Texas Custodial Trust

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Field Demonstration of Zerovalent Iron Treatment Technology in Parker Brothers Arroyo – Status Report

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Acronyms

AOI	analytes of interest
amsl	above mean sea level
ASARCO	Former ASARCO LLC
ASTM	American Society for Testing and Materials
bgs	below ground surface
COC	constituents of concern
CQA	construction quality assurance
DTW	depth to water
ft	feet
ft/day	feet per day
ft^2	square feet
MCL	Maximum Contaminant Levels
mg/L	milligrams per liter
PBA	Parker Brothers Arroyo
PRB	permeable reactive barrier
PVP	point velocity probe
SC	specific conductivity
SPLP	synthetic precipitation leaching procedure
SWTT	single well tracer test
TCEQ	Texas Commission on Environmental Quality
TDS	total dissolved solids
Trust	Texas Custodial Trust
USEPA	United States Environmental Protection Agency
ZVI	zerovalent iron

1. Introduction

Remedial action at the Former ASARCO LLC (ASARCO) El Paso Smelter (the Site) is being conducted by the Texas Custodial Trust (Trust), the property Trustee, on behalf of the Trust's beneficiaries, the Texas Commission on Environmental Quality (TCEQ), the United States Environmental Protection Agency (USEPA), and the United States Department of Justice. Environmental impacts from historical smelting operations are present within the plant site, the adjacent arroyos, the floodplain of the Rio Grande west of the plant site, and the East Property located east of Interstate 10.

This Status Report presents the details associated with construction of the *in situ* zerovalent iron (ZVI)-based permeable reactive barriers (PRBs) located in Parker Brothers Arroyo (PBA) along with current performance results. The objectives of this field demonstration are to verify the effectiveness of the targeted PRB technology, initiate groundwater remediation at the Site, and provide data to support the final site-wide groundwater remedy.

Installation of the entire performance monitoring network was completed in June 2013 which facilitated a comprehensive evaluation of PRB performance. Performance monitoring results indicate the following:

- Impacted groundwater is flowing through PRB-1 and PRB-2 consistent with design parameters.
- In-wall monitoring wells at PRB-1 (EP-141B) and PRB-2 (EP-150) show a reduction in antimony, selenium, and thallium concentrations to below their respective regulatory maximum contaminant levels (MCLs).
- In-wall monitoring wells at PRB-1 (EP-141B) and PRB-2 (EP-150) show total arsenic concentration declines of at least 96 percent.

Additional data provided in this report further support the effectiveness of this technology. PRB performance monitoring will continue on a semi-annual frequency throughout 2014. The next status update will be provided in mid-2014.

1.1. Background

The remedial strategy being pursued for groundwater involves significantly reducing the flux of constituents of concern (COCs) leaving the Site to minimize long-term risks to groundwater and potential surface water receptors (see Figure 1). Due to its elevated concentrations, areal extent, and presence in surface water, arsenic has been identified as

the primary groundwater COC at the Site, and thus is the primary driver for remedial efforts at the Site. Arsenic concentrations in PBA groundwater vary spatially and seasonally, but generally range from 1 to 2 milligrams per liter (mg/L) (see Figure 2). Other groundwater COCs that exceed standards in PBA groundwater are antimony, cadmium, molybdenum, selenium, and thallium.

Analysis of the Site hydrogeologic data shows that groundwater passing through PBA contributes the largest COC flux of all arroyos at the Site and thus has been the focus of the initial remediation activities. With the removal of slag and impacted soil from PBA, the primary remaining sources of COCs to PBA groundwater are the Ephemeral Pond and Plant Site (northern portion including the Boneyard) areas. Due to the presence of saturated slag at depth and the enhanced recharge from ponded water, the Ephemeral Pond area is considered the most significant source of groundwater impacts in PBA (Malcolm Pirnie 2011a). The other areas are being evaluated to be capped.

Groundwater in PBA is present within an unconfined alluvial aquifer underlain by a regional bedrock unit of low conductivity (Alvarez and Buckner 1980). The alluvial PBA groundwater flows west into the floodplain, ultimately discharging to the Rio Grande. The lateral extent of alluvial groundwater and COC migration is controlled by the underlying bedrock surface and, to a lesser extent, the coarseness of alluvial sediments. The saturated alluvium ranges in thickness from 10 to 30 feet (ft) and is well understood due to the hydraulic monitoring data from the PRB monitoring network presented herein.

As discussed in the *Field Demonstration of ZVI Treatment Technology in Parker Brothers Arroyo*, referred to as the "Design Report", the PRB technology relies on groundwater flow through an emplaced zone of permeable reactive medium, resulting in a "barrier" to contaminant transport (Malcolm Pirnie 2012). The basis of design and objectives of the field demonstration are discussed in Section 2.

Construction of the two ZVI PRBs was completed in October 2012 and was discussed in a letter titled *PRB Field Demonstration – Three Month Status Update*, submitted to TCEQ on February 15, 2013 (Malcolm Pirnie 2013). This letter included an overview of construction and performance monitoring data collected from a subset of the monitoring network.

This report includes a complete summary of construction and performance results:

- **Section** 2 summarizes the design of the PRBs and the objectives of the field demonstration.
- **Section** 3 provides construction quality assurance (CQA) information and discusses construction of the performance monitoring network in July 2013.

- **Section** 4 discusses the two sampling events that were conducted with the full performance monitoring network in July and September 2013.
- **Section** 5 presents the performance monitoring results and provides a comparison of these data with the field demonstration objectives.
- **Section** 6 proposes a revised monitoring program, based on the monitoring conducted to date, and includes an updated schedule for this program.

2. Field Demonstration Design

The proposed remedial action to reduce COC mass flux in PBA includes a combination of the following: 1) source control via removal and/or capping (soil remedial actions), 2) reduction of groundwater recharge by means of an upgradient hydraulic barrier and reduction of infiltration in the arroyo itself (surface water remedial actions), and 3) direct interception and treatment of groundwater in PBA with the ZVI PRB technology.

The PRB technology relies on groundwater flow through an emplaced zone of permeable reactive medium. This results in the passive treatment of groundwater as it flows through the medium, essentially creating a "barrier" to contaminant transport over the designed lifetime of the PRB. The effective removal of arsenic from groundwater by ZVI has been demonstrated extensively *(*e.g., Su and Puls 2001a, Su and Puls 2001b, Melitas *et al* 2002, Kober *et al* 2005, and Su 2007). More recently, the field demonstration of a ZVI-based PRB designed specifically to treat arsenic was shown to be effective (Wilkin *et al* 2009, Beak and Wilkin 2009). The primary removal mechanisms include adsorption to and co-precipitation with fresh forms of iron that are produced as the ZVI corrodes, such as oxides, sulfides, carbonates, and carbonate/sulfate green rusts (Beak and Wilkin 2009). The effectiveness of the ZVI PRB in PBA is enhanced by the bedrock topography, which channelizes groundwater flow through a concentrated area, making it practical to construct a permeable zone of reactive medium that intercepts the saturated zone (see Figure 3).

The field demonstration includes two PRBs, referred to as PRB-1 and PRB-2 (Figure 2):

- PRB-1 is located downgradient of the Fines Pile and Ephemeral Pond areas to intercept and treat groundwater from these source areas. This begins the interception of COC mass in groundwater before the planned source remediation is complete, helping to mitigate the ongoing migration of additional mass downgradient and begin the process of restoring groundwater.

- PRB-2 is located approximately 470 ft downgradient of PRB-1 in an area where PBA groundwater flow is focused in an incised alluvial channel bounded by bedrock outcrops. In addition to being evaluated for individual performance as part of the demonstration, this location will also support evaluation of the potential additive effect PRB-2 may have, working in conjunction with PRB-1 to remove arsenic and other COCs from the aquifer in PBA.

The following sections present the design basis and objectives of the field demonstration.

2.1. Field Demonstration Design Basis

In addition to proper orientation and configuration to intercept the zone of impacted groundwater, there are three critical factors to the long-term success of PRBs:

1. The PRBs must be more permeable than the surrounding aquifer throughout their design life for proper hydraulic performance. As the barriers age, pore space becomes increasingly occupied by chemical precipitates and fine-grained soil particles carried through groundwater. To ensure that the PRB is not hydraulically "bypassed" before the end of its estimated lifetime, the decrease in hydraulic conductivity must be accounted for in design.

2. To support adequate reaction kinetics, provide sufficient uptake capacity, and remain reactive throughout its design life, there must be sufficient media, because treatment via ZVI is contact-driven and ultimately results in the retention of both targeted and non-targeted inorganics within the PRB matrix.

3. Groundwater residence time in the PRB must remain sufficient to complete the desired degree of treatment, based on the reaction kinetics exhibited by the medium.

The design was based on an understanding of the aquifer characteristics and geochemistry in the vicinity of the proposed PRBs, and the anticipated effectiveness of the specific ZVI targeted for use in treating site-specific groundwater to address these factors. Aquifer characterization activities included identifying the extent of the saturated zone (to establish that it is adequately intercepted), the nature of the hydraulics (to establish proper orientation, hydraulic conductivity, and support estimation of residence times), and the distribution of COC concentrations (to support estimates of mass flux). Given that reaction kinetics and uptake capacity vary based on the properties of the specific ZVI targeted for use and the site-specific groundwater chemistry, laboratory treatability testing was performed prior to finalization of the PRB design. These pre-design activities and the resulting design parameters are discussed in detail in the Design Report (Malcolm Pirnie 2012).

2.2. Field Demonstration Objectives

The objective of this field demonstration is to verify the effectiveness of the targeted PRB technology, initiate groundwater remediation at the Site, and provide data to support full-scale design of other PRB applications as part of the final site-wide groundwater remedy. The specific performance objectives of this field demonstration are as follows:

1. Confirm the effectiveness of the PRBs in removing COCs from the groundwater. Evaluation of PRB performance includes a focus on treatment of COCs within

and downgradient of the PRBs, along with confirmation of expected geochemistry, treatment kinetics and ZVI reactivity.

2. Confirm the hydraulic performance of the PRBs; specifically, show that groundwater is flowing through the reactive barriers. This includes evaluating hydraulic gradients, in-situ hydraulic conductivity, and measurement of groundwater seepage velocities.

Performance monitoring data are evaluated based on these objectives and are discussed in Section 5. Future performance monitoring data will be used to evaluate the performance longevity of the PRBs.

3. Installation

3.1. PRB-1 Construction

PRB-1 was constructed between September 10 and October 5, 2012. The construction process consisted of excavating the native alluvium and backfilling with a mixture of ZVI and sand (see Appendix A for PRB Backfill Design details) using a 20-foot by 8-foot slide-rail system, or modular trench box (see Appendix B1 for photographic logs of construction). This method begins with construction of a 20-foot cell, after which three sides of the slide-rail are removed and reinstalled to create the next 20-foot cell. A total of six 20-foot cells were installed for a total length of 120 ft for PRB-1 (see Figures 4 and 5). Comprehensive CQA monitoring was conducted to ensure that construction proceeded in accordance with the design. The design parameters and the corresponding CQA monitoring information and deviations from the design are as follows:

- Backfill Source – The PRB is composed of 70 percent sand / 30 percent ZVI by mass, as discussed in the Design Report. A regional sand source was identified and testing was conducted to verify that the source did not contain any contaminants that could negatively affect groundwater quality and that the mineralogy was appropriate for an inert backfill. Testing consisted of synthetic precipitation leaching procedure (SPLP, EPA SW-846 Method 1312) and a modified SPLP (pH 9) and X-Ray diffraction. The results, presented in Appendix A1 and A2, verified that the sand backfill was acceptable for use.

- Backfill Hydraulic Conductivity – The minimum required initial hydraulic conductivity of PRB-1 is 42 feet per day (ft/day) as discussed in the Design Report. The sand source was screened using a #16 sieve, and the sample was prepared at the design value (70 percent sand/ 30percent ZVI) for laboratory testing to estimate the hydraulic conductivity. Testing using American Society for Testing and Materials (ASTM) method D2434 estimated a hydraulic conductivity of 311.8 ft/day, which satisfies the design requirement (Appendix A3). *In situ* hydraulic conductivity estimates were conducted during performance monitoring to estimate the actual hydraulic conductivity after construction (Section 4).

- Backfill Gradation – Given the correlation of hydraulic conductivity and grain size (especially the fine fraction passing the #200 sieve) and based on hydraulic conductivity testing, a specification was produced to verify the gradation of the sand. Approximately 800 tons of sand material was used for PRB construction, and CQA monitoring of the grain size analysis was conducted on every truckload of material (approximately 30 tons) to verify specification. The critical

specification was less than 5 percent passing a #200 sieve; all results were less than 2.2 percent passing the 200 sieve (Appendix B2).

- Dimensions – The top and bottom corners of each cell were surveyed in order to verify and document the constructed dimensions of the PRB. The average bedrock elevation (bottom of the ZVI) was between 3,720 ft above mean sea level (amsl) at the south end (Cell A) and 3,727 ft amsl at the north end (Cell F). Each cell was advanced to sandstone bedrock as determined by lithologic logging of excavated material and survey of the bottom of the excavation. After advancement to bedrock, backfill material was placed in the cell. The PRB was completed to a top elevation of 3,736 ft amsl (see Figure 5). A photographic log of the PRB construction is included in Appendix B1, the cell lithology excavation logs are included in Appendix B3, and the construction survey data are included in Appendix B4.

- ZVI Content – The sand and ZVI was mixed off-site using a pug mill and transported to the Site for use. CQA monitoring was conducted to verify the percentage of ZVI content to the design specification of 30 percent by mass. Results were within 3 percent of this specification and estimates outside of the range prompted additional mixing and/or the addition of ZVI or sand to meet specification (Appendix B5). In total, 342 tons of ZVI were placed into PRB-1 which is consistent with the estimate of 370 tons which was based on the design specification of 30 percent by mass. This is a difference of less than 10 percent and is due to the variations in the as-built dimensions compared to dimensions assumed in the design.

3.2. PRB-2 Construction

PRB-2 was constructed 500 ft downgradient (west) of PRB-1, between October 8 and October 15, 2012. PRB-2 was constructed using the same methods as PRB-1; however, due to the narrowing of the PBA, only five 20-foot cells were constructed, resulting in a final PRB width of 100 ft (see Figures 4 and 6). As with PRB-1, comprehensive CQA monitoring was conducted to ensure construction proceeded in accordance with the design, as discussed below:

- Backfill Hydraulic Conductivity – The minimum required initial hydraulic conductivity of PRB-2 is 1,100 ft/day, as discussed in the Design Report. As with PRB-1, hydraulic conductivity testing was conducted using ASTM method D2434. The estimated hydraulic conductivity for PRB-2 is 7,370 ft/day, which satisfies the design requirement (Appendix A3). Hydraulic testing was conducted during performance monitoring to estimate the actual hydraulic conductivity, as discussed in Section 4.

- Backfill Gradation – Approximately 750 tons of sand material was used for construction, and CQA monitoring consisted of grain size analysis conducted on every truckload of material (approximately 30 tons) to verify specification. The critical specification was less than 5 percent passing a #200 sieve, and all results were less than 1.7 percent passing the 200 sieve (Appendix B2).

- Dimensions – The average bedrock elevation (based on the average elevation of each corner of a cell) was between 3,717 ft amsl at the south end (Cell A) and 3,731 ft amsl at the north end (Cell E). Each cell was advanced to sandstone bedrock as determined by lithologic logging of excavated material and survey of the bottom of the excavation. After advancement to bedrock, the cell was backfilled with the backfill material. The PRB was completed to a top elevation of 3,735 ft amsl (see Figure 6). The construction survey data are included in Appendix B4.

- ZVI Content – The ZVI specification for PRB-2 was the same as for PRB-1. In total, 320 tons of ZVI were placed into PRB-2, compared to the estimated value of 537 tons which was based on the design specification of 30 percent ZVI by mass. This difference is due to a smaller saturated cross sectional area of the alluvium than assumed in the design.

During construction of PRB-2, competent bedrock was encountered closer to the surface than anticipated; thus, the installed depth of PRB-2 was shallower than the original design. The original design depth was based on several drilled borings encountering refusal at the presumed alluvium/competent bedrock interface. However, during PRB construction it became apparent that competent bedrock was closer to the surface than projected. The reactive medium was installed down to sandstone bedrock and is intercepting the entire saturated zone through the PBA (see Appendix B4).

4. Performance Monitoring

The performance monitoring program has been designed to support both short- and long-term evaluation of the PRBs based on the specific objectives of the field demonstration discussed in Section 2. Ultimately, the program will be used to determine the effectiveness of the PRB technology. Performance monitoring consists of hydraulic monitoring, groundwater quality monitoring, and PRB solids analysis.

4.1. Monitoring Network

To meet the objectives of the field demonstration, a network of upgradient, cross-gradient, downgradient, and in-wall monitoring wells was installed. A total of 20 individual monitoring wells, five nested monitoring wells, and six point velocity probes (PVPs) were installed to meet monitoring objectives of the field demonstration. Monitoring locations and construction details are presented in Table 1 and locations are depicted on Figure 4. Details regarding the installation of the monitoring network are included in Appendix C1.

4.1.1. Interim Monitoring Wells

The interim monitoring well network was installed between May 1 and May 4, 2012, prior to construction of the two PRBs (Figure 4). The purpose of the interim network was to collect baseline hydraulic and analytical data before PRB installation. The wells generally span the length of PBA and are located a safe distance away from the location of the PRBs to avoid interference with construction.

4.1.2. Additional Monitoring Wells

After construction of the PRBs and backfill associated with the Interim Channel, the remainder of the performance monitoring well network was installed between June 10 and June 25, 2013. This included installation of 16 individual monitoring wells and five nested monitoring well pairs (see Table 1). Nested groundwater monitoring wells were used both in and downgradient of PRB-2 to evaluate vertical differences in hydraulic and analytical monitoring results and reduce the number of well completions in the Interim Channel.

During well installation, 12 six-inch soil cores were collected using split-spoon samplers from the EP-141 (A,B,C) and EP-150 (A,B,C) series for analysis of the PRB backfill. The core samples were frozen upon collection, and the samples from the A and B wells in each series were shipped to the Malcolm Pirnie Treatability Laboratory in Durham, NC

for possible treatability testing at a later time, if deemed necessary, as described in the Design Report.

4.1.3. Point Velocity Probes

PVPs were installed at selected locations upgradient of or directly in the PRBs to provide *in situ* measurements of groundwater velocity within the PRBs and the adjacent alluvium. PVPs were installed during the July 2013 drilling activities. A summary of PVP installation details are provided in Appendix C1.

4.2. Hydraulic Monitoring

A specific objective of the field demonstration is to confirm the hydraulic performance of the PRBs by ensuring that groundwater is flowing through the PRBs. Hydraulic monitoring conducted to date has included manual water level measurements, high-resolution water level monitoring (via pressure transducers and dataloggers), slug tests, and single well tracer tests (SWTTs). Details regarding hydraulic monitoring are included in Appendix D.

4.2.1. Water Level Measurements

Monitoring the groundwater elevation across the performance monitoring network is critical to evaluation of horizontal and vertical hydraulic gradients, responses to precipitation events, and changes in local gradients in the vicinity of the PRBs. Water level monitoring consists of both manual depth to water (DTW) measurements and high-resolution monitoring with pressure transducers.

4.2.2. Slug Tests

Slug tests were conducted to estimate hydraulic conductivity within the PRBs and the aquifer for comparison with design hydraulic conductivity estimates. Future slug testing at the same locations will provide long-term monitoring of potential decreases in hydraulic conductivity due to accumulation of mineral precipitates or fine soil particles.

4.2.3. Single Well Tracer Tests

SWTTs were conducted to estimate groundwater seepage velocities within the PRBs and the aquifer for comparison with design seepage velocity requirements. Future SWTTs at the same monitoring wells will provide long-term monitoring of potential changes in seepage velocities over the lifetime of the PRBs.

4.2.4. Point Velocity Probe Tests

As discussed in the Design Report, the PVPs were installed to provide an alternative to SWTT for estimating groundwater seepage velocity, which is a key design and

performance parameter. As summarized in Appendix C1, some of the PVPs would not accept injected water due to some form of obstruction, which prevented effective testing. Testing of the functional PVPs did not result in a hydraulic conductivity response sufficient to allow interpretation. As the PVP data quality was insufficient to provide estimates of groundwater velocity, the scope of the SWTTs will be expanded to satisfy this monitoring objective (as discussed in Section 5).

4.3. Water Quality Monitoring

A specific objective of the field demonstration is to confirm the degree to which the PRBs are effective in removing COCs from groundwater and reducing mass flux in PBA. Monitoring of COC concentrations within the PRBs and downgradient is the primary focus, but monitoring of changes in overall groundwater geochemistry is also necessary to meet this objective.

Groundwater quality monitoring is conducted in accordance with the approved monitoring plan included in the Design Report. Groundwater quality monitoring was initiated at the ten interim monitoring wells in 2012 to establish baseline COC and biogeochemical conditions in PBA before construction of the PRBs; baseline sampling events were conducted in May and June 2012. Performance monitoring was initiated after the construction of the PRBs at the interim monitoring well network with sampling events conducted in October 2012, November 2012, December 2012, and February 2013. Upon installation of the remainder of the monitoring network, quarterly performance monitoring has been conducted in July and September 2013. In total, six performance monitoring events have been conducted to compare with the two baseline monitoring events.

Groundwater performance monitoring is conducted using low-flow groundwater sampling methodology. All performance monitoring wells are sampled for the COCs and Analytes of Interest (AOIs) which include both total and dissolved metals, arsenate/arsenite, and various geochemical analyses including iron, total dissolved solids (TDS), sulfate, nitrate, etc. Samples are collected, packed on ice in coolers and shipped to Test America Laboratories in Corpus Christi, TX for analysis. All analytical data are validated and compiled in a database. Laboratory analytical reports are included in Appendix E.

4.4. PRB Solids Analysis

Twelve soil cores from the two PRBs were collected from the EP-141 (PRB-1) and EP-150 (PRB-2) locations during well installation to confirm that the installed PRB material met the design specifications. Four of these samples (EP-141A [32.5-33 ft below ground surface (bgs)], EP-141B [32.0-32.6 ft bgs], EP-150A [21.5-22.0 ft bgs] and EP-150B [21.5-22.0 ft bgs]) were submitted to the laboratory for analysis of grain size distribution

(see Appendix F). The sample collection depths at EP-141A (32.5-33 ft bgs) and EP-141B (32.0-32.6 ft bgs) correspond to an elevation of approximately 3,725 ft amsl and the collection depths at EP-150A (21.5-22.0 ft bgs) and EP-150B (21.5-22.0 ft bgs) correspond to an elevation of approximately 3,723 ft amsl. These elevations indicate the samples were collected from the middle of the vertical ranges of both PRBs.

The grain size analysis is compared to the design values in Appendix F.

5. Results and Interpretation

The ultimate objective of this field demonstration is to evaluate the effectiveness of the ZVI PRB technology for groundwater remediation at the Site and to collect information necessary for design of the final environmental remedy. Construction of the PRBs was completed in October 2012 and one year of performance monitoring data have been collected to assess short-term performance and predict long-term performance. The evaluation provided in this section focuses on the short-term objectives of confirming the following: 1) the degree to which the PRBs are effective in removing COCs from groundwater and 2) the hydraulic performance of the PRBs, specifically showing that groundwater is flowing through the barriers. The third objective of assessing the performance longevity of the PRBs will be evaluated prior to 2015, once additional monitoring data are available for a complete evaluation.

5.1. Hydraulic Evaluation

A subset of the monitoring wells were designed to be screened within the PRBs (i.e., the EP-140 and EP-141 series in PRB-1, and the EP-150 series in PRB-2), approximately 2, 4, and 6 ft from the influent side of each PRB. Monitoring data (including soil samples, grain size analyses, lithologic logs, and geochemical data) collected from EP-141A, 141C, and 150A-D suggest that these wells were installed approximately 2 ft outside of the PRBs. This is due to the variable nature of the subsurface material and the potential for auger drift at depth. Monitoring data from the remaining in-wall wells confirm they're completed within the PRBs and are sufficient to demonstrate that groundwater treatment is occurring, as discussed in Sections 5.2.1 and 5.2.2.

As mentioned in Section 4.2, the hydraulic assessment of PRB performance consisted of water level gaging events, slug tests, and SWTTs. The data collected from this monitoring have been evaluated and the results are discussed below.

5.1.1. Water Level Measurements

Manual water level monitoring began in May 2012 using the interim monitoring network (see Table 2). Manual water levels have been collected at all wells at a minimum bi-weekly frequency, and weekly during construction and following substantial precipitation events. Monitoring wells EP-78 and OBS-1 are also gauged to evaluate hydraulic gradients along the entire PBA. Groundwater elevations are calculated after each gauging event by subtracting the observed DTW from the surveyed well casing elevation. The top of casing elevations for several wells have changed during the monitoring period; these changes have been recorded, and the surveyed casing elevations are adjusted accordingly.

Hydrographs from the interim monitoring wells for the monitoring period of May 2013 to October 2013 are presented in Figure 7. For monitoring wells inside and immediately up- and downgradient of the PRBs, hydrographs are presented in Figures 8 and 9 for PRB-1 and PRB-2, respectively. Groundwater elevations collected during the October 11, 2013 event were used to construct potentiometric surface contours (see Figure 10).

Pressure transducers were installed in eight monitoring wells to monitor groundwater elevations at a 4-hour frequency. In July 2013, transducers were installed in EP-139R, 141B, 143, 146, 148, 150B, 152, and 155. Hydrographs for these monitoring data, including synoptic manual gauging events, are included in Appendix D1. Precipitation data (collected from the El Paso airport gaging station) are also shown.

5.1.2. Slug Tests

Slug testing was conducted at nine monitoring wells on September 26 and 27 and October 1 and 2, 2013 (Table 3A). Two sets of falling-head/rising-head tests were conducted in each well (for a total of four tests per well) using a 1.5-inch diameter, 6-foot long solid slug. All four tests for the upgradient wells installed in the alluvium displayed clean response curves (e.g., little noise) and were subsequently selected for analysis. For the in-wall wells in both PRB-1 and PRB-2, the falling- and rising-head tests providing water level data of greatest quality were selected for analysis. This was deemed necessary because of the unusual response curves and high maximum displacement values of the in-wall wells, which are discussed below.

Observed water level data were evaluated using the parameter estimation program AQTESOLV™. The Bouwer-Rice analytical solution (1976) for unconfined water-bearing units was used to fit the observed water levels in the upgradient alluvial wells EP-138R and EP-139R. For the in-wall wells, the Springer and Gelhar (1991) Analytical Solution for unconfined aquifers was used to fit the observed water levels during the early-time response. This solution accounts for oscillatory water level responses commonly observed in aquifers with high hydraulic conductivity, as expected for the PRB material. The analysis methods are discussed in greater detail in Appendix D2.

Table 3A presents the estimated hydraulic permeability from each test and the average values for each PRB and the aquifer upgradient of PRB-1. The slug test analyses are discussed in greater detail in Appendix D2.

5.1.3. Single Well Tracer Tests

SWTTs were conducted at six monitoring wells between September 16 and 18, 2013 (Table 3B). Baseline vertical profiles of specific conductivity (SC) values were measured every 1 to 2 ft across the screened interval. Then, a small volume of distilled water (1 to 2 gallons) was introduced to the test wells, providing a sufficient SC contrast compared to

background groundwater. During the washout period, the vertical SC profiles were monitored every 2 minutes for the first 10 minutes, then every 5 minutes for the next 30 minutes, and then every 10 minutes for the next hour.

The SC washout data were interpreted by visually fitting a mathematical model to the measured data (Drost et al. 1968, Hall 1993). Table 3B presents the flux and seepage velocity estimates for each of the SWTTs. The method theory, along with analysis of the results and curve fitting, are discussed in greater detail in Appendix D3.

5.2. PRB Performance

A critical short-term element of the groundwater quality monitoring is demonstrating effective removal of groundwater COCs within the PRBs, given that downgradient effects are controlled by sorbed COC mass and desorption rates from downgradient soils. To evaluate trends within the PRBs, analytical profiles have been created to evaluate COC, geochemistry, and groundwater level trends immediately upgradient, within, and downgradient of the PRBs (Figures 11 through 13). For PRB-1, two profiles are generated for the EP-140 and EP-141 well sets (Figures 14 and 15), and two profiles are generated for the shallow and deep screens in the EP-150 well set (Figures 16 and 17).

5.2.1. PRB-1

Groundwater entering the eastern end of the PBA channel is impacted by COCs primarily associated with the Ephemeral Pond source area. PRB-1 is located at the eastern end of the channel and provides the initial treatment of PBA groundwater (Figure 2). The construction of PRB-1 was completed as designed (as discussed in Section 3); the final construction specifications and performance monitoring data are summarized as follows:

- PRB-1 is 122 ft long and 8 ft wide. Each cell was excavated to the top of sandstone bedrock and the bottom elevation ranges from 3,719.0 to 3,727.7 ft amsl. A total ZVI quantity of 342 tons were emplaced. The design estimate of 365 tons was based on the borings collected during the pre-design activities; the cross-sectional area is 1,800 square feet (ft^2), compared to a design estimate of 2,200 ft^2 (Malcolm Pirnie 2012).

- Hydraulic testing data confirm that groundwater is flowing through the barrier. The average hydraulic conductivity (985 ft/day) and seepage velocity (8.5 ft/day) calculated from testing of in-wall wells meet or exceed design specifications.

- Groundwater analytical data show that the primary COCs (arsenic, antimony, and selenium) are reduced to concentrations below their respective MCLs in wells EP-140A, 140B, 140C, and 141B.

- Groundwater quality monitoring data show evidence of ZVI reactivity, as evidenced by pH increases between upgradient and in-wall monitoring wells (e.g., EP-139R and 141B).

5.2.1.1. PRB-1 Hydraulics

The results of the water level monitoring events, slug tests, and SWTTs, as discussed in Section 5.1, are considered in the evaluation of hydraulic gradients, hydraulic permeabilities, and groundwater seepage velocities, respectively.

HYDRAULIC GRADIENT

Groundwater elevations at upgradient monitoring wells EP-138R and EP-139R are approximately 2.5 to 3 ft higher than elevations in monitoring wells approximately 5 and 10 ft downgradient (EP-142 and EP-143, respectively). The groundwater elevation at EP-140A is within 0.1-foot of the elevation observed at EP-140B, while EP-140C is generally 0.2 ft lower. The groundwater elevations at the EP-141 series wells are higher because of the difference in their screened locations. Considering that the EP-140 and EP-141 well series were offset by at least 5 ft during drilling (i.e., not in the same groundwater flow path), it is not appropriate to use these wells to estimate horizontal hydraulic gradients. However, the horizontal hydraulic gradient from upgradient to downgradient wells confirms groundwater flow through the barrier (Figures 8, 12, and 13).

A precipitation event in mid-September resulted in a groundwater level increase of approximately 2 ft in upgradient monitoring wells and approximately 3 ft in downgradient monitoring wells (apparently the result of ponding downgradient of PRB-2) (Figure 8).

Groundwater levels are greater at the southern end of the PRB and immediate vicinity. However, data do not suggest that this is negatively affecting flow through the barrier (Figure 10).

HYDRAULIC CONDUCTIVITY

A design hydraulic conductivity of 18.0 ft/day was assumed for the aquifer upgradient of PRB-1 and the average estimated value from slug testing is 17.3 ft/day (Table 3A) which is acceptable.

A minimum design hydraulic conductivity of 42.0 ft/day was estimated for PRB-1 to accommodate accumulation of mineral precipitates and gases over the design lifetime of 20 years. An average hydraulic conductivity of 985 ft/day was calculated from slug tests conducted at PRB-1 monitoring locations (Table 3A). Additional slug testing will confirm this average value, and repeated slug testing will be used to evaluate potential decreases in hydraulic conductivity over the lifetime performance of the barrier.

Grain size analysis was used to verify the gradation of the sand backfill during construction as discussed in Section 3.1. The grain size analysis conducted on the soil sample collected from EP-141B (32.0-32.6 ft bgs) shows the gradation of the installed PRB conforms to design specification and that minimal fines have migrated into PRB-1 (Appendix F).

SEEPAGE VELOCITY

A design seepage velocity of 2.2 ft/day was estimated for PRB-1 assuming a mobile porosity of 25 percent. The average seepage velocity from the SWTTs conducted at EP-140B and EP-141B is estimated at 8.5 ft/day, also assuming a mobile porosity of 25 percent. This estimated velocity is greater than the value used for the design; however there is sufficient residence time in the barrier to achieve treatment as demonstrated by analytical monitoring results discussed in the Section 5.2.1.2.

5.2.1.2. PRB-1 Treatment

As discussed previously, significant removal of target COCs was confirmed within PRB-1, as evidenced by groundwater analytical data (Tables 4 and 5). Influent groundwater into PRB-1 (EP-138R and EP-139R) contains the following COCs that exceed their respective standards: antimony, arsenic, selenium, and thallium (Table 5). To confirm groundwater treatment, the monitoring data from the in-wall and downgradient wells were compared to these influent data.

IN-WALL MONITORING

As mentioned in Section 5.1, monitoring wells EP-141A and 141C were installed outside of the PRB in the native alluvium (EP-141A was completed upgradient of the wall and EP-141C was completed downgradient of the wall). However, the data from EP-141B are sufficient to demonstrate the effectiveness of the PRB in removing COCs from groundwater. The following trends are observed when comparing EP-139R to EP-141B during the September 2013 event (Tables 4 and 5 and Figure 14):

- Total antimony, selenium and thallium concentrations are reduced to below their respective MCLs at EP-141B.

- Total arsenic concentrations are reduced from 1.02 to 0.038 mg/L at EP-141B, a 96 percent reduction in concentration.

- Calcium concentrations decrease from 97.4 to 6.42 mg/L and sulfate concentrations decrease from 1,130 to 823 mg/L at EP-141B. These are two key water quality indicators of the mineral precipitation rate in the barrier, which were considered in the design (Appendix X of Design Report). These values, in addition to other effluent and influent water quality parameters, are used to estimate porosity loss discussed later in Section 5.3.

- pH values increased from 7.37 in EP-139R to 9.09 in EP-141B. This is indicative of reactivity, as hydroxide ions are generated during the oxidation of ZVI (Dixit and Hering 2003).

All three wells in the EP-140 series are screened within PRB-1, and the observed improvements in water quality increase with each well installed farther downgradient in the barrier. The following COC trends are observed when comparing EP-138R to EP-140 series wells during the September 2013 event (Figure 15):

- Total antimony and selenium concentrations are reduced to below their respective MCLs at all three EP-140 wells. Furthermore, the concentration of antimony is reduced to below the detection limit (0.00500 mg/L) at all three wells in both the July and September 2013 events.

- Total arsenic concentrations are reduced from 1.21 mg/L to below the MCL (0.01 mg/L) at all three EP-140 wells in both the July and September 2013 events. Total arsenic concentrations are reduced by as much as 99 percent (to 0.00131 mg/L in EP-140C) from influent concentrations (Table 5).

- Dissolved metal concentrations at EP-138R during July 2013 are comparable to September 2013 results. Total metal concentrations from July 2013 are suspiciously low and are not considered representative. Thus, the dissolved concentrations at EP-138R from July 2012 were used for plotting on Figure 15.

- Groundwater quality trends at all three EP-140 wells, which were reviewed for indicators of mineral precipitation in the barrier, are comparable to the EP-141 well series (Table 4). These results and implications on porosity and hydraulic conductivity reduction are discussed in Section 5.3.

DOWNGRADIENT MONITORING

Seven monitoring wells are used as downgradient monitoring wells for PRB-1 (Figure 3). The locations of these wells range from 5 to 10 ft downgradient (EP-142 and EP-143, respectively) to 335 ft downgradient (EP-147). Downgradient performance evaluation focuses on selenium and arsenic concentration trends. The following bullets provide an overview of the groundwater quality trends downgradient of PRB-1:

- Baseline total arsenic concentrations range from 0.585 to 1.12 mg/L in May 2012 at the four locations installed before construction (EP-144, 145, 146, and 147). Baseline total selenium concentrations range from 0.140 to 0.150 mg/L (Table 5).

- Total antimony and selenium concentrations have been reduced to below their respective MCLs at EP-142, 10 ft downgradient of PRB-1. The total arsenic

concentration has been reduced to 0.0287 mg/L at this location (Figure 15), which represents a 97 percent reduction over influent concentrations (as measured at EP-138R).

- Total selenium concentrations at wells farther downgradient were reduced by as much as 90 percent (EP-144) in late 2012/early 2013 but have since increased. This may be attributed to increasing water levels in July and September 2013 which could've saturated additional soil with solid selenium phases resulting in an increase in groundwater concentration (Appendix G).

As indicated by these data, downgradient evidence of treatment is limited by COC mass sorbed to soils that will desorb and re-impact treated groundwater. However, the presence of PRB-2 downgradient from PRB-1 will provide a cumulative treatment effect.

The implications of these results regarding long-term performance are discussed in Section 5.3.

5.2.2. PRB-2

PRB-2 was constructed approximately 470 ft downgradient of PRB-1 in an area where groundwater flow is focused in an incised alluvial channel bounded by bedrock outcrops (Figure 6). Two PRBs emplaced in series will provide a cumulative reduction in COC mass flux through PBA. The construction of PRB-2, discussed in Section 3.2, is summarized below:

- PRB-2 is 105 ft long and 8 ft wide. Each cell was excavated to the top of sandstone bedrock and the bottom elevation of the PRB ranges from 3,715.2 to 3,730.9 ft amsl (Appendix B4). The depth of PRB-2 was less than designed resulting in less total backfill. A total ZVI quantity of 321 tons were emplaced (compared to design estimate of 550 tons since the total volume was smaller). The cross-sectional area of 1,680 ft^2 estimated compared to a design estimate of 3,200 ft^2.

- Hydraulic testing data confirm that groundwater is flowing through the barrier. The average hydraulic conductivity (1,550 ft/day) and seepage velocity (13 ft/day) calculated from testing of in-wall wells meet or exceed design specifications.

- Groundwater analytical data show that concentrations of antimony, thallium, and selenium are reduced to concentrations below their respective MCLs in wells EP-150B-D and EP-150C-D.

- Arsenic concentrations are reduced by 99 percent (compared to influent concentrations) in EP-150B-D.

- Groundwater quality monitoring data show evidence of ZVI reactivity, as evidenced by pH increases between upgradient and in-wall monitoring wells (e.g., EP-149 and 150B-D).

The saturated cross-sectional area and ZVI content of PRB-2 is smaller than designed because bedrock was encountered at shallower depth than was assumed during design. The bedrock (bottom of PRB-2) elevation was estimated around 3,705 ft amsl; however, bedrock was encountered during construction in the center of PRB-2 around 3,715 ft amsl. As constructed, PRB-2 intercepts the entire thickness of the saturated alluvium to the top of bedrock.

The two in-wall monitoring wells in the EP-150 series are a focus point for short-term monitoring objectives. The EP-150 monitoring well series consists of three sets of nested well pairs (A,B,C) to discretely monitor both shallow and deep intervals of PRB-2 (Table 1). As discussed in Section 5.1the screened interval of EP-150A-D is located outside of PRB-2. However, the monitoring data from the other in-wall monitoring wells is sufficient to evaluate treatment efficacy.

5.2.2.1. PRB-2 Hydraulics

The hydraulic design of PRB-2 is different from PRB-1, given the confined nature of the arroyo and the greater design aquifer hydraulic conductivity and seepage velocity (Malcolm Pirnie 2012). The results of water level monitoring events, slug tests, and SWTTs (discussed in Section 5.1) are considered in the evaluation of hydraulic gradients, hydraulic permeabilities, and groundwater seepage velocities, respectively.

HYDRAULIC GRADIENT

Groundwater elevations at monitoring wells located approximately 50 ft upgradient of PRB-2 (EP-148 and EP-149) are approximately 3 to 4 ft higher than elevations in monitoring wells approximately 10 ft downgradient of PRB-2 (EP-151 and EP-152S/D), which confirms that groundwater is flowing through the barrier (Figures 12 and 13). As shown in Figure 9, the groundwater elevations at all EP-150 series wells screened within the barrier are within 0.3 ft of each other throughout the entire monitoring period (with the exception of EP-150A-D, for reasons discussed above). The gentle horizontal hydraulic gradient within this barrier is due to the engineered hydraulic conductivity of greater than 1,000 ft/day in the PRB, as discussed below.

Groundwater elevation measurements from the shallow and deep well pairs allow for the estimation of vertical hydraulic gradients. An upward vertical gradient ranging from less than 0.1 to 0.35 ft was observed during the monitoring period (Figure 9).

A precipitation event in mid-September resulted in a groundwater level increase of approximately 2 ft in upgradient monitoring wells and approximately 3 ft in

downgradient monitoring wells (apparently the result of ponding downgradient of PRB-2) (Figure 8).

HYDRAULIC CONDUCTIVITY

A minimum design hydraulic conductivity of 1,100 ft/day was estimated in the PRB-2 design to accommodate accumulation of mineral precipitates and fine soil particles over the design lifetime of 20 years. An average hydraulic conductivity of 1,550 ft/day was calculated from slug testing conducted at PRB-2 monitoring locations approximately one year after construction (Table 3A). Additional slug testing will confirm this average value, and repeated slug testing will be used to evaluate potential decreases in hydraulic conductivity over the lifetime of the barrier.

SEEPAGE VELOCITY

A design seepage velocity of 6.0 ft/day was estimated for PRB-2, assuming a mobile porosity of 25 percent. The seepage velocity estimated from the SWTTs conducted in PRB-2 is 1.6 to 4.4 ft/day (EP-150B-S) and 24.0 ft/day (EP-150B-D), also assuming a mobile porosity of 25 percent. Although the latter seepage velocity would theoretically result in residence times that are insufficient for treatment, the monitoring data discussed in Section 5.2.2.2 below clearly indicate that treatment is occurring in this PRB. Most likely, the half-life estimates that were incorporated into the design seepage velocity estimate were overly conservative.

5.2.2.2. PRB-2 Treatment

Influent groundwater into PRB-2 (as measured by EP-148 and EP-149) contains the following COCs at concentrations that exceed their respective standards: antimony, arsenic, cadmium, selenium, and thallium (Table 5). However, EP-150A-D and EP-156 are the only two monitoring wells in PBA with cadmium concentrations that exceed the screening standard of 0.005 mg/L. Furthermore, EP-148 and EP-149 exhibit the highest total arsenic concentrations observed in PBA, ranging from 1.75 to 2.38 mg/L (with concentrations at EP-149 being the greater of the two wells for the majority of the COCs).

IN-WALL MONITORING

The following trends are observed when comparing EP-149 to the EP-150 deep-screened well series (Tables 4 and 5 and Figure 16):

- Total antimony, selenium, and thallium concentrations are reduced to below their respective MCLs at EP-150B-D and EP-150C-D.
- Total arsenic concentrations are reduced from 1.93 to 0.0204 mg/L at EP-150B-D (September 2013), a 99 percent reduction.

- Calcium concentrations decrease from 125 to 7.47 mg/L (a 94 percent reduction), and sulfate concentrations decrease from 1,110 to 928 mg/L at EP-150B-D (a 16 percent reduction).

- pH values increase from 7.28 in EP-149 to a maximum of 8.89 in EP-150B-D.

The following COC trends are observed when comparing EP-148 to the EP-150 shallow-screened well series (Tables 4 and 5 and Figure 17):

- Total antimony, selenium, and thallium concentrations are reduced to below their respective MCLs at EP-150A-S, 150B-S, and 150C-S.

- Total arsenic concentrations are reduced from 1.82 mg/L to below the MCL at EP-150A-S and EP-150C-S (September 2013), which is a reduction of greater than 99 percent.

- Calcium concentrations decrease from 119 to 0.78 mg/L (a 99 percent reduction), and sulfate concentration decreases from 1,120 to 679 mg/L (a 39 percent reduction) at EP-150C-S. These values, in addition to other effluent and influent water quality parameters, are used to calibrate the estimate of porosity loss from the Design Report and are discussed in Section 5.3.

DOWNGRADIENT MONITORING

Six monitoring wells are used as downgradient monitoring wells for PRB-2 (Figure 3). The locations of these wells range from 10 ft downgradient (at nested wells EP-151 and EP-152) to 445 ft downgradient (at EP-156R). The downgradient performance evaluation focuses on arsenic and selenium concentration trends. The following bullets provide an overview of the groundwater quality trends downgradient of PRB-2:

- Baseline total arsenic concentrations range from 0.671 to 0.888 mg/L in May 2012 at the three locations (EP-153, 154, and 155) that were installed before construction of PRB-2 (Table 5).

- Total arsenic concentrations at nested wells EP-151-S/D and EP-152-D were reduced by approximately 55-65 percent (relative to influent concentrations at EP-149) during the two sampling events. Comparing the concentration of total arsenic at EP-152-S of 0.296 mg/L to the influent arsenic concentration at EP-149, this represents an 85 percent reduction in arsenic concentration 10 ft downgradient of the barrier.

- Total selenium concentrations at nested wells EP-151-S/D and EP-152-S/D were reduced by approximately 40 percent (relative to influent concentrations at EP-149) during the two sampling events (Appendix G).

The implications of these results for long-term performance are discussed in Section 5.3.

5.3. Summary

PRB construction was completed in October 2012. A performance monitoring network was installed in July 2013, and that network has facilitated a comprehensive of review of PRB performance.

PRB-1 was constructed as designed and current performance monitoring data indicate that the barrier is effectively treating groundwater flowing through the barrier, as summarized below:

- Hydraulic Performance:
    - Groundwater elevations at upgradient monitoring wells are 2.5 to 3 ft higher than elevations at downgradient monitoring wells, confirming that groundwater is flowing through barrier.
    - Results of slug testing in-wall wells indicate an average hydraulic conductivity of 985 ft/day. This value exceeds the minimum design hydraulic conductivity (42 ft/day), confirming that the barrier is sufficiently permeable.
    - SWTTs conducted at in-wall monitoring wells EP-140B and 141B indicate an average seepage velocity of 8.5 ft/day, compared to the design seepage value of 5 ft/day. Although the calculated seepage velocity is slightly higher than the design value, it is low enough to maintain the minimum residence time required for treatment, as supported by the groundwater analytical data.
- Treatment Performance:
    - Concentrations of total arsenic, antimony, and selenium have been reduced to below their respective MCLs at in-wall monitoring wells EP-140 and 141. This represents an arsenic concentration reduction of between 96 and 99 percent compared to influent groundwater.
    - Significant reductions in calcium and sulfate concentrations, as well as a significant increase in pH values, are observed at the in-wall monitoring wells, which is indicative of ZVI-reactivity.
    - Downgradient monitoring wells show significant reductions in COC concentrations, with dissolved arsenic reduced by up to 97 percent compared to influent concentrations.

- PRB-1 is meeting all design criteria and is achieving treatment as expected.

PRB-2 was constructed as designed, although bedrock was encountered at a shallower depth than anticipated, resulting in a shallower installation depth. However, the current performance monitoring data indicate that groundwater is flowing through the barrier and shows strong evidence of treatment, as discussed below:

- Hydraulic Performance:
  - Groundwater elevations at upgradient monitoring wells are 3 to 4 ft higher than elevations at downgradient monitoring wells, confirming that groundwater is flowing through barrier.
  - Results of slug testing in-wall wells indicate an average hydraulic conductivity of 1,550 ft/day, which exceeds the minimum design hydraulic conductivity of 1,100 ft/day). This confirms that the barrier is sufficiently permeable.
  - SWTTs conducted at in-wall monitoring wells EP-150B-S and 150B-D indicate seepage velocities between 1.6 and 24 ft/day. While this velocity range exceeds the design velocity of 6.0 ft/day, groundwater residence time in the barrier appears to be sufficient to achieve treatment, as supported by the groundwater analytical monitoring data.
- Treatment Performance:
  - Arsenic concentrations exhibited reductions up to 99 percent compared to influent groundwater. Total antimony, thallium, and selenium concentrations are reduced to concentrations below their respective MCLs at most of the in-wall monitoring wells.
  - Groundwater quality monitoring data show significant reductions in calcium and sulfate concentrations, as well as a significant increase in pH values, indicating ZVI-reactivity.
  - Downgradient monitoring wells show significant reductions in COC concentrations, with dissolved arsenic reduced by 55 and 65 percent compared to influent concentrations.
  - PRB-2 is meeting all design criteria and is achieving treatment as expected.

6. Path Forward and Schedule

Based on the results discussed in the previous section, Malcolm Pirnie has revisited the monitoring program to assure that data collection is occurring as necessary to evaluate PRB performance with respect to the field objectives. Performance monitoring will continue to focus on water quality analysis of COCs and biogeochemical parameters, and continued hydraulic monitoring to confirm persistent groundwater flow through the barriers. Slug tests and SWTTs will be continued to estimate hydraulic conductivity and seepage velocities, respectively. Given the extremely high groundwater flux, the field methods for these tests will be refined to provide more reliable estimates of hydraulic parameters using and protocols that are repeatable. The proposed monitoring program for the duration of 2014 is shown in Table 6, and the schedule for monitoring is shown in Figure 18.

The proposed monitoring program consists of the following:

Hydraulic Monitoring

- Continued monthly water level measurements, supplemented by additional measurements as needed (e.g., following precipitation events).
- Semi-annual slug tests at six locations.
- Semi-annual SWTTs at six locations.

Water Quality Monitoring

- Semi-annual sampling of 11 monitoring wells (currently sampled quarterly): EP-138R, 139R, 144, 145, 146, 147, 148, 149, 153, 154, and 156R.
- Semi-annual monitoring of 19 monitoring wells inside the PRBs and immediately downgradient through June 2014. It is anticipated that all wells will be reduced to semi-annual monitoring frequency after June 2014.
- The following parameters do not provide data necessary for performance evaluation and will not be analyzed in future events: chloride, fluoride, total organic carbon, and silica (via method 6010, it will still be included with the metals analysis via method 6020).

Reporting of field demonstration performance monitoring results will continue on a semi-annual frequency. The next status report will be submitted to TCEQ for review after receipt and interpretation of the June 2014 monitoring data. It is anticipated that sufficient information regarding downgradient cleanup timeframes will be collected by December 2014, allowing for conclusions regarding the appropriateness of the field demonstration

for the final groundwater remedy and any additional remedial action required for PBA. This discussion will be included in a status report to be submitted in February 2015.

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Tables

Table 1
Well Construction Matrix
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

PRB Location	Well Location	Well ID	Top of Casing Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Screen Length (ft)	Installation Phase	Notes
PRB-1	50 ft Upgradient	EP-138	3743.5	3725.5	3715.5	10	Interim[1]	Single MW
	15 ft Upgradient	EP-138R	3758.1	3721.0	3711.0	10	Post-construction[2]	Replacement (EP-138)
	50 ft Upgradient	EP-139	3743.0	3723.4	3713.4	10	Interim[1]	Single MW
	10 ft Upgradient	EP-139R	3758.1	3721.0	3711.0	10	Post-construction[2]	Replacement (EP-139)
	10 ft Upgradient	PVP-1	--	3725.0	3724.0	--	Post-construction[2]	Point Velocity Probe[3]
	In Barrier	EP-140A	3757.9	3727.5	3717.5	10	Post-construction[2]	Single MW
	In Barrier	EP-140B	3758.3	3728.0	3718.0	10	Post-construction[2]	Single MW
	In Barrier	EP-140C	3758.5	3728.0	3718.0	10	Post-construction[2]	Single MW
	2 ft upgradient	EP-141A	3757.6	3728.0	3718.0	10	Post-construction[2]	Single MW
	In Barrier	EP-141B	3757.8	3728.0	3718.0	10	Post-construction[2]	Single MW
	2 ft downgradient	EP-141C	3758.0	3728.0	3718.0	10	Post-construction[2]	Single MW
	In Barrier	PVP-2	--	3723.0	3722.0	--	Post-construction[2]	Point Velocity Probe[3]
	In Barrier	PVP-3S	--	3727.0	3726.0	--	Post-construction[2]	Point Velocity Probe[3]
	In Barrier	PVP-3D	--	3722.0	3721.0	--	Post-construction[2]	Point Velocity Probe[3]
	In Barrier	PVP-4S	--	3728.0	3727.0	--	Post-construction[2]	Point Velocity Probe[3]
	In Barrier	PVP-4D	--	3723.0	3722.0	--	Post-construction[2]	Point Velocity Probe[3]
	5 ft Downgradient	EP-142	3757.7	3728.0	3718.0	10	Post-construction[2]	Single MW
	10 ft Downgradient	EP-143	3757.7	3728.0	3718.0	10	Post-construction[2]	Single MW
	55 ft Downgradient	EP-157	3757.0	3734.5	3724.5	10	Post-construction[2]	Single MW
	120 ft Downgradient	EP-144	3762.1	3733.5	3723.5	10	Interim [1]	Single MW
	100 ft Downgradient	EP-145	3757.6	3730.0	3720.0	10	Interim [1]	Single MW
	205 ft Downgradient	EP-146	3755.6	3728.5	3718.5	10	Interim [1]	Single MW
	335 ft Downgradient	EP-147	3747.1	3728.5	3713.5	15	Interim [1]	Single MW
PRB-2	45 ft Upgradient	EP-148	3744.3	3730.0	3715.0	15	Post-construction[2]	Single MW
	50 ft Upgradient	EP-149	3744.8	3731.0	3716.0	15	Post-construction[2]	Single MW
	10 ft Upgradient	PVP-6	--	3720.0	3719.0	--	Post-construction[2]	Point Velocity Probe[3]
	In Barrier	EP-150A-S	3743.9	3728.0	3723.0	5	Post-construction[2]	Shallow
	2 ft upgradient	EP-150A-D	3745.2	3720.0	3715.0	5	Post-construction[2]	Deep
	In Barrier	EP-150B-S	3743.6	3728.0	3723.0	5	Post-construction[2]	Shallow
	In Barrier	EP-150B-D	3745.2	3720.0	3715.0	5	Post-construction[2]	Deep
	In Barrier	EP-150C-S	3743.6	3728.5	3723.5	5	Post-construction[2]	Shallow
	In Barrier	EP-150C-D	3744.8	3720.5	3715.5	5	Post-construction[2]	Deep
	In Barrier	PVP-7S	--	3724.5	3723.5	--	Post-construction[2]	Point Velocity Probe[3]
	In Barrier	PVP-7D	--	3719.5	3718.5	--	Post-construction[2]	Point Velocity Probe[3]
	10 ft Downgradient	EP-151-S	3744.5	3729.0	3724.0	5	Post-construction[2]	Shallow
	10 ft Downgradient	EP-151-D	3745.7	3721.0	3716.0	5	Post-construction[2]	Deep
	10 ft Downgradient	EP-152-S	3747.5	3725.0	3720.0	5	Post-construction[2]	Shallow
	10 ft Downgradient	EP-152-D	3745.2	3715.0	3710.0	5	Post-construction[2]	Deep
	55 ft Downgradient	EP-153	3746.0	3726.0	3711.0	15	Interim [1]	Single MW
	40 ft Downgradient	EP-154	3743.0	3721.0	3706.0	15	Interim [1]	Single MW
	150 ft Downgradient	EP-155	3745.4	3721.0	3706.0	15	Interim[1]	Single MW
	350 ft Downgradient	EP-156	3738.9	3731.0	3716.0	15	Interim[1]	Single MW
	445 ft Downgradient	EP-156R	3740.5	3716.5	3706.5	10	Post-construction[2]	Replacement (EP-156)

Notes:
PRB = permeable reactive barrier
ft = feet
amsl = above mean sea level
MW = monitoring well
-- = not surveyed/not applicable
1 = Interim monitoring wells installed between May 1 and May 4, 2012
2 = Post-construction monitoring wells installed between June 10 and June 25, 2013
3 = Point Velocity Probes do not have a traditional screen, instead they have a one-foot long section of polyvinyl chloride pipe with a series of small ports installed
= abandoned

MALCOLM PIRNIE

Table 2
Groundwater Elevations
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Well ID	Date	Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Water Elevation (ft amsl)
EP-78	1/22/2013	3782.30	35.68	3746.62
EP-78	1/25/2013	3782.30	35.66	3746.64
EP-78	1/29/2013	3782.30	35.66	3746.64
EP-78	3/6/2013	3782.30	35.62	3746.68
EP-78	3/20/2013	3782.30	35.62	3746.68
EP-78	4/4/2013	3782.30	35.65	3746.65
EP-78	4/19/2013	3782.30	35.66	3746.64
EP-78	5/2/2013	3782.30	35.66	3746.64
EP-78	5/17/2013	3782.30	35.80	3746.50
EP-78	5/31/2013	3782.30	35.87	3746.43
EP-78	6/14/2013	3782.30	36.03	3746.27
EP-78	7/23/2013	3782.30	36.21	3746.09
EP-78	8/2/2013	3782.30	35.81	3746.49
EP-78	8/9/2013	3782.30	35.69	3746.61
EP-78	8/23/2013	3782.30	35.59	3746.71
EP-78	9/4/2013	3782.30	34.87	3747.43
EP-78	9/14/2013	3782.30	33.33	3748.97
EP-78	9/26/2013	3782.30	32.55	3749.75
EP-78	10/11/2013	3782.30	32.56	3749.74
EP-138	5/8/2012	3743.50	10.21	3733.29
EP-138	6/5/2012	3743.50	10.78	3732.72
Well abandoned July 2012				
EP-138R	7/23/2013	3758.06	21.33	3736.73
EP-138R	8/2/2013	3758.06	21.17	3736.89
EP-138R	8/9/2013	3758.06	21.14	3736.92
EP-138R	8/23/2013	3758.06	20.93	3737.13
EP-138R	9/4/2013	3758.06	20.41	3737.65
EP-138R	9/14/2013	3758.06	17.12	3740.94
EP-138R	9/26/2013	3758.06	17.94	3740.12
EP-138R	10/11/2013	3758.06	17.72	3740.34
EP-139	5/8/2012	3743.00	9.66	3733.34
EP-139	6/5/2012	3743.00	10.23	3732.77
Well abandoned July 2012				
EP-139R	7/23/2013	3758.10	21.38	3736.72
EP-139R	8/2/2013	3758.10	21.34	3736.76
EP-139R	8/9/2013	3758.10	21.29	3736.81
EP-139R	8/23/2013	3758.10	21.11	3736.99
EP-139R	9/4/2013	3758.10	20.58	3737.52
EP-139R	9/14/2013	3758.10	17.32	3740.78
EP-139R	9/26/2013	3758.10	18.13	3739.97
EP-139R	10/11/2013	3758.10	17.91	3740.19
EP-140A	7/23/2013	3757.85	23.60	3734.25
EP-140A	8/2/2013	3757.85	23.42	3734.43
EP-140A	8/9/2013	3757.85	23.40	3734.45

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Well ID	Date	Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Water Elevation (ft amsl)
EP-140A	8/23/2013	3757.85	23.33	3734.52
EP-140A	9/4/2013	3757.85	22.98	3734.87
EP-140A	9/14/2013	3757.85	20.80	3737.05
EP-140A	9/26/2013	3757.85	20.68	3737.17
EP-140A	10/11/2013	3757.85	20.58	3737.27
EP-140B	7/23/2013	3758.32	23.80	3734.52
EP-140B	8/2/2013	3758.32	23.87	3734.45
EP-140B	8/9/2013	3758.32	23.84	3734.48
EP-140B	8/23/2013	3758.32	23.76	3734.56
EP-140B	9/4/2013	3758.32	23.43	3734.89
EP-140B	9/14/2013	3758.32	21.23	3737.09
EP-140B	9/26/2013	3758.32	21.13	3737.19
EP-140B	10/11/2013	3758.32	21.02	3737.30
EP-140C	7/23/2013	3758.51	23.62	3734.89
EP-140C	8/2/2013	3758.51	24.27	3734.24
EP-140C	8/9/2013	3758.51	24.23	3734.28
EP-140C	8/23/2013	3758.51	24.16	3734.35
EP-140C	9/4/2013	3758.51	23.83	3734.68
EP-140C	9/14/2013	3758.51	21.78	3736.73
EP-140C	9/26/2013	3758.51	21.55	3736.96
EP-140C	10/11/2013	3758.51	21.43	3737.08
EP-141A	7/23/2013	3757.58	21.44	3736.14
EP-141A	8/2/2013	3757.58	21.13	3736.45
EP-141A	8/9/2013	3757.58	21.09	3736.49
EP-141A	8/23/2013	3757.58	20.91	3736.67
EP-141A	9/4/2013	3757.58	20.41	3737.17
EP-141A	9/14/2013	3757.58	17.28	3740.30
EP-141A	9/26/2013	3757.58	18.95	3738.63
EP-141A	10/11/2013	3757.58	17.74	3739.84
EP-141B	7/23/2013	3757.84	22.97	3734.87
EP-141B	8/2/2013	3757.84	22.72	3735.12
EP-141B	8/9/2013	3757.84	22.67	3735.17
EP-141B	8/23/2013	3757.84	22.55	3735.29
EP-141B	9/4/2013	3757.84	22.13	3735.71
EP-141B	9/14/2013	3757.84	19.67	3738.17
EP-141B	9/26/2013	3757.84	19.66	3738.18
EP-141B	10/11/2013	3757.84	19.49	3738.35
EP-141C	7/23/2013	3758.02	22.50	3735.52
EP-141C	8/2/2013	3758.02	22.57	3735.45
EP-141C	8/9/2013	3758.02	22.46	3735.56
EP-141C	8/23/2013	3758.02	22.32	3735.70
EP-141C	9/4/2013	3758.02	21.88	3736.14
EP-141C	9/14/2013	3758.02	19.23	3738.79
EP-141C	9/26/2013	3758.02	19.44	3738.58

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Well ID	Date	Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Water Elevation (ft amsl)
EP-141C	10/11/2013	3758.02	19.34	3738.68
EP-142	7/23/2013	3757.72	24.02	3733.70
EP-142	8/2/2013	3757.72	23.85	3733.87
EP-142	8/9/2013	3757.72	23.82	3733.90
EP-142	8/23/2013	3757.72	23.75	3733.97
EP-142	9/4/2013	3757.72	23.43	3734.29
EP-142	9/14/2013	3757.72	21.72	3736.00
EP-142	9/26/2013	3757.72	21.16	3736.56
EP-142	10/11/2013	3757.72	21.05	3736.67
EP-143	7/23/2013	3757.74	23.57	3734.17
EP-143	8/2/2013	3757.74	23.56	3734.18
EP-143	8/9/2013	3757.74	23.53	3734.21
EP-143	8/23/2013	3757.74	23.44	3734.30
EP-143	9/4/2013	3757.74	23.09	3734.65
EP-143	9/14/2013	3757.74	21.23	3736.51
EP-143	9/26/2013	3757.74	20.80	3736.94
EP-143	10/11/2013	3757.74	20.66	3737.08
EP-144	5/8/2012	3747.00	14.75	3732.25
EP-144	6/5/2012	3747.00	15.33	3731.67
EP-144	8/30/2012	3747.00	13.85	3733.15
EP-144	10/12/2012	3757.00	25.92	3731.08
EP-144	10/19/2012	3757.00	25.45	3731.55
EP-144	10/26/2012	3767.00	34.95	3732.05
EP-144	10/30/2012	3767.00	34.85	3732.15
EP-144	11/2/2012	3767.00	34.81	3732.19
EP-144	11/6/2012	3767.00	34.74	3732.26
EP-144	11/9/2012	3767.00	34.72	3732.28
EP-144	11/13/2012	3767.00	34.62	3732.38
EP-144	11/27/2012	3767.00	34.45	3732.55
EP-144	12/4/2012	3767.00	34.42	3732.58
EP-144	12/18/2012	3767.00	34.26	3732.74
EP-144	1/2/2013	3767.00	34.21	3732.79
EP-144	1/22/2013	3767.00	33.95	3733.05
EP-144	1/25/2013	3767.00	34.14	3732.86
EP-144	1/29/2013	3767.00	34.05	3732.95
EP-144	3/6/2013	3767.00	33.90	3733.10
EP-144	3/20/2013	3767.00	33.88	3733.12
EP-144	4/4/2013	3767.00	33.81	3733.19
EP-144	4/19/2013	3767.00	33.79	3733.21
EP-144	5/2/2013	3767.00	33.76	3733.24
EP-144	5/17/2013	3767.00	33.80	3733.20
EP-144	5/31/2013	3767.00	33.82	3733.18
EP-144	6/14/2013	3767.00	33.90	3733.10
EP-144	7/23/2013	3767.12	33.82	3733.30

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Well ID	Date	Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Water Elevation (ft amsl)
EP-144	8/2/2013	3767.12	33.70	3733.42
EP-144	8/9/2013	3767.12	33.64	3733.48
EP-144	8/23/2013	3762.12	28.58	3733.54
EP-144	9/4/2013	3762.12	28.29	3733.83
EP-144	9/14/2013	3762.12	26.85	3735.27
EP-144	9/26/2013	3762.12	26.07	3736.05
EP-144	10/11/2013	3762.12	25.94	3736.18
EP-145	5/8/2012	3747.50	15.10	3732.40
EP-145	6/5/2012	3747.50	15.67	3731.83
EP-145	8/30/2012	3747.50	14.19	3733.31
EP-145	10/12/2012	3747.50	16.42	3731.08
EP-145	10/19/2012	3747.50	15.80	3731.70
EP-145	10/26/2012	3747.50	15.33	3732.17
EP-145	10/30/2012	3747.50	15.23	3732.27
EP-145	11/2/2012	3747.50	15.18	3732.32
EP-145	11/6/2012	3747.50	15.10	3732.40
EP-145	11/9/2012	3752.50	20.14	3732.36
EP-145	11/13/2012	3752.50	20.07	3732.43
EP-145	11/27/2012	3752.50	19.89	3732.61
EP-145	12/4/2012	3752.50	19.86	3732.64
EP-145	12/18/2012	3752.50	19.71	3732.79
EP-145	1/2/2013	3752.50	19.63	3732.87
EP-145	1/22/2013	3752.50	19.39	3733.11
EP-145	1/25/2013	3752.50	19.61	3732.89
EP-145	1/29/2013	3752.50	19.50	3733.00
EP-145	3/6/2013	3757.50	24.38	3733.12
EP-145	3/20/2013	3757.50	24.37	3733.13
EP-145	4/4/2013	3757.50	24.31	3733.19
EP-145	4/19/2013	3757.50	24.26	3733.24
EP-145	5/2/2013	3757.50	24.25	3733.25
EP-145	5/17/2013	3757.50	24.28	3733.22
EP-145	5/31/2013	3757.50	24.32	3733.18
EP-145	6/14/2013	3757.50	24.40	3733.10
EP-145	7/23/2013	3757.64	24.30	3733.34
EP-145	8/2/2013	3757.64	24.16	3733.48
EP-145	8/9/2013	3757.64	24.15	3733.49
EP-145	8/23/2013	3757.64	24.07	3733.57
EP-145	9/4/2013	3757.64	23.24	3734.40
EP-145	9/14/2013	3757.64	21.76	3735.88
EP-145	9/26/2013	3757.64	21.02	3736.62
EP-145	10/11/2013	3757.64	20.91	3736.73
EP-146	5/8/2012	3745.40	13.40	3732.00
EP-146	6/5/2012	3745.40	14.29	3731.11
EP-146	8/30/2012	3745.40	12.74	3732.66

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Well ID	Date	Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Water Elevation (ft amsl)
EP-146	10/12/2012	3745.40	14.95	3730.45
EP-146	10/19/2012	3745.40	14.22	3731.18
EP-146	10/26/2012	3745.40	13.81	3731.59
EP-146	10/30/2012	3745.40	13.72	3731.68
EP-146	11/2/2012	3745.40	13.66	3731.74
EP-146	11/6/2012	3745.40	13.57	3731.83
EP-146	11/9/2012	3750.40	18.72	3731.68
EP-146	11/13/2012	3750.40	18.53	3731.87
EP-146	11/27/2012	3750.40	18.35	3732.05
EP-146	12/4/2012	3750.40	18.30	3732.10
EP-146	12/18/2012	3750.40	18.17	3732.23
EP-146	1/2/2013	3750.40	18.10	3732.30
EP-146	1/22/2013	3750.40	17.86	3732.54
EP-146	1/25/2013	3750.40	18.05	3732.35
EP-146	1/29/2013	3750.40	17.96	3732.44
EP-146	3/6/2013	3755.40	22.85	3732.55
EP-146	3/20/2013	3755.40	22.82	3732.58
EP-146	4/4/2013	3755.40	22.77	3732.63
EP-146	4/19/2013	3755.40	22.72	3732.68
EP-146	5/2/2013	3755.40	22.71	3732.69
EP-146	5/17/2013	3755.40	22.75	3732.65
EP-146	5/31/2013	3755.40	22.78	3732.62
EP-146	6/14/2013	3755.40	22.84	3732.56
EP-146	7/23/2013	3755.60	22.72	3732.88
EP-146	8/2/2013	3755.60	22.62	3732.98
EP-146	8/9/2013	3755.60	22.57	3733.03
EP-146	8/23/2013	3755.60	22.51	3733.09
EP-146	9/4/2013	3755.60	22.22	3733.38
EP-146	9/14/2013	3755.60	20.90	3734.70
EP-146	9/26/2013	3755.60	20.02	3735.58
EP-146	10/11/2013	3755.60	19.92	3735.68
EP-147	5/8/2012	3742.00	10.64	3731.36
EP-147	6/5/2012	3742.00	11.56	3730.44
EP-147	8/30/2012	3742.00	9.93	3732.07
EP-147	10/12/2012	3742.10	13.28	3728.82
EP-147	10/19/2012	3742.10	11.35	3730.75
EP-147	10/26/2012	3742.10	10.91	3731.19
EP-147	10/30/2012	3742.10	10.83	3731.27
EP-147	11/2/2012	3742.10	10.81	3731.29
EP-147	11/6/2012	3742.10	10.93	3731.17
EP-147	11/9/2012	3747.10	15.72	3731.38
EP-147	11/13/2012	3747.10	15.57	3731.53
EP-147	11/27/2012	3747.10	15.50	3731.60
EP-147	12/4/2012	3747.10	15.41	3731.69

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Well ID	Date	Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Water Elevation (ft amsl)
EP-147	12/18/2012	3747.10	15.32	3731.78
EP-147	1/2/2013	3747.10	15.25	3731.85
EP-147	1/22/2013	3747.10	15.00	3732.10
EP-147	1/25/2013	3747.10	15.18	3731.92
EP-147	1/29/2013	3747.10	15.10	3732.00
EP-147	3/6/2013	3752.10	20.02	3732.08
EP-147	3/20/2013	3752.10	19.99	3732.11
EP-147	4/4/2013	3752.10	19.93	3732.17
EP-147	4/19/2013	3752.10	19.87	3732.23
EP-147	5/2/2013	3752.10	19.86	3732.24
EP-147	5/17/2013	3752.10	19.91	3732.19
EP-147	5/31/2013	3752.10	19.94	3732.16
EP-147	6/14/2013	3752.10	19.96	3732.14
EP-147	7/23/2013	3752.12	19.75	3732.37
EP-147	8/2/2013	3747.12	14.65	3732.47
EP-147	8/9/2013	3747.12	14.63	3732.49
EP-147	8/23/2013	3747.12	14.58	3732.54
EP-147	9/4/2013	3747.12	14.29	3732.83
EP-147	9/14/2013	3747.12	13.02	3734.10
EP-147	9/26/2013	3747.12	12.17	3734.95
EP-147	10/11/2013	3747.12	12.09	3735.03
EP-148	7/23/2013	3744.34	12.97	3731.37
EP-148	8/2/2013	3744.34	12.90	3731.44
EP-148	8/9/2013	3744.34	12.89	3731.45
EP-148	8/23/2013	3744.34	12.86	3731.48
EP-148	9/4/2013	3744.34	12.54	3731.80
EP-148	9/14/2013	3744.34	11.03	3733.31
EP-148	9/26/2013	3744.34	10.55	3733.79
EP-148	10/11/2013	3744.34	10.51	3733.83
EP-149	7/23/2013	3744.75	13.19	3731.56
EP-149	8/2/2013	3744.75	13.11	3731.64
EP-149	8/9/2013	3744.75	13.10	3731.65
EP-149	8/23/2013	3744.75	13.07	3731.68
EP-149	9/4/2013	3744.75	12.74	3732.01
EP-149	9/14/2013	3744.75	11.29	3733.46
EP-149	9/26/2013	3744.75	10.74	3734.01
EP-149	10/11/2013	3744.75	10.70	3734.05
EP-150A-S	7/23/2013	3743.93	13.93	3730.00
EP-150A-S	8/2/2013	3743.93	13.95	3729.98
EP-150A-S	8/9/2013	3743.93	13.99	3729.94
EP-150A-S	8/23/2013	3743.93	14.03	3729.90
EP-150A-S	9/4/2013	3743.93	13.77	3730.16
EP-150A-S	9/14/2013	3743.93	12.19	3731.74
EP-150A-S	9/26/2013	3743.93	12.24	3731.69

Table 2
Groundwater Elevations
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Well ID	Date	Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Water Elevation (ft amsl)
EP-150A-S	10/11/2013	3743.93	12.30	3731.63
EP-150A-D	7/23/2013	3745.19	14.18	3731.01
EP-150A-D	8/2/2013	3745.19	14.41	3730.78
EP-150A-D	8/9/2013	3745.19	14.34	3730.85
EP-150A-D	8/23/2013	3745.19	14.23	3730.96
EP-150A-D	9/4/2013	3745.19	13.87	3731.32
EP-150A-D	9/14/2013	3745.19	12.20	3732.99
EP-150A-D	9/26/2013	3745.19	11.97	3733.22
EP-150A-D	10/11/2013	3745.19	11.90	3733.29
EP-150B-S	7/23/2013	3743.56	13.61	3729.95
EP-150B-S	8/2/2013	3743.56	13.64	3729.92
EP-150B-S	8/9/2013	3743.56	13.68	3729.88
EP-150B-S	8/23/2013	3743.56	13.72	3729.84
EP-150B-S	9/4/2013	3743.56	13.40	3730.16
EP-150B-S	9/14/2013	3743.56	11.88	3731.68
EP-150B-S	9/26/2013	3743.56	11.91	3731.65
EP-150B-S	10/11/2013	3743.56	11.98	3731.58
EP-150B-D	7/23/2013	3745.21	15.01	3730.20
EP-150B-D	8/2/2013	3745.21	15.39	3729.82
EP-150B-D	8/9/2013	3745.21	15.40	3729.81
EP-150B-D	8/23/2013	3745.21	15.43	3729.78
EP-150B-D	9/4/2013	3745.21	15.10	3730.11
EP-150B-D	9/14/2013	3745.21	13.14	3732.07
EP-150B-D	9/26/2013	3745.21	13.32	3731.89
EP-150B-D	10/11/2013	3745.21	13.51	3731.70
EP-150C-S	7/23/2013	3743.64	13.58	3730.06
EP-150C-S	8/2/2013	3743.64	13.70	3729.94
EP-150C-S	8/9/2013	3743.64	13.74	3729.90
EP-150C-S	8/23/2013	3743.64	13.79	3729.85
EP-150C-S	9/4/2013	3743.64	13.48	3730.16
EP-150C-S	9/14/2013	3743.64	11.96	3731.68
EP-150C-S	9/26/2013	3743.64	12.01	3731.63
EP-150C-S	10/11/2013	3743.64	12.06	3731.58
EP-150C-D	7/23/2013	3744.82	14.51	3730.31
EP-150C-D	8/2/2013	3744.82	14.76	3730.06
EP-150C-D	8/9/2013	3744.82	14.79	3730.03
EP-150C-D	8/23/2013	3744.82	14.85	3729.97
EP-150C-D	9/4/2013	3744.82	14.70	3730.12
EP-150C-D	9/14/2013	3744.82	13.70	3731.12
EP-150C-D	9/26/2013	3744.82	12.94	3731.88
EP-150C-D	10/11/2013	3744.82	13.07	3731.75
EP-151-S	7/23/2013	3744.47	16.87	3727.60
EP-151-S	8/2/2013	3744.47	16.92	3727.55
EP-151-S	8/9/2013	3744.47	16.98	3727.49

Table 2
Groundwater Elevations
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Well ID	Date	Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Water Elevation (ft amsl)
EP-151-S	8/23/2013	3744.47	17.04	3727.43
EP-151-S	9/4/2013	3744.47	16.67	3727.80
EP-151-S	9/14/2013	3744.47	13.48	3730.99
EP-151-S	9/26/2013	3744.47	14.43	3730.04
EP-151-S	10/11/2013	3744.47	15.06	3729.41
EP-151-D	7/23/2013	3745.73	16.83	3728.90
EP-151-D	8/2/2013	3745.73	17.63	3728.10
EP-151-D	8/9/2013	3745.73	17.70	3728.03
EP-151-D	8/23/2013	3745.73	17.74	3727.99
EP-151-D	9/4/2013	3745.73	17.36	3728.37
EP-151-D	9/14/2013	3745.73	14.43	3731.30
EP-151-D	9/26/2013	3745.73	15.45	3730.28
EP-151-D	10/11/2013	3745.73	15.75	3729.98
EP-152-S	7/23/2013	3747.50	19.35	3728.15
EP-152-S	8/2/2013	3747.50	19.35	3728.15
EP-152-S	8/9/2013	3747.50	19.35	3728.15
EP-152-S	8/23/2013	3747.50	19.41	3728.09
EP-152-S	9/4/2013	3747.50	19.09	3728.41
EP-152-S	9/14/2013	3747.50	16.18	3731.32
EP-152-S	9/26/2013	3747.50	17.24	3730.26
EP-152-S	10/11/2013	3747.50	17.51	3729.99
EP-152-D	7/23/2013	3745.23	16.80	3728.43
EP-152-D	8/2/2013	3745.23	16.80	3728.43
EP-152-D	8/9/2013	3745.23	16.83	3728.40
EP-152-D	8/23/2013	3745.23	16.87	3728.36
EP-152-D	9/4/2013	3745.23	16.51	3728.72
EP-152-D	9/14/2013	3745.23	13.72	3731.51
EP-152-D	9/26/2013	3745.23	14.67	3730.56
EP-152-D	10/11/2013	3745.23	14.93	3730.30
EP-153	5/8/2012	3736.00	4.19	3731.81
EP-153	6/5/2012	3736.00	7.96	3728.04
EP-153	8/30/2012	3736.00	6.14	3729.86
EP-153	10/12/2012	3741.00	13.57	3727.43
EP-153	10/19/2012	3741.00	14.62	3726.38
EP-153	10/26/2012	3741.00	14.45	3726.55
EP-153	10/30/2012	3741.00	14.43	3726.57
EP-153	11/2/2012	3741.00	14.39	3726.61
EP-153	11/6/2012	3741.00	14.36	3726.64
EP-153	11/9/2012	3741.00	14.36	3726.64
EP-153	11/13/2012	3741.00	14.36	3726.64
EP-153	11/27/2012	3741.00	14.38	3726.62
EP-153	12/4/2012	3741.00	14.39	3726.61
EP-153	12/18/2012	3741.00	14.31	3726.69
EP-153	1/2/2013	3741.00	14.30	3726.70

Table 2
Groundwater Elevations
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Well ID	Date	Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Water Elevation (ft amsl)
EP-153	1/22/2013	3741.00	14.19	3726.81
EP-153	1/25/2013	3741.00	14.27	3726.73
EP-153	1/29/2013	3741.00	14.21	3726.79
EP-153	3/6/2013	3741.00	14.19	3726.81
EP-153	3/20/2013	3741.00	14.15	3726.85
EP-153	4/4/2013	3741.00	14.21	3726.79
EP-153	4/19/2013	3741.00	14.16	3726.84
EP-153	5/2/2013	3741.00	14.16	3726.84
EP-153	5/17/2013	3741.00	14.20	3726.80
EP-153	5/31/2013	3741.00	14.22	3726.78
EP-153	6/14/2013	3741.00	14.01	3726.99
EP-153	7/23/2013	3741.19	13.69	3727.50
EP-153	8/2/2013	3741.19	13.75	3727.44
EP-153	8/9/2013	3741.19	13.83	3727.36
EP-153	8/23/2013	3741.19	13.89	3727.30
EP-153	9/4/2013	3741.19	13.49	3727.70
EP-153	9/14/2013	3741.19	10.22	3730.97
EP-153	9/26/2013	3746.19	16.80	3729.39
EP-153	10/11/2013	3746.02	17.17	3728.85
EP-154	5/8/2012	3737.80	8.91	3728.89
EP-154	6/5/2012	3737.80	9.68	3728.12
EP-154	8/30/2012	3737.80	7.85	3729.95
EP-154	10/12/2012	3737.80	10.30	3727.50
EP-154	10/19/2012	3737.80	11.22	3726.58
EP-154	10/26/2012	3737.80	11.10	3726.70
EP-154	10/30/2012	3737.80	10.93	3726.87
EP-154	11/2/2012	3737.80	10.96	3726.84
EP-154	11/6/2012	3737.80	10.37	3727.43
EP-154	11/9/2012	3742.80	15.99	3726.81
EP-154	11/13/2012	3742.80	16.01	3726.79
EP-154	11/27/2012	3742.80	15.98	3726.82
EP-154	12/4/2012	3742.80	16.00	3726.80
EP-154	12/18/2012	3742.80	15.91	3726.89
EP-154	1/2/2013	3742.80	15.88	3726.92
EP-154	1/22/2013	3742.80	15.78	3727.02
EP-154	1/25/2013	3742.80	15.87	3726.93
EP-154	1/29/2013	3742.80	15.81	3726.99
EP-154	3/6/2013	3742.80	15.78	3727.02
EP-154	3/20/2013	3742.80	15.74	3727.06
EP-154	4/4/2013	3742.80	15.73	3727.07
EP-154	4/19/2013	3742.80	15.73	3727.07
EP-154	5/2/2013	3742.80	15.73	3727.07
EP-154	5/17/2013	3742.80	15.75	3727.05
EP-154	5/31/2013	3742.80	15.81	3726.99

Table 2
Groundwater Elevations
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Well ID	Date	Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Water Elevation (ft amsl)
EP-154	6/14/2013	3742.80	15.59	3727.21
EP-154	7/23/2013	3743.02	15.28	3727.74
EP-154	8/2/2013	3743.02	15.34	3727.68
EP-154	8/9/2013	3743.02	15.39	3727.63
EP-154	8/23/2013	3743.02	15.44	3727.58
EP-154	9/4/2013	3743.02	15.05	3727.97
EP-154	9/14/2013	3743.02	11.89	3731.13
EP-154	9/26/2013	3743.02	13.27	3729.75
EP-154	10/11/2013	3743.02	13.61	3729.41
EP-155	5/8/2012	3735.10	4.08	3731.02
EP-155	6/5/2012	3735.10	7.88	3727.22
EP-155	8/30/2012	3735.10	5.98	3729.12
EP-155	10/12/2012	3740.20	13.35	3726.85
EP-155	10/19/2012	3740.20	14.40	3725.80
EP-155	10/26/2012	3740.20	14.34	3725.86
EP-155	10/30/2012	3740.20	14.26	3725.94
EP-155	11/2/2012	3740.20	14.23	3725.97
EP-155	11/6/2012	3740.20	14.12	3726.08
EP-155	11/9/2012	3740.20	14.20	3726.00
EP-155	11/13/2012	3740.20	14.22	3725.98
EP-155	11/27/2012	3740.20	14.22	3725.98
EP-155	12/4/2012	3740.20	14.24	3725.96
EP-155	12/18/2012	3740.20	14.17	3726.03
EP-155	1/2/2013	3740.20	14.16	3726.04
EP-155	1/22/2013	3740.20	14.08	3726.12
EP-155	1/25/2013	3740.20	14.15	3726.05
EP-155	1/29/2013	3740.20	14.10	3726.10
EP-155	3/6/2013	3740.20	14.08	3726.12
EP-155	3/20/2013	3740.20	14.02	3726.18
EP-155	4/4/2013	3740.20	14.02	3726.18
EP-155	4/19/2013	3740.20	14.00	3726.20
EP-155	5/2/2013	3740.20	14.02	3726.18
EP-155	5/17/2013	3740.20	14.08	3726.12
EP-155	5/31/2013	3740.20	14.09	3726.11
EP-155	6/14/2013	3740.20	13.82	3726.38
EP-155	7/23/2013	3740.38	13.50	3726.88
EP-155	8/2/2013	3740.38	13.33	3727.05
EP-155	8/9/2013	3745.38	17.40	3727.98
EP-155	8/23/2013	3745.38	17.47	3727.91
EP-155	9/4/2013	3745.38	17.06	3728.32
Well abandoned September 2013				
EP-156	5/8/2012	3733.90	7.61	3726.29
EP-156	8/30/2012	3733.90	8.21	3725.69
EP-156	10/12/2012	3733.90	8.35	3725.55

Table 2
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Well ID	Date	Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Water Elevation (ft amsl)
EP-156	10/26/2012	3733.90	9.57	3724.33
EP-156	10/30/2012	3733.90	9.52	3724.38
EP-156	11/2/2012	3733.90	9.49	3724.41
EP-156	11/6/2012	3733.90	9.15	3724.75
EP-156	11/9/2012	3733.90	9.51	3724.39
EP-156	11/13/2012	3733.90	9.53	3724.37
EP-156	11/27/2012	3733.90	9.58	3724.32
EP-156	12/4/2012	3733.90	9.61	3724.29
EP-156	12/18/2012	3733.90	9.51	3724.39
EP-156	1/2/2013	3733.90	9.56	3724.34
EP-156	1/22/2013	3733.90	9.48	3724.42
EP-156	1/25/2013	3733.90	9.55	3724.35
EP-156	1/29/2013	3733.90	9.51	3724.39
EP-156	3/6/2013	3738.90	14.54	3724.36
EP-156	3/20/2013	3738.90	14.51	3724.39
EP-156	4/4/2013	3738.90	14.55	3724.35
EP-156	4/19/2013	3738.90	14.52	3724.38
EP-156	5/2/2013	3738.90	14.52	3724.38
EP-156	5/17/2013	3738.90	14.55	3724.35
EP-156	5/31/2013	3738.90	14.61	3724.29
EP-156	6/14/2013	3738.90	14.20	3724.70
Well abandoned June 2013				
EP-156R	7/23/2013	3740.54	17.88	3722.66
EP-156R	8/2/2013	3740.54	18.08	3722.46
EP-156R	8/9/2013	3740.54	18.25	3722.29
EP-156R	8/23/2013	3740.54	18.37	3722.17
EP-156R	9/4/2013	3740.54	18.39	3722.15
EP-156R	9/14/2013	3740.54	15.63	3724.91
EP-156R	9/26/2013	3740.54	16.92	3723.62
EP-156R	10/11/2013	3740.54	17.53	3723.01
EP-157	7/23/2013	3757.00	23.41	3733.59
EP-157	8/2/2013	3757.00	23.27	3733.73
EP-157	8/9/2013	3757.00	23.23	3733.77
EP-157	8/23/2013	3757.00	23.16	3733.84
EP-157	9/4/2013	3757.00	22.84	3734.16
EP-157	9/14/2013	3757.00	21.22	3735.78
EP-157	9/26/2013	3757.00	20.58	3736.42
EP-157	10/11/2013	3757.00	20.45	3736.55
OBS-1	1/22/2013	3741.07	20.15	3720.92
OBS-1	1/25/2013	3741.07	20.12	3720.95
OBS-1	1/29/2013	3741.07	20.08	3720.99
OBS-1	3/6/2013	3741.07	19.13	3721.94
OBS-1	3/20/2013	3741.07	20.17	3720.90
OBS-1	4/4/2013	3741.07	20.13	3720.94

Table 2
Groundwater Elevations
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Well ID	Date	Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Water Elevation (ft amsl)
OBS-1	4/19/2013	3741.07	20.18	3720.89
OBS-1	5/2/2013	3741.07	20.20	3720.87
OBS-1	5/17/2013	3741.07	20.24	3720.83
OBS-1	5/31/2013	3741.07	20.27	3720.80
OBS-1	6/14/2013	3741.07	19.42	3721.65
OBS-1	7/23/2013	3741.07	19.41	3721.66
OBS-1	8/2/2013	3741.07	19.66	3721.41
OBS-1	8/9/2013	3741.07	19.80	3721.27
OBS-1	8/23/2013	3741.07	19.95	3721.12
OBS-1	9/4/2013	3741.07	19.98	3721.09
OBS-1	9/14/2013	3741.07	18.23	3722.84
OBS-1	9/26/2013	3741.07	19.08	3721.99
OBS-1	10/11/2013	3741.07	19.45	3721.62

Notes:
amsl = above mean sea level
btoc = below top of casing
ft = feet

Table 3A
Slug Test Results
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Location	Well ID	Slug Test Type	Design Hydraulic Conductivity		Calculated Hydraulic Conductivity		Average Hydraulic Conductivity		Analytical Solution[1]
			ft/day	cm/sec	ft/day	cm/sec	ft/day	cm/sec	
Upgradient of PRB-1	EP-138R	Falling Head	> 18	> 6.4E-3	18.1	6.4E-03	17.7	6.3E-03	Bouwer and Rice (1976)[2]
		Rising Head			17.9	6.3E-03			
		Falling Head			17.9	6.3E-03			
		Rising Head			15.3	5.4E-03			
	EP-139R	Falling Head			22.6	8.0E-03			
		Rising Head			12.3	4.3E-03			
		Falling Head			24.2	8.5E-03			
		Rising Head			13.5	4.8E-03			
PRB-1	EP-140A	Falling Head	> 42	> 1.5E-2	690	2.4E-01	986	3.5E-01	Springer and Gelhar (1991)[3]
		Rising Head			520	1.8E-01			
	EP-140B	Falling Head			665	2.3E-01			
		Rising Head			520	1.8E-01			
	EP-141B	Falling Head			1720	6.1E-01			
		Rising Head			1800	6.4E-01			
PRB-2	EP-150A-S	Falling Head	> 1100	> 3.9E-1	1690	6.0E-01	1549	5.5E-01	
		Rising Head			1220	4.3E-01			
	EP-150A-D	Rising Head			1050	3.7E-01			
		Falling Head			1820	6.4E-01			
	EP-150B-S	Falling Head			1550	5.5E-01			
		Rising Head			1830	6.5E-01			
	EP-150B-D	Rising Head			1330	4.7E-01			
		Falling Head			1900	6.7E-01			

Notes:
ft = feet
ft/day = feet per day
cm/sec = centimeters per second
PRB = permeable reactive barrier
> = greater than

[1] data analyzed using the software AQTESOLV (Duffield, G.M., 2007. AQTESOLV for Windows Version 4.5 , HydroSOLVE, Inc., Reston, VA)

[2] Bouwer, H. and R.C. Rice, 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, Water Resources Research, vol. 12, no. 3, pp. 423-428.

[3] Springer, R.K. and L.W. Gelhar, 1991. Characterization of large-scale aquifer heterogeneity in glacial outwash by analysis of slug tests with oscillatory response, Cape Cod, Massachusetts, U.S. Geol. Surv. Water Res. Invest. Rep. 91-4034, pp. 36-40

Table 3B
Single Well Tracer Test Results
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Location	Well ID	Design Groundwater Velocity (ft/day)	Calculated Aquifer Flux[1] (ft/day)	Calculated Groundwater Velocity[2] (ft/day)
PRB-1	EP-140B	2.2	2.4	10
	EP-141B		1.7	7.0
PRB-2	EP-150B-S	6.0	0.40-1.1	1.6-4.4
	EP-150B-D		6.0	24
Downgradient of PRB-2	EP-151S	NE	8-21	42-104
	EP-151D		10	34

Notes:

ft/day = feet per day

NE = not estimated

PRB = permeable reactive barrier

[1] ranges are provided where additional calculated aquifer flux estimate were conducted due to tracer washout rates that were not uniform.

[2] mobile porosity assumed to be 0.20 for the downgradient wells installed in the alluvium and 0.25 for wells installed in the PRBs

Table 4
Performance Monitoring Results - Field and Water Quality Parameters
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Level	Well	EP-138	EP-138	EP-138R	EP-138R	EP-139	EP-139	EP-139R	EP-139R	EP-140A	EP-140A	EP-140B
		Sample Date	5/8/2012	6/5/2012	7/11/2013	9/5/2013	5/7/2012	6/5/2012	7/11/2013	9/6/2013	7/11/2013	9/5/2013	7/11/2013
Water Quality Parameters (mg/L)													
Chloride	250[1]		226	438	299	293	337	333	284	341	303	307	301
Fluoride	4		2.52	2.84	2.51	3.02	3.06	3.28	2.39	2.86	2.11	2.28	2.01
Nitrate/Nitrite	--		--	6.41	--	8.23	--	8.71	--	7.50	--	< 5.00	--
Sulfate	250[1]		--	2970	--	971	--	1110	--	1130	--	930	--
Sulfide	--		<0.0500	<0.0500	--	< 0.0500	<0.0500	0.0240 J	--	0.0330 J	--	0.854	--
Total Alkalinity	--		343	386	392	391	395	382	395	414	284	292	288
Total Dissolved Solids	500[1]		3030	6060	2440	2460	3380	2670	2470	2600	2120	2130	2090
Total Organic Carbon	--		3.14	3.47	--	2.33	2.73	3.00	--	2.54	--	2.22	--
Total Suspended Solids	--		--	14.8	--	4.40 H	--	3.40	--	< 3.00 H	--	< 3.00 H	--
Silica	--		34.1	30.2	37.2	32.7	31.2	31.6	37.9	32.4	4.37	4.50	4.18
Iron (II)	--		--	--	--	0.186 JHF	--	--	--	< 0.200 HF	--	0.0670 JHF	--
Iron (III)	--		--	--	--	< 0.400	--	--	--	< 0.400	--	< 0.400	--
Iron	--		--	--	--	< 0.400	--	--	--	< 0.400	--	< 0.400	--
Field Parameters													
Temperature (°C)	--		24.02	24.45	24.99	25.17	25.82	24.00	27.18	24.97	25.4	26.13	26.41
Specific Conductivity (S/cm)	--		3886	6733	3962	3582	3817	3799	4112	3661	3666	3244	3683
pH	--		7.21	6.03	7.35	7.25	7.20	6.34	7.31	7.37	9.45	8.86	9.38
ORP (mV)	--		91.2	371.1	-14.9	27.4	61.2	303.2	-137.1	43	-240.7	-116.2	-232.5
Dissolved Oxygen (mg/L)	--		1.58	5.61	0.7	0.23	0.39	9.24	0.36	0.32	0.39	0.09	0.32
Turbidity (NTU)	--		25.1	20.2	11.9	5.53	11.8	8.40	11.4	4.5	4.89	9.35	11.9
Ambient Parameters													
Air Temperature (°F)	--		68.3	85.9	91	85.8	81	85.9	91	85.4	91	85.8	91
Barometric Pressure (in Hg)	--		29.869	29.684	29.744	29.87	29.792	29.684	29.744	29.84	29.744	29.87	29.744

Notes:
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mV = millivolts
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Dup = duplicate sample
Silica analysis by Environmental Protection Agency (EPA) method 8010B except for July 2013, which was analyzed by EPA method 8020

Table 4
Performance Monitoring Results - Field and Water Quality Parameters
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Level	Well	EP-140B	EP-140C	EP-140C (Dup)	EP-140C	EP-141A	EP-141A	EP-141B	EP-141B	EP-141C	EP-141C	EP-142
		Sample Date	9/5/2013	7/10/2013	7/10/2013	9/5/2013	7/11/2013	9/6/2013	7/11/2013	9/6/2013	7/11/2013	9/6/2013	7/11/2013
Water Quality Parameters (mg/L)													
Chloride	250[1]		297	279	258	302	279	304	292	312	282	308	310
Fluoride	4		2.42	1.99	1.98	2.04	2.78	3.18	2.27	2.32	2.78	2.88	1.95
Nitrate/Nitrite	--		< 5.00	--	--	< 5.00	--	7.53	--	< 5.00	--	7.13	--
Sulfate	250[1]		887	--	--	834	--	1000	--	823	--	997	--
Sulfide	--		0.357	--	--	0.209	--	0.0300 J	--	0.260	--	0.0430 J	--
Total Alkalinity	--		288	256	257	271	392	382	205	274	386	390	248
Total Dissolved Solids	500[1]		2230	1990	2040	2060	2540	2380	1780	1990	2480	2450	2010
Total Organic Carbon	--		2.06	--	--	2.03	--	2.24	--	2.09	--	2.29	--
Total Suspended Solids	--		4.00 H	--	--	4.25 H	--	< 3.00 H	--	< 3.00 H	--	< 3.00 H	--
Silica	--		4.40	2.91	2.91	2.57	30.7	29.4	2.95	6.43	35.0	29.7	4.39
Iron (II)	--		0.179 JHF	--	--	0.228 HF	--	< 0.200 HF	--	0.0330 JHF	--	< 0.200 HF	--
Iron (III)	--		< 0.400	--	--	< 0.400	--	< 0.400	--	< 0.400	--	< 0.400	--
Iron	--		< 0.400	--	--	< 0.400	--	< 0.400	--	< 0.400	--	< 0.400	--
Field Parameters													
Temperature (°C)	--		25.59	28.08	28.08	26.5	25.12	24.84	28.02	25.02	25.91	26.33	26.7
Specific Conductivity (S/cm)	--		3216	3547	3547	3147	3968	3519	3318	3087	4027	3600	3549
pH	--		8.83	9.7	9.7	8.9	7.57	7.31	10.05	9.09	7.49	7.33	9.51
ORP (mV)	--		-101.9	-179.6	-179.6	-45.9	-155.4	84.5	-204.1	-64.1	-182	42.9	-204.5
Dissolved Oxygen (mg/L)	--		0.06	0.38	0.38	0.16	0.26	0.18	0.8	0.1	0.25	0.12	0.21
Turbidity (NTU)	--		7.09	7.92	7.92	5.64	5.12	4.14	4.17	6.06	6.01	6.12	7.61
Ambient Parameters													
Air Temperature (°F)	--		85.8	89.7	89.7	85.8	91	85.4	91	85.4	91	85.4	91
Barometric Pressure (in Hg)	--		29.87	29.819	29.819	29.87	29.744	29.84	29.744	29.84	29.744	29.84	29.744

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Table 4
Performance Monitoring Results - Field and Water Quality Parameters
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Level	Well	EP-142	EP-143	EP-143	EP-143 (Dup)	EP-144	EP-144	EP-144	EP-144	EP-144	EP-144	EP-144
		Sample Date	9/5/2013	7/15/2013	9/6/2013	9/6/2013	5/8/2012	6/5/2012	10/18/2012	11/15/2012	12/4/2012	2/6/2013	7/11/2013
Water Quality Parameters (mg/L)													
Chloride	250[1]		298	289	314	305	319	330	339	311	335	332	294
Fluoride	4		2.22	3.18	2.78	2.66	3.80	3.45	5.22	4.32	3.68	3.26	2.16
Nitrate/Nitrite	--		< 5.00	--	5.46	5.35	--	8.74	0.942 J	< 0.800	1.44 J	2.44 J	--
Sulfate	250[1]		837	--	936	908	--	1120	1070	928	1060	1040	--
Sulfide	--		0.243	--	0.0270 J	0.0280 J	< 0.0500	0.0170 J	< 0.0500	< 0.00131	< 0.0500	< 0.0500	--
Total Alkalinity	--		271	323	342	339	386	390	186	188	225	257	322
Total Dissolved Solids	500[1]		2080	2280	2250	2330	2540	2660	2230	2190	2150	2130	2330
Total Organic Carbon	--		2.02	--	2.28	2.29	2.61	3.03	2.66	2.27	2.21	2.26	--
Total Suspended Solids	--		4.00 H	--	< 3.00 H	3.00 H	--	< 3.00	5.40	15.4	40.0	13.6	--
Silica	--		3.75	19.9	22.8	25.1	32.8	31.9	24.4	14.3	--	--	22.9
Iron (II)	--		0.207 HF	--	< 0.200 HF	< 0.200 HF	--	--	< 0.200 HF	< 0.106 J HF	0.359 HF	0.0940 JHF	--
Iron (III)	--		< 0.400	--	< 0.400	< 0.400	--	--	< 0.400	< 0.400	< 0.400	0.564	--
Iron	--		< 0.400	--	< 0.400	< 0.400	--	--	--	< 0.400	0.717	--	--
Field Parameters													
Temperature (°C)	--		26.43	24.72	25.71	25.71	23.88	24.4	25.35	24.68	24.63	24.27	25.23
Specific Conductivity (S/cm)	--		3121	3836	3434	3434	3657	3841	3160	3113	3385	3489	3792
pH	--		8.74	7.85	7.6	7.6	7.33	6.17	7.5	7.93	7.94	8.15	7.90
ORP (mV)	--		-64.6	-27.7	57.3	57.3	102.3	389.9	110.8	136.3	7.6	-16.7	-38.8
Dissolved Oxygen (mg/L)	--		0.18	0.40	0.11	0.11	0.43	6.72	0.67	0.05	0.14	0.08	0.18
Turbidity (NTU)	--		6.07	49.2	7.42	7.42	2.25	2.75	10.60	14.3	36.2	28	32.1
Ambient Parameters													
Air Temperature (°F)	--		85.8	77.6	85.4	85.4	68.3	85.9	66	54	64.5	63.1	91
Barometric Pressure (in Hg)	--		29.87	29.758	29.84	29.84	29.869	29.684	29.93	30.16	30.268	29.937	29.744

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Table 4
Performance Monitoring Results - Field and Water Quality Parameters
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Level	Well	EP-144	EP-145	EP-145	EP-145	EP-145	EP-145	EP-145	EP-145	EP-145	EP-146	EP-146
		Sample Date	9/17/2013	5/8/2012	6/5/2012	10/18/2012	11/15/2012	12/4/2012	2/5/2013	7/10/2013	9/9/2013	5/8/2012	6/5/2012
Water Quality Parameters (mg/L)													
Chloride	250[1]		320	360	366	356	336	377	332	329	349	332	368
Fluoride	4		2.70	2.82	2.32	3.11	2.83	3.10	3.32	2.44	2.88	3.56	2.86
Nitrate/Nitrite	--		4.80	--	6.44	3.83	4.48	5.80	6.30	--	6.49	--	6.84
Sulfate	250[1]		959	--	1160	1080	1030	1230	1060	--	1070	--	1180
Sulfide	--		< 0.0500	< 0.0500	0.0210 J	< 0.0500	< 0.0200	< 0.0500	0.0550	--	< 0.0500	< 0.0500	< 0.0500
Total Alkalinity	--		343	418	407	351	351	366	380	391	405	416	397
Total Dissolved Solids	500[1]		2360	2590	2770	2480	2470	2470	2440	2540	2530	2560	2800
Total Organic Carbon	--		2.13	3.02	3.47	2.30	2.75	3.18	2.76 b	--	2.65	2.94	3.44
Total Suspended Solids	--		13.4 H	--	< 3.00	< 3.00	< 3.00	< 3.00	< 3.00	--	3.00 H	--	< 3.00
Silica	--		21.3	31.1	29.5	29.2	26.1	--	--	33.7	30.6	31.4	29.9
Iron (II)	--		< 0.200	--	--	< 0.200 HF	0.0530 JHF	0.0590 JHF	< 0.200 HF	--	< 0.200 HF	--	--
Iron (III)	--		< 0.400 HF	--	--	< 0.400	< 0.400	< 0.400	< 0.400	--	< 0.400	--	--
Iron	--		0.446 HF	--	--	--	< 0.400	< 0.400	--	--	< 0.400	--	--
Field Parameters													
Temperature (°C)	--		26.9	22.39	23.91	24.85	23.2	22.5	19.75	26.48	23.87	23.16	24.48
Specific Conductivity (S/cm)	--		3574	3626	3878	3527	3551	3763	3805	4088	3619	3655	3909
pH	--		7.82	7.3	5.99	7.07	7.37	7.47	7.35	7.32	7.3	7.28	5.78
ORP (mV)	--		38.1	90.7	362.8	72.1	124.7	-22.8	22	-19.6	83	104.3	390
Dissolved Oxygen (mg/L)	--		0.06	0.51	7.55	0.13	0.3	0.2	0.59	0.48	0.24	0.63	8.09
Turbidity (NTU)	--		23.7	4.48	2.94	2.48	2.98	2.79	2.03	3	5.57	4.24	4.34
Ambient Parameters													
Air Temperature (°F)	--		77.75	68.3	85.9	66	54	64.5	40.1	89.7	78	68.3	85.9
Barometric Pressure (in Hg)	--		29.83	29.869	29.684	29.93	30.16	30.268	30.262	29.819	29.67	29.869	29.684

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µS/cm = microSiemens per centimeter
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NT = nephelometric turbidity nits
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Table 4
Performance Monitoring Results - Field and Water Quality Parameters
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Level	Well	EP-146	EP-146	EP-146	EP-146	EP-146	EP-147	EP-147	EP-147	EP-147	EP-147	EP-147
		Sample Date	10/18/2012	12/4/2012	2/5/2013	7/10/2013	9/9/2013	5/8/2012	6/6/2012	10/18/2012	12/4/2012	2/5/2013	7/10/2013
Water Quality Parameters (mg/L)													
Chloride	250[1]		370	372	311	284	369	340	377	339	388	349	329
Fluoride	4		2.89	3.10	3.12	2.33	2.78	3.40	3.86	2.88	2.90	3.12	2.33
Nitrate/Nitrite	--		4.15	5.34	5.77	--	6.06	--	6.07	5.27	4.81	4.78	--
Sulfate	250[1]		1180	1220	1010	--	1140	--	1160	1080	1230	1130	--
Sulfide	--		< 0.0500	< 0.0500	0.0340 J	--	< 0.0500	< 0.0500	0.0170 J	< 0.0500	< 0.0500	0.0440 J	--
Total Alkalinity	--		372	355	386	401	401	419	400	398	372	382	413
Total Dissolved Solids	500[1]		2610	2590	2210	2570	2530	2610	2670	2560	2600	2410	2720
Total Organic Carbon	--		2.25	2.56	2.69 b	--	2.54	2.88	3.80	2.55	2.84	2.60 b	--
Total Suspended Solids	--		< 3.00	5.00	7.40	--	< 3.00 H	--	10.8	3.80	3.60	< 3.00	--
Silica	--		30.6	--	--	33.3	30.7	29.6	28.7	29.9	--	--	29.3
Iron (II)	--		< 0.200 HF	0.0790 JHF	0.0370 JHF	--	0.261 HF	--	--	< 0.200 HF	0.0660 JHF	< 0.200 HF	--
Iron (III)	--		< 0.400	< 0.400	< 0.400	--	< 0.400	--	--	< 0.400	< 0.400	< 0.400	--
Iron	--		--	< 0.400	--	--	< 0.400	--	--	--	< 0.400	--	--
Field Parameters													
Temperature (°C)	--		25.07	23.45	20.45	26.84	24.88	22.4	22.87	24.91	23.69	20.79	25.45
Specific Conductivity (S/cm)	--		3662	3810	3857	4123	3667	3564	3754	3569	3857	3778	4157
pH	--		7.01	7.38	7.35	7.29	7.14	7.27	6.55	7	7.12	7.37	7.28
ORP (mV)	--		39.6	-51.7	7.4	-2	125.6	113.9	281.6	37.4	-20.7	-0.3	-14.8
Dissolved Oxygen (mg/L)	--		0.19	0.3	0.2	0.54	0.33	0.28	8.05	0.1	0.28	0.2	0.55
Turbidity (NTU)	--		9.83	3.96	14.2	5.26	7.25	5.07	12.5	4.43	3.35	1.69	3.79
Ambient Parameters													
Air Temperature (°F)	--		66	64.5	40.1	89.7	78	68.3	91.7	66	64.5	40.1	89.7
Barometric Pressure (in Hg)	--		29.93	30.268	30.262	29.819	29.67	29.869	29.658	29.93	30.268	30.262	29.819

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Table 4
Performance Monitoring Results - Field and Water Quality Parameters
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Level	Well	EP-147	EP-148	EP-148	EP-149	EP-149 (Dup)	EP-149	EP-149 (Dup)	EP-150A-S	EP-150A-S	EP-150A-D	EP-150A-D
		Sample Date	9/9/2013	7/15/2013	9/17/2013	7/15/2013	7/15/2013	9/17/2013	9/17/2013	7/16/2013	9/16/2013	7/16/2013	9/10/2013
Water Quality Parameters (mg/L)													
Chloride	250[1]		363	388	360	358	350	319	365	384	388	395	382
Fluoride	4		2.66	3.01	3.00	3.18	2.89	2.90	2.84	1.86	1.83	2.73	2.78
Nitrate/Nitrite	--		5.36	--	7.48	--	--	7.31	7.36	--	< 0.500	--	6.49
Sulfate	250[1]		1070	--	1120	--	--	956	1110	--	882	--	2390
Sulfide	--		< 0.0500	--	0.0310 J	--	--	0.0230 J	0.0210 J	--	0.227	--	< 0.0500
Total Alkalinity	--		412	408	386	403	416	398	402	245	241	404	405
Total Dissolved Solids	500[1]		2640	2730	2760	2910	2860	2770	2810	2260	2110	2680	2670
Total Organic Carbon	--		2.74	--	3.28	--	--	3.09	3.06	--	2.40	--	3.28
Total Suspended Solids	--		4.40 H	--	< 3.00 H	--	--	< 3.00 H	< 3.00 H	--	9.20 H	--	6.80 H
Silica	--		28.1	27.2	27.8	28.0	27.7	27.5	29.1	1.94	2.38	28.5	31.2
Iron (II)	--		< 0.200 HF	--	0.0530 J	--	--	< 0.200	< 0.200	--	0.0600 JHF	--	< 0.200 HF
Iron (III)	--		< 0.400	--	< 0.400 HF	--	--	< 0.400 HF	< 0.400 HF	--	< 0.400 HF	--	< 0.400
Iron	--		< 0.400	--	< 0.400 HF	--	--	< 0.400 HF	< 0.400 HF	--	< 0.400 HF	--	< 0.400
Field Parameters													
Temperature (°C)	--		23.45	24.51	23.7	24.29	24.29	23.5	23.5	23.82	24.4	23.44	22.79
Specific Conductivity (S/cm)	--		3700	4354	3774	4525	4525	3964	3964	3987	3403	4273	3765
pH	--		7.1	7.21	7.31	7.18	7.18	7.28	7.28	9.82	9.78	7.22	7.39
ORP (mV)	--		128	-21.1	126.3	-17.1	-17.1	115.1	115.1	-169.4	-101.3	-98.8	-13.8
Dissolved Oxygen (mg/L)	--		0.08	0.26	0.15	0.27	0.27	0.19	0.19	0.17	0.12	0.24	0.34
Turbidity (NTU)	--		7.59	4.75	5.86	3	3	2.44	2.44	17.6	13.9	4.24	4.05
Ambient Parameters													
Air Temperature (°F)	--		78	77.6	77.75	77.6	77.6	77.75	77.75	79.4	76.8	79.4	69.9
Barometric Pressure (in Hg)	--		29.67	29.758	29.83	29.758	29.758	29.83	29.83	29.947	29.86	29.947	29.78

Notes:
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°C = degrees Celsius
°F = degrees Farenheit
µS/cm = microSiemens per centimeter
mV = millivolts
NT = nephelometric turbidity nits
in Hg = inches of mercury
Dup = duplicate sample
Silica analysis by Environmental Protection Agency (EPA) method 8010B except for July 2013, which was analyzed by EPA method 8020

Table 4
Performance Monitoring Results - Field and Water Quality Parameters
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Level	Well	EP-150B-S	EP-150B-S	EP-150B-D	EP-150B-D	EP-150C-S	EP-150C-S	EP-150C-D	EP-150C-D	EP-151-S	EP-151-S	EP-151-D
		Sample Date	7/16/2013	9/10/2013	7/16/2013	9/10/2013	7/17/2013	9/16/2013	7/17/2013	9/16/2013	7/18/2013	9/16/2013	7/17/2013
Water Quality Parameters (mg/L)													
Chloride	250[1]		397	387	378	386	396	398	394	366	375	390	364
Fluoride	4		2.50	2.34	2.19	2.02	2.11	2.26	2.73	2.44	2.85	3.02	3.18
Nitrate/Nitrite	--		--	< 0.500	--	< 0.500	--	< 0.500	--	0.214 J	--	4.60	--
Sulfate	250[1]		--	716	--	928	--	679	--	925	--	1130	--
Sulfide	--		--	0.706	--	0.648	--	0.215	--	0.0390 J	--	< 0.0500	--
Total Alkalinity	--		152	217	256	233	201	272	290	229	367	372	372
Total Dissolved Solids	500[1]		1910	1900	2240	2220	1910	1910	2220	2220	2420	2470	2430
Total Organic Carbon	--		--	3.28	--	2.96	--	2.72	--	2.47	--	2.66	--
Total Suspended Solids	--		--	3.60 H	--	< 3.00 H	--	5.20 H	--	4.60 H	--	< 3.00 H	--
Silica	--		3.34	6.55	3.28	4.98	2.80	3.41	7.84	5.79	28.7	25.2	25.8
Iron (II)	--		--	< 0.200 HF	--	0.165 JHF	--	< 0.200 HF	--	0.284 HF	--	0.0390 JHF	--
Iron (III)	--		--	< 0.400	--	< 0.400	--	< 0.400 HF	--	< 0.400 HF	--	< 0.400 HF	--
Iron	--		--	< 0.400	--	< 0.400	--	< 0.400 HF	--	< 0.400 HF	--	< 0.400 HF	--
Field Parameters													
Temperature (°C)	--		23.28	24.56	23.26	23.6	23.52	24.7	23.09	24.6	22.12	23.5	23.17
Specific Conductivity (S/cm)	--		3541	3080	3916	3271	3607	3187	3942	3450	4025	3760	4005
pH	--		10.52	9.9	9.45	8.89	10.71	10.62	8.23	8.69	7.33	7.38	7.33
ORP (mV)	--		-221.6	-142.5	-197.9	-53.8	-143.1	-167.4	-220.4	-63.5	-2.6	207.1	-43.7
Dissolved Oxygen (mg/L)	--		0.2	0.34	0.14	0.42	0.15	0.15	0.24	0.14	0.34	0.16	0.39
Turbidity (NTU)	--		7.38	8.74	5.93	29.3	4.64	9.86	12.8	11.8	3.58	7.55	2.96
Ambient Parameters													
Air Temperature (°F)	--		79.4	69.9	79.4	69.9	74.7	76.8	74.7	76.8	68.3	76.8	74.7
Barometric Pressure (in Hg)	--		29.947	29.78	29.947	29.78	30.022	29.86	30.022	29.86	30.024	29.86	30.022

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mV = millivolts
NT = nephelometric turbidity nits
in Hg = inches of mercury
Dup = duplicate sample
Silica analysis by Environmental Protection Agency (EPA) method 8010B except for July 2013, which was analyzed by EPA method 8020

Table 4
Performance Monitoring Results - Field and Water Quality Parameters
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Level	Well	EP-151-D	EP-152-S	EP-152-S	EP-152-D	EP-152-D	EP-153	EP-153	EP-153	EP-153 (Dup)	EP-153	EP-153
		Sample Date	9/16/2013	7/16/2013	9/10/2013	7/16/2013	9/10/2013	5/9/2012	6/6/2012	10/19/2012	10/19/2012	11/15/2012	12/5/2012
Water Quality Parameters (mg/L)													
Chloride	250[1]		369	367	366	372	374	323	361	328	367	353	357
Fluoride	4		3.18	2.81	2.68	2.84	2.72	4.02	2.58	3.14	3.68	2.78	3.16
Nitrate/Nitrite	--		5.05	--	3.88	--	5.42	--	6.64	6.03	6.15	3.99	4.28
Sulfate	250[1]		1100	--	2380	--	2340	--	1150	1050	1210	1110	1120
Sulfide	--		< 0.0500	--	< 0.0500	--	< 0.0500	< 0.0500	0.0160 J	< 0.0500	< 0.0500	< 0.0500	< 0.0500
Total Alkalinity	--		387	402	412	383	406	398	394	402	369	339	328
Total Dissolved Solids	500[1]		2520	2490	2620	2460	2590	2480	2660	2610	2530	2570	2480
Total Organic Carbon	--		2.64	--	2.57	--	2.74	3.30	3.52	2.27	2.23	3.20	3.17
Total Suspended Solids	--		< 3.00 H	--	3.40 H	--	< 3.00 H	--	< 3.00	4.20	3.40	< 3.00	4.40
Silica	--		27.4	24.3	25.5	26.2	28.7	30.7	28.6	31.1	31.6	29.6	--
Iron (II)	--		0.0810 JHF	--	0.0670 JHF	--	0.0600 JHF	--	--	< 0.200 HF	< 0.200 HF	0.0590 J HF	< 0.200 HF
Iron (III)	--		< 0.400 HF	--	< 0.400	--	< 0.400	--	--	< 0.400	< 0.400 HF	< 0.400	< 0.400
Iron	--		< 0.400 HF	--	< 0.400	--	< 0.400	--	--	--	--	< 0.400	< 0.400
Field Parameters													
Temperature (°C)	--		23.4	24.19	22.8	23.85	22.29	21.12	23.52	22.77	22.77	24.21	23.23
Specific Conductivity (S/cm)	--		3776	4111	3669	4129	3686	3389	3780	3428	3428	3631	3738
pH	--		7.37	7.48	7.6	7.22	7.52	7.34	5.2	7.02	7.02	7.37	7.28
ORP (mV)	--		187.2	-47.5	-5.2	-51.5	6.4	56.8	398.3	82.5	82.5	96.4	95.1
Dissolved Oxygen (mg/L)	--		0.13	0.94	0.24	0.3	0.26	0.44	3.73	0.16	0.16	0.48	0.27
Turbidity (NTU)	--		7.99	13.4	4.85	13.7	5.04	5.04	3.35	5.78	5.78	4.17	5.07
Ambient Parameters													
Air Temperature (°F)	--		76.8	79.4	69.9	79.4	69.9	65	91.7	66	66	54	40.1
Barometric Pressure (in Hg)	--		29.86	29.947	29.78	29.947	29.78	30.01	29.658	29.93	29.93	30.16	30.262

Notes:
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mV = millivolts
NT = nephelometric turbidity nits
in Hg = inches of mercury
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Table 4
Performance Monitoring Results - Field and Water Quality Parameters
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Level	Well	EP-153 (Dup)	EP-153	EP-153	EP-153	EP-154	EP-154	EP-154	EP-154	EP-154	EP-154	EP-154
		Sample Date	12/5/2012	2/6/2013	7/10/2013	9/18/2013	5/9/2012	6/6/2012	10/19/2012	11/15/2012	12/5/2012	2/5/2013	7/10/2013
Water Quality Parameters (mg/L)													
Chloride	250[1]		324	347	310	328	345	368	324	333	385	361	317
Fluoride	4		3.10	3.32	2.65	2.70	3.56	3.05	3.66	2.60	2.90	3.12	2.45
Nitrate/Nitrite	--		4.08	4.51	--	5.21	--	6.15	5.65	4.60	5.18	4.71	--
Sulfate	250[1]		992	1070	--	939	--	1140	1010	1020	1220	1170	--
Sulfide	--		< 0.0500	0.0230 J	--	0.0300 J	< 0.0500	0.0140 J	< 0.0500	< 0.0500	< 0.0500	0.0280 J	--
Total Alkalinity	--		345	369	380	396	416	389	396	386	375	397	409
Total Dissolved Solids	500[1]		2560	2390	2470	2580	2520	2580	2600	2750	2620	2410	2640
Total Organic Carbon	--		2.73	2.74	--	2.57	3.29	3.64	2.43	2.65	4.26	2.68 b	--
Total Suspended Solids	--		< 3.00	3.40	--	8.80	--	3.80	< 3.00	< 3.00	< 3.00	< 3.00	--
Silica	--		--	--	30.8	25.6	29.4	29.4	29.6	28.6	--	--	33.5
Iron (II)	--		< 0.200 HF	< 0.200 HF	--	< 0.200	--	--	< 0.200 HF	0.0660 JHF	< 0.200 HF	< 0.200 HF	--
Iron (III)	--		< 0.400	< 0.400	--	< 0.400 HF	--	--	< 0.400	< 0.400	< 0.400	< 0.400	--
Iron	--		< 0.400	--	--	< 0.400 HF	--	--	--	< 0.400	< 0.400	--	--
Field Parameters													
Temperature (°C)	--		23.23	22.3	24.66	23	22.02	23.18	22.77	22.52	21.61	21.15	24.14
Specific Conductivity (S/cm)	--		3738	3801	4071	3833	3512	3771	3443	3704	3865	3926	4169
pH	--		7.28	7.36	7.32	7.37	7.31	6.13	7.01	7.38	7.24	7.3	7.24
ORP (mV)	--		95.1	3.2	-34.1	132.9	72.6	327.3	82.1	108.2	112.2	-0.5	-73.2
Dissolved Oxygen (mg/L)	--		0.27	0.19	0.59	0.3	0.40	8.28	0.13	0.14	0.3	0.18	0.46
Turbidity (NTU)	--		5.07	6.68	3.14	14.3	6.57	6.06	3.39	3.58	3.48	2.54	2.62
Ambient Parameters													
Air Temperature (°F)	--		40.1	63.1	89.7	78.1	65	91.7	66	54	40.1	63	89.7
Barometric Pressure (in Hg)	--		30.262	29.937	29.819	29.74	30.01	29.658	29.93	30.16	30.262	30.032	29.819

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Table 4
Performance Monitoring Results - Field and Water Quality Parameters
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Level	Well	EP-154	EP-155	EP-155	EP-155	EP-155	EP-155	EP-155	EP-155	EP-156R	EP-156R	EP-156R (Dup)
		Sample Date	9/17/2013	5/9/2012	6/6/2012	10/19/2012	12/5/2012	2/6/2013	7/10/2013	9/18/2013	7/18/2013	9/13/2013	9/13/2013
Water Quality Parameters (mg/L)													
Chloride	250[1]		368	308	349	363	359	369	283	328	328	268	275
Fluoride	4		2.40	3.66	2.85	1.92	3.32	3.48	3.22	2.98	4.84	4.37	4.40
Nitrate/Nitrite	--		5.14	--	7.50	5.85	3.45	3.65	--	4.31	--	5.96	5.97
Sulfate	250[1]		1050	--	1130	1220	1130	1160	--	949	--	1010	1050
Sulfide	--		< 0.0500	< 0.0500	0.0160 J	< 0.0500	< 0.0500	0.0230 J	--	0.0330 J	--	< 0.0500	< 0.0500
Total Alkalinity	--		420	389	390	374	309	329	350	358	352	299	301
Total Dissolved Solids	500[1]		2620	2520	2580	2500	2420	2320	2390	2470	2410	2190	2260
Total Organic Carbon	--		2.88	3.44	3.40	2.27	2.57	2.54	--	2.37	--	2.59	2.46
Total Suspended Solids	--		8.00 H	--	< 3.00	< 3.00	< 3.00	< 3.00	--	12.8	--	< 3.00 H	< 3.00 H
Silica	--		28.2	31.4	30.0	32.6	--	--	30.8	24.4	24.2	27.8	28.6
Iron (II)	--		< 0.200	--	--	< 0.200 HF	< 0.200 HF	< 0.200 HF	--	< 0.200	--	0.0600 J	0.0530 J
Iron (III)	--		< 0.400 HF	--	--	< 0.400	< 0.400	< 0.400	--	< 0.400 HF	--	< 0.400 HF	< 0.400 HF
Iron	--		< 0.400 HF	--	--	--	< 0.400	--	--	< 0.400 HF	--	< 0.400 HF	< 0.400 HF
Field Parameters													
Temperature (°C)	--		23.8	21.52	23.61	24.44	23.65	22.74	24.63	23.9	23.52	24.4	24.4
Specific Conductivity (S/cm)	--		3918	3347	3798	3545	3621	3671	3919	3705	3956	3233	3233
pH	--		7.31	7.33	6.22	7.04	7.41	7.41	7.35	7.46	7.23	7.2	7.2
ORP (mV)	--		125.5	85.2	353.4	44.3	6.2	-3.9	-1	21.2	-40	281	281
Dissolved Oxygen (mg/L)	--		0.23	0.33	7.96	0.13	0.16	0.14	0.6	0.12	0.3	0.73	0.73
Turbidity (NTU)	--		11.9	3.59	3.63	1.4	2.26	1.98	5.11	24.2	6.86	5.91	5.91
Ambient Parameters													
Air Temperature (°F)	--		77.75	65	91.7	66	40.1	63.1	89.7	78.1	68.3	68.7	68.7
Barometric Pressure (in Hg)	--		29.83	30.01	29.658	29.93	30.262	29.937	29.819	29.74	30.024	29.86	29.86

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µS/cm = microSiemens per centimeter
mV = millivolts
NT = nephelometric turbidity nits
in Hg = inches of mercury
Dup = duplicate sample
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Table 4
Performance Monitoring Results - Field and Water Quality Parameters
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Level	Well	EP-157	EP-157
		Sample Date	7/15/2013	9/9/2013
Water Quality Parameters (mg/L)				
Chloride	250[1]		303	338
Fluoride	4		3.38	3.12
Nitrate/Nitrite	--		--	8.57
Sulfate	250[1]		--	1120
Sulfide	--		--	< 0.0500
Total Alkalinity	--		385	393
Total Dissolved Solids	500[1]		2450	2430
Total Organic Carbon	--		--	2.26
Total Suspended Solids	--		--	< 3.00 H
Silica	--		29.6	33.2
Iron (II)	--		--	< 0.200 HF
Iron (III)	--		--	< 0.400
Iron	--		--	< 0.400
Field Parameters				
Temperature (°C)	--		22.83	24.53
Specific Conductivity (S/cm)	--		3959	3542
pH	--		7.31	7.43
ORP (mV)	--		-6.4	54.4
Dissolved Oxygen (mg/L)	--		0.86	0.41
Turbidity (NTU)	--		15.6	6.3
Ambient Parameters				
Air Temperature (°F)	--		77.6	78
Barometric Pressure (in Hg)	--		29.758	29.67

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mV = millivolts
NT = nephelometric turbidity nits
in Hg = inches of mercury
Dup = duplicate sample
Silica analysis by Environmental Protection Agency (EPA) method 8010B except for July 2013, which was analyzed by EPA method 8020

Table 5
Performance Monitoring Results - Metals Analysis
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Levels	Well	EP-138	EP-138	EP-138R	EP-138R	EP-139	EP-139	EP-139R	EP-139R	EP-140A	EP-140A
		Sample Date	5/8/2012	6/5/2012	7/11/2013	9/5/2013	5/7/2012	6/5/2012	7/11/2013	9/6/2013	7/11/2013	9/5/2013
Total Metals (mg/L)												
Aluminum	100		0.527	0.0940	0.0669	< 0.0500	< 0.0500	0.0425 J	0.0272 J	< 0.0500	< 0.0500	< 0.0500
Antimony	0.006		0.00622	0.00309 J	< 0.00500	0.0287	0.0200	0.0162	0.0141	0.0176	< 0.00500	< 0.00500
Arsenic	0.01		0.0129	0.0112	0.0185	1.21	0.900	1.07	0.975	1.02	0.00415 J	0.00784
Barium	2		0.0592	0.0306	0.0565	0.0328	0.0410	0.0309	0.0288	0.0277	0.0224	0.0172
Cadmium	0.005		< 0.00200	< 0.00200	< 0.00200	0.000869 J	< 0.00200	< 0.00200	0.00204	< 0.00200	0.00174 J	< 0.00200
Calcium	--		209	384	37.1	89.6	99.2	102	106	97.4	8.14	7.23
Chromium	0.1		0.00169 J	< 0.00500	< 0.00500	0.00329 J	0.00238 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	6.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Copper	1.3		0.00210 J	< 0.0100	< 0.0100	< 0.0100	0.00360 J	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
Iron	--		0.714	0.170 J	0.116 J	--	< 0.250	< 0.250	0.191 J	--	0.111 J	--
Lead	0.015		0.000747 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.000822 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		137	266	20.3	53.7	59.0	58.4	68.8	56.8	53.1	39.3
Manganese	14		0.258	0.475	< 0.0500	0.0137 J	0.0307 J	< 0.0500	0.0256 J	< 0.0500	0.0156 J	0.0120 J
Mercury	0.002		< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.000393 J	< 0.00200	< 0.00200
Molybdenum	0.51		0.274	0.168	0.0130	0.502	0.504	0.505	0.482	0.454	0.377	0.367
Nickel	2		0.00231 J	< 0.00500	< 0.00500	< 0.00500	0.00361 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Potassium	--		19.9	23.9	6.25	25.3	27.9	28.2	26.6	27.0	23.9	24.3
Selenium	0.05		0.117	0.0607	0.00354 J	0.144	0.140	0.154	0.173	0.147	0.00492 J	0.00364 J
Sodium	--		673	966	199	714	809	769	885	721	847	695
Thallium	0.002		< 0.00100	< 0.00100	0.00120 J	< 0.00200	0.000889 J	0.00225	0.00131 J	0.00282	0.00209	< 0.00200
Zinc	31		0.00571 J	< 0.0250	< 0.0250	< 0.0250	< 0.0250	0.00408 J	< 0.0250	< 0.0250	< 0.0250	< 0.0250
Dissolved Metals (mg/L)												
Aluminum	--		--	--	--	< 0.0500	--	--	--	< 0.0500	--	< 0.0500
Antimony	--		0.00823	0.00324 J	0.0223	0.0261	0.0203	0.0162	0.0143	0.0174	< 0.00500	< 0.00500
Arsenic	--		0.0116	0.0108	1.07	1.20	0.947	1.11	1.01	1.02	0.00687	0.00747
Barium	--		0.0565	0.0313	0.0296	0.0286	0.0371	0.0371	0.0275	0.0270	0.0199	0.0173
Cadmium	--		< 0.00200	< 0.00200	0.00205	0.000896 J	< 0.00200	< 0.00200	0.00204	0.000927 J	0.00155 J	< 0.00200
Calcium	--		--	--	--	86.2	--	--	--	96.2	--	6.36
Chromium	--		0.00223 J	< 0.00500	< 0.00500	0.00255 J	< 0.00500	0.00149 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	--		0.00175 J	0.00164 J	< 0.00500	0.00151 J	< 0.00500	0.00185 J	0.00201 J	0.00153 J	< 0.00500	0.00140 J
Copper	--		0.00308 J	< 0.0100	< 0.0100	< 0.0100	0.00874 J	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
Iron	--		< 0.250	< 0.250	< 0.250	--	< 0.250	< 0.250	< 0.250	--	< 0.250	--
Lead	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00195 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		--	--	--	52.8	--	--	--	58.0	--	38.0
Manganese	--		--	--	--	0.0166 J	--	--	--	< 0.0500	--	0.0129 J
Mercury	--		< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Molybdenum	--		0.286	0.173	0.490	0.484	0.496	0.509	0.482	0.438	0.356	0.347
Nickel	--		0.00263 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Selenium	--		0.124	0.0623	0.178	0.147	0.155	0.154	0.178	0.145	0.00392 J	0.00271 J
Thallium	--		< 0.00100	< 0.00100	< 0.00200	< 0.00200	0.00130	0.00126	0.00145 J	0.00235	< 0.00200	< 0.00200
Zinc	--		0.00754 J	< 0.0250	< 0.0250	< 0.0250	< 0.0250	0.00640 J	< 0.0250	< 0.0250	< 0.0250	< 0.0250
Arsenic Speciation (mg/L)												
Arsenate (v)	--		--	--	--	1.28	--	--	--	1.07	--	0.00568
Arsenite (iii)	--		--	--	--	0.00438	--	--	--	0.00380 J	--	0.00097 J
Dimethylarsinic Acid	--		--	--	--	< 0.00076	--	--	--	< 0.00076	--	< 0.00076
Monomethylarsonic Acid	--		--	--	--	< 0.00061	--	--	--	< 0.00061	--	< 0.00061

Notes:

exceedences of screening levels are shaded gray

mg/L = milligrams per liter

-- = not analyzed/no cleanup level established

< = analyte not detected above listed sample detection limit (SDL)

J = estimated value

< = not detected

Dup = duplicate sample

MALCOLM PIRNIE

Table 5
Performance Monitoring Results - Metals Analysis
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Levels	Well	EP-140B	EP-140B	EP-140C	EP-140C (Dup)	EP-140C	EP-141A	EP-141A	EP-141B	EP-141B	EP-141C
		Sample Date	7/11/2013	9/5/2013	7/10/2013	7/10/2013	9/5/2013	7/11/2013	9/6/2013	7/11/2013	9/6/2013	7/11/2013
Total Metals (mg/L)												
Aluminum	100		< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500
Antimony	0.006		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.0142	0.0237	< 0.00500	< 0.00500	0.0168
Arsenic	0.01		0.00249 J	0.00473 J	0.00142 J	0.00131 J	0.00200 J	0.272	0.924	0.0128	0.0380	0.745
Barium	2		0.0291	0.0208	0.0328	0.0262	0.0228	0.0363	0.0366	0.0237	0.0310	0.0378
Cadmium	0.005		0.00180 J	< 0.00200	0.00117 J	0.00127 J	< 0.00200	0.00212	0.00108 J	0.00148 J	< 0.00200	0.00219
Calcium	--		7.56	5.98	3.60	3.61	2.70	88.6	82.2	3.33	6.42	93.9
Chromium	0.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	6.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Copper	1.3		< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
Iron	--		0.525	--	0.227 J	0.213 J	--	1.59	--	< 0.250	--	4.00
Lead	0.015		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		55.9	37.5	19.9	20.7	16.0	61.7	51.1	2.79	10.5	63.2
Manganese	14		0.0377 J	0.0158 J	0.0134 J	0.0129 J	< 0.0500	0.0948	0.0212 J	< 0.0500	< 0.0500	0.0385 J
Mercury	0.002		< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Molybdenum	0.51		0.371	0.372	0.343	0.344	0.336	0.487	0.497	0.407	0.393	0.504
Nickel	2		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Potassium	--		25.2	24.1	28.4	29.4	25.8	26.1	27.4	13.8	25.8	27.3
Selenium	0.05		0.00424 J	0.00341 J	0.00240 J	0.00167 J	0.00255 J	0.158	0.144	0.00257 J	0.0119	0.161
Sodium	--		879	677	745	775	702	845	699	766	680	893
Thallium	0.002		0.000894 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.00531	< 0.00200	< 0.00200	< 0.00200
Zinc	31		< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250
Dissolved Metals (mg/L)												
Aluminum	--		--	< 0.0500	--	--	< 0.0500	--	< 0.0500	--	< 0.0500	--
Antimony	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.0139	0.0218	< 0.00500	0.00292 J	0.0163
Arsenic	--		0.00290 J	0.00660	0.00118 J	< 0.00500	0.00281 J	0.246	0.898	0.0141	0.0684	0.667
Barium	--		0.0235	0.0201	0.0273	0.0268	0.0224	0.0356	0.0358	0.0259	0.0350	0.0344
Cadmium	--		0.00164 J	< 0.00200	0.00120 J	0.00130 J	< 0.00200	0.00137 J	0.00106 J	0.00116 J	< 0.00200	0.00139 J
Calcium	--		--	6.62	--	--	2.73	--	81.2	--	12.6	--
Chromium	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	--		< 0.00500	0.00175 J	< 0.00500	0.00150 J	0.00148 J	< 0.00500	0.00159 J	0.00170 J	0.00152 J	< 0.00500
Copper	--		< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
Iron	--		< 0.250	--	< 0.250	< 0.250	--	1.35	--	< 0.250	--	3.33
Lead	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00932	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		--	39.2	--	--	16.2	--	49.3	--	14.4	--
Manganese	--		--	0.0177 J	--	--	< 0.0500	--	0.0227 J	--	< 0.0500	--
Mercury	--		< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Molybdenum	--		0.350	0.354	0.362	0.342	0.332	0.475	0.464	0.432	0.395	0.482
Nickel	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Selenium	--		0.00469 J	0.00352 J	0.00196 J	0.00169 J	0.00140 J	0.156	0.133	0.00383 J	0.0221	0.154
Thallium	--		< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.00449	< 0.00200	< 0.00200	< 0.00200
Zinc	--		< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250
Arsenic Speciation (mg/L)												
Arsenate (v)	--		--	0.00247 J	--	--	< 0.00080	--	0.965	--	0.0119	--
Arsenite (iii)	--		--	< 0.00028	--	--	< 0.00028	--	0.00475	--	0.00227 J	--
Dimethylarsinic Acid	--		--	< 0.00076	--	--	< 0.00076	--	< 0.00076	--	< 0.00076	--
Monomethylarsonic Acid	--		--	< 0.00061	--	--	< 0.00061	--	< 0.00061	--	< 0.00061	--

Notes:

exceedences of screening levels are shaded gray

mg/L = milligrams per liter

-- = not analyzed/no cleanup level established

< = analyte not detected above listed sample detection limit (SDL)

J = estimated value

< = not detected

Dup = duplicate sample

Table 5
Performance Monitoring Results - Metals Analysis
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Levels	Well	EP-141C	EP-142	EP-142	EP-143	EP-143	EP-143 (Dup)	EP-144	EP-144	EP-144	EP-144
		Sample Date	9/6/2013	7/11/2013	9/5/2013	7/15/2013	9/6/2013	9/6/2013	5/8/2012	6/5/2012	10/18/2012	11/15/2012
Total Metals (mg/L)												
Aluminum	100		< 0.0500	< 0.0500	< 0.0500	0.228	< 0.0500	< 0.0500	< 0.0500	< 0.0500	0.293	0.508
Antimony	0.006		0.0203	< 0.00500	< 0.00500	0.00889	0.0116	0.0108	0.0201	0.0203	0.0186	0.0182
Arsenic	0.01		0.815	0.0333	0.0287	0.653	0.749	0.716	1.12	1.22	1.04	0.746
Barium	2		0.0271	0.0195	0.0214	0.0311	0.0282	0.0262	0.0324	0.0327	0.0255	0.0213
Cadmium	0.005		0.000966 J	0.00154 J	< 0.00200	0.00107 J	0.00101 J	0.000966 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Calcium	--		87.5	3.25	2.69	53.9	58.5	56.2	103	104	73.8	48.8
Chromium	0.1		0.00200 J	< 0.00500	< 0.00500	< 0.00500	0.00200 J	< 0.00500	0.00258 J	< 0.00500	< 0.00500	< 0.00500
Cobalt	6.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Copper	1.3		< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	0.0137	< 0.0100
Iron	--		--	< 0.250	--	0.410	--	--	< 0.250	< 0.250	0.295	0.482
Lead	0.015		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00178 J	0.000742 J
Magnesium	--		51.7	22.9	20.1	51.0	39.9	38.5	57.6	58.9	41.5	25.5
Manganese	14		0.0165 J	0.0217 J	0.0210 J	0.0228 J	0.0346 J	< 0.0500	0.0198 J	< 0.0500	0.0121 J	< 0.0500
Mercury	0.002		< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.000142 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Molybdenum	0.51		0.471	0.359	0.347	0.478	0.486	0.451	0.520	0.550	0.310	0.267
Nickel	2		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Potassium	--		27.3	24.4	22.8	26.5	26.9	26.1	27.7	28.6	23.7	21.9
Selenium	0.05		0.138	0.00156 J	0.00179 J	0.0958	0.101	0.0966	0.147	0.158	0.0121	0.00634
Sodium	--		708	896	656	876	745	710	727	711	520	810
Thallium	0.002		0.00177 J	< 0.00200	< 0.00200	0.00441	0.00578	0.00546	0.00101	0.000840 J	0.00124 J	0.00107 J
Zinc	31		< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	0.00392 J	< 0.0250
Dissolved Metals (mg/L)												
Aluminum	--		< 0.0500	--	< 0.0500	--	< 0.0500	< 0.0500	--	--	--	--
Antimony	--		0.0198	< 0.00500	< 0.00500	0.00847	0.0103	0.0113	0.0251	0.0201	0.0184	0.0185
Arsenic	--		0.809	0.0313	0.0296	0.603	0.683	0.750	1.06	1.11	1.03	0.781
Barium	--		0.0271	0.0193	0.0236	0.0262	0.0251	0.0278	0.0321	0.0317	0.0219	0.0169
Cadmium	--		< 0.00200	0.00142 J	< 0.00200	0.00121 J	< 0.00200	0.000972 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Calcium	--		82.9	--	2.56	--	52.4	56.7	--	--	--	--
Chromium	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00178 J	< 0.00500	< 0.00500	< 0.00500
Cobalt	--		< 0.00500	0.00238 J	< 0.00500	0.00317 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Copper	--		< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	0.00362 J	< 0.0100	< 0.0100	< 0.0100
Iron	--		--	< 0.250	--	< 0.250	--	--	< 0.250	< 0.250	< 0.250	< 0.250
Lead	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00123 J	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		50.6	--	21.6	--	36.2	39.5	--	--	--	--
Manganese	--		0.0142 J	--	0.0236 J	--	< 0.0500	0.0136 J	--	--	--	--
Mercury	--		< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.000303 J	< 0.00200	< 0.00200	< 0.00200
Molybdenum	--		0.447	0.345	0.347	0.456	0.417	0.457	0.535	0.525	0.301	0.275
Nickel	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Selenium	--		0.137	0.00368 J	0.00164 J	0.0845	0.0921	0.105	0.144	0.152	0.0106	0.00694
Thallium	--		0.00140 J	< 0.00200	< 0.00200	0.00413	0.00586	0.00631	0.00101	< 0.00100	0.00118 J	< 0.000693
Zinc	--		< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	0.00364 J	< 0.0250	< 0.0250	< 0.0250
Arsenic Speciation (mg/L)												
Arsenate (v)	--		0.895	--	0.0233	--	0.754	0.77	--	--	0.928	0.699
Arsenite (iii)	--		0.00529	--	0.00173 J	--	0.00333 J	0.00380 J	--	--	< 0.00080	0.00101
Dimethylarsinic Acid	--		< 0.00076	--	< 0.00076	--	< 0.00076	< 0.00076	--	--	< 0.00058	< 0.00019
Monomethylarsonic Acid	--		< 0.00061	--	< 0.00061	--	< 0.00061	< 0.00061	--	--	0.00571	< 0.00021

Notes:

exceedences of screening levels are shaded gray

mg/L = milligrams per liter

-- = not analyzed/no cleanup level established

< = analyte not detected above listed sample detection limit (SDL)

J = estimated value

< = not detected

Dup = duplicate sample

Table 5
Performance Monitoring Results - Metals Analysis
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Levels	Well	EP-144	EP-144	EP-144	EP-144	EP-145	EP-145	EP-145	EP-145	EP-145	EP-145
		Sample Date	12/4/2012	2/6/2013	7/11/2013	9/17/2013	5/8/2012	6/5/2012	10/18/2012	11/15/2012	12/4/2012	2/5/2013
Total Metals (mg/L)												
Aluminum	100		0.663	0.609	0.235	0.388	0.0315 J	0.0418 J	< 0.0500	< 0.0500	< 0.0500	< 0.0500
Antimony	0.006		0.0150	0.0103	0.00735	0.0112	0.0104	0.0114	0.00905	0.00878	0.00811	0.00856
Arsenic	0.01		0.608	0.524	0.585	0.636	0.585	0.635	0.664	0.554	0.582	0.564
Barium	2		0.0224	0.0263	0.0275	0.0333	0.0383	0.0337	0.0273	0.0247	0.0255	0.0250
Cadmium	0.005		< 0.00200	< 0.00200	0.00202	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Calcium	--		38.1	43.1	47.4	52.4	124	125	107	105	102	91.8
Chromium	0.1		< 0.00500	0.00250 J	< 0.00500	0.00165 J	< 0.00500	0.00311 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	6.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Copper	1.3		0.00267 J	0.00540 J	0.00351 J	0.00229 J	0.00332 J	0.00377 J	< 0.0100	< 0.0100	< 0.0100	< 0.0100
Iron	--		0.717	0.658	0.317	--	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250
Lead	0.015		0.000868 J	< 0.00500	0.000950 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		20.0	27.3	52.7	43.3	68.6	70.0	59.0	62.1	69.3	46.2
Manganese	14		0.0177 J	0.0127 J	0.0152 J	0.0132 J	0.0277 J	0.0143 J	< 0.0500	< 0.0500	< 0.0500	< 0.0500
Mercury	0.002		< 0.00200	0.000256 J	< 0.00200	0.000234 J	0.000406 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.000188 J
Molybdenum	0.51		0.293	0.396	0.435	0.468	0.378	0.386	0.323	0.359	0.364	0.356
Nickel	2		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00307 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Potassium	--		15.3	22.6	18.0	25.0	28.3	31.9	26.9	27.7	21.7	21.8
Selenium	0.05		0.0158	0.0384	0.0880	0.0859	0.140	0.149	0.100	0.110	0.127	0.120
Sodium	--		811	670	659	754	632	748	574	817	842	442
Thallium	0.002		< 0.00200	< 0.00200	0.000835 J	0.00139 J	0.00480	0.00454	0.00475	0.00397	0.00425	0.00372
Zinc	31		0.00357 J	0.00901 J	< 0.250	0.00403 J	< 0.0250	0.0151 J	< 0.0250	< 0.0250	< 0.0250	< 0.0250
Dissolved Metals (mg/L)												
Aluminum	--		--	--	--	< 0.0500	--	--	--	--	--	--
Antimony	--		0.0155	0.0104	0.00756	0.0111	0.0112	0.00984	0.00929	0.00903	0.00862	0.00811
Arsenic	--		0.593	0.504	0.613	0.596	0.603	0.601	0.665	0.571	0.569	0.567
Barium	--		0.0161	0.0196	0.0247	0.0252	0.0353	0.0322	0.0271	0.0238	0.0268	0.0244
Cadmium	--		< 0.00200	< 0.00200	0.00172 J	0.000889 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Calcium	--		--	--	--	48.3	--	--	--	--	--	--
Chromium	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	--		< 0.00500	0.00237 J	0.00249 J	0.00192 J	< 0.00500	0.00144 J	< 0.00500	< 0.00500	< 0.00500	0.00184 J
Copper	--		< 0.0100	0.00543 J	< 0.0100	< 0.0100	0.0102	0.00287 J	< 0.0100	< 0.0100	0.00825 J	< 0.0100
Iron	--		< 0.250	< 0.250	< 0.250	--	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250
Lead	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		--	--	--	39.8	--	--	--	--	--	--
Manganese	--		--	--	--	< 0.0500	--	--	--	--	--	--
Mercury	--		< 0.00200	0.000217 J	< 0.00200	0.000235 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.000184 J
Molybdenum	--		0.286	0.373	0.432	0.438	0.369	0.366	0.341	.352	0.369	0.352
Nickel	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Selenium	--		0.0157	0.0366	0.104	0.0819	0.152	0.143	0.0992	0.109	0.124	0.113
Thallium	--		0.000776 J	< 0.00200	< 0.00200	0.00134 J	0.00462	0.00443	0.00494	0.00429	0.00441	0.00358
Zinc	--		< 0.0250	0.0138 J	< 0.0250	< 0.0250	< 0.0250	0.00665 J	< 0.0250	< 0.0250	< 0.0250	< 0.0250
Arsenic Speciation (mg/L)												
Arsenate (v)	--		0.568	0.512	--	0.741	--	--	0.603	0.529	0.534	0.653
Arsenite (iii)	--		0.00307 J	< 0.0019	--	< 0.0019	--	--	< 0.00080	0.00066 J	0.00085 J	< 0.0019
Dimethylarsinic Acid	--		< 0.00043	< 0.0014	--	< 0.0017	--	--	< 0.00058	< 0.00019	< 0.00043	< 0.0014
Monomethylarsonic Acid	--		< 0.00063	< 0.0016	--	< 0.0018	--	--	0.00345	< 0.00021	< 0.00063	< 0.0016

Notes:
exceedences of screening levels are shaded gray
mg/L = milligrams per liter
-- = not analyzed/no cleanup level established
< = analyte not detected above listed sample detection limit (SDL)
J = estimated value
< = not detected
Dup = duplicate sample

MALCOLM PIRNIE

Table 5
Performance Monitoring Results - Metals Analysis
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Levels	Well	EP-145	EP-145	EP-146	EP-146	EP-146	EP-146	EP-146	EP-146	EP-146	EP-147
		Sample Date	7/10/2013	9/9/2013	5/8/2012	6/5/2012	10/18/2012	12/4/2012	2/5/2013	7/10/2013	9/9/2013	5/8/2012
Total Metals (mg/L)												
Aluminum	100		< 0.0500	< 0.0500	< 0.0500	0.0353 J	< 0.0500	0.0472 J	1.90	< 0.0500	< 0.0500	< 0.0500
Antimony	0.006		0.00860	0.0104	0.0124	0.0116	0.0102	0.00966	0.0107	0.00892	0.0106	0.0159
Arsenic	0.01		0.642	0.728	0.728	0.717	0.717	0.634	0.646	0.676	0.732	0.590
Barium	2		0.0261	0.0266	0.0303	0.0296	0.0277	0.0248	0.0533	0.0256	0.0249	0.0286
Cadmium	0.005		0.00127 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.00132 J	< 0.00200	< 0.00200
Calcium	--		85.5	99.8	118	122	111	104	105	83.1	100	118
Chromium	0.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00176 J	< 0.00500	< 0.00500	< 0.00500
Cobalt	6.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Copper	1.3		0.00223 J	< 0.0100	0.00212 J	0.00270 J	< 0.0100	< 0.0100	0.00337 J	0.00287 J	< 0.0100	0.00299 J
Iron	--		< 0.250	--	< 0.250	< 0.250	< 0.250	< 0.250	2.08	< 0.250	--	< 0.250
Lead	0.015		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00232 J	< 0.00500	< 0.00500	0.000743 J
Magnesium	--		50.9	59.4	66.1	68.0	63.0	70.3	50.0	48.9	59.1	63.8
Manganese	14		< 0.0500	< 0.0500	0.0135 J	< 0.0500	< 0.0500	< 0.0500	0.0453 J	< 0.0500	< 0.0500	0.0422 J
Mercury	0.002		< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.000136 J	0.000221 J	< 0.00200	< 0.00200	< 0.00200
Molybdenum	0.51		0.357	0.394	0.432	0.409	0.350	0.343	0.363	0.352	0.405	0.350
Nickel	2		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00219 J	< 0.00500	< 0.00500	< 0.00500
Potassium	--		22.7	25.7	27.8	32.2	27.6	24.4	23.6	22.5	25.7	27.3
Selenium	0.05		0.131	0.132	0.150	0.129	0.115	0.115	0.122	0.132	0.136	0.144
Sodium	--		617	755	745	776	590	831	476	615	791	709
Thallium	0.002		0.00341	0.00430	0.00398	0.00404	0.00404	0.00371	0.00315	0.00367	0.00380	0.00696
Zinc	31		0.00541 J	< 0.0250	0.00552 J	0.00483 J	< 0.0250	< 0.0250	0.00682 J	0.00543 J	< 0.0250	0.00408 J
Dissolved Metals (mg/L)												
Aluminum	--		--	< 0.0500	--	--	--	--	--	--	< 0.0500	--
Antimony	--		0.0104	0.00987	0.0147	0.0114	0.00974	0.00983	0.00983	0.0107	0.00929	0.0180
Arsenic	--		0.709	0.684	0.727	0.715	0.686	0.646	0.626	0.766	0.687	0.600
Barium	--		0.0301	0.0254	0.0300	0.0314	0.0263	0.0245	0.0230	0.0258	0.0230	0.0304
Cadmium	--		0.00162 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.00152 J	< 0.00200	< 0.00200
Calcium	--		--	93.3	--	--	--	--	--	--	95.9	--
Chromium	--		< 0.00500	0.00259 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00199 J	< 0.00500
Copper	--		< 0.0100	< 0.0100	0.00438 J	0.00251 J	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	0.00305 J
Iron	--		< 0.250	--	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	--	< 0.250
Lead	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		--	55.7	--	--	--	--	--	--	59.1	--
Manganese	--		--	< 0.0500	--	--	--	--	--	--	< 0.0500	--
Mercury	--		< 0.00200	< 0.00200	0.000180 J	< 0.00200	< 0.00200	0.000137 J	0.000168 J	< 0.00200	< 0.00200	0.000156 J
Molybdenum	--		0.405	0.366	0.428	0.409	0.346	0.340	0.344	0.407	0.369	0.356
Nickel	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Selenium	--		0.135	0.123	0.151	0.156	0.105	0.115	0.114	0.143	0.130	0.147
Thallium	--		0.00412	0.00411	0.00356	0.00369	0.00390	0.00357	0.00285	0.00360	0.00314	0.00627
Zinc	--		< 0.0250	< 0.0250	< 0.0250	0.00442 J	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250
Arsenic Speciation (mg/L)												
Arsenate (v)	--		--	0.771	--	--	0.649	0.600	0.703	--	0.779	--
Arsenite (iii)	--		--	0.00315 J	--	--	< 0.00080	0.00077 J	< 0.0019	--	0.00174 J	--
Dimethylarsinic Acid	--		--	< 0.00076	--	--	< 0.00058	< 0.00043	< 0.0014	--	< 0.00076	--
Monomethylarsonic Acid	--		--	< 0.00061	--	--	0.00483	< 0.00063	< 0.0016	--	< 0.00061	--

Notes:
exceedences of screening levels are shaded gray
mg/L = milligrams per liter
-- = not analyzed/no cleanup level established
< = analyte not detected above listed sample detection limit (SDL)
J = estimated value
< = not detected
Dup = duplicate sample

MALCOLM PIRNIE

Table 5
Performance Monitoring Results - Metals Analysis
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Levels	Well	EP-147	EP-147	EP-147	EP-147	EP-147	EP-147	EP-148	EP-148	EP-149	EP-149 (Dup)
		Sample Date	6/6/2012	10/18/2012	12/4/2012	2/5/2013	7/10/2013	9/9/2013	7/15/2013	9/17/2013	7/15/2013	7/15/2013
Total Metals (mg/L)												
Aluminum	100		0.154	0.0335 J	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500
Antimony	0.006		0.0137	0.0148	0.0147	0.0178	0.0154	0.0138	0.0232	0.0261	0.0224	0.0196
Arsenic	0.01		0.626	0.644	0.591	0.658	0.688	0.621	1.75	1.82	2.38	2.28
Barium	2		0.0269	0.0248	0.0241	0.0233	0.0262	0.0219	0.0362	0.0270	0.0305	0.0274
Cadmium	0.005		< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.00123 J	< 0.00200	0.0492	0.0505	0.0330	0.0289
Calcium	--		121	109	110	94.7	106	109	119	109	132	126
Chromium	0.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	6.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Copper	1.3		< 0.0100	< 0.0100	0.00268 J	< 0.0100	0.00213 J	< 0.0100	0.00257 J	< 0.0100	0.00257 J	0.00250 J
Iron	--		0.128 J	< 0.250	< 0.250	< 0.250	< 0.250	--	< 0.250	--	< 0.250	< 0.250
Lead	0.015		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		70.0	61.7	74.9	47.1	60.1	64.4	94.9	61.5	101	96.1
Manganese	14		0.0208 J	0.0116 J	< 0.0500	< 0.0500	< 0.0500	< 0.0500	0.0327 J	< 0.0500	0.0134 J	0.0141 J
Mercury	0.002		< 0.00200	< 0.00200	< 0.00200	0.000226 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Molybdenum	0.51		0.341	0.348	0.317	0.303	0.326	0.322	0.405	0.367	0.489	0.433
Nickel	2		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00371 J	< 0.00500
Potassium	--		29.1	26.8	24.8	22.7	24.9	24.7	44.6	35.8	52.4	46.6
Selenium	0.05		0.149	0.120	0.117	0.100	0.130	0.125	0.210	0.188	0.287	0.281
Sodium	--		667	565	819	437	674	719	910	672	942	905
Thallium	0.002		0.00808	0.00715	0.00711	0.00552	0.00674	0.00619	0.0155	0.0165	0.0205	0.0192
Zinc	31		< 0.0250	< 0.0250	< 0.0250	< 0.0250	0.00531 J	< 0.0250	0.298	0.302	0.167	0.162
Dissolved Metals (mg/L)												
Aluminum	--		--	--	--	--	--	< 0.0500	--	< 0.0500	--	--
Antimony	--		0.0131	0.0145	0.0145	0.0165	0.0144	0.0131	0.0233	0.0270	0.0203	0.0213
Arsenic	--		0.596	0.657	0.592	0.649	0.646	0.644	1.70	1.88	2.29	2.39
Barium	--		0.0246	0.0235	0.0233	0.0230	0.0238	0.0215	0.0364	0.0277	0.0287	0.0293
Cadmium	--		< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.00131 J	< 0.00200	0.0482	0.0444	0.0302	0.0304
Calcium	--		--	--	--	--	--	111	--	114	--	--
Chromium	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	--		0.00177 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00138 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Copper	--		< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	0.00230 J	< 0.0100	< 0.0100	< 0.0100
Iron	--		< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	--	< 0.250	--	< 0.250	< 0.250
Lead	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		--	--	--	--	--	65.0	--	63.7	--	--
Manganese	--		--	--	--	--	--	< 0.0500	--	< 0.0500	--	--
Mercury	--		< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.000253 J	0.000524 J	< 0.00200
Molybdenum	--		0.329	0.345	0.313	0.299	0.304	0.318	0.405	0.380	0.448	0.452
Nickel	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Selenium	--		0.148	0.118	0.121	0.112	0.119	0.122	0.207	0.193	0.281	0.287
Thallium	--		0.00686	0.00736	0.00682	0.00595	0.00593	0.00589	0.0155	0.0175	0.0196	0.0206
Zinc	--		< 0.0250	< 0.0250	0.00409 J	< 0.0250	< 0.0250	< 0.0250	0.285	0.312	0.164	0.166
Arsenic Speciation (mg/L)												
Arsenate (v)	--		--	0.592	0.567	0.691	--	0.681	--	1.98	--	--
Arsenite (iii)	--		--	< 0.00080	0.00074 J	< 0.0019	--	0.00165 J	--	< 0.0019	--	--
Dimethylarsinic Acid	--		--	< 0.00058	< 0.00043	< 0.0014	--	< 0.00076	--	< 0.0017	--	--
Monomethylarsonic Acid	--		--	0.00427	< 0.00063	< 0.0016	--	< 0.00061	--	< 0.0018	--	--

Notes:
exceedences of screening levels are shaded gray
mg/L = milligrams per liter
-- = not analyzed/no cleanup level established
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J = estimated value
< = not detected
Dup = duplicate sample

Table 5
Performance Monitoring Results - Metals Analysis
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Levels	Well	EP-149	EP-149 (Dup)	EP-150A-S	EP-150A-S	EP-150A-D	EP-150A-D	EP-150B-S	EP-150B-S	EP-150B-D	EP-150B-D
		Sample Date	9/17/2013	9/17/2013	7/16/2013	9/16/2013	7/16/2013	9/10/2013	7/16/2013	9/10/2013	7/16/2013	9/10/2013
Total Metals (mg/L)												
Aluminum	100		< 0.0500	< 0.0500	< 0.0500	0.0386 J	< 0.0500	< 0.0500	< 0.0500	0.0658	< 0.0500	0.0573
Antimony	0.006		0.0249	0.0252	< 0.00500	< 0.00500	0.0251	0.0245	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Arsenic	0.01		1.93	1.89	0.0123	0.00724	1.07	1.22	0.0169	0.0159	0.0139	0.0204
Barium	2		0.0252	0.0259	0.0323	0.0277	0.0308	0.0292	0.0215	0.0177	0.0393	0.0259
Cadmium	0.005		0.0355	0.0372	< 0.00200	< 0.00200	0.00751	0.0109	0.00108 J	< 0.00200	< 0.00200	< 0.00200
Calcium	--		125	124	3.20	3.08	119	114	3.42	1.54	9.59	7.47
Chromium	0.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00155 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	6.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Copper	1.3		< 0.0100	0.00225 J	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
Iron	--		--	--	0.435	--	0.673	--	0.208 J	--	< 0.250	--
Lead	0.015		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		69.4	71.0	10.5	14.7	65.9	64.1	0.568	0.113 J	48.2	38.9
Manganese	14		< 0.0500	< 0.0500	0.0136 J	0.0133 J	0.0211 J	0.0122 J	< 0.0500	< 0.0500	0.0161 J	0.0137 J
Mercury	0.002		< 0.00200	0.000303 J	< 0.00200	0.000261 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Molybdenum	0.51		0.382	0.391	0.187	0.236	0.340	0.352	0.395	0.367	0.198	0.257
Nickel	2		< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00387 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Potassium	--		39.9	40.4	29.6	33.6	35.4	32.4	7.60	6.93	35.6	29.2
Selenium	0.05		0.201	0.193	0.00145 J	0.00458 J	0.164	0.168	0.00445 J	0.00301 J	0.00345 J	0.00348 J
Sodium	--		718	741	652	752	618	730	647	768	655	741
Thallium	0.002		0.0206	0.0201	< 0.00200	< 0.00200	0.0122	0.0136	0.00157 J	< 0.00200	< 0.00200	< 0.00200
Zinc	31		0.205	0.215	< 0.0250	< 0.0250	0.0333	0.0530	< 0.0250	< 0.0250	< 0.0250	< 0.0250
Dissolved Metals (mg/L)												
Aluminum	--		< 0.0500	< 0.0500	--	< 0.0500	--	< 0.0500	--	< 0.0500	--	< 0.0500
Antimony	--		0.0244	0.0249	< 0.00500	< 0.00500	0.0255	0.0199	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Arsenic	--		1.78	1.88	0.0119	0.00750	1.09	1.27	0.0187	0.0149	0.0142	0.0195
Barium	--		0.0250	0.0254	0.0334	0.0274	0.0301	0.0256	0.0206	0.0153	0.0383	0.0212
Cadmium	--		0.0347	0.0354	< 0.00200	< 0.00200	0.00724	0.0102	0.00101 J	< 0.00200	< 0.00200	< 0.00200
Calcium	--		117	123	--	2.86	--	118	--	1.33	--	6.49
Chromium	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	--		< 0.00500	0.00188 J	0.00158 J	0.00202 J	< 0.00500	< 0.00500	0.00151 J	0.00166 J	0.00175 J	0.00157 J
Copper	--		< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
Iron	--		--	--	< 0.250	--	0.577	--	< 0.250	--	< 0.250	--
Lead	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		66.7	70.4	--	14.9	--	67.2	--	< 0.500	--	38.5
Manganese	--		< 0.0500	< 0.0500	--	< 0.0500	--	0.0136 J	--	< 0.0500	--	< 0.0500
Mercury	--		0.000258 J	0.000266 J	< 0.00200	0.000166 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Molybdenum	--		0.370	0.379	0.205	0.244	0.353	0.334	0.378	0.342	0.213	0.231
Nickel	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Selenium	--		0.187	0.192	0.00288 J	0.00466 J	0.166	0.172	0.00351 J	0.00189 J	0.00423 J	0.00241 J
Thallium	--		0.0194	0.0198	< 0.00200	< 0.00200	0.0126	0.0131	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Zinc	--		0.191	0.196	< 0.0250	< 0.0250	0.0227 J	0.0532	< 0.0250	< 0.0250	< 0.0250	< 0.0250
Arsenic Speciation (mg/L)												
Arsenate (v)	--		1.98	2.03	--	0.0424	--	1.33	--	0.0135	--	0.0131
Arsenite (iii)	--		< 0.0019	< 0.0019	--	< 0.0019	--	0.00317 J	--	< 0.00028	--	0.00098 J
Dimethylarsinic Acid	--		< 0.0017	< 0.0017	--	< 0.0017	--	< 0.00076	--	< 0.00076	--	< 0.00076
Monomethylarsonic Acid	--		< 0.0018	< 0.0018	--	< 0.0018	--	< 0.00061	--	< 0.00061	--	< 0.00061

Notes:

exceedences of screening levels are shaded gray

mg/L = milligrams per liter

-- = not analyzed/no cleanup level established

< = analyte not detected above listed sample detection limit (SDL)

J = estimated value

< = not detected

Dup = duplicate sample

Table 5
Performance Monitoring Results - Metals Analysis
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Levels	Well	EP-150C-S	EP-150C-S	EP-150C-D	EP-150C-D	EP-151-S	EP-151-S	EP-151-D	EP-151-D	EP-152-S	EP-152-S
		Sample Date	7/17/2013	9/16/2013	7/17/2013	9/16/2013	7/18/2013	9/16/2013	7/17/2013	9/16/2013	7/16/2013	9/10/2013
Total Metals (mg/L)												
Aluminum	100		< 0.0500	0.0261 J	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500
Antimony	0.006		< 0.00500	< 0.00500	0.00436 J	< 0.00500	0.0169	0.0247	0.0219	0.0242	0.0159	0.0150
Arsenic	0.01		0.0124	0.00781	0.0218	0.0510	0.593	0.770	0.843	0.825	0.228	0.296
Barium	2		0.0190	0.0157	0.0344	0.0191	0.0199	0.0257	0.0217	0.0233	0.0416	0.0325
Cadmium	0.005		< 0.00200	< 0.00200	0.000953 J	< 0.00200	0.00133 J	0.00110 J	0.00102 J	< 0.00200	< 0.00200	0.00100 J
Calcium	--		1.38	0.781	50.3	26.9	74.7	93.2	89.5	94.1	102	99.8
Chromium	0.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	6.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00181 J	< 0.00500
Copper	1.3		< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
Iron	--		< 0.250	--	0.972	--	< 0.250	--	< 0.250	--	< 0.250	--
Lead	0.015		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		0.205 J	< 0.500	44.1	41.1	42.4	58.3	50.6	60.3	62.7	63.0
Manganese	14		< 0.0500	< 0.0500	0.0929	0.0192 J	0.0255 J	0.0120 J	< 0.0500	< 0.0500	0.220	0.138
Mercury	0.002		< 0.00200	0.000238 J	< 0.00200	0.000268 J	< 0.00200	0.000156 J	< 0.00200	0.000247 J	< 0.00200	< 0.00200
Molybdenum	0.51		0.359	0.360	0.227	0.215	0.265	0.384	0.330	0.396	0.295	0.345
Nickel	2		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Potassium	--		15.1	13.2	32.8	28.5	19.6	24.4	23.3	24.4	26.8	25.3
Selenium	0.05		0.00523	0.00455 J	0.0260	0.00713	0.0796	0.102	0.109	0.111	0.105	0.101
Sodium	--		619	714	607	735	473	702	568	717	632	765
Thallium	0.002		< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.00337	0.00720	0.00675	0.00681	0.00238	0.00266
Zinc	31		< 0.0250	< 0.0250	< 0.0250	< 0.0250	0.0117 J	< 0.0250	< 0.0250	< 0.0250	0.00737 J	< 0.0250
Dissolved Metals (mg/L)												
Aluminum	--		--	< 0.0500	--	< 0.0500	--	0.556	--	< 0.0500	--	< 0.0500
Antimony	--		< 0.00500	< 0.00500	0.00430 J	< 0.00500	0.0245	0.0248	0.0233	0.0252	0.0161	0.0136
Arsenic	--		0.0115	0.00802	0.0157	0.0490	0.825	0.762	0.791	0.817	0.227	0.269
Barium	--		0.0197	0.0149	0.0330	0.0200	0.0274	0.0250	0.0227	0.0234	0.0393	0.0294
Cadmium	--		0.000930 J	< 0.00200	< 0.00200	< 0.00200	0.00178 J	0.00140 J	0.000883 J	< 0.00200	< 0.00200	0.000966 J
Calcium	--		--	0.770	--	27.8	--	90.9	--	97.6	--	93.0
Chromium	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00151 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	--		< 0.00500	< 0.00500	0.00190 J	0.00254 J	0.00156 J	0.00137 J	0.00164 J	0.00189 J	0.00298 J	0.00212 J
Copper	--		< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
Iron	--		< 0.250	--	0.616	--	< 0.250	--	< 0.250	--	< 0.250	--
Lead	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		--	< 0.500	--	41.9	--	56.2	--	60.7	--	59.0
Manganese	--		--	< 0.0500	--	0.0197 J	--	0.0194 J	--	< 0.0500	--	0.124
Mercury	--		< 0.00200	0.000198 J	< 0.00200	0.000140 J	< 0.00200	0.000232 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Molybdenum	--		0.364	0.354	0.234	0.236	0.383	0.352	0.360	0.397	0.281	0.328
Nickel	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00243 J	< 0.00500
Selenium	--		0.00189 J	0.00230 J	0.0203	0.00847	0.109	0.0962	0.101	0.119	0.105	0.0959
Thallium	--		< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.00509	0.00731	0.00501	0.00799	0.00240	0.00144 J
Zinc	--		< 0.0250	< 0.0250	0.00378 J	< 0.0250	0.00833 J	0.00581 J	< 0.0250	< 0.0250	0.00570 J	< 0.0250
Arsenic Speciation (mg/L)												
Arsenate (v)	--		--	0.0082	--	0.0461	--	0.766	--	0.812	--	0.178
Arsenite (iii)	--		--	< 0.0019	--	0.0041	--	< 0.0019	--	< 0.0019	--	0.00403
Dimethylarsinic Acid	--		--	< 0.0017	--	< 0.0017	--	< 0.0017	--	< 0.0017	--	< 0.00076
Monomethylarsonic Acid	--		--	< 0.0018	--	< 0.0018	--	< 0.0018	--	< 0.0018	--	< 0.00061

Notes:

exceedences of screening levels are shaded gray

mg/L = milligrams per liter

-- = not analyzed/no cleanup level established

< = analyte not detected above listed sample detection limit (SDL)

J = estimated value

< = not detected

Dup = duplicate sample

Table 5
Performance Monitoring Results - Metals Analysis
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Levels	Well	EP-152-D	EP-152-D	EP-153	EP-153	EP-153	EP-153 (Dup)	EP-153	EP-153	EP-153 (Dup)	EP-153
		Sample Date	7/16/2013	9/10/2013	5/9/2012	6/6/2012	10/19/2012	10/19/2012	11/15/2012	12/5/2012	12/5/2012	2/6/2013
Total Metals (mg/L)												
Aluminum	100		< 0.0500	< 0.0500	0.0463 J	< 0.0500	0.0790	0.0489 J	0.0416 J	0.0682	0.0385 J	0.0675
Antimony	0.006		0.0206	< 0.00500	0.0170	0.0194	0.0159	0.0163	0.0158	0.0145	0.0155	0.0190
Arsenic	0.01		0.779	0.716	0.712	0.797	0.780	0.843	0.751	0.737	0.716	0.853
Barium	2		0.0252	0.00222 J	0.0254	0.0276	0.0256	0.0250	0.0224	0.0227	0.0225	0.0223
Cadmium	0.005		0.000937 J	< 0.00200	0.00123 J	0.00104 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Calcium	--		110	102	101	123	106	108	114	96.3	97.1	104
Chromium	0.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	6.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Copper	1.3		< 0.0100	< 0.0100	0.00391 J	0.00246 J	0.00215 J	0.00367 J	0.00313 J	0.00249 J	< 0.0100	0.00311 J
Iron	--		< 0.250	--	< 0.250	< 0.250	0.119 J	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250
Lead	0.015		< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.000796 J	0.000881 J	0.00117 J	< 0.00500	< 0.00500	0.000839 J
Magnesium	--		62.4	59.6	53.7	67.1	55.6	56.5	62.5	63.7	64.4	63.2
Manganese	14		0.0208 J	< 0.0500	0.127	0.0543	0.0164 J	0.0181 J	< 0.0500	< 0.0500	< 0.0500	0.0142 J
Mercury	0.002		< 0.00200	< 0.00200	0.000189 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.000762 J	0.000201 J
Molybdenum	0.51		0.329	0.00422 J	0.376	0.436	0.381	0.383	0.386	0.349	0.348	0.354
Nickel	2		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Potassium	--		26.9	24.2	25.0	29.4	26.7	27.6	33.8	28.9	26.1	27.1
Selenium	0.05		0.127	0.119	0.132	0.147	0.114	0.119	0.101	0.0977	0.0944	0.106
Sodium	--		639	734	127	706	559	563	908	700	739	644
Thallium	0.002		0.00546	0.00701	0.00631	0.00673	0.00613	0.00714	0.00645	0.00639	0.00637	0.00778
Zinc	31		0.00469 J	0.0103 J	0.00543 J	0.0115 J	0.00510 J	0.00437 J	< 0.0250	0.00446 J	0.00566 J	0.00740 J
Dissolved Metals (mg/L)												
Aluminum	--		--	< 0.0500	--	--	--	--	--	--	--	--
Antimony	--		0.0197	0.0208	0.0212	0.0191	0.0161	0.0162	0.0167	0.0155	0.0162	0.0180
Arsenic	--		0.746	0.740	0.761	0.812	0.823	0.826	0.755	0.720	0.761	0.797
Barium	--		0.0222	0.0246	0.0266	0.0281	0.0237	0.0251	0.0224	0.0224	0.0233	0.0217
Cadmium	--		< 0.00200	< 0.00200	0.00116 J	0.000894 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200
Calcium	--		--	103	--	--	--	--	--	--	--	--
Chromium	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	--		< 0.00500	< 0.00500	0.00170 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Copper	--		< 0.0100	< 0.0100	0.0105	0.00272 J	< 0.0100	0.0142	< 0.0100	< 0.0100	< 0.0100	< 0.0100
Iron	--		< 0.250	--	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250
Lead	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		--	60.8	--	--	--	--	--	--	--	--
Manganese	--		--	< 0.0500	--	--	--	--	--	--	--	--
Mercury	--		< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.000180 J	< 0.00200	0.000316 J
Molybdenum	--		0.329	0.373	0.408	0.432	0.382	0.383	0.388	0.351	0.362	0.343
Nickel	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Selenium	--		0.120	0.121	0.152	0.151	0.123	0.121	0.102	0.0957	0.100	0.109
Thallium	--		0.00528	0.00706	0.00660	0.00685	0.00682	0.00683	0.00635	0.00634	0.00666	0.00674
Zinc	--		< 0.0250	< 0.0250	0.00559 J	0.0101 J	< 0.0250	< 0.0250	< 0.0250	0.00444 J	0.00381 J	< 0.0250
Arsenic Speciation (mg/L)												
Arsenate (v)	--		--	0.8	--	--	0.707	0.734	0.674	0.694	0.661	0.876
Arsenite (iii)	--		--	0.00303 J	--	--	< 0.00080	<0.00080	0.00103	0.00114 J	0.00099 J	< 0.0019
Dimethylarsinic Acid	--		--	< 0.00076	--	--	<0.00058	<0.00058	< 0.00019	< 0.00043	< 0.00043	< 0.0014
Monomethylarsonic Acid	--		--	< 0.00061	--	--	0.00485	0.00453	< 0.00021	< 0.00063	< 0.00063	< 0.0016

Notes:

exceedences of screening levels are shaded gray

mg/L = milligrams per liter

-- = not analyzed/no cleanup level established

< = analyte not detected above listed sample detection limit (SDL)

J = estimated value

< = not detected

Dup = duplicate sample

Table 5
Performance Monitoring Results - Metals Analysis
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Levels	Well	EP-153	EP-153	EP-154	EP-154	EP-154	EP-154	EP-154	EP-154	EP-154	EP-154
		Sample Date	7/10/2013	9/18/2013	5/9/2012	6/6/2012	10/19/2012	11/15/2012	12/5/2012	2/5/2013	7/10/2013	9/17/2013
Total Metals (mg/L)												
Aluminum	100		< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	0.0465 J	< 0.0500	< 0.0500	< 0.0500	0.108
Antimony	0.006		0.0187	0.0208	0.0157	0.0150	0.0147	0.0154	0.0141	0.0168	0.0181	0.0179
Arsenic	0.01		0.861	0.798	0.671	0.722	0.764	0.708	0.699	0.744	0.804	0.683
Barium	2		0.0219	0.0257	0.0217	0.0225	0.0204	0.0195	0.0189	0.0204	0.0216	0.0307
Cadmium	0.005		0.00165 J	0.00153 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.00128 J	0.00109 J
Calcium	--		91.2	97.9	109	120	111	121	110	110	106	103
Chromium	0.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	6.1		< 0.00500	< 0.00500	0.00199 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Copper	1.3		0.00214 J	< 0.0100	0.00292 J	< 0.0100	< 0.0100	< 0.0100	0.00285 J	< 0.0100	0.0373	0.00502 J
Iron	--		< 0.250	--	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	--
Lead	0.015		< 0.00500	0.00113 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00395 J
Magnesium	--		52.7	45.8	59.7	69.3	58.3	67.9	73.1	54.0	60.8	61.1
Manganese	14		< 0.0500	< 0.0500	0.0537	0.0180 J	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	0.0179 J
Mercury	0.002		< 0.00200	< 0.00200	0.000237 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.000225 J
Molybdenum	0.51		0.349	0.354	0.344	0.360	0.344	0.325	0.309	0.298	0.313	0.302
Nickel	2		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Potassium	--		24.9	25.3	27.5	30.2	28.2	30.6	29.6	25.5	27.2	25.4
Selenium	0.05		0.131	0.107	0.141	0.164	0.128	0.127	0.127	0.131	0.142	0.113
Sodium	--		645	542	141	693	565	787	721	475	669	668
Thallium	0.002		0.00651	0.00603	0.00908	0.00883	0.00959	0.00863	0.00894	0.00863	0.00944	0.00937
Zinc	31		0.00721 J	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	0.00986 J	0.00508 J	0.00733 J
Dissolved Metals (mg/L)												
Aluminum	--		--	< 0.0500	--	--	--	--	--	--	--	< 0.0500
Antimony	--		0.0187	0.0218	0.0199	0.0143	0.0143	0.00157	0.0142	0.0167	0.0167	0.0184
Arsenic	--		0.905	0.802	0.698	0.722	0.756	0.705	0.675	0.714	0.792	0.717
Barium	--		0.0219	0.0256	0.0242	0.0210	0.0201	0.0189	0.0210	0.0187	0.0215	0.0272
Cadmium	--		0.00166 J	0.00161 J	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	< 0.00200	0.00109 J	0.00127 J
Calcium	--		--	98.1	--	--	--	--	--	--	--	108
Chromium	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	--		< 0.00500	0.00188 J	< 0.00500	0.00177 J	< 0.00500	< 0.00500	< 0.00500	0.00179 J	< 0.00500	0.00139 J
Copper	--		< 0.0100	< 0.0100	0.00303 J	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	0.00346 J
Iron	--		< 0.250	--	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	--
Lead	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00120 J
Magnesium	--		--	45.7	--	--	--	--	--	--	--	65.5
Manganese	--		--	< 0.0500	--	--	--	--	--	--	--	0.0185 J
Mercury	--		< 0.00200	< 0.00200	< 0.00200	0.000488 J	< 0.00200	< 0.00200	< 0.00200	0.000156 Jb	< 0.00200	0.000199 J
Molybdenum	--		0.346	0.363	0.367	0.347	0.339	0.350	0.320	0.295	0.293	0.314
Nickel	--		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Selenium	--		0.125	0.111	0.151	0.164	0.127	0.123	0.119	0.128	0.125	0.117
Thallium	--		0.00548	0.00625	0.00852	0.00789	0.00928	0.00870	0.00915	0.00869	0.00914	0.00986
Zinc	--		< 0.0250	< 0.0250	< 0.0250	0.00422 J	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0250
Arsenic Speciation (mg/L)												
Arsenate (v)	--		--	0.885	--	--	0.689	0.648	0.674	0.838	--	0.832
Arsenite (iii)	--		--	< 0.0019	--	--	< 0.00080	0.00045 J	0.00096 J	< 0.0019	--	< 0.0019
Dimethylarsinic Acid	--		--	< 0.0017	--	--	< 0.00058	< 0.00019	< 0.00043	< 0.0014	--	< 0.0017
Monomethylarsonic Acid	--		--	< 0.0018	--	--	0.00427	< 0.00021	< 0.00063	< 0.0016	--	< 0.0018

Notes:

exceedences of screening levels are shaded gray

mg/L = milligrams per liter

-- = not analyzed/no cleanup level established

< = analyte not detected above listed sample detection limit (SDL)

J = estimated value

< = not detected

Dup = duplicate sample

Table 5
Performance Monitoring Results - Metals Analysis
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Levels	Well	EP-155	EP-155	EP-155	EP-155	EP-155	EP-155	EP-155	EP-156R	EP-156R	EP-156R (Dup)
		Sample Date	5/9/2012	6/6/2012	10/19/2012	12/5/2012	2/6/2013	7/10/2013	9/18/2013	7/18/2013	9/13/2013	9/13/2013
Total Metals (mg/L)												
Aluminum	100		< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	0.321	< 0.0500	< 0.0500	< 0.0500
Antimony	0.006		0.0226	0.0243	0.0200	0.0185	0.0209	0.0217	0.0230	< 0.00500	0.00455 J	0.00466 J
Arsenic	0.01		0.888	0.974	0.921	0.740	0.944	0.917	0.793	0.0103	0.157	0.157
Barium	2		0.0237	0.0294	0.0241	0.0212	0.0219	0.0237	0.0318	0.0249	0.0153	0.0140
Cadmium	0.005		0.00339	0.00420	0.00388	0.00327	0.00350	0.00460	0.00430	0.00177 J	0.0451	0.0451
Calcium	--		96.5	118	100	83.6	97.6	85.8	83.2	149	136	131
Chromium	0.1		< 0.00500	< 0.00500	< 0.00500	0.0111	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	6.1		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00216 J	0.00196 J
Copper	1.3		0.00316 J	0.00238 J	< 0.0100	< 0.0100	< 0.0100	0.00250 J	0.00515 J	< 0.0100	< 0.0100	< 0.0100
Iron	--		< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	--	0.298	--	--
Lead	0.015		< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.000790 J	0.00124 J	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		50.2	63.7	52.2	50.3	58.0	50.4	39.6	61.5	58.0	55.8
Manganese	14		0.0250 J	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	0.0144 J	0.300	0.121	0.115
Mercury	0.002		< 0.00200	< 0.00200	< 0.00200	0.000196 J	0.000262 J	< 0.00200	< 0.00200	< 0.00200	0.000274 J	0.000257 J
Molybdenum	0.51		0.427	0.483	0.399	0.354	0.364	0.380	0.386	0.386	0.558	0.556
Nickel	2		< 0.00500	< 0.00500	< 0.00500	0.00505	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00689	0.00672
Potassium	--		25.0	29.5	27.1	26.6	27.7	24.8	23.2	62.2	64.6	63.5
Selenium	0.05		0.128	0.153	0.115	0.0700	0.0809	0.113	0.0940	0.0514	0.247	0.238
Sodium	--		88.2	761	547	663	669	692	539	568	543	524
Thallium	0.002		0.00692	0.00748	0.00847	0.00641	0.00633	0.00591	0.00554	< 0.00200	0.00397	0.00365
Zinc	31		0.0233 J	0.0320	0.0268	0.0345	0.0222 J	0.0252	0.0188 J	0.147	0.843	0.798
Dissolved Metals (mg/L)												
Aluminum	--		--	--	--	--	--	--	< 0.0500	--	< 0.0500	< 0.0500
Antimony	--		0.0290	0.0245	0.0217	0.0195	0.0212	0.0201	0.0242	< 0.00500	0.00397 J	0.00500
Arsenic	--		0.951	0.977	0.981	0.766	0.886	0.918	0.812	0.00821	0.151	0.159
Barium	--		0.0269	0.0299	0.0262	0.0217	0.0222	0.0221	0.0296	0.0235	0.0133	0.0155
Cadmium	--		0.00383	0.00450	0.00374	0.00330	0.00322	0.00429	0.00433	0.00177 J	0.0393	0.0466
Calcium	--		--	--	--	--	--	--	84.5	--	125	134
Chromium	--		< 0.00500	0.00226 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cobalt	--		< 0.00500	0.00253 J	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00153 J	0.00191 J	0.00211 J	0.00357 J
Copper	--		0.00334 J	0.0468	0.00282 J	< 0.0100	< 0.0100	< 0.0100	0.00235 J	< 0.0100	< 0.0100	< 0.0100
Iron	--		< 0.250	0.270	< 0.250	< 0.250	< 0.250	< 0.250	--	0.118 J	--	--
Lead	--		< 0.00500	0.00826	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
Magnesium	--		--	--	--	--	--	--	40.6	--	52.2	58.1
Manganese	--		--	--	--	--	--	--	0.0117 J	--	0.11	0.124
Mercury	--		< 0.00200	< 0.00200	< 0.00200	0.000515 J	0.000246 J	< 0.00200	< 0.00200	< 0.00200	0.000253 J	0.000265 J
Molybdenum	--		0.481	0.474	0.421	0.368	0.362	0.359	0.402	0.380	0.466	0.565
Nickel	--		< 0.00500	0.0329	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500	0.00622	0.00705
Selenium	--		0.150	0.158	0.121	0.0704	0.0811	0.100	0.0937	0.0504	0.237	0.245
Thallium	--		0.00688	0.00726	0.00812	0.00638	0.00611	0.00502	0.00566	< 0.00200	0.00343	0.00433
Zinc	--		0.0253	0.171	0.0282	0.0220 J	0.0206 J	0.0196 J	0.0150 J	0.129	0.774	0.819
Arsenic Speciation (mg/L)												
Arsenate (v)	--		--	--	0.707	0.732	0.903	--	0.836	--	0.146	0.141
Arsenite (iii)	--		--	--	< 0.00080	0.00112 J	0.0022 J	--	< 0.0019	--	< 0.0019	< 0.0019
Dimethylarsinic Acid	--		--	--	< 0.00058	< 0.00043	< 0.0014	--	< 0.0017	--	< 0.0017	< 0.0017
Monomethylarsonic Acid	--		--	--	0.00571	< 0.00063	< 0.0016	--	< 0.0018	--	< 0.0018	< 0.0018

Notes:
exceedences of screening levels are shaded gray
mg/L = milligrams per liter
-- = not analyzed/no cleanup level established
< = analyte not detected above listed sample detection limit (SDL)
J = estimated value
< = not detected
Dup = duplicate sample

MALCOLM PIRNIE

Table 5
Performance Monitoring Results - Metals Analysis
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Parameters	Screening Levels	Well Sample Date	EP-157 7/15/2013	EP-157 9/9/2013
Total Metals (mg/L)				
Aluminum	100		< 0.0500	< 0.0500
Antimony	0.006		0.0181	0.0207
Arsenic	0.01		1.17	1.17
Barium	2		0.0311	0.0274
Cadmium	0.005		0.00113 J	0.000982 J
Calcium	--		78.3	84.1
Chromium	0.1		< 0.00500	0.00166 J
Cobalt	6.1		< 0.00500	< 0.00500
Copper	1.3		< 0.0100	< 0.0100
Iron	--		0.141 J	--
Lead	0.015		< 0.00500	< 0.00500
Magnesium	--		69.9	49.2
Manganese	14		0.0303 J	< 0.0500
Mercury	0.002		< 0.00200	< 0.00200
Molybdenum	0.51		0.536	0.461
Nickel	2		< 0.00500	< 0.00500
Potassium	--		26.8	25.8
Selenium	0.05		0.148	0.143
Sodium	--		875	746
Thallium	0.002		0.00188 J	0.00226
Zinc	31		< 0.0250	< 0.0250
Dissolved Metals (mg/L)				
Aluminum	--		--	< 0.0500
Antimony	--		0.0160	0.0194
Arsenic	--		1.08	1.18
Barium	--		0.0270	0.0253
Cadmium	--		0.000967 J	0.000902 J
Calcium	--		--	81.9
Chromium	--		< 0.00500	0.00154 J
Cobalt	--		< 0.00500	0.00147 J
Copper	--		< 0.0100	< 0.0100
Iron	--		< 0.250	--
Lead	--		< 0.00500	< 0.00500
Magnesium	--		--	49.8
Manganese	--		--	< 0.0500
Mercury	--		< 0.00200	< 0.00200
Molybdenum	--		0.495	0.457
Nickel	--		0.00220 J	< 0.00500
Selenium	--		0.135	0.144
Thallium	--		0.00228	0.00208
Zinc	--		< 0.0250	< 0.0250
Arsenic Speciation (mg/L)				
Arsenate (v)	--		--	1.28
Arsenite (iii)	--		--	0.00197 J
Dimethylarsinic Acid	--		--	< 0.00076
Monomethylarsonic Acid	--		--	< 0.00061

Notes:
exceedences of screening levels are shaded gray
mg/L = milligrams per liter
-- = not analyzed/no cleanup level established
< = analyte not detected above listed sample detection limit (SDL)
J = estimated value
< = not detected
Dup = duplicate sample

MALCOLM PIRNIE

Table 6
Performance Monitoring Program
Field Demonstration Status Update
Former ASARCO Smelter Site
El Paso, Texas

Location	Well ID	Well Location	Analytical Monitoring Frequency		Hydraulic Monitoring Frequency	
			Quarterly	Semi-Annually	Monthly	Semi-Annually and/or As Needed
					Water Level Monitoring	Slug Testing/Single Well Tracer Testing
PRB-1	EP-138R	15 ft Upgradient	--	X	X	--
	EP-139R	10 ft Upgradient	--	X	X	X
	EP-140A	In Barrier	X	X	X	X
	EP-140B	In Barrier	X	X	X	X
	EP-140C	In Barrier	X	X	X	--
	EP-141A	2 ft upgradient	X	X	X	--
	EP-141B	In Barrier	X	X	X	X
	EP-141C	2 ft downgradient	X	X	X	--
	EP-142	5 ft Downgradient	X	X	X	--
	EP-143	10 ft Downgradient	X	X	X	--
	EP-157	55 ft Downgradient	X	X	X	--
	EP-144	120 ft Downgradient	--	X	X	--
	EP-145	100 ft Downgradient	--	X	X	--
	EP-146	205 ft Downgradient	--	X	X	--
	EP-147	335 ft Downgradient	--	X	X	--
PRB-2	EP-148	45 ft Upgradient	--	X	X	--
	EP-149	50 ft Upgradient	--	X	X	--
	EP-150A-S	In Barrier	X	X	X	X
	EP-150A-D	2 ft upgradient	X	X	X	X
	EP-150B-S	In Barrier	X	X	X	X
	EP-150B-D	In Barrier	X	X	X	X
	EP-150C-S	In Barrier	X	X	X	X
	EP-150C-D	In Barrier	X	X	X	X
	EP-151-S	10 ft Downgradient	X	X	X	X
	EP-151-D	10 ft Downgradient	X	X	X	X
	EP-152-S	10 ft Downgradient	X	X	X	--
	EP-152-D	10 ft Downgradient	X	X	X	--
	EP-153	55 ft Downgradient	--	X	X	--
	EP-154	40 ft Downgradient	--	X	X	--
	EP-156R	445 ft Downgradient	--	X	X	--

Detailed Analyte List[1, 2]

Metals: Arsenic (As^{+5} and As^{+3}), antimony, barium, cadmium, chromium, cobalt, copper, iron (Fe^{+2} and Fe^{+3}), lead, mercury, molybdenum, nickel, selenium, silica, thallium, and zinc

Water Quality Parameter: aluminum, calcium, magnesium, manganese, potassium, sodium, alkalinity, nitrate/nitrite, sulfate, sulfide, total suspended solids, total dissolved solids

Field Parameters: temperature, disolved oxygen, oxidation/reduction potential, turbidity, ferrous iron, atmospheric air temperature, barometric pressure, pH, specific conductivity

Notes:

1 = analytical methods are as follows: dissolved metals including silica and total metals (6020), dissovled and total mercury (7470A), dissolved and total iron (SM 3500 FE D), anions (300.0), suflide (376.2), total dissolved solids (160.1), total suspended solids (160.2), and alkalinity (SM 2320B)

2 = semi-annual peformance monitoring for the 11 upgradient and downgradient wells excluded from quarterly performance monitoring (EP-156R, EP-153, EP-154, EP-144, EP-145, EP-146, EP-147, EP-148, EP-149, EP-138R and EP-139R) will be analyzed for total metals only. All other wells will be analyzed for total and dissolved metals.

ft = feet

-- = Not Applicable/Not Scheduled for Analysis

MALCOLM PIRNIE

Figures

East Mountain

East Property

Plant Entrance Arroyo

10

Fines Pile and
Ephemeral Pond

Plant Site

South Terrace Arroyo

Boneyard

Pond 1 Arroyo

Pond 5, 6
Arroyo

Parker Brothers
Arroyo

Acid Plant
Arroyo

American Canal

Rio Grande Floodplain

Rio Grande

NM
OK
AR
El Paso
TEXAS
LA
MEXICO
GULF OF
MEXICO

LEGEND:

- Property Boundary
- Historic Contours - 1890 (10-foot interval)
- Historic Arroyo Trace Lines
- Historic Drainage Divide
- Secondary Unit Areas

N

0 500 1,000 Feet

GRAPHIC SCALE

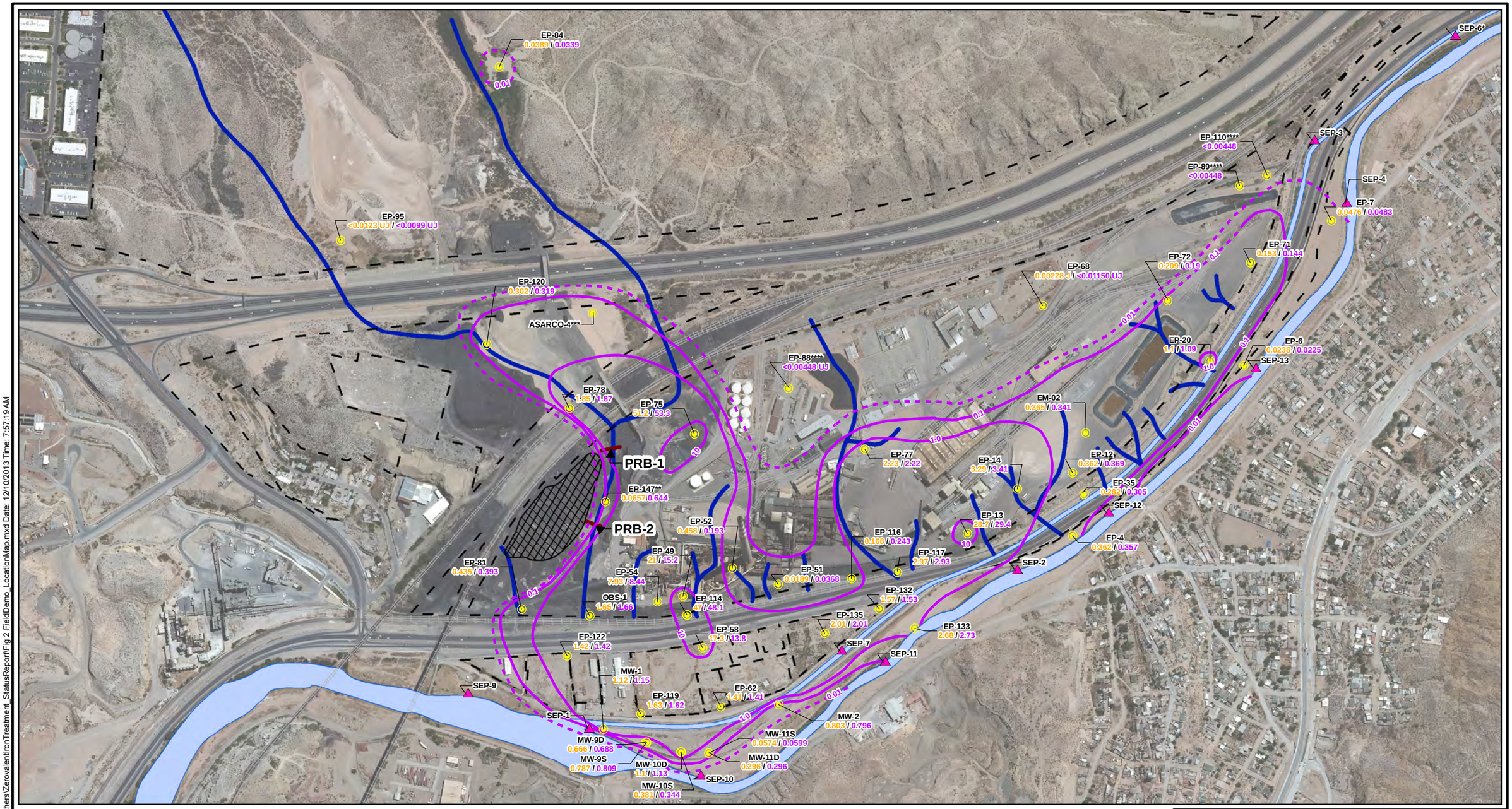
FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT
TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

SITE MAP

MALCOLM PIRNIE

FIGURE
1

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Project (Project #)
Path: I:\ASARCO_ElPaso\GIS\MXD\ParkerBrothers\ZerovalentIronTreatment_StatusReport\Fig 1 SiteMap.mxd Date: 11/7/2013 Time: 8:07:04 AM



LEGEND:

- Monitoring Wells
- Abandoned Monitoring Wells
- Surface Water Stations

EP-75 Well ID
55 / 51.1 Dissolved Arsenic/Total Arsenic (mg/L)
October 2012

- Total Arsenic Contours (mg/L) (Dashed where inferred)
- Historical Arroyo Trace Lines
- Property Boundary
- Landfill Extent
- Permeable Reactive Barrier

Note:
Arsenic Screening Level = 0.01 mg/L (EPA Drinking Water MCL)
EPA = Environmental Protection Agency
J = The reported value was obtained from a reading that was less than reporting limit but greater than or equal to the method detection limit.
UJ = Estimated reporting limit
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
< = Non detect at the reporting limit shown

*Actual location of SEP-6 is approximately one mile further downstream on the American Canal.
**Data collected October 2012
***TxDOT monitoring well not sampled
****Data collected August 2009

N

0 600 1,200 Feet

GRAPHIC SCALE

FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

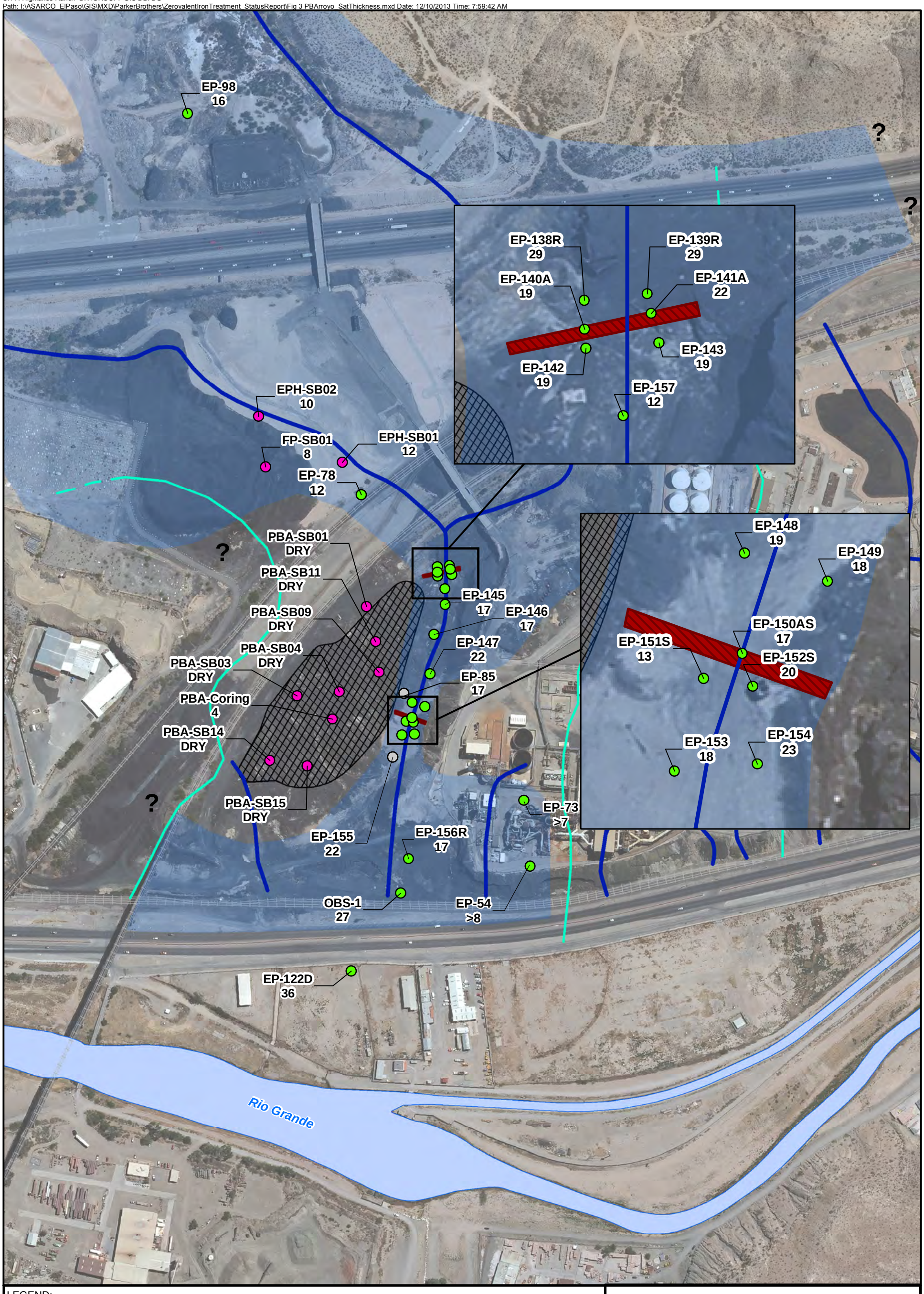
FIELD DEMONSTRATION LOCATION MAP

MALCOLM PIRNIE

FIGURE 2

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Project (Project #)
Path: I:\ASARCO_ElPaso\GIS\MXD\ParkerBrothers\ZerovalentIronTreatment_StatusReport\Fig 2 FieldDemo_LocationMap.mxd Date: 12/10/2013 Time: 7:57:19 AM

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Path: I:\ASARCO_ElPaso\GIS\MXD\ParkerBrothers\ZerovalentIronTreatment_StatusReport\Fig 3 PBArroyo_SatThickness.mxd Date: 12/10/2013 Time: 7:59:42 AM



LEGEND:

EP-145 17 — Monitoring Well (feet) - Approximate Alluvial Saturated Thickness

EP-155 22 — Abandoned Monitoring Well - Approximate Alluvium Saturated Thickness

EPH-SB02 10 — Soil Boring (feet) - Approximate Alluvial Saturated Thickness

Approximate Saturated Alluvium Extent

Permeable Reactive Barrier

Landfill Extent

Historic Arroyo Trace Lines

Historic Drainage Divide

N

0 300 600 Feet

GRAPHIC SCALE

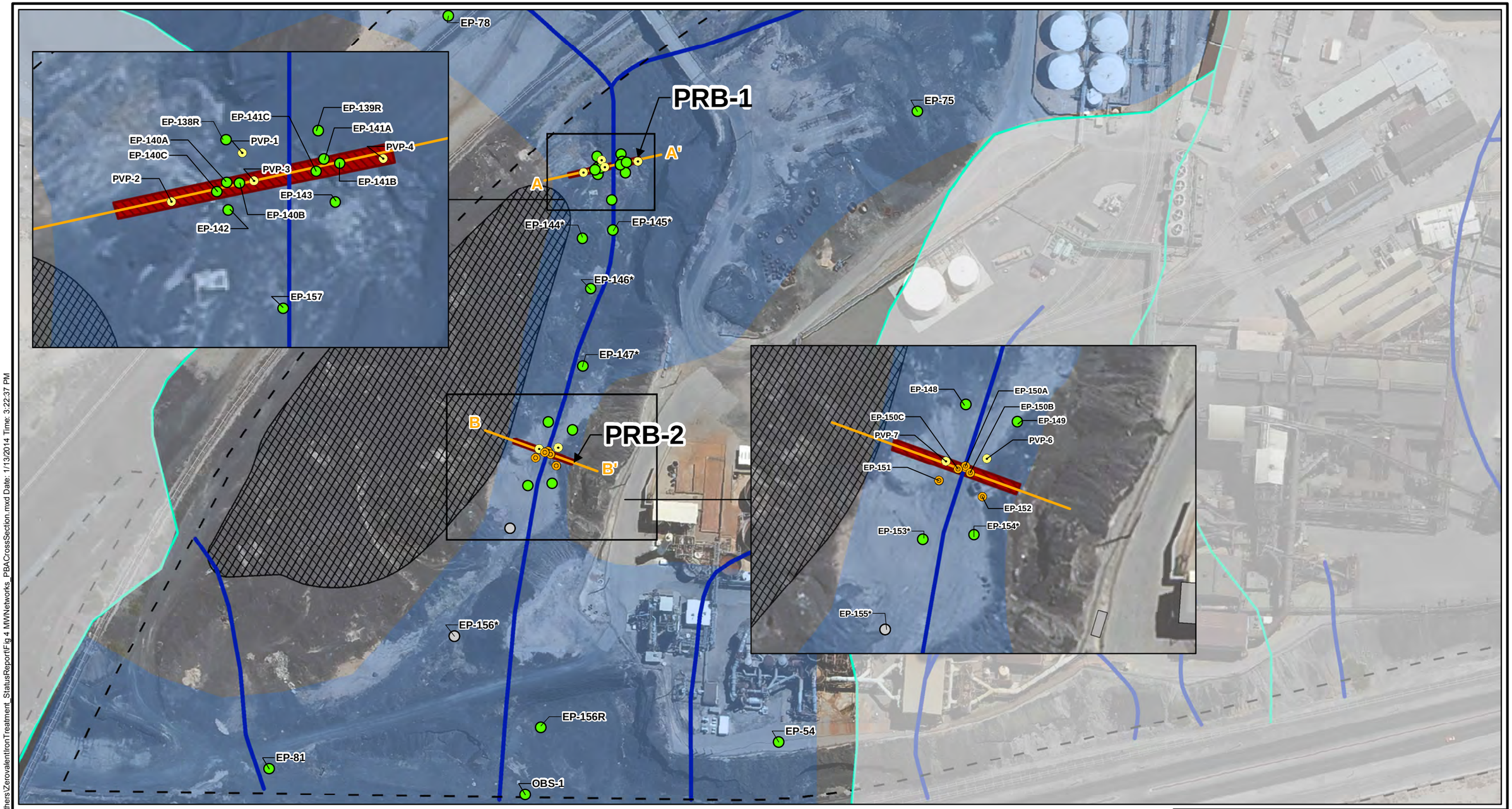
FORMER EL PASO SMELTER SITE
EL PASO, TEXAS

FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

PARKER BROTHERS ARROYO ALLUVIAL SATURATED THICKNESS

MALCOLM PIRNIE

FIGURE
3



LEGEND:

- Monitoring Well
- Nested Monitoring Well
- Point Velocity Probe
- Abandoned Monitoring Well
- Property Boundary
- Historic Arroyo Trace Lines
- Cross Section Lines
- Historic Drainage Divide
- Approximate Parker Brothers Arroyo Saturated Thickness Extent
- Permeable Reactive Barrier
- Landfill Extent

Note:
* = well is part of the Interim Monitoring Network installed in May 2012

N

0 160 320 Feet

GRAPHIC SCALE

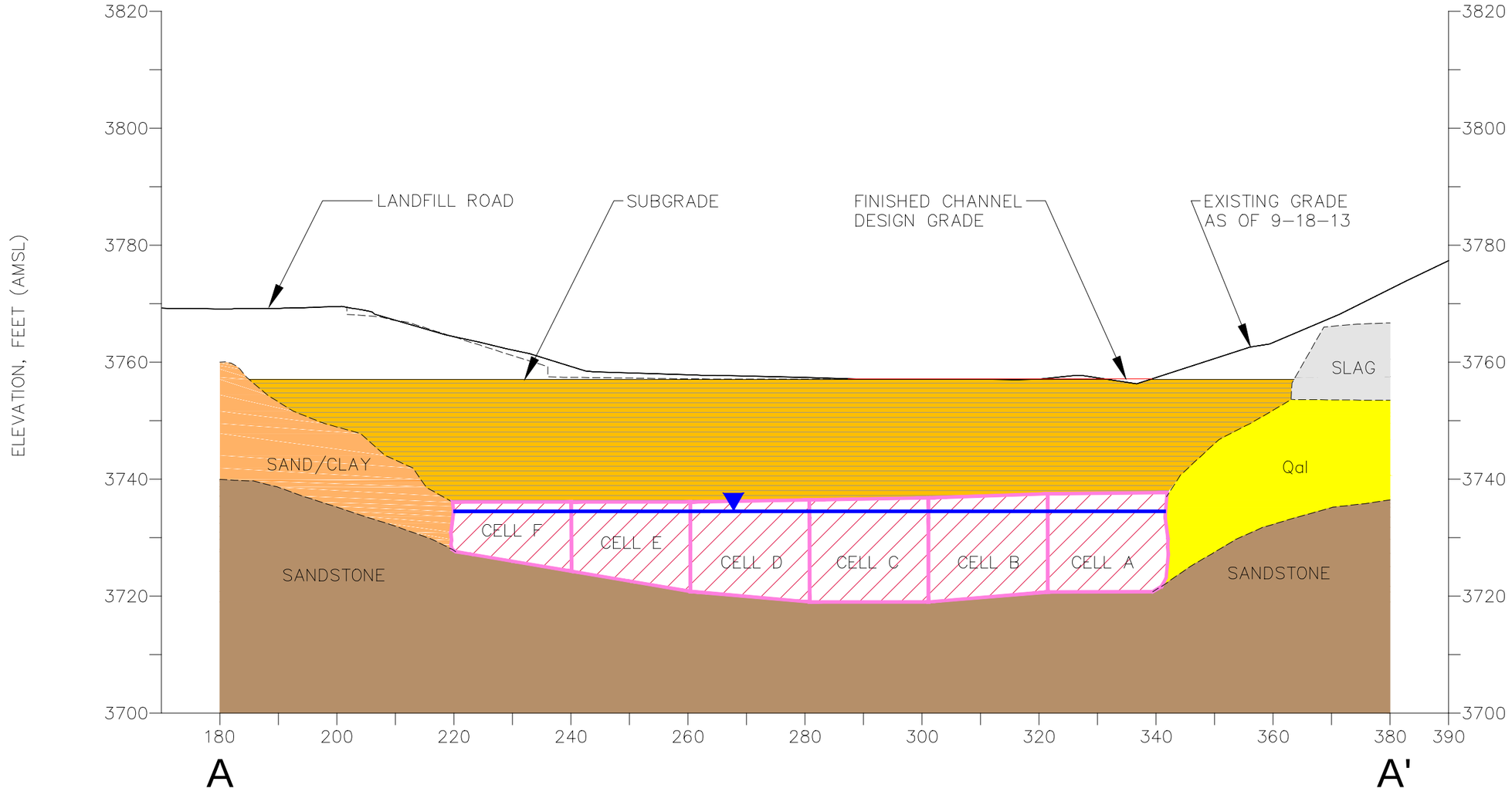
FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

MONITORING WELL NETWORK WITH PRB CROSS SECTION LAYOUTS

MALCOLM PIRNIE

FIGURE 4

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Project (Project #)
Path: I:\ASARCO_ElPaso\GIS\MXD\ParkerBrothersZerovalentIronTreatment_StatusReport\Fig 4 MWNetworks_PBACrossSection.mxd Date: 1/13/2014 Time: 3:22:37 PM



LEGEND:

- GROUNDWATER ELEVATION (8/3/13)
- SLAG
- SAND/GRAVEL (Qal ALLUVIUM)
- LOWER PERMEABILITY INTERBEDDED SAND/CLAY (FORT HANCOCK FORMATION)
- SANDSTONE (UPPER MOJADO FORMATION)
- PERMEABLE REACTIVE BARRIER
- BACKFILL (LOW PERMEABILITY MATERIAL)

DEFINITIONS:

AMSL = ABOVE MEAN SEA LEVEL

NAVD = NORTH AMERICAN VERTICAL DATUM

NGS = NATIONAL GEODETIC SURVEY

0 20 40

HOIZONTAL AND VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION: 1:1

NOTES:

1. ELEVATIONS ARE BASED ON NGS VERTICAL CONTROL MONUMENT Q460. RECORD ELEVATION IS 3738.19 (NAVD 88 DATUM)
2. PRB BOTTOM ELEVATION SHOWN IS BASED ON THE AVERAGE OF EACH CELL'S FOUR BOTTOM CORNER ELEVATIONS

FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO - STATUS REPORT

PRB-1 CROSS-SECTION

MALCOLM PIRNIE

FIGURE
5

Acad Version : R18.1s (LMS Tech)
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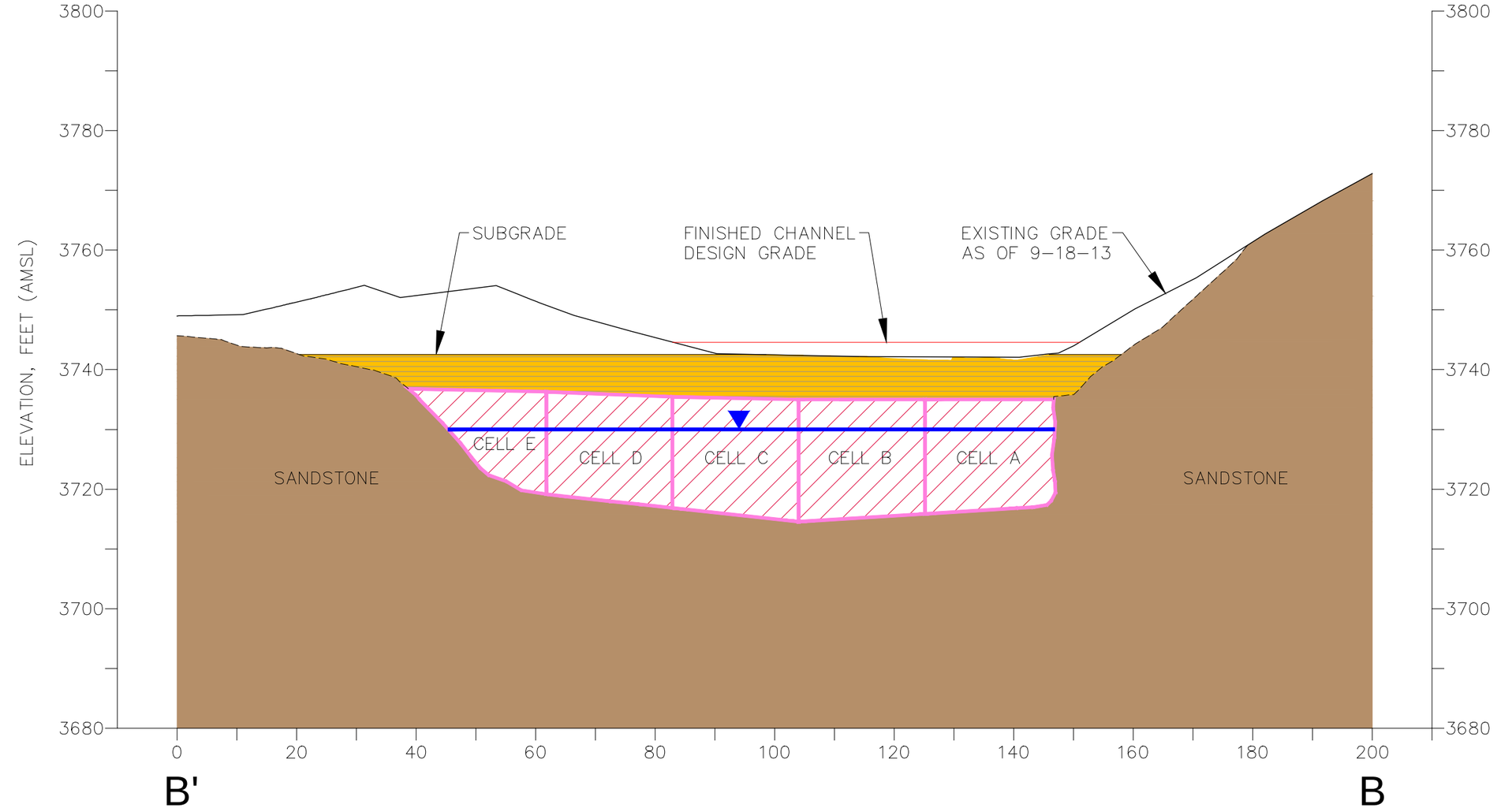
Date\Time : Tue, 10 Dec 2013 - 10:02am
Path\Name : G:\ENV\ENV\PROJ\1200\1209 - MP - El Paso Smelter\180 - CAD\53-Exhibits\BU.dwg



0 20 40

HOIZONTAL AND VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION: 1:1

LEGEND:

- GROUNDWATER ELEVATION (8/3/13)
- SANDSTONE (UPPER MOJADO FORMATION)
- PERMEABLE REACTIVE BARRIER
- BACKFILL (LOW PERMEABILITY MATERIAL)

DEFINITIONS:

AMSL = ABOVE MEAN SEA LEVEL

NAVD = NORTH AMERICAN VERTICAL DATUM

NGS = NATIONAL GEODETIC SURVEY

NOTES:

1. ELEVATIONS ARE BASED ON NGS VERTICAL CONTROL MONUMENT Q460. RECORD ELEVATION IS 3738.19 (NAVD 88 DATUM)
2. PRB BOTTOM ELEVATION SHOWN IS BASED ON THE AVERAGE OF EACH CELL'S FOUR BOTTOM CORNER ELEVATIONS

FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO - STATUS REPORT

PRB-2 CROSS-SECTION

MALCOLM PIRNIE

FIGURE 6

Acad Version : R18.1s (LMS Tech)
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Date\Time : Tue, 10 Dec 2013 - 10:02am
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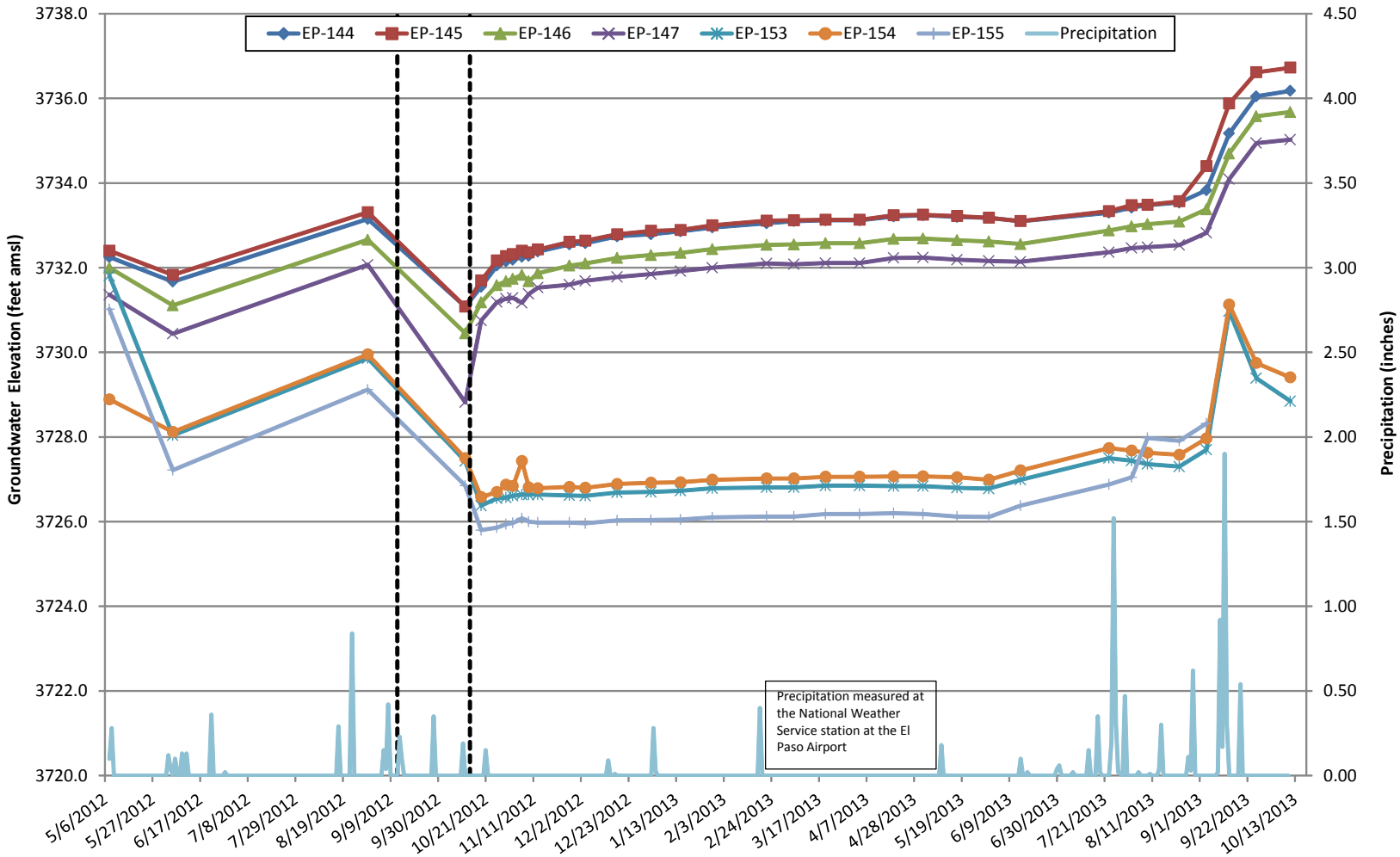
Interim Monitoring Wells Groundwater Elevations



Note:
amsl = above mean sea level
Precipitation measured at the National Weather Service station at the El Paso Airport
- - - -PRB construction period

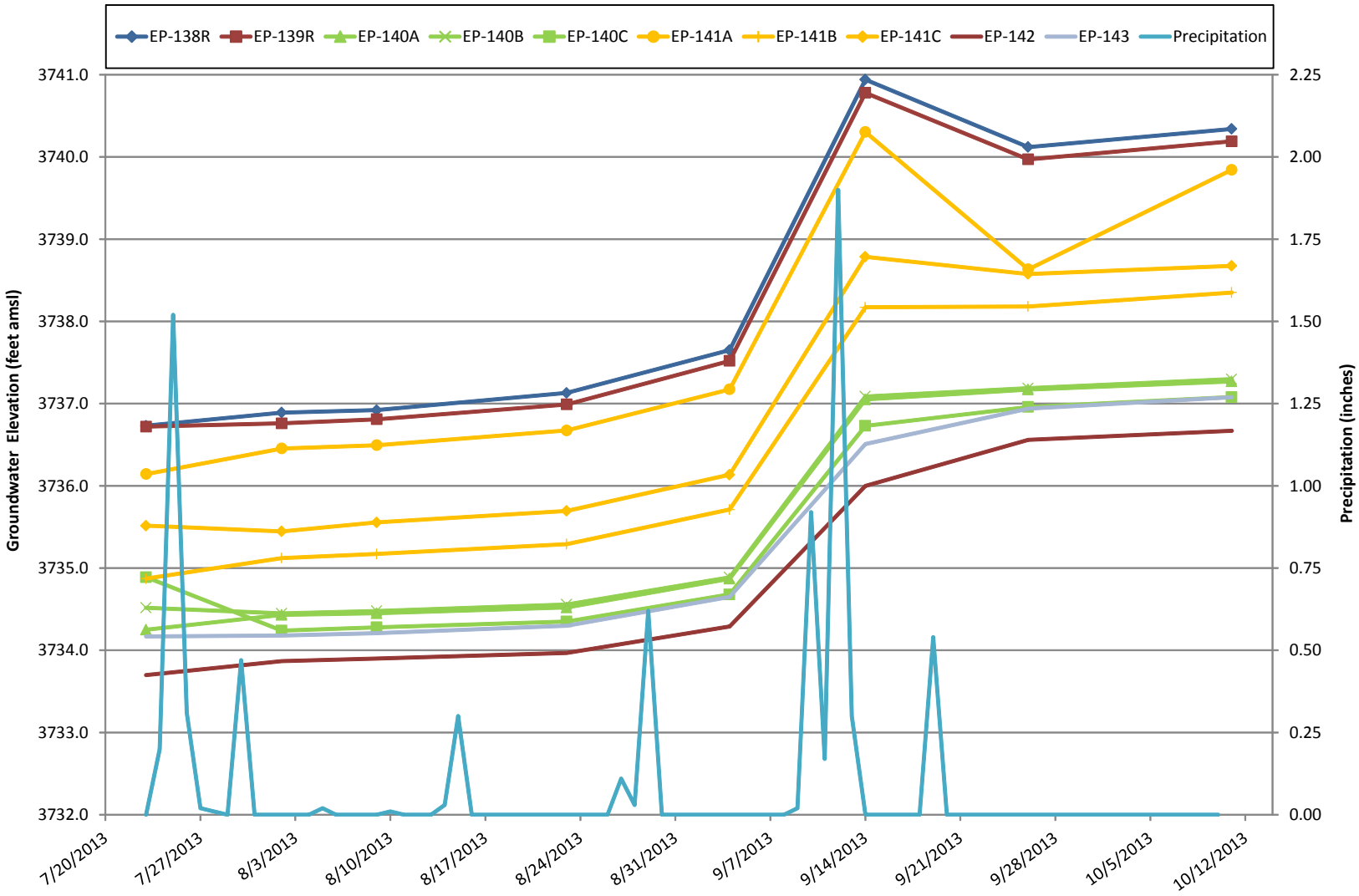
FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

PARKER BROTHERS ARROYO – HYDROGRAPHS

MALCOLM PIRNIE

FIGURE 7

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Project (Project #)
Path: I:\ASARCO_ElPaso\GIS\MXD\ParkerBrothers\ZerovalentIronTreatment_StatusReport\Fig 7 InterimMWGWElevations.mxd Date: 11/26/2013 Time: 10:49:59 AM



Note:
amsl = above mean sea level
Precipitation measured at the National Weather Service station at the El Paso Airport

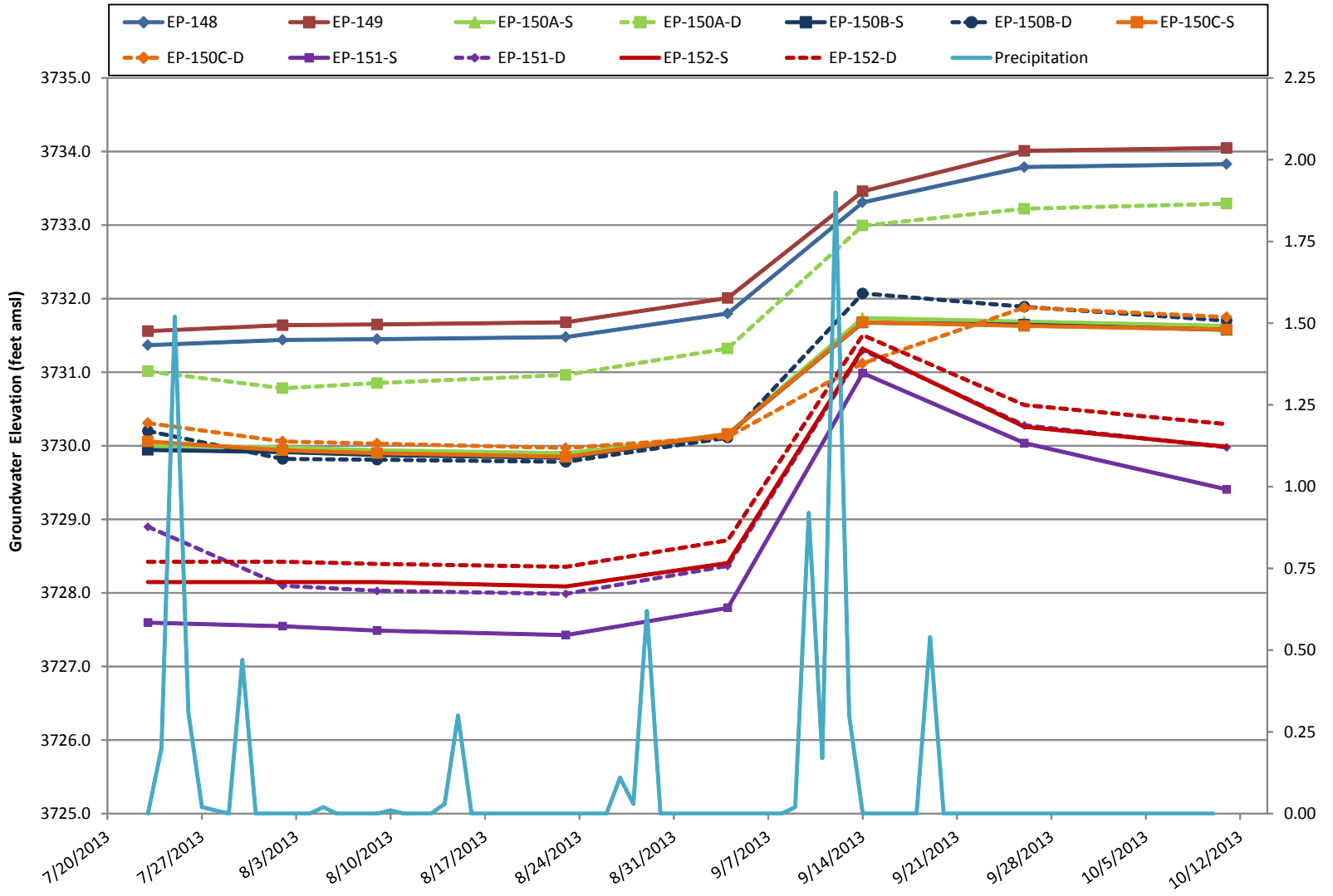
FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT
TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

PRB-1 – HYDROGRAPHS

MALCOLM PIRNIE

FIGURE
8

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Project (Project #)
Path: I:\ASARCO_ElPaso\GIS\MXD\ParkerBrothers\ZerovalentIronTreatment_StatusReport\Fig 8 PRB1MWGWElevations.mxd Date: 11/12/2013 Time: 5:35:02 PM



Note:
amsl = above mean sea level
Precipitation measured at the National Weather Service station at the El Paso Airport

FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

PRB-2 – HYDROGRAPHS

MALCOLM PIRNIE

FIGURE
9

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Project (Project #)
Path: I:\ASARCO_ElPaso\GIS\MXD\ParkerBrothers\ZerovalentIronTreatment_StatusReport\Fig 9 PRB2MWGWElevations.mxd Date: 11/12/2013 Time: 5:35:42 PM

EP-78
3749.74

PRB-1

EP-75

EP-138R
3740.34

EP-139R
3740.19

EP-140A
3737.27

EP-141A
3739.84

EP-141C
3738.68

EP-140C
3737.08

EP-141B
3738.35

EP-140B
3737.30

EP-143
3737.08

EP-142
3736.67

EP-157
3736.55

EP-144
3736.18

EP-145
3736.73

EP-146
3735.68

EP-147
3735.03

EP-150C
S: 3731.58
D: 3731.75

EP-148
3733.83

EP-150A
S: 3731.63
D: 3733.29

EP-149
3734.05

EP-150B
S: 3731.58
D: 3731.70

EP-151
S: 3729.41
D: 3729.98

EP-153
3728.85

EP-152
S: 3729.99
D: 3730.30

EP-154
3729.41

PRB-2

EP-155

EP-73

EP-156

EP-156R
3723.01

EP-54

EP-81

OBS-1
3721.62

LEGEND:

- Monitoring Well
- Nested Monitoring Well
- Abandoned Monitoring Well
- Property Boundary
- Historic Arroyo Trace Lines
- Historic Drainage Divide
- Bedrock
- Water Level Contour (feet amsl)
- 3730.95 Groundwater Elevation in Feet AMSL
- Approximate Parker Brothers Arroyo Saturated Thickness Extent
- Permeable Reactive Barrier
- Landfill Extent

Notes:
1) amsl = above mean sea level
2) S = shallow interval
3) D = deep interval

N

0 160 320 Feet

GRAPHIC SCALE

FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

POTENTIOMETRIC SURFACE MAP - OCTOBER 11, 2013

MALCOLM PIRNIE

FIGURE
10

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Project (Project #)
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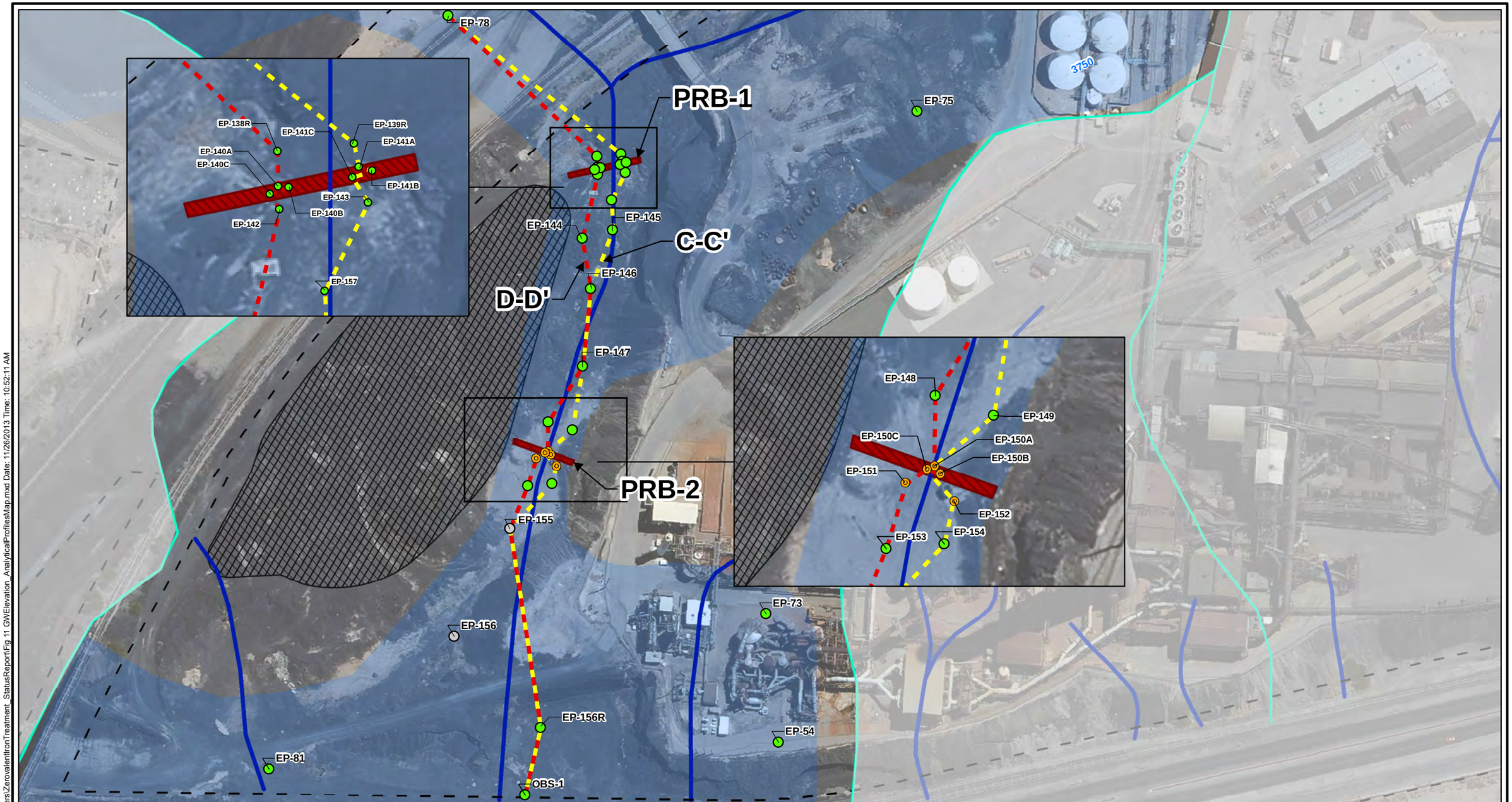


LEGEND:

- Existing Monitoring Well
- Nested Monitoring Well
- Abandoned Monitoring Well
- Property Boundary
- Profile C-C'
- Profile D-D'
- Historic Arroyo Trace Lines
- Historic Drainage Divide
- Approximate Parker Brothers Arroyo Saturated Thickness Extent
- Permeable Reactive Barrier
- Landfill Extent

N

0 160 320 Feet

GRAPHIC SCALE

FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

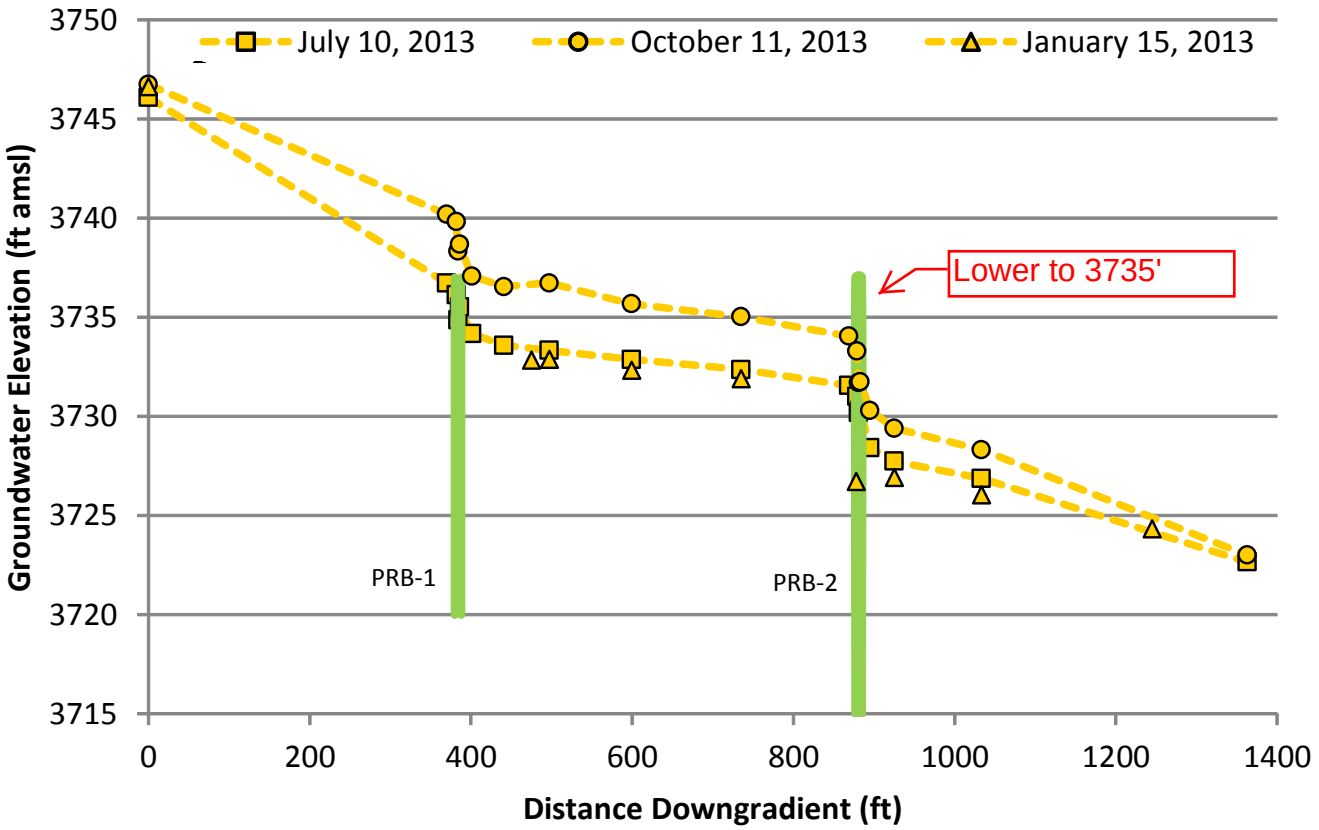
GROUNDWATER ELEVATION AND ANALYTICAL PROFILES LAYOUT

MALCOLM PIRNIE

FIGURE 11

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Project (Project #)
Path: I:\ASARCO_ElPaso\GIS\MXD\ParkerBrothers\ZerovalentIronTreatment_StatusReport\Fig 11 GWElevation_AnalyticalProfilesMap.mxd Date: 11/26/2013 Time: 10:52:11 AM

Groundwater Elevation Profile C-C'



Note: Measurements for EP-150A, EP-150B, EP-150 C, and EP-152 are from the deep screen intervals.

FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

GROUNDWATER ELEVATION PROFILE – SECTION C-C'

MALCOLM PIRNIE

FIGURE 12

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Project (Project #)
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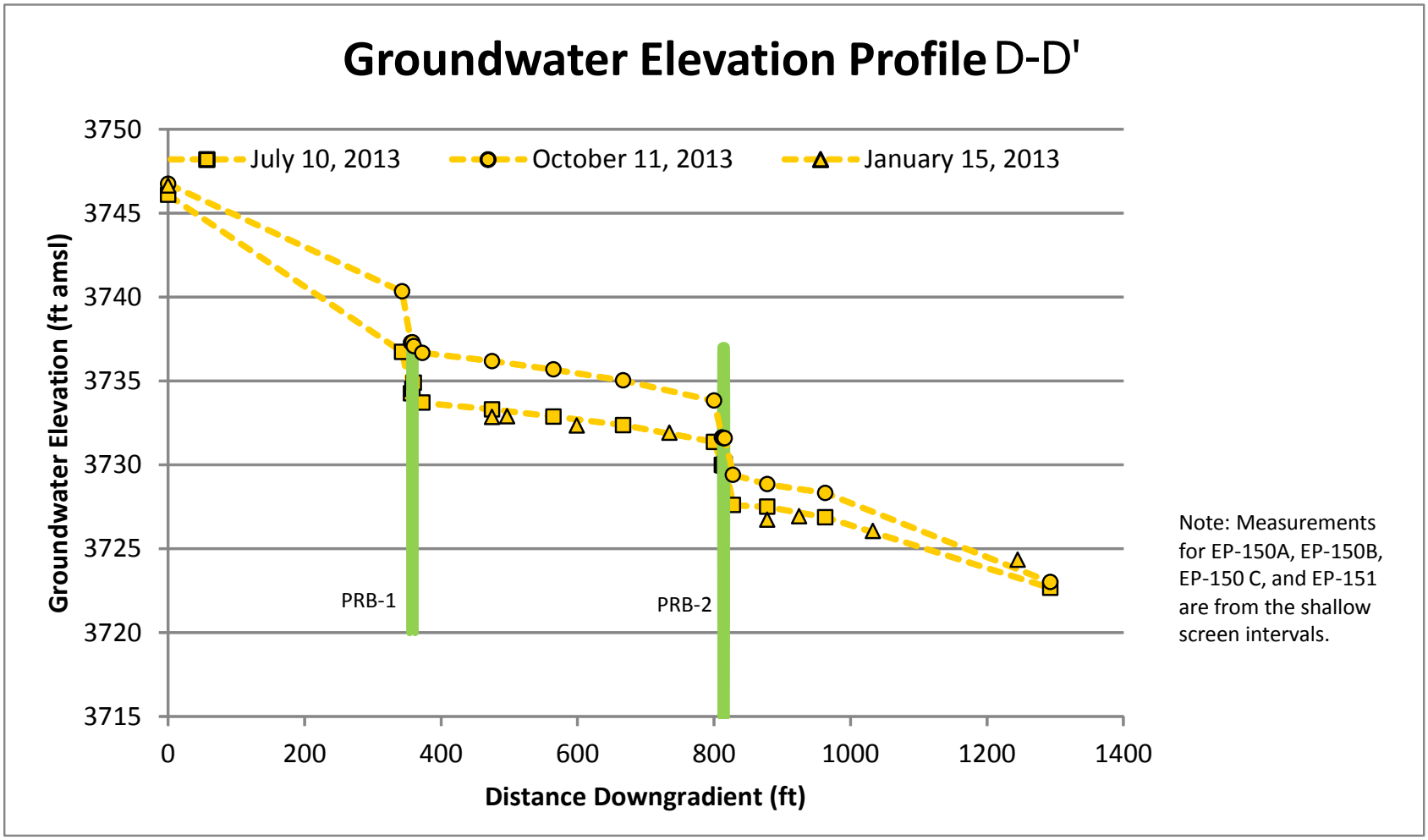

FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

GROUNDWATER ELEVATION PROFILE – SECTION D-D'

MALCOLM PIRNIE

FIGURE 13

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Project (Project #)
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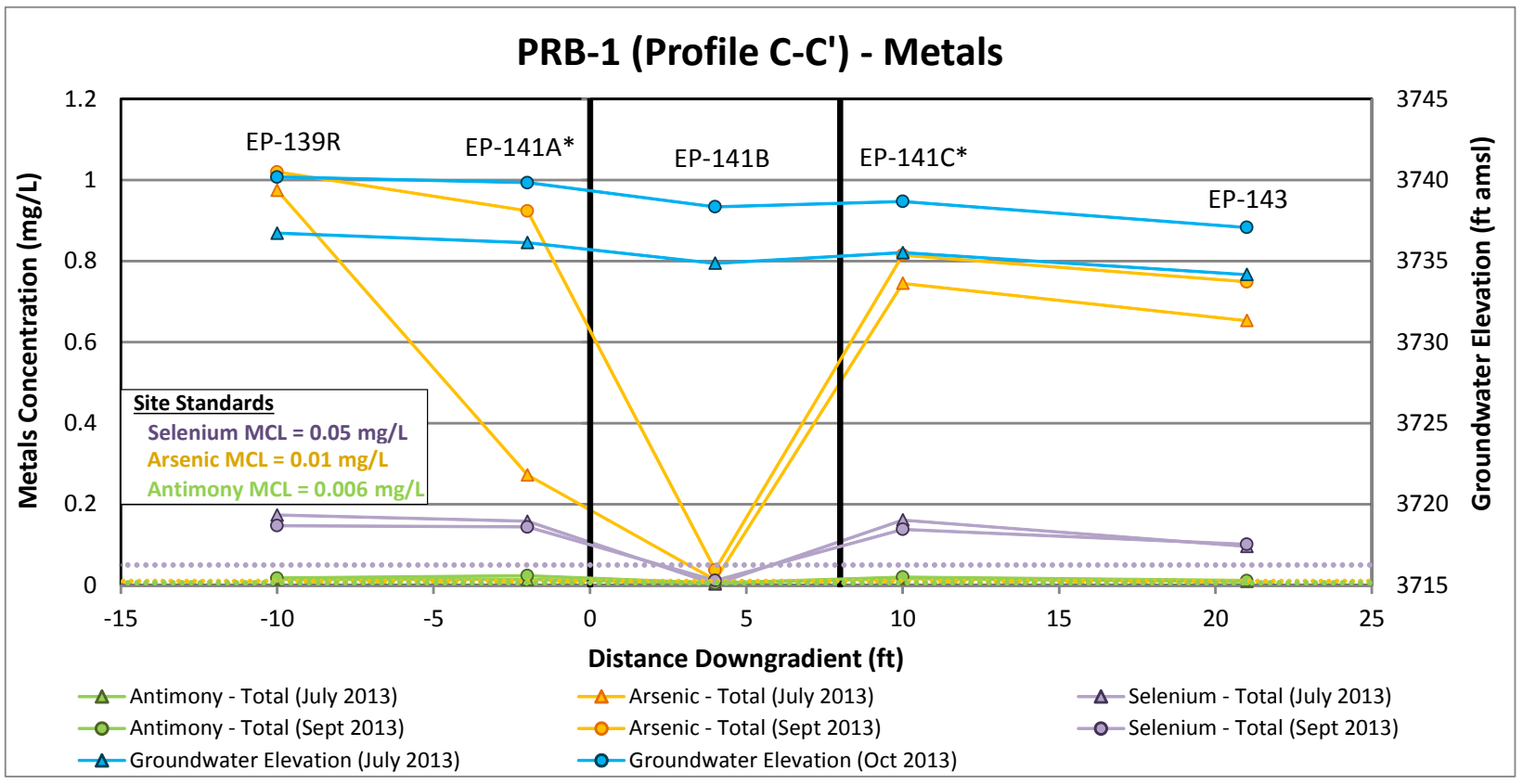

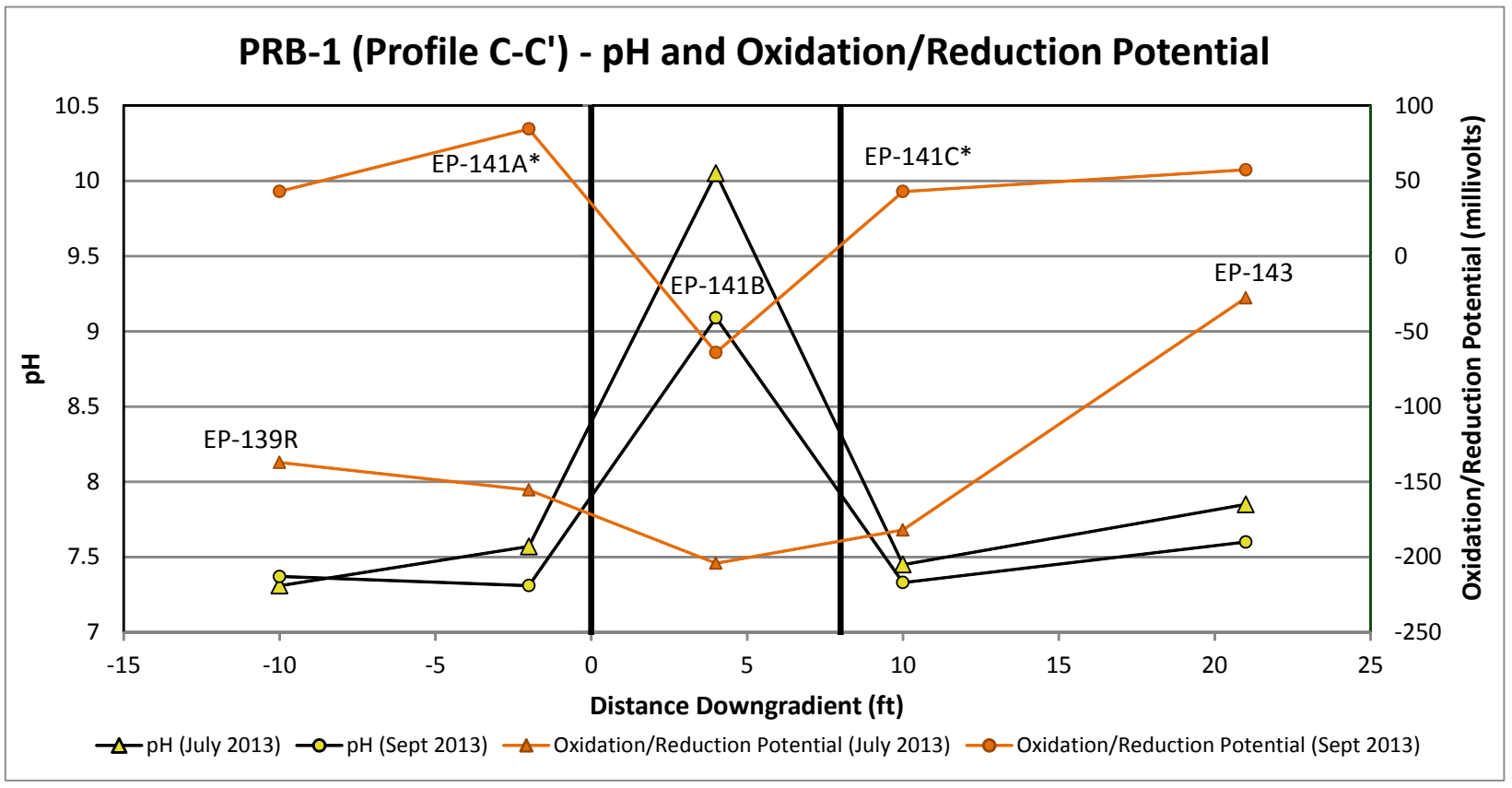

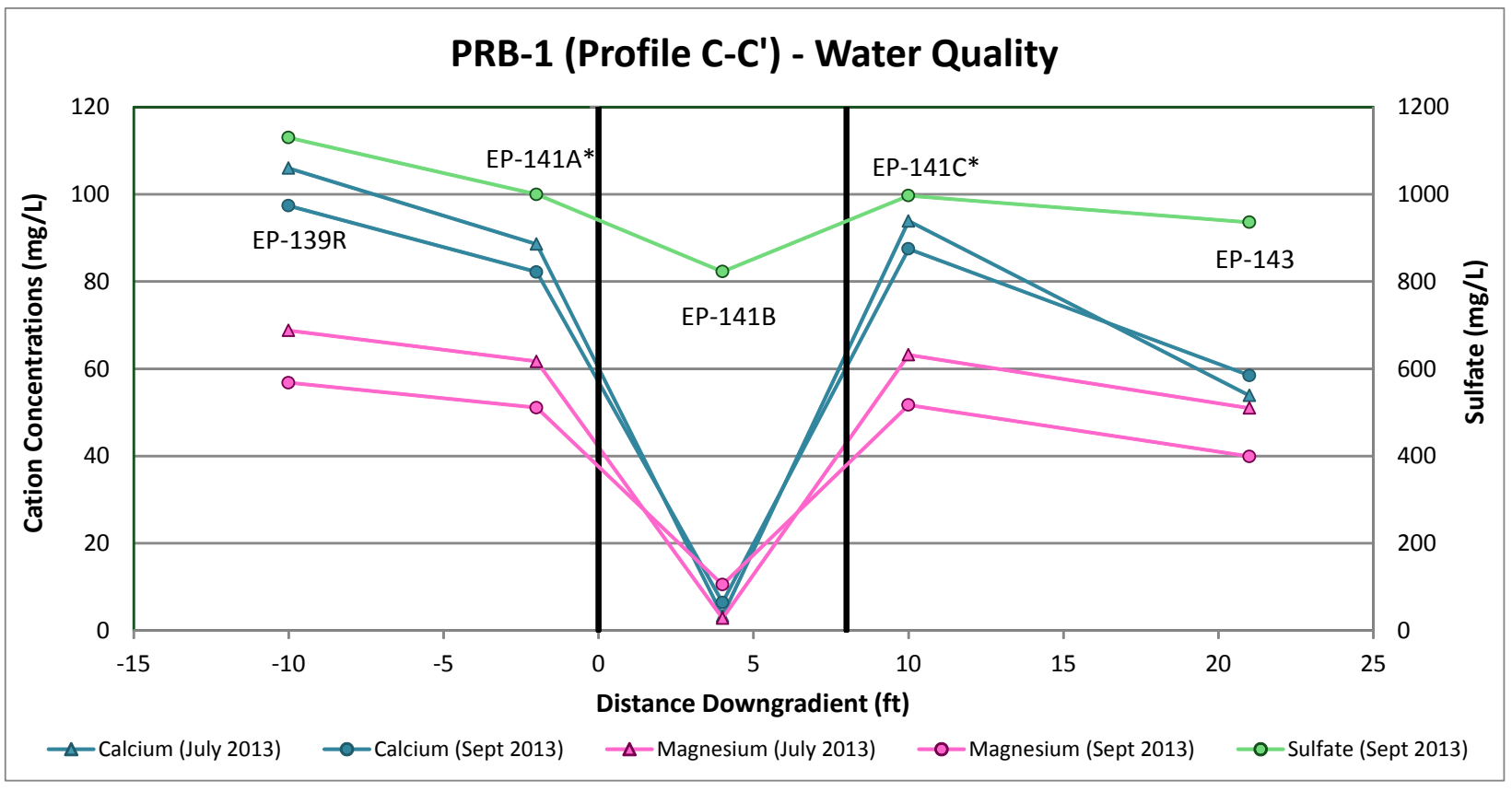

Notes:
mg/L = milligrams per liter
ft amsl = feet above mean sea level
* = well location depicted on the profiles is estimated based on observed water levels, analytical results, and boring logs

Maximum Contaminant Levels (MCLs) for metals are EPA Drinking Water MCLs

Extent of PRB

FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

PRB-1 ANALYTICAL PROFILE C-C'

MALCOLM PIRNIE

FIGURE
14

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
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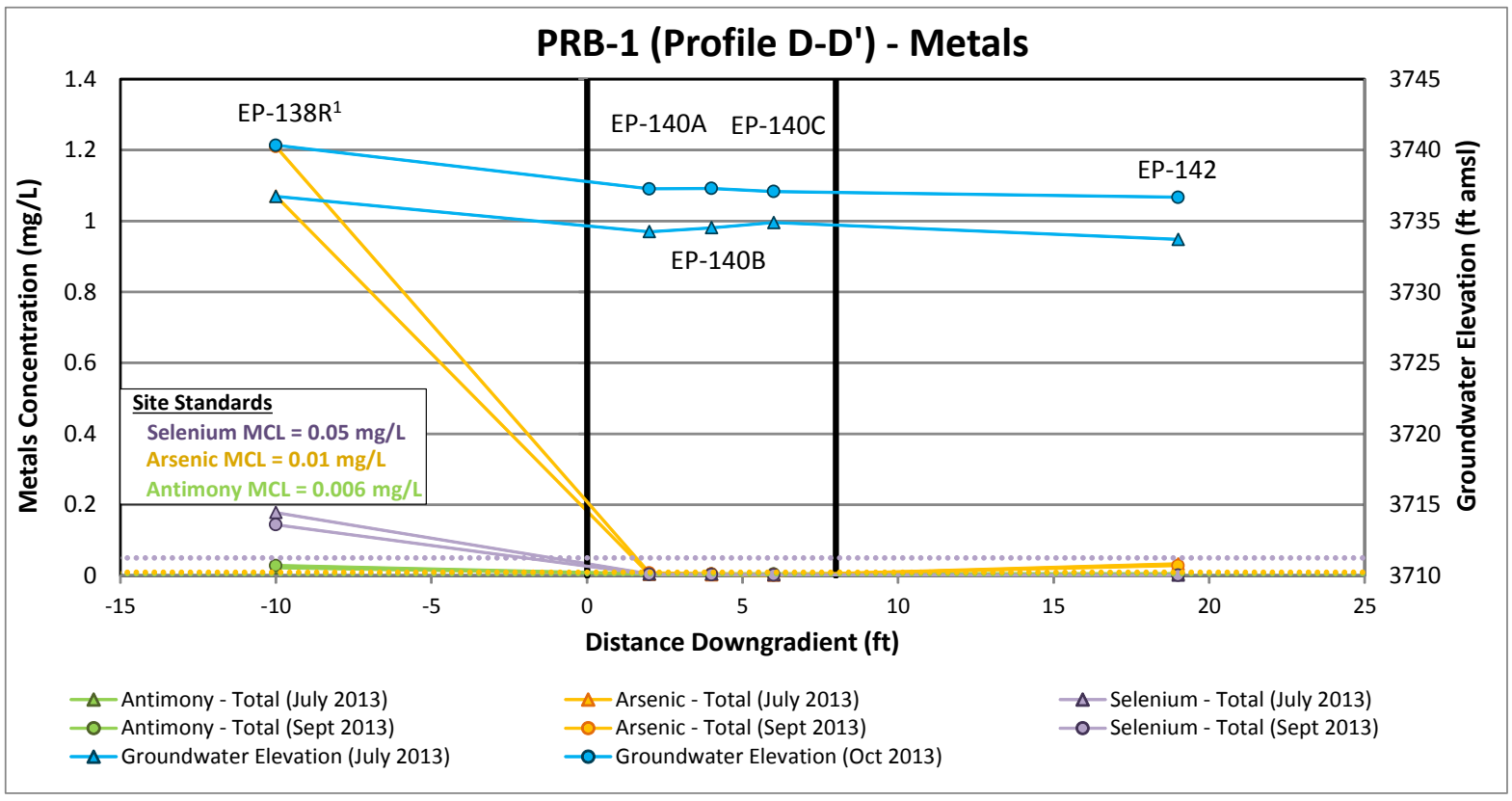

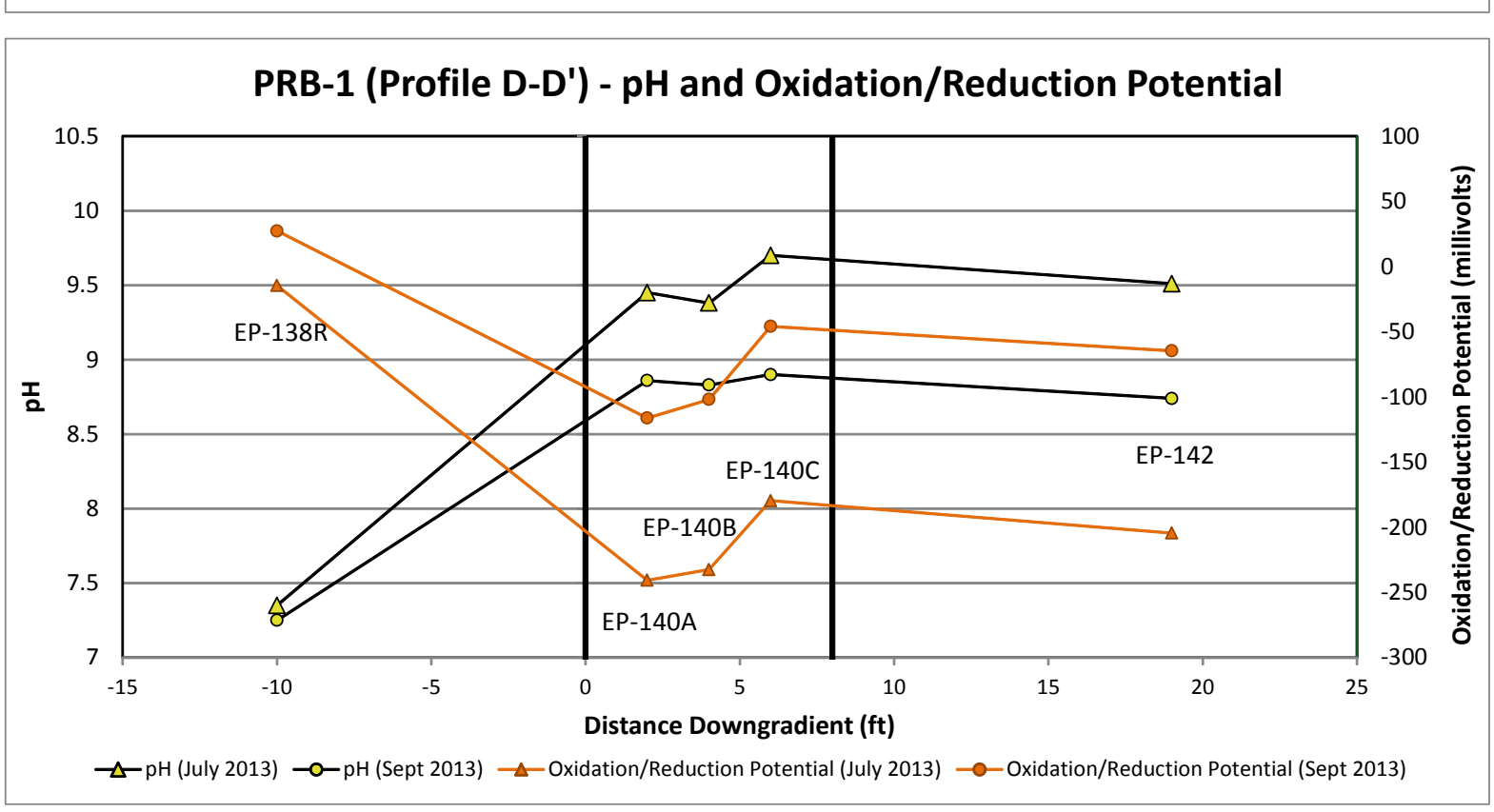

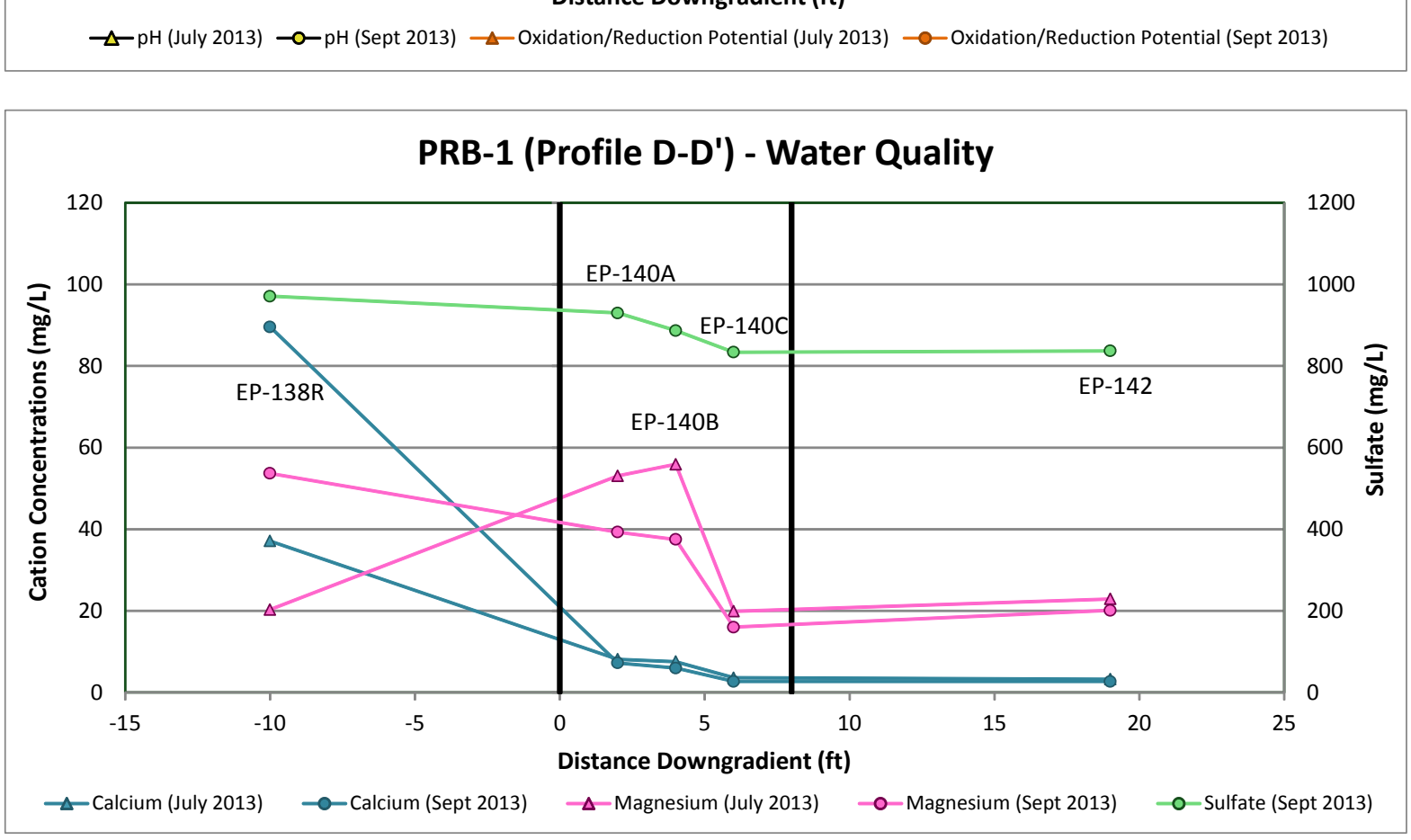

Notes:
mg/L = milligrams per liter
ft amsl = feet above mean sea level
* = well location depicted on the profiles is estimated based on observed water levels, analytical results, and boring logs
1 = Due to analytical errors in total metal concentration results, dissolved metal concentrations have been substituted for total metal concentrations at EP-138R for the July 2013 sampling event

Maximum Contaminant Levels (MCLs) for metals are EPA Drinking Water MCLs

Extent of PRB

FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

PRB-1 ANALYTICAL PROFILE D-D'

MALCOLM PIRNIE

FIGURE
15

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
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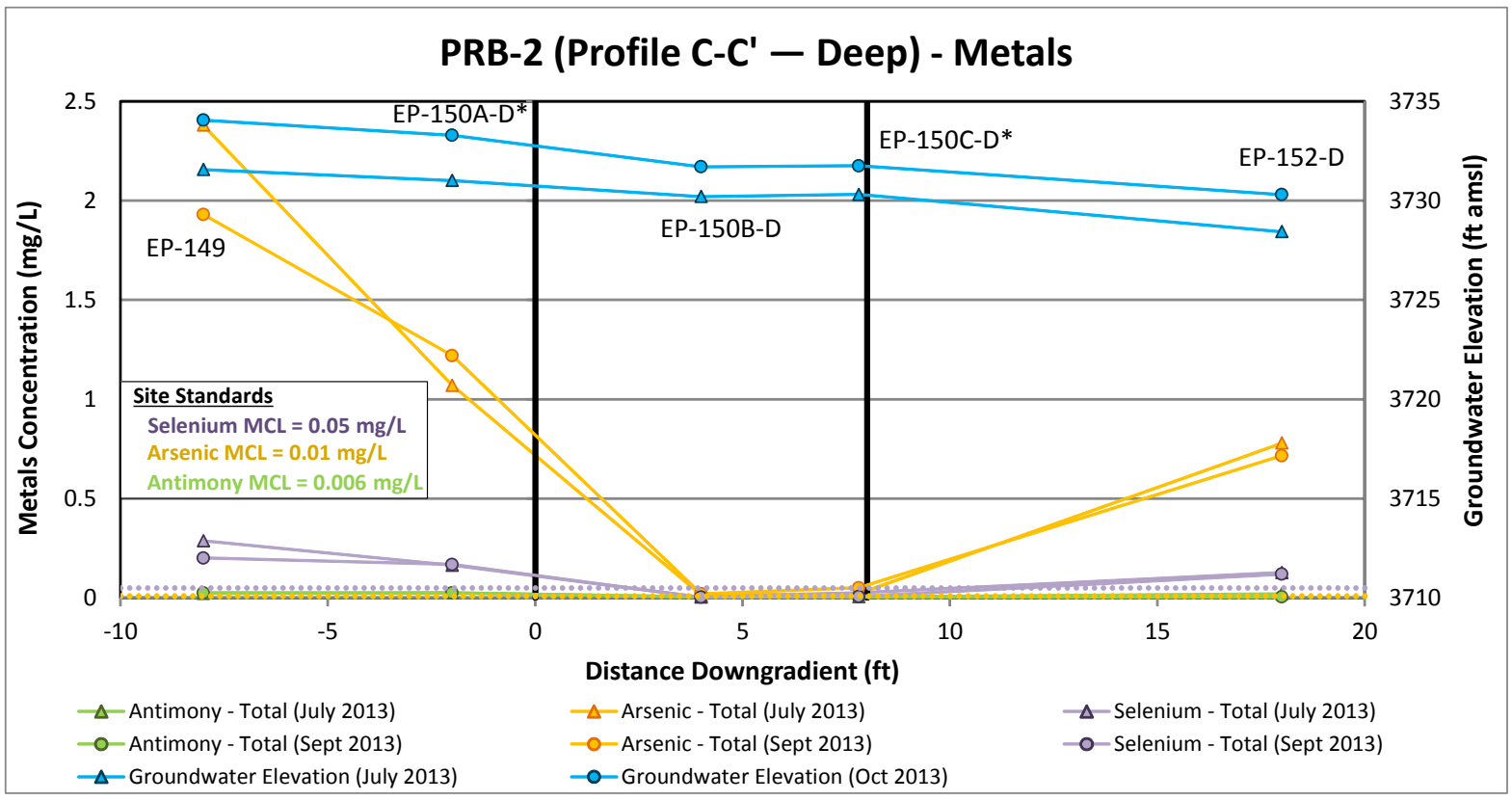

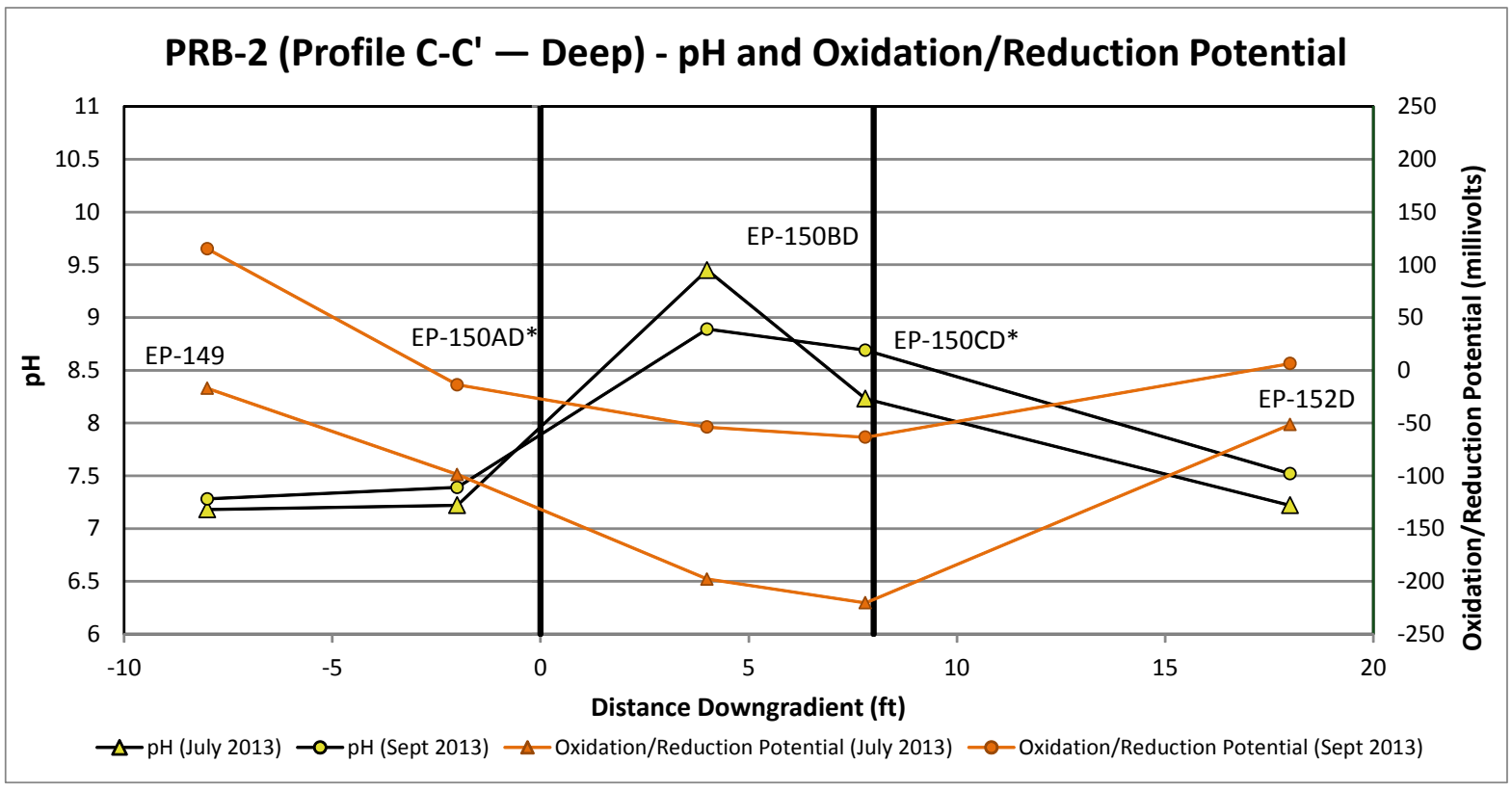

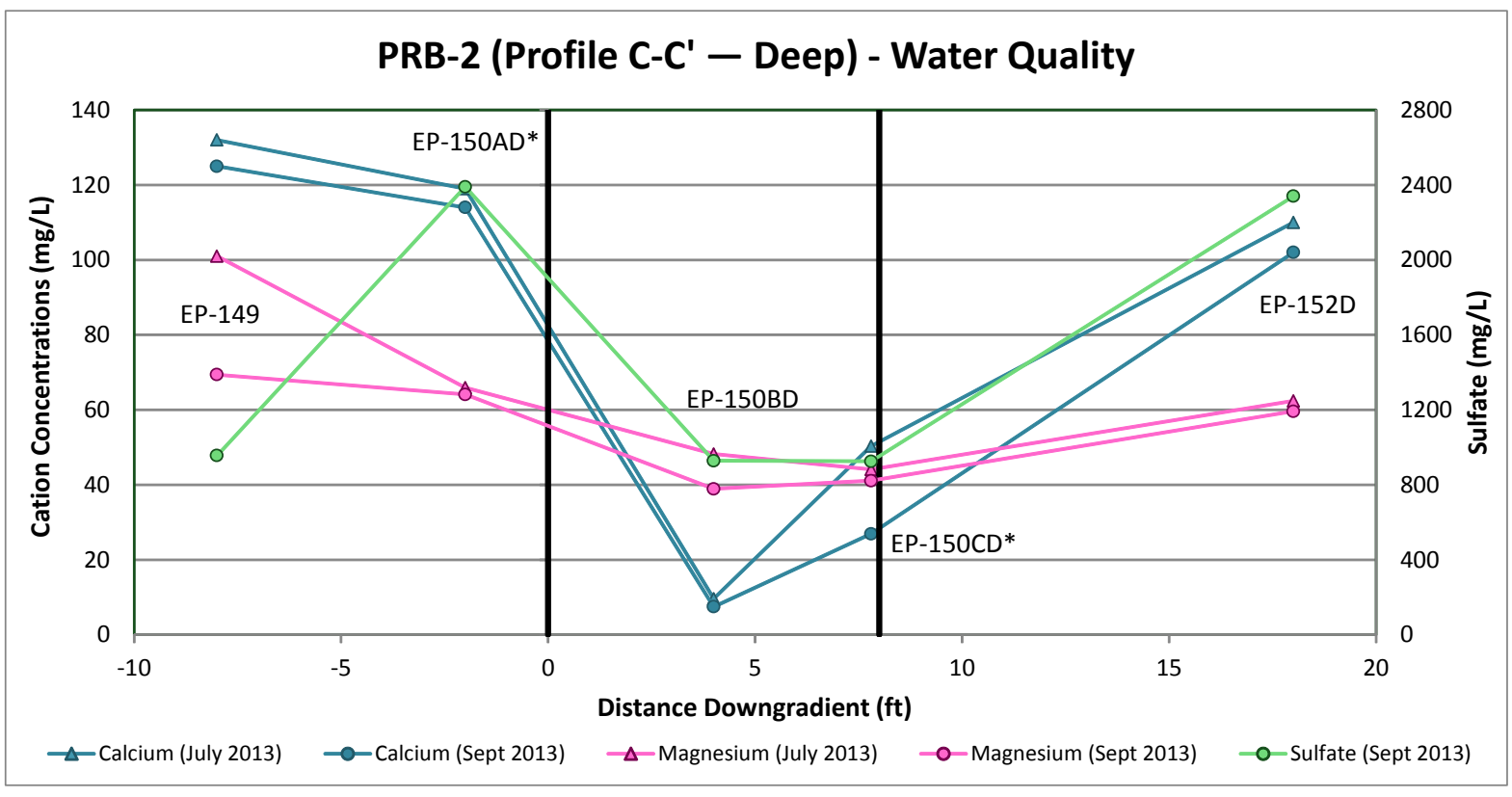

Notes:
mg/L = milligrams per liter
ft amsl = feet above mean sea level
* = well location depicted on the profiles is estimated based on observed water levels, analytical results, and boring logs

Maximum Contaminant Levels (MCLs) for metals are EPA Drinking Water MCLs

Extent of PRB

FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

PRB-2 ANALYTICAL PROFILE C-C'

MALCOLM PIRNIE

FIGURE
16

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
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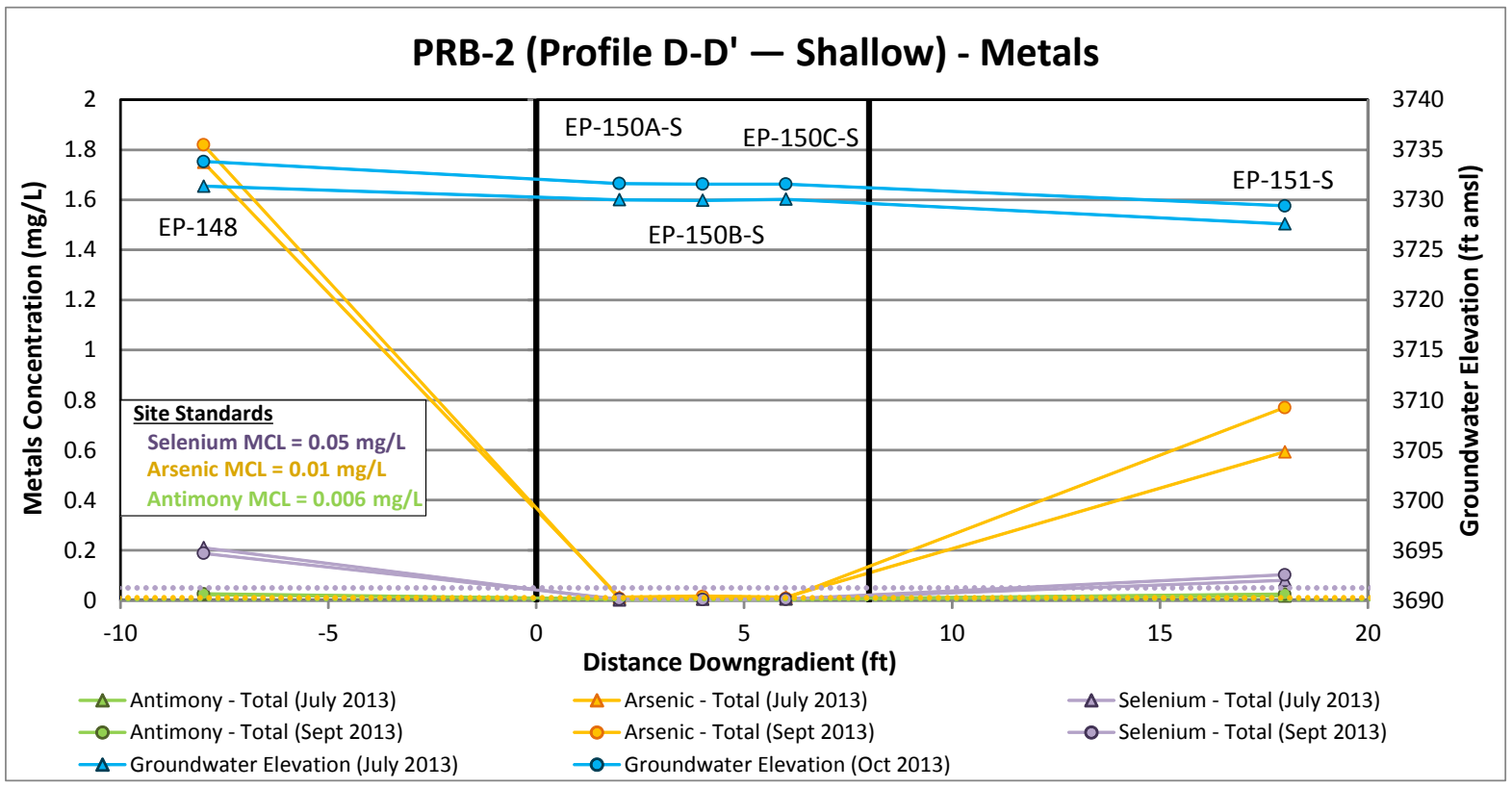

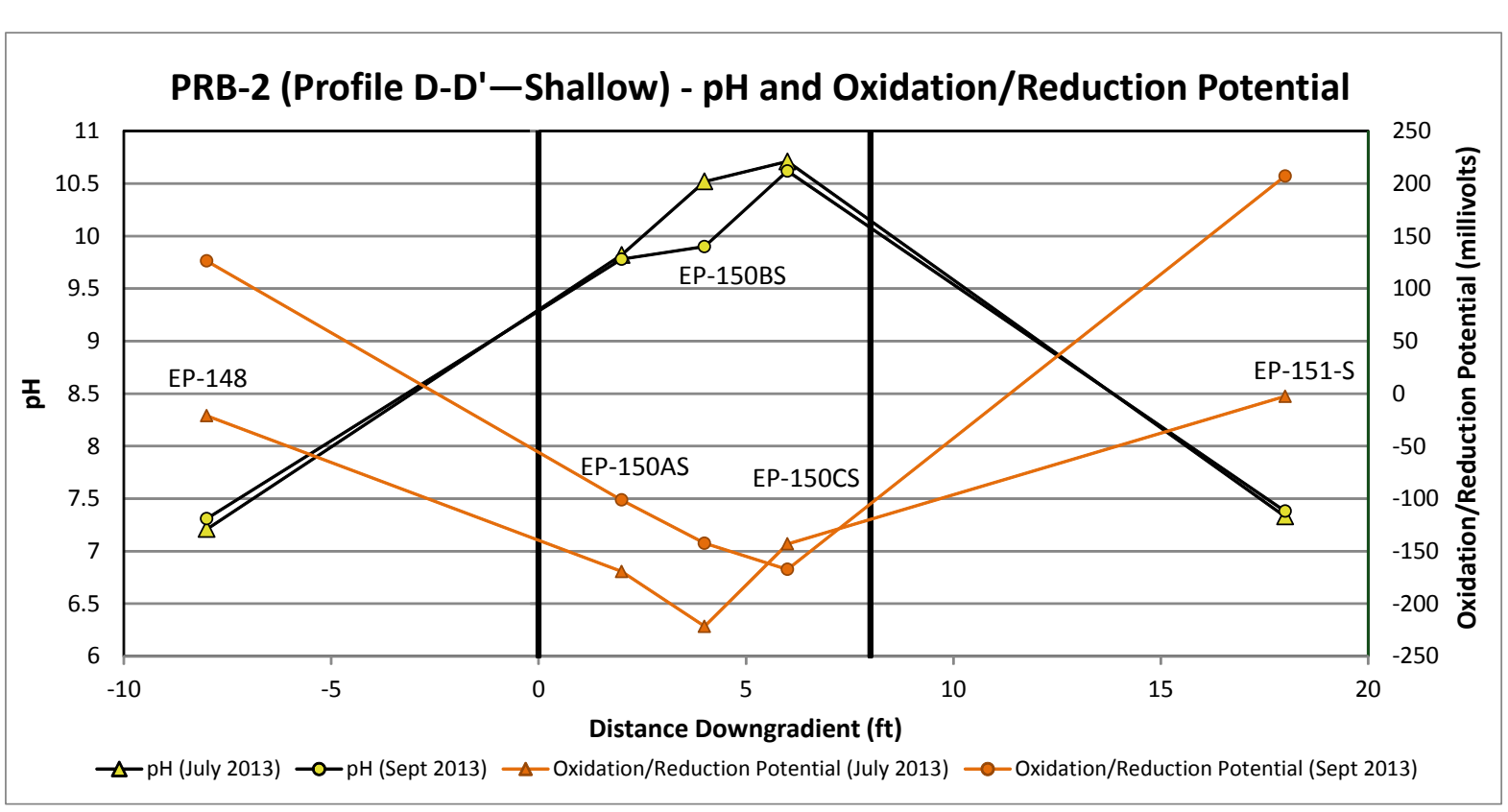

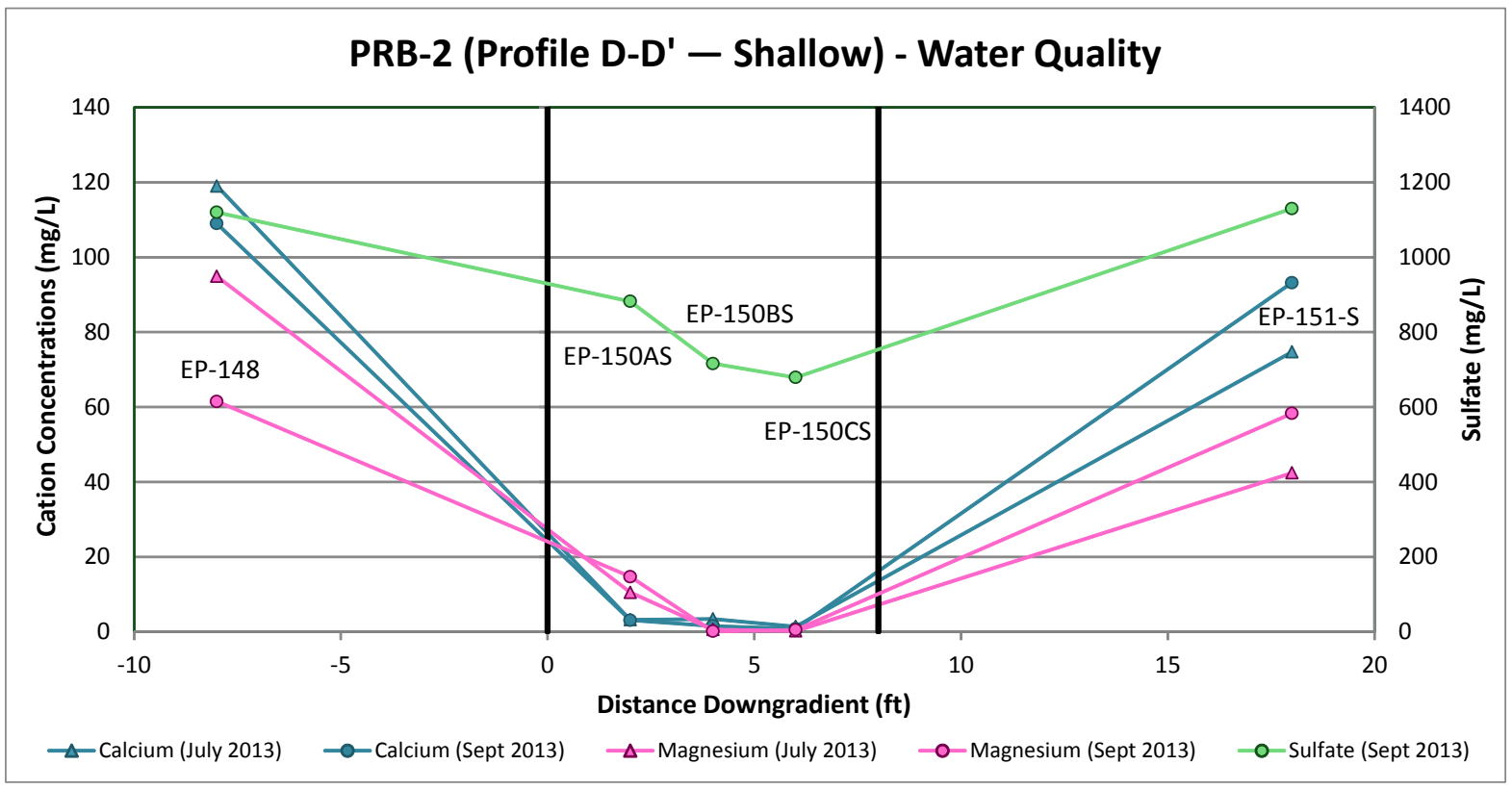

Notes:
mg/L = milligrams per liter
ft amsl = feet above mean sea level
* = well location depicted on the profiles is estimated based on observed water levels, analytical results, and boring logs

Maximum Contaminant Levels (MCLs) for metals are EPA Drinking Water MCLs

Extent of PRB

FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

PRB-2 ANALYTICAL PROFILE D-D'

MALCOLM PIRNIE

FIGURE
17

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Path: I:\ASARCO_ElPaso\GIS\MXD\ParkerBrothersZerovalentIronTreatment_StatusReport\Fig 17 PRB2AnalyticalProfileD.mxd Date: 1/16/2014 Time: 3:18:36 PM

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Analytical Monitoring																										
Quarterly Performance Monitoring[1]																										
Semi-Annual Performance Monitoring																										
Hydraulic Monitoring																										
Water Level Monitoring																										
Hydraulic Testing[2]																										
Reporting																										
Performance Monitoring Report																										

	July				August				September					October				November				December					January 2015			
	7	14	21	28	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26
Analytical Monitoring																														
Quarterly Performance Monitoring[1]																														
Semi-Annual Performance Monitoring																														
Hydraulic Monitoring																														
Water Level Monitoring																														
Hydraulic Testing[2]																														
Reporting																														
Performance Monitoring Report																														

Notes:

color shading legend as follows:

- Quarterly Analytical Monitoring Event
- Semi-Annual Analytical Monitoring Event
- Water Level Monitoring Event
- Hydraulic Testing Event
- Anticipated Reporting Date

1 = quarterly peformance monitoring will exclude 11 upgradient and downgradient wells (EP-156R, EP-153, EP-154, EP-144, EP-145, EP-146, EP-147, EP-148, EP-149, EP-138R and EP-139R)

2 = hydraulic testing will include slug testing and/or single well tracer tests, as deemed necessary

FORMER EL PASO SMELTER SITE
EL PASO, TEXAS
FIELD DEMONSTRATION OF ZEROVALENT IRON TREATMENT TECHNOLOGY IN PARKER BROTHERS ARROYO – STATUS REPORT

MONITORING SCHEDULE 2014

MALCOLM PIRNIE

FIGURE 18

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Project (Project #)
Path: I:\ASARCO_ElPaso\GIS\MXD\FieldDemo_GW_Remedy_ParkerBrothers\2014\Fig 18 MonitoringSchedule2014.mxd Date: 1/16/2014 Time: 10:08:36 AM