date Sampled		12/7/94	12/7/94	12/7/94	12/7/94	12/7/94	12/7/94	12/8/94
Chemical Analysis *Parameter*	Units							
Benzene	mg/L	0.092	0.006	<0.002	0.018	0.009	<0.002	<0.002
Toluene	mg/L	0.050	0.005	<0.002	0.071	0.020	0.003	<0.002
Ethylbenzene	mg/L	0.054	<0.002	<0.002	0.004	0.004	<0.002	<0.002
Total Xylenes	mg/L	<0.111	<0.004	<0.004	0.16	0.064	<0.006	<0.004
Total BTEX	mg/L	<0.307	<0.0017	<0.010	0.253	0.097	<0.013	<0.010
Total Dissolved Solids	mg/L	7100	2600	320	4700	9500	4700	NA
Ammonia-Nitrogen	mg/L	37	6.6	0.44	120	140	160	NA
Orthophosphate	mg/L	0.3	0.1	0.2	0.6	0.6	0.7	NA
Total Kjeldahl Nitrogen	mg/L	31	5	0.28	83	110	110	NA
Chemical Oxygen Demand	mg/L	420	160	<1	780	1100	560	NA
Sulfate	mg/L	140	51	31	70	49	150	NA
Nitrate-Nitrite	mg/L	0.06	<0.05	3.6	<0.05	<0.05	<0.05	NA
Soluble Chemical Oxygen Demand	mg/L	340	140	<1	720	1100	620	NA
Manganese	ug/L	36	72	8.1	35	2.3	56	NA
Manganese Dioxide	ug/L	46	93	10	45	3.0	72	NA
Heterotrophs (water)	counts/ml	10^6	10^6	10^5	10^5	10^5	10^6	NA
Petrophilic (water)	counts/ml	10^3	10^2	10^2	10^3	10^2	10^1	NA

mg/L = milligrams per Liter

ug/L = micrograms per Liter

NA = Not Analyzed

counts/ml-counts per milliter

TOTAL BTEX ASSIMILATIVE CAPACITY CALCULATION DETAILS

Table 6
Total BTEX Assimilative Capacity Calculation Details

Electron Acceptor or Process	BTEX Biodegradation Factor (mg/L/mg/L)	Site Background Levels (mg/L)	Expressed BTEX Assimilative Capacity (µg/L)
Dissolved Oxygen (DO)	0.32 / 1.0 DO	6.06	1,939
Nitrate (NO_3)	0.21 / 1.0 NO_3	0.44	92
Ferric Hydroxide ($Fe(OH)_3$)	1.0 / 21.8 Fe^{+2} produced	0	0
Sulfate (SO_4)	0.21 / 1.0 SO_4	31	6,510
Methanogenesis (CH_4)	1.0 /0.78 CH_4	Not Analyzed	-
Total Expressed Assimilative Capacity			8,541
Highest Observed Total BTEX Concentration			307

Notes:

1. Site background electron acceptor levels are based on analyses of samples from MW-3.

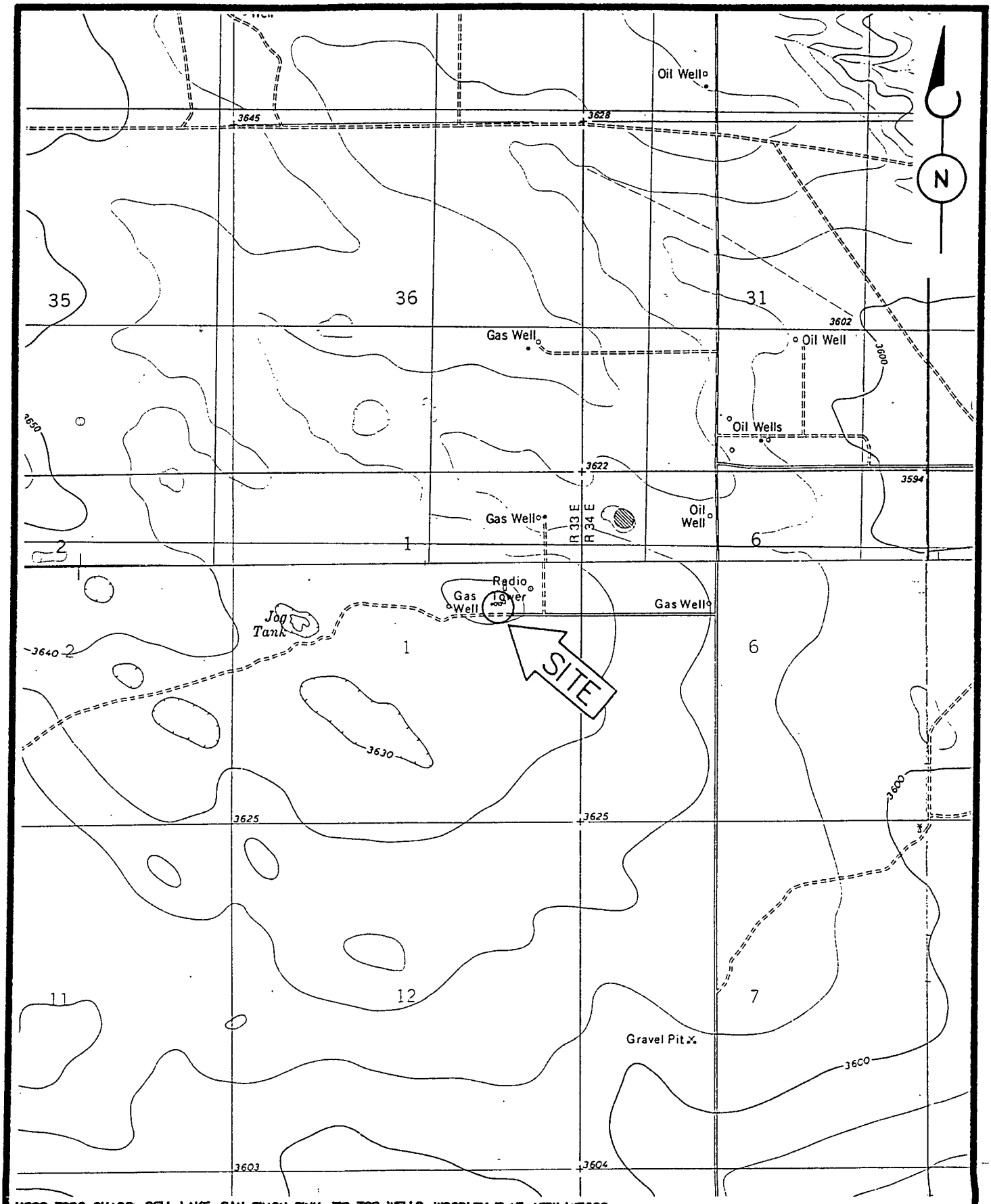
2. The inverse relationship between the quantities of dissolved oxygen and BTEX indicate aerobic biodegradation at the site (see Figure 4).

3. Sulfate and nitrate concentrations do not indicate anaerobic biodegradation at the site (See Figures 6,7).

4. Data indicate that groundwater at the site has enough assimilative capacity to degrade observed concentrations of dissolved-phase BTEX.

FIGURES

SITE LOCATION MAP



USGS TOPO QUADS: BELL LAKE, SAN SIMON SINK, TIP TOP WELLS, WOODLEY FLAT, NEW MEXICO

E:\BELLAKE\SITEPLAN

BROWN AND CALDWELL
DALLAS, TEXAS

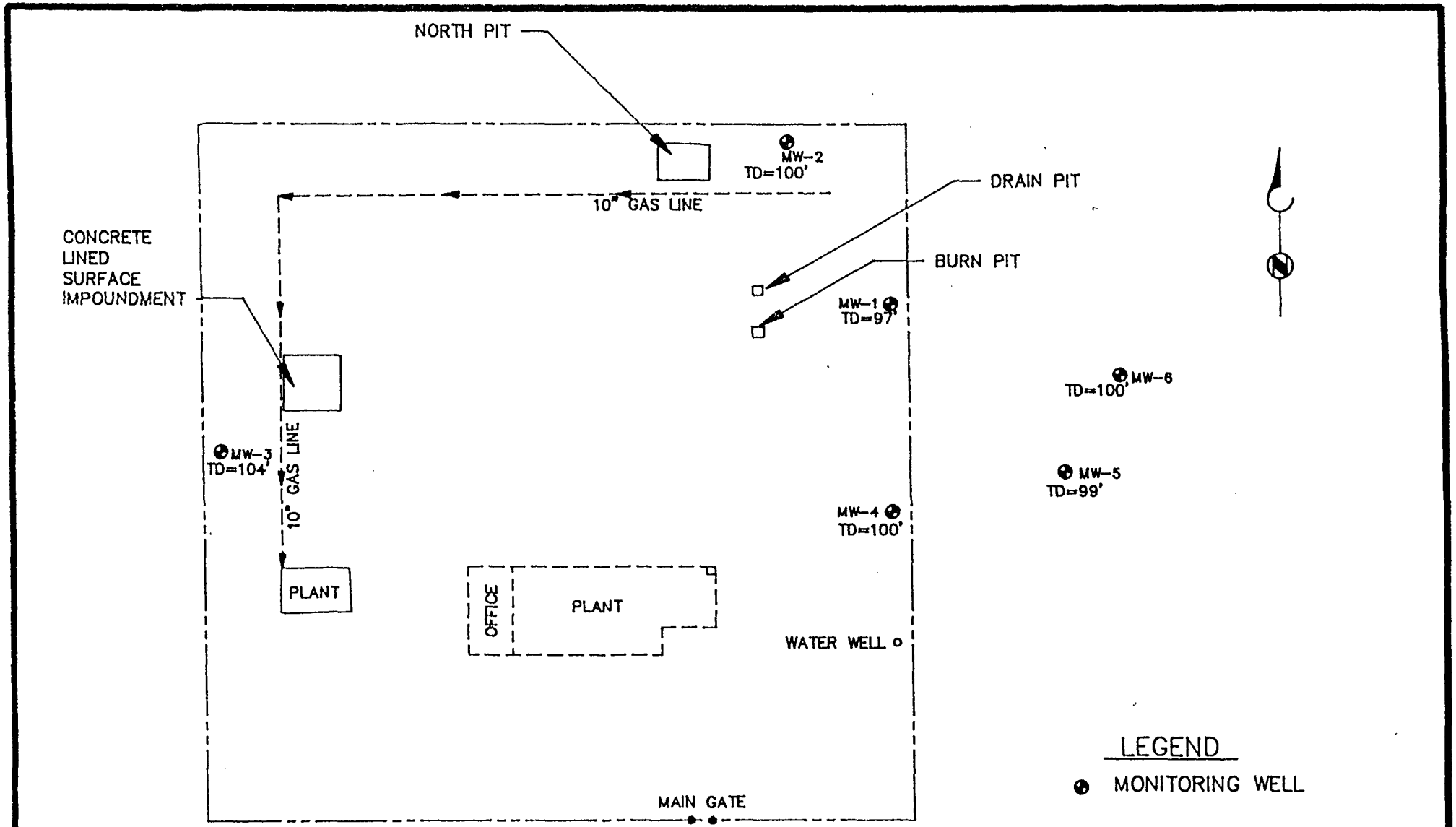
SUBMITTED: _____ DATE: _____
PROJECT MANAGER

APPROVED: _____ DATE: _____
BROWN AND CALDWELL

0 1000 2000
SCALE: 1" = 2000'
DRAWN BY: JDN DATE 0/0
CHK'D BY: — DATE
APPROVED: — DATE

TITLE: SITE LOCATION MAP
DATE: 01/24/95
CLIENT: TRANSWESTERN PIPELINE COMPANY
PROJECT NUMBER: 1820-02
SITE: BELL LAKE COMPRESSOR STATION
JAL, NEW MEXICO
FIGURE NUMBER: 1

MONITORING WELL LOCATION MAP

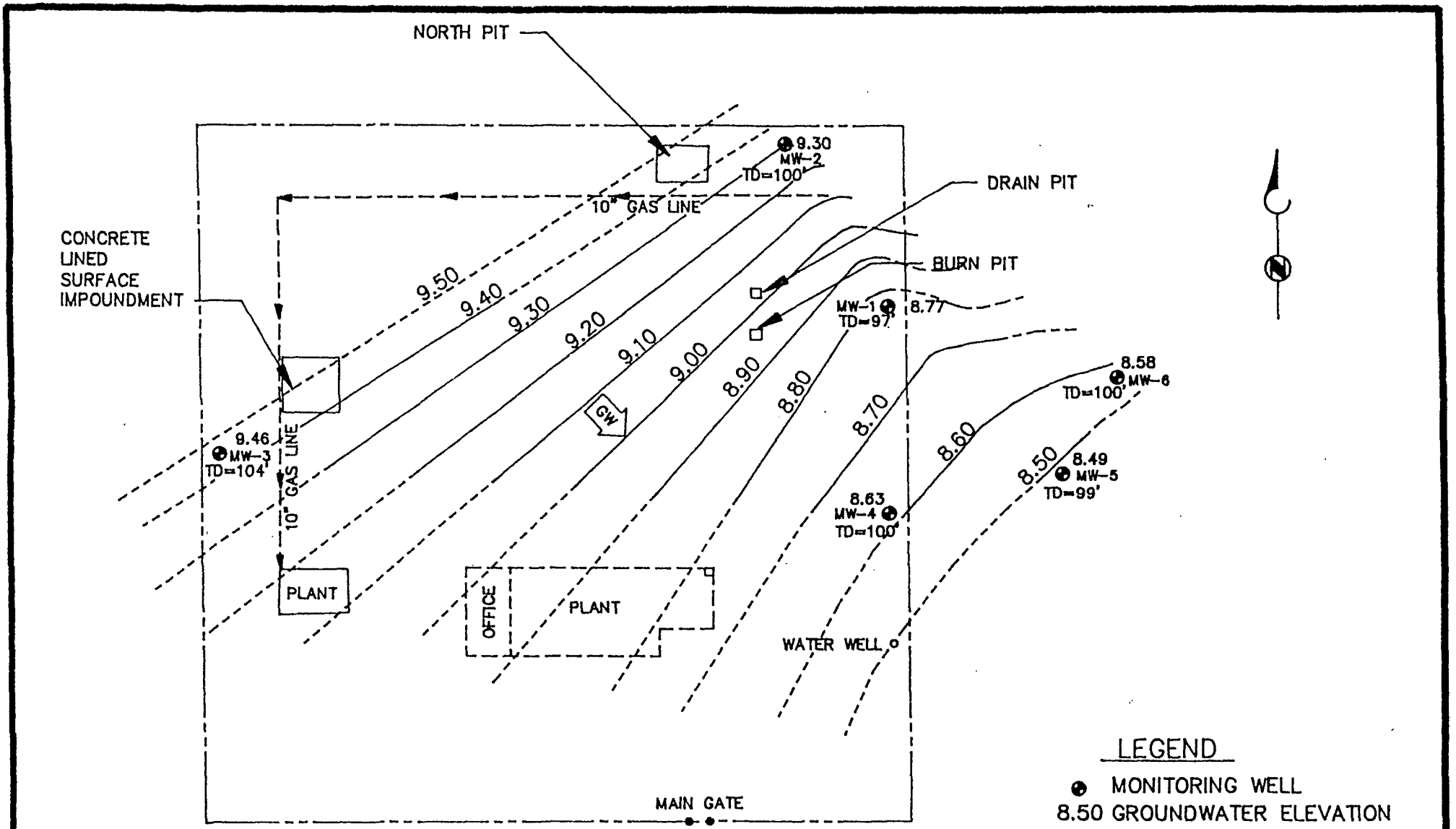


BROWN AND CALDWELL DALLAS, TEXAS SUBMITTED: _____ DATE: _____ PROJECT MANAGER APPROVED: _____ DATE: _____ BROWN AND CALDWELL	0 50 100 SCALE: 1" = 100' DRAWN BY: JDN DATE 11/8 CHK'D BY: SR DATE 11/9 APPROVED: DATE	TITLE: MONITORING WELL LOCATION MAP CLIENT: TRANSWESTERN PIPELINE COMPANY SITE LOCATION: BELL LAKE PLANT JAL, NEW MEXICO	DATE: 01/24/95 PROJECT NUMBER: 1820-02 FIGURE NUMBER: 2

REV.	DESCRIPTION	BY	DATE

E:\BELLAKE\SITEPLAN

GROUNDWATER GRADIENT MAP



BROWN AND CALDWELL
DALLAS, TEXAS

SUBMITTED: _____ DATE: _____
PROJECT MANAGER

APPROVED: _____ DATE: _____
BROWN AND CALDWELL

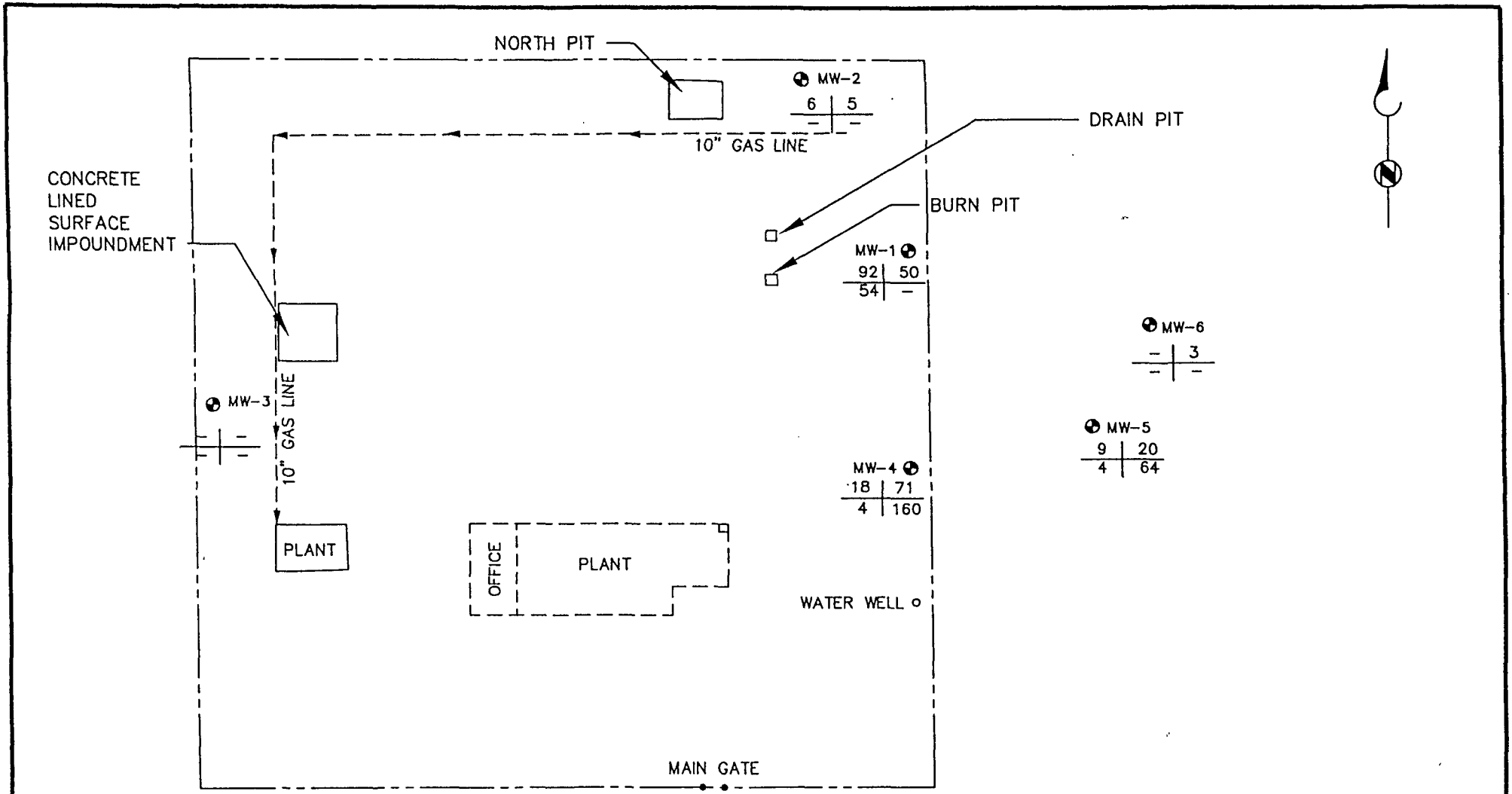
REV.	DESCRIPTION	BY	DATE

0 50 100
SCALE: 1" = 100'
DRAWN BY: JDN DATE 11/8
CHK'D BY: SR DATE 11/9
APPROVED: DATE

TITLE: GROUNDWATER GRADIENT MAP DECEMBER 8, 1994
CLIENT: TRANSWESTERN PIPELINE COMPANY
SITE LOCATION: BELL LAKE PLANT JAL, NEW MEXICO

DATE: 01/24/95
PROJECT NUMBER: 1820--02
FIGURE NUMBER: 3

GROUNDWATER BTEX LEVELS MAP



LEGEND

EXISTING MONITORING WELL
MW-5 LOCATION AND IDENTIFICATION

ABBREVIATIONS

B = BENZENE
T = TOLUENE
E = ETHYLBENZENE
X = XYLENE

B	T
E	X

– BDL

RESULTS MEASURED IN ppb (ug/L)

0 50 100
SCALE: 1" = 100'

BROWN AND CALDWELL
HOUSTON, TEXAS

SUBMITTED: SUSANNE RICHARD DATE:
PROJECT MANAGER
APPROVED: ROBERT JENNINGS, P.E. DATE:
BROWN AND CALDWELL

DRAWN BY: DHD DATE 6/21
CHK'D BY: ____ DATE ____
APPROVED: ____ DATE ____

TITLE: GROUNDWATER BTEX LEVELS
CLIENT: TRANSWESTERN PIPE LINE COMPANY
SITE LOCATION: BELL LAKE PLANT
JAL, NEW MEXICO

DATE: 6/21/95
PROJECT NUMBER: 1820-02
FIGURE NUMBER: 4

T:\1820\BTEX DHD

COMPARISON OF DISSOLVED OXYGEN AND BTEX CONCENTRATION IN GROUNDWATER

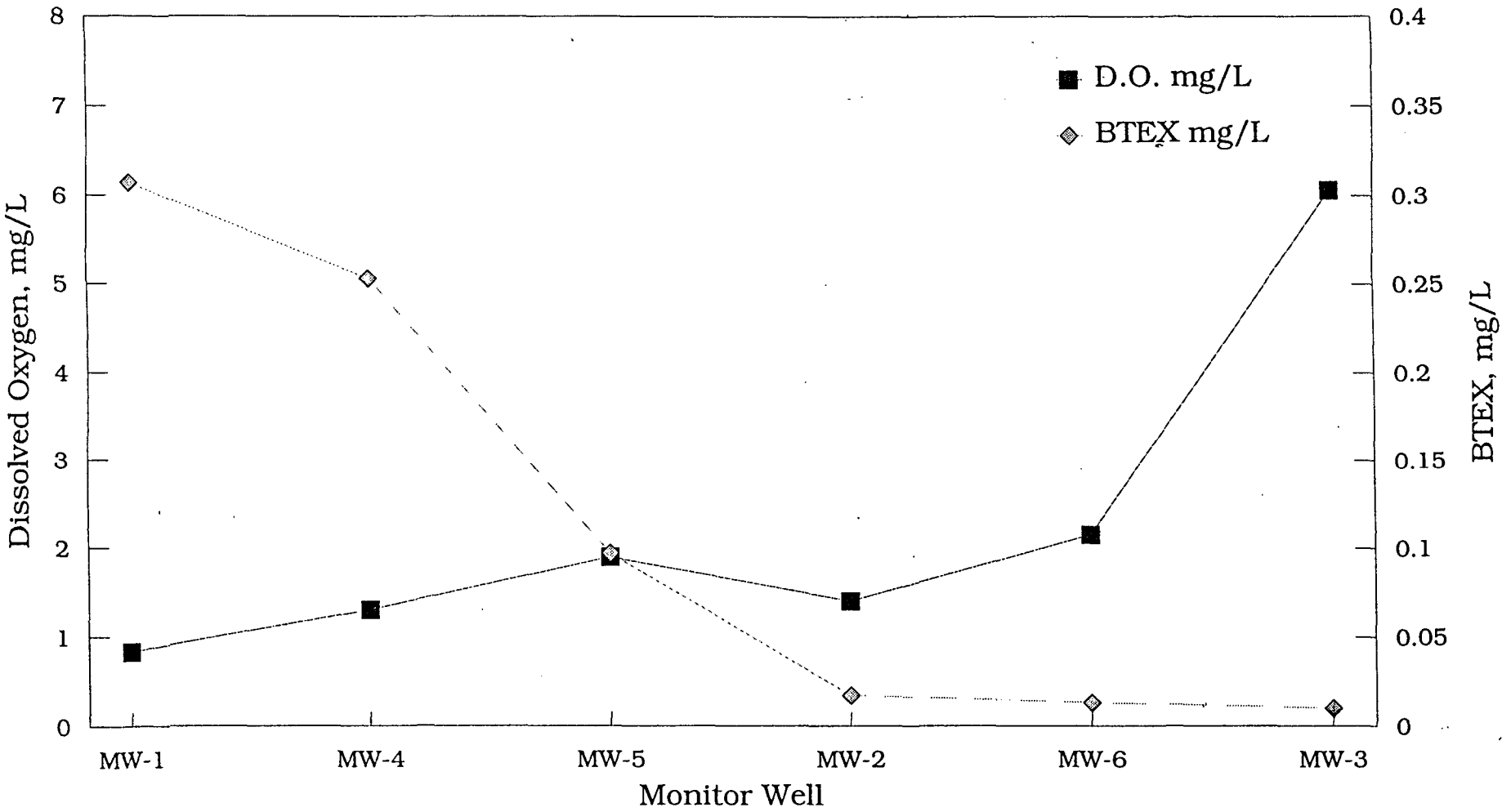


Figure 5 - Comparison of Dissolved Oxygen and BTEX Concentration in Ground Water at Bell Lake Plant

COMPARISON OF MANGANESE DIOXIDE AND BTEX CONCENTRATION IN GROUNDWATER

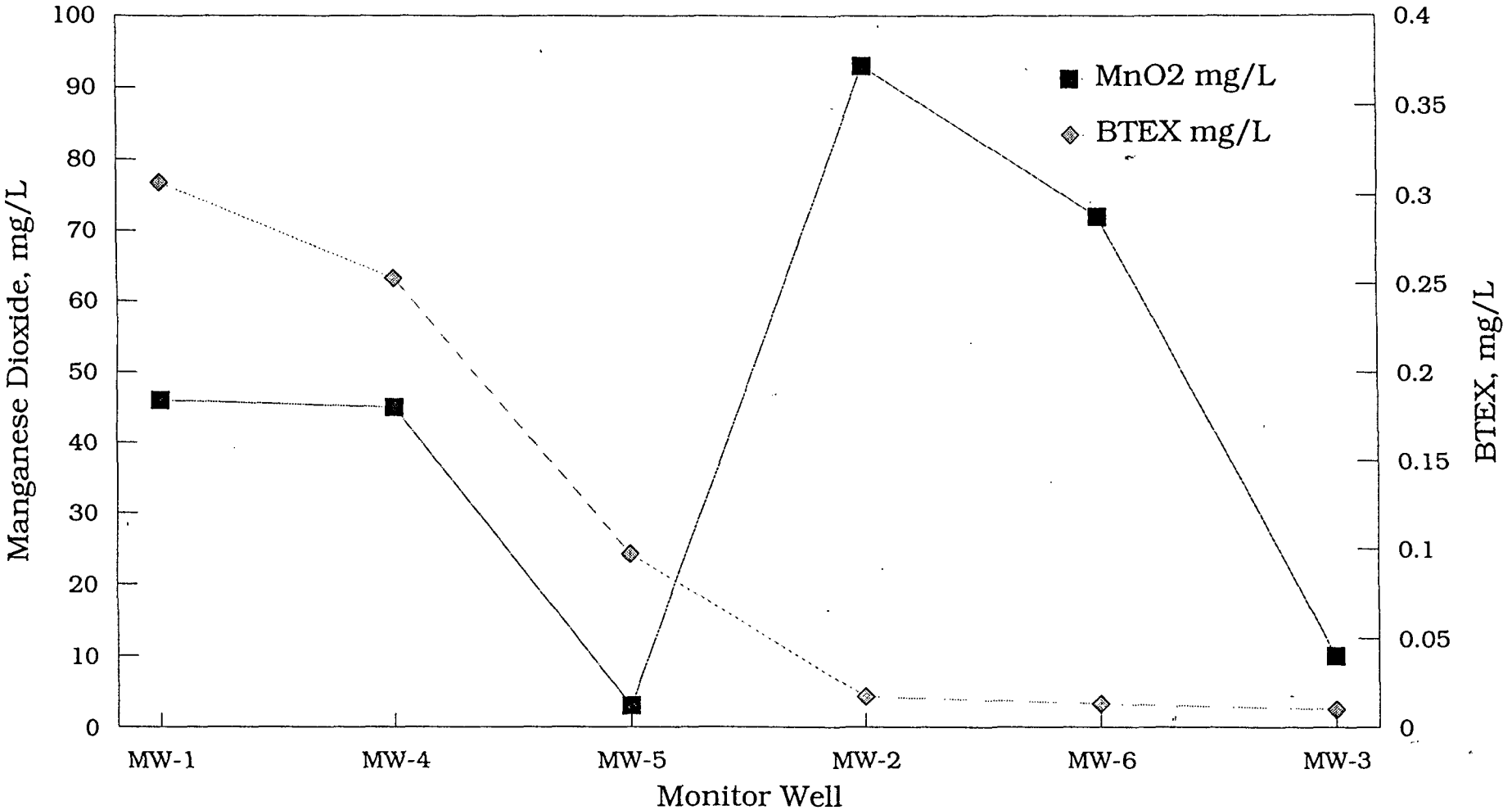


Figure 6 - Comparison of Manganese Dioxide and BTEX Concentration in Ground Water at Bell Lake Plant

COMPARISON OF NITRATE AND BTEX CONCENTRATION IN GROUNDWATER

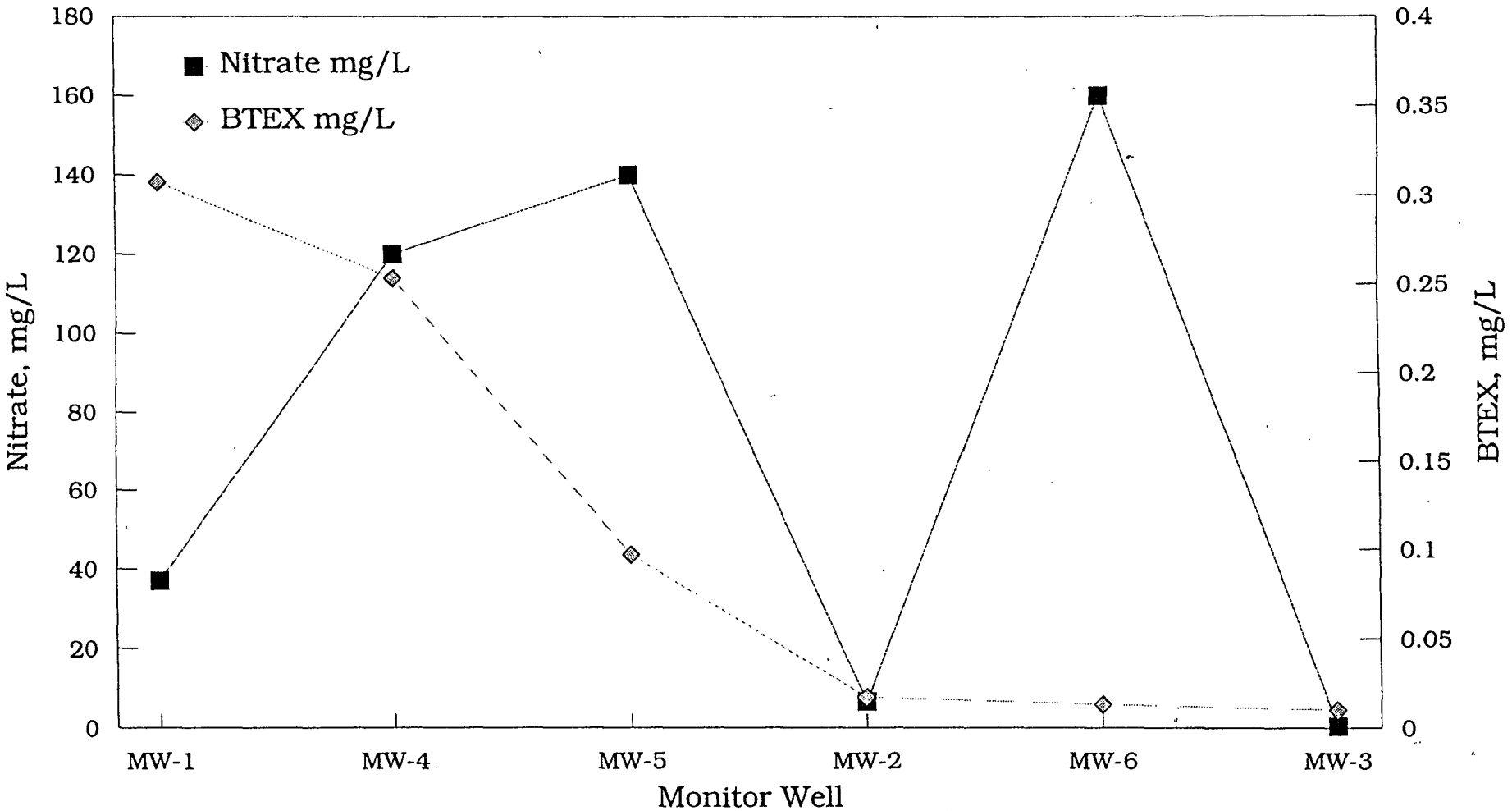


Figure 7 - Comparison of Nitrate and BTEX Concentration in Ground Water at Bell Lake Plant

COMPARISON OF SULFATE AND BTEX CONCENTRATION IN GROUNDWATER

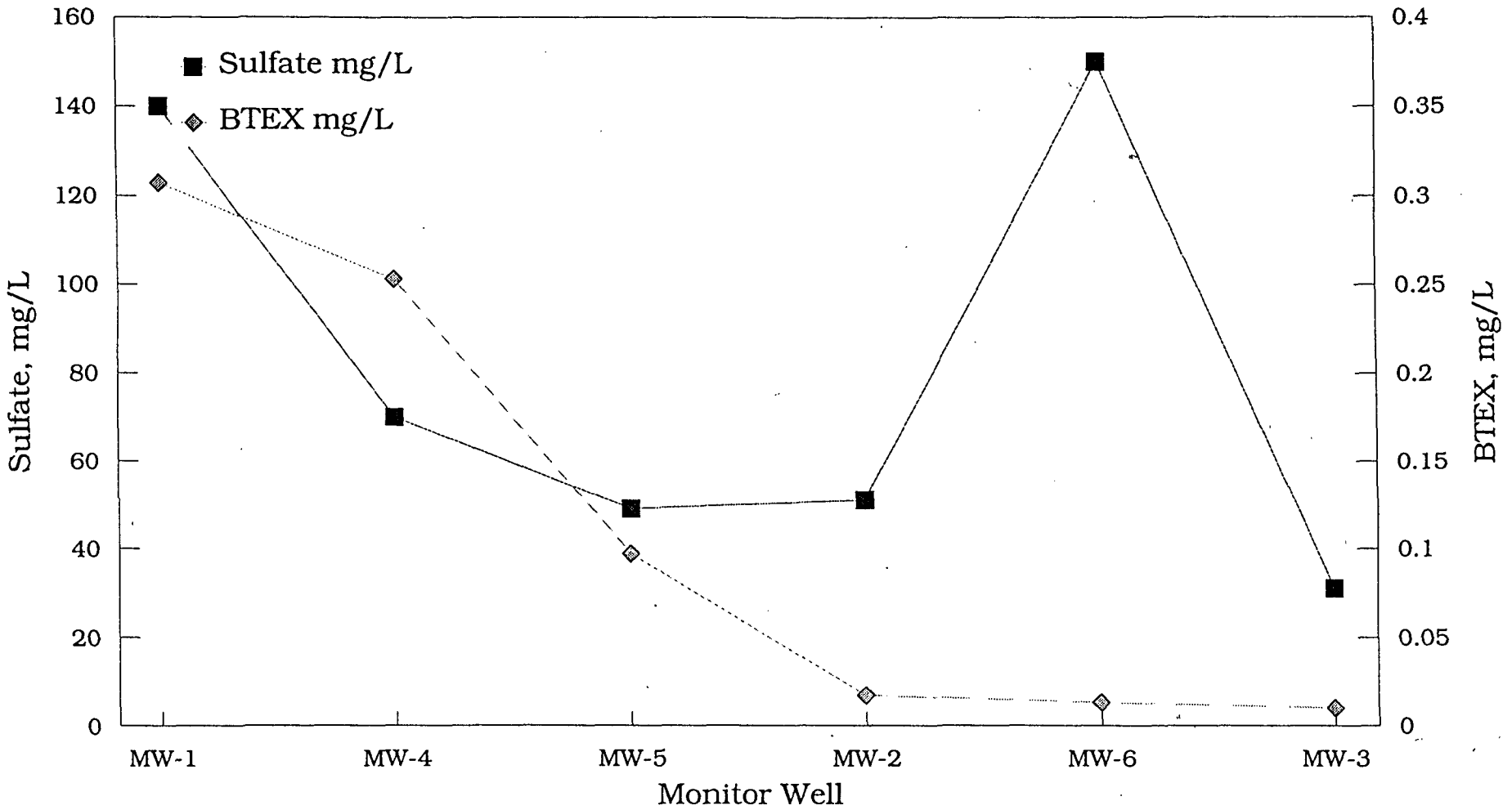


Figure 8 - Comparison of Sulfate and BTEX Concentration in Ground Water at Bell Lake Plant

APPENDICES

Boring Logs
Laboratory Results Soil Samples
Geotechnical Results
Laboratory Results Groundwater Samples
Slug Test Results
Biological Results

APPENDIX A

BORING LOGS

BROWN AND CALDWELL

BORING LOG

Project Name: Transwestern Pipeline Company - Bell Lake Plant Project Number: 1820

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-4 Sheet 1 of 1

Boring Location: On-site		Elevation and Datum: 98.5	
Drilling Contractor: GPI	Driller: Wes Cowser	Date Started: 12/3/94	Date Finished: 12/3/94
Drilling Equipment: Mobile Drill	Borehole Diameter: 3.5"	Completed Depth: (feet) 100.0	Water Depth: (feet) 89.9
Sampling Method: Split Spoon		WELL CONSTRUCTION	
Drilling Method: Air Rotary	Drilling Fluid:	Type and Diameter of Well Casing: 2" Sched 40 PVC	
Backfill Material:		Slot Size: .010	Filter Material: Sand
Logged By: Al Fear	Checked By: Al Fear	Development Method: Bail and Surge	

Depth (feet)	USC Soil Type	Description	Recovery %	Blow Counts	Sample No.	Graphic Log: Sample	Graphic Log: Lithology	Graphic Log: Well	OVM Readings OVA PPM	Remarks	Elevation (feet)
0	SC	CALICHE AND SAND, white									95
5											90
10		SAND, tan, medium-grained									85
15											80
20		SAND									75
25											70
30		SAND, consolidated	100		1	⊠			2		65
35		SANDSTONE, cherty									60
40		SANDSTONE, semi-consolidated SANDSTONE, tan, semi-consolidated									55
45											50
50		SANDSTONE, pink to tan, semi-consolidated									45
55											40
60		SANDSTONE, semi-consolidated									35
65											30
70		SANDSTONE, semi-consolidated									25
75											20
80		SANDSTONE, semi-consolidated								Top of bentonite - 78 feet Top of sand - 81 feet	15
85			100		2	⊠			150	Top of screen - 85 feet	10
90		SANDSTONE, semi-consolidated									5
95		SANDSTONE, green to black, semi-consolidated	100		3	⊠				Odor-mercaptan	0
100										TD = 100 feet	

BROWN AND CALDWELL

BORING LOG

Project Name: Transwestern Pipeline Company - Bell Lake Plant Project Number: 1820

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-5 Sheet 1 of 1

Boring Location: Off-site		Elevation and Datum: 97.8	
Drilling Contractor: GPI	Driller: Wes Cowser	Date Started: 12/3/94	Date Finished: 12/4/94
Drilling Equipment: Mobile Drill	Borehole Diameter: 3.5"	Completed Depth: (feet) 99.0	Water Depth: (feet) 88.6
Sampling Method: Split Spoon		WELL CONSTRUCTION	
Drilling Method: Air Rotary	Drilling Fluid:	Type and Diameter of Well Casing: 2" Sched 40 PVC	
Backfill Material:		Slot Size: .010	Filter Material: Sand
Logged By: Al Fear	Checked By: Al Fear	Development Method: Bail and Surge	

Depth (feet)	USC Soil Type	Description	Recovery %	Blow Counts	Sample No.	Graphic Log: Sample	Graphic Log: Lithology	Graphic Log: Well	OVM Readings OVA PPM	Remarks	Elevation (feet)
0	SC	CALICHE AND SAND, white									95
5											90
10		SAND, tan									85
15											80
20		SAND, tan									75
25											70
30		SAND, tan									65
35	SM	SAND									60
40		SANDSTONE, cherty, semi-consolidated	100		1				2		55
45		SANDSTONE, tan, semi-consolidated									50
50		SANDSTONE, pink to tan, semi-consolidated									45
55											40
60		SANDSTONE, pink to tan, semi-consolidated									35
65											30
70		SANDSTONE, pink to tan, semi-consolidated									25
75											20
80		SANDSTONE, pink to tan, semi-consolidated								Top of bentonite - 79 feet	15
85										Top of sand - 82 feet Top of screen - 84 feet	10
90		SANDSTONE, green to black, semi-consolidated	100		2				600	Odor-mercaptan	5
95			100		3						0
										TD = 99 feet	

BROWN AND CALDWELL

BORING LOG

Project Name: Transwestern Pipeline Company - Bell Lake Plant Project Number: 1820

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-6 Sheet 1 of 1

Boring Location: Off-site		Elevation and Datum: 97.2	
Drilling Contractor: GPI	Driller: Wes Cowser	Date Started: 12/4/94	Date Finished: 12/5/94
Drilling Equipment: Mobile Drill	Borehole Diameter: 3.5"	Completed Depth: (feet) 100.0	Water Depth: (feet) 88.6
Sampling Method: Split Spoon		WELL CONSTRUCTION	
Drilling Method: Air Rotary	Drilling Fluid:	Type and Diameter of Well Casing: 2" Sched 40 PVC	
Backfill Material:		Slot Size: .010	Filter Material: Sand
Logged By: Al Fear	Checked By: Al Fear	Development Method: Bail and Surge	

Depth (feet)	USC Soil Type	Description	Recovery %	Blow Counts	Sample No.	Graphic Log: Sample	Graphic Log: Lithology	Graphic Log: Well	OVM Readings OVA PPM	Remarks	Elevation (feet)
0	SC	CALICHE AND SAND, white									95
5											90
10		SAND, tan									85
15											80
20		SAND, tan									75
25											70
30	SM	SAND, tan									65
35		SAND									60
40		SANDSTONE, cherty, tan, semi-consolidated	100		1				3		55
45		SANDSTONE, tan, semi-consolidated									50
50		SANDSTONE, pink to tan, semi-consolidated									45
55											40
60		SANDSTONE, pink to tan, semi-consolidated									35
65											30
70		SANDSTONE, pink to tan, semi-consolidated									25
75											20
80		SANDSTONE, pink to tan, semi-consolidated								Top of bentonite - 78.5 feet Top of sand - 81 feet Top of screen - 83 feet	15
85											10
90		SANDSTONE, pink to tan, semi-consolidated	100		2				130		5
95			100		3						0
										TD = 100 feet	

APPENDIX B

LABORATORY RESULTS
SOIL SAMPLES

Terra Laboratories, Ltd.
Quality Analytical Services

January 2, 1995

Al Fear
Brown and Caldwell
2710 Stemmons Frwy., Suite 1100
Dallas, TX 75207

Re: Six (6) solid samples (Project Name: Bell Lake, Jal,NM) received on 12/07/94

Dear Mr. Fear:

Attached are the final reports of analysis of the samples referenced above as per your analysis and/or method requests. As per Suzanne Richard Ortho-Phosphate was cancelled on Sample ID#'s: MW-4 87-98', MW-5 89-91', and MW-6 87-89'.

The samples were received in good condition and at 1^{o} Centigrade.

We appreciate this opportunity to serve Brown and Caldwell. Please let me, or Linda McKee, know if there is any other way we can help you.

Sincerely,

Larry D. Wallace
Laboratory Director

2525 South Shore Blvd. ♦ League City, Texas 77573 ♦ (713) 334-5052 Fax: (713) 334-3116

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 27 1994 Page # 1

Brown and Caldwell
2710 Stemmons Frwy. Ste1100
Dallas , TX 75207

Reviewed by:TMG
Customer#: 309
Job Number:

Attn: Fear, Al

Date Collected:12/03/94

Sample Number: 94008500
Project Name: BELL LAKE JAL, N.M.
Sample ID: MW-4 87-89' GRAB

Time Collected:1130

Date Received: 12/07/94

Test Code	Analyte	Result	Units	Method	Analyst
BTEXS'D	BTEX Analysis Prep(Date/Time)	12/09 1652	init.	6-5030	NSH
BZ8020S	Benzene	< 0.005	ppm	6-8020	NSH
TOL8020S	Toluene	< 0.005	ppm	6-8020	NSH
EBZ8020S	Ethylbenzene	< 0.005	ppm	6-8020	NSH
XYLSTLs	Total Xylenes	< 0.010	ppm	6-8020	NSH
BTEXTLs	Total BTEX	< 0.025	ppm	6-8020	NSH
aaaTFTs	aaa-TFT (surr)	96.	%	74-121	NSH
4BFBs	4-BFB (surr)	94.	%	75-115	NSH
418_1S'D	TPH Analysis Prep(Date/Time)	12/08 1330	init.	6-3550	MLC
TPH'S	TPH(Total Petroleum Hydrocarbon	< 25	ppm	2-418.1	MLC
PHS'D	Soil pH Analysis(Date/Time)	12/08 1042	init.	6-9045	AM
pH'S	pH, Soils	8.6		6-9045	AM
NH3S'D	Ammonia Analysis (D/T)	12/16 1200	init.		CJT
NH3'S	Ammonia-N	19	mg/kg		CJT
351'4S	Nitrogen, Total Kjeldahl	31	mg/kg	2-351.4	CJT
TOCS'D	TOC Analysis (Date/Time)	12/15 0500	init.		JMR
TOC'S	TOC (Walkley-Black)	0.02	%	**	JMR
TKN'D	TKN Analysis (Date/Time)	12/21 1300	init.		CJT

COMMENTS:

FOOTNOTES: MI - Surrogate recovery is not reportable due to matrix interferences
Dil.Fx.- Minimum dilution required to allow acceptable quantitation
ppm = mg/L(Liquid), mg/kg(Solid) ppb = ug/L(Liquid), ug/kg(Soil)
init = date & time initiated B=found in blank J=>mdl< reporting limit

RW 12-27-94
Larry Caldwell

Preparation and Analysis Method References:

1. ASTM: American Society for Testing and Materials, 1984.
2. EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, 1978 (revised 1983).
3. EPA-600/4-82-057, Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater, 1982.
4. HACH: Test Methods, accepted by EPA in November, 1983.
5. SM: Standard Methods for the Examination of Water and Wastewater, 18th edition.
6. SW: SW-846, Test Methods for Evaluation of Solid Waste, Third edition. Update I, July 1992.

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 9 1994 Page # 1

Brown and Caldwell
2710 Stemmons Frwy. Ste1100
Dallas , TX 75207

Reviewed by:TMG
Customer#: 309
Job Number:

Attn: Fear, Al

Date Collected:12/03/94

Sample Number: 94008501
Project Name: BELL LAKE JAL, N.M.
Sample ID: MW-4 32-34' GRAB

Time Collected:0925

Date Received: 12/07/94

Test Code	Analyte	Result	Units	Method	Analyst
418_1S'D	TPH Analysis Prep(Date/Time)	12/08 1330	init.	6-3550	MLC
TPH'S	TPH(Total Petroleum Hydrocarbon	< 25	ppm	2-418.1	MLC

COMMENTS:

FOOTNOTES: MI - Surrogate recovery is not reportable due to matrix interferences
Dil.Fx.- Minimum dilution required to allow acceptable quantitation
ppm = mg/L(Liquid), mg/kg(Solid) ppb = ug/L(Liquid), ug/kg(Soil)
init = date & time initiated B=found in blank J=>mdl< reporting limit

Preparation and Analysis Method References:

1. ASTM: American Society for Testing and Materials, 1984.
2. EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, 1978 (revised 1983).
3. EPA-600/4-82-057, Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater, 1982.
4. HACH: Test Methods, accepted by EPA in November, 1983.
5. SM: Standard Methods for the Examination of Water and Wastewater, 18th edition.
6. SW: SW-846, Test Methods for Evaluation of Solid Waste, Third edition. Update I, July 1992.

12/22/94

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 27 1994 Page # 1

Brown and Caldwell
2710 Stemmons Frwy. Ste1100
Dallas , TX 75207

Reviewed by:TMG
Customer#: 309
Job Number:

Attn: Fear, Al

Date Collected:12/04/94

Sample Number: 94008502
Project Name: BELL LAKE JAL, N.M.
Sample ID: MW-5 89-91 GRAB

Time Collected:1220

Date Received: 12/07/94

Test Code	Analyte	Result	Units	Method	Analyst
BTEXS'D	BTEX Analysis Prep(Date/Time)	12/12 0932	init.	6-5030	NSH
BZ8020S	Benzene	< 0.010	ppm	6-8020	NSH
TOL8020S	Toluene	< 0.010	ppm	6-8020	NSH
EBZ8020S	Ethylbenzene	< 0.010	ppm	6-8020	NSH
XYLSTLs	Total Xylenes	< 0.020	ppm	6-8020	NSH
BTEXTLs	Total BTEX	< 0.050	ppm	6-8020	NSH
aaaTFTs	aaa-TFT (surr)	102.	%	74-121	NSH
4BFBs	4-BFB (surr)	96.	%	75-115	NSH
418_1S'D	TPH Analysis Prep(Date/Time)	12/08 1330	init.	6-3550	MLC
TPH'S	TPH(Total Petroleum Hydrocarbon	< 25	ppm	2-418.1	MLC
PHS'D	Soil pH Analysis(Date/Time)	12/08 1042	init.	6-9045	AM
pH'S	pH, Soils	8.9		6-9045	AM
NH3S'D	Ammonia Analysis (D/T)	12/16 1200	init.		CJT
NH3'S	Ammonia-N	200	mg/kg		CJT
351'4S	Nitrogen, Total Kjeldahl	200	mg/kg	2-351.4	CJT
TOCS'D	TOC Analysis (Date/Time)	12/15 0500	init.		JMR
TOC'S	TOC (Walkley-Black)	0.02	%	**	JMR
TKN'D	TKN Analysis (Date/Time)	12/21 1300	init.		CJT

COMMENTS: BTEX Dil.Fx. X 5

FOOTNOTES: MI - Surrogate recovery is not reportable due to matrix interferences
Dil.Fx.- Minimum dilution required to allow acceptable quantitation
ppm = mg/L(Liquid), mg/kg(Solid) ppb = ug/L(Liquid), ug/kg(Soil)
init = date & time initiated B=found in blank J=>mdl< reporting limit

Rec 12/27/94

Preparation and Analysis Method References:

1. ASTM: American Society for Testing and Materials, 1984.
2. EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, 1978 (revised 1983).
3. EPA-600/4-82-057, Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater, 1982.
4. HACH: Test Methods, accepted by EPA in November, 1983.
5. SM: Standard Methods for the Examination of Water and Wastewater, 18th edition.
6. SW: SW-846, Test Methods for Evaluation of Solid Waste, Third edition. Update I, July 1992.

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 9 1994 Page # 1

Brown and Caldwell
2710 Stemmons Frwy. Ste1100
Dallas , TX 75207

Reviewed by:TMG
Customer#: 309
Job Number:

Attn: Fear, Al

Date Collected:12/04/94

Sample Number: 94008503
Project Name: BELL LAKE JAL, N.M.
Sample ID: MW-5 39-41 GRAB

Time Collected:0850

Date Received: 12/07/94

Test Code	Analyte	Result	Units	Method	Analyst
418_1S'D	TPH Analysis Prep(Date/Time)	12/08 1330	init.	6-3550	MLC
TPH'S	TPH(Total Petroleum Hydrocarbon	< 25	ppm	2-418.1	MLC

COMMENTS:

FOOTNOTES: MI - Surrogate recovery is not reportable due to matrix interferences
Dil.Fx.- Minimum dilution required to allow acceptable quantitation
ppm = mg/L(Liquid), mg/kg(Solid) ppb = ug/L(Liquid), ug/kg(Soil)
init = date & time initiated B=found in blank J=>mdl< reporting limit

Preparation and Analysis Method References:

1. ASTM: American Society for Testing and Materials, 1984.
2. EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, 1978 (revised 1983).
3. EPA-600/4-82-057, Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater, 1982.
4. HACH: Test Methods, accepted by EPA in November, 1983.
5. SM: Standard Methods for the Examination of Water and Wastewater, 18th edition.
6. SW: SW-846, Test Methods for Evaluation of Solid Waste, Third edition. Update I, July 1992.

12/27/94

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 27 1994 Page # 1

Brown and Caldwell
2710 Stemmons Frwy. Ste1100
Dallas , TX 75207

Reviewed by:TMG
Customer#: 309
Job Number:

Attn: Fear, Al

Date Collected:12/05/94

Sample Number: 94008504
Project Name: BELL LAKE JAL, N.M.
Sample ID: MW-6 87-89 GRAB

Time Collected:1115

Date Received: 12/07/94

Test Code	Analyte	Result	Units	Method	Analyst
BTEXS'D	BTEX Analysis Prep(Date/Time)	12/09 1711	init.	6-5030	NSH
BZ8020S	Benzene	< 0.005	ppm	6-8020	NSH
TOL8020S	Toluene	< 0.005	ppm	6-8020	NSH
EBZ8020S	Ethylbenzene	< 0.005	ppm	6-8020	NSH
XYLSTLs	Total Xylenes	< 0.010	ppm	6-8020	NSH
BTEXTLs	Total BTEX	< 0.025	ppm	6-8020	NSH
aaaTFTs	aaa-TFT (surr)	95.	%	74-121	NSH
4BFBs	4-BFB (surr)	94.	%	75-115	NSH
418_1S'D	TPH Analysis Prep(Date/Time)	12/08 1330	init.	6-3550	MLC
TPH'S	TPH(Total Petroleum Hydrocarbon	< 25	ppm	2-418.1	MLC
PHS'D	Soil pH Analysis(Date/Time)	12/08 1042	init.	6-9045	AM
pH'S	pH, Soils	8.5		6-9045	AM
NH3S'D	Ammonia Analysis (D/T)	12/16 1200	init.		CJT
NH3'S	Ammonia-N	1.1	mg/kg		CJT
351'4S	Nitrogen, Total Kjeldahl	< 10	mg/kg	2-351.4	CJT
TOCS'D	TOC Analysis (Date/Time)	12/15 0500	init.		JMR
TOC'S	TOC (Walkley-Black)	0.02	%	**	JMR
TKN'D	TKN Analysis (Date/Time)	12/21 1300	init.		TMG

COMMENTS:

FOOTNOTES: MI - Surrogate recovery is not reportable due to matrix interferences
Dil.Fx.- Minimum dilution required to allow acceptable quantitation
ppm = mg/L(Liquid), mg/kg(Solid) ppb = ug/L(Liquid), ug/kg(Soil)
init = date & time initiated B=found in blank J=>mdl< reporting limit

Rev. 12/27/94

Preparation and Analysis Method References:

1. ASTM: American Society for Testing and Materials, 1984.
2. EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, 1978 (revised 1983).
3. EPA-600/4-82-057, Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater, 1982.
4. *HACH: Test Methods, accepted by EPA in November, 1983.*
5. SM: Standard Methods for the Examination of Water and Wastewater, 18th edition.
6. SW: SW-846, Test Methods for Evaluation of Solid Waste, Third edition. Update I, July 1992.

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 9 1994 Page # 1

Brown and Caldwell
2710 Stemmons Frwy. Ste1100
Dallas , TX 75207

Reviewed by:TMG
Customer#: 309
Job Number:

Attn: Fear, Al

Date Collected:12/05/94

Sample Number: 94008505
Project Name: BELL LAKE JAL, N.M.
Sample ID: MW-6 40-41 GRAB

Time Collected:0950

Date Received: 12/07/94

Test Code	Analyte	Result	Units	Method	Analyst
418_1S'D	TPH Analysis Prep(Date/Time)	12/08 1330	init.	6-3550	MLC
TPH'S	TPH(Total Petroleum Hydrocarbon	< 25	ppm	2-418.1	MLC

COMMENTS:

FOOTNOTES: MI - Surrogate recovery is not reportable due to matrix interferences
Dil.Fx.- Minimum dilution required to allow acceptable quantitation
ppm = mg/L(Liquid), mg/kg(Solid) ppb = ug/L(Liquid), ug/kg(Soil)
init = date & time initiated B=found in blank J=>mdl< reporting limit

Preparation and Analysis Method References:

1. ASTM: American Society for Testing and Materials, 1984.
2. EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, 1978 (revised 1983).
3. EPA-600/4-82-057, Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater, 1982.
4. HACH: Test Methods, accepted by EPA in November, 1983.
5. SM: Standard Methods for the Examination of Water and Wastewater, 18th edition.
6. SW: SW-846, Test Methods for Evaluation of Solid Waste, Third edition. Update I, July 1992.

12/7/94

QUALITY CONTROL REPORT

Report To: Brown and Caldwell
Terra Laboratories Sample No(s). 94008500 - 94008505

			Precision			Accuracy	
Analyte	Units	Blank	Orig	Dup	RPD(%)	MSR(%)	LCSR(%)
BTEX (Batch 120994S) Sample No. 94008633 Spike							
MTBE	ppb	< 5	29	25	15	125	
Benzene	ppb	< 5	32	21	41*	75	84
Toluene	ppb	< 5	21	14	40*	100	88
Ethylbenzene	ppb	< 5	35	27	26*	85	81
Xylenes	ppb	< 10	102	67	41*	75	88
*LCS passes for all analytes; compounds are non-detect for all samples except spike sample.							
TPH (Batch A120894S)							
Sample No. 94008505	mg/kg	< 25	< 25	< 25	-		90
pH (Batch 120894S)							
Sample No. 94008481	pH Units		6.62	6.62	-		
Ammonia Nitrogen (Batch 121694S)							
Sample No.94008500	mg/kg	< 0.1	15.3	18.7	20	97	100
BTEX (Batch 121294S) Sample No. 94008641 Spike							
MTBE	ppb	< 5	20	21	5	100	
Benzene	ppb	< 5	21	22	5	105	98
Toluene	ppb	< 5	25	25	0	110	101
Ethylbenzene	ppb	< 5	22	22	0	110	93
Xylenes	ppb	< 10	64	64	0	105	101
TOC (Batch 121594S)							
Sample No. 94008500	%	< 0.1	0.02	< 0.01	-	71*	90
*Matrix interference with spike recovery; LCS is within acceptable limits							
TKN (Batch 122794S)							
Sample No. 94008500	mg/kg	< 0.1	31.4	27.6	12.9	83	85

RW 1/5/95
Larry D Miller

TERRA LABORATORIES LTD.

2525 South Shore Blvd. League City, Texas 77573 (713) 334-5052 Fax: (713) 334-3116

CHAIN OF CUSTODY

REPORT TO:			REMIT TO:		
COMPANY Brown & Caldwell			COMPANY SAME		
ADDRESS 2710 Stemmons Fwy Ste. 1100 Tower North			ADDRESS		
CITY Dallas	STATE TX	ZIP 75207	CITY	STATE	ZIP
ATTN Al Fear	PHONE 214 630 0001	FAX 214 630-9866	ATTN	PHONE	FAX
Client Comments:			Project Name: Bell Lake Jal, NM.	P.O. #	
			Turnaround Time Standard	Release #	

ANALYSES REQUESTED

DATE	24HR TIME	MATRIX	COMPOSITE	GRAB	SAMPLE DESCRIPTION	CONTAINERS NUMBER	TPH 418.1	BTEX 8020	pH	Ammonia Nitrogen	Orthophosphate	TKN	Total Organic Carbon	TERRA SAMPLE NO.
12/3/94	1130	Soil		X	MW-4 87-89'	2	X	X	X	X	X	X	X	94 = 8500
12/3/94	925	↓		X	MW-4 32-34	1	X							- 8501
12/4/94	1220			X	MW-5 89-91	2	X	X	X	X	X	X	X	- 8502
12/4/94	850			X	MW-5 39-41	1	X							- 8503
12/5/94	1115			X	MW-6 87-89	2	X	X	X	X	X	X	X	- 8504
12/5/94	950	↓		X	MW-6 40-41	1	X							- 8505

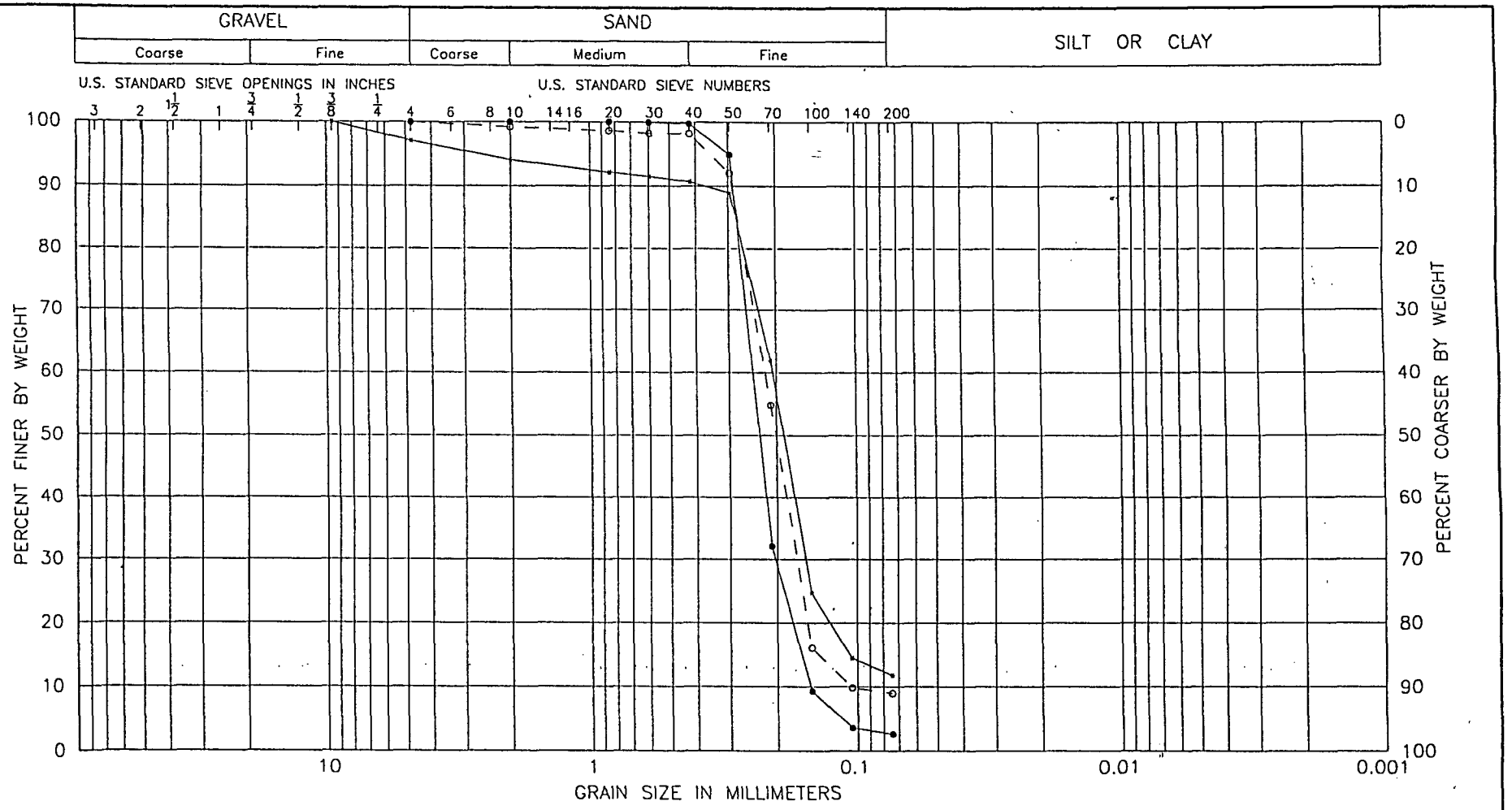
Per Suzanne Richard
Cancel Ortho.phospha
on Soils. CW
12/9/94

Collected by:	Date:	Time:	Received by Terra:	Date:	Time:	Remarks
Al Fear Alan J. Fear	12/6/94	630am		12-7-94	1040	1°C WC 12-7-94
Relinquished by:	Date:	Time:	Received by:	Date:	Time:	
Relinquished by:	Date:	Time:	Received by:	Date:	Time:	

APPENDIX C

GEOTECHNICAL RESULTS

Job No. 94G817



LEGEND	BORING NO.	SAMPLE NO.	DEPTH FT.	SAMPLE DESCRIPTION
●—●—●	MW-4		94-96	Brown fine sand w/organic odor
o—o—o	MW-5		95-97	Brown fine sand w/silt and organic odor
•—•—•	MW-6		94-96	Brown fine sand w/silt and organic odor

GRAIN SIZE DISTRIBUTION CURVES

FIGURE 1

Geotest Engineering, Inc.

1701 W. Glenlake, Itasca, IL 60143, (708) 980-1600

946817

NATIONAL ENVIRONMENTAL TESTING, INC.

Geotest Engineering Inc
5600 Bintliff
Houston Tx 77036
713-266-0588

CHAIN OF CUSTODY RECORD

COMPANY Brown & Caldwell
ADDRESS 2710 Stemmons Fwy Ste. 1100 Tower North
PHONE 214 630 0001 FAX 214-630-9866
PROJECT NAME/LOCATION Bell Lake Jal, NM.
PROJECT NUMBER
PROJECT MANAGER Susanne Richard

REPORT TO: Al Fear
INVOICE TO:
P.O. NO.
NET QUOTE NO.

SAMPLED BY Al Fear (PRINT NAME) Alan J. Fear (SIGNATURE)
(PRINT NAME) (SIGNATURE)

					# and Type of Containers	ANALYSES: grain size distribution	COMMENTS
12/3	1150	MW-4 94-96'	Soil	X		X	
12/4	1240	MW-5 95-97'	Soil	X		X	
12/5	1130	MW-6 94-96	Soil	X		X	

CONDITION OF SAMPLE: BOTTLES INTACT? YES / NO
FIELD FILTERED? YES / NO
COC SEALS PRESENT AND INTACT? YES / NO
VOLATILES FREE OF HEADSPACE? YES / NO
TEMPERATURE UPON RECEIPT:
Bottles supplied by NET? YES / NO

SAMPLE REMAINDER DISPOSAL: RETURN SAMPLE REMAINDER TO CLIENT VIA
I REQUEST NET TO DISPOSE OF ALL SAMPLE REMAINDERS DATE

RELINQUISHED BY:	DATE/TIME	RECEIVED BY:	RELINQUISHED BY:	DATE/TIME	RECEIVED FOR NET BY:
Al Fear	12/6/94 1630				

APPENDIX D

LABORATORY RESULTS
GROUNDWATER SAMPLES

Terra Laboratories, Ltd.
Quality Analytical Services

AJF copy

January 3, 1995

Jack Cooper
Brown and Caldwell
1415 Louisiana, Suite 2500
Houston, TX 77002

Re: Seven (7) liquid samples (Project Name: Bell Lake) received on 12/09/94

Dear Mr. Cooper:

Attached are the final reports of analysis of the samples referenced above as per your analysis and/or method requests. As per Suzanne Richards BTEX by Method 8020 was analyzed in place of Volatiles by Method 8260 and Nitrate-Nitrite was analyzed in place of Nitrite. The analysis for Manganese was subcontracted to Chester LabNet. Manganese Dioxide concentrations are calculated from the Manganese results, and are as follows:

Sample	MnO2 (ug/L)
94008625	10
94008626	46
94008627	93
94008628	3.0
94008629	72
94008630	45

The samples were received in good condition and at 0^{o} Centigrade.

We appreciate this opportunity to serve Brown and Caldwell. Please let me, or Linda McKee, know if there is any other way we can help you.

Sincerely,

Larry D. Wallace
Laboratory Director

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 29 1994 Page # 1

Brown and Caldwell
515 Louisiana, Suite 2500
Houston , TX 77002

Attn: Cooper, Jack

Reviewed by:JMH
Customer#: 309
Job Number:

Date Collected:12/07/94

Time Collected:1610

Date Received: 12/09/94

Sample Number: 94008626
Project Name: BELL LAKE
Sample ID: MW-1

Test Code	Analyte	Result	Units	Method	Analyst
BTEXW'D	BTEX Analysis Prep(Date/Time)	12/14 1921	init.	6-5030	NSH
BZ8020W	Benzene	.092	ppm	6-8020	NSH
TOL8020W	Toluene	.050	ppm	6-8020	NSH
EBZ8020W	Ethylbenzene	.054	ppm	6-8020	NSH
XYLSTLw	Total Xylenes	< 0.111	ppm	6-8020	NSH
BTEXTLw	Total BTEX	< 0.307	ppm	6-8020	NSH
SaaTFTw	aaa-TFT (surr)	MI	%	82-114	NSH
4BFBw	4-BFB (surr)	98.	%	85-115	NSH
TDS'D	TDS Analysis (Date/Time)	12/14 0715	init.	2-160.1	JMR
TDS'RES	TDS(Total Dissolved Solids)	7100	mg/L	2-160.1	JMR
OPO4W'D	OrthoPO4 Analysis Date/Time	12/09 1400	init.		AM
oPO4'W	Orthophosphate	0.3	mg/L	2-365.2	AM
TKN'D	TKN Analysis (Date/Time)	12/28 0930	init.		JMR
TKN'WJ	Total Kjeldahl Nitrogen	31	mg/L	2-351.4	JMR
COD'D	COD Analysis (Date/Time)	12/21 1600	init.		CJT
CODppm	Chemical Oxygen Demand	420	mg/L	4-8000	CJT
NO3NO2'D	Nitrate-Nitrite Analysis (D/T)	12/20 1000	init.		CJT
NO3NO2	Nitrate-Nitrite N	.06	mg/L	2-353.3	TMG
SO4'D	Sulfate Analysis (D/T)	12/28 0830	init.		DPP
Sulfate	Sulfate	140	mg/L	2-375.4	DPP

1cw 1/2/95
Terry Williams

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 29 1994

Brown and Caldwell
1415 Louisiana, Suite 2500
Houston , TX 77002

Reviewed by:JMH
Customer#: 309
Job Number:

Attn: Cooper, Jack

Date Collected:12/07/94

Sample Number: 94008626
Project Name: BELL LAKE
Sample ID: MW-1

Time Collected:1610

Date Received: 12/09/94

Test Code	Analyte	Result	Units	Method	Analyst
NH3W'D	Ammonia Analysis (D/T)	12/20 1400	init.		JMH
NH3ISEW	Ammonia-Nitrogen	37	mg/L	2-350.3	JMH
SOLCOD'D	Soluable COD Analysis (Date/Tim	12/21 1600	init.		CJT
SCODppm	Soluable Carbon Oxygen Demand	340	mg/L	4-8000	CJT
LAB'NAME	Analyses subcontracted to:	Chester			JMH
SUBCON'D	Date subcontracted:	12/15 1200			JMH

COMMENTS: BTEX Dil. Factor X 10,NH3 > TKN, Anal. Repeated, Suspect. Interfe

FOOTNOTES: MI - Surrogate recovery is not reportable due to matrix interferences
Dil.Fx.- Minimum dilution required to allow acceptable quantitation
ppm = mg/L(Liquid), mg/kg(Solid) ppb = ug/L(Liquid), ug/kg(Soil)
init = date & time initiated B=found in blank J=>mdl< reporting limit

Preparation and Analysis Method References:

1. ASTM: American Society for Testing and Materials, 1984.
2. EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, 1978 (revised 1983).
3. EPA-600/4-82-057, Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater, 1982.
4. HACH: Test Methods, accepted by EPA in November, 1983.
5. SM: Standard Methods for the Examination of Water and Wastewater, 18th edition.
6. SW: SW-846, Test Methods for Evaluation of Solid Waste, Third edition. Update I, July 1992.

1/2/95

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 29 1994 Page # 1

Brown and Caldwell
1415 Louisiana, Suite 2500
Houston, TX 77002

Reviewed by:JMH
Customer#: 309
Job Number:

Attn: Cooper, Jack

Date Collected:12/07/94

Sample Number: 94008627
Project Name: BELL LAKE
Sample ID: MW-2

Time Collected:1640

Date Received: 12/09/94

Test Code	Analyte	Result	Units	Method	Analyst
BTEXW'D	BTEX Analysis Prep(Date/Time)	12/15 1108	init.	6-5030	NSH
BZ8020W	Benzene	.006	ppm	6-8020	TMG
TOL8020W	Toluene	.005	ppm	6-8020	TMG
EBZ8020W	Ethylbenzene	< 0.002	ppm	6-8020	NSH
XYLSTLw	Total Xylenes	< 0.004	ppm	6-8020	NSH
BTEXTLw	Total BTEX	< 0.017	ppm	6-8020	NSH
aaaTFTw	aaa-TFT (surr)	101.	%	82-114	NSH
4BFBw	4-BFB (surr)	MI	%	85-115	NSH
TDS'D	TDS Analysis (Date/Time)	12/14 0715	init.	2-160.1	JMR
TDS'RES	TDS(Total Dissolved Solids)	2600	mg/L	2-160.1	JMR
NH3W'D	Ammonia Analysis (D/T)	12/20 1400	init.		JMH
NH3ISEW	Ammonia-Nitrogen	6.6	mg/L	2-350.3	JMH
oPO4W'D	OrthoPO4 Analysis Date/Time	12/09 1400	init.		AM
oPO4'W	Orthophosphate	0.1	mg/L	2-365.2	AM
TKN'D	TKN Analysis (Date/Time)	12/28 0930	init.		JMR
TKN'WJ	Total Kjeldahl Nitrogen	5	mg/L	2-351.4	JMR
COD'D	COD Analysis (Date/Time)	12/21 1600	init.		CJT
CODppm	Chemical Oxygen Demand	160	mg/L	4-8000	CJT
NO3NO2'D	Nitrate-Nitrite Analysis (D/T)	12/20 1000	init.		CJT
NO3NO2	Nitrate-Nitrite N	< 0.05	mg/L	2-353.3	CJT

RW 1/2/95
Larry D Stallcup

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 29 1994 Page # 2

Brown and Caldwell
1415 Louisiana, Suite 2500
Houston , TX 77002

Reviewed by:JMH
Customer#: 309
Job Number:

Attn: Cooper, Jack

Date Collected:12/07/94

Sample Number: 94008627
Project Name: BELL LAKE
Sample ID: MW-2

Time Collected:1640

Date Received: 12/09/94

Test Code	Analyte	Result	Units	Method	Analyst
SO4'D	Sulfate Analysis (D/T)	12/28 0830	init.		DPP
Sulfate	Sulfate	51	mg/L	2-375.4	DPP
SOLCOD'D	Soluable COD Analysis (Date/Tim	12/21 1600	init.		CJT
SCODppm	Soluable Carbon Oxygen Demand	140	mg/L	4-8000	CJT
LAB'NAME	Analyses subcontracted to:	Chester			JMH
SUBCON'D	Date subcontracted:	12/15 1200			JMH

COMMENTS: NH3 > TKN, Anal. Repeated, Suspected Interference

FOOTNOTES: MI - Surrogate recovery is not reportable due to matrix interferences
Dil.Fx.- Minimum dilution required to allow acceptable quantitation
ppm = mg/L(Liquid), mg/kg(Solid) ppb = ug/L(Liquid), ug/kg(Soil)
init = date & time initiated B=found in blank J=>mdl< reporting limit

Preparation and Analysis Method References:

1. ASTM: American Society for Testing and Materials, 1984.
2. EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, 1978 (revised 1983).
3. EPA-600/4-82-057, Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater, 1982.
4. HACH: Test Methods, accepted by EPA in November, 1983.
5. SM: Standard Methods for the Examination of Water and Wastewater, 18th edition.
6. SW: SW-846, Test Methods for Evaluation of Solid Waste, Third edition. Update I, July 1992.

Rw 1/2/95
Larry D Wallace

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC 29 1994

Page # 1

Brown and Caldwell
1415 Louisiana, Suite 2500
Houston, TX 77002

Attn: Cooper, Jack

Reviewed by: JMH
Customer#: 309
Job Number:

Date Collected: 12/07/94

Sample Number: 94008625
Project Name: BELL LAKE
Sample ID: MW-3

Time Collected: 1530

Date Received: 12/09/94

Test Code	Analyte	Result	Units	Method	Analyst
BTEXW'D	BTEX Analysis Prep(Date/Time)	12/15 1048	init.	6-5030	NSH
BZ8020W	Benzene	< 0.002	ppm	6-8020	NSH
TOL8020W	Toluene	< 0.002	ppm	6-8020	NSH
EBZ8020W	Ethylbenzene	< 0.002	ppm	6-8020	NSH
XYLSTLw	Total Xylenes	< 0.004	ppm	6-8020	NSH
BTEXTLw	Total BTEX	< 0.010	ppm	6-8020	NSH
aaaTFTw	aaa-TFT (surr)	99.	%	82-114	NSH
4BFBw	4-BFB (surr)	98.	%	85-115	NSH
TDS'D	TDS Analysis (Date/Time)	12/14 0715	init.	2-160.1	JMR
TDS'RES	TDS(Total Dissolved Solids)	320	mg/L	2-160.1	JMR
NH3W'D	Ammonia Analysis (D/T)	12/20 1400	init.		JMH
NH3ISEW	Ammonia-Nitrogen	0.44	mg/L	2-350.3	JMH
oPO4W'D	OrthoPO4 Analysis Date/Time	12/09 1400	init.		AM
oPO4'W	Orthophosphate	0.2	mg/L	2-365.2	AM
TKN'D	TKN Analysis (Date/Time)	12/28 0930	init.		JMR
TKN'WJ	Total Kjeldahl Nitrogen	.28	mg/L	2-351.4	JMR
COD'D	COD Analysis (Date/Time)	12/21 1600	init.		CJT
CODppm	Chemical Oxygen Demand	< 1	mg/L	4-8000	CJT
SO4'D	Sulfate Analysis (D/T)	12/28 0830	init.		DPP
Sulfate	Sulfate	31	mg/L	2-375.4	DPP

Rcvd 1/2/95
Larry D [signature]

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 29 1994 Page # 2

Brown and Caldwell
1415 Louisiana, Suite 2500
Houston , TX 77002

Reviewed by:JMH
Customer#: 309
Job Number:

Attn: Cooper, Jack

Date Collected:12/07/94

Sample Number: 94008625
Project Name: BELL LAKE
Sample ID: MW-3

Time Collected:1530

Date Received: 12/09/94

Test Code	Analyte	Result	Units	Method	Analyst
NO3NO2'D	Nitrate-Nitrite Analysis (D/T)	12/20 1000	init.		CJT
NO3NO2	Nitrate-Nitrite N	3.6	mg/L	2-353.3	CJT
SOLCOD'D	Soluable COD Analysis (Date/Tim	12/21 1600	init.		CJT
SCODppm	Soluable Carbon Oxygen Demand	< 1	mg/L	4-8000	CJT
LAB'NAME	Analyses subcontracted to:	Chester			JMH
SUBCON'D	Date subcontracted:	12/15 1200			JMH

COMMENTS: NH3 > TKN, Anal. Repeated, Suspected Interference

FOOTNOTES: MI - Surrogate recovery is not reportable due to matrix interferences
Dil.Fx.- Minimum dilution required to allow acceptable quantitation
ppm = mg/L(Liquid), mg/kg(Solid) ppb = ug/L(Liquid), ug/kg(Soil)
init = date & time initiated B=found in blank J=>mdl< reporting limit

Preparation and Analysis Method References:

1. ASTM: American Society for Testing and Materials, 1984.
2. EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, 1978 (revised 1983).
3. EPA-600/4-82-057, Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater, 1982.
4. HACH: Test Methods, accepted by EPA in November, 1983.
5. SM: Standard Methods for the Examination of Water and Wastewater, 18th edition.
6. SW: SW-846, Test Methods for Evaluation of Solid Waste, Third edition. Update I, July 1992.

RW 1/2/95
Larry Dahlberg

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 29 1994 Page # 1

Brown and Caldwell
1415 Louisiana, Suite 2500
Houston, TX 77002

Reviewed by: JMH
Customer#: 309
Job Number:

Attn: Cooper, Jack

Date Collected: 12/07/94

Sample Number: 94008630
Project Name: BELL LAKE
Sample ID: MW-4

Time Collected: 1855

Date Received: 12/09/94

Test Code	Analyte	Result	Units	Method	Analyst
BTEXW'D	BTEX Analysis Prep(Date/Time)	12/15 1208	init.	6-5030	NSH
BZ8020W	Benzene	.018	ppm	6-8020	NSH
TOL8020W	Toluene	.071	ppm	6-8020	NSH
EBZ8020W	Ethylbenzene	.004	ppm	6-8020	TMG
XYLSTLw	Total Xylenes	.16	ppm	6-8020	NSH
BTEXTLw	Total BTEX	0.253	ppm	6-8020	NSH
aaaTFTw	aaa-TFT (surr)	98.	%	82-114	NSH
4BFBw	4-BFB (surr)	MI	%	85-115	NSH
TDS'D	TDS Analysis (Date/Time)	12/14 0715	init.	2-160.1	JMR
TDS'RES	TDS(Total Dissolved Solids)	4700	mg/L	2-160.1	JMR
NH3W'D	Ammonia Analysis (D/T)	12/20 1400	init.		JMH
NH3ISEW	Ammonia-Nitrogen	120	mg/L	2-350.3	JMH
oPO4W'D	OrthoPO4 Analysis Date/Time	12/09 1400	init.		AM
oPO4'W	Orthophosphate	0.6	mg/L	2-365.2	AM
TKN'D	TKN Analysis (Date/Time)	12/28 0930	init.		JMR
TKN'WJ	Total Kjeldahl Nitrogen	83	mg/L	2-351.4	JMR
COD'D	COD Analysis (Date/Time)	12/21 1600	init.		CJT
CODppm	Chemical Oxygen Demand	780	mg/L	4-8000	CJT
NO3NO2'D	Nitrate-Nitrite Analysis (D/T)	12/20 1000	init.		CJT
NO3NO2	Nitrate-Nitrite N	< 0.05	mg/L	2-353.3	CJT

RW 1/2/95
Larry D. Miller

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 29 1994 Page # 2

Brown and Caldwell
1415 Louisiana, Suite 2500
Houston , TX, 77002

Reviewed by:JMH
Customer#: 309
Job Number:

Attn: Cooper, Jack

Date Collected:12/07/94

Sample Number: 94008630
Project Name: BELL LAKE
Sample ID: MW-4

Time Collected:1855

Date Received: 12/09/94

Test Code	Analyte	Result	Units	Method	Analyst
SO4'D	Sulfate Analysis (D/T)	12/28 0830	init.		DPP
Sulfate	Sulfate	70	mg/L	2-375.4	DPP
SOLCOD'D	Soluable COD Analysis (Date/Tim	12/21 1600	init.		CJT
SCODppm	Soluable Carbon Oxygen Demand	720	mg/L	4-8000	CJT
LAB'NAME	Analyses subcontracted to:	Chester			JMH
SUBCON'D	Date subcontracted:	12/15 1200			JMH

COMMENTS: NH3 > TKN, Anal. Repeated, Suspected Interference

FOOTNOTES: MI - Surrogate recovery is not reportable due to matrix interferences
Dil.Fx.- Minimum dilution required to allow acceptable quantitation
ppm = mg/L(Liquid), mg/kg(Solid) ppb = ug/L(Liquid), ug/kg(Soil)
init = date & time initiated B=found in blank J=>mdl< reporting limit

Preparation and Analysis Method References:

1. ASTM: American Society for Testing and Materials, 1984.
2. EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, 1978 (revised 1983).
3. EPA-600/4-82-057, Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater, 1982.
4. HACH: Test Methods, accepted by EPA in November, 1983.
5. SM: Standard Methods for the Examination of Water and Wastewater, 18th edition.
6. SW: SW-846, Test Methods for Evaluation of Solid Waste, Third edition. Update I, July 1992.

1/2/95

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 29 1994 Page # 1

Brown and Caldwell
1415 Louisiana, Suite 2500
Houston , TX 77002

Reviewed by:JMH
Customer#: 309
Job Number:

Attn: Cooper, Jack

Date Collected:12/07/94

Sample Number: 94008628
Project Name: BELL LAKE
Sample ID: MW-5

Time Collected:1740

Date Received: 12/09/94

Test Code	Analyte	Result	Units	Method	Analyst
BTEXW'D	BTEX Analysis Prep(Date/Time)	12/15 1128	init.	6-5030	NSH
BZ8020W	Benzene	.009	ppm	6-8020	TMG
TOL8020W	Toluene	.020	ppm	6-8020	NSH
EBZ8020W	Ethylbenzene	.004	ppm	6-8020	TMG
XYLSTLw	Total Xylenes	.064	ppm	6-8020	NSH
BTEXTLw	Total BTEX	0.097	ppm	6-8020	NSH
aaaTFTw	aaa-TFT (surr)	100.	%	82-114	NSH
4BFBw	4-BFB (surr)	MI	%	85-115	NSH
TDS'D	TDS Analysis (Date/Time)	12/14 0715	init.	2-160.1	JMR
TDS'RES	TDS(Total Dissolved Solids)	9500	mg/L	2-160.1	JMR
NH3W'D	Ammonia Analysis (D/T)	12/20 1400	init.		JMH
NH3ISEW	Ammonia-Nitrogen	140	mg/L	2-350.3	JMH
oPO4W'D	OrthoPO4 Analysis Date/Time	12/09 1400	init.		AM
oPO4'W	Orthophosphate	0.6	mg/L	2-365.2	AM
TKN'D	TKN Analysis (Date/Time)	12/28 0930	init.		JMR
TKN'WJ	Total Kjeldahl Nitrogen	110	mg/L	2-351.4	JMR
COD'D	COD Analysis (Date/Time)	12/21 1600	init.		CJT
CODppm	Chemical Oxygen Demand	1100	mg/L	4-8000	CJT
NO3NO2'D	Nitrate-Nitrite Analysis (D/T)	12/20 1000	init.		CJT
NO3NO2	Nitrate-Nitrite N	< 0.05	mg/L	2-353.3	CJT

RW 1/2/95
Larry D. Stallcup

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 29 1994 Page # 2

Brown and Caldwell
1415 Louisiana, Suite 2500
Houston , TX 77002

Reviewed by:JMH
Customer#: 309
Job Number:

Attn: Cooper, Jack

Date Collected:12/07/94

Sample Number: 94008628
Project Name: BELL LAKE
Sample ID: MW-5

Time Collected:1740

Date Received: 12/09/94

Test Code	Analyte	Result	Units	Method	Analyst
SO4'D	Sulfate Analysis (D/T)	12/28 0830	init.		DPP
Sulfate	Sulfate	49	mg/L	2-375.4	DPP
SOLCOD'D	Soluable COD Analysis (Date/Tim	12/21 1600	init.		CJT
SCODppm	Soluable Carbon Oxygen Demand	1100	mg/L	4-8000	CJT
LAB'NAME	Analyses subcontracted to:	Chester			JMH
SUBCON'D	Date subcontracted:	12/15 1200			JMH

COMMENTS: NH3 > TKN, Anal. Repeated, Suspected Interference

FOOTNOTES: MI - Surrogate recovery is not reportable due to matrix interferences
Dil.Fx.- Minimum dilution required to allow acceptable quantitation
ppm = mg/L(Liquid), mg/kg(Solid) ppb = ug/L(Liquid), ug/kg(Soil)
init = date & time initiated B=found in blank J->mdl< reporting limit

Preparation and Analysis Method References:

1. ASTM: American Society for Testing and Materials, 1984.
2. EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, 1978 (revised 1983).
3. EPA-600/4-82-057, Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater, 1982.
4. HACH: Test Methods, accepted by EPA in November, 1983.
5. SM: Standard Methods for the Examination of Water and Wastewater, 18th edition.
6. SW: SW-846, Test Methods for Evaluation of Solid Waste, Third edition. Update I, July 1992.

RW 1/2/95
Larry D Miller

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 29 1994 Page # 1

Brown and Caldwell
1415 Louisiana, Suite 2500
Houston TX 77002

Reviewed by:JMH
Customer#: 309
Job Number:

Attn: Cooper, Jack

Date Collected:12/07/94

Sample Number: 94008629
Project Name: BELL LAKE
Sample ID: MW-6

Time Collected:0000

Date Received: 12/09/94

Test Code	Analyte	Result	Units	Method	Analyst
BTEXW'D	BTEX Analysis Prep(Date/Time)	12/15 1148	init.	6-5030	NSH
BZ8020W	Benzene	< 0.002	ppm	6-8020	NSH
TOL8020W	Toluene	.003	ppm	6-8020	TMG
EBZ8020W	Ethylbenzene	< 0.002	ppm	6-8020	NSH
XYLSTLw	Total Xylenes	< 0.006	ppm	6-8020	NSH
BTEXTLw	Total BTEX	< 0.013	ppm	6-8020	NSH
aaaTFTw	aaa-TFT (surr)	106.	%	82-114	NSH
4BFBw	4-BFB (surr)	MI	%	85-115	NSH
TDS'D	TDS Analysis (Date/Time)	12/14 0715	init.	2-160.1	JMR
TDS'RES	TDS(Total Dissolved Solids)	4700	mg/L	2-160.1	JMR
NH3W'D	Ammonia Analysis (D/T)	12/20 1400	init.		JMH
NH3ISEW	Ammonia-Nitrogen	160	mg/L	2-350.3	JMH
oPO4W'D	OrthoPO4 Analysis Date/Time	12/09 1400	init.		AM
oPO4'W	Orthophosphate	0.7	mg/L	2-365.2	AM
TKN'D	TKN Analysis (Date/Time)	12/28 0930	init.		JMR
TKN'WJ	Total Kjeldahl Nitrogen	110	mg/L	2-351.4	JMR
COD'D	COD Analysis (Date/Time)	12/21 1600	init.		CJT
CODppm	Chemical Oxygen Demand	560	mg/L	4-8000	CJT
NO3NO2'D	Nitrate-Nitrite Analysis (D/T)	12/20 1000	init.		CJT
NO3NO2	Nitrate-Nitrite N	< 0.05	mg/L	2-353.3	CJT

Rw 1/2/95
Larry D Stallcup

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 29 1994 Page # 2

Brown and Caldwell
1415 Louisiana, Suite 2500
Houston , TX 77002

Reviewed by:JMH
Customer#: 309
Job Number:

Attn: Cooper, Jack

Date Collected:12/07/94

Sample Number: 94008629
Project Name: BELL LAKE
Sample ID: MW-6

Time Collected:0000

Date Received: 12/09/94

Test Code	Analyte	Result	Units	Method	Analyst
SO4'D	Sulfate Analysis (D/T)	12/28 0830	init.		DPP
Sulfate	Sulfate	150	mg/L	2-375.4	DPP
SOLCOD'D	Soluable COD Analysis (Date/Tim	12/21 1600	init.		CJT
SCODppm	Soluable Carbon Oxygen Demand	620	mg/L	4-8000	CJT
LAB'NAME	Analyses subcontracted to:	Chester			JMH
SUBCON'D	Date subcontracted:	12/15 1200			JMH

COMMENTS: Sol. & T. COD W/In Exper. Precison Range,NH3 > TKN, Interference

FOOTNOTES: MI - Surrogate recovery is not reportable due to matrix interferences
Dil.Fx.- Minimum dilution required to allow acceptable quantitation
ppm = mg/L(Liquid), mg/kg(Solid) ppb = ug/L(Liquid), ug/kg(Soil)
init = date & time initiated B=found in blank J=>mdl< reporting limit

Preparation and Analysis Method References:

1. ASTM: American Society for Testing and Materials, 1984.
2. EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, 1978 (revised 1983).
3. EPA-600/4-82-057, Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater, 1982.
4. HACH: Test Methods, accepted by EPA in November, 1983.
5. SM: Standard Methods for the Examination of Water and Wastewater, 18th edition.
6. SW: SW-846, Test Methods for Evaluation of Solid Waste, Third edition. Update I, July 1992.

Rw 1/2/95
Gary Waldrop

TERRA LABORATORIES, LTD.
2525 SOUTH SHORE BLVD, SUITE 100
LEAGUE CITY, TX 77573
713/334-5052 FAX 713/334-3116

LAB ANALYSIS REPORT

Report Date: DEC. 16 1994

Brown and Caldwell
1415 Louisiana, Suite 2500
Houston , TX, 77002

Attn: Cooper, Jack

Reviewed by:TMG
Customer#: 309
Job Number:

Date Collected:12/08/94

Sample Number: 94008631
Project Name: BELL LAKE
Sample ID: TB-1

Time Collected:1000

Date Received: 12/09/94

Test Code	Analyte	Result	Units	Method	Analyst
BTEXW'D	BTEX Analysis Prep(Date/Time)	12/15 1228	init.	6-5030	NSH
BZ8020W	Benzene	< 0.002	ppm	6-8020	NSH
TOL8020W	Toluene	< 0.002	ppm	6-8020	NSH
EBZ8020W	Ethylbenzene	< 0.002	ppm	6-8020	NSH
XYLSTLw	Total Xylenes	< 0.004	ppm	6-8020	NSH
BTEXTLw	Total BTEX	< 0.010	ppm	6-8020	NSH
aaaTFTw	aaa-TFT (surr)	89.	%	82-114	NSH
4BFBw	4-BFB (surr)	107.	%	85-115	NSH

COMMENTS:

FOOTNOTES: MI - Surrogate recovery is not reportable due to matrix interferences
Dil.Fx.- Minimum dilution required to allow acceptable quantitation
ppm = mg/L(Liquid), mg/kg(Solid) ppb = ug/L(Liquid), ug/kg(Soil)
init = date & time initiated B=found in blank J=>mdl< reporting limit

Preparation and Analysis Method References:

1. ASTM: American Society for Testing and Materials, 1984.
2. EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, 1978 (revised 1983).
3. EPA-600/4-82-057, Methods for Organic Chemical Analysis of Municipal & Industrial Wastewater, 1982.
4. HACH: Test Methods, accepted by EPA in November, 1983.
5. SM: Standard Methods for the Examination of Water and Wastewater, 18th edition.
6. SW: SW-846, Test Methods for Evaluation of Solid Waste, Third edition. Update I, July 1992.

Rw 1/2/95
Larry D[illegible]

TERRA LABORATORIES LTD.

2525 South Shore Blvd. League City, Texas 77573 (713) 334-5052 Fax: (713) 334-3116

CHAIN OF CUSTODY

REPORT TO:			REMIT TO:		
COMPANY	BROWN AND CALDWELL		COMPANY	SAME	
ADDRESS	1415 LOUISIANA, STE 2500		ADDRESS		
CITY	HOUSTON	STATE TX ZP 77002	CITY		STATE ZP
ATTN	JACK COOPER	PHONE 713/759-0999 FAX 713/759-0952	ATTN	[redacted] J. Cooper	PHONE FAX
Client Comments:			Project Name:	BELL LAKE	P.O. #
			Turnaround Time	STANDARD	Release #

ANALYSES REQUESTED

DATE	24HR TIME	MATRIX	COMPOSITE	GRAB	SAMPLE DESCRIPTION	CONTAINER NUMBERS	TERRA SAMPLE NO.
12/7/94	1530/1550	GW			MW-3	5	94-8625
	1610/1630				MW-1	5	-8626
	1640/1655				MW-2	5	-8627
	1740/1755				MW-5	5	-8628
					MW-6	5	-8629
	1855/1905				MW-4	5	-8630
12/8/94	1000	W			TB-1	2	-8631

HOLD

0°C Temp ok 12/9/94

Per Suzanne Richardson run 8020 volatiles not 8260 as on fax from Jack Cooper. 12/9/94 CW

Per Suzanne Richardson summarize - nitrate 12/9/94 DM

Collected by:	Date:	Time:	Received by Terra:	Date:	Time:
Jack Cooper	12/8/94	1300	FED EX		
Relinquished by:	Date:	Time:	Received by:	Date:	Time:
				12/9/94	1000
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

Remarks: Hold all samples A corrected COC with analyses to be run will be faxed on Friday 12/9/94. Jack Cooper

TERRA LABORATORIES LTD.

2525 South Shore Blvd. League City, Texas 77573 (713) 334-5052 Fax: (713) 334-3116

CHAIN OF CUSTODY

Amended Chain of Custody

REPORT TO		REMIT TO	
COMPANY	BROWN AND CALDWELL	COMPANY	TAME
ADDRESS	1415 LOUISIANA STE 2500	ADDRESS	
CITY	HOUSTON	CITY	
STATE	TX	STATE	
ZIP	77002	ZIP	
ATTN	JACK COOPER	ATTN	J. Cooper
PHONE	713/754-0999	PHONE	
FAX	713/754-0952	FAX	
Client Comments:		Project Name:	BELL LAKE
		P.O.#	
		Turnaround Time	STANDARD
		Release #	

ANALYSES REQUESTED

DATE	24HR TIME	MATRIX	COMPOSITE	GRAB	SAMPLE DESCRIPTION	CONTAINERS NUMBERS	TPH-D	8260 - Target List	TDS	Ammonia Nitrate	Ortho-phosphate	TKN	Soluble COD	Total COD	Nitrate Sulfate	Manganese Dioxide			TERRA SAMPLE NO.
12/7/94	1533/1510	GW			MW-3	5	X	X	X	X	X	X	X	X	X	X			* Substitute 8020-BTEX per Suganne Richards 12/9/94
"	1410/1430	"			MW-1	5	"	"	"	"	"	"	"	"	"	"			
"	1640/1655	"			MW-2	5	"	"	"	"	"	"	"	"	"	"			
"	1420/1355	"			MW-5	5	"	"	"	"	"	"	"	"	"	"			Per Suganne Richards sum nitrate-nitrite 12/9/94 DM
"		"			MW-6	5	"	"	"	"	"	"	"	"	"	"			
↓	1517/1505	↓			MW-4	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓			
12/8/94	1000	LW			TB-1	2	X												

Collected by:	Date: 12/8/94	Time: 1300	Received by/Terra:	FED EX	Date:	Time:	Remarks: Held all samples. A corrected COC with analysis to be run will be faxed on Friday 12/9/94.
Relinquished by:	Date:	Time:	Received by:		Date: 12/9/94	Time: 1445	
Relinquished by:	Date:	Time:	Received by:		Date:	Time:	

BROWN AND
CALDWELL

Suite 2500
1415 Louisiana
Houston, Texas 77002
(713) 759-0999 • FAX (713) 759-0952

FAX TRANSMITTAL COVER SHEET

PLEASE DELIVER THE FOLLOWING PAGES TO:

Name: Ms. Diane Meyer Company: Terra Laboratories, Ltd

City: League City FAX No: (713) 334-3116

THIS TRANSMITTAL IS BEING SENT FROM:

Name/User ID: Jane Cooper Date: 12/9/94

Job #: 1820.01 Return originals: Yes X No

Stamp: Yes X No

SPECIAL INSTRUCTIONS/REMARKS:

Diane -
If you don't hear from Suzanne by this afternoon, you may want to give her a call to make sure this is correct.
Thanks
Jane

NUMBER OF PAGES BEING TRANSMITTED, INCLUDING COVER SHEET: 2

21-DEC-1994

Summary of Analytical Results

Date received: 15-DEC-1994 Customer: TERRA LABORATORIES, LTD. Job name: H94-12.206

		Samples						
Chester LabNet ID		206-001	206-002	206-003	206-004	206-005	206-006	206-007
Sampling Point		QA_QC	X	X	X	X	X	X
Date Sampled								
Customer ID		LAB BLANK	94-8478	94-8479	94-8551	94-8553	94-8543	94-8544
Parameters	Units							
METALS								
Aluminum	µg/L	<32.0	NR	NR	NR	NR	NR	NR
Chromium	µg/L	<4.0	NR	NR	NR	NR	NR	<4.0
Copper	µg/L	<3.0	<3.0	<3.0	NR	NR	NR	<3.0
Manganese	µg/L	<1.0	NR	NR	NR	NR	NR	NR
Nickel	µg/L	<11.0	NR	NR	NR	<11.0	NR	<11.0
Lead	µg/L	<30.0	NR	NR	NR	NR	NR	<30.0
Vanadium	µg/L	<4.0	NR	NR	<4.0	NR	NR	NR
Zinc	µg/L	<2.0	34.0	57.0	NR	19.0	28.0	NR
GC 8015								
2-Propanol	µg/L	<7.5	NR	NR	NR	NR	NR	NR

NR - Not Required

21-DEC-1994

Summary of Analytical Results

Date received: 15-DEC-1994 Customer: TERRA LABORATORIES, LTD. Job name: H94-12.206

		Samples					
Chester LabNet ID		206-008	206-009	206-010	206-012	206-013	206-014
Sampling Point		X	X	X	X	X	X
Date Sampled							
Customer ID		94-8444	94-8701	94-8738	94-8739	94-8740	94-8741
Parameters	Units						
METALS							
Aluminum	µg/L	<32.0	NR	NR	<32.0	NR	NR
Chromium	µg/L	NR	NR	NR	NR	NR	NR
Copper	µg/L	NR	NR	NR	NR	NR	NR
Manganese	µg/L	NR	NR	NR	NR	NR	NR
Nickel	µg/L	NR	<11.0	14.0	NR	<11.0	<11.0
Lead	µg/L	NR	NR	NR	NR	NR	NR
Vanadium	µg/L	NR	NR	NR	NR	NR	NR
Zinc	µg/L	NR	14.0	15.0	NR	47.0	42.0
GC 8015							
2 Propanol	µg/L	NR	NR	NR	NR	NR	NR

NR - Not Required

Summary of Analytical Results

Date received: 15-DEC-1994 Customer: TERRA LABORATORIES, LTD. Job name: H94-12.206

		Samples						
Chester LabNet ID		206-015	206-016	206-017	206-018	206-019	206-020	206-021
Sampling Point		X	X	X	X	X	X	X
Date Sampled								
Customer ID		94-8812	94-8625	94-8626	94-8627	94-8628	94-8629	94-8630
Parameters	Units		MW-3	MW-1	MW-2	MW-5	MW-6	MW-4
METALS								
Aluminum	µg/L	NR	NR	NR	NR	NR	NR	NR
Chromium	µg/L	NR	NR	NR	NR	NR	NR	NR
Copper	µg/L	NR	NR	NR	NR	NR	NR	NR
Manganese	µg/L	NR	8.1	36.0	72.0	2.3	56.0	35.0
Nickel	µg/L	NR	NR	NR	NR	NR	NR	NR
Lead	µg/L	NR	NR	NR	NR	NR	NR	NR
Vanadium	µg/L	NR	NR	NR	NR	NR	NR	NR
Zinc	µg/L	130	NR	NR	NR	NR	NR	NR
GC 8015								
2 Propanol	µg/L	NR	NR	NR	NR	NR	NR	NR

NR - Not Required

21-DEC-1994

Summary of Analytical Results

Date received: 15-DEC-1994 Customer: TERRA LABORATORIES, INC. Job name: P94-12.206

	Samples	
Chester LabNet ID	206-022	206-023
Sampling Point	X	QA_QC
Date Sampled		
Customer ID	94-0590	BLANK SPIKE

Parameters	Units		
METALS			
Aluminum	µg/L	NR	104 *
Chromium	µg/L	NR	110 *
Copper	µg/L	NR	103 *
Manganese	µg/L	NR	103 *
Nickel	µg/L	NR	102 *
Lead	µg/L	NR	95.0 *
Vanadium	µg/L	NR	104 *
Zinc	µg/L	NR	102 *
GC 8015			
2 Propanol	µg/L	75.0	130 *

NR - Not Required
* - PERCENT RECOVERY

TERRA LABORATORIES LTD.

2525 South Shore Blvd. League City, Texas 77573 (713) 334-5052 Fax: (713) 334-3115

CHAIN OF CUSTODY

REPORT TO:				REMIT TO:			
COMPANY: TERRA Labs				COMPANY			
ADDRESS: 2525 S. Shore Blvd. Ste 4				ADDRESS			
CITY: LEAGUE CITY	STATE: TX	ZIP: 77573		CITY	STATE	ZIP	
ATTN: LARRY WALLACE	PHONE: 334-5052	FAX: 334-3115		ATTN	PHONE	FAX	
Client Comments:				Project Name:		P.O. #	
				Turnaround Time: ASAP		Release #	

ANALYSES REQUESTED

DATE	24HR TIME	MATRIX	COMPOSITE	GRAB	SAMPLE DESCRIPTION	# CONTAINERS	Copper - total	Zinc - total	Vanadium - total	Nickel - total	Lead - total	Chromium - total	Arsenic - TCLP	Barium - TCLP	Cadmium - TCLP	Chromium - TCLP	Lead - TCLP	Selenium - TCLP	Silver - TCLP	Aluminum	TERRA SAMPLE NO.
		Liquid			94 - 8478	1	X	X													These metals are for several different jobs - will need permission from Chester to split up copies of the final report.
					- 8479		X	X													
					- 8551				X												
					- 8553			X		X											
					- 8543			X													
					- 8544		X			X	X	X									
					- 7457 *								X	X	X	X	X	X	X		
					- 8444															X	
					- 8480 *								X	X	X	X	X	X	X		
					- 8701			X		X											

Collected by:	Date:	Time:	Received by Terra:	Date:	Time:
Relinquished by:	Date: 12-15-94	Time: 1630	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by: Glenda Forter	Date: 12/15/94	Time: 1630

Remarks:
* Sample has been extracted, [illegible] for [illegible]

SEND QA/QC DATA

Please Return SAMPLES - to [illegible]

TERRA LABORATORIES LTD.

2525 South Shore Blvd. League City, Texas 77573 (713) 334-5052 Fax: (713) 334-3118

CHAIN OF CUSTODY

REPORT TO			REMIT TO		
COMPANY			COMPANY		
ADDRESS			ADDRESS		
CITY	STATE	ZIP	CITY	STATE	ZIP
ATTN	PHONE	FAX	ATTN	PHONE	FAX
Client Comments:			Project Name:	P.O. #	
			Turnaround Time	Release #	

ANALYSES REQUESTED

DATE	24HR TIME	MATRIX	COMPOSITE	GRAB	SAMPLE DESCRIPTION	CONTAINER NUMBERS	Nickel - total	Zinc - total	Arsenic - TCLP	Barium - TCLP	Cadmium - TCLP	Chromium - TCLP	Lead - TCLP	Selenium - TCLP	Silver - TCLP	Aluminum - total	Manganese - total	TERRA SAMPLE NO.
		liquid			94-8738	1	X	X										
					- 8384 *				X	X	X	X	X	X				
					- 8739										X			
					- 8740		X	X										
					- 8741		X	X										
					- 8812			X										
					- 8625											X		
					- 8626											X		
					- 8627											X		
					- 8628											X		

Collected by:	Date:	Time:	Received by Terra:	Date:	Time:	Remarks
Relinquished by:	Date: 12-15-94	Time: 1630	Received by:	Date:	Time:	
Relinquished by:	Date:	Time:	Received by:	Date: 12/15/94	Time: 1630	

3 of 3

TERRA LABORATORIES LTD.

2525 South Shore Blvd. League City, Texas 77573 (713) 334-5052 Fax: (713) 334-3118

CHAIN OF CUSTODY

REPORT TO:			REMIT TO:		
COMPANY			COMPANY		
ADDRESS			ADDRESS		
CITY	STATE	ZIP	CITY	STATE	ZIP
ATTN	PHONE	FAX	ATTN	PHONE	FAX
Client Comments:			Project Name:	P.O.#	
			Turnaround Time	Release #	

ANALYSES REQUESTED

DATE	24HR TIME	MATRIX	COMPOSITE	GRAB	SAMPLE DESCRIPTION	# CONTAINERS	Manganese - Total	Copper - TCLP	Isopropyl Alcohol	TERRA SAMPLE NO.
		liquid			94-8629	1	X			
					1-8630	1	X			
					94-7717	1		X		
					94-859	1			X	

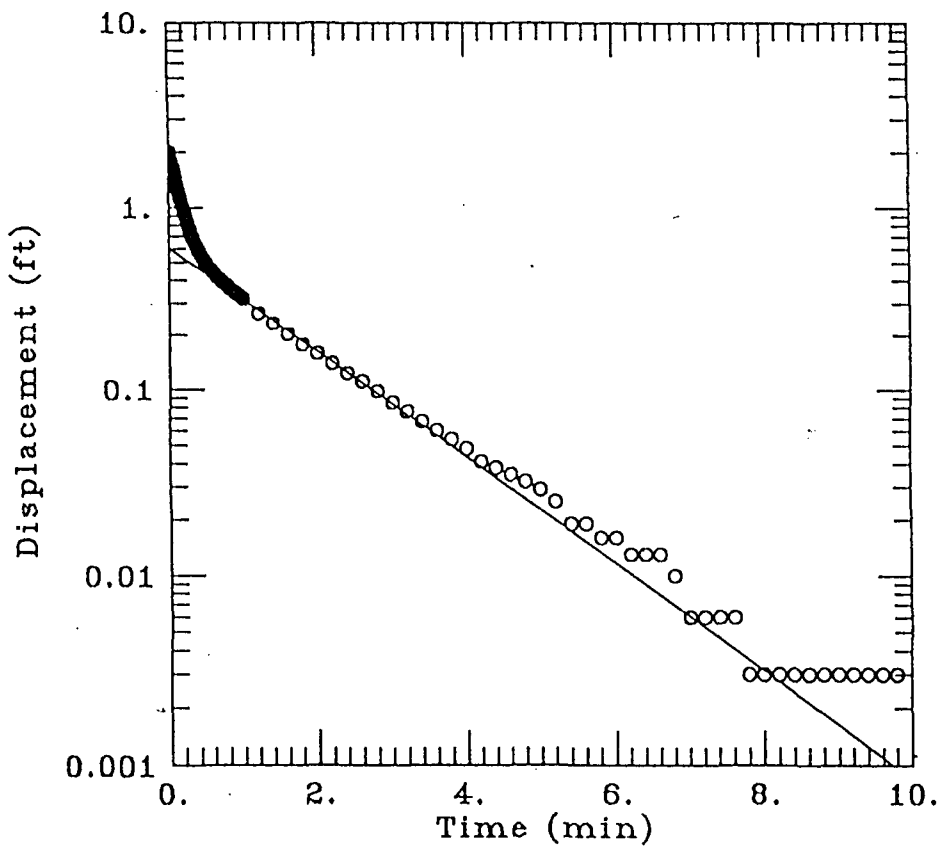
Collected by:	Date:	Time:	Received by Terra:	Date:	Time:	Remarks
Relinquished by:	Date: 12-15-94	Time: 1630	Received by:	Date:	Time:	
Relinquished by:	Date:	Time:	Received by:	Date: 12/15/94	Time: 1630	

APPENDIX E

SLUG TEST RESULTS

Brown and Caldwell

Test 12 - Bell Lake Plant: MW-3



DATA SET:
test12.aq
02/08/95

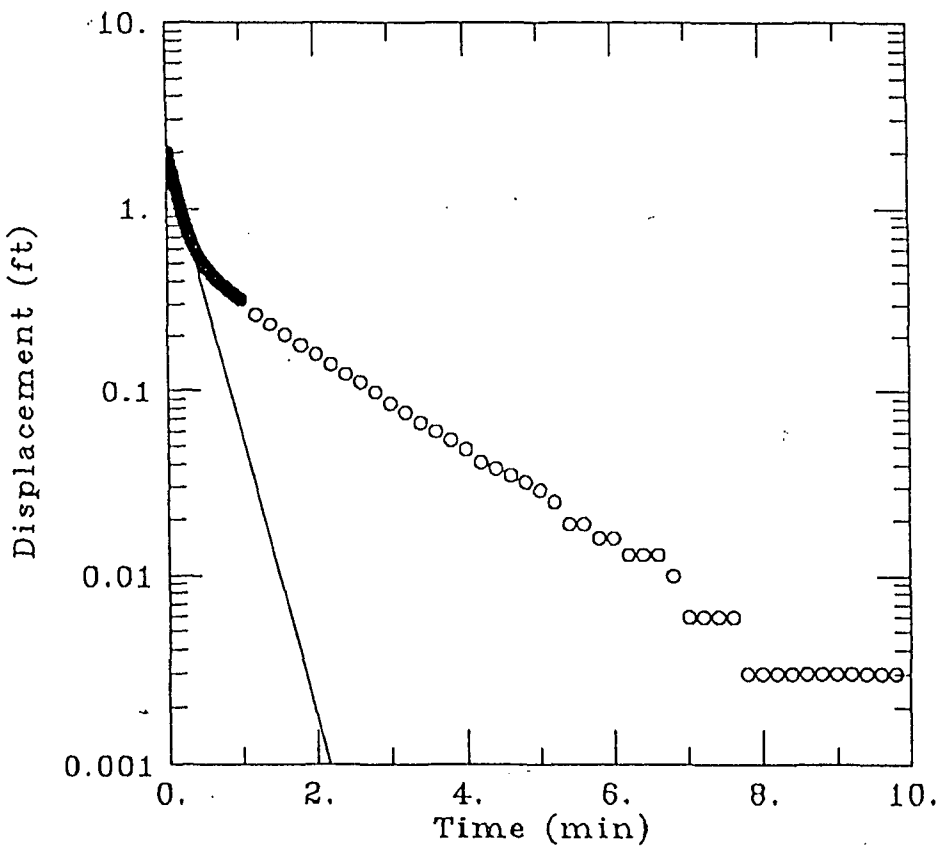
AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.001534 ft/min
y0 = 0.6048 ft

TEST DATA:
H0 = 1.994 ft
rc = 0.1667 ft
rw = 0.4167 ft
L = 15. ft
b = 10.92 ft
H = 10.92 ft

Brown and Caldwell

Test 12 – Bell Lake Plant: MW-3



DATA SET:
test12.aq
02/14/95

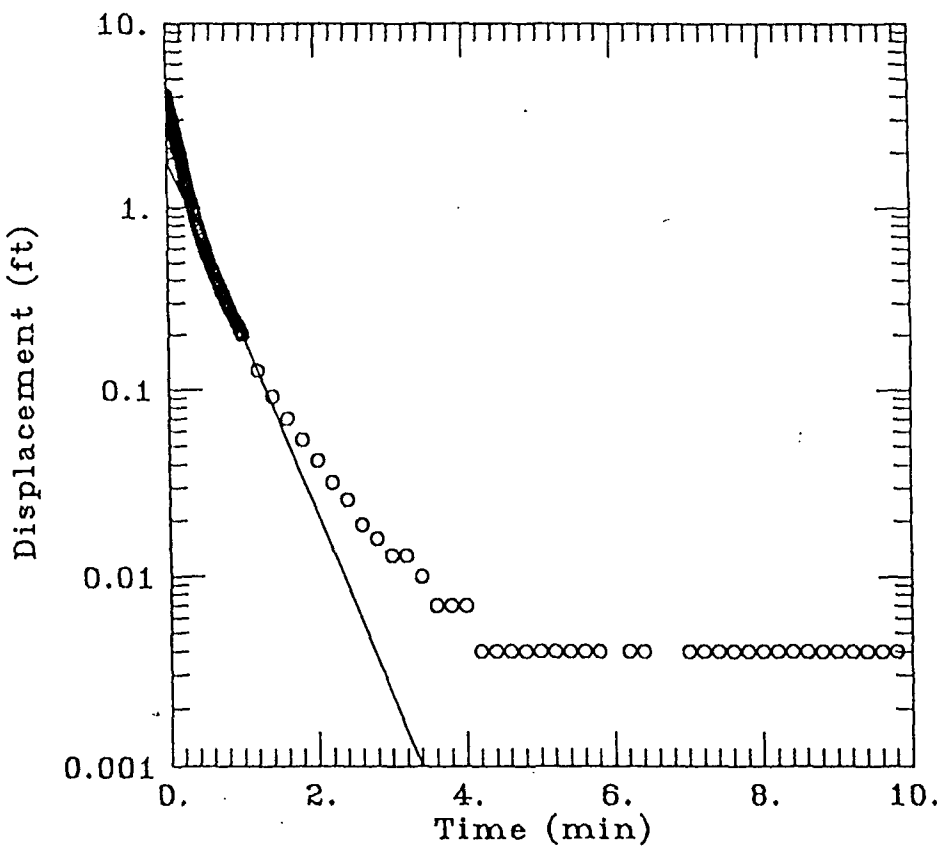
AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.008246 ft/min
y0 = 1.991 ft

TEST DATA:
H0 = 1.994 ft
rc = 0.1667 ft
rw = 0.4167 ft
L = 15. ft
b = 10.92 ft
H = 10.92 ft

Brown and Caldwell

Test 13 - Bell Lake Plant: MW-5



DATA SET:
test13.aq
02/08/95

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.001342 ft/min
y0 = 1.813 ft

TEST DATA:
H0 = 4.053 ft
rc = 0.00334 ft
rw = 0.3333 ft
L = 15. ft
b = 9.67 ft
H = 9.67 ft

APPENDIX F

BIOLOGICAL RESULTS

Advanced Biological Solutions, Inc.

Environmental Services

1701 West Hillsboro Boulevard, Suite 103
Deerfield Beach, Florida 33442
TEL (305) 428-3880 FAX (305) 428-2102

VIABLE COUNTS

PREPARED FOR: BROWN & CALDWELL

BELL LAKE

JANUARY 11, 1995

PREPARED BY:
ADVANCED BIOLOGICAL SOLUTIONS INC.
1701 W. HILLSBORO BLVD. SUITE 103
DEERFIELD BEACH, FLORIDA 33442

INTRODUCTION

Advanced Biological Solutions Inc. was retained by Brown & Caldwell to determine the total number of heterotrophs and petrophilic bacteria in six groundwater samples. Groundwater samples were received by ABS with the intent of reflecting the range of contaminant conditions at the site.

COMPARATIVE MICROBIAL ENUMERATION METHODOLOGY

The comparative enumeration assay provides information about the extent to which viable adapted microbial populations are present at the site. Additionally, the assay provides data about the relative number of organisms capable of degrading the target contaminant. This data is important in deciding if further investigation of bioremediation as a treatment alternative is merited. The assay results also provide a baseline for later analysis of whether biodegradation has been enhanced through applied treatments, if such an option is pursued.

A modified version of the National Environmental Technology Applications Center method was utilized for all bacterial counts. Viable counts to determine the concentration of the heterotrophic and petrophilic bacteria were made on each sample. Ten fold extinction dilution counts were determined using 9 ml of either sterile nutrient broth for heterotrophs or sterile Bushnell-Haas broth for petrophilic bacteria (petroleum degraders). Gasoline was added to the Bushnell-Haas medium at 1% (V/V). The tubes were incubated at 24-28 degrees Centigrade for 72 hours for heterotrophs and 14 days for petrophilics.

Viable counts of aerobic heterotrophs and petroleum degraders in soil and water samples

Sample Number	Aerobic Heterotrophs	Petroleum Degraders
BELL LAKE		
Water MW-1	10^6	10^3
Water MW-2	10^6	10^2
Water MW-3	10^5	10^2
Water MW-4	10^5	10^3
Water MW-5	10^5	10^2
Water MW-6	10^6	10^1

NOTES:

1. Nutrient broth was utilized for aerobic heterotrophs

2. Minimal media was utilized for petroleum degraders using commercial gasoline as a carbon and energy source. Gasoline concentration was 1% (V/V). Ten fold extinction dilution viable counts were determined.

3. Viable counts are expressed per ml for water and per gram for soils

[illegible]

TERRA LABORATORIES LTD.

2525 South Shore Blvd. League City, Texas 77573 (713) 334-5052 Fax: (713) 334-3116

CHAIN OF CUSTODY

REPORT TO:			REMIT TO:		
[COMP]ANY: BROWN AND CALDWELL			COMPANY		
[ADDR]ESS: 1415 LOUISIANA St 2500			ADDRESS		
HOUSTON	STATE TX	ZIP 77002	CITY	STATE	ZIP
S. RICHARD	PHONE (713)759-0999	FAX 759-0952	ATTN	PHONE	FAX
[Clie]nt Comments:			Project Name: BELL LAKE	P.O. # 1820.	
			Turnaround Time	Release #	

ANALYSES REQUESTED

[DA]TE	24HR TIME	MATRIX	COMPOSITE	GRAB	SAMPLE DESCRIPTION	NUMBER CONTAINERS	32 oz - BTX													TERRA SAMPLE NO.
[1]2/15	1315	H_2O		X	MW-1	1	1													
[1]2/15	1345	H_2O		X	MW-2	1	1													
12/15	1115	H_2O		X	MW-3	1	1													
[12]/15	1240	"		X	MW-4	1	1													
12/15	1150	"		X	MW-5	1	1													
12/15	1215	"		X	MW-6	1	1													

[Relinqui]shed by:	Date:	Time:	Received by Terra:	Date:	Time:	Remarks
[signature]	12/15	18:20				
[Relin]quished by:	Date:	Time:	Received by:	Date:	Time:	
[Relin]quished by:	Date:	Time:	Received by:	Date:	Time:	

National Environmental Technology Applications Center
UNIVERSITY OF PITTSBURGH APPLIED RESEARCH CENTER
615 William Pitt Way • Pittsburgh, PA 15238
Facsimile (412) 826-5552
(412) 826-5511
NETAC

TOTAL HYDROCARBON DEGRADERS/TOTAL HETEROTROPHS BY MOST PROBABLE NUMBER (MPN) METHOD

The following are general descriptions of microbial methods used by NETAC's Bioremediation Product Evaluation Center (BPEC) for conducting microbial analyses to determine the number of heterotrophic and hydrocarbon degrading organisms in a given sample. These methods are part of the protocols used to determine the efficacy of oil spill response bioremediation products.

FRESHWATER ENVIRONMENTS

Dilutions:

Remove 0.5 ml of water from each sample to be tested and add it to a tube of 4.5 mL sterile of Phosphate buffer. This is the 10^{-1} dilution. Using sterile technique, mix and perform serial dilutions to (0.5 mL of previous dilution to 4.5 mL of sterile phosphate buffer) 10^{-9} dilution. NOTE: All of the following MPN methods are incubated in a 24 well multiple well plate such as catalog number 25820-24 Corning Cell Wells disposable cell culture plate. Volumes indicated are reflective of a 3.1 mL cell volume.

Total Heterotrophic Organisms:

Prepare sufficient tryptic soy broth (TSB) per page 1027, 10th edition Difco Manual, to fill the number of wells required for the test (1.0 mL/well).

Using sterile technique, add 1.0 mL of TSB to each well.

Label the top of the MPN plate with the appropriate dilution for each row of wells.

Add 0.1 mL of fluid from each dilution tube to each well in the appropriate row, starting with the most dilute.

Incubate the MPN plates at 20°C or other prescribed temperature.

After an incubation period of two to six days, add 100 µl of p-iodonitrotetrazolium violet (50 mg/10 mL deionized water) to each well to determine growth. Development of a pink or purple color upon standing for 20 minutes is considered a positive test. View plates against a white background to determine if color is present. Note: Prepared tetrazolium dye may be stored in the refrigerator in an amber bottle until used.

Record the number of positive wells and the dilutions at which they occur. Base counts on the six wells in each row. Enter the data into computerized enumeration method such as the "MPN Calculator" software program (version 2.3 or higher), by Albert J. Klee, U.S. EPA, Office of Research and Development, Risk Reduction Engineering Laboratory, Cincinnati, OH.

Total Hydrocarbon Degrading Organisms:

Prepare sufficient sterile Bushnell-Haas (B-H) broth per page 184, 10th edition of Difco Manual, to fill the number of wells required for the test.

Using sterile technique, add 1.75 mL of B-H broth to each well.

Label the top of the plate with the proper dilution for each row.

Add 0.1 mL of fluid from each dilution tube to each well in the appropriate row, starting with the most dilute.

After adding the fluid to all the wells, add 20 μL of filter sterilized #2 diesel fuel oil to the top of each well.

Incubate each plate at 20°C or other prescribed temperature.

After 14 days of incubation, add 100 mL of p-iodotetrazolium violet dye (50 mg/10 mL of deionized water) to each well to determine growth. Development of a purple or pink color upon standing for 45 minutes constitutes a positive test. View plates against a white background to determine if color is present.

Record the number of positive wells and the dilutions at which they occur. Base counts on five wells/row. Enter the data into computerized enumeration method such as the "MPN Calculator" software program (version 2.3 or higher), by Albert J. Klee, U.S. EPA, Office of Research and Development, Risk Reduction Engineering Laboratory, Cincinnati, OH.

Soil or Sand Studies Test for Hydrocarbon Degrading Organisms:

Place 1 gram of sample to be analyzed in 99 mL of phosphate buffer pH 7.2-7.5 (Standard Methods for the Examination of Waste and Wastewater, 1988, p. 9-31). Sonicate mixture for 15 seconds, and proceed with the above noted procedure.

MARINE ENVIRONMENTS

Dilutions:

Prior to sacrificing each Tier II test flask, 0.5 mL of water is removed and added to a test tube of 4.5 mL of sterile phosphate buffer (1:10 dilution). Using sterile technique, mix and perform serial dilutions (0.5 mL of previous dilution to 4.5 mL of sterile phosphate buffer) to 10^{-8} dilution.

Total Heterotrophic Organisms:

Label the top of a 24 well disposable cell culture plate (e.g., cat. no. 25820-24 Corning Cell Wells) with the appropriate sample identification and the appropriate dilution sequence per row of wells.