

SENT VIA EMAIL (robert.chesson@state.co.us)

January 18, 2011

Mr. Robert Chesson  
Colorado Oil & Gas Conservation Commission, Department of Natural Resources  
1120 Lincoln Street, Suite 801  
Denver, Colorado 80203

RE: June 2010 Quarterly Monitoring Report and No-Further Action Request  
Berger Tank Battery (API Number 05-123-08554)  
County Road 11 and County Road 20  
Frederick, Weld County, Colorado  
Project Number 1007004

Dear Mr. Chesson:

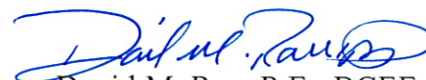
Enclosed is the June 2010 Quarterly Monitoring Report and No-Further Action Request for the above-referenced site. Please read the attached report for a summary of the sampling activities performed at the site. If you have any questions or require additional information, please contact us.

Sincerely,  
PARAGON CONSULTING GROUP, INC.



Amy Weber, P.E.  
Project Engineer

ADW/DMR:adwl



David M. Rau, P.E., BCEE  
Principal Engineer

enc: June 2010 Quarterly Monitoring Report and No-Further Action Request

cc: Mr. Andy Peterson/Peterson Energy Management (via email)  
Mr. Neil Rehkop/SBC Global (via email)  
Machii-Ross Petroleum Company  
Jennifer Biever, Esq./Hogan Lovells US LLP (via email)

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HEATHER S. ALDERMAN  
DAVID L. WALKER

January 18, 2011

Machii-Ross Petroleum Company  
2901 28<sup>th</sup> Street, Suite 205  
Santa Monica, California 90405

RE: June 2010 Quarterly Monitoring Report and No-Further Action Request  
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Project Number 1007004

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Machii-Ross Petroleum Company:

The purpose of this report is to summarize the results of the June 2010 quarterly sampling event performed at the subject site by Paragon Consulting Group, Inc. (Paragon). A copy of this report was submitted to the Colorado Oil & Gas Conservation Commission (COGCC). The approximate location of the site is shown on Figures 1 and 2 which are attached to this letter. The approximate locations of the groundwater monitoring wells located at the site are shown on Figures 3 and 4 which are also attached to this report.

## 1. BACKGROUND

Previous site assessment activities are discussed below. The soil and groundwater analytical results in this chapter are compared to the former COGCC Allowable Concentrations in effect prior to April 1, 2009. Series 900 of the COGCC Rules and Regulations were revised and issued on April 1, 2009. Table 910-1 in Series 900 describes Concentration Levels for contaminants in soil and groundwater which are different than the Allowable Concentrations. For work performed after April 1, 2009, contaminant levels are compared to the COGCC Concentration Levels.

### 1.1 ENVIRON Site Assessment

Seven (7) direct-push probes, SB-1 through SB-7, were completed at the site on January 9, 2007 by ENVIRON of Denver, Colorado. Two (2) soil samples were analyzed from SB-1 and one (1) soil sample was analyzed from SB-2 through SB-7. The laboratory report and site diagram were included in ENVIRON's draft memorandum dated January 15, 2007. The soil samples were analyzed for benzene-toluene-ethylbenzene-xylenes (BTEX), methyl-tertiary-butyl-ether (MTBE), total petroleum hydrocarbons (TPH), total petroleum hydrocarbons - gasoline range organics (TPH-GRO), diesel fuel, fuel oil, jet fuel, kerosene, mineral spirits and motor. TPH was observed to range from not observed above the laboratory detection limit to 30,200 mg/Kg in soil samples submitted for analyses by

ENVIRON. TPH-GRO ranged from not observed above the laboratory detection limit to 15,000 mg/Kg in soil samples submitted for analyses by ENVIRON. The TPH and TPH-GRO concentrations observed in the soil sample analyzed from SB-1 (at 13 feet) exceeded the Allowable Concentration for total recoverable petroleum hydrocarbons (TRPH). The soil in this area was removed during the initial abatement activities. Groundwater samples were collected by ENVIRON from probes SB-3 through SB-6 for BTEX analyses. BTEX concentrations observed in the groundwater samples collected from SB-3 and SB-5 exceeded the Allowable Concentrations. It should be noted that probe water samples are generally considered qualitative since they were not collected from completed and developed groundwater monitoring wells.

Laboratory results for split groundwater samples BTB-SB-3 and BTB-4 collected during ENVIRON site assessment activities on January 9, 2007 are summarized in Table 2 attached to this letter. BTB-SB-3 and BTB-4 were collected from ENVIRON's probes SB-3 and SB-4, respectively, on January 9, 2007. BTEX concentrations were observed at relatively low concentrations in groundwater sample BTB-4 collected from SB-4 on January 9, 2007. Relatively high BTEX concentrations were observed in the groundwater sample collected by Paragon from probe SB-3 on January 9, 2007. BTEX concentrations observed in BTB-4 collected by Paragon from SB-4 in January 2007 were not observed above the Allowable Concentrations. The BTEX concentrations observed in the groundwater sample collected by Paragon from probe SB-3 exceeded the Allowable Concentrations. It should be noted that probe water samples are generally considered qualitative since they were not collected from completed and developed groundwater monitoring wells.

## **1.2 Abatement Activities**

During a routine site inspection on January 7, 2007, Machii-Ross Petroleum Company personnel observed crude oil (product) in the bermed area for the southern aboveground storage tank (AST). The leak from the AST was repaired on January 7, 2007. It was estimated by Machii-Ross Petroleum Company personnel that approximately 70 barrels (bbls) of oil were released. Key Energy was mobilized to the site to recover the product on January 8, 2007 using a vacuum truck. Excavation activities were also initiated on January 8, 2007. Soil abatement activities consisting of the excavation and off-site disposal of contaminated soil was performed at the site by Flint Energy Services, Inc. (Flint) between January 8, 2007 and January 16, 2007. The approximate limits of the excavation are shown on Figure 3 attached to this letter.

A subsurface drain located to the west of the tank battery was impacted and subsequently excavated. The drain was replaced and the former drain was connected to riser to be used as groundwater recovery points if necessary. In the excavation trench performed during removal of the subsurface drain, four (4) separate slotted horizontal drain lines were installed

with risers extending approximately three (3) feet above ground surface. These remedial drains were constructed with two (2) and three (3) inch diameter PVC pipe. The trenches were excavated below observed hydrocarbon impact into what appeared to be a relatively impermeable, hard and dry siltstone. During the trench excavation, oil/groundwater was removed by a vacuum truck directly from the excavation and from the risers once installed.

On January 11, 2007 following interviews with the property owners, it was discovered that the subsurface drain was connected to an unnamed creek located to the west of the site. Product was then observed on the creek and the release was reported to the National Response Center, the COGCC and the Colorado Department of Public Health and Environment on January 11, 2007.

Paragon and Peterson Energy Management personnel installed booms at the outlet of the subsurface drain to the creek and at several other locations downstream. The booms were maintained and periodically replaced by Peterson Energy Management. Periodically, vacuum trucks were used to remove product from the creek and from vegetation near the creek. On January 12, 2007, the subsurface drain was flushed with approximately 500 gallons of BioSolve and the mixture was recovered from the downstream end of the pipe.

Approximately 100 cubic yards of contaminated soil were excavated from the subsurface drain area. The soil was transported by Flint to the Denver Regional Landfill in Erie, Colorado. Groundwater encountered in the bottom of the excavation during the abatement activities was removed using a vacuum truck. Approximately 10 bbls of oil were recovered during abatement activities. The excavation was backfilled with imported soil.

Seven (7) soil samples, T-1 through T-7, and 12 surface water samples were collected during the abatement process. The TRPH concentration observed in soil sample T-1 exceeded the Allowable Concentration. The excavation area could not be increased to the east of sample location T-1 due to the location of the ASTs. The TRPH concentrations observed in the remaining soil samples collected from the excavation were not observed above the Allowable Concentration. Six (6) Creek Samples were collected from an area of the creek located to the north of County Road 20. Three (3) Tile Drain samples were collected approximately 60 feet upgradient of where the subsurface drain flowed into the creek. Three (3) Drain Outlet samples were collected from the subsurface drain outfall into the creek. BTEX concentrations observed in the surface water samples collected near the site in January and February 2007 were not observed above the Surface Water Standards.

### **1.3 Paragon Site Assessment Activities**

Based on the soil and water contamination observed during excavation activities, additional site assessment was performed at the site in February 2007. Four (4) monitoring wells,

PMW-1 through PMW-4, and three (3) direct-push probes, PB-1 through PB-3, were installed at the site on February 12 and 14, 2007 to obtain information regarding potential petroleum hydrocarbon contamination. The approximate locations of the monitoring wells and direct-push probes are shown on Figure 3 attached to this letter. The TRPH concentration observed in the soil sample analyzed from PB-2 exceeded the Allowable Concentration. The TRPH concentrations in soil samples analyzed from PMW-1, PMW-2, PMW-3, PMW-4, PB-1 and PB-3 were not observed above the Allowable Concentration of 1,000 mg/Kg.

## **2. GEOHYDROLOGY**

Groundwater elevations in wells PMW-1, PMW-2, PMW-3 and PMW-4 were measured by Paragon on June 22, 2010. Groundwater elevation data for the site is summarized in Table 1 which is attached to this report. Groundwater was observed in wells PMW-1, PMW-2, PMW-3 and PMW-4 to range from approximately 3.2 to 7.0 feet below the top of casings on June 22, 2010. Free-phase product was not observed in monitoring wells PMW-1 through PMW-4 on June 22, 2010.

A piezometric surface diagram for groundwater elevations observed during the June 2010 sampling event is attached to this report as Figure 3. The piezometric surface was estimated using the Surfer<sup>®</sup> software distributed by Golden Software based on groundwater table measurements in wells PMW-1, PMW-2, PMW-3 and PMW-4. As seen from Figure 3, the general groundwater flow direction appeared to be towards the northwest. The hydraulic gradient observed at the site on June 22, 2010 was estimated to range from approximately 0.03 to 0.04. The groundwater flow direction and hydraulic gradient estimated for June 2010 are similar to previous observations at the site. It should be noted that local geohydrologic characteristics may change due to variations in precipitation, recharge, stratigraphy or conditions not apparent at the time of sampling.

## **3. GROUNDWATER QUALITY RESULTS**

Information collected during the June 2010 sampling event relative to groundwater quality at the site is summarized below. That information includes temperature, electrical conductance and pH measurements, dissolved oxygen (DO) measurements, and laboratory results.

### **3.1 Field Data**

Groundwater temperature, electrical conductance and pH measurements were performed on June 22, 2010 during purging of wells PMW-1 through PMW-4 prior to collecting groundwater samples for laboratory analysis. Purging of monitoring wells prior to sampling was accomplished using clean disposable bailers. Measurements were recorded during the removal of water from the wells. The wells were considered purged when temperature,

electrical conductance, and pH measurements stabilized to within ten (10) percent for three (3) consecutive measurements and a minimum of three (3) well volumes were removed from the well or after the well was purged essentially dry. The wells were allowed to recharge prior to sampling.

DO measurements were performed in wells PMW-1 and PMW-2 on June 22, 2010. DO measurements were not performed at wells PMW-3 and PMW-4 due to a malfunctioning DO meter. DO monitoring results are summarized in Table 2 attached to this report. As seen from Table 2, DO concentrations were observed to range from approximately 0.9 to 1.3 milligrams per liter (mg/L) during the June 2010 sampling episode. In general, an obvious correlation was not observed between BTEX concentrations observed in groundwater samples and DO measurements in June 2010.

### **3.2 Groundwater Analytical Results**

Groundwater samples were collected from monitoring wells PMW-1 through PMW-4 and trench recovery locations T-1 through T-5 on June 22, 2010 for laboratory analysis. Groundwater samples were transported under standard chain-of-custody procedures to Technology Laboratory, Inc. (TLI) in Fort Collins, Colorado for BTEX analysis by EPA Method 8260B. Groundwater sample results are summarized in Table 2 attached to this letter. The approximate locations of PMW-1 through PMW-4 and T-1 through T-5 are shown on Figure 4 attached to this letter. The TLI laboratory report for wells PMW-1 through PMW-4 and T-1 through T-5 is also attached to this letter.

BTEX concentrations were not observed above the laboratory detection limit of 1.0 micrograms per liter ( $\mu\text{g/L}$ ) or were observed at relatively low concentrations in the groundwater samples collected from PMW-1 through PMW-4 and T-1, T-4 and T-5 on June 22, 2010. Benzene concentrations were observed at 12 and eight (8)  $\mu\text{g/L}$  in the groundwater samples collected in June 2010 from T-2 and T-3, respectively. The benzene and xylenes concentrations observed in the groundwater sample collected from T-2 in June 2010 increased compared to previous sample results. The benzene concentration observed in the groundwater sample collected from T-4 on June 22, 2010 decreased compared to previous sample results. In general, the remaining BTEX concentrations observed in the groundwater samples collected from PMW-1 through PMW-4 and T-1 through T-5 in June 2010 were similar to previous sample results.

The benzene concentrations observed in groundwater samples collected from T-2 and T-3 in June 2010 slightly exceeded the COGCC Concentration Level. The remaining BTEX concentrations observed in the groundwater samples collected from PMW-1 through PMW-4 and T-1 through T-5 on June 22, 2010 were not observed above the COGCC Concentration Levels.

#### **4. VACUUM-ENHANCED RECOVERY EVENTS**

A vacuum-enhanced recovery (VER) event using a Key Energy vacuum truck was performed at the recovery trenches, T-2 through T-5, on June 21, 2010 the day prior to sampling since the recovery trench locations can not be purged manually. T-1 riser pipe is damaged and Key Energy was unable to recover from this riser pipe location. As seen from Table 3, approximately 271,000 gallons of groundwater have been recovered from recovery wells T-1 through T-5 between March 2007 and June 2010. The recovered groundwater was transported to a COGCC-approved disposal well operated by Conquest Disposal Service. The Key Energy work ticket is attached to this report.

#### **5. GROUNDWATER MODELING RESULTS**

Paragon performed groundwater modeling to estimate benzene concentrations at the downgradient point of exposure (POE), the creek located approximately 1,800 feet (549 meters) from the apparent benzene source area which appears to be in the vicinity of the aboveground storage tanks (ASTs). The software program BP RISC, Version 3.08 Saturated Zone Model was used to model benzene concentrations in groundwater at the site. The saturated zone model used in BP RISC considers one-dimensional flow, three-dimensional dispersion, adsorption and degradation. The dissolved-phase “source” concentration used in BP RISC is assumed to be uniform within the source volume and constant for the length of the pulse. The only process causing retardation of the dissolved-phase plume is the presence of organic carbon and the chemicals’ (i.e. benzene) affinity for the organic carbon.

The benzene concentration at the POE located 1,800 feet from the site was predicted using the highest observed benzene concentration of 12 µg/L in the last year of monitoring in the groundwater sample collected from well T-2 on June 22, 2010 and the longest pulse length of 100 years. Based on soil conditions observed during drilling, a range of effective porosity and hydraulic conductivity were estimated. Various model scenarios were run using the lower and upper range of the estimated effective porosity and hydraulic conductivity. A copy of the graphs, receptor concentrations and model input summaries are attached to this report. The results of the modeling for the various conditions are summarized in the following table.

### Summary of BP RISC Model Results

Benzene Source Concentration (µg/L)	Pulse Length (Years)	Maximum Predicted Benzene Concentration at Receptor (µg/L)	Estimated Effective Porosity and Hydraulic Conductivity used in model
<b>12</b>	100	0.00	Effective Porosity = 0.12 Hydraulic Conductivity = 0.00016 meters/day
<b>12</b>	100	0.00	Effective Porosity = 0.3 Hydraulic Conductivity = 0.00016 meters/day
<b>12</b>	100	0.052	Effective Porosity = 0.12 Hydraulic Conductivity = 1.88 meters/day
<b>12</b>	100	0.052	Effective Porosity = 0.3 Hydraulic Conductivity = 1.88 meters/day

Note: **Bold** values indicate an exceedance of the COGCC Concentration Level for benzene of 5 µg/L.

As seen from above, BP RISC predicts that benzene could reach the downgradient POE (the creek) located 1,800 feet northwest of the site at a concentration well below the COGCC Concentration Level.

The shortest distance downgradient of the source at which a benzene concentration of 5 µg/L was predicted using BP RISC using the source concentration of 12 µg/L and a pulse length of 100 years. The distance predicted was 17 meters (56 feet) downgradient of the source.

Based on the modeling results, it does not appear that benzene from the subject site will be a significant threat to the downgradient POE (the creek) in the future.

## 6. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are made based on information obtained during the quarterly sampling event.

1. Groundwater was observed in wells PMW-1, PMW-2, PMW-3 and PMW-4 to range from approximately 3.2 to 7.0 feet below the top of casings on June 22, 2010. Free-phase product was not observed in monitoring wells PMW-1 through PMW-4 on June 22, 2010.
2. The general groundwater flow direction on June 22, 2010 appeared to be towards the northwest. The hydraulic gradient observed at the site on June 22, 2010 was estimated to range from approximately 0.03 to 0.04. The groundwater flow direction and hydraulic gradient estimated for June 22, 2010 are similar to previous observations at the site.



3. The benzene and xylenes concentrations observed in the groundwater sample collected from T-2 in June 2010 increased compared to previous sample results. The benzene concentration observed in the groundwater sample collected from T-4 on June 22, 2010 decreased compared to previous sample results. In general, the remaining BTEX concentrations observed in the groundwater samples collected from PMW-1 through PMW-4 and T-1 through T-5 in June 2010 were similar to previous sample results.
4. The benzene concentrations observed in groundwater samples collected from T-2 and T-3 in June 2010 slightly exceeded the COGCC Concentration Level. The remaining BTEX concentrations observed in the groundwater samples collected from PMW-1 through PMW-4 and T-1 through T-5 on June 22, 2010 were not observed above the Concentration Levels.
5. The extent of groundwater impacts at the site appears to be limited and bracketed.
6. Approximately 271,000 gallons of groundwater have been recovered from recovery wells T-1 through T-5 between March 2007 and June 2010. The recovered groundwater was transported to a COGCC-approved disposal well operated by Conquest Disposal Service.
7. Based on the modeling results, it does not appear that benzene from the subject site will be a significant threat to the downgradient POE (the creek) in the future.

The following recommendations are made based on information obtained during the quarterly sampling event.


1. Significant remedial actions have been performed at the site including soil excavation activities and removal of approximately 271,000 gallons groundwater at the recovery trench locations. As a result, BTEX concentrations observed in groundwater samples collected from T-1 through T-5 have decreased significantly since initial sampling in 2007. Groundwater samples collected from PMW-1 through PMW-4 between 2007 and June 2010 have not been observed above the COGCC Concentration Levels. Based on modeling results and since remaining groundwater contamination observed in two (2) groundwater samples collected from the site in June 2010 were just slightly above the COGCC Concentration Levels, we request No-Further Action (NFA) status be granted to Machii-Ross Petroleum Company for this release. Copies of the Berger Lease area are attached to this report.

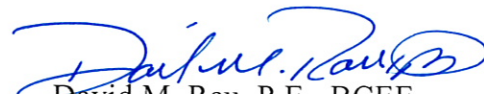
## 7. GENERAL COMMENTS

The analyses and opinions expressed in this report are based on data obtained from the indicated locations along with other information described in the report. The report does not reflect any variations in subsurface geohydrology or contaminant distribution which may occur between sample locations and or across the site. Actual subsurface conditions may vary and may not become evident without further exploration. Due to the dynamic nature of groundwater flow and contaminant migration, subsurface conditions will vary with time.

This report was prepared for the exclusive use of Machii-Ross Petroleum Company for specific application to the subject property and has been prepared in accordance with generally accepted geo-environmental engineering practices. No warranties, either express or implied, are intended or made. In the event that changes in the nature or location of suspected sources of contamination as outlined in this report are observed, the conclusions and recommendations contained in this report shall not be valid unless these changes are reviewed and the opinions of this report are modified and verified in writing by Paragon. If you have questions or require additional information regarding this site, please do not hesitate to contact us.

Sincerely,  
PARAGON CONSULTING GROUP, INC.

  
Amy D. Weber, P.E.  
Colorado No. 37665

  
David M. Rau, P.E., BCEE  
Principal Engineer

ADW/DMR:adwl

enc: Figure 1 - General Location Diagram  
Figure 2 - Vicinity Map  
Figure 3 - Piezometric Surface Diagram  
Figure 4 - Groundwater Sample Results Diagram  
Table 1 - Summary of Groundwater Elevation Data  
Table 2 - Summary of Water Quality Results  
Table 3 - Groundwater Recovery  
Laboratory Report  
Key Energy Work Ticket  
Modeling Results and Berger Lease Maps

cc: Mr. Neil Rehkop/SBC Global (via email)  
Mr. Robert Chesson/COGCC (via email)  
Mr. Andy Peterson/Peterson Energy Management (via email)  
Jennifer Biever, Esq./Hogan Lovells US LLP (via email)

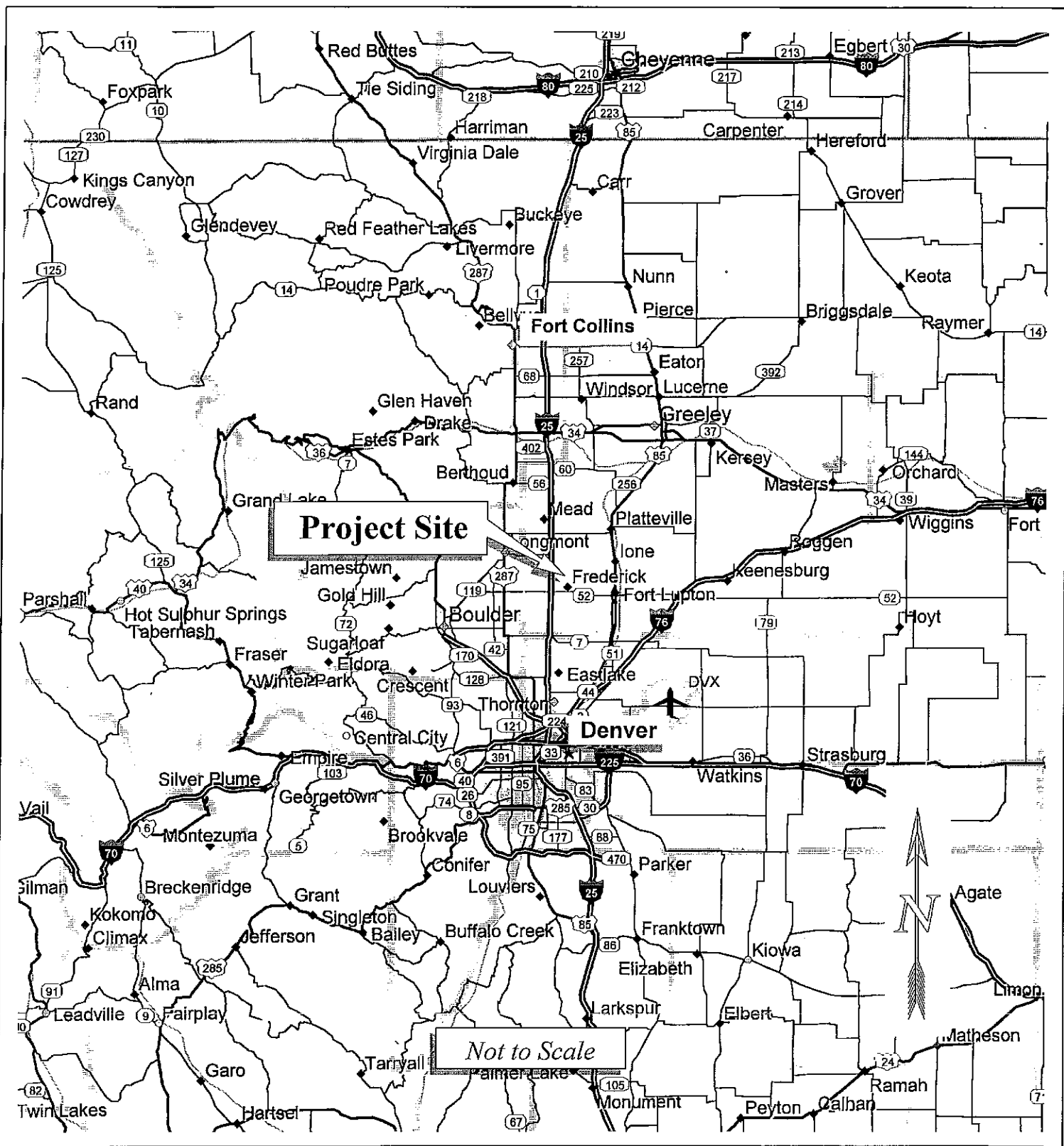
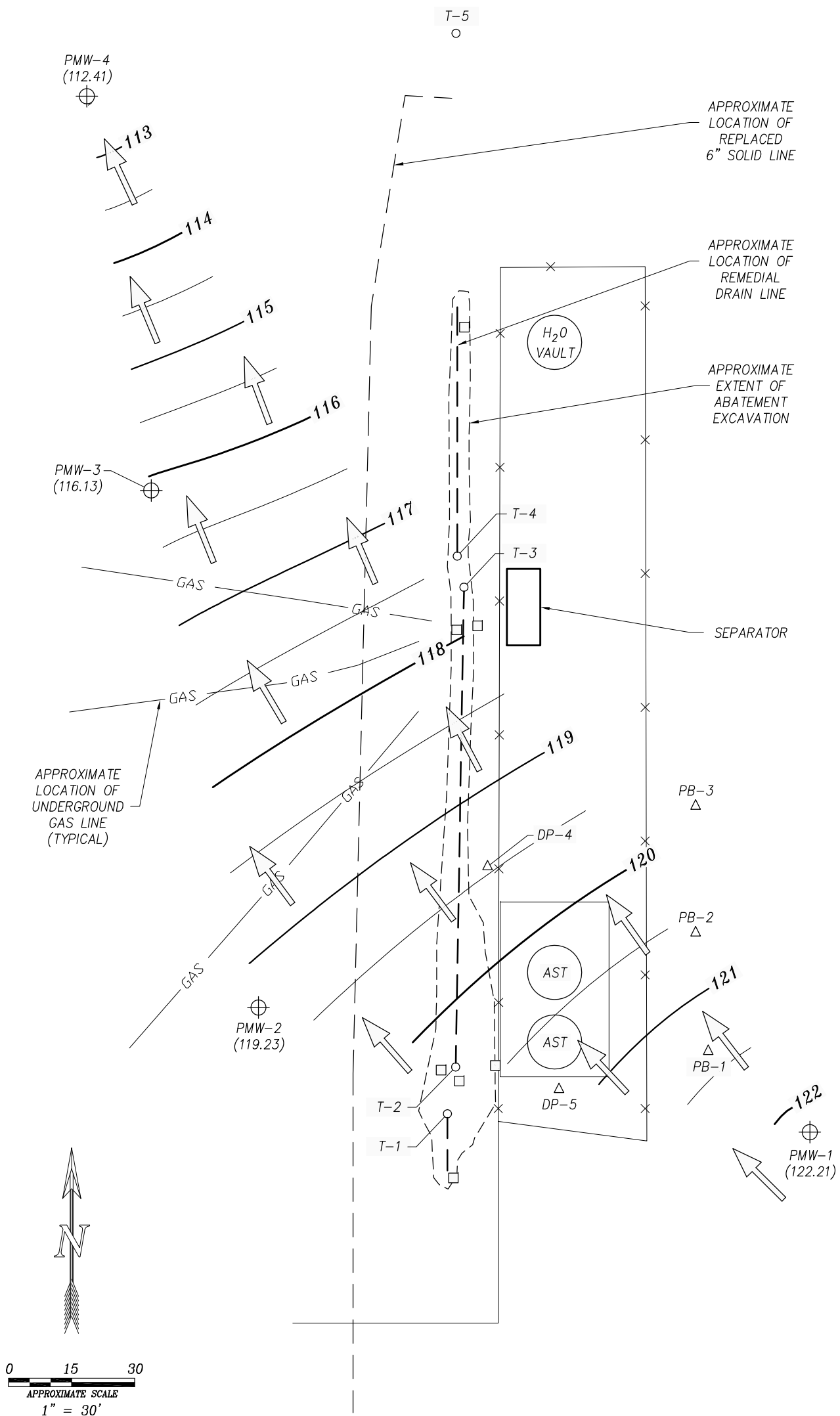


Figure 1 General Location Map  
Machii-Ross Petroleum  
Weld County Road 11, Weld County, Colorado  
Project No. 1007001-1007004 March 2007 Drawn by PJH(04fig1)

PARAGON

Figure 2 Vicinity Map  
Machii-Ross Petroleum – Berger Tank Battery  
Weld County Road 11 and Weld County Road 20, Weld County, Colorado  
Project No. 1007004 June 2007 Drawn by PJH(04fig2a)



**Legend**

- APPROXIMATE LOCATION OF REMEDIAL DRAIN LINE RISER
- △ APPROXIMATE LOCATION OF SOIL BORING
- ⊕ APPROXIMATE LOCATION OF MONITORING WELL
- APPROXIMATE LOCATION OF SOIL SAMPLE
- ESTIMATED DIRECTION OF GROUNDWATER FLOW
- 120 — ESTIMATED GROUNDWATER ELEVATION IN FEET ABOVE A COMMON DATUM

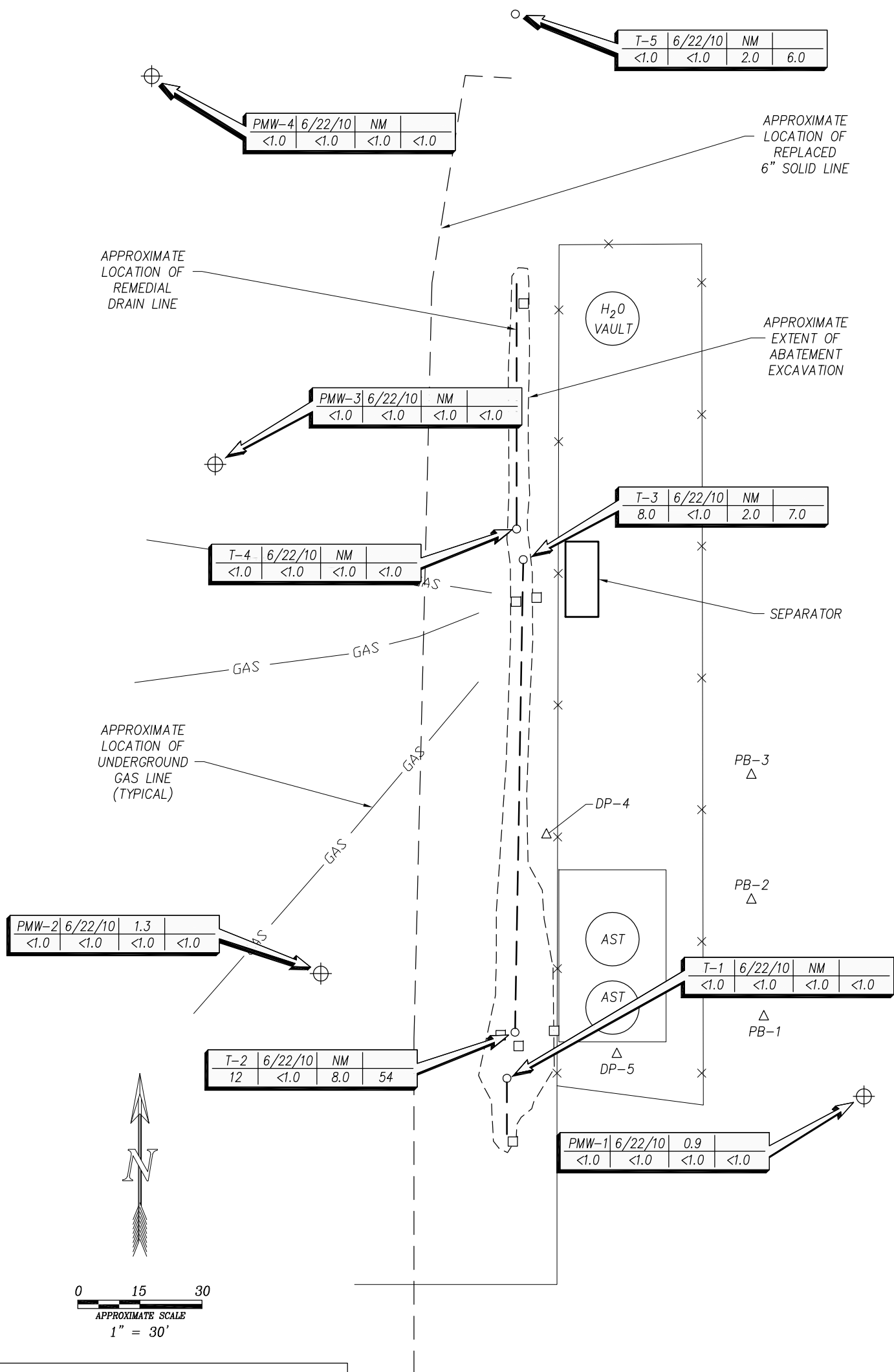
NOTE: GROUNDWATER CONTOURS WERE ESTIMATED USING THE "SURFER" PROGRAM FROM GOLDEN SOFTWARE BASED ON DATA COLLECTED FROM WELLS PMW-1, PMW-2, PMW-3, & PMW-4 ON JUNE 22, 2010. ACTUAL CONDITIONS MAY VARY.

**Figure 3 Piezometric Surface Diagram  
Berger Tank Battery  
Machii-Ross Petroleum Company  
Weld County Road 11 & 20  
Weld County, Colorado**

Project Mngr:  
ADW  
Designed by:  
Drawn by:  
PJH  
Checked by:  
ADW  
Approved by:  
DMR

**PARAGON**  
Consulting Group  
Environmental Engineering  
and Geohydrology  
6901 Broadway  
Denver, Colorado 80221

Project No:  
1007004  
Scale:  
As Shown  
File No:  
04jun10  
Date:  
Jul 2010  
Sheet No:



### Legend

- APPROXIMATE LOCATION OF REMEDIAL DRAIN LINE RISER
- △ APPROXIMATE LOCATION OF SOIL BORING
- ⊕ APPROXIMATE LOCATION OF MONITORING WELL
- APPROXIMATE LOCATION OF SOIL SAMPLE

WHERE:

SAMPLE NAME	SAMPLE DATE	DO	X
B	T	E	X

B = BENZENE CONCENTRATION IN µg/L.  
T = TOLUENE CONCENTRATION IN µg/L.  
E = ETHYLBENZENE CONCENTRATION IN µg/L.  
X = TOTAL XYLENES CONCENTRATION IN µg/L.  
DO = DISSOLVED OXYGEN CONCENTRATION IN mg/L.  
NM = NOT MEASURED.

Figure 4 Groundwater Quality Results Diagram  
Berger Tank Battery  
Machii-Ross Petroleum Company  
Weld County Road 11 & 20  
Weld County, Colorado

Project Mngr:  
ADW

Designed by:

Drawn by:  
PJH

Checked by:  
ADW

Approved by:  
DMR

**PARAGON**  
Consulting Group

Environmental Engineering  
and Geohydrology  
6901 Broadway  
Denver, Colorado 80221

Project No:  
1007004

Scale:  
As Shown

File No:  
04w0610

Date:  
Jul 2010

Sheet No:

**TABLE 1**  
**SUMMARY OF GROUNDWATER ELEVATION DATA**

**PROJECT NAME:** Machii Ross/Berger Battery  
**PROJECT LOCATION:** WCR 11 & WCR 20, Weld County, Colorado  
**PROJECT NUMBER:** 1007004

Well Name	PMW-1	PMW-2	PMW-3	PMW-4
Casing Elevation (feet)	125.44	124.82	121.50	119.41
<u>Date Measured: March 1, 2007</u>				
Depth to Water (feet)	11.38	3.96	7.02	10.42
Groundwater Elevation (feet)	114.06	120.86	114.48	108.99
<u>Date Measured: April 9, 2007</u>				
Depth to Water (feet)	3.99	7.60	6.71	9.61
Groundwater Elevation (feet)	121.45	117.22	114.79	109.80
<u>Date Measured: June 13, 2007</u>				
Depth to Water (feet)	4.11	4.70	7.20	10.61
Groundwater Elevation (feet)	121.33	120.12	114.30	108.80
<u>Date Measured: September 28, 2007</u>				
Depth to Water (feet)	3.85	8.25	8.00	11.18
Groundwater Elevation (feet)	121.59	116.57	113.50	108.23
<u>Date Measured: January 28, 2008</u>				
Depth to Water (feet)	4.90	7.96	NM	9.79
Groundwater Elevation (feet)	120.54	116.86	NM	109.62
<u>Date Measured: April 30, 2008</u>				
Depth to Water (feet)	4.68	7.60	6.80	9.52
Groundwater Elevation (feet)	120.76	117.22	114.70	109.89
<u>Date Measured: July 21, 2008</u>				
Depth to Water (feet)	4.15	8.49	7.54	10.89
Groundwater Elevation (feet)	121.29	116.33	113.96	108.52
<u>Date Measured: October 6, 2008</u>				
Depth to Water (feet)	3.82	8.26	7.08	9.58
Groundwater Elevation (feet)	121.62	116.56	114.42	109.83
<u>Date Measured: May 12, 2009</u>				
Depth to Water (feet)	3.95	7.45	6.39	8.03
Groundwater Elevation (feet)	121.49	117.37	115.11	111.38
<u>Date Measured: August 6, 2009</u>				
Depth to Water (feet)	3.11	8.13	6.94	8.78
Groundwater Elevation (feet)	122.33	116.69	114.56	110.63
<u>Date Measured: November 3, 2009</u>				
Depth to Water (feet)	3.92	7.60	6.88	8.53
Groundwater Elevation (feet)	121.52	117.22	114.62	110.88
<u>Date Measured: February 5, 2010</u>				
Depth to Water (feet)	6.39	7.43	6.70	7.69
Groundwater Elevation (feet)	119.05	117.39	114.80	111.72
<u>Date Measured: June 22, 2010</u>				
Depth to Water (feet)	3.23	5.59	5.37	7.00
Groundwater Elevation (feet)	122.21	119.23	116.13	112.41

**Notes:**

1. Approximate well locations are shown on Figure 3.
2. NM = Not Measured.

**TABLE 2**  
**SUMMARY OF WATER QUALITY RESULTS**

(Page 1 of 4)

**PROJECT NAME:** Machii Ross/Berger Battery

**PROJECT LOCATION:** WCR 11 & WCR 20, Weld County, Colorado

**PROJECT NUMBER:** 1007004

Sample Point Name	Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	Dissolved Oxygen (mg/L)
PMW-1 <sup>11</sup>	03/01/07	<0.5	<0.5	<0.5	<0.5	2.6
PMW-1	04/09/07	NS	NS	NS	NS	1.1
PMW-1	06/13/07	<0.5	<0.5	<0.5	<0.5	0.7
PMW-1	09/28/07	<0.5	<0.5	<0.5	<0.5	0.1
PMW-1	01/28/08	<0.5	<0.5	<0.5	<0.5	0.8
PMW-1	04/30/08	<0.5	<0.5	<0.5	<0.5	NM
PMW-1	07/21/08	<0.5	<0.5	<0.5	<0.5	0.9
PMW-1	10/06/08	<1.	<1.	<1.	<1.	1.0
PMW-1	05/12/09	<1.	<1.	<1.	<1.	0.8
PMW-1	08/06/09	<1.	<1.	<1.	<1.	0.9
PMW-1	11/03/09	<1.	<1.	<1.	<1.	1.3
PMW-1	02/05/10	<1.	<1.	<1.	<1.	0.9
PMW-1	06/22/10	<1.	<1.	<1.	<1.	0.9
PMW-2	03/01/07	NS	NS	NS	NS	1.2
PMW-2	04/09/07	<0.5	<0.5	<0.5	<0.5	1.1
PMW-2	06/13/07	<0.5	<0.5	<0.5	<0.5	0.9
PMW-2	09/28/07	<0.5	<0.5	<0.5	<0.5	0.3
PMW-2	01/28/08	<0.5	<0.5	<0.5	<0.5	0.7
PMW-2	04/30/08	<0.5	<0.5	<0.5	<0.5	NM
PMW-2	07/21/08	<0.5	<0.5	<0.5	<0.5	1.0
PMW-2	10/06/08	<1.	<1.	<1.	<1.	1.1
PMW-2	05/12/09	<1.	<1.	<1.	<1.	1.1
PMW-2	08/06/09	<1.	<1.	<1.	<1.	1.3
PMW-2	11/03/09	<1.	<1.	<1.	<1.	1.0
PMW-2	02/05/10	<1.	<1.	<1.	<1.	1.2
PMW-2	06/22/10	<1.	<1.	<1.	<1.	1.3
Concentration Levels		5.0	560.	700.	1,400.	NR

**Notes:**

1. Approximate sample locations are shown on Figure 4.
2. µg/L = micrograms per liter.
3. mg/L = milligrams per liter.
4. Concentration Levels for groundwater are described in Table 910-1 of Series 900 of the Colorado Oil & Gas Conservation Commission Rules and Regulations established April 1, 2009.
5. Bold concentrations indicate an exceedance of the Concentration Levels.
6. NR = Not Regulated.
7. NM = Not Measured.
8. NS = Not Sampled.
9. Groundwater levels did not appear to have stabilized in PMW-1, PMW-2 and PMW-3 since drilling and groundwater samples were not collected from these wells.
10. Groundwater samples BTB-SB-3 and BTB-4 were split samples collected from ENVIRON's probes SB-3 and SB-4, respectively, by Paragon personnel.
11. PMW-1 was inadvertently labeled as PMW-4 during the groundwater sampling performed in March 2007.



**TABLE 2**  
**SUMMARY OF WATER QUALITY RESULTS**

(Page 2 of 4)

**PROJECT NAME:** Machii Ross/Berger Battery

**PROJECT LOCATION:** WCR 11 & WCR 20, Weld County, Colorado

**PROJECT NUMBER:** 1007004

Sample Point Name	Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	Dissolved Oxygen (mg/L)
PMW-3	03/01/07	NS	NS	NS	NS	1.4
PMW-3	04/09/07	<0.5	<0.5	<0.5	<0.5	1.0
PMW-3	06/13/07	<0.5	<0.5	<0.5	<0.5	1.0
PMW-3	09/28/07	<0.5	<0.5	<0.5	<0.5	0.4
PMW-3	01/28/08	<0.5	<0.5	<0.5	<0.5	0.8
PMW-3	04/30/08	<0.5	<0.5	<0.5	<0.5	NM
PMW-3	07/21/08	<0.5	<0.5	<0.5	<0.5	1.1
PMW-3	10/06/08	<1.	<1.	<1.	<1.	1.2
PMW-3	05/12/09	<1.	<1.	<1.	<1.	1.0
PMW-3	08/06/09	<1.	<1.	<1.	<1.	1.1
PMW-3	11/03/09	<1.	<1.	<1.	<1.	1.0
PMW-3	02/05/10	<1.	<1.	<1.	<1.	1.3
PMW-3	06/22/10	<1.	<1.	<1.	<1.	NM
PMW-4	03/01/07	NS	NS	NS	NS	1.8
PMW-4	04/09/07	<0.5	<0.5	<0.5	<0.5	1.0
PMW-4	06/13/07	<0.5	<0.5	<0.5	<0.5	1.0
PMW-4	09/28/07	<0.5	<0.5	<0.5	<0.5	2.2
PMW-4	01/28/08	<0.5	<0.5	<0.5	<0.5	0.9
PMW-4	04/30/08	<0.5	<0.5	<0.5	<0.5	NM
PMW-4	07/21/08	<0.5	<0.5	<0.5	<0.5	1.3
PMW-4	10/06/08	<1.	<1.	<1.	<1.	1.0
PMW-4	05/12/09	<1.	<1.	<1.	<1.	1.1
PMW-4	08/06/09	<1.	<1.	<1.	<1.	1.0
PMW-4	11/03/09	<1.	<1.	<1.	<1.	1.2
PMW-4	02/05/10	<1.	<1.	<1.	<1.	1.3
PMW-4	06/22/10	<1.	<1.	<1.	<1.	NM
BTB-SB-3	01/09/07	<b>20,047.</b>	<b>97,441.</b>	<b>10,824.</b>	<b>142,796.</b>	NM
BTB-4	01/09/07	3.5	65.	6.0	98.	NM
Concentration Levels		5.0	560.	700.	1,400.	NR

**Notes:**

1. Approximate sample locations are shown on Figure 4.
2. µg/L = micrograms per liter.
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4. Concentration Levels for groundwater are described in Table 910-1 of Series 900 of the Colorado Oil & Gas Conservation Commission Rules and Regulations established April 1, 2009.
5. **Bold** concentrations indicate an exceedance of the Concentration Levels.
6. NR = Not Regulated.
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8. NS = Not Sampled.
9. Groundwater levels did not appear to have stabilized in PMW-1, PMW-2 and PMW-3 since drilling and groundwater samples were not collected from these wells.
10. Groundwater samples BTB-SB-3 and BTB-4 were split samples collected from ENVIRON's probes SB-3 and SB-4, respectively, by Paragon personnel.
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**TABLE 2**  
**SUMMARY OF WATER QUALITY RESULTS**

(Page 3 of 4)

**PROJECT NAME:** Machii Ross/Berger Battery

**PROJECT LOCATION:** WCR 11 & WCR 20, Weld County, Colorado

**PROJECT NUMBER:** 1007004

Sample Point Name	Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	Dissolved Oxygen (mg/L)
T-1	06/25/07	<b>517.</b>	<b>1,877.</b>	11.	<b>4,397.</b>	NM
T-1	09/28/07	NS	NS	NS	NS	NM
T-1	01/28/08	NS	NS	NS	NS	NM
T-1	04/30/08	NS	NS	NS	NS	NM
T-1	07/21/08	<b>134.</b>	129.	124.	<b>1,550.</b>	NM
T-1	10/06/08	NS	NS	NS	NS	NM
T-1	05/12/09	NS	NS	NS	NS	NM
T-1	08/06/09	NS	NS	NS	NS	NM
T-1	11/03/09	1.	<1.	3.	13.	NM
T-1	02/05/10	NS	NS	NS	NS	NM
T-1	06/22/10	<1.	<1.	<1.	<1.	NM
T-2	06/25/07	<b>868.</b>	<b>775.</b>	12.	<b>6,330.</b>	NM
T-2	09/28/07	NS	NS	NS	NS	NM
T-2	01/28/08	<b>300.</b>	49.	<0.5	<b>1,415.</b>	NM
T-2	04/30/08	NS	NS	NS	NS	NM
T-2	07/21/08	<b>289.</b>	55.	150.	<b>1,961.</b>	NM
T-2	10/06/08	NS	NS	NS	NS	NM
T-2	05/12/09	<b>94.</b>	65.	32.	663.	NM
T-2	08/06/09	NS	NS	NS	NS	NM
T-2	11/03/09	2.	<1.	4.	2.	NM
T-2	02/05/10	NS	NS	NS	NS	NM
T-2	06/22/10	<b>12.</b>	<1.	8.	54.	NM
T-3	06/25/07	<b>394.</b>	24.	<0.5	<b>3,449.</b>	NM
T-3	09/28/07	NS	NS	NS	NS	NM
T-3	01/28/08	<b>214.</b>	8.1	<0.5	627.	NM
T-3	04/30/08	NS	NS	NS	NS	NM
T-3	07/21/08	<b>199.</b>	3.5	48.	246.	NM
T-3	10/06/08	NS	NS	NS	NS	NM
T-3	05/12/09	<1.	<1.	<1.	<1.	NM
T-3	08/06/09	NS	NS	NS	NS	NM
T-3	11/03/09	7.	<1.	4.	2.	NM
T-3	02/05/10	NS	NS	NS	NS	NM
T-3	06/22/10	<b>8.</b>	<1.	2.	7.	NM
<b>Concentration Levels</b>		<b>5.0</b>	<b>560.</b>	<b>700.</b>	<b>1,400.</b>	<b>NR</b>

**Notes:**

1. Approximate sample locations are shown on Figure 4.
2. µg/L = micrograms per liter.
3. mg/L = milligrams per liter.
4. Concentration Levels for groundwater are described in Table 910-1 of Series 900 of the Colorado Oil & Gas Conservation Commission Rules and Regulations established April 1, 2009.
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6. NR = Not Regulated.
7. NM = Not Measured.
8. NS = Not Sampled.
9. Groundwater levels did not appear to have stabilized in PMW-1, PMW-2 and PMW-3 since drilling and groundwater samples were not collected from these wells.
10. Groundwater samples BTB-SB-3 and BTB-4 were split samples collected from ENVIRON's probes SB-3 and SB-4, respectively, by Paragon personnel.
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**TABLE 2**  
**SUMMARY OF WATER QUALITY RESULTS**

(Page 4 of 4)

**PROJECT NAME:** Machii Ross/Berger Battery

**PROJECT LOCATION:** WCR 11 & WCR 20, Weld County, Colorado

**PROJECT NUMBER:** 1007004

Sample Point Name	Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	Dissolved Oxygen (mg/L)
T-4	06/25/07	<b>240.</b>	2.2	<0.5	<b>1,270.</b>	NM
T-4	09/28/07	NS	NS	NS	NS	NM
T-4	01/28/08	<b>44.</b>	0.7	<0.5	28.	NM
T-4	04/30/08	NS	NS	NS	NS	NM
T-4	07/21/08	<b>172.</b>	6.6	17.	66.	NM
T-4	10/06/08	NS	NS	NS	NS	NM
T-4	05/12/09	<1.	<1.	<1.	<1.	NM
T-4	08/06/09	NS	NS	NS	NS	NM
T-4	11/03/09	<b>5.</b>	<1.	<1.	<1.	NM
T-4	02/05/10	NS	NS	NS	NS	NM
T-4	06/22/10	<1.	<1.	<1.	<1.	NM
T-5	06/25/07	<b>1,451.</b>	<b>692.</b>	426.	<b>6,938.</b>	NM
T-5	09/28/07	NS	NS	NS	NS	NM
T-5	01/28/08	<b>168.</b>	<0.5	132.	<b>1,547.</b>	NM
T-5	04/30/08	NS	NS	NS	NS	NM
T-5	07/21/08	<b>177.</b>	7.5	226.	1,216.	NM
T-5	10/06/08	NS	NS	NS	NS	NM
T-5	05/12/09	<b>11.</b>	<1.	40.	165.	NM
T-5	08/06/09	NS	NS	NS	NS	NM
T-5	11/03/09	<1.	<1.	2.	10.	NM
T-5	02/05/10	NS	NS	NS	NS	NM
T-5	06/22/10	<1.	<1.	2.	6.	NM
Concentration Levels		5.0	560.	700.	1,400.	NR

**Notes:**

1. Approximate sample locations are shown on Figure 4.
2. µg/L = micrograms per liter.
3. mg/L = milligrams per liter.
4. Concentration Levels for groundwater are described in Table 910-1 of Series 900 of the Colorado Oil & Gas Conservation Commission Rules and Regulations established April 1, 2009.
5. **Bold** concentrations indicate an exceedance of the Concentration Levels.
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10. Groundwater samples BTB-SB-3 and BTB-4 were split samples collected from ENVIRON's probes SB-3 and SB-4, respectively, by Paragon personnel.
11. PMW-1 was inadvertently labeled as PMW-4 during the groundwater sampling performed in March 2007.

# **TABLE 3** **GROUNDWATER RECOVERY**

(Page 1 of 3)

**PROJECT NAME:** Machii Ross/Berger Battery

**PROJECT LOCATION:** WCR 11 & WCR 20, Weld County, Colorado

**PROJECT NUMBER:** 1007004

DATE	WELL NAME	AMOUNT RECOVERED (gal)	RECOVERY METHOD
3/23/2007	T-1 through T-5	1,050	vacuum extraction truck
5/29/2007	T-1 through T-5	2,310	vacuum extraction truck
5/31/2007	T-1 through T-5	2,100	vacuum extraction truck
6/4/2007	T-1 through T-5	2,310	vacuum extraction truck
7/3/2007	T-1 through T-5	2,730	vacuum extraction truck
7/5/2007	T-1 through T-5	2,310	vacuum extraction truck
7/9/2007	T-1 through T-5	2,310	vacuum extraction truck
7/16/2007	T-1 through T-5	2,520	vacuum extraction truck
7/23/2007	T-1 through T-5	2,184	vacuum extraction truck
7/30/2007	T-1 through T-5	2,730	vacuum extraction truck
8/20/2007	T-1 through T-5	2,520	vacuum extraction truck
8/27/2007	T-1 through T-5	1,890	vacuum extraction truck
9/4/2007	T-1 through T-5	2,730	vacuum extraction truck
9/18/2007	T-1 through T-5	1,680	vacuum extraction truck
10/8/2007	T-1 through T-5	2,100	vacuum extraction truck
10/15/2007	T-1 through T-5	1,680	vacuum extraction truck
10/22/2007	T-1 through T-5	2,730	vacuum extraction truck
10/29/2007	T-1 through T-5	2,184	vacuum extraction truck
11/5/2007	T-1 through T-5	2,730	vacuum extraction truck
11/14/2007	T-1 through T-5	2,730	vacuum extraction truck
11/19/2007	T-1 through T-5	2,730	vacuum extraction truck
12/3/2007	T-1 through T-5	1,470	vacuum extraction truck
12/10/2007	T-1 through T-5	1,722	vacuum extraction truck
12/17/2007	T-1 through T-5	1,638	vacuum extraction truck
12/26/2007	T-1 through T-5	2,940	vacuum extraction truck
1/2/2008	T-1 through T-5	2,520	vacuum extraction truck
1/7/2008	T-1 through T-5	1,974	vacuum extraction truck
1/14/2008	T-1 through T-5	2,520	vacuum extraction truck
1/21/2008	T-1 through T-5	2,646	vacuum extraction truck
1/29/2008	T-1 through T-5	1,764	vacuum extraction truck
2/4/2008	T-1 through T-5	2,730	vacuum extraction truck
2/11/2008	T-1 through T-5	2,520	vacuum extraction truck
2/18/2008	T-1 through T-5	2,520	vacuum extraction truck
3/3/2008	T-1 through T-5	2,730	vacuum extraction truck
3/10/2008	T-1 through T-5	2,940	vacuum extraction truck
3/17/2008	T-1 through T-5	2,730	vacuum extraction truck
3/24/2008	T-1 through T-5	2,730	vacuum extraction truck
3/31/2008	T-1 through T-5	2940	vacuum extraction truck
4/8/2008	T-1 through T-5	2,058	vacuum extraction truck
4/14/2008	T-1 through T-5	2,436	vacuum extraction truck
4/23/2008	T-1 through T-5	2,100	vacuum extraction truck
4/28/2008	T-1 through T-5	NR	vacuum extraction truck
5/5/2008	T-1 through T-5	2,436	vacuum extraction truck
5/15/2008	T-1 through T-5	2,730	vacuum extraction truck
5/19/2008	T-1 through T-5	2,730	vacuum extraction truck
5/27/2008	T-1 through T-5	NR	vacuum extraction truck

Notes:

1) Approximate sample locations are shown on Figure 3.

**PARAGON**

**TABLE 3**  
**GROUNDWATER RECOVERY**

(Page 2 of 3)

**PROJECT NAME:** Machii Ross/Berger Battery

**PROJECT LOCATION:** WCR 11 & WCR 20, Weld County, Colorado

**PROJECT NUMBER:** 1007004

DATE	WELL NAME	AMOUNT RECOVERED (gal)	RECOVERY METHOD
6/2/2008	T-1 through T-5	2,730	vacuum extraction truck
6/10/2008	T-1 through T-5	2,814	vacuum extraction truck
6/16/2008	T-1 through T-5	2,142	vacuum extraction truck
6/24/2008	T-1 through T-5	2,604	vacuum extraction truck
6/30/2008	T-1 through T-5	2,814	vacuum extraction truck
7/7/2008	T-1 through T-5	1,848	vacuum extraction truck
7/14/2008	T-1 through T-5	NR	vacuum extraction truck
7/22/2008	T-1 through T-5	1,974	vacuum extraction truck
7/28/2008	T-1 through T-5	3,066	vacuum extraction truck
8/4/2008	T-1 through T-5	2,940	vacuum extraction truck
8/13/2008	T-1 through T-5	1,680	vacuum extraction truck
8/18/2008	T-1 through T-5	2,940	vacuum extraction truck
8/25/2008	T-1 through T-5	2,940	vacuum extraction truck
9/3/2008	T-1 through T-5	2,940	vacuum extraction truck
9/8/2008	T-1 through T-5	1,848	vacuum extraction truck
9/22/2008	T-1 through T-5	2,940	vacuum extraction truck
9/29/2008	T-1 through T-5	2,310	vacuum extraction truck
10/6/2008	T-1 through T-5	2,730	vacuum extraction truck
10/13/2008	T-1 through T-5	2,940	vacuum extraction truck
11/3/2008	T-1 through T-5	2,520	vacuum extraction truck
11/10/2008	T-1 through T-5	2,940	vacuum extraction truck
11/17/2008	T-1 through T-5	2,730	vacuum extraction truck
11/24/2008	T-1 through T-5	2,730	vacuum extraction truck
12/1/2008	T-1 through T-5	2,520	vacuum extraction truck
12/8/2008	T-1 through T-5	2,310	vacuum extraction truck
12/15/2008	T-1 through T-5	2,268	vacuum extraction truck
12/22/2008	T-1 through T-5	1,974	vacuum extraction truck
12/29/2008	T-1 through T-5	2,520	vacuum extraction truck
1/5/2009	T-1 through T-5	2,520	vacuum extraction truck
1/12/2009	T-1 through T-5	2,058	vacuum extraction truck
1/19/2009	T-1 through T-5	1,680	vacuum extraction truck
1/26/2009	T-1 through T-5	2,310	vacuum extraction truck
2/2/2009	T-1 through T-5	2,142	vacuum extraction truck
2/9/2009	T-1 through T-5	1,680	vacuum extraction truck
2/16/2009	T-1 through T-5	2,142	vacuum extraction truck
2/23/2009	T-1 through T-5	2,142	vacuum extraction truck
3/2/2009	T-1 through T-5	1,890	vacuum extraction truck
3/9/2009	T-1 through T-5	2,436	vacuum extraction truck
3/16/2009	T-1 through T-5	2,730	vacuum extraction truck
3/23/2009	T-1 through T-5	2,730	vacuum extraction truck

Notes:

1) Approximate sample locations are shown on Figure 3.

**TABLE 3**  
**GROUNDWATER RECOVERY**

(Page 3 of 3)

**PROJECT NAME:** Machii Ross/Berger Battery

**PROJECT LOCATION:** WCR 11 & WCR 20, Weld County, Colorado

**PROJECT NUMBER:** 1007004

DATE	WELL NAME	AMOUNT RECOVERED (gal)	RECOVERY METHOD
3/30/2009	T-1 through T-5	2,520	vacuum extraction truck
4/6/2009	T-1 through T-5	2,730	vacuum extraction truck
4/13/2009	T-1 through T-5	2,562	vacuum extraction truck
4/20/2009	T-1 through T-5	2,898	vacuum extraction truck
4/27/2009	T-1 through T-5	2,562	vacuum extraction truck
5/4/2009	T-1 through T-5	2,940	vacuum extraction truck
5/11/2009	T-1 through T-5	2,730	vacuum extraction truck
5/18/2009	T-1 through T-5	2,520	vacuum extraction truck
5/26/2009	T-1 through T-5	2,184	vacuum extraction truck
6/1/2009	T-1 through T-5	2,268	vacuum extraction truck
6/8/2009	T-1 through T-5	2,142	vacuum extraction truck
6/15/2009	T-1 through T-5	2,730	vacuum extraction truck
6/22/2009	T-1 through T-5	2,394	vacuum extraction truck
6/29/2009	T-1 through T-5	2,730	vacuum extraction truck
7/6/2009	T-1 through T-5	2,478	vacuum extraction truck
7/13/2009	T-1 through T-5	NR	vacuum extraction truck
7/20/2009	T-1 through T-5	2,562	vacuum extraction truck
7/27/2009	T-1 through T-5	1,806	vacuum extraction truck
8/3/2009	T-1 through T-5	2,730	vacuum extraction truck
8/10/2009	T-1 through T-5	2,940	vacuum extraction truck
8/17/2009	T-1 through T-5	2,940	vacuum extraction truck
8/24/2009	T-1 through T-5	2,940	vacuum extraction truck
8/31/2009	T-1 through T-5	2,268	vacuum extraction truck
9/14/2009	T-1 through T-5	2,940	vacuum extraction truck
9/28/2009	T-1 through T-5	3,150	vacuum extraction truck
10/12/2009	T-1 through T-5	2,268	vacuum extraction truck
10/26/2009	T-1 through T-5	2,436	vacuum extraction truck
11/24/2009	T-1 through T-5	2,520	vacuum extraction truck
6/21/2010	T-2 through T-5	2,184	vacuum extraction truck
<b>TOTAL LIQUID REMOVED</b>		<b>271,026</b>	

Notes:

1) Approximate sample locations are shown on Figure 3.



# TECHNOLOGY LABORATORY, INC.

## CENTRE PROFESSIONAL PARK

1012 Centre Avenue  
Fort Collins, Colorado 80526  
(970) 490-1414

### CERTIFICATE OF ANALYSIS

Paragon Consulting Group, Inc.  
1103 Oak Park Drive  
Fort Collins, CO 80525

Date Received: 06/22/10

Matrix: Water

Project No.: 1007004

<u>Lab ID</u>	<u>Sample ID</u>	<u>Date Sampled</u>	<u>Date Analyzed</u>	<u>Benzene mg/L</u>	<u>Toluene mg/L</u>	<u>Ethylbenzene mg/L</u>	<u>Total Xylenes mg/L</u>
A1551-01	PMW-1	06/22/10	06/22/10	< 0.001	< 0.001	< 0.001	< 0.001
A1551-02	PMW-2	06/22/10	06/22/10	< 0.001	< 0.001	< 0.001	< 0.001
A1551-03	PMW-3	06/22/10	06/22/10	< 0.001	< 0.001	< 0.001	< 0.001
A1551-04	PMW-4	06/22/10	06/22/10	< 0.001	< 0.001	< 0.001	< 0.001
A1551-05	T-1	06/22/10	06/23/10	< 0.001	< 0.001	< 0.001	< 0.001
A1551-06	T-2	06/22/10	06/23/10	0.012	< 0.001	0.008	0.054
A1551-07	T-3	06/22/10	06/23/10	0.008	< 0.001	0.002	0.007
A1551-08	T-4	06/22/10	06/23/10	< 0.001	< 0.001	< 0.001	< 0.001
A1551-09	T-5	06/22/10	06/23/10	< 0.001	< 0.001	0.002	0.006

BTEX Method:

EPA-8260B

Todd Thea



# TECHNOLOGY LABORATORY, INC.

## CENTRE PROFESSIONAL PARK

1012 Centre Avenue  
Fort Collins, Colorado 80526  
(970) 490-1414

### CERTIFICATE OF ANALYSIS

#### QA/QC SURROGATE RECOVERY

Paragon Consulting Group, Inc.  
1103 Oak Park Drive  
Fort Collins, CO 80525

Date Received: 06/22/10

Matrix: Water

Project No.: 1007004

(% Recovery)

<u>Lab ID</u>	<u>Sample ID</u>	Bromofluorobenzene <u>Limits (70-113%)</u>	Dibromofluoromethane <u>Limits (68-120%)</u>	Toluene-d8 <u>Limits (81-128%)</u>
A1551-01	PMW-1	92	99	97
A1551-02	PMW-2	87	99	97
A1551-03	PMW-3	90	101	96
A1551-04	PMW-4	85	97	95
A1551-05	T-1	91	99	96
A1551-06	T-2	92	99	96
A1551-07	T-3	91	99	97
A1551-08	T-4	88	99	97
A1551-09	T-5	92	96	94

*Test Area*



Key Energy Services, Inc.  
TRUCKING JSA  
REMIT TO: PO BOX 201858 DALLAS, TX 75320-1858

Service Location  
Berger Battery



Date: 6-21-10  
S (M) T W

Work Ticket No. T1688109

Yard No. 2009 1200	Unit/Asset No. 0106319	Manifest	RCC No.
SWD Name <input type="checkbox"/> Key SWD <input type="checkbox"/> Customer SWD <input type="checkbox"/> Public SWD			Disposal Ticket No.

[illegible]

Tank No.	Tank No.	Tank No.	Mileage Start	Mileage End
Top Gauge	Top Gauge	Top Gauge		
Bottom Gauge	Bottom Gauge	Bottom Gauge	Ifa _____ State	Ifa _____ State

☐ Hard Hat      ☐ Safety Belts      ☐ Safety Harness / Anti Fall Device      ☐ Proper Clothing      ☐ Hearing Protection

☐ Fire Extinguishers      ☐ Steel Toed Boots      ☐ Cotton/ Rubber Gloves      ☐ Safety Glasses      ☐ Other - Explain: \_\_\_\_\_

☐ Face Shields / Goggles      ☐ Wheel Chock/Cones      ☐ Confined Space Permit      ☐ Work Permit Required

☐ H2S / Tin Monitors      ☐ Back Support Belts      ☐ Lock Out/Tag Out      ☐ Ground Cable

Pre-Job Hazard Assessment			
<b>Lifting</b>			
Manual Lifting (Body Position)	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Mechanical Lifting Equipment	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Awkward Body Position	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Slip/Trip Potential	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Lifting w/Other Employees	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Proper Rigging Practices	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
<b>Access/Exit</b>			
Scaffold (properly inspected)	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Ladder	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Hoisting of Tools/Materials	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Secure Footing	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
<b>Hazards</b>			
Proper Tool/Material Placement	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Hot/Cold Surface or Material	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Inadequate Lighting	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Fall Protection/ Anchor Points	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Pinch Points	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Trenching/Excavation	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Hand and Finger Hazards	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
<b>Electrical Hazards</b>			
Welding/Flame Cutting	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Mechanical Cutting	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
<b>Environmental</b>			
Pollution (Personal Exposure)	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
<b>Body Position/Movement</b>			
Climbing	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Pulling, Pushing	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Bending	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Twisting Motion	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Walking	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Swinging	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Straining	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Stretching	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Reaching	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Over Extending	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Jumping	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
Crawling	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N	
<b>Environmental Condition</b>			
Day	<input checked="" type="checkbox"/>	Night	<input checked="" type="checkbox"/>
Drizzle	<input type="checkbox"/>	Humid	<input checked="" type="checkbox"/>
Ice	<input type="checkbox"/>	Snow	<input type="checkbox"/>
Temp	65	Dust	<input type="checkbox"/>
Wind	5	Fog	<input type="checkbox"/>
Degrees			
mph			
Chairs Required			
Steep Grades			
Mud			
Condition			
If YES to any HAZARDS - Identify:			

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ATRISK BEHAVIORS OR OTHER HAZARDS	POTENTIAL HAND AND/OR FINGER HAZARDS	ACTION TAKEN TO ELIMINATE OR REDUCE POTENTIAL HAZARDS

Key Approval - Date: Chris Darling 6-22-10 Customer Approval - Date: \_\_\_\_\_

Jerry Sparling

Asset	Service Code	Description	Qty	Rate	Total
		<input type="checkbox"/> Transport <input checked="" type="checkbox"/> Trans/Vac <input type="checkbox"/> Vacuum			
		Minimum : <input type="checkbox"/> 130 BBL <input type="checkbox"/> 60-80 BBL <input type="checkbox"/> 50 BBL <input checked="" type="checkbox"/> Hour <input type="checkbox"/> Barrel <input type="checkbox"/> Load <input type="checkbox"/> 130 BBL <input type="checkbox"/> 60-80 BBL <input type="checkbox"/> 50 BBL			
010639	3D0143	Pump/Kill Truck Minimum <input type="checkbox"/> 130 BBL <input type="checkbox"/> 60-80 BBL <input type="checkbox"/> 50 BBL	3	\$78.00	234.00
		Pump/Kill Truck Hourly <input type="checkbox"/> 130 BBL <input type="checkbox"/> 60-80 BBL <input type="checkbox"/> 50 BBL			
		Hot Oil Unit Minimum <input type="checkbox"/> 130 BBL <input type="checkbox"/> 75 BBL			
		Hot Oil Unit Hourly <input type="checkbox"/> 130 BBL <input type="checkbox"/> 75 BBL			
		Hot Oil by the BBL			
		Propane			
		Winch Truck Minimum <input type="checkbox"/> Light Duty <input type="checkbox"/> Heavy Duty			
		Winch Truck Hourly <input type="checkbox"/> Light Duty <input type="checkbox"/> Heavy Duty			
		Haul, Set & Deliver Equipment			
		<input type="checkbox"/> Swamper <input type="checkbox"/> Special Fluid Helper			
		Supervisor <input type="checkbox"/> Truck <input type="checkbox"/> Acid <input type="checkbox"/> Special Fluid			
		Fresh Water Key Owned			
		Fresh Water Non Key			
		Brine Water Key Owned			
		Brine Water Non Key			
		Disposal Key Owned : <input type="checkbox"/> Solid <input type="checkbox"/> B/S			
		Disposal Non Key : <input type="checkbox"/> Solid <input type="checkbox"/> B/S			
		Disposal Key Owned : <input type="checkbox"/> Produced <input type="checkbox"/> Flowback			
		Disposal Non Key <input type="checkbox"/> Produced <input type="checkbox"/> Flowback			
		Third Party			
		KCL (Potassium Chloride) Powdered			
		KCL Substitute			
		KCL <input type="checkbox"/> 2% <input type="checkbox"/> 3% <input type="checkbox"/> 4% <input type="checkbox"/> Other			
		Chemicals - Specify:			
		FUEL <input type="checkbox"/> Fuel Surcharge <input type="checkbox"/> Fuel Charge			
Sales tax calculated on invoice			Sub Total		234.00

Sales tax calculated on invoice

Sub Total	234.00
-----------	--------

PAYROLL:

Class	Employee No.	Employee Name / Signature	Start	End	Work	Travel	Down	Other	Total Hours
DRIVER	33205	Roger Fender Rye	6:30	7:30	3.0	-	-	-	3
SWAMP TRAINER	33205		Am	Am					

DVT-005 - 8/11

15x No Signature Required

RECEIVED

AUG 04 2010

# PARAGON

# Saturated zone model (dissolved phase source)

Title: New Project

Simulation time (years)..... 100

## Saturated Zone Model Source

### Pulse Source:

Length of pulse (yr)..... 100.  
Total thickness of source (m)..... 2.44  
Length of source (m)..... 15.2  
Width of source (m)..... 9.14

## Aquifer Properties

Effective porosity (cm<sup>3</sup>/cm<sup>3</sup>)..... .120  
Fraction organic carbon (g oc/g soil)... 9.000E-03  
Hydraulic conductivity (m/d)..... 1.642E-04  
Soil bulk density (g/cm<sup>3</sup>)..... 1.64  
Hydraulic gradient (m/m)..... 3.500E-02  
Longitudinal dispersivity (m)..... code calculated  
Transverse dispersivity (m)..... code calculated  
Vertical dispersivity (m)..... code calculated

## Receptor Well Location

Distance downgradient (m)..... 549.  
Distance cross-gradient (m)..... .000  
Depth to top of well screen (m)..... .000  
Depth to bottom of well screen(m)..... 1.00  
Number of points used to calc. conc..... 2

## CHEMICAL DATA INPUT: Benzene

Diffusion coeff. in air (cm<sup>2</sup>/s)..... 8.800E-02  
Diffusion coeff. in water (cm<sup>2</sup>/s)... 9.800E-06  
Solubility (mg/l)..... 1.750E+03  
KOC (ml/g)..... 58.9  
Henry's Law Coefficient (-)..... .228  
Molecular Weight (g/mol)..... 78.0  
Density of chemical (g/cm<sup>3</sup>)..... .877  
Degradation rate sat. zone (1/d).... .000  
Degradation rate unsat. zone (1/d).. .000

## Source Concentrations: Benzene

Source conc. for GW model (mg/l)..... 1.200E-02

The benzene concentration at the POE located 1,800 feet from the site was predicted using the highest observed benzene concentration of 12 µg/L in the last year in the groundwater sample collected from well T-2 on June 22, 2010 and the longest pulse length of 100 years.

Effective Porosity = 0.12

Hydraulic Conductivity = 0.00016 meters/day

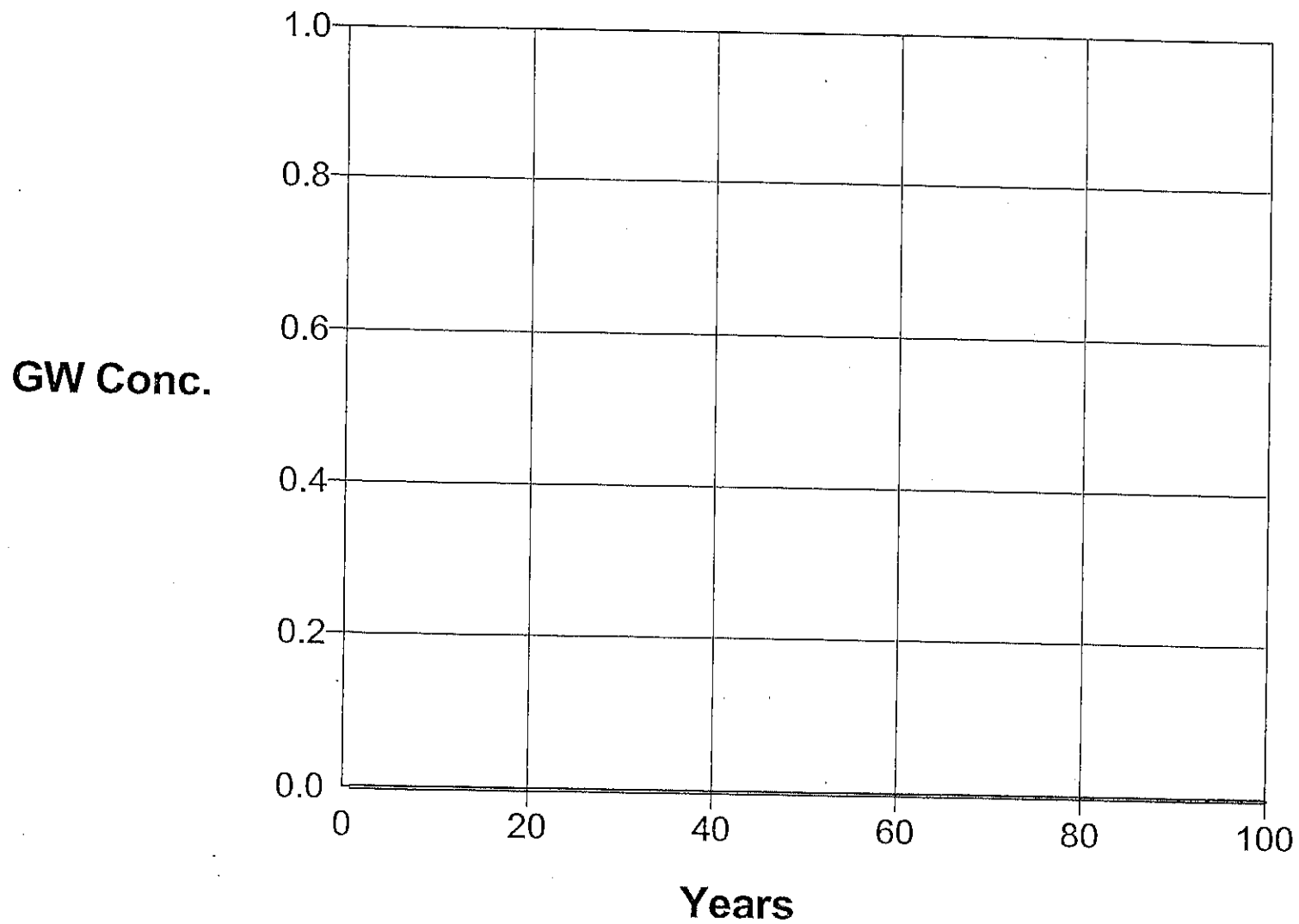
GROUNDWATER CONCENTRATION AT RECEPTOR WELL  
Benzene  
Averaged Annually

Time (yr)	Concentration at well (mg/l)
1.0	0.00E+00
2.0	0.00E+00
3.0	0.00E+00
4.0	0.00E+00
5.0	0.00E+00
6.0	0.00E+00
7.0	0.00E+00
8.0	0.00E+00
9.0	0.00E+00
10.0	0.00E+00
11.0	0.00E+00
12.0	0.00E+00
13.0	0.00E+00
14.0	0.00E+00
15.0	0.00E+00
16.0	0.00E+00
17.0	0.00E+00
18.0	0.00E+00
19.0	0.00E+00
20.0	0.00E+00
21.0	0.00E+00
22.0	0.00E+00
23.0	0.00E+00
24.0	0.00E+00
25.0	0.00E+00
26.0	0.00E+00
27.0	0.00E+00
28.0	0.00E+00
29.0	0.00E+00
30.0	0.00E+00
31.0	0.00E+00
32.0	0.00E+00
33.0	0.00E+00
34.0	0.00E+00
35.0	0.00E+00
36.0	0.00E+00
37.0	0.00E+00
38.0	0.00E+00
39.0	0.00E+00
40.0	0.00E+00
41.0	0.00E+00
42.0	0.00E+00
43.0	0.00E+00
44.0	0.00E+00
45.0	0.00E+00
46.0	0.00E+00
47.0	0.00E+00
48.0	0.00E+00
49.0	0.00E+00
50.0	0.00E+00
51.0	0.00E+00
52.0	0.00E+00
53.0	0.00E+00
54.0	0.00E+00
55.0	0.00E+00
56.0	0.00E+00
57.0	0.00E+00
58.0	0.00E+00
59.0	0.00E+00
60.0	0.00E+00
61.0	0.00E+00
62.0	0.00E+00
63.0	0.00E+00
64.0	0.00E+00

65.0	0.00E+00
66.0	0.00E+00
67.0	0.00E+00
68.0	0.00E+00
69.0	0.00E+00
70.0	0.00E+00
71.0	0.00E+00
72.0	0.00E+00
73.0	0.00E+00
74.0	0.00E+00
75.0	0.00E+00
76.0	0.00E+00
77.0	0.00E+00
78.0	0.00E+00
79.0	0.00E+00
80.0	0.00E+00
81.0	0.00E+00
82.0	0.00E+00
83.0	0.00E+00
84.0	0.00E+00
85.0	0.00E+00
86.0	0.00E+00
87.0	0.00E+00
88.0	0.00E+00
89.0	0.00E+00
90.0	0.00E+00
91.0	0.00E+00
92.0	0.00E+00
93.0	0.00E+00
94.0	0.00E+00
95.0	0.00E+00
96.0	0.00E+00
97.0	0.00E+00
98.0	0.00E+00
99.0	0.00E+00
100.0	0.00E+00

The maximum concentration occurred at the following time:  
.0 0.00E+00

# Concentration in Groundwater [mg/l]



# Saturated zone model (dissolved phase source)

Title: New Project

Simulation time (years)..... 100

## Saturated Zone Model Source

### Pulse Source:

Length of pulse (yr)..... 100.  
Total thickness of source (m)..... 2.44  
Length of source (m)..... 15.2  
Width of source (m)..... 9.14

## Aquifer Properties

Effective porosity (cm<sup>3</sup>/cm<sup>3</sup>)..... .300  
Fraction organic carbon (g oc/g soil)... 9.000E-03  
Hydraulic conductivity (m/d)..... 1.642E-04  
Soil bulk density (g/cm<sup>3</sup>)..... 1.64  
Hydraulic gradient (m/m)..... 3.500E-02  
Longitudinal dispersivity (m)..... code calculated  
Transverse dispersivity (m)..... code calculated  
Vertical dispersivity (m)..... code calculated

## Receptor Well Location

Distance downgradient (m)..... 549.  
Distance cross-gradient (m)..... .000  
Depth to top of well screen (m)..... .000  
Depth to bottom of well screen(m)..... 1.00  
Number of points used to calc. conc..... 2

## CHEMICAL DATA INPUT: Benzene

Diffusion coeff. in air (cm<sup>2</sup>/s)..... 8.800E-02  
Diffusion coeff. in water (cm<sup>2</sup>/s)... 9.800E-06  
Solubility (mg/l)..... 1.750E+03  
KOC (ml/g)..... 58.9  
Henry's Law Coefficient (-)..... .228  
Molecular Weight (g/mol)..... 78.0  
Density of chemical (g/cm<sup>3</sup>)..... .877  
Degradation rate sat. zone (1/d).... .000  
Degradation rate unsat. zone (1/d).. .000

## Source Concentrations: Benzene

Source conc. for GW model (mg/l)..... 1.200E-02

The benzene concentration at the POE located 1,800 feet from the site was predicted using the highest observed benzene concentration of 12 µg/L in the last year in the groundwater sample collected from well T-2 on June 22, 2010 and the longest pulse length of 100 years.

Effective Porosity = 0.3

Hydraulic Conductivity = 0.00016 meters/day

## GROUNDWATER CONCENTRATION AT RECEPTOR WELL

Benzene

Averaged Annually

Time (yr)	Concentration at well (mg/l)
1.0	0.00E+00
2.0	0.00E+00
3.0	0.00E+00
4.0	0.00E+00
5.0	0.00E+00
6.0	0.00E+00
7.0	0.00E+00
8.0	0.00E+00
9.0	0.00E+00
10.0	0.00E+00
11.0	0.00E+00
12.0	0.00E+00
13.0	0.00E+00
14.0	0.00E+00
15.0	0.00E+00
16.0	0.00E+00
17.0	0.00E+00
18.0	0.00E+00
19.0	0.00E+00
20.0	0.00E+00
21.0	0.00E+00
22.0	0.00E+00
23.0	0.00E+00
24.0	0.00E+00
25.0	0.00E+00
26.0	0.00E+00
27.0	0.00E+00
28.0	0.00E+00
29.0	0.00E+00
30.0	0.00E+00
31.0	0.00E+00
32.0	0.00E+00
33.0	0.00E+00
34.0	0.00E+00
35.0	0.00E+00
36.0	0.00E+00
37.0	0.00E+00
38.0	0.00E+00
39.0	0.00E+00
40.0	0.00E+00
41.0	0.00E+00
42.0	0.00E+00
43.0	0.00E+00
44.0	0.00E+00
45.0	0.00E+00
46.0	0.00E+00
47.0	0.00E+00
48.0	0.00E+00
49.0	0.00E+00
50.0	0.00E+00
51.0	0.00E+00
52.0	0.00E+00
53.0	0.00E+00
54.0	0.00E+00
55.0	0.00E+00
56.0	0.00E+00
57.0	0.00E+00
58.0	0.00E+00
59.0	0.00E+00
60.0	0.00E+00
61.0	0.00E+00
62.0	0.00E+00
63.0	0.00E+00
64.0	0.00E+00

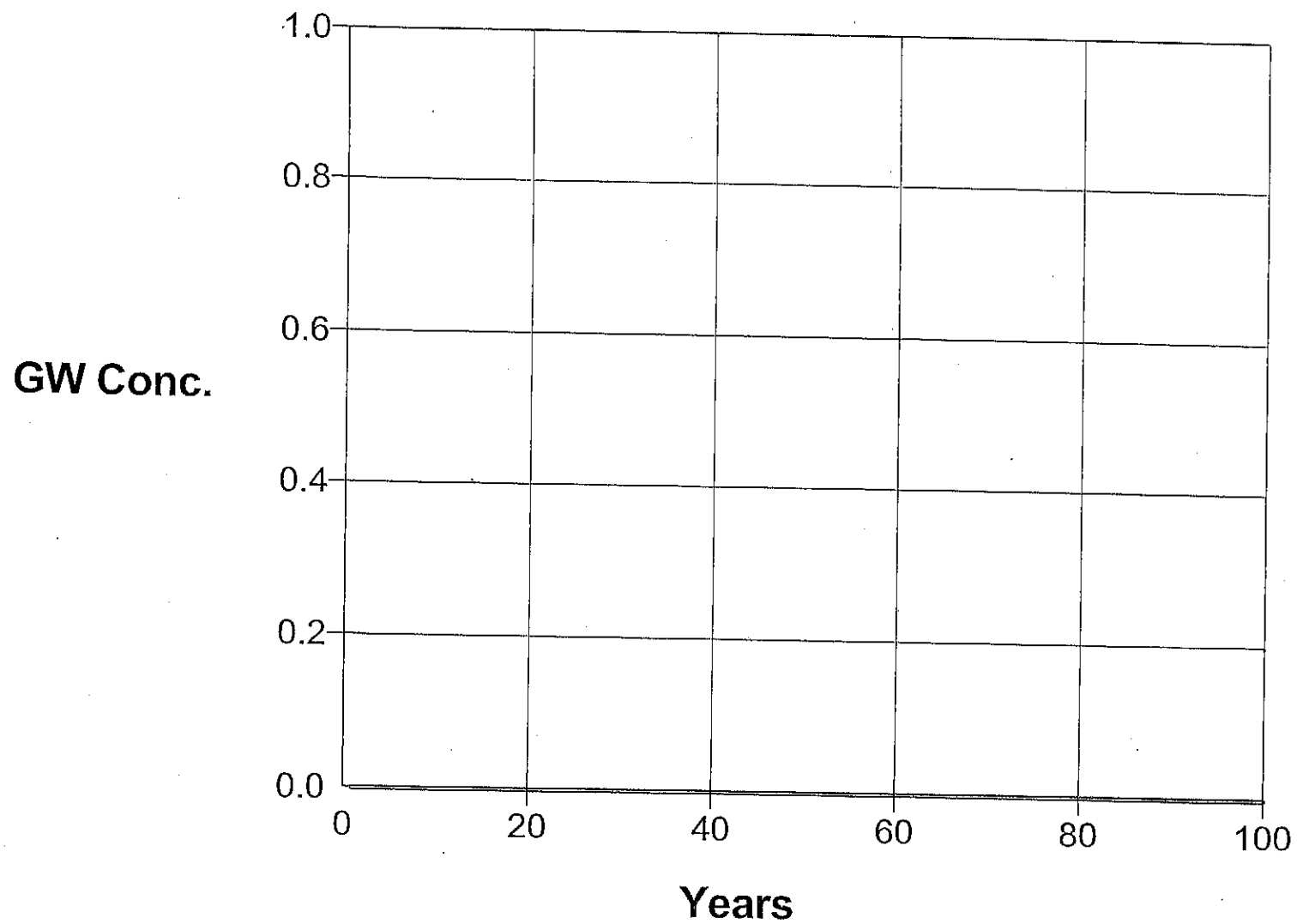
65.0	0.00E+00
66.0	0.00E+00
67.0	0.00E+00
68.0	0.00E+00
69.0	0.00E+00
70.0	0.00E+00
71.0	0.00E+00
72.0	0.00E+00
73.0	0.00E+00
74.0	0.00E+00
75.0	0.00E+00
76.0	0.00E+00
77.0	0.00E+00
78.0	0.00E+00
79.0	0.00E+00
80.0	0.00E+00
81.0	0.00E+00
82.0	0.00E+00
83.0	0.00E+00
84.0	0.00E+00
85.0	0.00E+00
86.0	0.00E+00
87.0	0.00E+00
88.0	0.00E+00
89.0	0.00E+00
90.0	0.00E+00
91.0	0.00E+00
92.0	0.00E+00
93.0	0.00E+00
94.0	0.00E+00
95.0	0.00E+00
96.0	0.00E+00
97.0	0.00E+00
98.0	0.00E+00
99.0	0.00E+00
100.0	0.00E+00

The maximum concentration occurred at the following time:

.0	0.00E+00
----	----------



# Concentration in Groundwater [mg/l]



Saturated zone model (dissolved phase source)

Title: New Project

Simulation time (years)..... 100

Saturated Zone Model Source

Pulse Source:

Length of pulse (yr)..... 100.  
Total thickness of source (m)..... 2.44  
Length of source (m)..... 15.2  
Width of source (m)..... 9.14

The benzene concentration at the POE located 1,800 feet from the site was predicted using the highest observed benzene concentration of 12  $\mu\text{g/L}$  in the last year in the groundwater sample collected from well T-2 on June 22, 2010 and the longest pulse length of 100 years.

Effective Porosity = 0.12

Hydraulic Conductivity = 1.88 meters/day

Aquifer Properties

Effective porosity ( $\text{cm}^3/\text{cm}^3$ )..... .120  
Fraction organic carbon (g oc/g soil)... 9.000E-03  
Hydraulic conductivity (m/d)..... 1.88  
Soil bulk density ( $\text{g}/\text{cm}^3$ )..... 1.64  
Hydraulic gradient (m/m)..... 3.500E-02  
Longitudinal dispersivity (m)..... code calculated  
Transverse dispersivity (m)..... code calculated  
Vertical dispersivity (m)..... code calculated

Receptor Well Location

Distance downgradient (m)..... 549.  
Distance cross-gradient (m)..... .000  
Depth to top of well screen (m)..... .000  
Depth to bottom of well screen (m)..... 1.00  
Number of points used to calc. conc..... 2

CHEMICAL DATA INPUT: Benzene

Diffusion coeff. in air ( $\text{cm}^2/\text{s}$ )..... 8.800E-02  
Diffusion coeff. in water ( $\text{cm}^2/\text{s}$ )... 9.800E-06  
Solubility ( $\text{mg}/\text{l}$ )..... 1.750E+03  
KOC ( $\text{ml}/\text{g}$ )..... 58.9  
Henry's Law Coefficient (-)..... .228  
Molecular Weight ( $\text{g}/\text{mol}$ )..... 78.0  
Density of chemical ( $\text{g}/\text{cm}^3$ )..... .877  
Degradation rate sat. zone (1/d).... .000  
Degradation rate unsat. zone (1/d).. .000

Source Concentrations: Benzene

Source conc. for GW model ( $\text{mg}/\text{l}$ )..... 1.200E-02

GROUNDWATER CONCENTRATION AT RECEPTOR WELL  
Benzene  
Averaged Annually

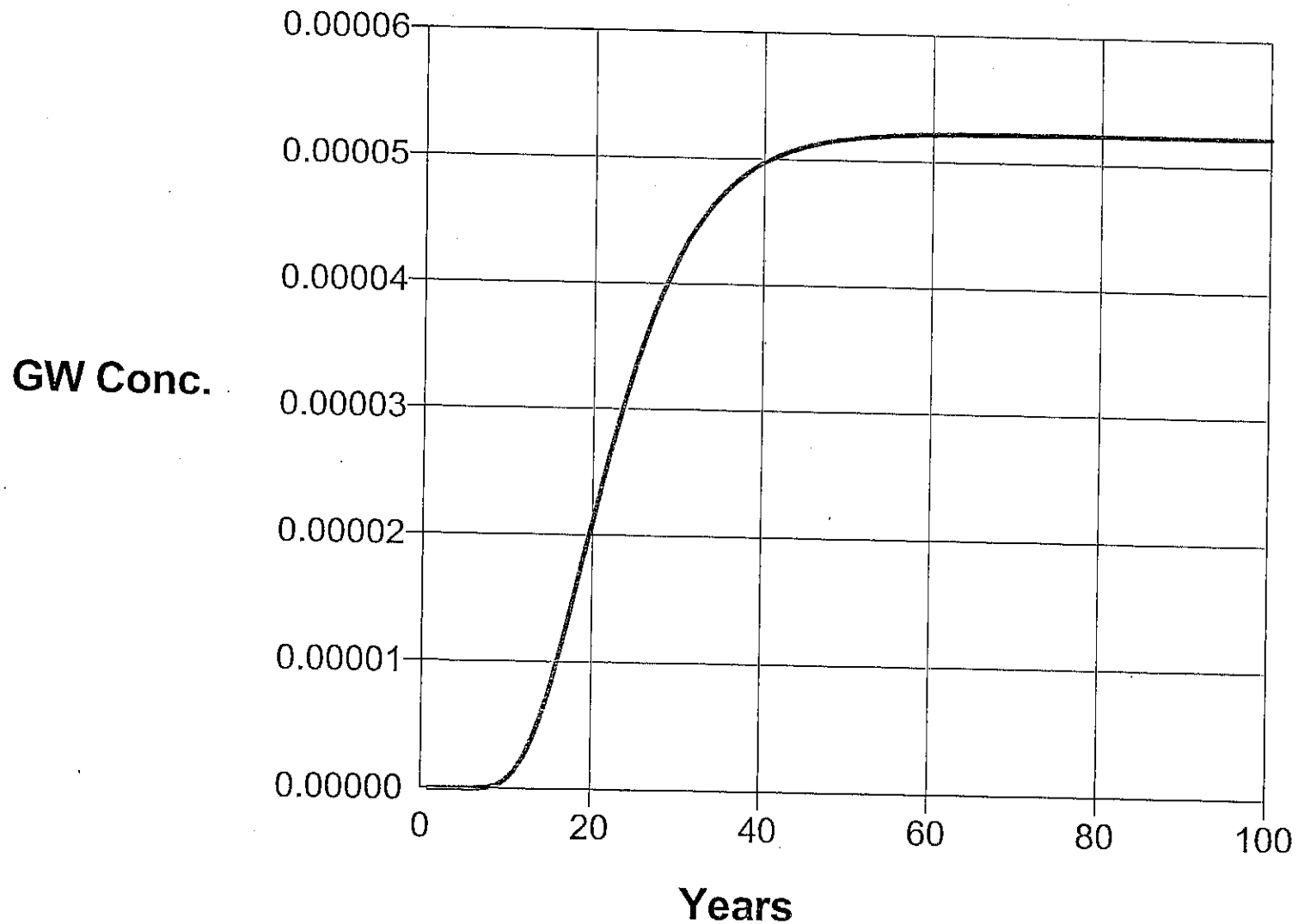
Time (yr)	Concentration at well (mg/l)
1.0	0.00E+00
2.0	0.00E+00
3.0	2.24E-15
4.0	2.31E-12
5.0	1.60E-10
6.0	2.74E-09
7.0	2.05E-08
8.0	9.04E-08
9.0	2.80E-07
10.0	6.75E-07
11.0	1.36E-06
12.0	2.40E-06
13.0	3.82E-06
14.0	5.60E-06
15.0	7.72E-06
16.0	1.01E-05
17.0	1.27E-05
18.0	1.54E-05
19.0	1.82E-05
20.0	2.10E-05
21.0	2.37E-05
22.0	2.64E-05
23.0	2.89E-05
24.0	3.13E-05
25.0	3.35E-05
26.0	3.55E-05
27.0	3.74E-05
28.0	3.91E-05
29.0	4.06E-05
30.0	4.20E-05
31.0	4.33E-05
32.0	4.44E-05
33.0	4.54E-05
34.0	4.63E-05
35.0	4.70E-05
36.0	4.77E-05
37.0	4.83E-05
38.0	4.88E-05
39.0	4.93E-05
40.0	4.97E-05
41.0	5.01E-05
42.0	5.04E-05
43.0	5.06E-05
44.0	5.09E-05
45.0	5.11E-05
46.0	5.12E-05
47.0	5.14E-05
48.0	5.15E-05
49.0	5.16E-05
50.0	5.17E-05
51.0	5.18E-05
52.0	5.19E-05
53.0	5.19E-05
54.0	5.20E-05
55.0	5.21E-05
56.0	5.21E-05
57.0	5.21E-05
58.0	5.22E-05
59.0	5.22E-05
60.0	5.22E-05
61.0	5.22E-05
62.0	5.22E-05
63.0	5.22E-05
64.0	5.23E-05

65.0	5.23E-05
66.0	5.23E-05
67.0	5.23E-05
68.0	5.23E-05
69.0	5.23E-05
70.0	5.23E-05
71.0	5.23E-05
72.0	5.23E-05
73.0	5.23E-05
74.0	5.23E-05
75.0	5.23E-05
76.0	5.23E-05
77.0	5.23E-05
78.0	5.23E-05
79.0	5.23E-05
80.0	5.23E-05
81.0	5.23E-05
82.0	5.23E-05
83.0	5.23E-05
84.0	5.23E-05
85.0	5.23E-05
86.0	5.23E-05
87.0	5.23E-05
88.0	5.23E-05
89.0	5.23E-05
90.0	5.23E-05
91.0	5.23E-05
92.0	5.23E-05
93.0	5.23E-05
94.0	5.23E-05
95.0	5.23E-05
96.0	5.23E-05
97.0	5.23E-05
98.0	5.23E-05
99.0	5.23E-05
100.0	5.23E-05

The maximum concentration occurred at the following time:

100.0	5.23E-05
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# Concentration in Groundwater [mg/l]



/ Benzene

# Saturated zone model (dissolved phase source)

Title: New Project

Simulation time (years)..... 100

## Saturated Zone Model Source

### Pulse Source:

Length of pulse (yr)..... 100.  
Total thickness of source (m)..... 2.44  
Length of source (m)..... 15.2  
Width of source (m)..... 9.14

## Aquifer Properties

Effective porosity (cm<sup>3</sup>/cm<sup>3</sup>)..... .300  
Fraction organic carbon (g oc/g soil)... 9.000E-03  
Hydraulic conductivity (m/d)..... 1.88  
Soil bulk density (g/cm<sup>3</sup>)..... 1.64  
Hydraulic gradient (m/m)..... 3.500E-02  
Longitudinal dispersivity (m)..... code calculated  
Transverse dispersivity (m)..... code calculated  
Vertical dispersivity (m)..... code calculated

## Receptor Well Location

Distance downgradient (m)..... 549.  
Distance cross-gradient (m)..... .000  
Depth to top of well screen (m)..... .000  
Depth to bottom of well screen(m)..... 1.00  
Number of points used to calc. conc..... 2

## CHEMICAL DATA INPUT: Benzene

Diffusion coeff. in air (cm<sup>2</sup>/s)..... 8.800E-02  
Diffusion coeff. in water (cm<sup>2</sup>/s)... 9.800E-06  
Solubility (mg/l)..... 1.750E+03  
KOC (ml/g)..... 58.9  
Henry's Law Coefficient (-)..... .228  
Molecular Weight (g/mol)..... 78.0  
Density of chemical (g/cm<sup>3</sup>)..... .877  
Degradation rate sat. zone (1/d).... .000  
Degradation rate unsat. zone (1/d).. .000

## Source Concentrations: Benzene

Source conc. for GW model (mg/l)..... 1.200E-02

The benzene concentration at the POE located 1,800 feet from the site was predicted using the highest observed benzene concentration of 12 µg/L in the last year in the groundwater sample collected from well T-2 on June 22, 2010 and the longest pulse length of 100 years.

Effective Porosity = 0.3

Hydraulic Conductivity = 1.88 meters/day

GROUNDWATER CONCENTRATION AT RECEPTOR WELL  
Benzene  
Averaged Annually

Time (yr)	Concentration at well (mg/l)
1.0	0.00E+00
2.0	0.00E+00
3.0	1.11E-17
4.0	5.77E-14
5.0	8.27E-12
6.0	2.34E-10
7.0	2.54E-09
8.0	1.49E-08
9.0	5.80E-08
10.0	1.69E-07
11.0	3.97E-07
12.0	7.96E-07
13.0	1.42E-06
14.0	2.29E-06
15.0	3.44E-06
16.0	4.85E-06
17.0	6.52E-06
18.0	8.41E-06
19.0	1.05E-05
20.0	1.27E-05
21.0	1.50E-05
22.0	1.73E-05
23.0	1.97E-05
24.0	2.20E-05
25.0	2.43E-05
26.0	2.66E-05
27.0	2.87E-05
28.0	3.07E-05
29.0	3.26E-05
30.0	3.44E-05
31.0	3.61E-05
32.0	3.76E-05
33.0	3.91E-05
34.0	4.04E-05
35.0	4.16E-05
36.0	4.27E-05
37.0	4.37E-05
38.0	4.46E-05
39.0	4.54E-05
40.0	4.62E-05
41.0	4.69E-05
42.0	4.75E-05
43.0	4.80E-05
44.0	4.85E-05
45.0	4.89E-05
46.0	4.93E-05
47.0	4.96E-05
48.0	5.00E-05
49.0	5.02E-05
50.0	5.05E-05
51.0	5.07E-05
52.0	5.09E-05
53.0	5.10E-05
54.0	5.12E-05
55.0	5.13E-05
56.0	5.15E-05
57.0	5.16E-05
58.0	5.16E-05
59.0	5.17E-05
60.0	5.18E-05
61.0	5.19E-05
62.0	5.19E-05
63.0	5.20E-05
64.0	5.20E-05

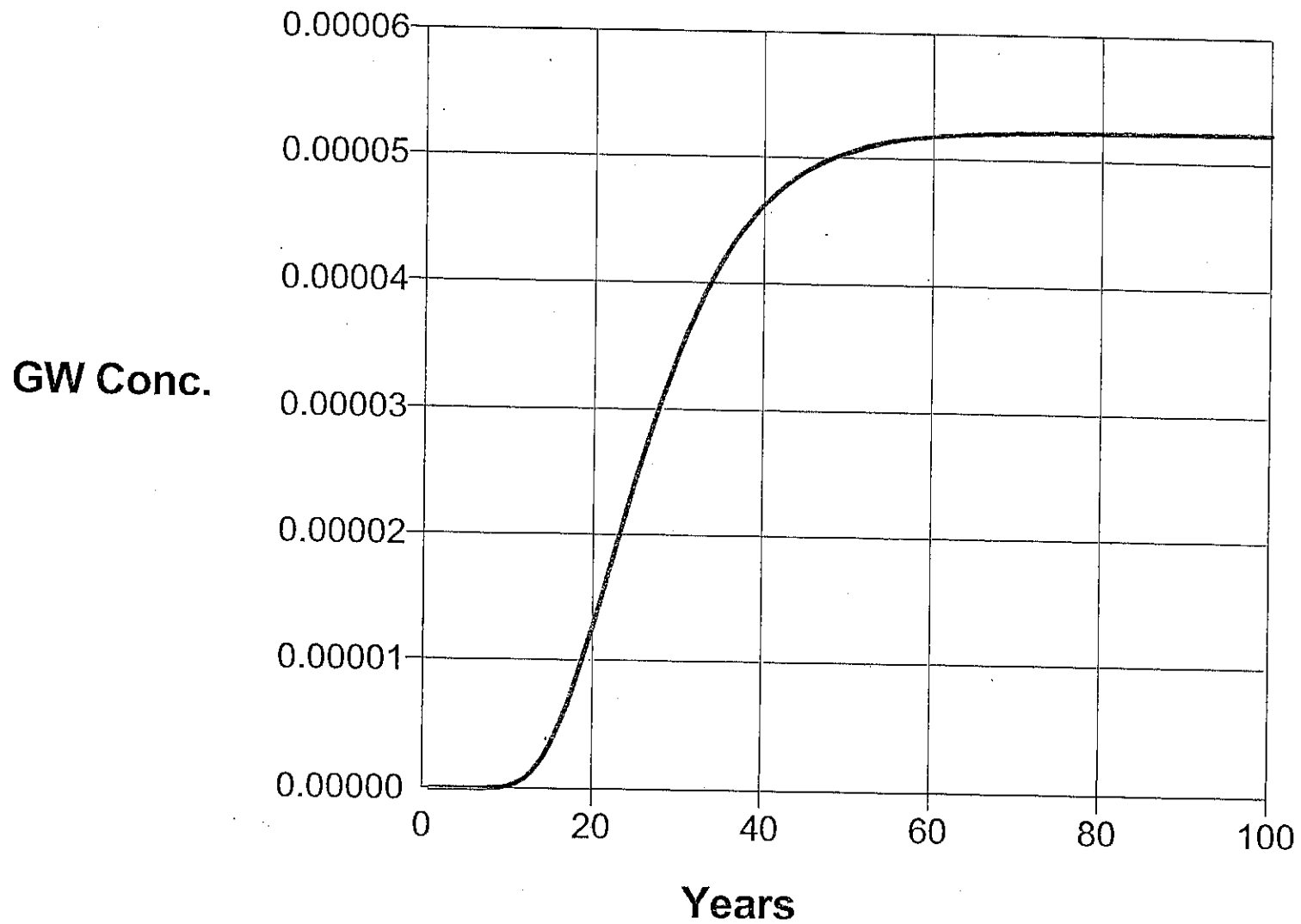
65.0	5.21E-05
66.0	5.21E-05
67.0	5.21E-05
68.0	5.21E-05
69.0	5.22E-05
70.0	5.22E-05
71.0	5.22E-05
72.0	5.22E-05
73.0	5.22E-05
74.0	5.22E-05
75.0	5.23E-05
76.0	5.23E-05
77.0	5.23E-05
78.0	5.23E-05
79.0	5.23E-05
80.0	5.23E-05
81.0	5.23E-05
82.0	5.23E-05
83.0	5.23E-05
84.0	5.23E-05
85.0	5.23E-05
86.0	5.23E-05
87.0	5.23E-05
88.0	5.23E-05
89.0	5.23E-05
90.0	5.23E-05
91.0	5.23E-05
92.0	5.23E-05
93.0	5.23E-05
94.0	5.23E-05
95.0	5.23E-05
96.0	5.23E-05
97.0	5.23E-05
98.0	5.23E-05
99.0	5.23E-05
100.0	5.23E-05

The maximum concentration occurred at the following time:

100.0	5.23E-05
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# Concentration in Groundwater [mg/l]



/ Benzene

# Saturated zone model (dissolved phase source)

Title: New Project

Simulation time (years)..... 100

The shortest distance downgradient of the source at which a benzene concentration of 5 µg/L was predicted using the source concentration of 12 µg/L and a pulse length of 100 years. Answer = 17 m (56 feet).

## Saturated Zone Model Source

### Pulse Source:

Length of pulse (yr).....	100.
Total thickness of source (m).....	2.44
Length of source (m).....	15.2
Width of source (m).....	9.14

## Aquifer Properties

Effective porosity (cm <sup>3</sup> /cm <sup>3</sup> ).....	.300
Fraction organic carbon (g oc/g soil)...	9.000E-03
Hydraulic conductivity (m/d).....	1.88
Soil bulk density (g/cm <sup>3</sup> ).....	1.64
Hydraulic gradient (m/m).....	3.500E-02
Longitudinal dispersivity (m).....	code calculated
Transverse dispersivity (m).....	code calculated
Vertical dispersivity (m).....	code calculated

## Receptor Well Location

Distance downgradient (m).....	17.0
Distance cross-gradient (m).....	.000
Depth to top of well screen (m).....	.000
Depth to bottom of well screen(m).....	1.00
Number of points used to calc. conc.....	2

## CHEMICAL DATA INPUT: Benzene

Diffusion coeff. in air (cm <sup>2</sup> /s).....	8.800E-02
Diffusion coeff. in water (cm <sup>2</sup> /s)...	9.800E-06
Solubility (mg/l).....	1.750E+03
KOC (ml/g).....	58.9
Henry's Law Coefficient (-).....	.228
Molecular Weight (g/mol).....	78.0
Density of chemical (g/cm <sup>3</sup> ).....	.877
Degradation rate sat. zone (1/d)....	.000
Degradation rate unsat. zone (1/d)...	.000

## Source Concentrations: Benzene

Source conc. for GW model (mg/l)..... 1.200E-02

## GROUNDWATER CONCENTRATION AT RECEPTOR WELL

Benzene

Averaged Annually

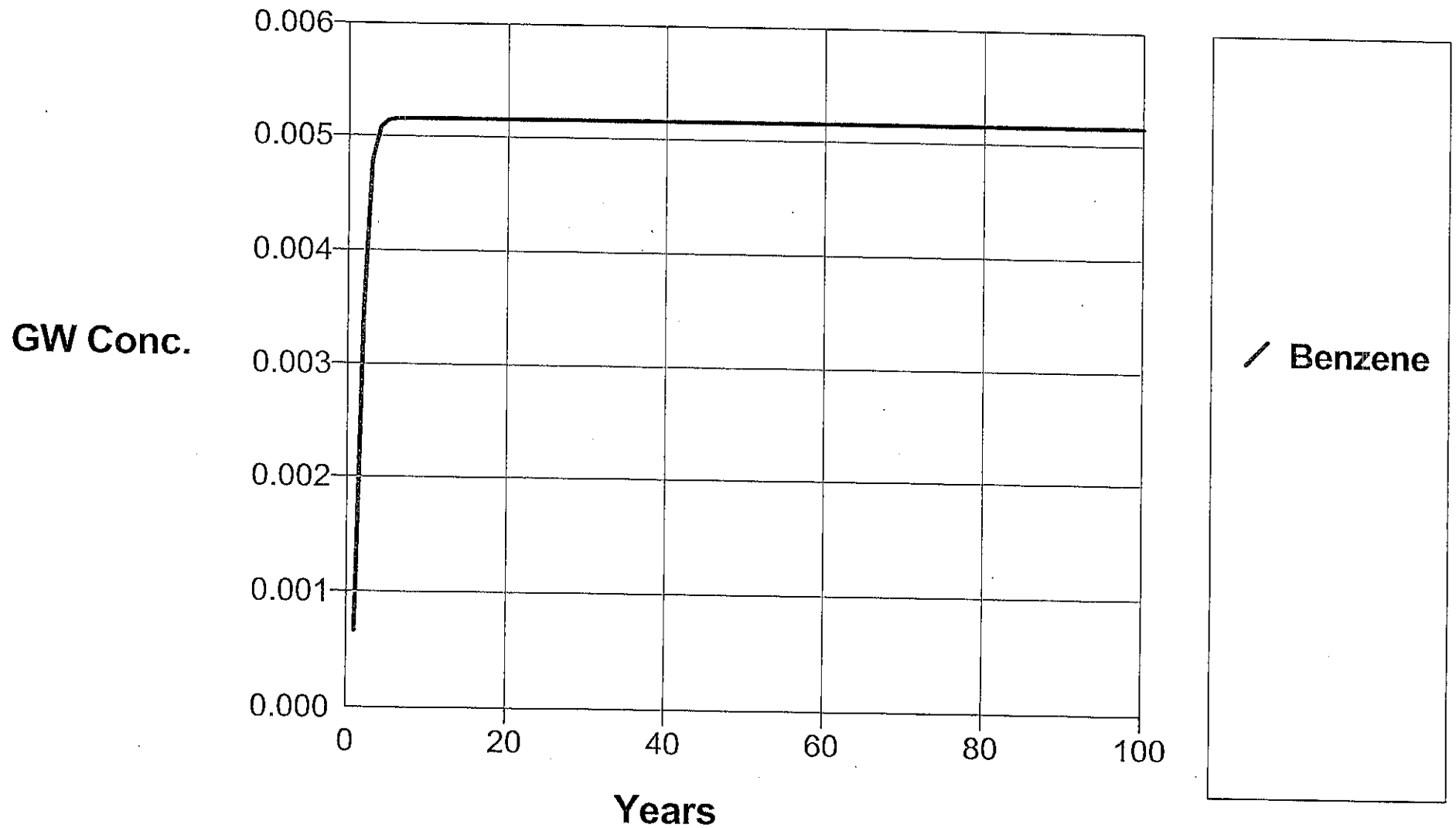
Time (yr)	Concentration at well (mg/l)
1.0	6.69E-04
2.0	3.47E-03
3.0	4.77E-03
4.0	5.08E-03
5.0	5.14E-03
6.0	5.15E-03
7.0	5.16E-03
8.0	5.16E-03
9.0	5.16E-03
10.0	5.16E-03
11.0	5.16E-03
12.0	5.16E-03
13.0	5.16E-03
14.0	5.16E-03
15.0	5.16E-03
16.0	5.16E-03
17.0	5.16E-03
18.0	5.16E-03
19.0	5.16E-03
20.0	5.16E-03
21.0	5.16E-03
22.0	5.16E-03
23.0	5.16E-03
24.0	5.16E-03
25.0	5.16E-03
26.0	5.16E-03
27.0	5.16E-03
28.0	5.16E-03
29.0	5.16E-03
30.0	5.16E-03
31.0	5.16E-03
32.0	5.16E-03
33.0	5.16E-03
34.0	5.16E-03
35.0	5.16E-03
36.0	5.16E-03
37.0	5.16E-03
38.0	5.16E-03
39.0	5.16E-03
40.0	5.16E-03
41.0	5.16E-03
42.0	5.16E-03
43.0	5.16E-03
44.0	5.16E-03
45.0	5.16E-03
46.0	5.16E-03
47.0	5.16E-03
48.0	5.16E-03
49.0	5.16E-03
50.0	5.16E-03
51.0	5.16E-03
52.0	5.16E-03
53.0	5.16E-03
54.0	5.16E-03
55.0	5.16E-03
56.0	5.16E-03
57.0	5.16E-03
58.0	5.16E-03
59.0	5.16E-03
60.0	5.16E-03
61.0	5.16E-03
62.0	5.16E-03
63.0	5.16E-03
64.0	5.16E-03

65.0	5.16E-03
66.0	5.16E-03
67.0	5.16E-03
68.0	5.16E-03
69.0	5.16E-03
70.0	5.16E-03
71.0	5.16E-03
72.0	5.16E-03
73.0	5.16E-03
74.0	5.16E-03
75.0	5.16E-03
76.0	5.16E-03
77.0	5.16E-03
78.0	5.16E-03
79.0	5.16E-03
80.0	5.16E-03
81.0	5.16E-03
82.0	5.16E-03
83.0	5.16E-03
84.0	5.16E-03
85.0	5.16E-03
86.0	5.16E-03
87.0	5.16E-03
88.0	5.16E-03
89.0	5.16E-03
90.0	5.16E-03
91.0	5.16E-03
92.0	5.16E-03
93.0	5.16E-03
94.0	5.16E-03
95.0	5.16E-03
96.0	5.16E-03
97.0	5.16E-03
98.0	5.16E-03
99.0	5.16E-03
100.0	5.16E-03

The maximum concentration occurred at the following time:

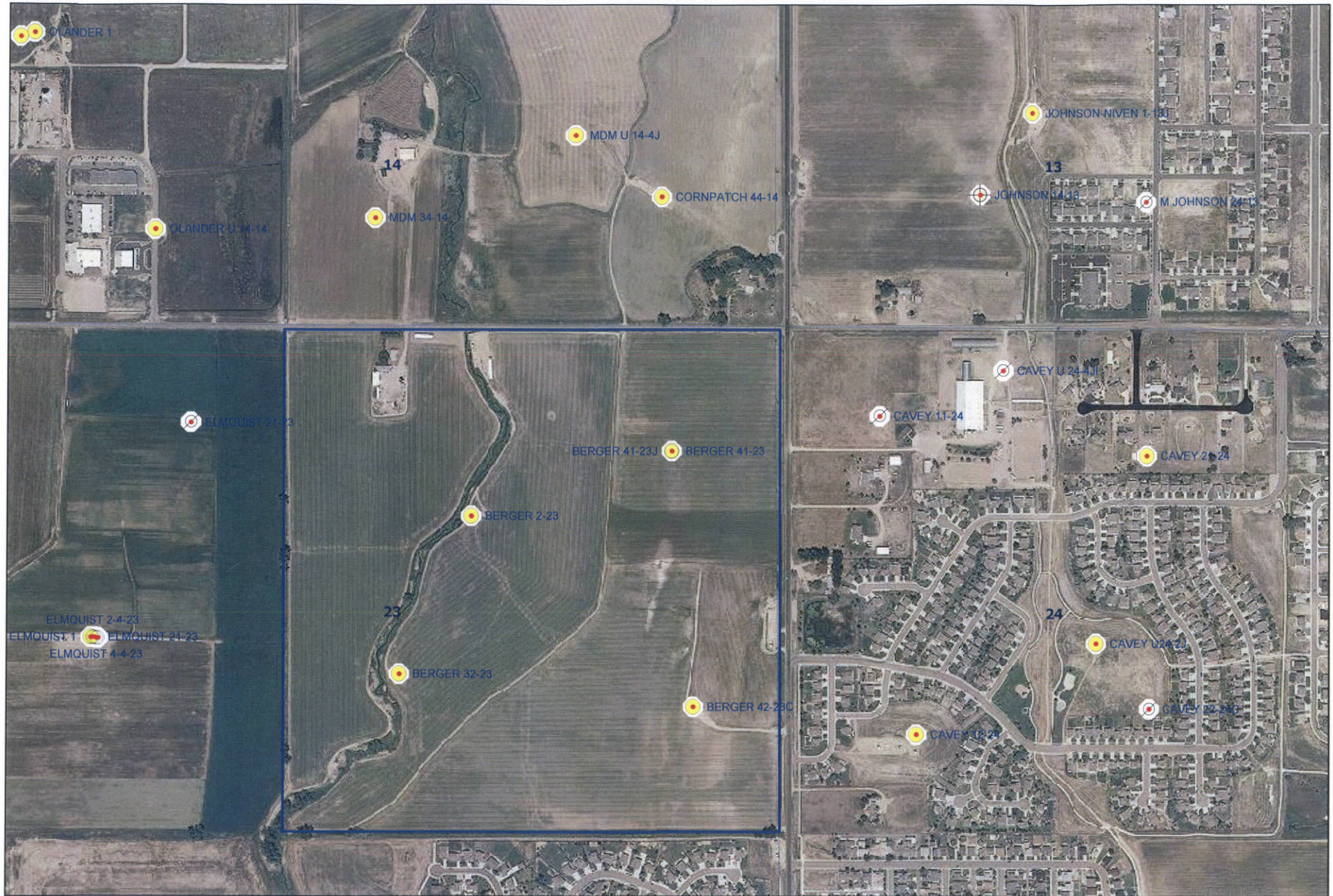
19.9	5.16E-03
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# Concentration in Groundwater [mg/l]

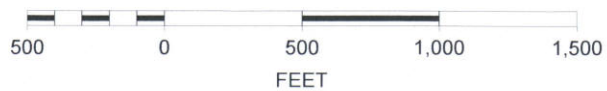




# MRPC Berger Lease 23-2N-68W

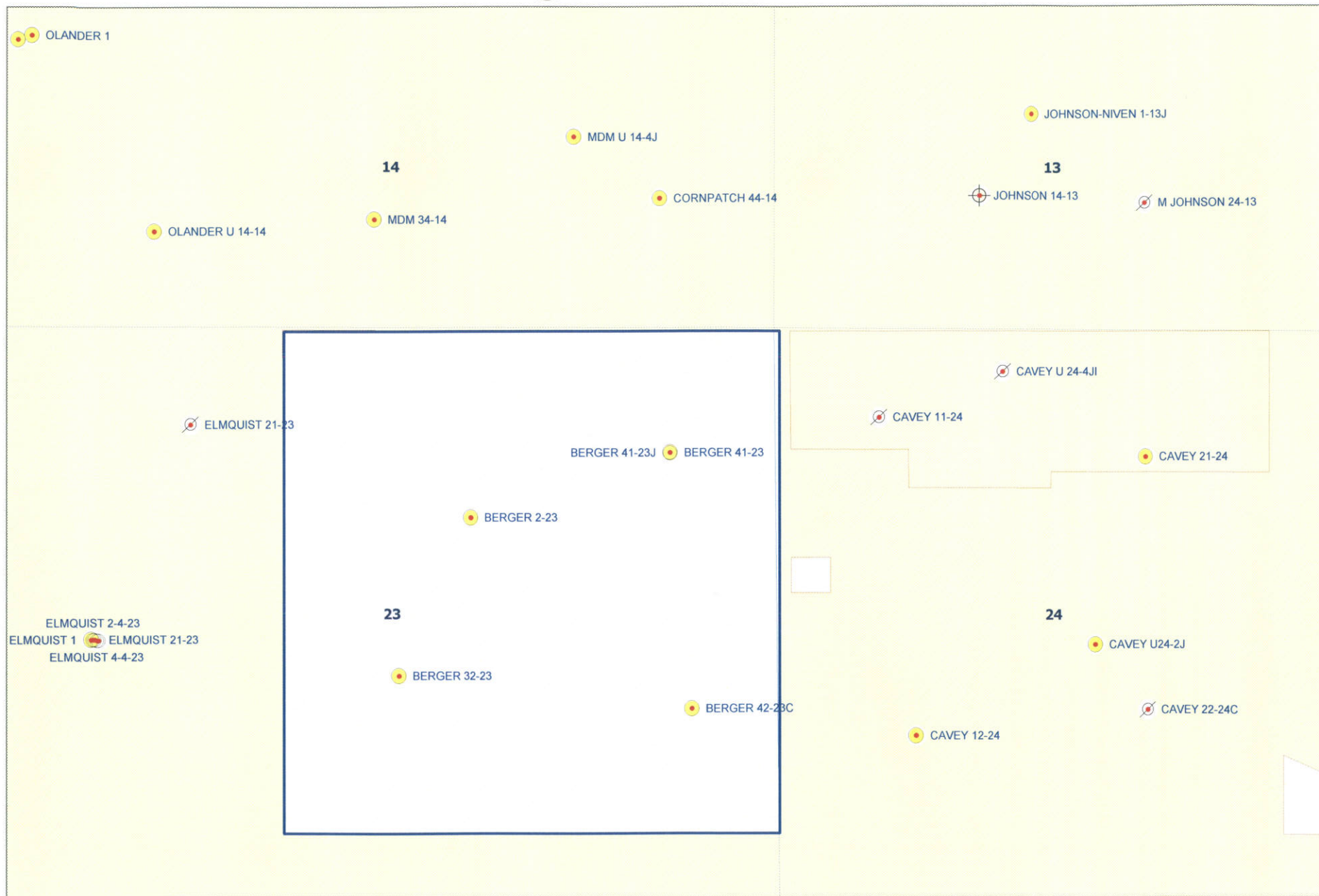


SCALE 1 : 8,421

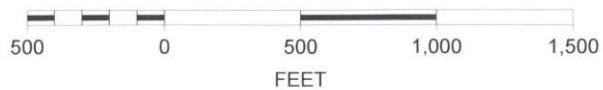




# MRPC Berger Lease 23-2N-68W



SCALE 1 : 8,421



N

