# 2014 GROUNDWATER ASSESSMENT REPORT

# IDAHO POLE COMPANY SITE

# BOZEMAN, MONTANA

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# 2014 GROUNDWATER ASSESSMENT REPORT
# IDAHO POLE COMPANY SITE
# BOZEMAN, MONTANA

## 1.0 INTRODUCTION

This Groundwater Quality Assessment Report contains the performance and compliance groundwater monitoring conducted at the Idaho Pole Company (IPC) site in Bozeman, Montana (Site) from January 2014 through December 2014. Groundwater sampling and reporting are conducted to fulfill the requirements of the United States Environmental Protection Agency (USEPA) identified in the Record of Decision (ROD) (USEPA 1992). Included in this report is a discussion of site-wide groundwater monitoring, residential well monitoring, groundwater remedy system (GRS) operations and a groundwater quality summary and evaluation.

### 1.1 SITE DESCRIPTION AND BACKGROUND

The IPC facility in Bozeman, Montana began preserving wood products using creosote in 1945. In 1952, the use of creosote was discontinued and was replaced with pentachlorophenol (PCP) in carrier oil as the wood treating preservative. The pole treating operations were terminated on September 15, 1997. Figure 1-1 shows the location of the facility in Bozeman, Montana.

In 1978, the Montana Department of Environmental Quality (MDEQ) found evidence of a release of oily wood treating fluid in ditches near the Site. In September 1992, USEPA Region VIII prepared the ROD for the Site. Contaminants of concern (COC) were identified and a discussion of the conceptual design for the GRS and soil remedy at the Site was included in the ROD. In May 1996, USEPA released an Explanation of Significant Differences (ESD) describing the significant deviations between the remedy that was to be implemented and the conceptual design discussed in the ROD. The ESD was approved by the USEPA based on additional studies conducted at the Site after issuance of the ROD. The

ESD included GRS details that included the use of granular activated carbon (GAC) to remove COC from the groundwater.

Construction of the GRS began in August 1996 and was completed in January 1997. The Construction Completion Report (Geraghty & Miller, 1998a) contains a description of the system design and construction. Operation of the GRS is detailed in the Operation and Maintenance Manual (Geraghty & Miller, 1998b). The GRS began treating groundwater on February 5, 1997. The GRS pumps groundwater to a holding tank, filters the water through particulate filters, removes contaminants via two GAC vessels, adds nutrients to enhance biodegradation of any remaining organics, and then injects the nutrient enriched treated water back into the aquifer at levels below designated cleanup levels.

In November 1998, USEPA released another ESD describing additional work necessary at the Site since IPC had ceased wood-treating operations in September 1997. The USEPA required that the facility structures, including buildings, tanks, concrete pads, piping and vaults, be demolished and impacted soils underlying the structures be excavated and treated in an on-site land treatment unit (LTU).

Demolition activities were initiated in May 1999 and completed by August 1999. Pressure plant demolition began in May 1999 and upon completion of pressure plant demolition, contaminated soils from beneath the structures were removed. Excavated soils were placed in the LTU for treatment. Prior to excavated soil placement, treated LTU soil that met treatment goals was removed from the upper lift of the LTU and used as backfill in the Barkfill and Pressure Plant areas. Treated soils in these two areas were covered with a minimum of 12-inches of imported soil. Additional information regarding the demolition activities at the IPC Site is provided in the Construction Completion Report (Maul Foster & Alongi, Inc., 1999) and soil removal activities were summarized in a letter to the USEPA (ThermoRetec, 1999).

By September 2000, both upper and lower lifts of LTU soils met the ROD cleanup levels for PCP and polycyclic aromatic hydrocarbon (PAHs). An LTU closure work plan was

submitted to the USEPA and approved in July 2002. USEPA approved placement of treated LTU soils on-site, upgradient of the pressure plant injection gallery (PPIG). The backfilled treated LTU soils were covered with 12 to 15 inches of imported material. Restoration of the Site was completed by November 2002. LTU Closure activities are summarized in the LTU Closure Completion Report (RETEC, 2003a).

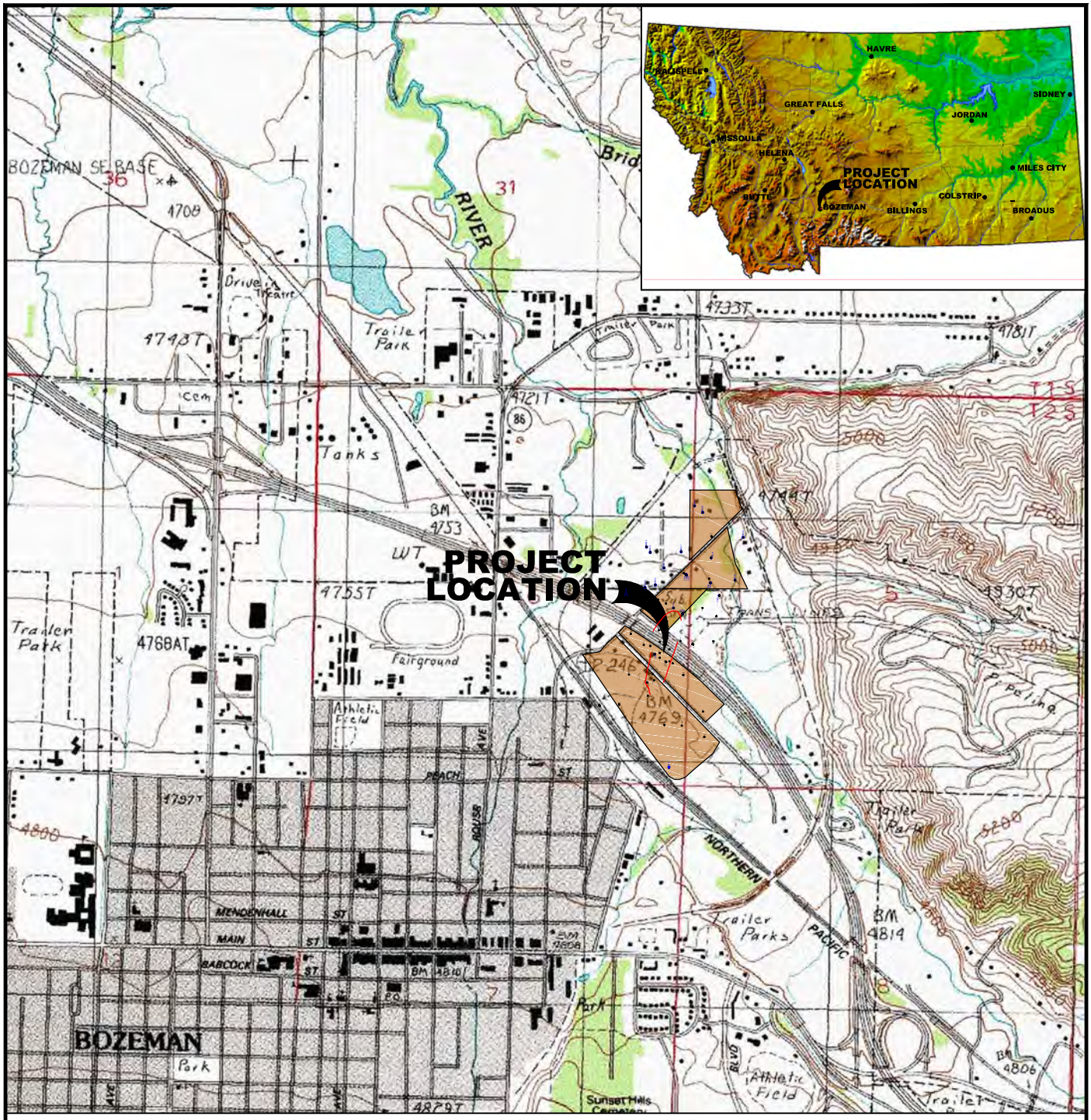
No construction activities have been conducted since the closure of the LTU. Operation of the GRS system has been ongoing since January 1997, with the exception of short periods of shut down for maintenance. Assessment of the site for 2014 is included in this report.

## 1.2 REPORT ORGANIZATION

This report is divided into six sections.

- Introduction, Site Description and Background information is provided in Section 1.
- The Site-wide Groundwater Monitoring program is described in Section 2.
- The Residential Well Monitoring Program is discussed in Section 3.
- GRS monitoring is discussed in Section 4.
- A Groundwater Quality Summary and Evaluation is provided in Section 5.
- References used to prepare this report are included in Section 6.

Tables and figures referenced in the text are included at the end of the respective section.




NORTH

SCALE

0 (In Feet) 2000

## LEGEND

IDAHO POLE COMPANY PROPERTY

UNITED STATES GEOLOGIC SURVEY
BOZEMAN QUADRANGLE BOZEMAN, MONTANA
1987 7.5 MINUTE SERIES (TOPOGRAPHIC)

| IDAHO POLE COMPANY<br>Bozeman, Montana<br>5029-300 | **SITE LOCATION MAP** | FIGURE<br>**1-1** |
|---|---|---|

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Hydrometrics, Inc.
Consulting Scientists and Engineers

# 2.0 SITE-WIDE GROUNDWATER MONITORING

A site-wide groundwater-monitoring program was implemented in 1996. The program incorporates routine sampling and analysis of groundwater collected from on-site and off-site monitoring wells. Appendix A contains a summary of analytical data of PCP and PAH compounds in the groundwater prior to installation of the GRS (1990, 1991 and 1994) as well as data collected after installation (1998 to 2014) of the GRS. Concentration maps of the PCP plume before and after the GRS installation are included in Appendix B.

## 2.1 GROUNDWATER ELEVATIONS AND GROUNDWATER FLOW DIRECTION

A total of 77 groundwater-monitoring wells are currently in place at the Site (Figure 2-1). Groundwater levels were measured in 40 wells in March and September of 2014 and elevations were calculated. Potentiometric surface maps based on the semi-annual groundwater measurements at shallow (A) wells are provided on Figures 2-2 and 2-3. Groundwater elevations calculated for the site for water levels measured in March and September 2014 are provided in Appendix C.

The potentiometric surface maps (Figures 2-2 and 2-3) illustrate that groundwater flows to the northeast throughout the year. Figure 2-4 displays semi-annual groundwater elevations in three wells (GM-1, 4-A, 6-A) that extend east-west across the Site during 2014. The graph shows typical seasonal fluctuations of the groundwater levels observed at the site.

## 2.2 SITE-WIDE GROUNDWATER MONITORING WELL PROGRAM

The ROD requires that the groundwater beneath and surrounding the Site be monitored routinely to evaluate the performance of the GRS and establish compliance with the ROD cleanup standards. In April 2001, the USEPA approved the revised sampling protocol. The revised protocol was used to amend the program outlined in the Groundwater Remedy Operations and Maintenance Manual (Geraghty & Miller, 1998b). A revised sampling network and schedule was presented in Appendix E of the 2002 Groundwater Quality Assessment Report (RETEC, 2003b). In a letter from the USEPA dated March 24, 2010, the sampling network and schedule was again revised (USEPA and MDEQ, 2010a). The current

monitoring network and protocol is subject to change based on groundwater results and the annual Site evaluation.

Compliance and performance monitoring includes 12 compliance monitoring wells (9-A, 9-C, 19-A, 23-A, 25-A, 25-B, 26-A, 26-C, 28-B, GM-4, GM-6 and GM-8) and the following 12 performance monitoring wells: 5-A, 5-C, 9-B, 11-A, 15-A, 16-B, 22, 23-B, 24-B, 26-B, 27-B and GM-5. In addition, performance monitoring includes a composite sample from the barkfill extraction gallery (BFEG) to assist in evaluating the performance of the GRS. Performance monitoring was conducted concurrent with compliance monitoring activities. Performance wells are sampled to evaluate remediation progress while compliance monitoring ensures that performance standards meet remediation goals. Approval to shut-down the pressure plant extraction gallery (PPEG) was received March 26, 2010 (USEPA and MDEQ, 2010b). Due to system shutdown, no samples were collected from the PPEG in 2014.

Table 2-1 presents the list of monitoring wells used for performance monitoring and compliance monitoring during 2014. During the fall sampling event conducted in September 2014, twenty two additional wells were sampled in support of the EPA's Five Year Review process initiated in late 2014. These additional wells were sampled for PCP only and include 3-B, 4-A, 4-B, 5-B, 6-A, 7-A, 7-B, 8-A, 8-B, 10-1, 10-B, 12-A, 13-A, 16-A, 19-A, 19-B, 23-C, 24-A1, 24-A2, 27-A, 29-D and GM-7.

## 2.3 SITE-WIDE GROUNDWATER QUALITY

Groundwater quality samples were collected at the Site for performance and compliance monitoring during April and September 2014.

### 2.3.1 Sample Collection

Each well was unlocked and the water level was measured using a decontaminated electronic water-measuring probe. Beginning in Fall 2013 low flow purge and sample techniques were adopted for groundwater sampling. Low flow sampling was conducted by purging each well slowly utilizing a peristaltic pump and monitoring the field parameters until stable, at which

time the sample was collected. The final pH, conductivity, temperature, redox potential, and dissolved oxygen (DO) readings were recorded and considered representative of the groundwater samples collected for laboratory analysis. A minimum of one field blank and two blind duplicate samples were collected and analyzed during each sampling event. Field blanks consisted of pouring newly opened deionized water directly into laboratory-supplied sample bottles. Duplicate samples were taken at a minimum frequency of one per ten samples. Duplicates consisted of collecting an additional set of samples from the same chosen well. All samples were placed in a cooler on ice after collection. Quality control samples (field blanks and duplicates) were sent blind to the laboratory by labeling the sample bottles with false well numbers.

### 2.3.2 Analytical Program

Table 2-1 presents the sampling schedule and analytical parameters for the groundwater monitoring conducted at the Site. Both the performance and compliance monitoring well networks were sampled and analyzed for PCP by USEPA Method 8041 and PAH by USEPA Method 8270 according to the schedule on Table 2-1. Bioremediation parameters are no longer routinely included in laboratory analysis of groundwater for sample the site. Historic analytical data has established that conditions at the Site promote bioremediation. Therefore, EPA concluded these parameters no longer need to be monitored.

Collection of samples for PCP analysis was conducted during the April sampling event. During the September sampling event, PAH samples were collected in addition to PCP samples. Samples from the BFEG were also collected and analyzed for PCP during April and September with addition of PAH compounds in September. Twenty two additional wells were sampled for PCP during September in support of the EPA's Five Year Review process initiated in late 2014.

Appendix D contains the complete analytical data and validation reports for both sampling events. All analyses were conducted in accordance with USEPA guidelines contained in the Sampling and Analysis Plan (SAP) (Geraghty & Miller, Inc., 1997). Analytical Resources Inc. (ARI), Tukwila, Washington, conducted the laboratory analysis for the site-wide

groundwater monitoring well samples. Field data recorded for both sampling events are attached in Appendix E.

### 2.3.3 Analytical Results

The following sections discuss analytical results for PCP and PAH. Results are discussed separately for each monitoring event.

#### 2.3.3.1 Pentachlorophenol

April

Twenty-seven monitoring wells and piezometers (including Res-8) were sampled for PCP in April 2014. PCP was detected in 15 of the 27 monitoring wells (Table 2-2). Eight of these wells had concentrations of PCP above the cleanup limit of 1 µg/L. The observed concentrations of PCP ranged from <0.25 micrograms per liter (µg/L) to 260D µg/L. The highest concentration of PCP was detected in piezometer P-4 located between BFEG wells BE-2 and BE-3. Concentration maps of the PCP plume for the shallow A-series and the deeper B-series depth intervals during the April 2014 sampling event are presented on Figures 2-5 and 2-6.

One field blank was collected at Well 26-A (labeled 26-AF) during the April 2014 event and analyzed for PCP. Pentachlorophenol was not detected (<0.25 µg/L) in the field blank. A sample and duplicate were collected at Well 23-A (labeled 23-D) and P-1 (labeled P-1D). The PCP concentrations in the sample and duplicate from Well 23-A were 0.38 and 0.46 µg/L, respectively. The PCP concentration from the sample and duplicate collected at P-1 were <0.25 µg/L. The GRS wells and analytical data are discussed in Section 4.

September

Twenty-four compliance monitoring wells, three piezometers and twenty two additional "5-Year Review" wells were sampled for PCP in September 2014 (Table 2-3). Pentachlorophenol was detected in 21 of the 49 wells. Twelve of the wells had concentrations of PCP above the cleanup limit of 1 µg/L. The observed concentrations of PCP ranged from <0.25 µg/L to 1,200D µg/L (310 µg/L in first run sample). Piezometer P-4

(located adjacent to the BFEG) had the highest concentration of PCP. A PCP concentration plume map of the A-series (shallow) wells for the September sampling event is presented on Figure 2-7. A PCP concentration plume map of the B-series (intermediate) wells for the September sampling event is presented on Figure 2-8. Only four of the fifteen B-series wells had reported PCP concentrations above the cleanup limit of 1 µg/L. These wells included 3-B (1.2 µg/L), 9-B (12 µg/L), 16-B (21 µg/L) and 24-B (2.6 µg/L).

One field blank was collected at Well 28-B (labeled 28-F) during the September 2014 event and analyzed for PCP. Pentachlorophenol was not detected in the field blank. A sample and duplicate were collected from Wells 4-B (duplicate labeled 4-D), 9-C (9-D) and 11-A (11-A). The PCP concentrations from the samples and duplicates from Wells 4-B and 9-C were <0.25 µg/L. PCP concentrations from the sample and duplicate at 11-A was 0.87 µg/L and 0.29 µg/L, respectively.

#### 2.3.3.2 PAH Compounds

Groundwater at nine wells (Wells 5-A, 15-A, 22, 23-A, 23-B, 23-C, GM-4, GM-5, and GM-6) was sampled and analyzed for PAH compounds during the September 2014 groundwater monitoring event. Concentrations of PAHs at all eight wells were below ROD levels for Total D PAH compounds (2 and 3 ringed) of 146 µg/L. The PAH cleanup levels for the Site are presented in Table 13 of the ROD (USEPA and MDEQ, 1992) and Appendix F of this report as well as on Table 2-3.

Only one (5-A) of the eight wells had B2 PAH compound concentrations above the ROD levels for B2 PAH (4 and 5 ringed PAHs) compounds. Table 2-3 presents the data for the September 2014 event.

#### 2.3.3.3 Data Validation

A complete data validation was conducted on analytical from both April and September 2014 sampling events. The data validation concluded that the data were valid and usable. Selected analytes and samples were flagged as follows:

- Dilution was required for the PCP analysis from samples collected at Wells 5-A and P-4 in both April and September. The analytical results were flagged with a “D” data validation code.

**Table 2-1**
**Performance and Compliance Monitoring Schedule - 2014**
**IPC - Bozeman, MT**

| Well No. | Performance Wells | Compliance Wells | 1st Qtr | | 2nd Qtr | | 3rd Qtr | | | 4th Qtr | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Field Screening | PCP | Field Screening | PCP | Field Screening | PCP | PAH | Field Screening | PCP |
| **3-B*** | | | | | | | x | x | | | |
| **4-A*** | | | | | | | x | x | | | |
| **4-B*** | | | | | | | x | x | | | |
| **5-A** | x | | x | x | | | x | x | x | | |
| **5-B*** | | | | | | | x | x | | | |
| **5-C** | x | | x | x | | | x | x | | | |
| **6-A*** | | | | | | | x | x | | | |
| **7-A*** | | | | | | | x | x | | | |
| **7-B*** | | | | | | | x | x | | | |
| **8-A*** | | | | | | | x | x | | | |
| **8-B*** | | | | | | | x | x | | | |
| **9-A** | x | x | x | x | | | x | x | | | |
| **9-B** | x | | x | x | | | x | x | | | |
| **9-C** | x | x | x | x | | | x | x | | | |
| **10-A*** | | | | | | | x | x | | | |
| **10-B*** | | | | | | | x | x | | | |
| **11-A** | x | | x | x | | | x | x | | | |
| **12-A*** | | | | | | | x | x | | | |
| **13-A*** | | | | | | | x | x | | | |
| **15-A** | x | | x | x | | | x | x | x | | |
| **16-A*** | | | | | | | x | x | | | |
| **16-B** | x | | x | x | | | x | x | | | |
| **19-A*** | | | | | | | x | x | | | |
| **19-B*** | | | | | | | x | x | | | |
| **22** | x | | x | x | | | x | x | x | | |
| **23-A** | x | x | x | x | | | x | x | x | | |
| **23-B** | x | | x | x | | | x | x | x | | |
| **23-C*** | | | | | | | x | x | | | |
| **24-A1*** | | | | | | | x | x | | | |
| **24-A2*** | | | | | | | x | x | | | |
| **24-B** | x | | x | x | | | x | x | | | |
| **25-A** | x | x | x | x | | | x | x | | | |
| **25-B** | x | x | x | x | | | x | x | | | |
| **26-A** | x | x | x | x | | | x | x | | | |
| **26-B** | x | | x | x | | | x | x | | | |
| **26-C** | x | x | x | x | | | x | x | | | |
| **27-A*** | | | | | | | x | x | | | |
| **27-B** | x | | x | x | | | x | x | | | |
| **28-B (28)** | x | x | x | x | | | x | x | | | |
| **29-D*** | | | | | | | x | x | | | |
| **GM-4** | x | x | x | x | x | x | x | x | x | x | x |
| **GM-5** | x | | x | x | | | x | x | x | | |
| **GM-6** | x | x | x | x | | | x | x | x | | |
| **GM-7*** | | | | | | | x | x | | | |
| **GM-8** | x | x | x | x | | | x | x | | | |
| **BFEG** | x | | x | x | | | x | x | x | | |
| **P-1**** | | | x | x | | | x | x | | | |
| **P-2**** | | | x | x | | | x | x | | | |
| **P-4**** | | | x | x | | | x | x | | | |
| **RES-1 to 9** | | | | | | | x | x | | | |
| **RES-8** | | | x | x | | | x | x | | | |

Note: Groundwater Levels are measured Semi-annually in conjunction with 1st and 3rd quarter sampling

* - Indicates wells were included in fall event in support of the Five Year Review, these wells are only sampled every five years.

** - Wells and Piezometers monitored as part of the Interim Measures Investigation

BFEG - Barkfill Extraction Gallery composite samples and are collected in conjunction with monthly GRS samples. Individual well samples collected quarterly.

PAH - Polycyclic aromatic hydrocarbons (EPA Method 8310)

PCP - Pentachlorophenol (EPA Method 8041)

Field Screening - DO, pH, Temperature, Conductivity

# Table 2-2
# Groundwater Analytical Data - April 2014
# IPC - Bozeman, Montana

| Well No. | Sample Date | Pentachlorophenol (EPA Method 8041) (ug/L) |
|---|---|---|
| 5-A/Dilution | 4/1/2014 | **300 ES/110** |
| 5-C | 4/1/2014 | <0.25 |
| 9-A | 4/7/2014 | <0.25 |
| 9-B | 4/7/2014 | <0.25 |
| 9-C | 4/7/2014 | 0.71 |
| 11-A | 4/2/2014 | <0.25 |
| 15-A | 4/1/2014 | 0.63 |
| 16-B | 4/7/2014 | **9.9** |
| 22 | 4/1/2014 | **1.2** |
| 23-A | 4/7/2014 | 0.38 |
| 23-A (Duplicate) | 4/7/2014 | 0.46 |
| 23-B | 4/7/2014 | <0.25 |
| 24-B | 4/7/2014 | **2.5** |
| 25-A | 4/7/2014 | 0.78 |
| 25-B | 4/7/2014 | <0.25 |
| 26-A | 4/2/2014 | 0.44 |
| 26-AF (Field Blank) | 4/2/2014 | <0.25 |
| 26-B | 4/2/2014 | <0.25 |
| 26-C | 4/2/2014 | <0.25 |
| 27-B | 4/7/2014 | 0.46 |
| 28-B (28) | 4/7/2014 | 0.47 |
| GM-4 | 4/2/2014 | **2.1** |
| GM-5 | 4/7/2014 | <0.25 |
| GM-6 | 4/2/2014 | **2.0** |
| GM-8 | 4/2/2014 | <0.25 |
| RES-8 | 4/2/2014 | <0.25 |
| P-1 | 4/1/2014 | <0.25 |
| P-1D (Duplicate) | 4/1/2014 | <0.25 |
| P-2 | 4/1/2014 | **3.7** |
| P-4/Dilution | 4/1/2014 | **1,400 ES/260** |

Note: Bolded concentrations are above cleanup levels of 1 ug/L

D - Diluted Sample

E - Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.

S - Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte.

# Table 2-3
## Summary of Grounwater Analytical Data
## September 2014
## IPC - Bozeman, Montana

| Sample ID: | ROD CLEAN UP LEVELS | 3B | 4-A | 4-B | 4-D (duplicate) | 5-A | 5-A (dilution) | 5-B | 5-C | 6-A | 7-A | 7-B | 8-A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | µg/L | 9/9/2014 | 9/9/2014 | 9/9/2014 | 9/9/2014 | 9/9/2014 | 9/9/2014 | 9/9/2014 | 9/9/2014 | 9/9/2014 | 9/11/2014 | 9/11/2014 | 9/11/2014 |
| **PCP-Method 8041 (ug/L)** | | | | | | | | | | | | | |
| Pentachlorophenol | **1** | **1.20** | U< 0.25 | U< 0.25 | U< 0.25 | **ESP 270** | **D 580** | U< 0.25 | U< 0.25 | U< 0.25 | U< 0.25 | U< 0.25 | U< 0.25 |
| **PAH-Method 8310 (ug/L)** | | | | | | | | | | | | | |
| Acenaphthylene | **NA** | NA | NA | NA | NA | 0.54 | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthene | **NA** | NA | NA | NA | NA | 7.60 | NA | NA | NA | NA | NA | NA | NA |
| **D PAH compounds** | | | | | | | | | | | | | |
| Naphthalene | **NA** | NA | NA | NA | NA | 2.40 | NA | NA | NA | NA | NA | NA | NA |
| Fluorene | **NA** | NA | NA | NA | NA | 5.20 | NA | NA | NA | NA | NA | NA | NA |
| Phenanthrene | **NA** | NA | NA | NA | NA | 0.53 | NA | NA | NA | NA | NA | NA | NA |
| Anthracene | **NA** | NA | NA | NA | NA | 1.30 | NA | NA | NA | NA | NA | NA | NA |
| Fluoranthene | **NA** | NA | NA | NA | NA | 3.00 | NA | NA | NA | NA | NA | NA | NA |
| Pyrene | **NA** | NA | NA | NA | NA | 2.90 | NA | NA | NA | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | **NA** | NA | NA | NA | NA | 0.17 | NA | NA | NA | NA | NA | NA | NA |
| **Total D PAHs** | **146.0** | | | | | 15.50 | | | | | | | |
| **B2 PAH compounds** | | | | | | | | | | | | | |
| Benzo(a)anthracene | **0.10** | NA | NA | NA | NA | **0.69** | NA | NA | NA | NA | NA | NA | NA |
| Chrysene | **0.20** | NA | NA | NA | NA | **0.81** | NA | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | **0.20** | NA | NA | NA | NA | **0.39** | NA | NA | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | **0.20** | NA | NA | NA | NA | **0.21** | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | **0.20** | NA | NA | NA | NA | **0.36** | NA | NA | NA | NA | NA | NA | NA |
| Dibenzo(a,h)anthracene | **0.30** | NA | NA | NA | NA | U< 0.10 | NA | NA | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | **0.40** | NA | NA | NA | NA | 0.14 | NA | NA | NA | NA | NA | NA | NA |

Note: Bolded concentration indicates exceedence of treatment level.
NA - indicates analyte was not included in lab analysis.
D - Diluted Sample.
U - Indicates that the target analyte was not detected at the reported concentration.
E - Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
P - The analyte was detected on both chromatographic columns but the quantified values differ by > 40% PRD with no obvious chromatographic interference.
S - Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obatin valid quantification of the analyte.

**Table 2-3**
**Summary of Grounwater Analytical Data**
**September 2014**
**IPC - Bozeman, Montana**

| Sample ID: / Sample Date: | ROD CLEAN UP LEVELS µg/L | 8-B 9/11/2014 | 9-A 9/10/2014 | 9-B 9/16/2014 | 9-C 9/10/2014 | 9-D (duplicate) 9/10/2014 | 10-A 9/10/2014 | 10-B 9/10/2014 | 11-A 9/16/2014 | 11-D (duplicate) 9/16/2014 | 12-A 9/16/2014 | 13-A 9/11/2014 | 15-A 9/9/2014 | 16-A 9/10/2014 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCP-Method 8041 (ug/L)** | | | | | | | | | | | | | | |
| Pentachlorophenol | **1** | 0.75 | U< 0.25 | **12** | U< 0.25 | U< 0.25 | U< 0.25 | U< 0.25 | 0.87 | 0.29 | U< 0.25 | U< 0.25 | 0.91 | U< 0.25 |
| **PAH-Method 8310 (ug/L)** | | | | | | | | | | | | | | |
| Acenaphthylene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | NA |
| Acenaphthene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.53 | NA |
| **D PAH compounds** | | | | | | | | | | | | | | |
| Naphthalene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | NA |
| Fluorene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.61 | NA |
| Phenanthrene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.50 | NA |
| Anthracene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.27 | NA |
| Fluoranthene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.23 | NA |
| Pyrene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.20 | NA |
| Benzo(g,h,i)perylene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | NA |
| **Total D PAHs** | **146.0** | | | | | | | | | | | | 2.01 | |
| **B2 PAH compounds** | | | | | | | | | | | | | | |
| Benzo(a)anthracene | **0.10** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | NA |
| Chrysene | **0.20** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | NA |
| Benzo(b)fluoranthene | **0.20** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | NA |
| Benzo(k)fluoranthene | **0.20** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | NA |
| Benzo(a)pyrene | **0.20** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | NA |
| Dibenzo(a,h)anthracene | **0.30** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | NA |
| Indeno(1,2,3-cd)pyrene | **0.40** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | NA |

Note: Bolded concentration indicates exceedence of treatment level
NA - indicates analyte was not included in lab analysis
D - Diluted Sample
U - Indicates that the target analyte was not detected at the reported concentration.
E - Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
P - The analyte was detected on both chromatographic columns but the quantified values differ by > 40% PRD with no obvious chromatographic interference.
S - Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obatin valid quantification of the analyte.

**Table 2-3**
**Summary of Grounwater Analytical Data**
**September 2014**
**IPC - Bozeman, Montana**

| Sample ID: | ROD CLEAN UP LEVELS | 16-B | 19-A | 19-B | 22 | 23-A | 23-B | 23-C | 24-A1 | 24-A2 | 24-B | 25-A | 25-B | 26-A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | µg/L | 9/10/2014 | 9/9/2014 | 9/9/2014 | 9/9/2014 | 9/11/2014 | 9/11/2014 | 9/11/2014 | 9/11/2014 | 9/11/2014 | 9/11/2014 | 9/10/2014 | 9/10/2014 | 9/10/2014 |
| **PCP-Method 8041 (ug/L)** | | | | | | | | | | | | | | |
| Pentachlorophenol | **1** | **21** | U< 0.25 | U< 0.25 | 0.91 | **2.5** | U< 0.25 | **2.9** | U< 0.25 | U< 0.25 | **2.6** | **19** | U< 0.25 | 0.34 |
| **PAH-Method 8310 (ug/L)** | | | | | | | | | | | | | | |
| Acenaphthylene | **NA** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| Acenaphthene | **NA** | NA | NA | NA | 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| **D PAH compounds** | | | | | | | | | | | | | | |
| Naphthalene | **NA** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| Fluorene | **NA** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| Phenanthrene | **NA** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| Anthracene | **NA** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| Fluoranthene | **NA** | NA | NA | NA | 0.19 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| Pyrene | **NA** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | **NA** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| **Total D PAHs** | **146.0** | | | | | | | | | | | | | |
| **B2 PAH compounds** | | | | | | | | | | | | | | |
| Benzo(a)anthracene | **0.10** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| Chrysene | **0.20** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | **0.20** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | **0.20** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | **0.20** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| Dibenzo(a,h)anthracene | **0.30** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | **0.40** | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | NA | NA |

Note: Bolded concentration indicates exceedence of treatment level
NA - indicates analyte was not included in lab analysis
D - Diluted Sample
U - Indicates that the target analyte was not detected at the reported concentration.
E - Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
P - The analyte was detected on both chromatographic columns but the quantified values differ by > 40% PRD with no obvious chromatographic interference.
S - Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obatin valid quantification of the analyte.

**Table 2-3**
**Summary of Grounwater Analytical Data**
**September 2014**
**IPC - Bozeman, Montana**

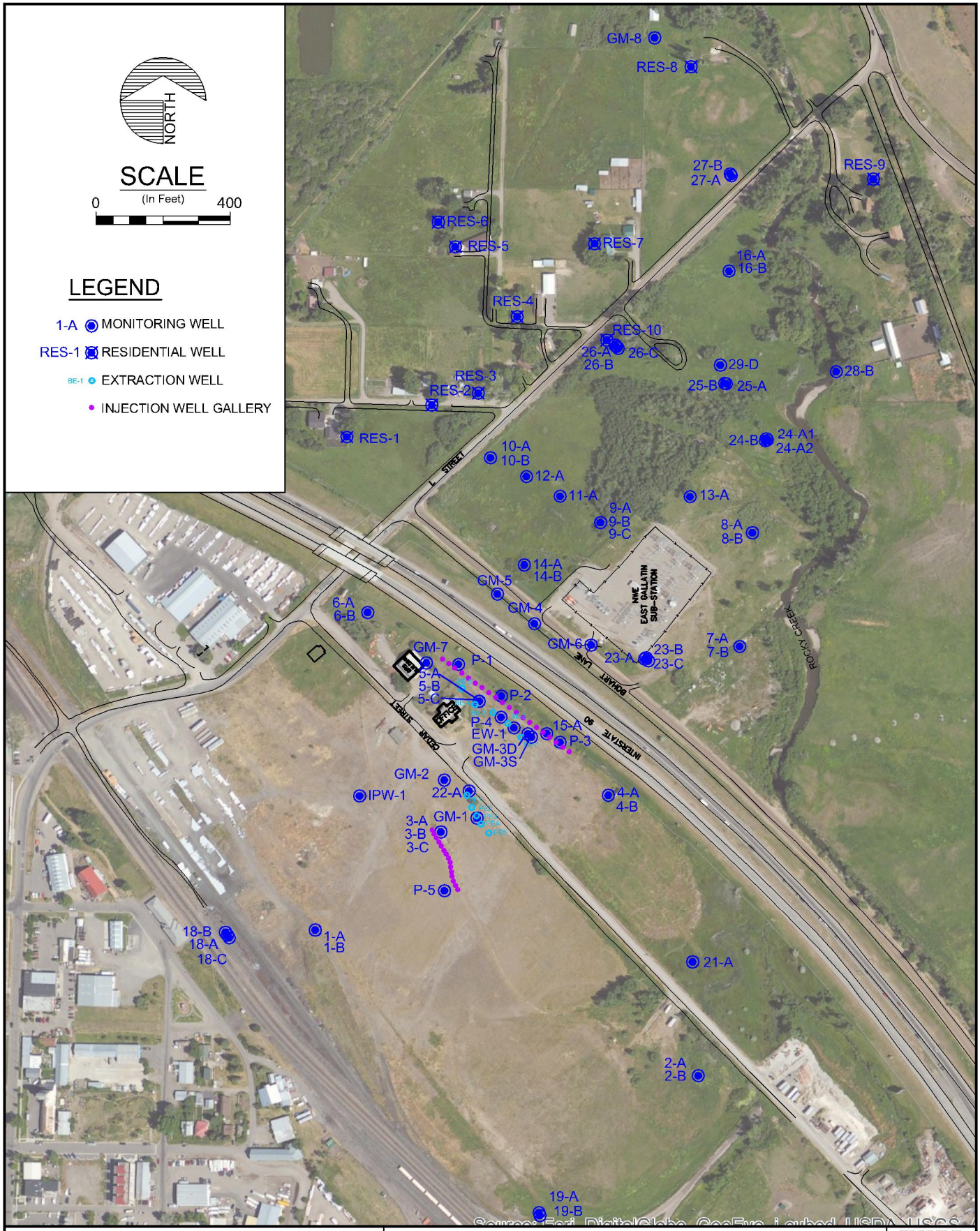
| Sample ID: / Sample Date: | ROD CLEAN UP LEVELS µg/L | 26-B 9/10/2014 | 26-C 9/10/2014 | 27-A 9/10/2014 | 27-B 9/10/2014 | 28-B 9/16/2014 | 28-F (field blank) 9/16/2014 | 29-D 9/10/2014 | BFEG 9/16/2014 | GM-4 9/11/2014 | GM-5 9/11/2014 | GM-6 9/11/2014 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCP-Method 8041 (ug/L)** | | | | | | | | | | | | |
| Pentachlorophenol | **1** | U< 0.25 | U< 0.25 | U< 0.25 | U< 0.25 | U< 0.25 | U< 0.25 | U< 0.25 | **7** | **38** | 0.54 | 0.57 |
| **PAH-Method 8310 (ug/L)** | | | | | | | | | | | | |
| Acenaphthylene | **NA** | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 |
| Acenaphthene | **NA** | NA | NA | NA | NA | NA | NA | NA | 0.41 | U< 0.10 | U< 0.10 | U< 0.10 |
| **D PAH compounds** | | | | | | | | | | | | |
| Naphthalene | **NA** | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 |
| Fluorene | **NA** | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 |
| Phenanthrene | **NA** | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 |
| Anthracene | **NA** | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 |
| Fluoranthene | **NA** | NA | NA | NA | NA | NA | NA | NA | 0.25 | U< 0.10 | U< 0.10 | U< 0.10 |
| Pyrene | **NA** | NA | NA | NA | NA | NA | NA | NA | 0.25 | U< 0.10 | U< 0.10 | U< 0.10 |
| Benzo(g,h,i)perylene | **NA** | NA | NA | NA | NA | NA | NA | NA | 0.12 | U< 0.10 | U< 0.10 | U< 0.10 |
| **Total D PAHs** | **146.0** | | | | | | | | 1.02 | | | |
| **B2 PAH compounds** | | | | | | | | | | | | |
| Benzo(a)anthracene | **0.10** | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 |
| Chrysene | **0.20** | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 |
| Benzo(b)fluoranthene | **0.20** | NA | NA | NA | NA | NA | NA | NA | 0.14 | U< 0.10 | U< 0.10 | U< 0.10 |
| Benzo(k)fluoranthene | **0.20** | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 |
| Benzo(a)pyrene | **0.20** | NA | NA | NA | NA | NA | NA | NA | 0.13 | U< 0.10 | U< 0.10 | U< 0.10 |
| Dibenzo(a,h)anthracene | **0.30** | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 |
| Indeno(1,2,3-cd)pyrene | **0.40** | NA | NA | NA | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 |

Note: Bolded concentration indicates exceedence of treatment level
NA - indicates analyte was not included in lab analysis
D - Diluted Sample
U - Indicates that the target analyte was not detected at the reported concentration.
E - Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
P - The analyte was detected on both chromatographic columns but the quantified values differ by > 40% PRD with no obvious chromatographic interference.
S - Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obatin valid quantification of the analyte.

**Table 2-3**
**Summary of Grounwater Analytical Data**
**September 2014**
**IPC - Bozeman, Montana**

| Sample ID: / Sample Date: | ROD CLEAN UP LEVELS µg/L | GM-7 9/9/2014 | GM-8 9/10/2014 | NWE-04 9/16/2014 | NWE-05 9/16/2014 | P-1 9/9/2014 | P-2 9/9/2014 | P-4 9/9/2014 | P-4 (dilution) 9/9/2014 |
|---|---|---|---|---|---|---|---|---|---|
| **PCP-Method 8041 (ug/L)** | | | | | | | | | |
| Pentachlorophenol | **1** | U< 0.25 | U< 0.25 | U< 0.25 | U< 0.25 | 0.46 | **39** | **ESP 310** | **D 1200** |
| **PAH-Method 8310 (ug/L)** | | | | | | | | | |
| Acenaphthylene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA |
| **D PAH compounds** | | | | | | | | | |
| Naphthalene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluorene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenanthrene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA |
| Anthracene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluoranthene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA |
| Pyrene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | **NA** | NA | NA | NA | NA | NA | NA | NA | NA |
| **Total D PAHs** | **146.0** | | | | | | | | |
| **B2 PAH compounds** | | | | | | | | | |
| Benzo(a)anthracene | **0.10** | NA | NA | NA | NA | NA | NA | NA | NA |
| Chrysene | **0.20** | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | **0.20** | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | **0.20** | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | **0.20** | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenzo(a,h)anthracene | **0.30** | NA | NA | NA | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | **0.40** | NA | NA | NA | NA | NA | NA | NA | NA |

Note: Bolded concentration indicates exceedence of treatment level
NA - indicates analyte was not included in lab analysis
D - Diluted Sample
U - Indicates that the target analyte was not detected at the reported concentration.
E - Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
P - The analyte was detected on both chromatographic columns but the quantified values differ by > 40% PRD with no obvious chromatographic interference.
S - Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obatin valid quantification of the analyte.




| IDAHO POLE COMPANY<br>BOZEMAN, MONTANA<br>5029-300 | **MONITORING WELL NETWORK<br>IPC - BOZEMAN, MT** | FIGURE<br>**2-1** |
|---|---|---|

UPDATE TIME: 4:14 PM
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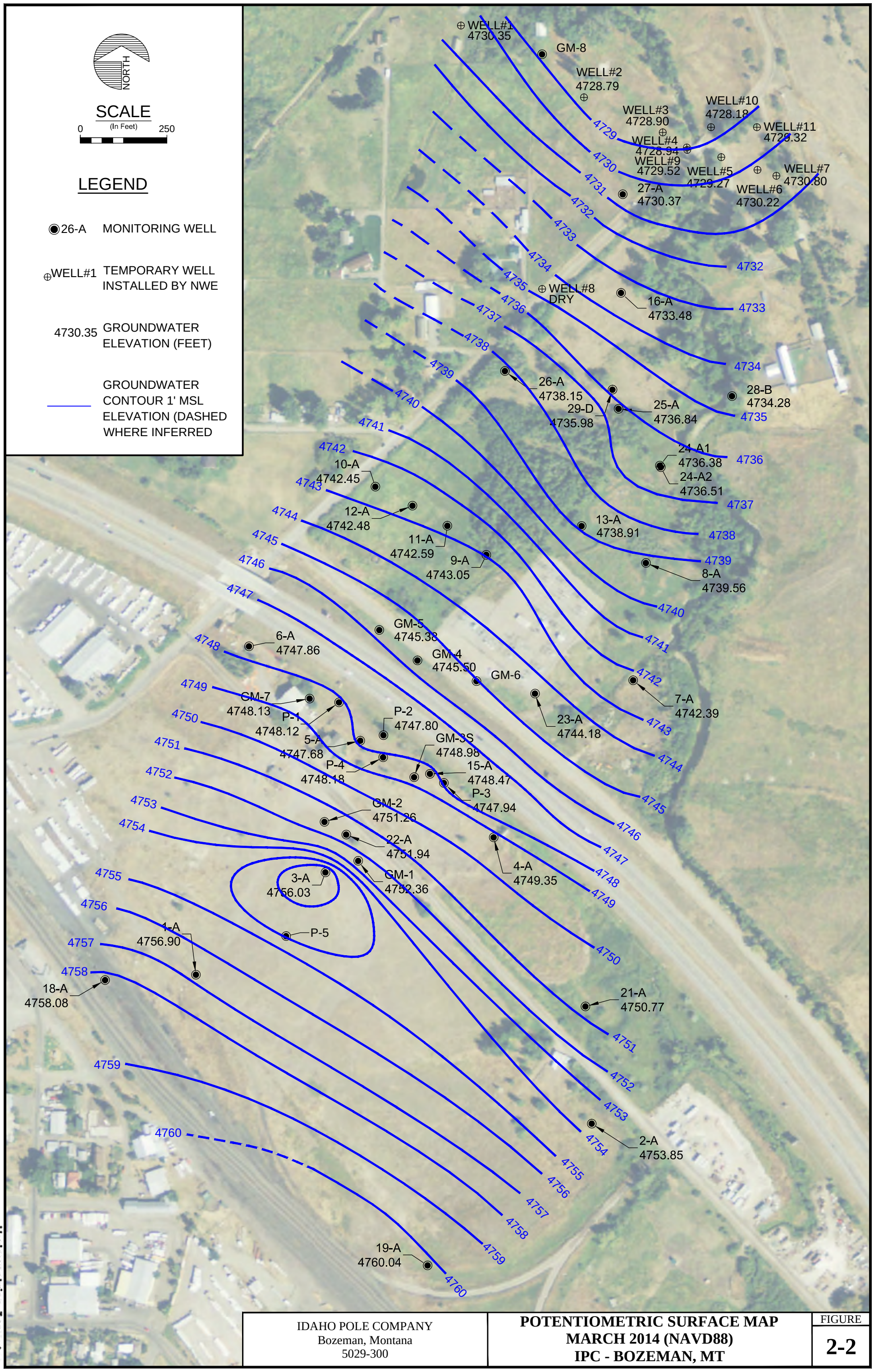


IDAHO POLE COMPANY
Bozeman, Montana
5029-300

**POTENTIOMETRIC SURFACE MAP**
**MARCH 2014 (NAVD88)**
**IPC - BOZEMAN, MT**

FIGURE
**2-2**

UPDATE TIME: 3:21 PM
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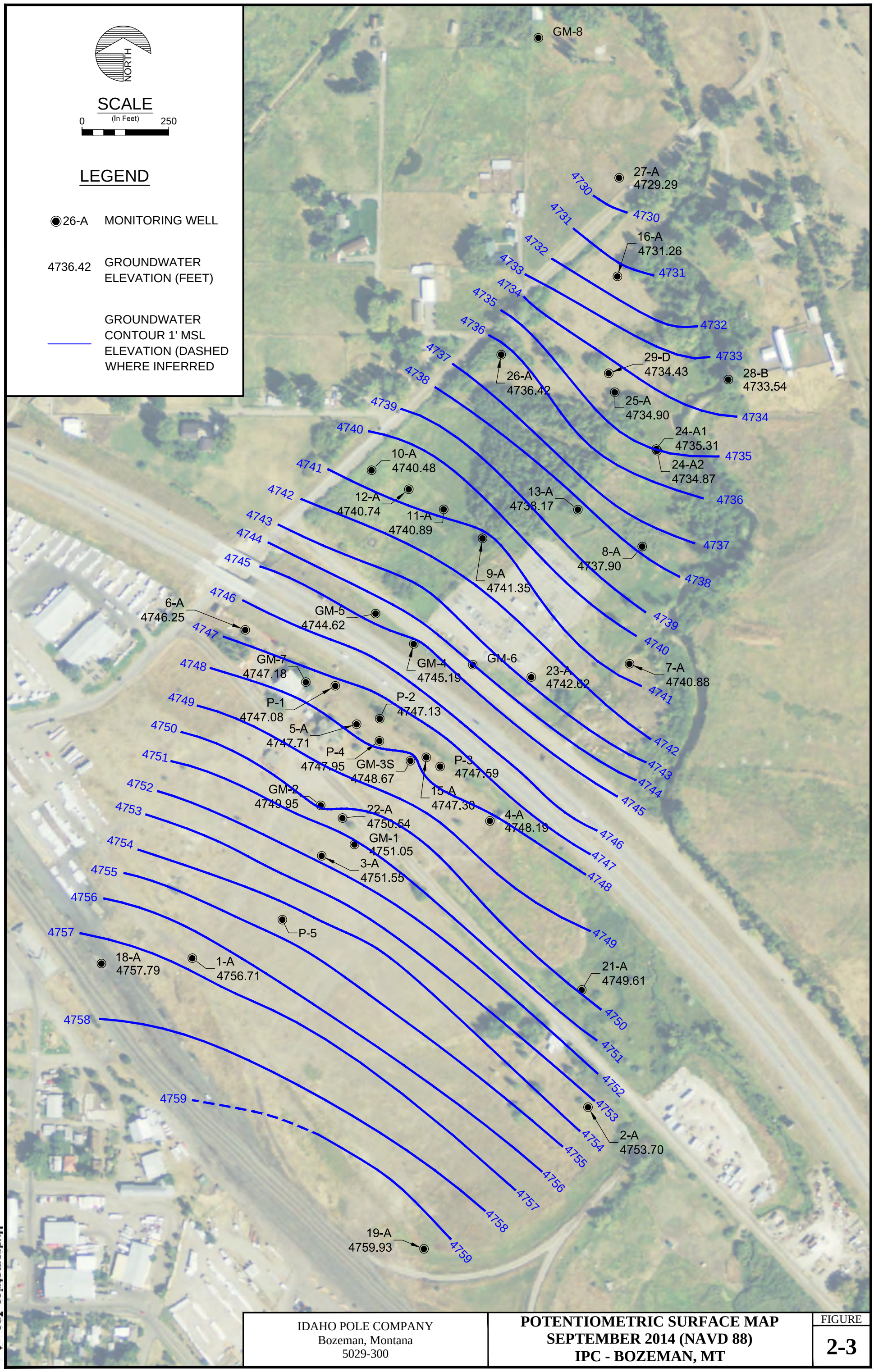


| IDAHO POLE COMPANY<br>Bozeman, Montana<br>5029-300 | **POTENTIOMETRIC SURFACE MAP<br>SEPTEMBER 2014 (NAVD 88)<br>IPC - BOZEMAN, MT** | FIGURE<br>**2-3** |
|---|---|---|

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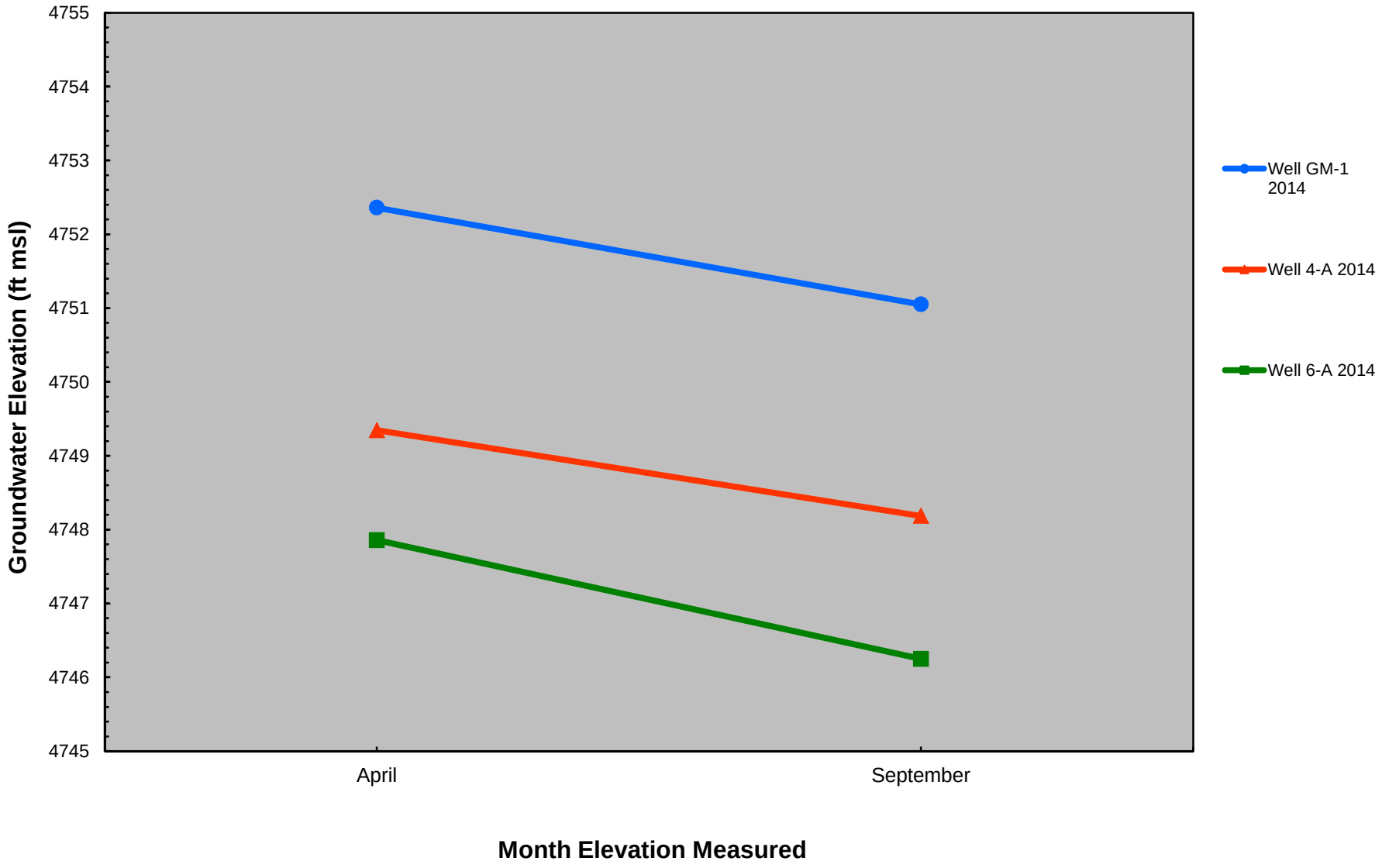
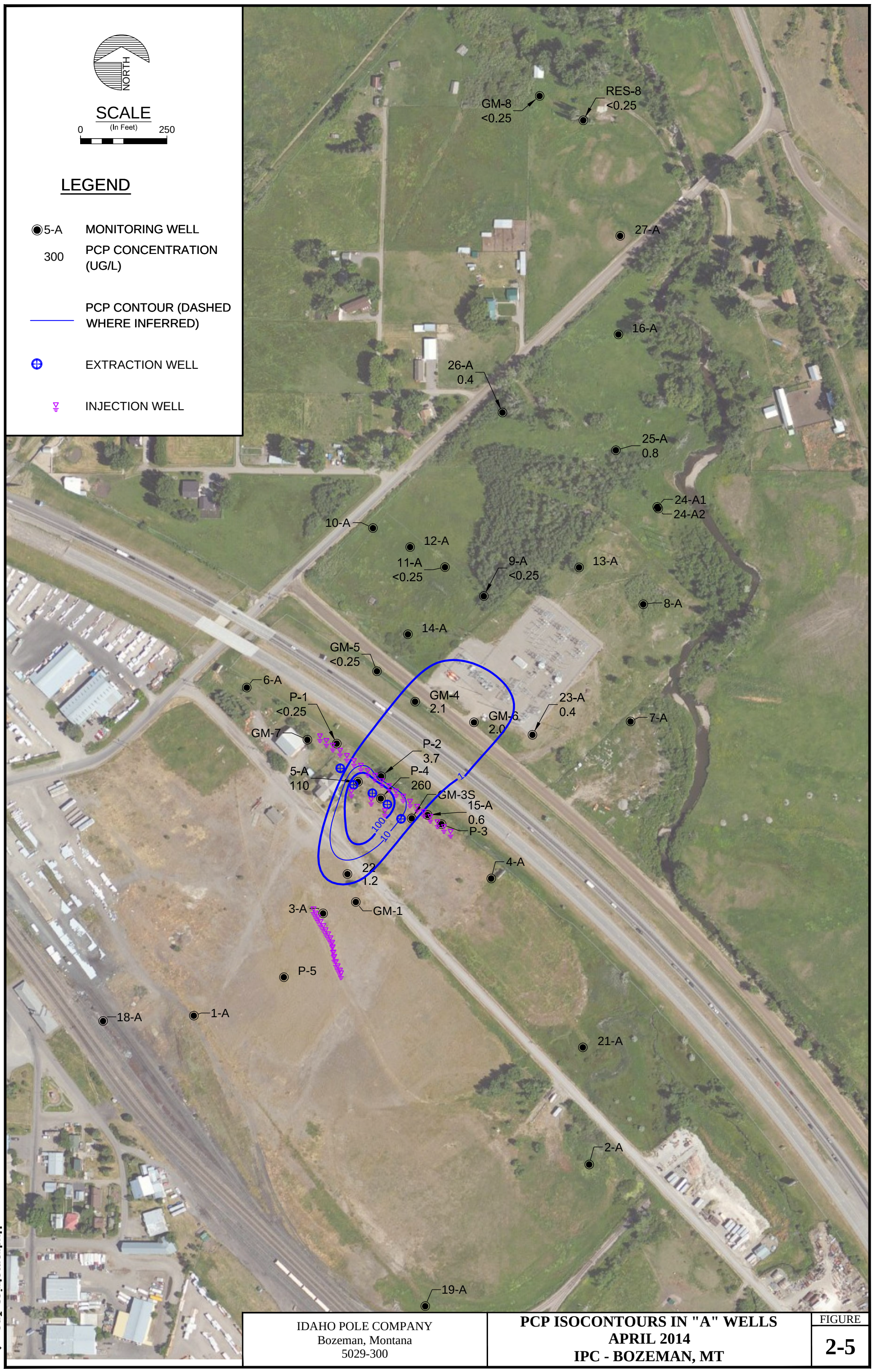
# Figure 2-4
# 2014 Semi-Annual Groundwater Elevations
# IPC - Bozeman, Montana






IDAHO POLE COMPANY
Bozeman, Montana
5029-300

**PCP ISOCONTOURS IN "A" WELLS**
**APRIL 2014**
**IPC - BOZEMAN, MT**

FIGURE
**2-5**

UPDATE TIME: 1:17 PM
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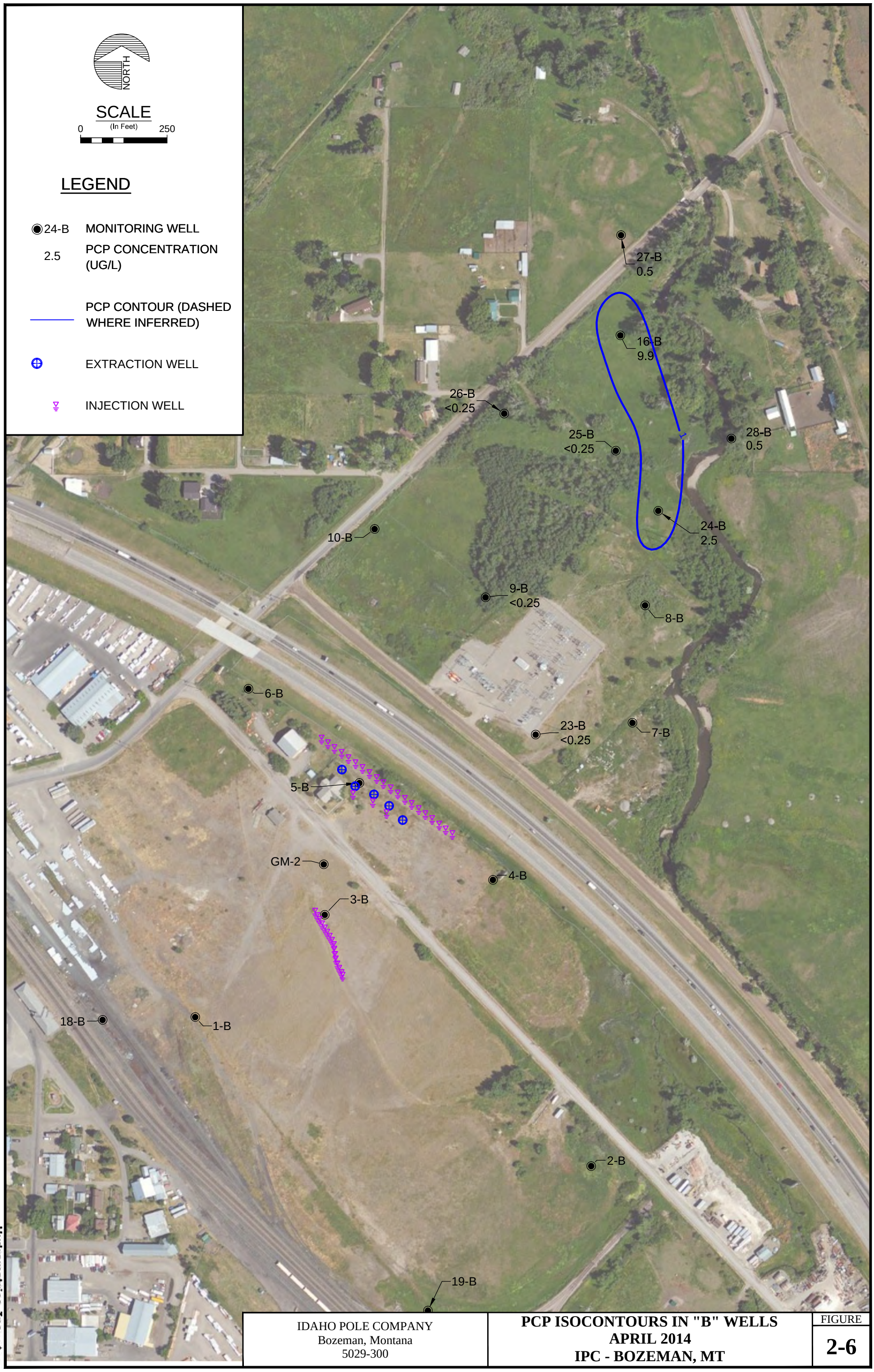


IDAHO POLE COMPANY
Bozeman, Montana
5029-300

**PCP ISOCONTOURS IN "B" WELLS**
**APRIL 2014**
**IPC - BOZEMAN, MT**

FIGURE
**2-6**

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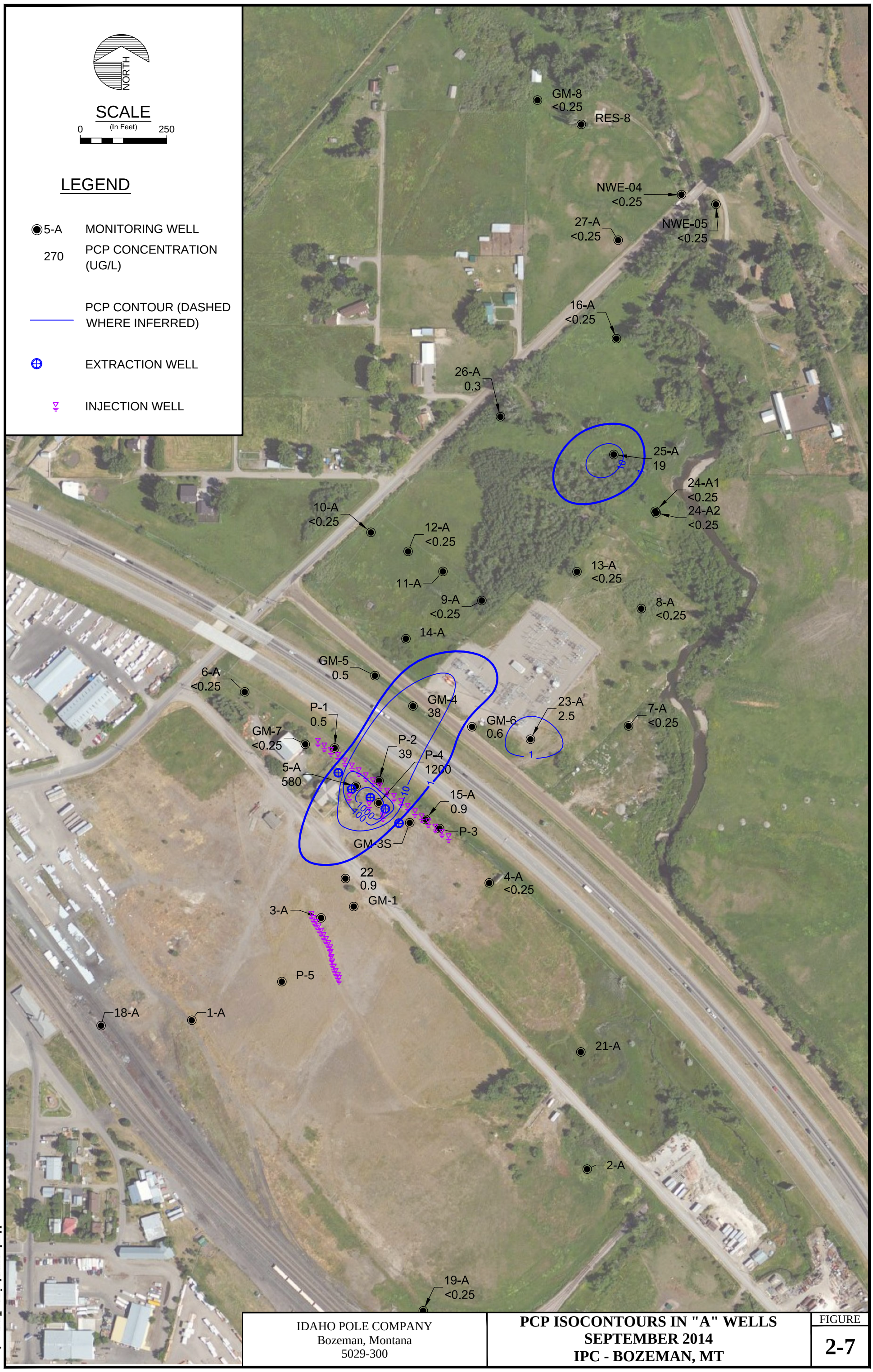


IDAHO POLE COMPANY
Bozeman, Montana
5029-300

**PCP ISOCONTOURS IN "A" WELLS**
**SEPTEMBER 2014**
**IPC - BOZEMAN, MT**

FIGURE
**2-7**

UPDATE TIME: 1:17 PM
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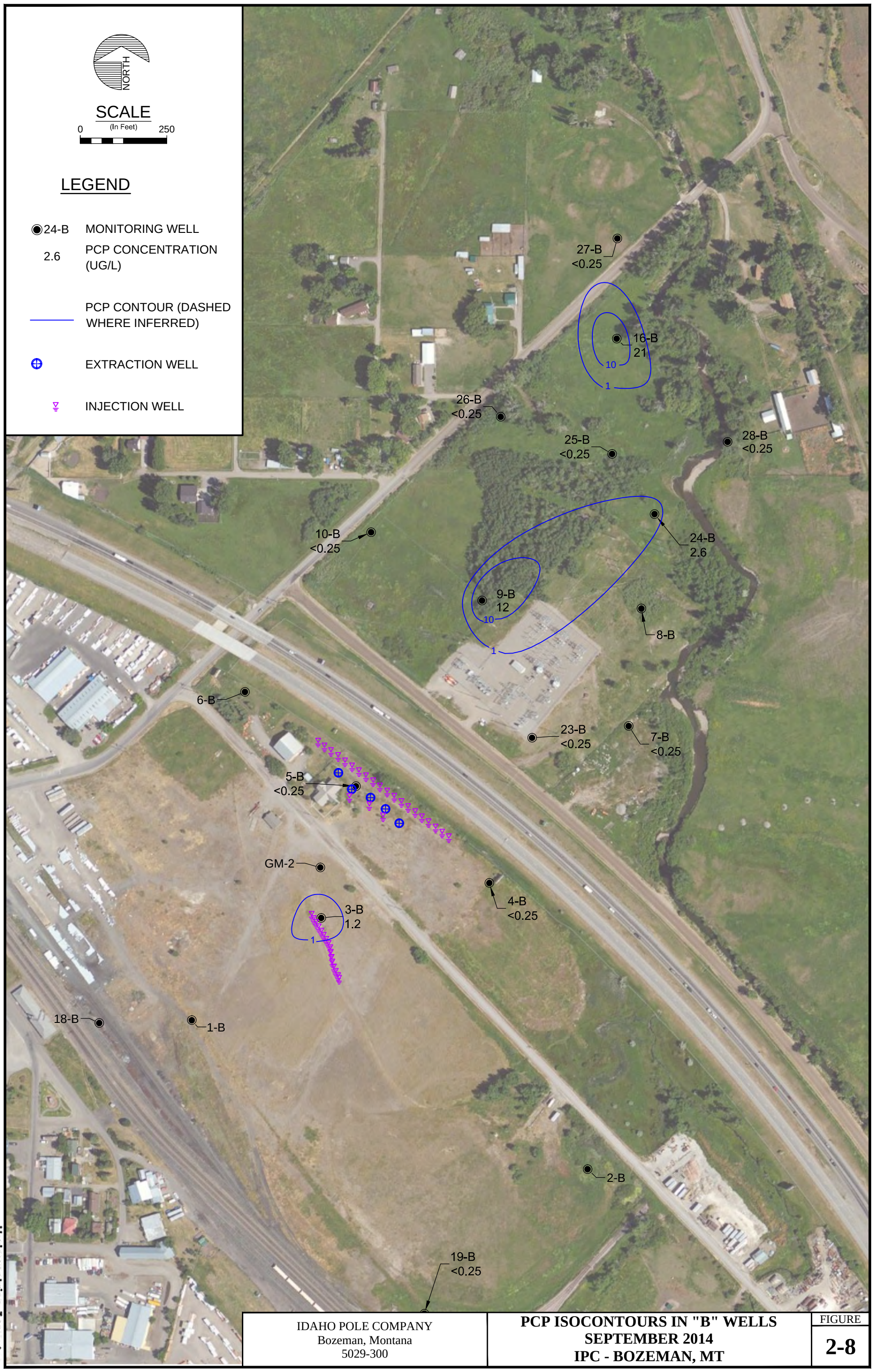


IDAHO POLE COMPANY
Bozeman, Montana
5029-300

**PCP ISOCONTOURS IN "B" WELLS**
**SEPTEMBER 2014**
**IPC - BOZEMAN, MT**

FIGURE
**2-8**

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Hydrometrics, Inc.
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# 3.0 RESIDENTIAL WELL MONITORING PROGRAM

A residential well monitoring program has been performed at the Site since 1989. Residential monitoring was conducted in coordination with site-wide groundwater monitoring to evaluate the presence of PCP concentrations in wells down gradient of the Site. The monitoring program originally included 10 wells identified as Wells Res-1 through Res-10 (Figure 2-1). Eight of 10 resident wells have consistently been below ROD levels for PCP. Historically, PCP has only been detected in two residential Wells, Res-8 and 10.

To prevent use of private water supply wells, the land associated with residential Wells Res-8 and Res-10 was purchased by IPC and the wells take out of service for domestic use. Upon installation of the GRS, Well Res-8 was sampled quarterly to aid in defining the leading edge of the PCP plume (northern boundary of the Site). Well Res-10 (located near center of PCP plume) was initially sampled as part of the resident well network and sampling continued until March 1991. In December 1990, three wells (Wells 26-A, 26-B and 26-C) were installed adjacent to Well Res-10 for performance and compliance monitoring. Sampling of Well Res-10 was discontinued after sampling of the new wells was initiated. Appendix G presents results of historical residential groundwater monitoring.

Annual residential well sampling was conducted in September 2014 in conjunction with site-wide monitoring with the exception of residential Well Res-8. Well Res-8 was sampled in conjunction with the semi-annual groundwater events in March and September 2014. All residential wells (Res-1 through Res-9) were sampled and analyzed for PCP.

## 3.1 RESIDENTIAL WELL NETWORK

The current residential well monitoring network (Figure 2-1) consists of nine wells located northeast of the Site (Wells Res-1 through Res-9). The wells provide residential water supplies with the exception of Well Res-8, which is used only for site groundwater monitoring. As described above, Idaho Pole owns the land associated with this well.

## 3.2 SAMPLE COLLECTION

Residents were notified verbally prior to sampling each well. Prior to sampling, each well was purged for 15 to 45 minutes to evacuate the well and ensure groundwater samples were representative of aquifer conditions. The purge times are in accordance with MDEQ guidance as indicated in the Operations and Maintenance Manual (SOP 3.12). Samples were collected directly from the resident well discharge. Specific conductivity, pH temperature, and dissolved oxygen were measured after purging the well. These field measurements were recorded and are considered representative of the groundwater samples collected for laboratory analysis.

## 3.3 SAMPLE ANALYSIS

Residential well samples were analyzed by ARI (Tukwila, WA) for PCP by USEPA Method 8041 (Table 3-1). The analyses conducted were in accordance with USEPA guidelines contained in the SAP.

Laboratory reports including QA/QC data, method blanks, duplicate analysis, and matrix and surrogate recoveries (if applicable) for all residential well samples are included in Appendix H. Validation reports of each sampling event were performed upon completion of analysis (Appendix H). Field sampling logs are included in Appendix I.

## 3.4 ANALYTICAL RESULTS

Analytical results for April and September 2014 sampling events are presented in Table 3-1. PCP concentrations in all wells, Wells Res-1 through Res-9 were less than the detection limits (Appendix G).

## 3.5 DATA VALIDATION

A complete data validation was conducted on analytical data from the March and September 2014 residential sampling events. The data validation concluded that the data were valid and usable.

**Table 3-1**
**Residential Well Analytical Results**
**April and September 2014**
**IPC - Bozeman, Montana**

| Sample Location:<br>Sample ID:<br>Sample Date: | Res-1<br>IP-0409-331<br>9/16/2014 | Res-2<br>IP-0409-332<br>9/16/2014 | Res-3<br>IP-0409-333<br>9/16/2014 | Res-4<br>IP-0409-334<br>9/16/2014 | Res-5<br>IP-0409-335<br>9/16/2014 | Res-6<br>IP-0409-336<br>9/16/2014 | Res-7<br>IP-0409-337<br>9/16/2014 | Res-8<br>Res-8<br>4/2/2014 | Res-8<br>Res-8<br>9/10/2014 | Res-9<br>IP-0409-339<br>9/16/2014 |
|---|---|---|---|---|---|---|---|---|---|---|
| **PCP-Method 8041(µg/L)** | | | | | | | | | | |
| Pentachlorophenol | U < 0.02 | U < 0.02 | U < 0.02 | U < 0.02 | U < 0.02 | U < 0.02 | U < 0.02 | < 0.25 | < 0.25 | U < 0.02 |

U - Indicates that the target analyte was not detected at the reported concentration

# 4.0 GROUNDWATER REMEDY SYSTEM

The ROD required that a groundwater remediation system be installed to accelerate the removal of dissolved phase PCP and PAH compounds from the aquifer beneath the Site. The following sections provide background information for the GRS, quarterly operation information and performance sampling results.

## 4.1 BACKGROUND

Construction of the GRS began in August 1996 and was completed in January of 1997. A detailed summary of construction of the GRS can be found in the Construction Completion Report (Geraghty & Miller, Inc., 1998a). The components of the GRS include two groundwater extraction galleries, bag filters, sequestering agent (not used at this time), two GAC units, a nutrient addition process, two injection galleries, and an interceptor trench. Figure 4-1 provides a layout of the GRS components.

Groundwater can be extracted from ten extraction wells located in two extraction galleries. The PPEG is a gallery of five wells located upgradient of the GRS and the BFEG is a gallery of five wells located down gradient of the GRS. The extracted water from both galleries is pumped to an influent equalization tank inside the water treatment building. Water is then pumped from the equalization tank through a series of bag filters to remove particulates greater than 10 microns from the water flow. After filtration, the water is routed through activated carbon where dissolved PCP and PAH compounds are removed from the water. Pumping operations and associated turbulence increases the dissolved oxygen levels in the treated water as it enters the effluent equalization tank from the GAC units. The treated water is enriched with nutrients by adding a bulk fertilizer mix of nitrogen and phosphorous downstream of the GAC units. Treated and enriched water in the effluent equalization tank is discharged to both the PPIG and the BFIG.

The PPIG consists of 15 wells located up gradient of the former pressure plant (Figure 4-1). Injection of water into the PPIG is intended to flush contaminants from beneath the former pressure plant toward the PPEG. The BFIG consists of twenty wells located down gradient

of the BFEG and southwest of Interstate 90 (I-90). Water injected into the BFIG flushes contaminants from beneath I-90 toward the pasture area down gradient of the interstate.

An interceptor trench was constructed just north of I-90 to recover any free product that may be present. Product that accumulates in the trench is removed from the trench, using absorbent pads, as needed. The product and pads removed from the trench are placed into 55-gallon drums for appropriate disposal. Full drums are labeled and scheduled for disposal off-site on an as needed basis. The 2014 interceptor trench recovery log is included in Appendix J.

The PPEG was shutdown on December 2, 2009 as approved in a letter from MDEQ and USEPA on November 17, 2009. The shutdown was recommended in the Remediation System Evaluation (GeoTrans and TetraTech, 2010). The Remediation System Evaluation (RSE) team believed there may have been gaps in capture at the BFEG that allowed PCP impacted water to migrate northward. Simplified one-layer groundwater model simulations (MODFLOW/MODPATH) performed by the RSE team indicated that the gaps would be greatly reduced or eliminated by eliminating extraction at the PPEG and pumping the BFEG with a target rate of 100 gallons per minute. Groundwater from monitoring Well GM-4 has been sampled quarterly (when accessible) for PCP concentrations at through December 2013 per the USEPA March 26, 2010 letter. Figure 4-2 presents a graph showing PCP concentrations at GM-4, GM-5 and GM-6 since PPEG shutdown. PCP concentrations have remained at or below levels observed prior to recommended system shutdown.

## 4.2 OPERATION AND MAINTENANCE

The performance of the GRS was evaluated quarterly during 2014, and the specific details concerning operations and maintenance can be found in the semi-annual progress reports (Hydrometrics, Inc., 2014 and 2015). Brief descriptions of GRS activities are described below.

### 4.2.1 First Half 2014 Operations

Approximately 18,314,100 gallons of water were processed through the IPC treatment plant during the first half of 2014. During this time groundwater was extracted from the BFEG) with approximately 22% of the flow from well BE-2, 25% from BE-3, 22% from BE-4, and 30% from BE-5. Average flow for most of the period was about 60 gallons per minute until the week of June 9 2014, when three new pumps were installed in Barkfill extraction wells BE-2, BE-3 and BE-4. The new pumps are 1.5 horsepower (HP) as opposed to the previous 3/4 HP at BE-2 and 1 HP pumps at BE-3 and BE-4. After all the pumps were brought on line the total overall extraction rate was 109 gpm. The pumps were also raised from a depth of about 30 feet to approximately 20 feet below ground surface. Treated water was injected into both the PPIG and BFIG galleries. Approximately 80% of the water was injected into the BFIG and approximately 20% was injected into the PPIG. The total volume of water processed from startup of the system in February 1997 to the end of June 2014 was approximately 528,174,700 gallons.

The interceptor trench was monitored periodically for product accumulation. Twelve adsorbent pads were collected from the trench during the first half of 2014. In addition, mixed product and water were removed by bailing on a bi-weekly basis from Extraction Well PE-1. Approximately 2.5 gallons were removed from this well during this period and placed in a drum for disposal.

### 4.2.2 Second Half 2014 Operations

Approximately 20,181,700 gallons of water were processed through the IPC treatment plant during the second half of 2014. During this time, approximately 28% of the flow from well BE-2, 26% from BE-3, 27% from BE-4, and 18% from BE-5 Average flow during operation for period was about 106 gallons per minute when the plant was in operation.

The GRS was inoperable from approximately August 8 through September 16, 2014 due to computer malfunction. The computer was replaced with a new system (including new software) during this time period and has been operating since September 16 without problems. Pumping wells were brought back online one by one in the following order: BE-2

(Sept. 16), BE-3 (Sept. 23), BE-4 (Sept. 29) and BE-5 (Oct. 6). As of September 2014, only one carbon unit has been treating water. Prior to September 2014, the carbon units were set up with GAC-502 (PV-2) as the lead vessel and GAC-501 (PV-1) as the lag vessel. Based on low levels of influent PCP, Idaho Pole Company requested the use of only one vessel, PV-1 (the former lag vessel and the one with the newest carbon) in order to eliminate back pressure and the need for back flushing until the carbon can be changed out in the spring. EPA approved IPC's request via email on September 4, 2014. Analytical results (Table 4-1) indicate the one GAC unit is adequately treating the recovered groundwater.

The total volume of water processed from startup of the system in February 1997 to the end of December 2014 was approximately 548,356,400 gallons.

The interceptor trench was monitored periodically for product accumulation. Five adsorbent pads were collected from the trench and placed in barrels for disposal during the second half of 2014. No product/water was present at Extraction Well PE-1 during bi-weekly inspections.

## 4.3 GROUNDWATER REMEDY SYSTEM WATER QUALITY

The water processed in the GRS is sampled and analyzed in order to monitor the performance of the system. The following sections describe the sample collection methods, the analytical program, and the analytical results. The analytical data for monthly GRS sampling are provided in Appendix K and the field logs are provided in Appendix L.

### 4.3.1 Sample Collection

The GRS sampling was conducted at the following frequencies in order to monitor system performance. Water samples were collected at the following locations:

- SP-1 - sample port from the PPEG (Influent) – not sampled due to shut down of PPEG;
- SP-2 - sample port from the BFEG (Influent) – sample collected monthly;

- SP-6 - sample port between the two GAC units (Mid-carbon) – sample collected every other month, however, only one GAC operated after September eliminating the need for this sample;
- SP-7 - sample port down stream of the second GAC unit (Post-carbon) – sample collected monthly; and
- BE-2, BE-3, BE-4, BE-5 – sampled through sample port SP-2 – sample collected quarterly of the water from each individual extraction well by only running one well at a time and then collecting sample.

Sampling was initiated by purging five gallons of water from each port. The temperature, specific conductivity, and pH of the water was measured and recorded after purging. Water samples were collected into sample containers at the designated sample ports. The samples were then packed in an iced cooler and shipped to the laboratory under chain of custody. ARI Inc., Tukwila, Washington, conducted the analysis for the GRS performance samples.

### 4.3.2 Analytical Program

Samples were collected from the GRS according to the schedule in Section 4.3.1. Samples were analyzed for PAH compounds by USEPA Method 8270 SIM, with the exception of BE-2 through BE-5. Samples collected from the influent sample ports (SP-1 and SP-2) were analyzed for PCP by USEPA Method 8041 to be comparable to other groundwater samples collected around the site. The mid-GAC sampling port (SP-6) samples and post-GAC sampling port (SP-7) samples were analyzed for PCP by USEPA Method 8270 SIM. Method 8270 SIM is already used to analyze for PAH in these samples and is capable of meeting a reporting limit lower than the cleanup goal. All analyses were conducted in accordance with USEPA guidelines contained in the Sampling and Analysis Plan (Geraghty & Miller, Inc., 1997). ARI conducted the analysis for all GRS samples.

### 4.3.3 Analytical Results

Table 4-1 summarizes results of the 2014 GRS sampling events. Samples were not collected in September since the system was not operational due to the computer system failure. Table 13 of the ROD (Appendix F) lists the required cleanup levels. During each of the sampling

events, the water processed through the GRS was treated to below these cleanup levels prior to injection.

A review of Table 4-1 shows that the majority of the inlet concentrations (SP-2) of PCP were greater than indicated ROD level of 1 µg/L and all outlet PCP concentrations (SP-6 & SP-7) are less than the detection limit of 0.50 µg/L, indicating effective treatment of PCP by the GRS. SP-2 concentrations ranged from 1.9 µg/L to 7.3 µg/L through the year. The highest concentrations of PCP and PAH's were observed at SP-2 after GRS startup following pump upgrades and after the system had been down for several weeks due to computer replacement.

A review of the tables for the PAH compounds showed that the inlet concentrations of PAH compounds varied during the year. Total D PAH compounds were below the ROD cleanup level (146 mg/L) throughout the year. Total D PAH outlet concentrations at SP-6 & SP-7 were non-detect for all monthly sampling events in 2014.

The B2 PAH compounds were observed at or above detection limits for inlet (SP-2) samples collected June, September and October during 2014. Otherwise B2 PAH compounds were non-detect at SP-2. The B2 PAH compounds were not detected in any of the outlet (SP-7) samples during 2014.

In addition to the composite influent sample (SP-2), samples were collected of the water from individual wells (BE-2 through BE-5) in the BFEG in March, June, September, and December 2014. The samples were analyzed for PCP by USEPA Method 8041. The PCP concentrations ranged from < 0.25 µg/L to 15 µg/L with an average concentration around 6 µg/L. All four wells had higher than average PCP concentrations measured in June, after the upgraded pumps were brought on-line.

Table 4-2 presents the total mass of dissolved constituents removed by the treatment system. Mass removed is based on the concentration of dissolved constituents removed and the monthly volume of water processed. Over the past operational year, the GRS treatment

process removed approximately 2.81 pounds of total PAH compounds and 1.38 pounds of PCP. The total volume of groundwater processed during 2014 was approximately 38,495,800 gallons.

# Table 4-1
# GRS Analytical Data
# First Quarter 2014
# IPC - Bozeman, Montana

| | JANUARY | | | FEBRUARY | | MARCH | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID:** | **SP-2** | **SP-6** | **SP-7** | **SP-2** | **SP-7** | **BE-2** | **BE-3** | **BE-4** | **BE-5** | **SP-2** | **SP-6** | **SP-7** |
| **Sample Location:** | **Inlet BFEG** | **Mid GAC** | **Post GAC** | **Inlet BFEG** | **Post GAC** | **Inlet BFEG** | **Inlet BFEG** | **Inlet BFEG** | **Inlet BFEG** | **Inlet BFEG** | **Mid GAC** | **Post GAC** |
| **Sample Date:** | **1/31/2014** | **1/31/2014** | **1/31/2014** | **2/27/2014** | **2/27/2014** | **3/31/2014** | **3/31/2014** | **3/31/2014** | **3/31/2014** | **3/31/2014** | **3/31/2014** | **3/31/2014** |
| **PAH Method:** | **8270SIM** | **8270SIM** | **8270SIM** | **8270SIM** | **8270SIM** | **8270SIM** | **SW8041** | **SW8041** | **SW8041** | **8270SIM** | **8270SIM** | **8270SIM** |
| **PAH-Method (µg/L)** | | | | | | | | | | | | |
| Acenaphthylene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 |
| Acenapthene | **0.35** | U< 0.10 | U< 0.10 | **0.14** | U< 0.10 | NA | NA | NA | NA | **0.31** | U< 0.10 | U< 0.10 |
| **D PAH compounds** | | | | | | | | | | | | |
| Naphthalene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 |
| Fluorene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 |
| Phenanthrene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 |
| Anthracene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 |
| Fluoranthene | **0.29** | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | **0.22** | U< 0.10 | U< 0.10 |
| Pyrene | **0.22** | U< 0.10 | U< 0.10 | **0.11** | U< 0.10 | NA | NA | NA | NA | **0.20** | U< 0.10 | U< 0.10 |
| Benzo (g,h,i) perylene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 |
| Total D PAH | **0.51** | 0.00 | 0.00 | **0.11** | 0.00 | NA | NA | NA | NA | **0.42** | 0.00 | 0.00 |
| **B2 PAH compounds** | | | | | | | | | | | | |
| Benzo (a) anthracene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 |
| Chrysene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 |
| Benzo (b) fluoranthene | U< 0.10 | U< 0.20 | U< 0.20 | U< 0.10 | U< 0.20 | NA | NA | NA | NA | U< 0.10 | U< 0.20 | U< 0.20 |
| Benzo (k) fluoranthene | U< 0.10 | U< 0.20 | U< 0.20 | U< 0.10 | U< 0.20 | NA | NA | NA | NA | U< 0.10 | U< 0.20 | U< 0.20 |
| Benzo (a) pyrene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 |
| Dibenzo (a,h) anthracene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 |
| Indeno (1,2,3-cd) pyrene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | U< 0.10 |
| **PCP - Method 8270SIM (µg/L)** | | | | | | | | | | | | |
| Pentachlorophenol | NA | U< 0.50 | U< 0.50 | NA | U< 0.50 | NA | NA | NA | NA | NA | U< 0.50 | U< 0.50 |
| **PCP-Method 8041 (µg/L)** | | | | | | | | | | | | |
| Pentachlorophenol | **4.1** | NA | NA | **1.9** | NA | **3.8** | **3.6** | **3.4** | **0.57** | **4.0** | NA | NA |

Note: Bolded concentration indicates exceedence of treatment level

Note: Analytical results are used for performance monitoring; therefore, data was not validated

PPEG - Pressure Plant Extraction Gallery

BFEG - Bark Fill Extraction Gallery

GAC - Granular Activated Carbon

U< - Indicates Undetected at reported detection limit

NA - Not analyzed for that constituent

## Table 4-1 (Continued)
## GRS Analytical Data
## Second Quarter 2014
## IPC - Bozeman, Montana

| | APRIL | | MAY | | | JUNE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID:** | **SP-2** | **SP-7** | **SP-2** | **SP-6** | **SP-7** | **BE-2** | **BE-3** | **BE-4** | **BE-5** | **SP-2** | **SP-7** | **GM-4** |
| **Sample Location:** | **Inlet BFEG** | **Post GAC** | **Inlet BFEG** | **Post GAC** | **Post GAC** | **Inlet BFEG** | **Inlet BFEG** | **Inlet BFEG** | **Inlet BFEG** | **Inlet BFEG** | **Post GAC** | |
| **Sample Date:** | **4/28/2014** | **4/28/2014** | **5/31/2014** | **5/31/2014** | **5/31/2014** | **6/26/2014** | **6/26/2014** | **6/26/2014** | **6/26/2014** | **6/26/2014** | **6/26/2014** | **6/26/2014** |
| **PAH Method:** | **8270SIM** | **8270SIM** | **8270SIM** | **8270SIM** | **8270SIM** | **8270SIM** | **8270SIM** | **8270SIM** | **8270SIM** | **8270SIM** | **8270SIM** | **SW8041** |
| **PAH-Method (µg/L)** | | | | | | | | | | | | |
| Acenaphthylene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Acenapthene | **0.25** | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | **0.51** | U< 0.10 | NA |
| **D PAH compounds** | | | | | | | | | | | | |
| Naphthalene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Fluorene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Phenanthrene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Anthracene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Fluoranthene | **0.17** | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | **0.35** | U< 0.10 | NA |
| Pyrene | **0.16** | U< 0.10 | **0.10** | U< 0.10 | U< 0.10 | NA | NA | NA | NA | **0.38** | U< 0.10 | NA |
| Benzo (g,h,i) perylene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Total D PAH | **0.33** | | **0.10** | 0.0 | 0.0 | NA | NA | NA | NA | **0.73** | 0.0 | NA |
| **B2 PAH compounds** | | | | | | | | | | | | |
| Benzo (a) anthracene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Chrysene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Benzo (b) fluoranthene | U< 0.10 | U< 0.20 | U< 0.10 | U< 0.20 | U< 0.20 | NA | NA | NA | NA | **0.12** | U< 0.20 | NA |
| Benzo (k) fluoranthene | U< 0.10 | U< 0.20 | U< 0.10 | U< 0.20 | U< 0.20 | NA | NA | NA | NA | U< 0.10 | U< 0.20 | NA |
| Benzo (a) pyrene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | **0.13** | U< 0.10 | NA |
| Dibenzo (a,h) anthracene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Indeno (1,2,3-cd) pyrene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| **PCP - Method 8270SIM (µg/L)** | | | | | | | | | | | | |
| Pentachlorophenol | NA | U< 0.50 | NA | U< 0.50 | U< 0.50 | NA | NA | NA | NA | NA | U< 0.50 | NA |
| **PCP-Method 8041 (µg/L)** | | | | | | | | | | | | |
| Pentachlorophenol | **4.7** | NA | **P 2.2** | NA | NA | **7.5** | **15** | **9.9** | **12** | **7.3** | NA | **8** |

Note: Bolded concentration indicates exceedence of treatment level

Note: Analytical results are used for performance monitoring; therefore, data was not validated

PPEG - Pressure Plant Extraction Gallery

BFEG - Bark Fill Extraction Gallery

GAC - Granular Activated Carbon

U< - Indicates Undetected at reported detection limit

NA - Not analyzed for that constituent

P - The analyte was detected on both chromatographic columns but the quantified values differ by $\geq$ 40% PRD with no obvious chromatographic interference.

## Table 4-1 (Continued)
## GRS Analytical Data
## Third Quarter 2014
## IPC - Bozeman, Montana

| | JULY | | | AUGUST * | | | |
|---|---|---|---|---|---|---|---|
| **Sample ID:** | **SP-2** | **SP-6** | **SP-7** | **BE-2** | **BE-2 Dilution** | **BE-3** | **GM-4** |
| **Sample Location:** | **Inlet BFEG** | **Mid GAC** | **Post GAC** | **Well Head** | **Well Head** | **Well Head** | |
| **Sample Date:** | **7/31/2014** | **7/31/2014** | **7/31/2014** | **8/17/2014** | **8/17/2014** | **8/17/2014** | **8/17/2014** |
| **PAH Method:** | **8270SIM** | **8270SIM** | **8270SIM** | **8270SIM** | **8270SIM** | **SW8041** | **8270SIM** |
| **PAH-Method (µg/L)** | | | | | | | |
| Acenaphthylene | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| Acenapthene | **0.39** | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| **D PAH compounds** | | | | | | | |
| Naphthalene | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| Fluorene | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| Phenanthrene | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| Anthracene | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| Fluoranthene | **0.18** | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| Pyrene | **0.16** | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| Benzo (g,h,i) perylene | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| Total D PAH | **0.34** | 0.00 | 0.00 | NA | NA | NA | NA |
| **B2 PAH compounds** | | | | | | | |
| Benzo (a) anthracene | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| Chrysene | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| Benzo(b)fluoranthene | U< 0.10 | U< 0.20 | U< 0.20 | NA | NA | NA | NA |
| Benzo(k)fluoranthene | U< 0.10 | U< 0.20 | U< 0.20 | NA | NA | NA | NA |
| Benzo (a) pyrene | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| Dibenzo (a,h) anthracene | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| Indeno (1,2,3-cd) pyrene | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA |
| **PCP - Method 8270SIM (µg/L)** | | | | | | | |
| Pentachlorophenol | NA | U< 0.50 | U< 0.50 | NA | NA | NA | NA |
| **PCP-Method 8041 (µg/L)** | | | | | | | |
| Pentachlorophenol | **7.20** | NA | NA | **ES 190** | **P 94** | **B 34** | **BP 0.53** |

Note: No samples collected in September; system was shut down.

Note: Bolded concentration indicates exceedence of treatment level

Note: Analytical results are used for performance monitoring; therefore, data was not validated

* GRS not in operation at time of sample collection. Samples retrieved via low flow sampling techniques

PPEG - Pressure Plant Extraction Gallery

BFEG - Bark Fill Extraction Gallery

GAC - Granular Activated Carbon

U< - Indicates Undetected at reported detection limit

NA - Not analyzed for that constituent

E - Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.

P - The analyte was detected on both chromatographic columns but the quantified values differ by > 40% PRD with no obvious chromatographic interference.

S - Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obatin valid quantification of the analyte.

B - Analyte detected in associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.

## Table 4-1 (Continued)
## GRS Analytical Data
## Fourth Quarter 2014
## IPC - Bozeman, Montana

| | OCTOBER | | NOVEMBER | | DECEMBER | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID:** | **SP-2** | **SP-7** | **SP-2** | **SP-7** | **BE-2** | **BE-3** | **BE-4** | **BE-5** | **SP-2** | **SP-7** | **GM-4** |
| **Sample Location:** | **Inlet BFEG** | **Post GAC** | **Inlet BFEG** | **Post GAC** | **Inlet BFEG** | **Inlet BFEG** | **Inlet BFEG** | **Inlet BFEG** | **Inlet BFEG** | **Post GAC** | **Well head** |
| **Sample Date:** | **10/23/2014** | **10/23/2014** | **11/24/2014** | **11/24/2014** | **12/22/2014** | **12/22/2014** | **12/22/2014** | **12/29/2014** | **12/22/2014** | **12/22/2014** | **12/22/2014** |
| **Extraction Date:** | **10/28/2014** | **10/28/2014** | **11/28/2014** | **11/28/2014** | **12/29/2014** | **12/29/2014** | **12/29/2014** | **1/2/2015** | **12/29/2014** | **12/26/2014** | **12/26/2014** |
| **PAH-Method - 8270 SIM (µg/L)** | | | | | | | | | | | |
| Acenaphthylene | **0.18** | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Acenapthene | U< 0.10 | U< 0.10 | **0.39** | U< 0.10 | NA | NA | NA | NA | 0.18 | U< 0.10 | NA |
| **D PAH compounds** | | | | | | | | | | | |
| Naphthalene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Fluorene | U< 0.10 | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Phenanthrene | **0.29** | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Anthracene | **0.32** | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Fluoranthene | **6.60** | U< 0.10 | **0.17** | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Pyrene | **6.20** | U< 0.10 | **0.38** | U< 0.10 | NA | NA | NA | NA | 0.18 | U< 0.10 | NA |
| Benzo (g,h,i) perylene | **2.80** | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Total D PAH | 16.21 | | **0.55** | 0.0 | NA | NA | NA | NA | 0.18 | 0.0 | |
| **B2 PAH compounds** | | | | | | | | | | | |
| Benzo (a) anthracene | **7.30** | U< 0.10 | **0.12** | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Chrysene | **3.90** | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Benzo(b)fluoranthene | **6.60** | U< 0.10 | **0.17** | U< 0.20 | NA | NA | NA | NA | 0.11 | U< 0.20 | NA |
| Benzo(k)fluoranthene | **3.60** | U< 0.10 | U< 0.10 | U< 0.20 | NA | NA | NA | NA | U< 0.10 | U< 0.20 | NA |
| Benzo (a) pyrene | **7.00** | U< 0.10 | **0.19** | U< 0.10 | NA | NA | NA | NA | 0.11 | U< 0.10 | NA |
| Dibenzo (a,h) anthracene | **0.78** | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| Indeno (1,2,3-cd) pyrene | **2.40** | U< 0.10 | U< 0.10 | U< 0.10 | NA | NA | NA | NA | U< 0.10 | U< 0.10 | NA |
| | 31.6 | | | | | | | | | | |
| **PCP - Method 8270SIM (µg/L)** | | | | | | | | | | | |
| Pentachlorophenol | NA | U< 0.50 | NA | U< 0.50 | NA | NA | NA | NA | NA | U< 0.50 | NA |
| **PCP-Method 8041 (µg/L)** | | | | | | | | | | | |
| Pentachlorophenol | **4.4** | NA | **B 3.7** | NA | **3.0** | **2.9** | **7.4** | U< 0.25 | **2.7** | NA | **18** |

Note: Bolded concentration indicates exceedence of treatment level

Note: Analytical results are used for performance monitoring; therefore, data was not validated

PPEG - Pressure Plant Extraction Gallery

BFEG - Bark Fill Extraction Gallery

GAC - Granular Activated Carbon

U< - Indicates Undetected at reported detection limit

NA - Not analyzed for that constituent

B - Reported value is less than the CRDL but > or = the Reporting Limit

# Table 4-2
# Constituent Mass Removed from Treatment - 2014
# Total PAH and PCP (pounds)
# IPC - Bozeman, Montana

## Total PAH Compounds

| Date<br>2014 | Volume of Water Pumped*<br>(gallons) | GRS Influent** Total PAH<br>(µg/L) | GRS Effluent** Total PAH<br>(µg/L) | Mass Removed<br>(pounds) |
|---|---|---|---|---|
| January | 3,248,566 | 0.8 | ND | 0.023 |
| February | 3,248,566 | 0.3 | ND | 0.007 |
| March | 3,248,566 | 0.7 | ND | 0.020 |
| April | 2,856,133 | 0.6 | ND | 0.014 |
| May | 2,856,133 | 0.1 | ND | 0.002 |
| June | 2,856,133 | 1.5 | ND | 0.036 |
| July | 4,111,200 | 0.7 | ND | 0.025 |
| August | 1,027,800 | 0.7 | ND | 0.006 |
| September | 2,055,600 | 48.0 | ND | 0.823 |
| October | 4329033 | 48.0 | ND | 1.734 |
| November | 4329033 | 1.5 | ND | 0.055 |
| December | 4329033 | 1.9 | ND | 0.067 |
| **Total amount removed** | **38,495,796** | | | **2.81** |

## Dissolved PCP

| Date<br>2014 | Volume of Water Pumped*<br>(gallons) | GRS Influent** PCP<br>(µg/L) | GRS Effluent** PCP<br>(µg/L) | Mass Removed<br>(pounds) |
|---|---|---|---|---|
| January | 3,248,566 | 4.1 | ND | 0.1 |
| February | 3,248,566 | 1.9 | ND | 0.1 |
| March | 3,248,566 | 3.8 | ND | 0.1 |
| April | 2,856,133 | 4.7 | ND | 0.1 |
| May | 2,856,133 | 2.2 | ND | 0.1 |
| June | 2,856,133 | 7.5 | ND | 0.2 |
| July | 4,111,200 | 7.2 | ND | 0.2 |
| August | 1,027,800 | 7.2 | ND | 0.1 |
| September | 2,055,600 | 4.1 | ND | 0.1 |
| October | 4329033 | 4.4 | ND | 0.2 |
| November | 4329033 | 3.7 | ND | 0.1 |
| December | 4329033 | 2.7 | ND | 0.1 |
| **Total amount removed** | **38,495,796** | | | **1.38** |

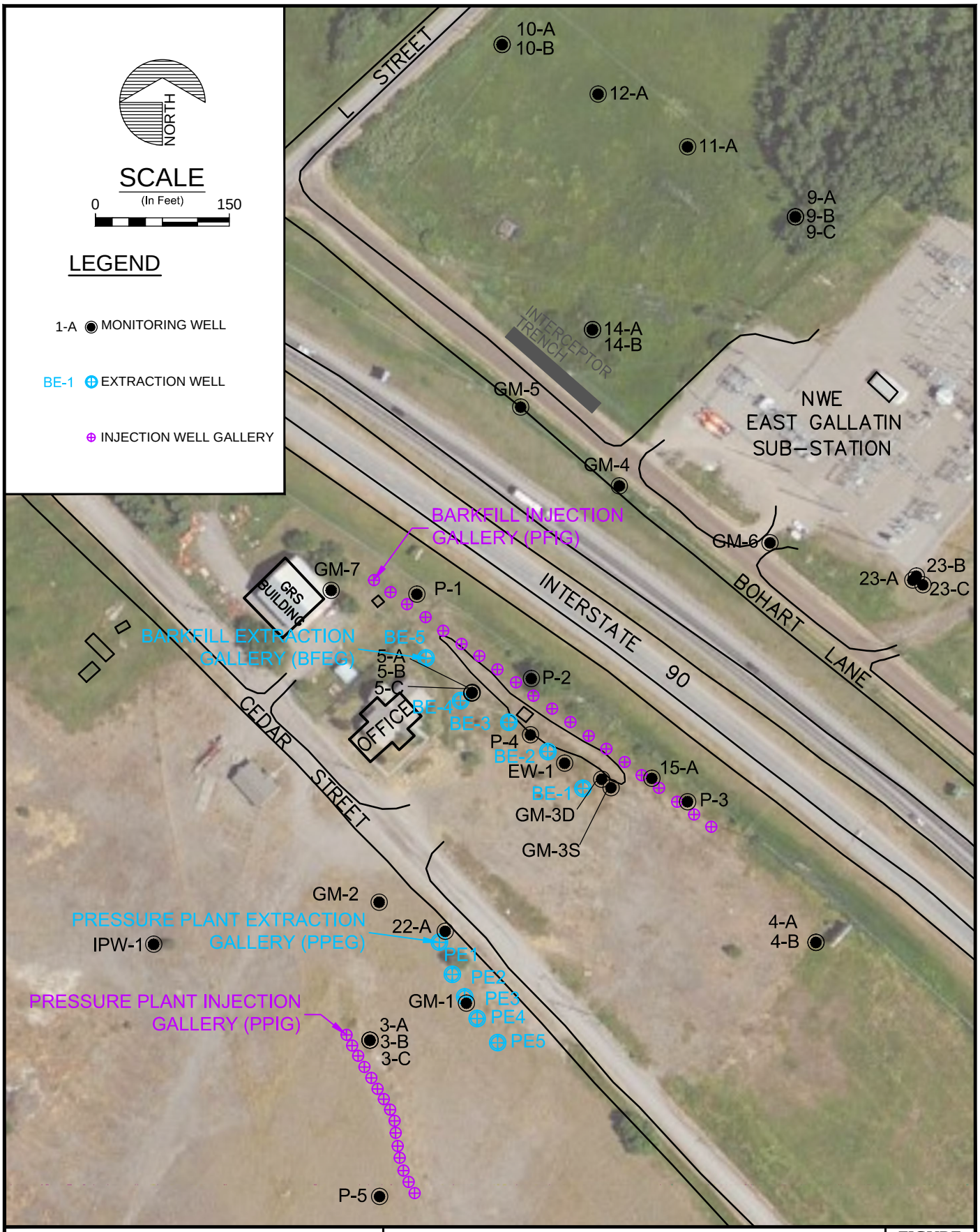
ND - Indicates no detection of analyte

PAH - Poly aromatic hydrocarbons

PCP - Pentachlorophenol

* - Values are derived from quarterly totals divided by three months, except for third quarter when the GRS was down from Aug 8 to Sept 16

** - Values for GRS influent are from sample port SP-2. GRS effluent is from sample port SP-6 or SP-7




| IDAHO POLE COMPANY<br>BOZEMAN, MONTANA<br>5029-300 | **GROUNDWATER REMEDY SYSTEM COMPONENTS IPC - BOZEMAN, MT** | FIGURE<br>**4-1** |
|---|---|---|

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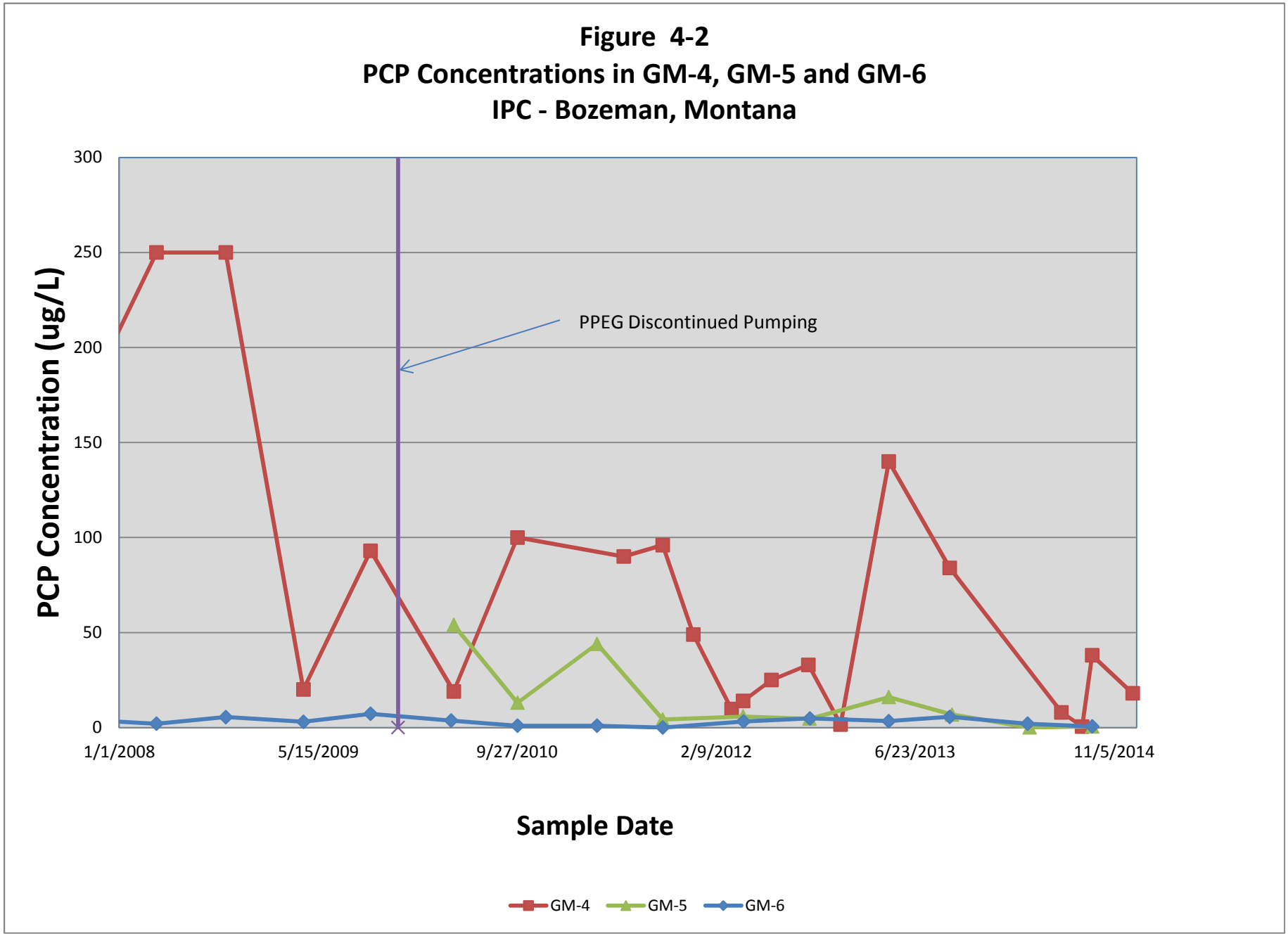


Figure 4-2
PCP Concentrations in GM-4, GM-5 and GM-6
IPC - Bozeman, Montana
PCP Concentration (ug/L)
300
250
200
150
100
50
0
PPEG Discontinued Pumping
1/1/2008
5/15/2009
9/27/2010
2/9/2012
6/23/2013
11/5/2014
Sample Date
GM-4
GM-5
GM-6

# 5.0 GROUNDWATER QUALITY SUMMARY AND EVALUATION

Methodologies, results and discussions of groundwater monitoring conducted at the Site, to fulfill the requirements by the USEPA and MDEQ, are presented in this section. Groundwater was monitored in three different programs including site-wide groundwater (twice a year), residential wells (annually except Res-8 which is semi-annually) and the GRS (monthly). The following is a summary of groundwater sampling results and GRS performance.

## 5.1 SITE-WIDE GROUNDWATER QUALITY

Site-wide groundwater monitoring was conducted in April and September 2014. The samples were analyzed for PCP and PAH compounds. The following is a discussion of site-wide groundwater quality. In general, PCP concentrations have decreased or been similar in site groundwater monitoring wells over the past several years. A downward trend of PCP concentrations has been observed in the wells surrounding, or within, the PCP plume as shown on the time versus concentration graphs in Exhibit 1. The PCP plume extent has been decreasing as a result of the GRS system operations, natural attenuation and source removal. As shown in Figures 5-1 through 5-8, the PCP plume with concentrations greater than 1 µg/L, reduced substantially in size in 2014 in the A wells as compared to previous years.
The 2014 PCP iso-contours for the 'B' wells also substantially reduced in size as compared to previous years as shown on Figures 5-9 and 5-10. A small PCP plume just downgradient of the PPIG is observed in September 2014 (Figure 5-9) at well 3-B. This well is only sampled every five years. PCP concentrations were <0.25 µg/L in 2009 at this well.

Overall, PCP concentrations decreased during 2014. While some fluctuation was observed in some of the site wide wells, the trend over the life of the project is decreasing concentrations. The relatively large decreases that were observed during the early years of the project are no longer apparent. Data obtained from the sampling of additional wells during the 2013 and 2014 resulted in migration of the highest concentrations observed eastward from Well 5A to Well P-4. Well P-4 is located between two BFEG wells. Three monitoring wells downgradient of the GRS exhibited concentrations of PCP that were either the lowest on

record (GM-6) or the first non-detects (9-C and 27-B in the fall). Otherwise, the 2014 concentrations were within the historical range for each site well.

Wells are sampled for PAH compounds annually in the fall. The September 2014 analytical results indicated that three of nine wells (Wells 5-A, 15-A and 22) contained either non-carcinogenic or carcinogenic PAH compounds. These three wells are within the GRS area. Wells GM-4 and GM-5, which typically have low concentrations of PAH compounds, were below detection levels for PAH's in 2014.

## 5.2 RESIDENTIAL WELLS

Residential well sampling was conducted in September 2014, with Well Res-8 sampled in both April and September. With the exception of Well Res-8, all residential well concentrations of PCP have been less than the drinking water standard, 1 part per billion, since sampling began in the mid-1990s and for the most part have been below the detection level of 0.05 parts per billion. The Res-8 property is owned by IPC and Well Res-8 is no longer used for residential purposes. Well Res-8 has historically had observed concentrations of PCP with the exception of samples collected in 2010 and early 2011, where levels were below detection. In 2014, PCP concentrations at Res-8 were again below detection limits during both sampling events.

## 5.3 GROUNDWATER REMEDY SYSTEM

In 2014, the GRS processed approximately 38,495,800 gallons of groundwater during operations from January to December. Approximately 548,356,400 gallons have been processed since start-up of the treatment system in February 1997. The monthly sampling data illustrate the GRS removal of PCP and PAH compounds from the groundwater. During 2014, all treated water discharged to the injection galleries was below reinjection limits and/or detection limits for PCP and PAH compounds. Improvements in groundwater quality at the Site indicate the GRS and monitoring program meets ROD performance and compliance requirements.

During 2014, the GRS removed approximately 2.81 pounds of total PAH compounds and 1.38 pounds of PCP. Overall, approximately 59 pounds of total PAH compounds and 286 pounds of PCP have been removed since startup in 1997.

## 5.4 GROUNDWATER REMEDY SYSTEM EFFECTIVENESS

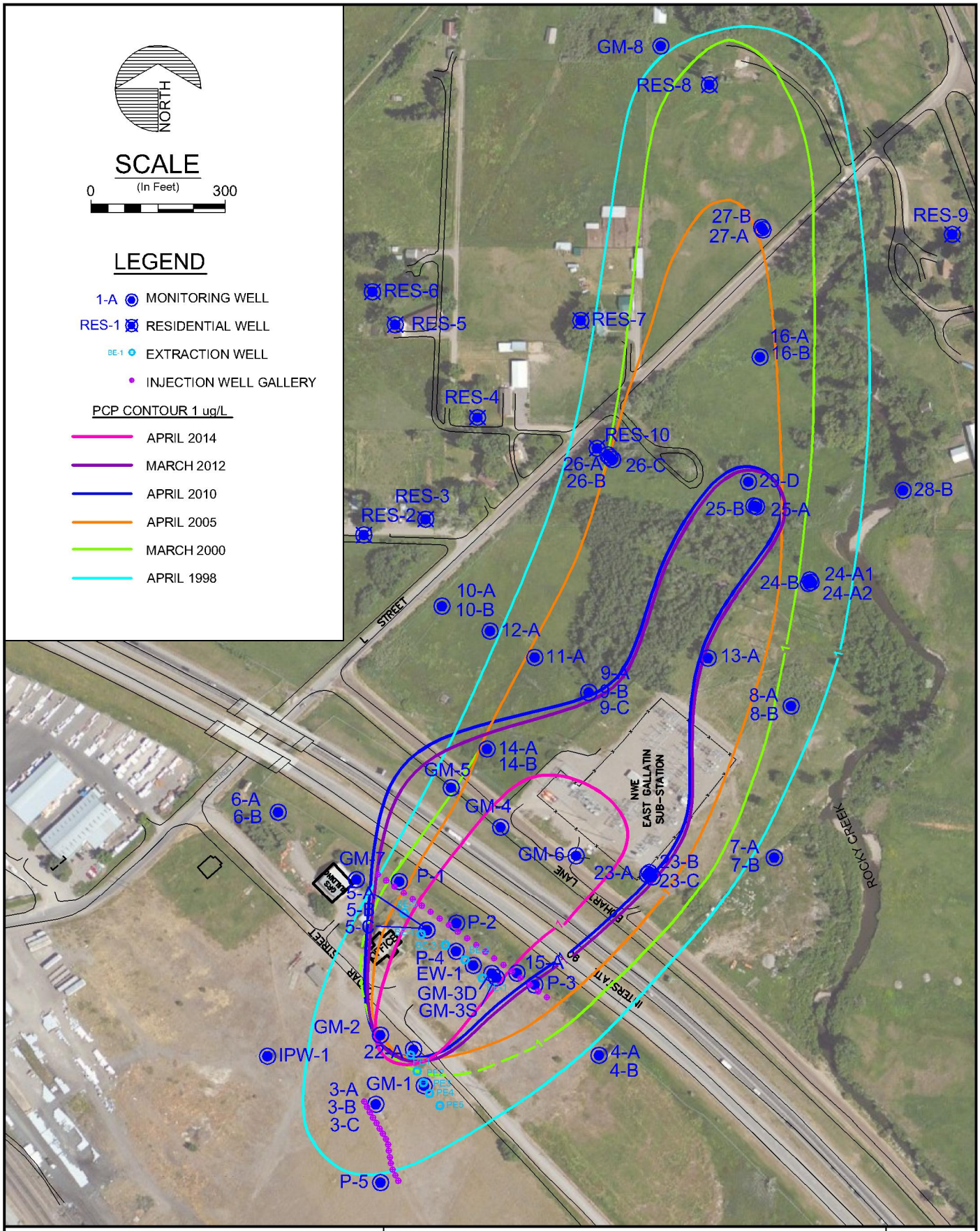
The GRS was installed and operating by February 1997 to treat contaminated groundwater present at the Site. Monthly monitoring of the GRS has ensured performance and has maintained compliance with the ROD cleanup standards. As shown on Figures 2-7 and 2-8, the current PCP plume has been reduced in size into two smaller plumes that are observed between the former pressure plant area to Well 16-B. Overall, PCP concentrations continue to decrease at the site. The 2014 plume(s) have reduced notably as compared to the 2013 and 2012 plumes, as delineated by the 1 µg/L so-contour as shown on Figures 5-1 and Figure 5-10.

The GRS effectively recovered and treated 38,495,796 gallons of impacted groundwater at the Site in 2014. The plume (PCP and PAH) constituent concentrations have decreased over time and the overall plume dimensions have decreased. Based on performance sampling results, the GRS has effectively treated recovered groundwater to meet ROD limits and has only re-injected water that meets these standards.

Groundwater from monitoring Well GM-4 has been sampled quarterly for PCP concentrations per the USEPA March 26, 2010 letter. Figure 4-2 presents a graph showing PCP concentrations at GM-4, GM-5 and GM-6, located downgradient from the GRS, since BFEG shutdown. PCP concentrations have remained at or below levels observed prior to system shutdown with an overall decreasing trend.

New extraction pumps installed at the four operation BFEG wells in June 2014 have increased pumping rates from an average of 60 gpm to almost 110 gpm. This higher pumping rate is slightly greater than the recommended pumping rate of 100 gpm recommended by the RSE team to reduce gaps in capture that may be occurring at lower pumping rates.

Routine monitoring will be conducted in 2015 to continue evaluation of GRS performance and progress toward Site treatment goals. GM-4 will continue to be monitored on a quarterly basis to evaluate effects of PPEG shutdown in 2009. Monitoring results and a performance evaluation will be included in the 2015 Groundwater Quality Assessment Report. Additional investigation is being performed up-gradient of the BFEG to evaluate additional treatment options to accelerate site cleanup. Results of these activities will also be included in the 2015 Report.




| IDAHO POLE COMPANY<br>BOZEMAN, MONTANA<br>5029-300 | **PCP ISOCONTOURS 1 UG/L IN "A" WELLS**<br>**SPRING SAMPLING EVENT**<br>**IPC - BOZEMAN, MT** | FIGURE<br>**5-1** |
|---|---|---|

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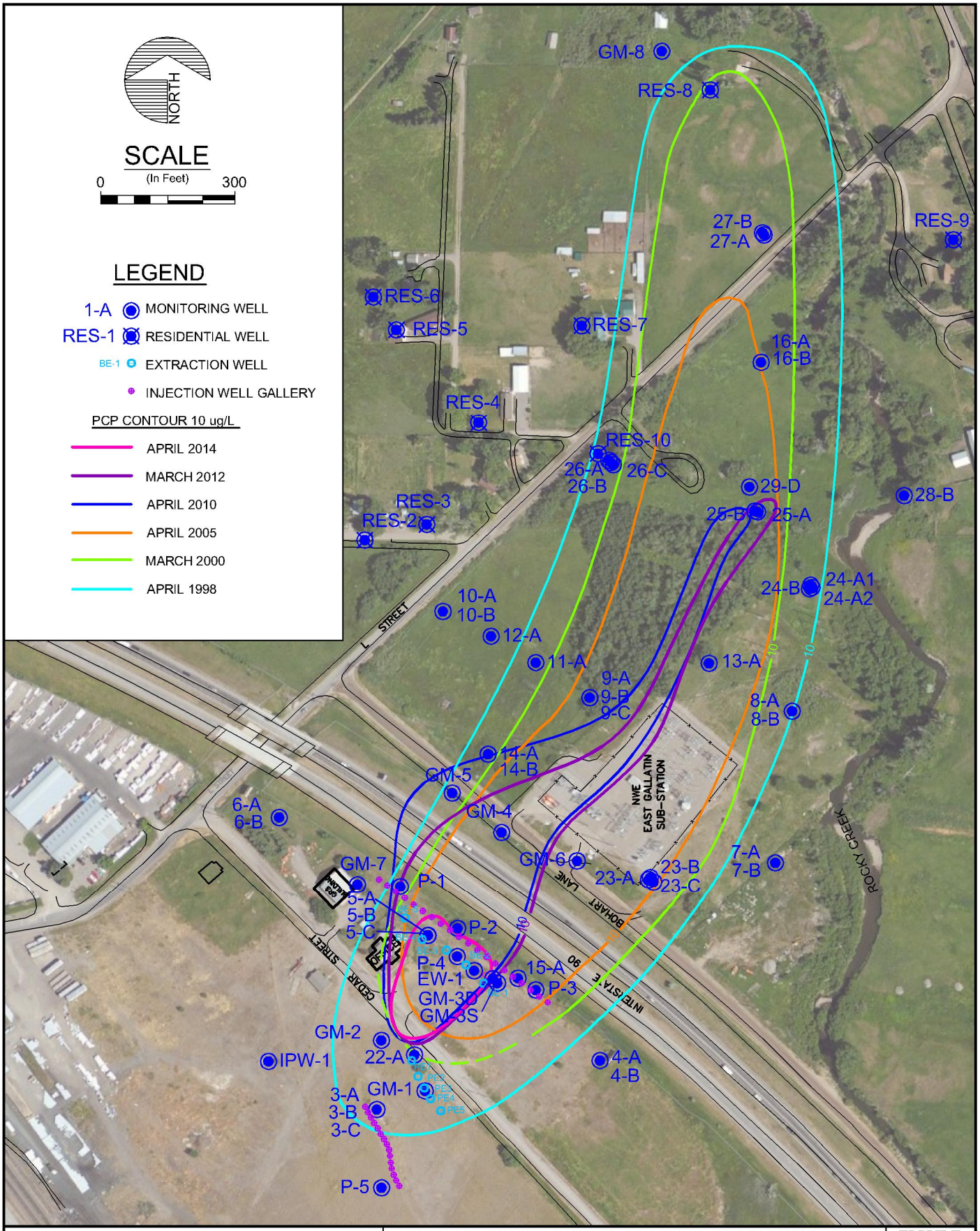


| IDAHO POLE COMPANY<br>BOZEMAN, MONTANA<br>5029-300 | **PCP ISOCONTOURS 10 UG/L IN "A" WELLS**<br>**SPRING SAMPLING EVENT**<br>**IPC - BOZEMAN, MT** | FIGURE<br>**5-2** |
|---|---|---|

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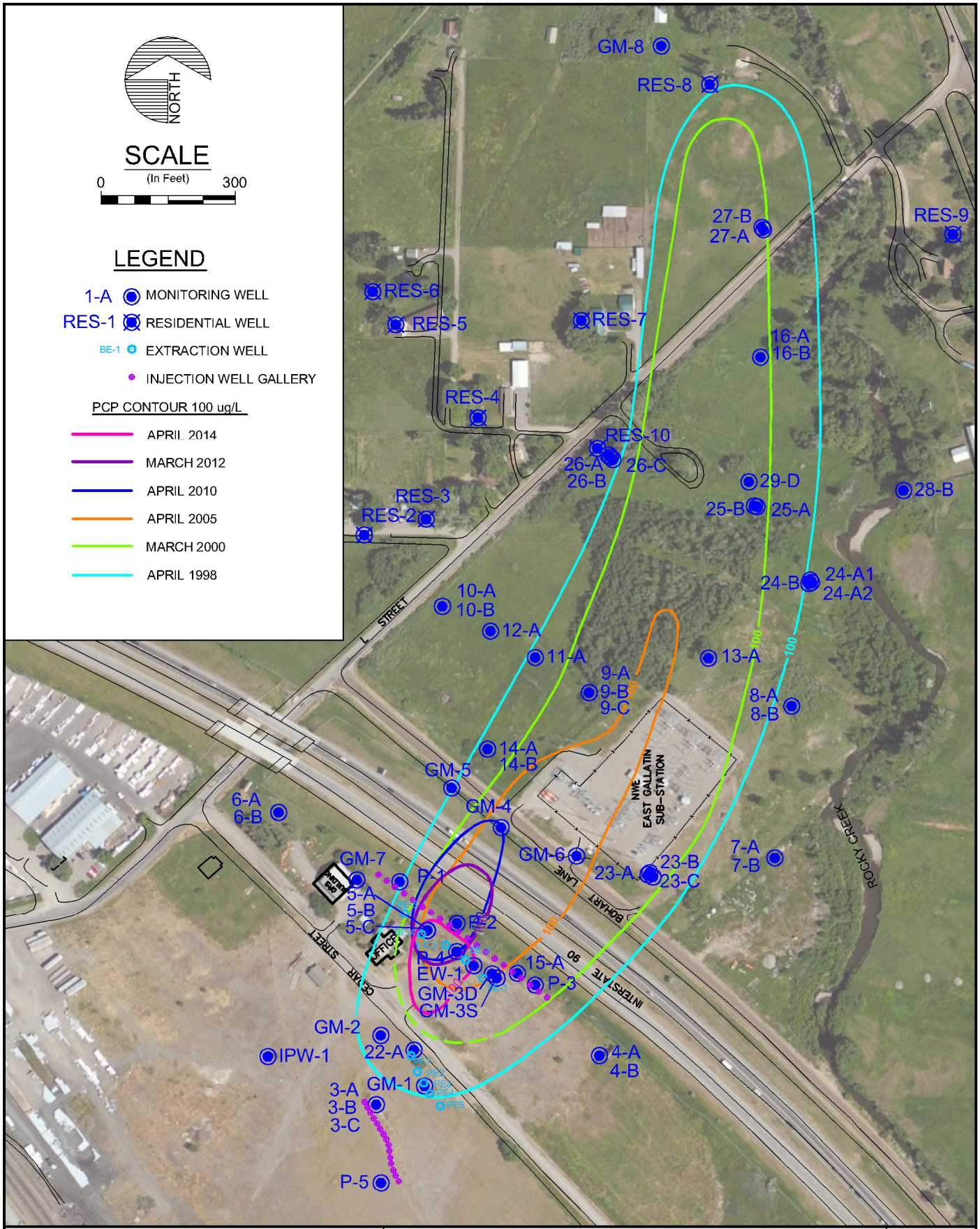


| IDAHO POLE COMPANY<br>BOZEMAN, MONTANA<br>5029-300 | **PCP ISOCONTOURS 100 UG/L IN "A" WELLS<br>SPRING SAMPLING EVENT<br>IPC - BOZEMAN, MT** | FIGURE<br>**5-3** |
|---|---|---|

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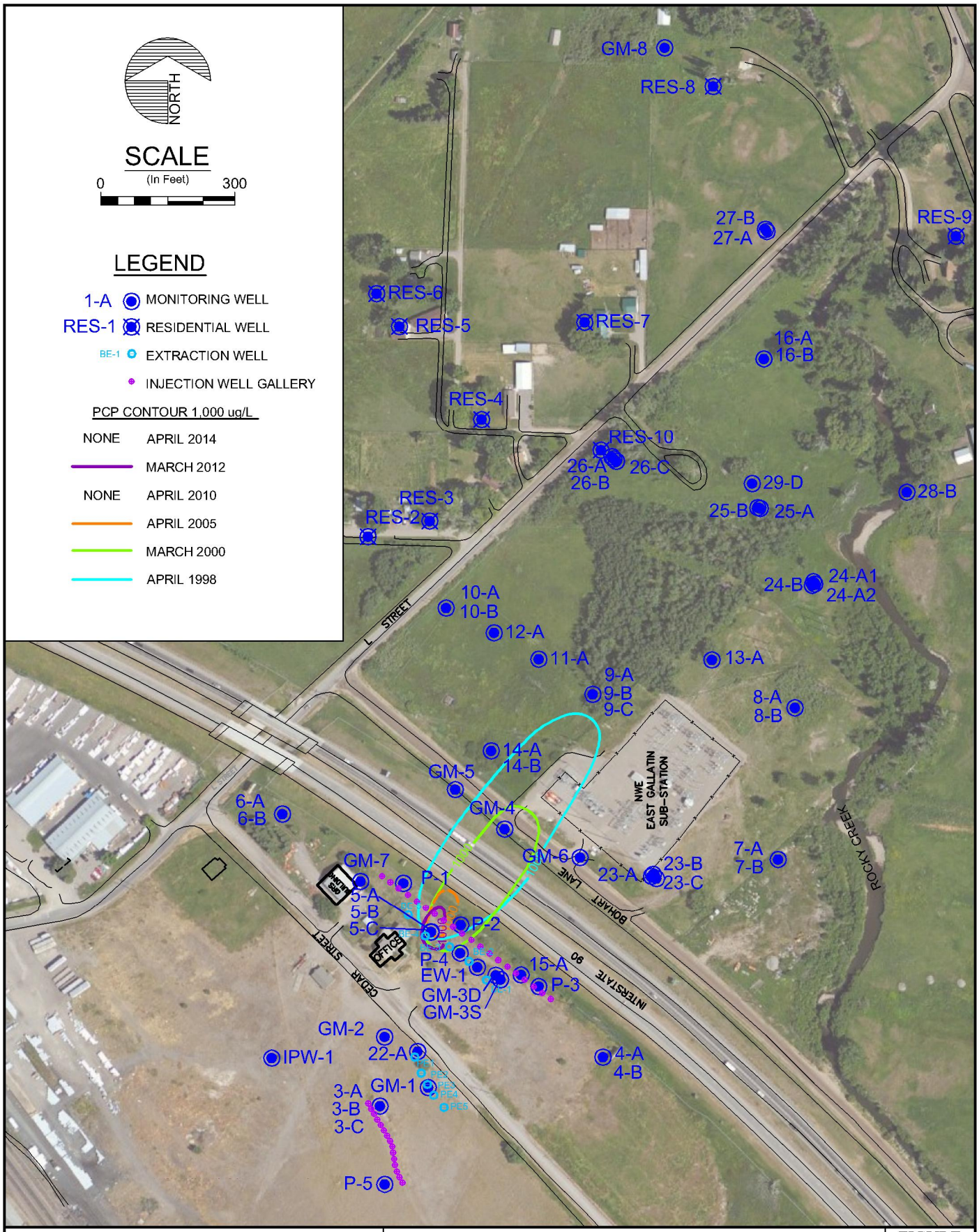


| IDAHO POLE COMPANY<br>BOZEMAN, MONTANA<br>5029-300 | **PCP ISOCONTOURS 1000 UG/L IN "A" WELLS**<br>**SPRING SAMPLING EVENT**<br>**IPC - BOZEMAN, MT** | FIGURE<br>**5-4** |
|---|---|---|

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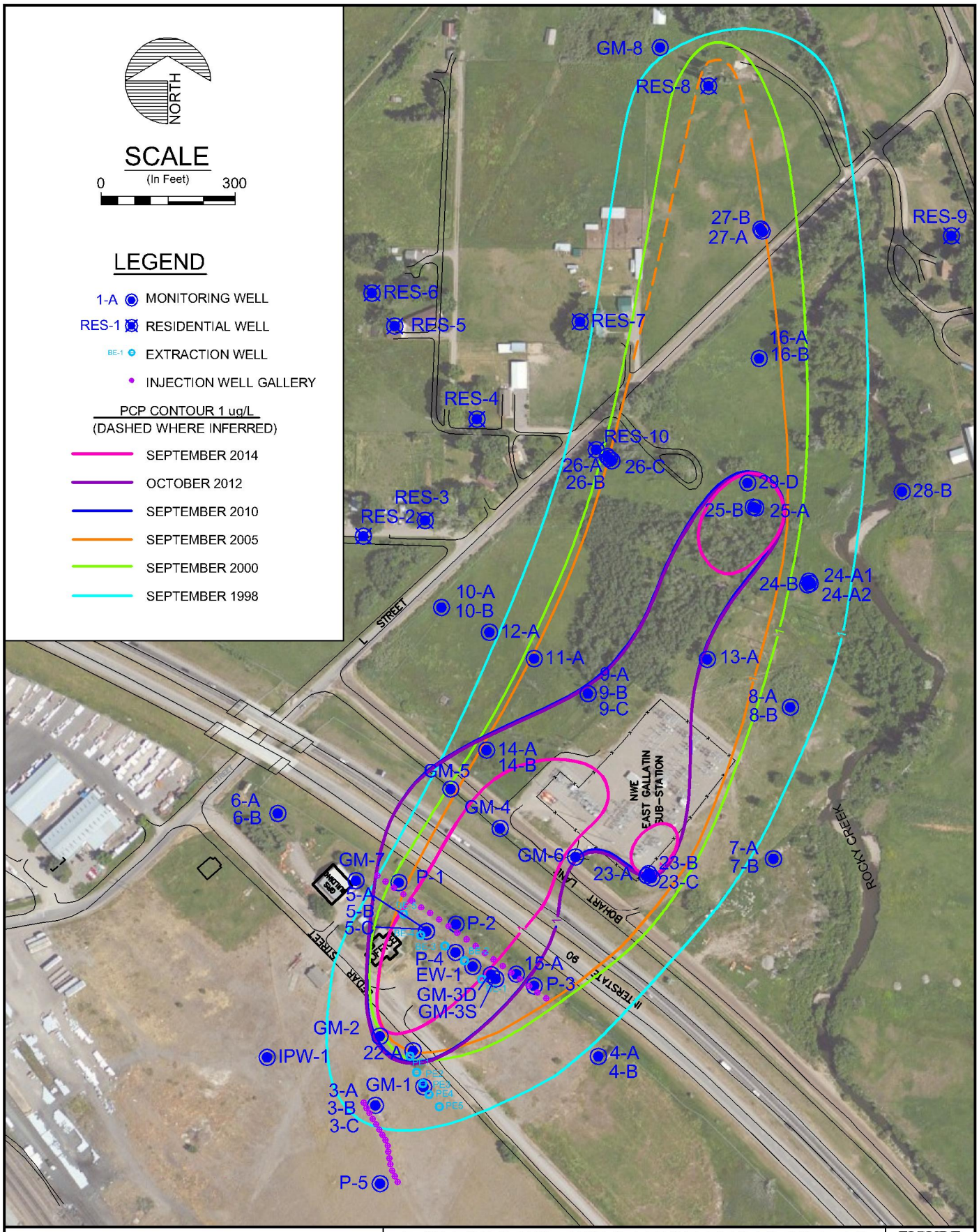


| IDAHO POLE COMPANY<br>BOZEMAN, MONTANA<br>5029-300 | **PCP ISOCONTOURS 1 UG/L IN "A" WELLS**<br>**FALL SAMPLING EVENT**<br>**IPC - BOZEMAN, MT** | FIGURE<br>**5-5** |
|---|---|---|

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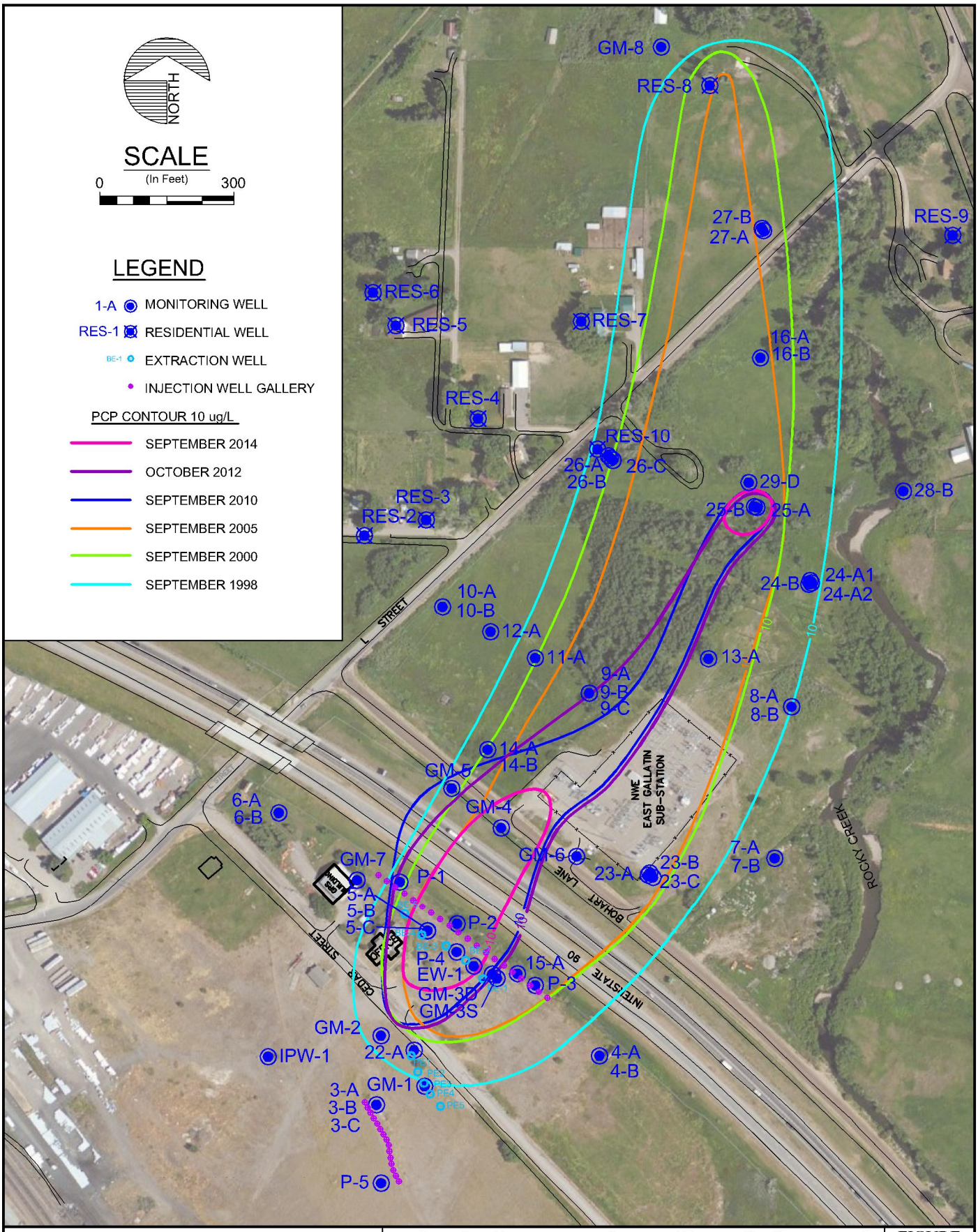


| IDAHO POLE COMPANY<br>BOZEMAN, MONTANA<br>5029-300 | **PCP ISOCONTOURS 10 UG/L IN "A" WELLS<br>FALL SAMPLING EVENT<br>IPC - BOZEMAN, MT** | FIGURE<br>**5-6** |
|---|---|---|

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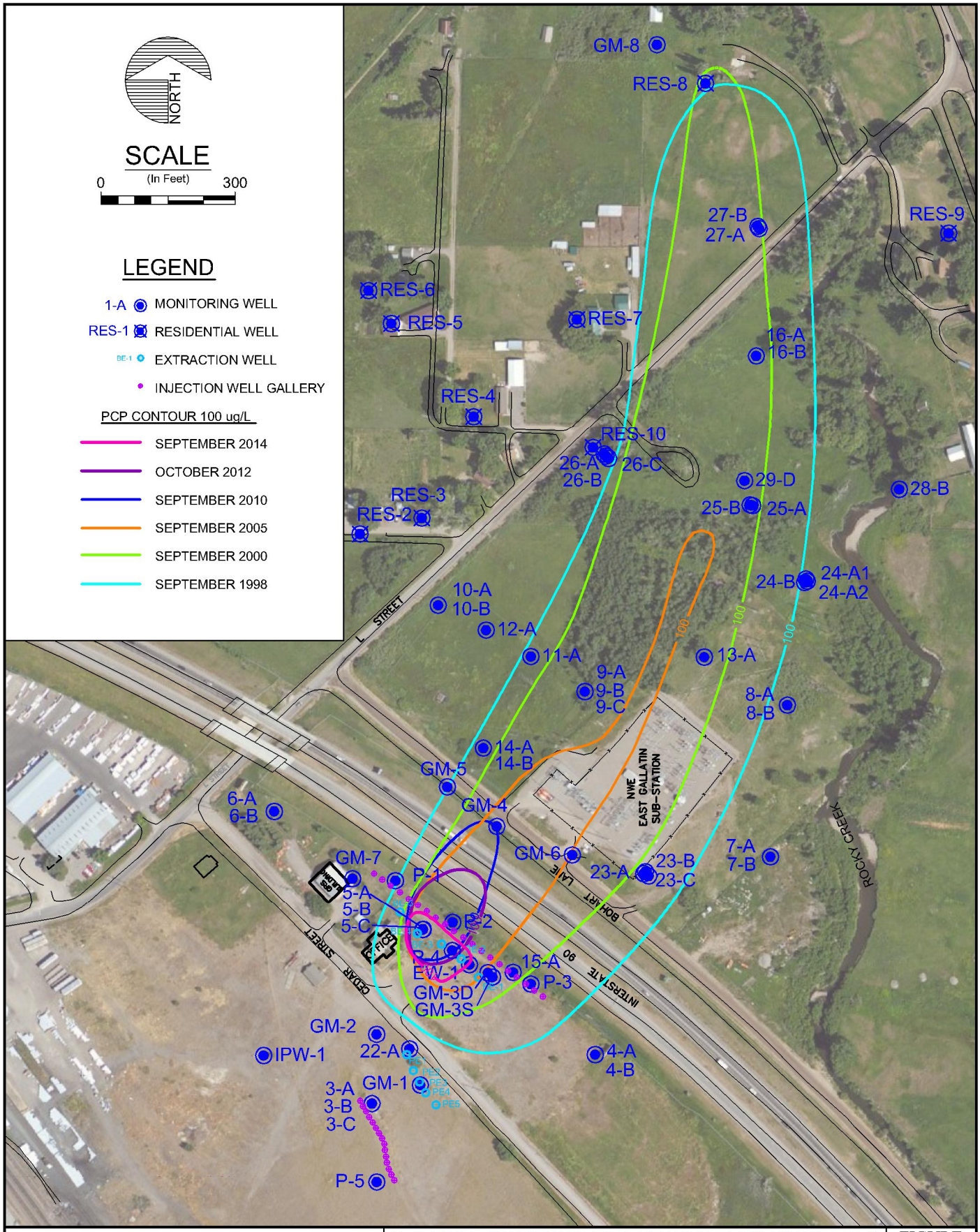


| IDAHO POLE COMPANY<br>BOZEMAN, MONTANA<br>5029-300 | **PCP ISOCONTOURS 100 UG/L IN "A" WELLS**<br>**FALL SAMPLING EVENT**<br>**IPC - BOZEMAN, MT** | FIGURE<br>**5-7** |
|---|---|---|

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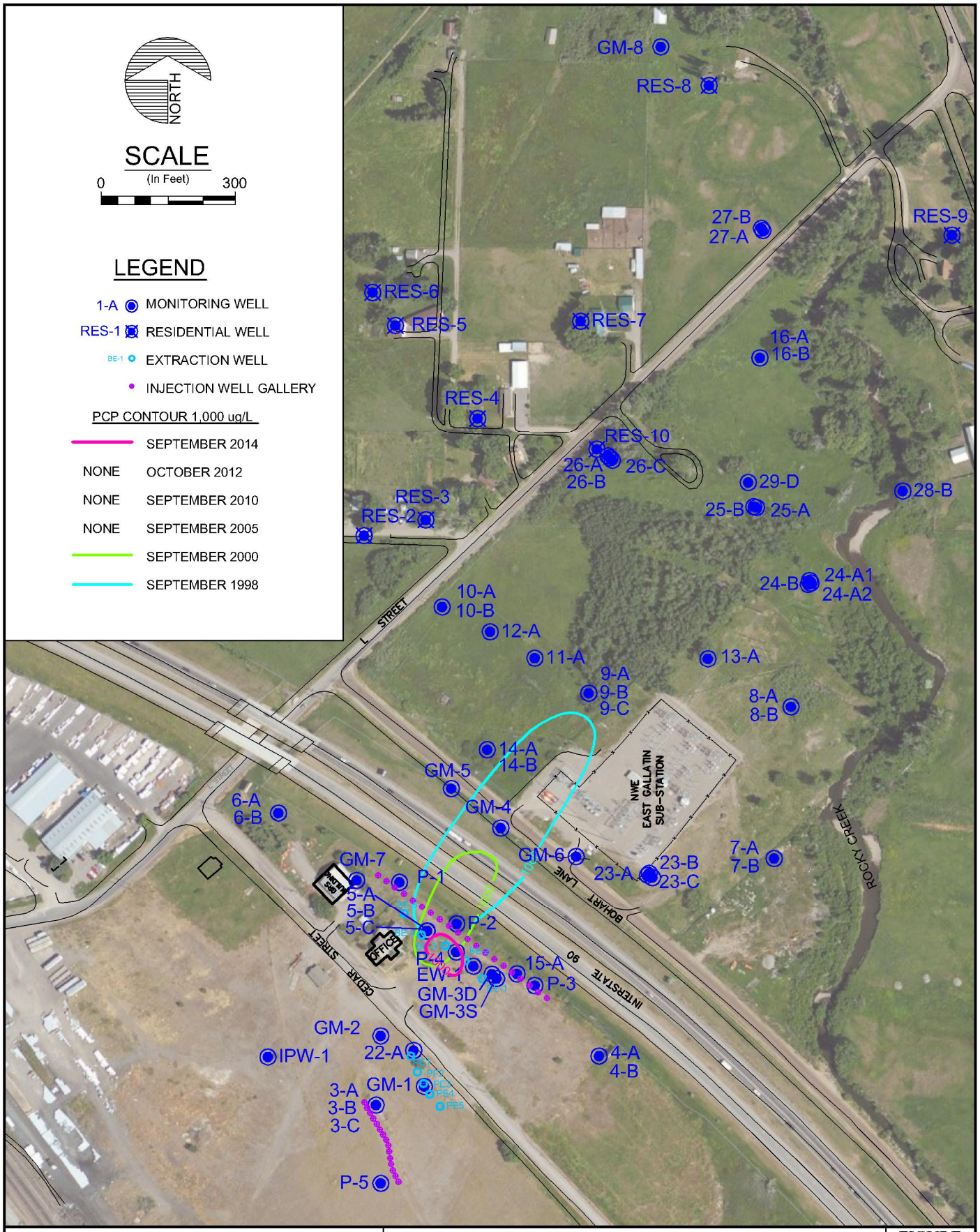


| IDAHO POLE COMPANY<br>BOZEMAN, MONTANA<br>5029-300 | **PCP ISOCONTOURS 1000 UG/L IN "A" WELLS**<br>**FALL SAMPLING EVENT**<br>**IPC - BOZEMAN, MT** | FIGURE<br>**5-8** |
|---|---|---|

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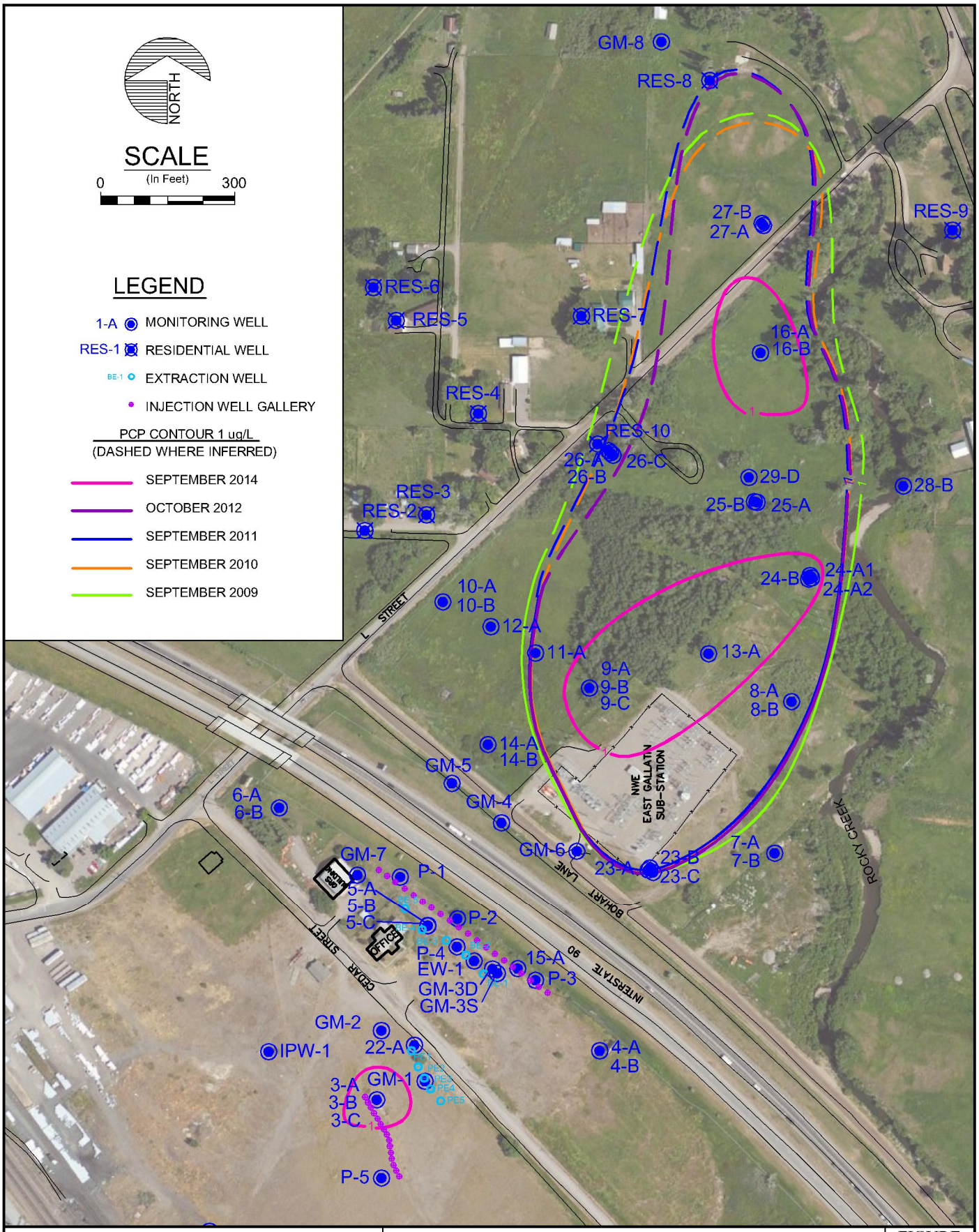


| IDAHO POLE COMPANY<br>BOZEMAN, MONTANA<br>5029-300 | **PCP ISOCONTOURS 1 UG/L IN "B" WELLS<br>FALL SAMPLING EVENT<br>IPC - BOZEMAN, MT** | FIGURE<br>**5-9** |
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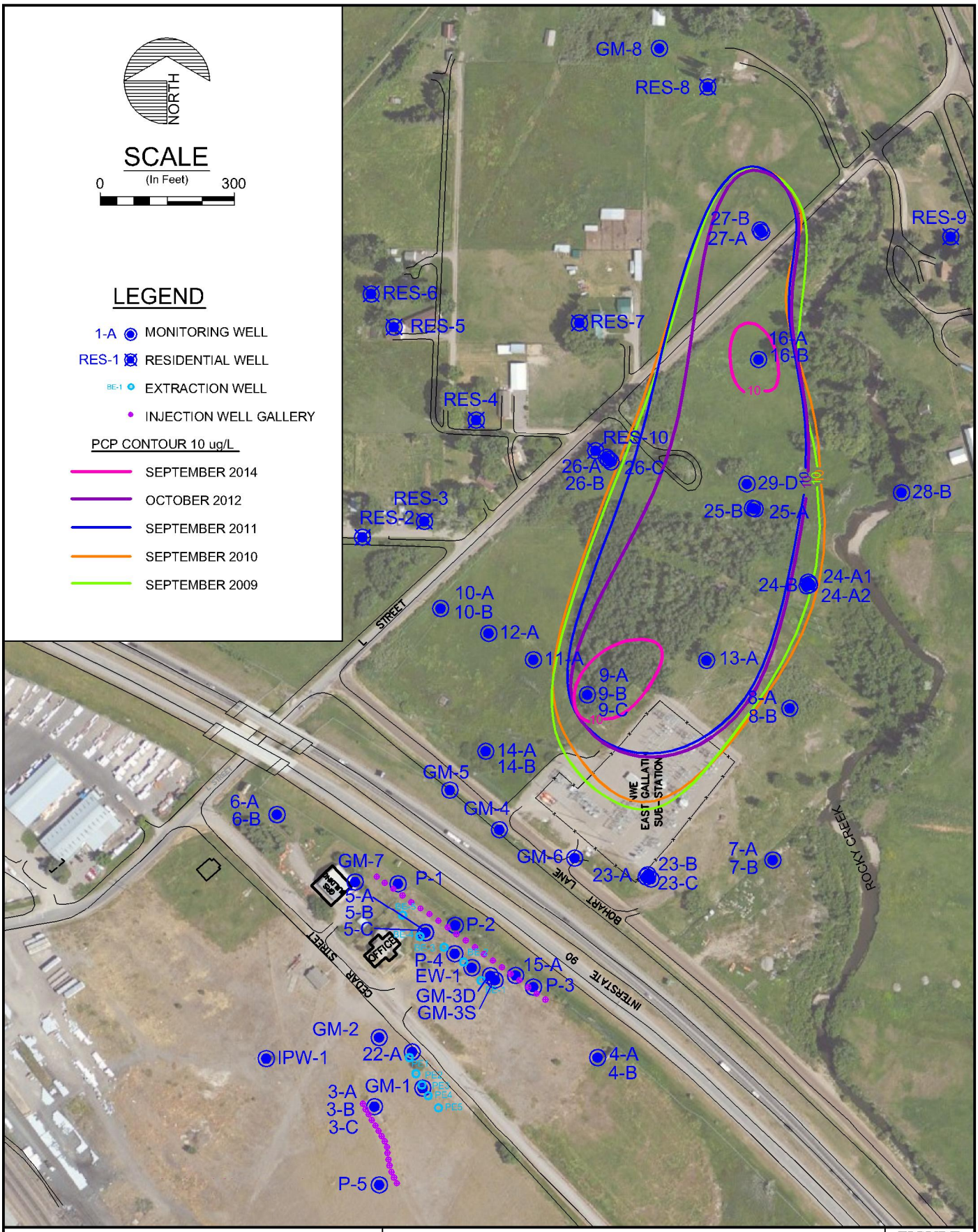


| IDAHO POLE COMPANY<br>BOZEMAN, MONTANA<br>5029-300 | **PCP ISOCONTOURS 10 UG/L IN "B" WELLS<br>FALL SAMPLING EVENT<br>IPC - BOZEMAN, MT** | FIGURE<br>**5-10** |
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**APPENDICES A THROUGH L ARE INCLUDED AS SEPARATE ATTACHMENTS**