Response Action Design

Use this worksheet to provide detailed descriptions of the response action. Attach design and layout drawings and equipment specifications in Attachment 2A.

Media: Soil and Groundwater
List all media to which this information applies. If the response action is different for another media, complete a separate worksheet.

Provide a detailed description of the response action. Describe the removal action, decontamination, treatment system(s), and/or physical or institutional control actions that are proposed for each media and discuss the reasons for choosing the response action(s). Identify and describe any ecological services analysis and compensatory restoration plan that will be utilized (if so, include the complete ESA and compensatory restoration plan in Attachment 2C).

The smelting and refining activities at the Site produced slag and waste materials that contained metals, principally arsenic, cadmium, lead, mercury, and selenium. These metals came into contact with surface soil, subsurface soil, groundwater, and surface water through use as fill in historic arroyo channels to prepare a level plant site and through on-site storage and disposal. The response action for the Site includes the following actions:

- Remove Category I materials, preventing direct contact with and migration of COCs to groundwater. Additional removal of Category II material from East Property, PBA channel, LC AA, Floodplain AA, Plant Entrance Arroyo AA, South Terrace Arroyo AA, and Pond 1 Arroyo AA in areas that will not be capped.
- Cap areas with Category II materials (Category II Material Storage Area, Fines Pile, Boneyard, TCT's portion of Pile 1, and plant site) with a combination cover, preventing direct contact with and migration of COCs from affected soil to groundwater.
- Line and stabilize channels of the Upper PBA (including the Ephemeral Pond) and the Lower PBA, preventing direct contact with COCs and surface water infiltration through COC-affected subsurface soil. The liner and channel stabilization also prevent entrainment of impacted soil/sediment from the PBA channel into stormwater runoff.
- Treat groundwater in the Upper and Lower PBA and upgradient from the South Arroyo using PRBs constructed of ZVI to remove metallic COCs.
- Minimize off-site impacts to groundwater through gradient controls including the GHB extraction well and covers/liners for the plant site and PBA channel.
- Control discharge of COCs in stormwater runoff through BMPs, including construction of gabions on the East Mountain AA, a gabion or equivalent stormwater BMP for flow from the TxDOT drainage along the west side of the I-10 ROW, and an in-channel, -lined stormwater rip-rap check dam in the upper portion of the PBA AA; operation of the SWCRS for the plant site; lining and stabilization of the PBA channel; stabilization of plant site slopes; ; and construction of rip-rap check dams the Floodplain AA where stormwater discharges to the concrete-lined channel of the PBA and the American Canal.
- Establish institutional controls that will eliminate use of groundwater, limit areas for residential land use to the East Property AA north of the South Arroyo, establish a PMZ, protect covers, and maintain long-term operation of the remedy.

Descriptions of each of the components of the response action are presented below by AA.

Soil Removals

East Property AA

As illustrated on **Figure 15**, soil removals have been performed in three areas on the East Property AA based on the PCLE zones with exceedances of the residential $^{Tot}Soil_{Comb}$ PCLs and ^{Eco}Soil PCLs:

1. Category I Removal Area
2. Category II Removal Area
3. Area 4.

Attachment 2A.5 provides the work plan and confirmation sampling grid for the removals performed at all three locations on the East Property AA. The goal of the East Property excavations was to remove all Category I material for disposal in the Cell 4 WCU and extend the excavations through Category II Removal Areas until residential $^{Tot}Soil_{Comb}$ PCLs were achieved. Each of the removal areas are described below.

Category I Removal Area

The "Excavation and Sampling Work Plan for Category I Materials, East Property Waste and Slag Piles" presented in **Attachment 2A.5** describes the test pit investigations performed to define the extent of Category I materials. Figure 1 in the work plan (**Attachment 2A.5**) shows the locations of Areas 1, 1a, 3, 4, and 22. Depths of Category I materials ranged from 3 to 4 feet in the surficial deposit areas identified as Areas 1a, 3, and 4 and up to 20 feet in Category I Landfill Areas 1 and 22. A total of approximately 65,000 cubic yards (cy) of material was estimated to be present in the vicinity of the Category I Landfill including Areas 1, 1a, 3, 4, and 22. These areas are all within the removal footprint presented on **Figure 15**. The clean cover material was confirmed to have concentrations of COCs below residential $^{Tot}Soil_{Comb}$ and to range in thickness between 3 and 7 feet. Category 1 materials were separated from Category II materials and were disposed of in the Cell 4 WCU. Category II materials from these excavations were placed in the Category II Material Storage Area, as described in **Attachment 2A.6** and illustrated on **Figure 15**. Excavations of the Category I Material Area were extended into the Category II Removal Area.

Category II Removal Area

The Category II Removal Area included slag disposal areas within the 100-year floodplain of the South Arroyo and sediment deposition from runoff originating in the East Mountain AA, as illustrated on **Figure 15**. Soil samples were collected in a grid pattern and analyzed for their arsenic concentration using X-ray fluorescence (XRF). Samples at each location were collected at increasing depths until the arsenic concentration was found to be below its residential PCL of 46 mg/kg. A total of 277 confirmation samples were collected on a 50-foot grid, as illustrated on the stand-alone **Figure 2** "East Property" in **Attachment 2A.5**, and sent to an analytical laboratory for analysis to confirm that residential PCLs were achieved as part of the Category II Removal.

Area 4

Area 4 is a former slag and waste storage area occupying approximately 4 acres along the North Arroyo in the East Property AA as illustrated on **Figure 15**. The work plan presented in **Attachment 2A.5** indicates that the eastern portion of Area 4 had Category I material to a depth of approximately 4 feet bgs, representing approximately 5,000 cy. Additional Category II material was characterized to the west and excavated as described for the Category II Removal Area. All Category I material was separated and disposed of in the Cell 4 WCU, while

Category II material was placed in the Category II Material Storage Area as illustrated on **Figure 15**.

Plant Entrance Arroyo AA

As illustrated on **Figures 4 and 16**, A PCLE zone based on concentrations of arsenic and lead in surface soil will be removed along the roadway of the Plant Entrance Arroyo. Most affected soil was delineated down to 1 foot bgs. However, several sample locations had elevated concentrations of arsenic and lead down to 2 feet bgs. Therefore, the area will be excavated to between 1 and 2 feet bgs, with the excavation limits to be determined by removing samples for field XRF analysis until XRF results indicate that arsenic and lead concentrations are below C/I PCLs. When XRF results show that these levels are achieved, excavation activities will stop and confirmation samples will be collected for laboratory analysis for verification.

South Terrace Arroyo and Pond 1 Arroyo AAs

A PCLE Zone has been identified at the former Antimony Processing Building and the storage yard to the south. The storage yard and gas utility line are shown on figures in **Attachment 2A.14**, and the PCLE Zone is illustrated on **Figure 4**. Characterization data for COCs in surface soil resulting from sloughing around the former Antimony Processing Building and storage yard is presented in **Appendix 2**. Soil sloughed onto the asphalt parking surfaces and building foundations from demolition activities contained concentrations of COCs above C/I $^{Tot}Soil_{Comb}$ PCLs for antimony, arsenic, cadmium, lead, and mercury. Mercury concentrations exceeded the $^{Air}Soil_{Inh\text{-}v}$ PCLs and require removal. COC concentrations in soil samples from the storage yard were above C/I PCLs and $^{SW\text{-}GW}$Soil PCLs for copper, iron, lead, mercury, and selenium. The PCLE zone extends over much of the storage yard and the high pressure gas utility easement along the eastern boundary of the storage yard...

Pond 5/6 Arroyo and Acid Plant Arroyo AA

Excavations were performed in both the Pond 5/6 Arroyo AA and the Acid Plant Arroyo AA to remove PCB-impacted soil, in accordance with TSCA and TRRP regulation requirements. A summary of the work plans and analytical characterization data for each are presented in **Appendix 3.3**. The excavation area within the Pond 5/6 Arroyo AA was located at the former Powerhouse Building around sample location AE11 as illustrated in **Appendix 3.3, Figure 2**. The excavation and disposal summary letter for PCB–impacted soil (Malcolm Pirnie 2014b) is presented in **Appendix 3.3** and demonstrates that PCBs were delineated vertically and laterally to the C/I PCL of 7.1 mg/kg. Two locations within the Acid Plant Arroyo AA had concentrations of PCBs in soil above the C/I $^{Tot}Soil_{Comb}$ PCL, as illustrated in **Appendix 3.3** on **Figure 2**. Soil around sample locations AE5/PCB02 and sample location PCB03 were delineated vertically and laterally in the work plan (Malcolm Pirnie 2012) presented in **Appendix 3.3**. PCB impacts at these locations were limited to surface soils within the top 2 feet. These areas were remediated in preparation for the demolition of the two smoke stacks in April 2013. PCB-containing soil from these two areas were disposed offsite as hazardous waste, due to the presence of metals, consistent with TSCA and Resource Conservation and Recovery Act requirements. **Appendix 3.3** includes the waste manifests for off-site disposal at U.S. Ecology.

Excavation of Category I material from the Cell 3 WCU in the Pond 5/6 Arroyo AA was performed as described in the work plan presented in **Attachment 2A.2**. Excavation was performed to lower the profile of the Cell 3 WCU from the previous elevation of 3805 feet amsl to a final elevation of 3788 feet amsl. Category I material was relocated from the Cell 3 WCU to

the Cell 4 WCU in the PBA. The work plan presented in **Attachment 2A.2** details the methodology for movement of Category I material from Cell 3 to Cell 4.

PBA AA

As illustrated on **Figures 9 and 17**, soil removals have been performed from six areas in the PBA, based on the PCLE zone exceedances of the C/I $^{Tot}Soil_{Comb}$ PCLs and $^{SW\text{-}GW}$Soil PCLs. These areas, shown on **Figure 17,** include:

1. The Cell 4 Landfill
2. The Lower PBA Channel
3. Area 12 (located within Upper PBA)
4. TCT Pile 1
5. Plant site areas containing Category I materials within the PBA
6. Adjacent to the Fines Pile

The goals of the Cell 4 excavations were to remove slag material from the landfill footprint and achieve the design specifications for the landfill. The goals of the Lower PBA Channel and Area 12 excavations were to remove all Category I material for disposal in the Cells 3 and 4 WCUs and to remove slag material in the channel of the Lower PBA. The plant site excavations included removal of specific areas where Category I materials were identified. All excavated Category I materials were contained on the plant site. Once the Cell 4 WCU was completed and approved by the TCEQ and USEPA, the excavated Category I materials were disposed of in Cell 4. Each of the removal areas are discussed below.

Cell 4 Landfill

Attachment 2A.1 provides the design (Malcolm Pirnie 2011a) for excavation of the Cell 4 Landfill. The limits of excavation for the landfill were based on the drainage and contour design presented in Drawing No. 3A of 15 of the Cell 4 design presented in **Attachment 2A.1**. Confirmation samples were collected on a grid following excavation as presented in Drawing 1 of **Attachment 2A.1**.

Lower PBA Channel

Attachment 2A.3 provides the design (Malcolm Pirnie 2011b) for excavation of the PBA channel. Excavation of the Lower PBA Channel was based on the design cut and contours presented in Drawing No. 1 of 2 as presented in the Interim Channel Project memorandum dated November 29, 2011 (see **Attachment 2A.3**). The channel excavation design was based on soil boring data and test pits detailing the subsurface distribution of arsenic that could continue to provide a source to groundwater in the Lower PBA. The memorandum provides characterization of the lateral and vertical extent of leachable arsenic in subsurface material and estimates that approximately 110,000 cy of material would be removed and managed as Category II material on the plant site. A sample grid for both the Cell 4 Landfill and Lower PBA Channel is presented in Drawing 1 of **Attachment 2A.1**.

Area 12

Attachment 2A.8 provides the previous excavations performed by ASARCO in 2006 for excavation of the PCLE Zone in the portion of the Upper PBA between the UPRR tracks and the TxDOT property along I-10. Previous removals in Area 12 address the PCLE Zone identified in this area.

TCT's Portion of Pile 1

Attachment 2A.18 provides the Notification of Removal and Cover Activities Planned for

TCT's portion of Pile 1. Category II materials will be removed, placed, and compacted on the north portion of the south pad. In the flatter areas, removal will proceed to the depth of visible slag or to a maximum depth of 3 feet bgs. Although not anticipated, if Category I materials are visually encountered in TCT's portion of Pile 1 during excavation, they will be removed and placed in Cell 4. **Figure 9** shows the footprint from within which limited removal of materials will occur.

Plant Site

Figure 2 in **Attachment 2A.4** provides an illustration of Category I Material identified on the plant site within the PBA. Category I materials were removed and disposed of in the Cell 4 WCU. Additional removals as illustrated on **Figure 9** occurred on the plant site within the PBA as part of the effort to level the property prior to construction of the North ET soil cover. These excavations were necessary to provide appropriate drainage.

Adjacent to Fines Pile

Soil excavations in areas with elevated COCs were identified adjacent to the Fines Pile as shown on **Figure 17**. The excavations consisted of surface soil removals between 0 and 2 feet bgs. Excavation limits were determined using XRF to monitor arsenic and lead concentrations in soil. Once XRF results indicated that the C/I PCLs had been achieved, confirmation samples were collected on a 50-foot sampling grid, as illustrated in **Attachment 2A.9**, **Drawing 1**. Excavations bring this area into compliance with requirements under TRRP.

LC AA

The LC AA had PCLE zones in surface soil based on concentrations of arsenic and lead above their respective C/I $^{Tot}Soil_{Comb}$ PCLs. Soil excavations were completed and documented for Parcel 13 in the Closure Report, Parcel 13 (Arcadis 2016d). Soil excavations in areas with elevated COCs were identified in the LC AA around former debris piles and the North Cemetery Area as illustrated on **Figure 9**. The excavations consisted of surface soil removals between 0 and 2 feet bgs. Excavation limits were determined using XRF to monitor arsenic and lead concentrations in soil. Once XRF results indicated that the C/I PCLs had been achieved, confirmation samples were collected on a 50-foot sampling grid, as illustrated in **Attachment 2A.9**, **Drawing 2**. Excavations bring LC AA into compliance with requirements under TRRP.

Floodplain AA and Paisano Drive

As illustrated on **Figure 4**, site characterization data for the Floodplain AA indicate localized elevated concentrations of lead in surface soil are present in the first 1.5 feet of soil. A surface removal of the PCL exceedances will be performed as shown on **Figure 9**. Excavated soil will be placed in Category II areas of the plant site prior to cover construction. The East Sliver, Paisano parcel will require a minimal removal of the top 0.5-foot of surface soil near two sample locations in the northern portion of the parcel which exceed the C/I PCL for lead.

Soil Covers

Soil covers will be the principal means of managing Category II materials at the Site. **Figure 10** provides a site-wide summary of covers used to prevent direct contact with COCs above PCLs and to prevent stormwater infiltration through Category II materials, preventing future groundwater impacts. All areas using covers to manage soils with elevated COCs will also have institutional controls to protect the integrity of the physical control and to perform operation, maintenance, and monitoring (OM&M) required to ensure long-term performance. Covers used as part of the site-wide response action are described below for each AA.

East Property AA

A soil ET cover will be placed over the Category II Storage Area. Since groundwater resources at the Site are Class 2 under TRRP, COCs in the soil of the Category II Material Storage Area can be managed in-place to meet requirements of TRRP by installing a physical barrier against direct contact and water infiltration [30 TAC §350.33(b)]. The ET soil cover will be composed of 3 feet of soil from the East Borrow source area previously characterized for the cover of the Cell 4 Landfill. In addition, the ET cover design calculations use the same model as approved for the Cell 4 Landfill. The soil ET cover is designed to have a maximum infiltration rate of 0.19 cm/yr, providing sufficient protection against potential leachate that might impact groundwater beneath the Category II Storage Area. Design of the cover system includes drainage improvements to prevent ponding of stormwater runoff on the cover.

Scheduling constraints and Category II material disposal dictate that the first foot of clay enhanced silty-sand cover soil will be placed on the outer slopes and top deck to isolate the material from inhalation and ingestion while substantially reducing infiltration. This configuration will be constructed and reported in the Soil RACR. The remaining 1.5 feet of silty-sand material and 0.5 foot of desert armor will be placed in 2017 along with construction of drainage improvements. 2017 components will be documented in a letter report to TCEQ that will be incorporated into the Groundwater RACR.

Since the Category II Storage Area does not have a liner, groundwater beneath the covered surface must be monitored. Groundwater monitoring well EP-94, which was completed within the footprint of the covered Category II Storage Area, will be monitored to determine the effectiveness of the cover in controlling leachate to groundwater. Details of the groundwater monitoring program for the Category II Storage Area are presented in **Worksheet 3.1** of the RAP. Finally, an institutional control will be added to the property over the footprint of the Category II Storage Area that restricts land use to C/I activities and notifies future developers of the presence of the soil cover and the impacted material beneath it. An institutional control will also be placed that requires any future development to maintain the maximum infiltration rate of 0.19 cm/yr, prevent stormwater ponding on the cover, and obtain approval for development by the TCEQ and USEPA.

A soil cover will be placed over a second area within 100-year floodplain of the South Arroyo to restore its ecological value. Excavation activities in this area went to a maximum depth of 4 feet bgs to achieve PCLs. This soil cover will be placed in the southern portion of the South Arroyo in areas where residual concentrations of selenium and molybdenum exceed ecological-based PCLs in surface soil (previously subsurface soil prior to the excavation of arsenic-affected soil). Imported fill obtained from the IBWC has been screened for concentrations of COCs to confirm that the imported fill contains COC concentrations below ecological screening levels. The imported fill material has been obtained from the Rio Grande floodplain and contains a native mix of vegetation allowing for natural restoration of the wetland in the South Arroyo.

Plant Entrance Arroyo AA

The Plant Entrance Arroyo AA was identified for excavation along the asphalt road near the junction with Paisano Drive to remove shallow surface soil affected by COCs due to historic deposition along the roadway by truck and rail traffic. Additional site characterization data collected since submittal of the *Revised Supplemental RI* (Malcolm Pirnie 2014a) demonstrate

the presence of arsenic and lead above their respective C/I $^{Tot}Soil_{Comb}$ PCLs. One of two existing lined stormwater ponds of the SWCRS is located in the Plant Entrance Arroyo AA. The characterization data and distribution of COCs in surface soil, as well as the PCLE Zone based on concentrations of arsenic and lead in soil are presented on **Figure 4.** The steep slopes and stormwater runoff from the plant site make removal less attractive for addressing areas with elevated concentrations of COCs around the existing stormwater pond. Therefore, a surface sealant application is proposed for the PCLE Zone around the stormwater pond as shown on Figure 16 and described in **Attachment 2A.15**.

COCs in soil at the Plant Entrance Arroyo AA do not pose a potential risk to groundwater quality, so no additional monitoring wells are recommended for this area. Institutional controls will be placed on the property deed as part of the remedy for this area (Appendix 4). The institutional controls will restrict land use to C/I development, provide notice of the presence of the sealant, and limit development.

South Terrace Arroyo and Pond 1 Arroyo AAs

As illustrated on **Figure 4**, the entire plant site is within the surface soil PCLE zone, principally based on arsenic and lead concentrations. **Figure 10** provides a detailed overview of the proposed combination cover for the plant site. The South Terrace Arroyo and Pond 1 Arroyo AAs occupy approximately 50 acres, which will be entirely covered with the combination cover. The combination cover is composed of existing asphalt pavement, Category II asphalt covers, the Cell 1 Landfill cover (and liner), a lined stormwater pond, low permeability (FML) covers between major cover components and on slopes, and the south ET cover. Each of these cover components is discussed below.

South ET Cover

As seen on **Figure 10**, the south ET cover represents the largest component of the cover system in the southern half of the plant site, covering 21 acres or 43 percent of the area of the South Terrace/Pond 1 Arroyo AAs. A cross-section detail for the ET cover is presented in **Attachment 2A.15**. The projected infiltration rate for the ET cover is 0.19 cm/yr. The 3-foot thick soil cover is an effective barrier against direct contact, and it provides sufficient protection against infiltration of water through the cover. Design of the cover system includes drainage improvements to prevent ponding of stormwater runoff on the cover. The footprint of the ET cover also provides a barrier against contact with and infiltration through soil potentially affected by four former waste units listed on the NOR: 016, 025, 030, 033, and 035 (**Figure 14**). An institutional control will be placed on the property deed that requires any future development to maintain the maximum infiltration rate of 0.19 cm/yr, to prevent stormwater ponding on the cover, and to obtain approval of development by the TCEQ and USEPA (Appendix 4).

Category II Asphalt Cover

The Category II asphalt covers represent the second largest coverage area of the southern portion of the plant site, covering approximately 8.5 acres or approximately 17 percent of the southern plant site. A cross-section detail for the Category II asphalt cover is presented in **Attachment 2A.15**. The projected infiltration rate for the Category II asphalt cover is 0.1 cm/yr (**Appendix 3.7**). The Category II cover design provides an effective barrier against both direct contact and water infiltration. An institutional control will also be placed on the property deed that alerts the developer to the presence of affected materials beneath the asphalt and requires future development to maintain the maximum infiltration rate of 0.1 cm/yr, to prevent stormwater ponding on the cover, and to obtain approval of development by the TCEQ and USEPA (Appendix 4).

Existing Asphalt Pavement
Existing asphalt pavement covers approximately 7 acres or approximately 14 percent of the southern plant site. A cross-section detail for the existing asphalt pavement is presented in **Attachment 2A.15**. The projected infiltration rate for the asphalt pavement is 0.1 cm/yr (**Appendix 3.7**). The existing pavement provides an effective barrier against both direct contact and water infiltration. An institutional control will also be placed on the property deed that alerts the property owner to the potential presence of impacted materials beneath the asphalt and requires maintaining the pavement to retain the effectiveness of the barrier. The institutional control will also require that any future development of areas with existing asphalt paving be designed to retain the maximum infiltration rate of 0.1 cm/yr, to prevent stormwater ponding on the cover, and to obtain approval by the TCEQ and USEPA (Appendix 4).

Low Permeability Cover
The former storage yard located along the eastern boundary of the South Terrace/Pond 1 Arroyo AAs occupies approximately 3.5 acres or 7 percent of the south half of the plant site. The compaction of native fill and re-vegetation is recommended for this area following excavation to $^{SW\text{-}GW}$Soil PCLs, as previously described in this worksheet under Soil Removals. The compacted native soil is proposed to reduce infiltration rates and to aid in groundwater gradient control in the South Terrace/Pond 1 Arroyo AAs. The projected infiltration rate for the compacted native soil cover is 3.35 cm/yr. Soils with COCs above their respective C/I $^{Tot}Soil_{Comb}$ and $^{SW\text{-}GW}$Soil PCLs were removed; therefore, no notification institutional control is required for this cover area. Design of the cover system includes drainage improvements to prevent ponding of stormwater runoff on the cover. An institutional control will be placed for any development that may include ponding on the cover.

The PCLE Zone extends to the high pressure gas utility easement along the eastern boundary of the storage yard. The presence of the gas line prohibits excavation to PCLs in this area. A low permeability cover will be installed over the utility easement to prevent infiltration from occurring through soils with concentrations of COCs above their respective $^{SW\text{-}GW}$Soil PCLs.

Other Structures
Existing structures, including concrete foundations, a lined stormwater pond, and the Cell 1 WCU, are within the southern plant site and occupy approximately 8 acres. The projected infiltration rate for these features is assumed to be 0.1 cm/yr (**Appendix 3.7**). These structures provide an effective barrier against both direct contact and water infiltration. An institutional control will be placed on the property deed that alerts the property owner to the potential presence of affected materials beneath these structures and requires approval by the TCEQ and USEPA for any re-development (Appendix 4).

The overall infiltration rate at the South Terrace Arroyo AA is projected to decrease by 78 percent due to the construction of the combination cover system as designed. The overall infiltration rate for the Pond 1 Arroyo AA is projected to decrease by 62 percent. The large differences in reduction of infiltration rates are strictly tied to the compacted natural soil area at the former storage yard. The calculations supporting the estimated decreases are presented in **Appendix 3.6**. The combined flux of arsenic in groundwater from the South Terrace/Pond 1 Arroyos only accounts for 2 percent of the entire mass discharged to the Rio Grande floodplain. Because the combination cover system is not being constructed with a liner system, groundwater monitoring beneath the cover must continue. Performance of the cover system will be monitored by tracking both groundwater quality and groundwater elevation data for

monitoring wells within the footprint of the covers. **Worksheet 3.1** provides more detail about the groundwater monitoring program to evaluate the performance of the plant site cover system.

Pond 5/6 Arroyo and Acid Plant Arroyo AAs

As illustrated on **Figure 4**, the entire footprint of the Pond 5/6 Arroyo and Acid Plant Arroyo AAs is within the surface soil PCLE zone. **Figure 10** provides a detailed overview of the proposed combination cover for the Pond 5/6 and Acid Plant Arroyo AAs, which occupy approximately 57 acres with the combination cover over the entire area. The cover is composed of existing asphalt pavement, Category II asphalt covers, Cell 2 and 3 Landfill covers (and liners), a future lined stormwater pond, low permeability (FML) covers between major cover components and on slopes, and the north ET cover. Each of these covers is discussed below.

North ET Cover

As seen on **Figure 10**, the north ET cover represents the largest component of the cover system in the northern half of the Site, covering 29 acres or 51 percent of the area of the Pond 5/6 and Acid Plant Arroyo AAs. As previously stated, the projected infiltration rate for the ET cover is 0.19 cm/yr. The 3-foot thick soil cover proves an effective barrier against direct contact and provides sufficient protection against infiltration of water through the cover. Design of the cover system includes drainage improvements to prevent ponding of stormwater runoff on the cover. A future lined stormwater retention pond is also planned within this area. The footprint of the ET cover also provides a barrier against contact with and infiltration through soil potentially affected by former waste units listed on the NOR: 013, 014, 017, 020, 026, 029, and 034 (**Figure 14**). An institutional control will also be placed on the property deed that requires any future development to maintain the maximum infiltration rate of 0.19 cm/yr, to prevent stormwater ponding on the cover, and to obtain approval of development by the TCEQ and USEPA (Appendix 4).

Existing Asphalt Pavement

Existing asphalt pavement covers approximately 11 acres or approximately 19 percent of the northern plant site. A cross-section detail for the existing asphalt pavement is presented in **Attachment 2A.15**. The projected infiltration rate for the asphalt pavement is 0.1 cm/yr (**Appendix 3.7**). The existing pavement provides an effective barrier against both direct contact and water infiltration. An institutional control will also be placed on the property deed that alerts the property owner to the potential presence of affected materials beneath the asphalt and requires pavement to be maintained to retain the effectiveness of the barrier. The institutional control will also require that any future development of areas with existing asphalt paving be designed to retain the maximum infiltration rate of 0.1 cm/yr, to prevent stormwater ponding on the cover, and to obtain approval by the TCEQ and USEPA (Appendix 4).

Category II Asphalt Cover

The Category II asphalt cover occupies approximately 7 acres or approximately 12 percent of the northern plant site. A cross-section detail for the Category II asphalt cover is presented in **Attachment 2A.15**. The projected infiltration rate for the Category II cover is 0.1 cm/yr (**Appendix 3.7**). The Category II cover design provides an effective barrier against both direct contact and water infiltration. An institutional control will also be placed that alerts the developer to the presence of affected materials beneath the asphalt and requires future development to maintain the maximum infiltration rate of 0.1 cm/yr, to prevent stormwater ponding on the cover, and to obtain approval of development by the TCEQ and USEPA.

Other Structures
Existing structures including concrete foundations, a new lined stormwater pond, and the Cell 2 WCU, which are within the northern plant site and occupy approximately 8 acres. The projected infiltration rate for these features is assumed to be 0.1 cm/yr (**Appendix 3.7**). These structures provide an effective barrier against both direct contact and water infiltration. An institutional control will also be placed on the property deed that alerts the property owner to the potential presence of affected materials beneath these structures and requires approval by the TCEQ and USEPA for any re-development (Appendix 4).

The overall infiltration rate for the Plant 5/6 Arroyo AA is projected to decrease by 82 percent due to the construction of the cover system as designed. The overall infiltration rate for the Acid Plant Arroyo AA is also projected to decrease by 82 percent. The calculations supporting the estimated decreases are presented in **Appendix 3.6**. The combined flux of arsenic in groundwater from the Pond 5/6 Arroyo is projected to account for approximately 9 percent of the entire mass discharged to the Rio Grande floodplain, while the Acid Plant Arroyo is projected to account for as much as 26 percent of the mass of arsenic being discharged to the floodplain. As previously stated, groundwater monitoring wells will be retained within the plant site cover footprint to monitor the performance of the cover system. Both groundwater quality and groundwater elevation data will be evaluated to determine the performance of the cover with regard to preventing leachate generation and reducing groundwater gradient to control off-site migration. **Worksheet 3.1** provides details of the monitoring program.

PBA AA

Figure 17 provides an illustration of the Upper and Lower PBA with five areas requiring covers over PCLE zones based on C/I $^{Tot}Soil_{Comb}$ PCLs and $^{SW\text{-}GW}$Soil PCLs: 1) Cell 4 Landfill, 2) Fines Pile, 3) Boneyard, 4) TCT's portion of Pile 1, and 5) plant site within the PBA. The covers for each of these areas are based on the same design presented for the soil ET cover in **Attachment 2A.15**. These areas are addressed individually below.

Cell 4 Landfill
Attachment 2A.7 provides the design (Malcolm Pirnie 2011a) for the cover system over the Cell 4 WCU. The cover design and material have previously been approved by TCEQ and USEPA. The cover has been approved as a barrier against direct contact with Category I material and as an appropriate control against water infiltration. Institutional controls will be placed on the property deed requiring inspection and maintenance activities to ensure the cover's integrity (Appendix 4).

Fines Pile
The Fines Pile will be capped with a low permeability cover such as Closure Turf, or an ET soil cover system including desert armor. Closure Turf™ is a three-part system using a 50 mL linear low-density polyethylene (LLDPE) geomembrane, sand, and an Ultraviolet (UV)-resistant artificial turf to stabilize slopes as presented in **Attachment 2A.16**. Extensive grading has been done to the Fines Pile area to prevent ponding of stormwater runoff on its surface and thereby eliminate the potential for infiltration through the material of the Fines Pile and down to groundwater. The closure of the Fines Pile will include placement of an institutional control on the property deed to restrict from future development over the area (Appendix 4). The Fines Pile does not have a liner system; therefore, groundwater monitoring will be required from wells located within the footprint of the area. Groundwater monitoring for the Fines Pile is discussed further in **Worksheet 3.1**.

Boneyard and Plant Site
As seen on **Figure 17**, the north ET cover provides coverage of the northern half of the plant site, including the Boneyard. Access to the material within the Boneyard will be maintained for potential future recovery of metals should technology make this feasible. All design criteria previously described for the soil ET cover are applicable to the Boneyard. Similar to other areas with soil covers and no liners, groundwater quality data will be collected from monitoring wells within the Boneyard to evaluate the effectiveness of the ET cover system. Institutional controls will be established to protect the integrity of the cover system until the material is removed in the future for potential recovery of metal assets.

TCT's Portion of Pile 1
TCT's portion of Pile 1 will be capped with an ET soil cover system 3 feet in depth that includes desert armor. The area of Pile 1 near the BNSF railway tracks may not be capped, provided that soil removal in the area can be brought to C/I $^{Tot}Soil_{Comb}$ PCLs. In this case, confirmation sample results will be provided in the soil RACR showing the area meets C/I PCLs.

Liners and Slope Stabilization

One principal area unaddressed by the plant site cover system and other covers around the PBA is the western and northern slopes of the plant site, as illustrated on **Figure 10**. Slope stabilization is a concern for the Site to prevent transport of COCs to downstream locations where direct contact to COCs at concentrations above their C/I $^{Tot}Soil_{Comb}$ PCLs could occur. Because of the slope, infiltration and groundwater impacts are not considered a complete exposure pathway for these areas. The slopes also represent areas where direct contact with impacted soils is a low probability. Management of COCs in soil from the slope areas, therefore, is being pursued through the application of stabilization materials.

Liners and channel stabilization are being used to address multiple exposure pathways for COCs from the Site including direct contact, migration to groundwater, entrainment in stormwater runoff, and deposition in sediment. Liners and channel stabilization are being applied in four areas: 1) Upper PBA and Ephemeral Pond, 2) Lower PBA channel and northern plan site slope, 3) South Arroyo on either side of I-10, and 4) western plant site slope and drainage. Each of these areas is described below.

Upper PBA/Ephemeral Pond and South Arroyo

As illustrated on **Figure 10**, the Upper PBA channel running along the Fines Pile includes the Ephemeral Pond. The slag in the regularly inundated Ephemeral Pond has been identified as a major source of groundwater contamination in the PBA; however, the presence of a large-diameter, high-pressure gas pipeline in the area of concern has removed excavation as a viable means of source control in the area. The response action, therefore, is to cap the slag material in place using a low permeability liner to prevent infiltration of surface water in the channel. **Attachment 2A.16** provides the design documents for the Upper PBA. The channel liner will use Hydroturf^{TM}, as previously described, including a three-part system using a 50 mil LLDPE geomembrane, hydrobinder, and a UV-resistant artificial turf to stabilize the channel. The liner system will provide a barrier against direct contact and to infiltrating surface water in the channel. The Ephemeral Pond will use an LLDPE geomembrane that will be overlain by a geotextile and riprap rather than Hydroturf^{TM}.

Lower PBA Channel

The lower PBA channel had slag and impacted soil excavated prior to construction of the lined,

stabilized channel as part of the final response action. The design of the liner in the Lower PBA is presented in **Attachment 2A.3** and includes a 60 mL LLDPE liner and non-woven geotextile. The liner on the slopes is overlain by geotextile and articulated concrete block (ACB). The liner in the bottom is overlain by geotextile and riprap for channel stabilization. The purpose of the stabilized channel is to prevent future erosion and migration of COCs in stormwater runoff and to provide a barrier against surface water infiltration, further reducing the groundwater gradient in the PBA.

The Lower PBA will be graded to drain to an existing outlet pipe that connects to a concrete box just east of the BNSF railroad tracks. This box routes flow to a set of culverts that convey stormwater under Paisano Drive and ultimately to the Rio Grande. In addition, a spillway will be constructed such that the area will safely pass the 100-year storm event. The spillway will discharge to the Rio Grande floodplain on TCT property. The grades in the outlet area are relatively flat (< 1.0%), and the area will be lined with Hydroturf™ underlain by an LLDPE FML for continuity with the lining system upstream of this area. In this configuration, a fully lined drainage system will convey flow from the top of the Lower PBA to the Rio Grande.
The northern plant site slope is adjacent to the southern bank of the Lower PBA. The northern plant site slope will be graded for drainage and stabilized using a spray-on sealant. Surficial seal coatings that have been evaluated include PennzSuppress® and Top Seal White™ liquid soil sealant (see Attachment 2A.17 for product information). Details and performance data of the selected product will be provided to TCEQ/USEPA under separate cover.

Western Plant Slope and Drainage

The surface soil in the drainage along the western slope of the plant poses little direct contact risk due to the presence of the active rail line and slope steepness, but it does pose a risk to stormwater from entrainment of soil particles in runoff. As previously stated, the remediation goal for the off-site area is to minimize direct contact with COCs in soil and to minimize infiltration of stormwater runoff, reducing the source of COCs to groundwater. Because the principal route of exposure to COCs in soil on the off-site portion of the western slope is the soil-to-groundwater pathway, the off-site portion is part of the remedy for the Groundwater Unit. The depth of COCs in surface soil on the slope is generally within the top 2 feet. Proximity of the railroad tracks will limit excavation activities in this area.

During installation of site covers, TCT will establish drainage that directs stormwater runoff away from the western slope of the plant site, effectively controlling potential erosion from the top of the slope. TCT will conduct limited excavations where access is practical and apply slope stabilization of the western plant site slopes to control potential migration of impacted soil in stormwater runoff. TCT will apply a surficial sealant (see Attachment 2A.17 for product information) to stabilize the on-site slopes with the goal of reducing the potential for erosion and entrainment of soil particles with elevated concentrations of COCs that could result in off-site migration. The sealant will be re-applied annually. TCT will monitor the effectiveness of this slope stabilization measure by conducting and documenting inspections on an annual basis to identify rills and other indicators of significant erosion. TCT will make repairs and re-apply surface sealant as appropriate.

At the toe of the western plant slopes, the close proximity of the railroad tracks to the drainage minimizes the risk of direct contact with COCs in surface soil. TCT will coordinate with off-site parties to determine appropriate means to prevent infiltration and promote positive drainage in this area.

The on-site response action will prevent impacts to stormwater runoff from impacted soil. An institutional control will be required to maintain drainage features, to restrict land use to C/I, to prohibit groundwater usage, and to provide notice of the PMZ.

Stormwater Controls

Long-term stormwater controls are an integral component of the response action at the Site. Because of the remote location and rugged conditions, removal of COCs in soil of the East Mountain AA is not practical; instead, stormwater gabion structures are being employed to minimize off-site transport of COCs adsorbed to sediment particles. Similarly, entrainment of particles in stormwater runoff from the plant site and Floodplain AA is being handled through the use of stormwater controls. The plant site uses the SWCRS retention ponds to control sediment entrainment in stormwater runoff, while smaller detention features are proposed for the Floodplain AA.

The design of the East Mountain AA gabions is presented in **Attachment 2A.17**. **Figure 11** provides an illustration of locations of existing and proposed gabions in the drainages of the East Mountain AA. Basket gabions are anchored to the bedrock, and filter fabric is placed on the up-gradient side to retain sediment being transported in stormwater runoff. The gabions installed to date have been effective in reducing the number of stormwater discharge events by ponding stormwater associated with low flow events. However, under high flow conditions, the gabions have allowed stormwater to flow over the top of the structures. The overflow has resulted in elevated levels of COCs in stormwater samples from the gabion structures. Consequently, the gabions with the upstream fabric are being used to collect sediment and promote removal. Maintenance of the gabions is presented in detail in **Worksheet 3.2**. An in-channel, rip-rap check dam will be constructed on the flow path of the South Arroyo that crosses the Trust property between the TxDOT right-of-way and the UPRR property. A new gabion structure or equivalent will be constructed to detain stormwater runoff from the northern half of the western TxDOT drainage along I-10. Both of the stormwater controls on the upper PBA channel will be monitored and maintained to assure proper containment of sediment from stormwater discharge emanating from the northern half of the East Mountain AA.

Additional gabions may be installed as needed in the East Mountain AA based on the performance of the rip-rap check dam in the upper portion of the PBA AA as illustrated on **Figure 11**. The proposed locations of these “as needed” gabions and the rip-rap check dam in the upper PBA are also shown on **Figure 11**.

In November 2015, the TCT slip-lined a leaking culvert beneath the TxDOT I-10 detention basin to restore effective transport of water from the South Arroyo on the East Property to the PBA. The slip-lining was performed using 32-inch high density polyethylene (HDPE) pipe grouted in place eliminating the leakage that previously occurred from the culvert.
Drainage improvements on either side of the UPRR right-of-way will terminate at the TCT property line. Improvements on UPRR property are planned that will tie into these structures. The anticipated structures include the following:

- New reinforced concrete pipe (RCP) culverts under UPRR tracks connecting the Ephemeral Pond to the Lower Reach.
- New RCP culvert under UPRR tracks connecting the triangle area to a new concrete-lined channel running parallel to the tracks and connecting to the Lower Reach.

TCT will continue to work with UPRR to assure the tie-ins are robust and that the two system capacities are compatible.

The proposed stormwater control for the Floodplain AA is the construction of several smaller stormwater BMPs in the form of rip-rap check dams. . **Figure 11** provides an illustration of the preliminary locations for stormwater controls at the Floodplain AA. The controls are planned to consist of one filter fabric-lined stormwater rip-rap check dams to control sediment discharge to the American Canal and two additional filter fabric-lined rip-rap check dams to control sediment discharge to the concrete-lined channel between Outfall SW-5 and the Rio Grande. Similar to other areas, stormwater monitoring presented in **Worksheet 3.1** and operations and maintenance of the BMP features presented in **Worksheet 3.2** are important to achieving the response action objectives. Records of all stormwater monitoring and maintenance activities will be needed to meet facility stormwater discharge permit requirements.

Groundwater Treatment and Control

The groundwater treatment and control systems for the Site include the PRBs in the PBA and the GHB extraction well on the East Property AA. Groundwater quality at the Site has been affected by metals from slag and smelting process materials used to fill arroyos and to level the plant site pad, as well as being stored in landfills and dumping areas within the PBA and East Property AA. The response actions for on-site soils described in this worksheet detail the approach to achieve source control of COCs in soils. The remaining discussion details source control for COCs in groundwater at the PBA. Analysis of the Site hydrogeologic data shows that groundwater passing through the PBA contributes over 80 percent of the groundwater flux of the arroyos at the Site, and thus has been the focus of restoration activities.

Groundwater Treatment by PRBs

Groundwater in the PBA has been impacted by metals including antimony, arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, thallium, and zinc at concentrations above their respective critical PCLs based on the groundwater-to-surface water (^{SW}GW) pathway. Due to its elevated concentrations, areal extent, and presence in surface water, arsenic has been identified as the primary groundwater COC at the Site. Consequently, arsenic is the primary driver for groundwater remedial efforts at the Site. Arsenic concentrations in PBA groundwater vary spatially and seasonally, but generally range from 1 to 2 mg/L.

Groundwater in the PBA is being treated using PRBs constructed with ZVI, as illustrated on **Figure 12**. 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, making it essentially a barrier to contaminant transport over the designed lifetime of the PRB. The effective removal of arsenic from groundwater by ZVI has been demonstrated in the field demonstration report (Malcolm Pirnie, 2015). Two PRBs have been constructed and are designated PRB-1 and PRB-2. PRB-1 is located down-gradient of the Fines Pile and Ephemeral Pond area to intercept and treat groundwater from these source areas. This PRB will intercept the mass of COCs in this critical area, mitigating down-gradient mass migration and restoring groundwater. PRB-2 is located approximately 470 feet down-gradient of PRB-1 (approximately 50 to 120 days groundwater travel time), in an area where PBA groundwater flow is focused in an incised alluvial channel bounded by bedrock outcrops. PRB-2, therefore, is particularly effective at intercepting groundwater within the PBA. In addition to its individual performance, PRB-2 working in conjunction with PRB-1 to have an

additive effect on removing arsenic and other COCs from the aquifer in the PBA.

The design of the PRBs was based on the characteristic of the alluvial groundwater system, depth to bedrock, projected mass removal of arsenic in groundwater, and desired groundwater flow characteristics. The PRB-1 design was based on soils consisting mostly of coarse-grained sand and gravel alluvial materials with an estimated average hydraulic conductivity (K) of approximately 21 feet/day and the current condition of an estimated groundwater seepage velocity of approximately 2.7 feet/day. A ZVI demand of 730,000 lbs was determined based on the arsenic loading rate of 0.10 lbs/day, the estimated uptake capacity of 1.0 mg arsenic/g ZVI, and a design lifetime of 20 years. The backfill is designed to have uniform porosity and higher hydraulic conductivity (design based on estimated minimum required initial hydraulic conductivity of 42 feet/day, later determined through in-situ field data to be approximately 1,000 feet/day) than the adjacent alluvium (18 feet/day) to enhance flow through the PRB and to accommodate porosity reductions due to mineral precipitation and hydrogen gas accumulation. Based on the design, PRB-1 is based on a design length of 140 feet, an average depth of 15 feet, a thickness of 8 feet, and contains ZVI at a concentration of approximately 30 wt% by mass.

PRB-2 extends approximately 100 feet across the channel with both southern and northern extents installed to shale and sandstone bedrock. PRB-2 was installed perpendicular to flow across the entire current saturated thickness and vertically to an elevation of approximately the current anticipated groundwater elevation. The soils in the footprint of PRB-2 consist of coarse-grained sand and gravel alluvium. The PRB-2 design included an average estimated hydraulic conductivity of soils of 116 feet/day and estimated groundwater seepage velocity of 7.5 feet/day. The influent arsenic concentration and the estimated groundwater flux result in an estimated arsenic loading of 0.15 lbs/day, which is 50 percent greater than PRB-1 due to higher estimated seepage velocities at PRB-2. A ZVI demand of 1,100,000 lbs is estimated based on the arsenic loading rate of 0.15 lbs/day, the estimated uptake capacity of 1.0 mg arsenic/g ZVI, and 20 years of operation. PRB-2 is based on a design length of 120 feet, average depth of 26 feet, and thickness of 8 feet, and is composed of approximately 30 wt% ZVI.

Performance monitoring data indicate that the PRB-1 barrier was effectively treating groundwater flowing through the PRB after initial installation in 2012 and 2013. The northern end of PRB-1 continues to treat COCs to below their respective PCLs. Groundwater quality data trends from recent monitoring events indicate areas within PRB-1 have reduced reactivity treatment efficiency on the southern end of the barrier. Reduction in treatment levels appear to be related to: 1) reduced residence times caused by hydraulic considerations from increased groundwater elevations and hydraulic gradients due to recent precipitation events; and 2) to passivation from calcium carbonate scale formation. While arsenic reductions of up to 30 percent were observed within the south end of PRB-1 and up to 50 percent were observed approximately 10 feet down-gradient of the PRB edge by December, arsenic concentrations as of February 2015 have not decreased to the levels seen in July 2013 (Arcadis 2015, **Appendix 3.8**).

Performance monitoring data from PRB-2 indicate that groundwater is flowing through the barrier and effectively treating groundwater. Groundwater quality data from the February and August 2015 monitoring events continue to show complete treatment of COCs at shallow well depths; however, similar trends are observed in deep locations as discussed above for PRB-1,

indicating a loss of reactivity treatment efficiency in the deeper portion of PRB-2. The data show evidence of limited ZVI passivation in the deeper portion of PRB-2. Performance data at both PRBs indicate that groundwater gradient control and reduced loading of calcium carbonate will extend to the operational life of the PRBs.

Groundwater Gradient Control with GHB Extraction System

The groundwater response action relies significantly on hydraulic gradient control. Gradient control in the PBA quickly decreases the groundwater flux from the PBA to the floodplain of the Rio Grande, decreasing the mass loading to the PRBs and floodplain. An additional added benefit of reduced groundwater gradient is decreased groundwater velocities through the PRBs, increasing the residence time and potential level of treatment. Groundwater gradient is being controlled partially by covers and liners over the Fines Pile, Boneyard, the plant site, and Upper/Lower PBA channel. However, the PBA has a large drainage basin east of I-10. As a result, hydraulic gradient control in the PBA also requires interception of groundwater inflow from upgradient areas. Operation of the GHB extraction well substantially reduces the amount of groundwater flowing into the PBA from upgradient areas.

The GHB system includes a 4-inch groundwater extraction well at EP-163, as illustrated on **Figure 12**. It also includes a transmission pipeline and water storage tank. Groundwater pumped from EP-163 can either be used for on-site construction activities, such as dust suppression, or discharged to the Rio Grande through Outfall SW-5. No TPDES discharge permit has been required for this discharge. The extraction well at EP-163 will initially operate at 15 gallons per minute (gpm), but it has been designed and equipped with a submersible pump capable of producing 20 to 25 gpm. Groundwater withdrawal is projected to reduce the groundwater hydraulic gradient in the PBA by approximately 87 percent (see **Appendix 3.6**). The covers and liners of the Upper and Lower PBA are estimated to reduce the hydraulic gradient by an additional 13 percent. The long-term groundwater extraction rate will be determined by monitoring groundwater quality from the extraction well and water elevations in down-gradient monitoring wells to track hydraulic gradient control. The groundwater monitoring program presented in **Worksheet 3.1** of this RAP provides more details.

Institutional Controls

Institutional Controls are an integral component of the response action for the Site. There are three general types of controls that are being proposed: 1) land use controls, 2) TRRP regulatory controls, and 3) land development restrictions to protect the response action. Each of the institutional controls is discussed below, organized by type. Appendix 4 includes preliminary draft institutional controls for affected parcels including those that are off-site.

Land Use Controls

Land use controls include groundwater PMZ and C/I land use restrictions. **Figure 8** provides an illustration of the extents of the land use institutional controls. The entire PCLE Zone for groundwater on the Site will be subject to the PMZ prohibiting the use of groundwater (Appendix 4). The PMZ will include a meets and bounds description of the groundwater PCLE Zone on the property and a list of COCs including antimony, arsenic, cadmium, chloride, chromium, copper, fluoride, lead, mercury, molybdenum, nickel, nitrate, selenium, sulfate, thallium, and zinc at concentrations above TRRP PCLs. The establishment of the PMZ removes the compete pathway for ingestion of groundwater.

The second land use control is a deed restriction limiting the land use to C/I (Appendix 4). The

C/I land use restriction will apply to the entire Site property located west of I-10. All the property east of I-10 within the PMZ and south of the South Arroyo will also have the C/I land use restriction, as illustrated on **Figure 8**. The C/I land use restriction will also be implemented as a deed restriction on the applicable portions of the property.

The East Property north of the PMZ and C/I use restricted area have been remediated to meet residential $^{Tot}Soil_{Comb}$ PCLs. Groundwater in the East Property AA upgradient of the Category I Material storage area, as represented by groundwater data from monitoring wells EP-86, EP-95, EP-96, and EP-129, have concentrations of COCs below their respective $^{GW}GW_{Ing}$ PCLs. Similar to other AAs, the soil-to-groundwater pathway is incomplete in the northern portion of the East Property AA, as COCs are present as the result of aerial deposition rather than slag and waste storage. Therefore, no land use restrictions are required in the northern portion of the East Property.

TRRP Regulatory Controls

Two regulatory institutional controls under TRRP are being proposed, including a PMZ and four WCUs. **Figure 8** provides an illustration of the extents of the PMZ and WCUs at the Site. The PMZ is being proposed to extend from monitoring well EP-84 on the East Property AA to the eastern bank of the Rio Grande. The purpose of the PMZ is to move the point of exposure (POE) from within the PCLE zone to the down-gradient edge of the PMZ, which will allow management of the groundwater in source areas (East Property, PBA, and south arroyos of the plant site) without having to achieve Tier 1 PCLs in these on-site areas. The goal of the response action at the Site is to contain COCs in soil and localized pockets of groundwater and prevent off-site migration. The PMZ will provide a point for evaluation and compliance for that goal without being required to conduct a technically infeasible remediation approach for on-site groundwater.

The four lined and covered landfills at the Site are being designated WCUs under TRRP. The purpose of this designation is to exclude that portion of the groundwater PCLE zone which lies directly beneath the WCU from the requirement to meet the general groundwater response objectives (*e.g.,* cleanup to the Tier 1 PCLs and of monitoring of groundwater quality beneath the covered landfill). Other covered portions of the Site that fall within the PMZ will still require that groundwater monitoring be conducted to evaluate the performance of the covers and to establish that PCLs will be met at the new alternate POE wells at the down-gradient edge of the PMZ. Since Cells 1 through 4 are lined, covered landfills, they meet the requirements of the WCU under TRRP.

Implementing the PMZ and WCU modified groundwater response action approaches requires that institutional controls be placed on the property deed and deeds for off-site properties to provide notice of the existence and location of the groundwater PCLE zone beneath the PMZ/WCU and to prevent usage of and exposure to this groundwater (Appendix 4).

Restrictions on Future Development

Restrictions on future development are principally related to maintaining the integrity of soil covers, maintaining drainage to eliminate pooling of stormwater or irrigation water runoff in unlined facilities, and maintaining stormwater discharge controls to eliminate potential off-site migration of affected soil. **Figures 6** and **7** provide a summary of response action facilities for both soil and groundwater (including soil covers, lined stormwater detention/retention ponds and channels, and groundwater remediation systems), and the corresponding development

restrictions. The types of development restrictions are related to the individual type of cover. All restrictions will be implemented in the form of restrictive covenants, and all restrictive covenants will include a requirement that all future development plans be reviewed and approved by the TCEQ and USEPA Region 9.

Three locations will have complete bans on any type of development. These locations include the Fines Pile, the Boneyard, and the channel areas of the Upper and Lower PBA. The Fines Pile will be covered with a Closure Turf™ system including a 50 mL LLDPE geomembrane, sand, and a UV-resistant artificial turf to stabilize the steep slopes, or an ET soil cover system with an outer layer of desert armor. The Closure Turf™ surface is not compatible with re-development. The Boneyard will be covered with an ET soil cover system (with the same soil section as the Plant Site); however, potential future mining of metal resources in the Boneyard will restrict its re-development. Finally, a critical component of the overall containment of COCs in soil and groundwater on site is related to the integrity of the surface drainage and the low permeability liner of the Upper and Lower PBA channel. The PBA channel is largely within the 100-year floodplain and does not lend itself to re-development.

ET soil covers identified on **Figure 10** include the north and south ET covers on the plant site. Areas designated for ET covers will require a deed notification that soils with COCs at levels above PCLs are contained beneath the cover (Appendix 4). Any future development on the soil ET covers must demonstrate that the proposed development will not adversely affect the designed infiltration rate of 0.19 cm/yr established for the original cover. In addition, all development will require grading and drainage plans that eliminate potential ponding or detention of stormwater runoff. Finally, no standing water features will be allowed as part of development on areas with ET covers.

As illustrated on **Figure 10**, the low permeability cover areas typically adjoin areas capped with ET covers and/or areas capped with asphalt. Asphalt covers include both with the Category II asphalt covers and the existing asphalt pavement on the plant site portion of the Site, as illustrated on **Figure 10**. Areas with asphalt covers will have institutional controls notifying the property owner of the presence of concentrations of COCs in soil above their respective PCLs. Penetrations through the asphalt covers are prohibited without agency approval. Any development requiring the disturbance or removal of asphalt must demonstrate that the 0.1 cm/yr infiltration rate is not exceeded.

Describe all major treatment system components and equipment of the response action. Illustrate the response action design and provide equipment specifications in Attachment 2A.

The treatment systems and equipment utilized as part of the response action for the Site are principally related to the groundwater treatment and gradient control in the PBA and include the PRBs and the GHB systems.

PRBs

Two PRBs have been designed and installed in the subsurface of the Lower PBA channel based on the in-situ treatment of arsenic and other metals in groundwater using ZVI as an iron source. ZVI will oxidize and adsorb metals of concern from groundwater passing through the PRBs. PRB-1 was designed based on contaminant concentrations, gradient, and groundwater seepage velocity to calculate a ZVI demand of 730,000 lbs. PRB-1 is based on a design length

of 140 feet, average depth of 15 feet, and thickness of 8 feet, and contains ZVI at a concentration of approximately 30 wt% by mass to accommodate the calculated ZVI demand. PRB-2 was designed based on a ZVI demand of 1,100,000 lbs. The design of PBA-2 was for a length of 120 feet, average depth of 26 feet, and thickness of 8 feet. The dimensions for PRB-2 are consistent with a ZVI concentration of approximately 30 wt%. **Attachment 2A.11** provides the basis for design and field constructed data for the PRBs in the PBA.

GHB System

The GHB system includes an extraction well, pipeline, and storage tank as detailed in **Attachment 2B**. The extraction well, EP-163, has a 4-inch PVC casing with 36 feet of screen extending from 20 to 56 feet bgs. The well is equipped with a 1 horsepower, three-phase pump. The transmission pipeline is 4-inch HDPE conveying water to the Rio Grande through Outfall SW-5. A 10,000-gallon storage tank is maintained at the well site for potential use of the water.

List permits or registrations needed to construct or implement the response action, including permits or registrations needed to conduct studies or tests. For VCP sites, list the permits that would be required if the site was not in the VCP (required by the VCP).

Permitting/Registration Authority	Type of permit/registration	Permit or registration number if already issued	Anticipated application date
TCEQ	Stormwater Discharge MSGP	TXR 05Y986	Existing

Identify and discuss the results of any studies or tests, such as pilot studies, feasibility studies, technical impracticability studies, treatability studies, and/or toxicity studies conducted or proposed to be conducted at the affected property. Discuss the reason for the study or test and how it verifies the effectiveness and appropriateness of the chosen response action or documents that a particular response action is not appropriate for the affected property. Describe how the results of completed studies or tests determined the design or choice of response action. Attach any separate reports and supporting documentation in Appendix 3.

Multiple studies have been performed in support of the response action at the Site. These studies are included as referenced in Appendix 3. A list of the studies is presented below:

Appendix 3.1 – Annual Summaries of Dust Monitoring Reports from 2011 through 2015.
Appendix 3.2 - Annual Groundwater and Surface Water Monitoring Reports 2013 through February 2015
Appendix 3.3 – PCB Removal Work Plan and Summary Letter
Appendix 3.4 – Stormwater Pollution Prevention Plans and 2012/2014 Discharge Monitoring Reports
Appendix 3.5 – ASARCO Notice of Registration and Waste Management Units
Appendix 3.6 – Groundwater Flux Estimate Summary Memorandum
Appendix 3.7 – GeoSyntec Cover Design Report
Appendix 3.8 – PRB Field Demonstration Report
Appendix 3.9 – Groundwater Flushing Summary Memorandum

Complete this worksheet when a PMZ is proposed as part of the response action. Include in Attachment 2D a map of the proposed PMZ with alternate POE(s) and attenuation monitoring points identified and the current groundwater PCLE zone. If a PMZ is not proposed, do not submit this worksheet.

Groundwater-bearing unit Mesilla Boson
Repeat this worksheet for each groundwater-bearing unit for which a PMZ is proposed.
Groundwater classification X 2 ____ 3
Provide justification as to why the PMZ is appropriate in accordance with §350.33(f)(4)(A). Include supporting documentation in Attachment 2E.

The PCLE zone in groundwater at the Site extends from the East Property at EP-84 to the Rio Grande as illustrated on **Figure 5**. COCs include antimony, arsenic, cadmium, chloride, chromium, copper, fluoride, lead, mercury, molybdenum, nickel, nitrate, selenium, sulfate, thallium, and zinc. Arsenic is the principal COC in groundwater based on concentration, distribution, and potential risk.

The proposed PMZ will extend from the East Property AA in the vicinity of EP-84 (identified on Figure 1 in **Attachment 3A**) to the eastern bank of the Rio Grande, as illustrated in **Attachment 2D**. The purpose of response action at the Site is to achieve the critical PCLs at the alternate POE wells, which will be located at the down-gradient edge of the PMZ. Groundwater monitoring wells MW-2, MW-9S, MW-11S, EP-112, and EP-133; EP-128; EP-4; EP-6; and EP-7 will be used as the alternate POE wells. With the institutional control prohibiting groundwater use within the PMZ, the critical PCLs are based on ^{SW}GW PCLs as presented below.

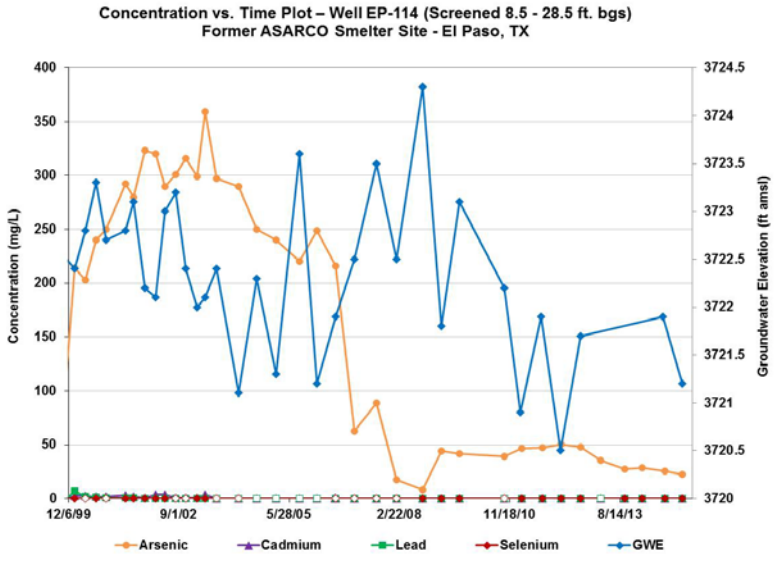
Maximum February 2015 Groundwater Metals Concentrations by AA (mg/L)

COC	^{SW}GW	Maximum Conc. PBA	Maximum Conc. Plant Site	Maximum Conc. Floodplain
Antimony	0.43	0.0873	**1.38**	0.0428
Arsenic	0.69	**27.2**	**27.7**	**2.74**
Cadmium	0.011	0.000613J	**1.05**	0.000756J
Chromium	0.1	0.00313J	**0.338**	0.0353
Copper	1.99	0.0199	**5.1**	0.00335J
Lead	0.14	0.00414	**0.463**	0.00113
Mercury	0.001	0.0000886	**0.00238**	0.000326
Molybdenum	10.34	2.9	1.53	0.449
Nickel	0.20	0.00998J	**4.02**	**1.09***
Selenium	0.147	**2.72**	**6.71**	**0.361**
Thallium	0.010	**0.575**	**0.881**	0.0005U
Zinc	3.0	0.0259	**10.1**	0.000706

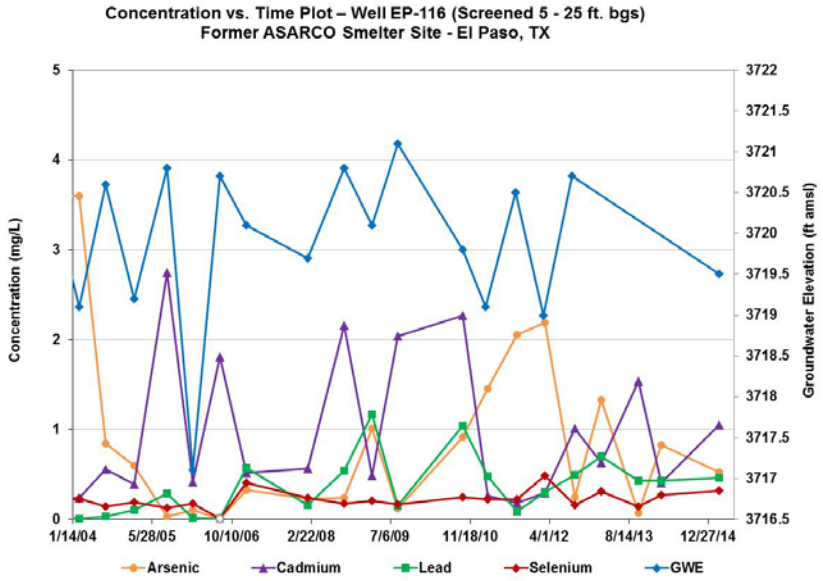
* - Just one exceedance of ^{SW}GW PCL for nickel at monitoring well EP-58

The groundwater COC concentrations exceeding the PCLs along the west slope boundary of the plant site occur along the entire boundary; however, the highest exceedances are associated with three isolated areas along the west boundary. One area is in the Acid Plant Arroyo AA at wells EP-49, EP-52, EP-54, and EP-114. Two smaller areas are in the Pond 5/6 Arroyo AA, with one at EP-116 and the second at EP-13. Concentrations of COCs in groundwater in the isolated areas around EP-114 and EP-116 are generally decreasing with time, but they increase with water elevations influenced by precipitation events. Concentration plots for COC concentrations versus time for these wells (presented below) support this

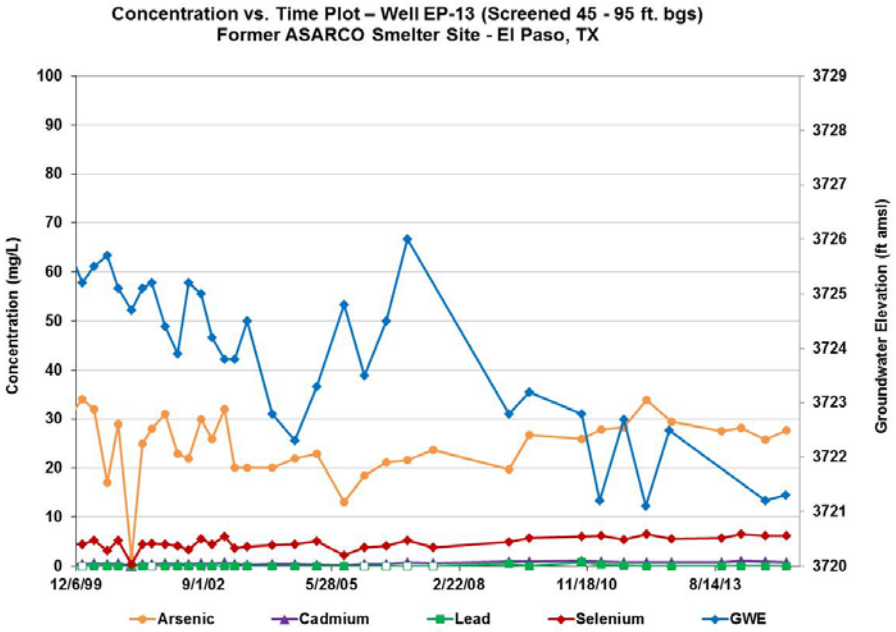
conclusion. Concentration versus time plots for significant monitoring wells at the Site are presented in **Attachment 1B.**



The time versus concentration plot for monitoring well EP-116, presented below, demonstrates a similar, though weaker, trend. This location has elevated concentrations of cadmium, copper, lead, and thallium in addition to arsenic and selenium, indicating a different source. However, the general trend of decreasing groundwater concentrations at lower water elevations still holds, indicating this area will respond to control through decreased surface infiltration from the cover system.



The third area with elevated concentrations of arsenic and selenium in groundwater is located at monitoring EP-13. This area demonstrates a similar overall decrease in water elevation; however, the concentrations of COCs in groundwater samples from this well have remained constant over the past 10 years, as seen in the time versus concentration plot presented below.



The arsenic concentrations in groundwater samples from monitoring well EP-13 have remained between 25 and 30 mg/L for the last decade. These concentrations have not resulted in elevated arsenic concentrations in surrounding wells, indicating this area is not serving as a significant source to surrounding groundwater.

In conformance with 30 TAC §350.33(f)(9)(A), and as part of the response action at the Site, a PMZ is being proposed for isolated pockets of groundwater exceeding the PCLs that have remained localized and relatively immobile. The response action for affected groundwater at the Site includes controlling and treating the source of contamination within the PMZ on site, and using MNA as a decontamination process for the portion of the PCLE Zone that currently extends off site into the groundwater discharging to the Rio Grande. The shallow groundwater on site and in the near vicinity is not currently used for potable purposes and, therefore, is considered Class 2. There are no potable wells currently installed on the Site or within the extent of the PCLE Zone. The groundwater response action will include institutional controls prohibiting groundwater use. The institutional controls will address the ingestion pathways for COCs in groundwater; however, the critical exposure pathway is discharge to surface water in the Rio Grande and the American Canal. The American Canal is scheduled for re-habilitation by the IBWC following a $22M settlement with ASARCO to address contamination. The Rio Grande only has substantial flow following releases from the up-river Elephant Butte Reservoir. When the river flows, concentrations of COCs from groundwater discharges are below drinking water criteria, and when the river is not flowing, there is not sufficient flow for beneficial use.

The groundwater characteristics at the Site are favorable for the proposed response action because of the nature of the arroyo drainages that convey groundwater from the Site to the

floodplain. Most of the groundwater flux comes from the PBA, which accounts for approximately 0.06 cfs of a total 0.074 cfs of groundwater flux from the Site. The GHB extraction well located east of I-10 will control the gradient from the east, while covers and liners applied to surfaces capable of infiltration are included in the on-site response for the PBA. The PBA has a narrow channel, allowing for installation of PRBs to treat groundwater flow from the PBA prior to exiting the property at Paisano Drive. The plant site arroyos all provide drainage for water that infiltrates locally on the plant site surface; therefore, the construction of the plant cover system will provide effective control of these lower-flux areas.

The arid conditions of El Paso also support the response action as proposed. Precipitation in El Paso primarily occurs in the summer months during brief, intense storms. The plant cover system and PBA channel improvements all include drainage designs that promote runoff rather than ponding. Brief, intense precipitation events also promote stormwater runoff rather than infiltration. The stormwater controls include retention/detention ponds, gabion structures, and riprap-lined channels to control erosion and mitigate mobilization of contaminated sediments potentially entrained in stormwater.

The attenuation action levels (AALs) for the PMZ will include both traditional groundwater quality goals for monitoring wells in the PBA and groundwater elevation goals for monitoring wells in AAs on the plant site. **Attachment 2D** provides an illustration of the PMZ and the locations of attenuation monitoring points (AMPs). The AMPs for the PBA include EX-01, EP-154, EP-155R, and EP-156R. Groundwater samples will be analyzed for arsenic and selenium to track progress toward the achievement of the critical ^{SW}GW PCLs at the property boundary on Paisano Drive. AMPs for the Floodplain AA include EP-64, EP-58, MW-132D, and EX-4. The analyte list for the Floodplain AA will include antimony, arsenic, cadmium, chloride, chromium, copper, fluoride, lead, mercury, molybdenum, nickel, nitrate, selenium, sulfate, thallium, and zinc. Groundwater target concentrations (provided in **Worksheet 2.1**) are based on modeling presented in **Attachment 2E**.

Groundwater elevations will be monitored at well pairs within each AA, to demonstrate that the target reductions in groundwater hydraulic gradients are being achieved by the cover systems, liners, and GHB extraction well. AMP well pairs for monitoring groundwater elevations have been identified for the East Property AA, PBA AA, and each Plant Site AA as follows:

- East Property AA: EP-162 (up-gradient well located in South Arroyo)
- PBA AA: EP-120 (up-gradient well) paired to down-gradient wells EP-54, EP-78 and EX-1
- Acid Plant Arroyo AA: New Well 3 (up-gradient well) paired to four down-gradient wells - EP-49 , EP-51 , EP-100 , and EP-114
- Pond 5/6 Arroyo AA: ew Well 2 (up-gradient well) and New Well 5 (down-gradient well)
- Pond 1 Arroyo AA: New Well 1 (up-gradient well) and EX-8 (down-gradient well)
- South Terrace Arroyo AA: EP-72R (up-gradient well) and EP-20 (down-gradient well)

The AMP well pairs for monitoring groundwater elevations are illustrated in **Attachment 2D.** Groundwater elevations based on projected infiltration rates have been evaluated (see **Appendix 3.6**). Target decreases in groundwater elevations have been projected and are presented in **Worksheet 2.1** of this RAP.

Is the alternate POE proposed to be beyond the current limits of the PCLE zone? ___ Yes _X_ No
If yes, how far? _____ (§350.37(l) or (m) as applicable)
Is it to be off-site? _X_ Yes ___ No
On an off-site property that currently does not contain a residential-based groundwater PCLE zone?
_X_ Yes ___ No

If yes and this is a Class 2 groundwater, provide the basis for concluding that this groundwater does not have a reasonably anticipated future beneficial use (§350.37(l)(3)).

The shallow groundwater at the Site is not currently used, and will not be used in the future. An institutional control will be established for the Site prohibiting the use of groundwater. The Site currently receives its potable water from El Paso Water Utility, so groundwater from the Site is not required for property development.

Is NAPL present? ___ Yes _X_ No
If so, describe how the response action will achieve the performance criteria in §350.33(f)(4)(E).

Not applicable.

If this is a Class 2 groundwater, explain how the response action will ensure that leachate from the surface soil and subsurface soil PCLE zones will not increase concentration of COCs greater than the current measured concentrations (at time of RAP submittal). (§350.33(a)(2))

The response action will minimize cross-media transport of COCs from soil to groundwater. The $^{SW\text{-}GW}$Soil pathway is addressed by construction of the plant cover system as described in **Attachment 2A.15**. For the plant site, groundwater protection is achieved by the overall reduction of the surface infiltration rate provided by the plant cover system compared to the current condition of the property. The infiltration rates for each cover system (e.g. asphalt covers, soil ET covers, and low permeability covers) are described in the 2015 Geosyntec memorandum attached to the plant cover system design (see **Appendix 3.7**). The plant cover system addresses the entire extent of the plant site pad with the exception of the storage yard adjacent to the former Antimony Processing Building as illustrated on **Figure 3**. This area has been delineated to $^{SW\text{-}GW}$Soil PCLs. Minor exceedance of PCLs in surface soil will be excavated, as described in **Worksheet 2.0**. The characterization data and PCL exceedances for COCs in the storage yard area are summarized in **Appendix 2.5**.

An evaluation of the plant cover system design was performed by modeling the overall surface infiltration rate for the entire plant site pad under both existing conditions and following future construction of the plant cover system, as described in Site Cover Modeling Report by Geosyntec (see **Appendix 3.7**). The Geosyntec report demonstrated that asphalt covers have an anticipated infiltration rate of 0.1 cm/yr, while the ET and the low permeability covers have an anticipated infiltration rate of 0.19 cm/yr. Compacted soil was estimated to have an infiltration rate of 3.35 cm/yr. Based on these infiltration rate estimates, the overall groundwater flux for each of the plant site AAs is estimated for current conditions and following construction of the plant cover system. The approach, assumptions, and results of the groundwater flux evaluations are presented in **Appendix 3.6**.

The approach to evaluate the change in groundwater flux is based on Darcy's Law. The first step was to estimate groundwater fluxes for current conditions, based on Darcy's Law and the following input parameters:

- Hydraulic conductivity: based on pump and slug field tests
- Hydraulic gradients: based on water levels measured in well pairs along each arroyo and representative hydraulic gradients calculated
- Arroyo widths: estimate based on historic topography, geologic logs, and hydraulic conductivity distribution
- Saturated thickness: based on measured water levels and geologic cross sections

The second step was to estimate expected hydraulic gradient reductions due to infiltration reductions from the construction of the proposed plant cover system. Finally, the expected groundwater flux for each AA was calculated using Darcy's Law and the expected hydraulic gradients based on the presence of the proposed plant cover system. A proposed monitoring network to assess hydraulic gradient reductions in response to the plant cover system is also proposed in the technical memorandum (see **Appendix 3.6**).

The plant cover system, including asphalt, ET, and low permeability covers, is intended to reduce groundwater flux and mass loading of arsenic from the plant site to the Rio Grande, which will eventually meet the ^{SW}SW PCL of 0.01 mg/L for arsenic during flow periods represented by the harmonic mean flow in the river. The flow rates in the American Canal are generally much higher than those reported in the river, so the most sensitive receptor is the Rio Grande. The effectiveness of the proposed cap in reducing groundwater fluxes from the plant site AAs will be evaluated using a series of paired monitoring wells that will measure a reduction in hydraulic gradients indicative of projected lower recharge rates. Details of the performance evaluation approach including estimated groundwater flux reductions and flushing times to achieve PCLs are provided in two technical memoranda included in **Appendix 3.6** and **Appendix 3.9**, respectively.

The plant cover system will only mitigate contributions of COCs from the plant site arroyos to the Rio Grande. Under current conditions, the plant site arroyos account for approximately 41 percent of the overall arsenic load reaching the Rio Grande. The remaining groundwater flux from the Site, approximately 59 percent of the overall mass of arsenic, emanates from the PBA. The reductions in groundwater flux and the associated arsenic load from the PBA is accomplished through the operation of the GHB extraction well. Details of the GHB are presented in **Attachment 2A.12**. The GHB currently operates at approximately 23 gpm, but has the capacity to operate at up to 25 gpm if required to control the gradient. The GHB accounts for approximately 87 percent decrease in groundwater flux from the PBA. In addition to the GHB, the PBA has several ET soil covers over the Cell 4 Landfill, Boneyard, and plant site portions of the PBA. The Fines Pile will be capped with a low permeability cover using Closure Turf™ or and ET cover. The Upper PBA channel is lined using Hydroturf™, including a 50 mil LLDPE geomembrane, hydrobinder, and a UV-resistant artificial turf to stabilize the channel. These covers and liners provide a barrier against infiltrating surface water, reducing the overall groundwater gradient in the PBA by an additional 13 percent. The overall reduction in groundwater flux from the PBA to the Rio Grande is approximately 84 percent following implementation of the response action (see **Appendix 3.6**).

The Site cap infiltration reduction estimates modeled by Geosyntec show variable bulk infiltration reductions per arroyo, dependent on the amount and type of cover proposed for each

arroyo. The following table presents the flux reductions due to capping and other remedy implementation in the case of PBA, for each arroyo area (i.e. up-gradient groundwater pumping and rerouting, PBA channel construction and grading). Reduction calculations are provided in **Appendix 3.6**.

Arroyo Area	Current Groundwater flux (cfs)	Relative Current Arsenic Mass Flux	Projected Future Groundwater flux (cfs)	Percent Reduction
PBA	0.060	59 %	0.00098	84%
Acid Plant	0.003	30 %	0.0006	82%
Pond 5,6	0.005	8 %	0.0009	82%
Pond 1	0.003	1 %	0.0009	62%
South Terrace	0.003	2 %	0.0007	78%

The monitoring program for the Site outlined in **Worksheet 3.1** includes collecting groundwater samples from wells within the covered areas to confirm that covers are providing effective protection.

Provide the basis that the COCs will not migrate beyond the downgradient boundary of the PMZ at concentrations above the critical PCL. Include supporting documentation in Attachment 2E.

The down-gradient edge of the proposed PMZ extends along the eastern bank of the Rio Grande as illustrated in **Attachment 2D**, and groundwater with COC concentrations above the PCL is currently discharging to the Rio Grande. Migration of groundwater with COC concentrations above the PCLs beyond the plant site and the PBA will be controlled through groundwater treatment in the PRBs and groundwater gradient control using both the GHB extraction well and covers installed at the Site to limit infiltration. The control of groundwater flux from the plant site will limit down-gradient impact to the Floodplain AA and ultimately to the Rio Grande. Control of both gradient and water quality in groundwater discharge from the PBA will protect against future migration of COCs in groundwater from the plant site to the Floodplain.

The current groundwater PCLE zone and the proposed limits of the PMZ extend to the Rio Grande, and MNA will be used as a decontamination process to ultimately achieve PCLs at the surface water discharge POE. The TCT has been established to control the source of groundwater contamination to the Rio Grande.

Describe the methods used to determine that there are no artificial penetrations which can allow COCs to migrate from the groundwater PCLE zone to currently unaffected groundwater-bearing units. Include supporting documentation in Attachment 2E.

A water well survey report was included in the *Conceptual Site Model, Pathway Evaluation, and Protective Concentration Level Report* (Arcadis, 2016a) demonstrating that no existing groundwater production wells are in the vicinity of the Site. Institutional controls prohibiting the use of groundwater at the Site will prevent future penetrations that may affect lower groundwater bearing units.

List the attenuation action level determined for each attenuation monitoring point. Illustrate the proposed attenuation monitoring points and the groundwater PCLE zone on the map in Attachment 2D. Include all calculations and other methods of determining the attenuation action levels in Attachment 2E.

COC	Attenuation Monitoring Point (well number)	Attenuation Action Level (mg/L)	Attenuation Action Level limited by $^{Air}GW_{Inh\text{-}V}$ or existing COC concentration? (Y/N)
Arsenic PBA	EP-154 – 2016	1.2	N
	EP-154 – 2020	1.2	N
	EP-154 – 2025	0.72	N
	EP-154 – 2030	0.38	N
	EP-154 – 2035	0.26	N
	EP-154 – 2040	0.19	N
	EP-154 – 2045	0.12	N
	EP-155R– 2016	1.2	N
	EP-155R – 2020	1.2	N
	EP-155R – 2025	0.97	N
	EP-155R – 2030	0.51	N
	EP-155R – 2035	0.36	N
	EP-155R – 2040	0.29	N
	EP-155R – 2045	0.13	N
	EP-156R – 2016	1.2	N
	EP-156R – 2020	1.2	N
	EP-156R – 2025	1.2	N
	EP-156R – 2030	0.97	N
	EP-156R – 2035	0.68	N
	EP-156R – 2040	0.46	N
	EP-156R – 2045	0.37	N
Arsenic Floodplain	EP-58 – 2016	5.0	N
	EP-58 – 2020	4.2	N
	EP-58 – 2025	1.5	N
	EP-58 – 2030	0.70	N
	EP-58 – 2035	0.51	N
	EP-58 – 2040	0.40	N
	EP-58– 2045	0.32	N
	EP-64 – 2016	0.03	N
	EP-64 – 2020	0.03	N
	EP-64 – 2025	0.03	N
	EP-64 – 2030	0.03	N
	EP-64 – 2035	0.03	N
	EP-64 – 2040	0.03	N
	EP-642045	0.2	N
	MW-132D - 2016	4.5	N
	MW-132D – 2020	4.6	N
	MW-132D – 2025	3.2	N

	MW-132D – 2030	1.7	N
	MW-132D – 2035	1.2	N
	MW-132D – 2040	0.8	N
	MW-132D - 2045	0.65	N
	EX-4 – 2016	2.0	N
	EX-4 – 2020	2.2	N
	EX-4 – 2025	1.8	N
	EX-4 – 2030	1.0	N
	EX-4 – 2035	0.65	N
	EX-4 – 2040	0.49	N
	EX-4 – 2045	0.40	N

Assessment Area	Attenuation Monitoring Point (well number) and Date (yyyy)	Attenuation Action Level (GW Elevation, feet)	Attenuation Action Level limited by $^{Air}GW_{Inh\text{-}V}$ or existing COC concentration? Y/N
Parker Brothers Arroyo AA	EP-78, 2016	3750.2	N
	EP-78, 2020	3736.7	N
	EP-78, 2025	3736.7	N
	EP-78, 2030	3736.7	N
	EP-78, 2035	3736.7	N
	EP-78, 2040	3736.7	N
	EP-78, 2045	3736.7	N
	EP-78, 2050	3736.7	N
	EP-78, 2055	3736.7	N
Acid Plant Arroyo AA	New Well 3, 2016	3740.0	N
	New Well 3, 2020	3730.5	N
	New Well 3, 2025	3730.5	N
	New Well 3, 2030	3730.5	N
	New Well 3, 2035	3730.5	N
	New Well 3, 2040	3730.5	N
	New Well 3, 2045	3730.5	N
	New Well 3, 2050	3730.5	N
	New Well 3, 2055	3730.5	N
Pond 5/6 Arroyo AA	MW-131, 2016	3723.8	N
	MW-131, 2020	3712	N
	MW-131, 2025	3712	N
	MW-131, 2030	3712	N
	MW-131, 2035	3712	N
	MW-131, 2040	3712	N
	MW-131, 2045	3712	N
	MW-131, 2050	3712	N
	MW-131, 2055	3712	N
Pond 1 Arroyo AA	EP-68, 2016	3725.8	N
	EP-68, 2020	3722	N
	EP-68, 2025	3722	N
	EP-68, 2030	3722	N
	EP-68, 2035	3722	N

	EP-68, 2040	3722	N
	EP-68, 2045	3722	N
	EP-68, 2050	3722	N
	EP-68, 2055	3722	N
South Terrace Arroyo AA	EP-72R, 2016	3724.5	N
	EP-72R, 2020	3717	N
	EP-72R, 2025	3717	N
	EP-72R, 2030	3717	N
	EP-72R, 2035	3717	N
	EP-72R, 2040	3717	N
	EP-72R, 2045	3717	N
	EP-72R, 2050	3717	N
	EP-72R, 2055	3717	N

Use this worksheet to document the use of a waste control unit to modify the groundwater response actions (§350.33(f)(2)). Provide a map in Attachment 2F of the waste control unit overlying the PCLE zone. Include proposed institutional controls in Appendix 4. If this modification does not apply, do not submit this worksheet.

Is the waste control unit an existing unit? ____ Yes X No
If yes, provide: the permit number _____
description _____
Status X active ____ Closed

Describe how the existing or proposed WCU meets the definition set forth in §350.4(a)(91).

30 TAC §350.4(a)(91) defines a WCU as a municipal or industrial solid waste landfill, including those RCRA regulated units classed as landfills, with a liner system (i.e., synthetic or clay) and an engineered cap that has been closed pursuant to an approved closure plan, previous regulations, or will be implemented pursuant to an approved RAP. Four WCUs are proposed for the Site that meet this definition: the existing Cell 1 Landfill in the Pond 1 Arroyo AA, the existing Cell 2 and Cell 3 Landfills in the Pond 5/6 Arroyo AA, and the new Cell 4 Landfill in the PBA. These units meet the TRRP WCU definition as follows:

- Cell 1 and Cell 2 Landfill details are presented on Sheet 5 of 9 dated September 2005 in **Attachment 2A.2**, which documents that these landfills are constructed with engineered, combination covers and liners.
- The Cell 3 liner and cover system details are presented in **Attachment 2A.2,** indicating the design of the Cell 3 Landfill meets all the requirements.
- The Cell 4 Landfill approved design documents are presented in **Attachment 2A.1** demonstrating that the liner design meets requirements. **Attachment 2A.7** provides the TCEQ-approved design for the cover system on the Cell 4.

Approval of this RAP with these landfills listed as WCUs will fulfill the approved RAP requirement. In accordance with 30 TAC §350.33(f)(2), that portion of the groundwater PCLE zone beneath the WCUs will be excluded from the requirement to meet the general groundwater response objectives, because these WCUs lie over existing groundwater PCLE zones. However, beyond the perimeter of the WCUs, the groundwater response objectives will be addressed.

If the WCU is proposed, identify any applicable permitting process that must be completed prior to operation of the WCU.

No landfill permits have been obtained for WCUs on the Site. All landfill design and construction documents have been reviewed and approved by TCEQ and USEPA. Local grading and construction permits have been obtained prior to construction.

Has the applicable permit been pursued yet? X Yes ____ No
If not, when will this be initiated?

Not Applicable.

Use this worksheet to justify the use of technical impracticability (TI) to modify the groundwater response objectives. Also complete Worksheet 2.2 to propose a plume management zone for the TI area. Include a map of the groundwater PCLE zone and area of technical impracticability in Attachment 2G. Include in the attachment any other documentation needed to make the justification. If technical impracticability is not proposed as part of the response action, do not submit this worksheet.

Describe the groundwater PCLE zone and demonstrate in accordance with *Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration* (EPA OSWER Directive 9234.2-25), unless otherwise approved by TCEQ, why it is technically impractical to reduce the COC concentrations to the critical PCLs, taking into account all currently available remediation technologies, and hydrogeologic and chemical-specific factors. Identify the specific COCs and list the PCLs that cannot be achieved.

Not applicable.

Are there groundwater COCs in excess of the critical PCLs beyond the TI area? ___ Yes ___ No
If yes, make sure removal/decontamination actions are documented in Worksheet 1.0.

Will actions be required or already completed to prevent COC migration outside the area of technical impracticability and/or outside the existing boundary of the groundwater PCLE zone?
_____ Yes _____ No
If yes, make sure removal/decontamination actions are documented in Worksheet 1.0.

Complete this worksheet if an institutional control will be used as part of the response action. Include a draft of the proposed institutional controls in Appendix 4. Provide a list of landowners from whom landowner concurrence will be requested, as necessary, in Appendix 5.
Specify the property for which this applies. East Mountain and East Property Assessment Areas
Repeat this worksheet for each different property for which an institutional control will be used.

Institutional Control	Type of Institutional Control[1]				Property Ownership		Anticipated Filing Date[2]
	Deed Notice	Restrictive Covenant	VCP Certificate of Completion	Equivalent zoning or governmental ordinance	Check if pertinent tract of land is owned by the person	Check if the pertinent tract of land is owned by an innocent owner or operator	
Document use of commercial/industrial land use (§350.31(g))		X			X		3 months after Approval of Soil RACR
Document use of physical or institutional control under Remedy Standard B §350.31(g))		X			X		3 months after Approval of Soil RACR
Document notice of on-going long term response action (§350.31(h))		X			X		3 months after Approval of Soil RACR
Document use of occupational inhalation criteria as RBELs (§350.74(b)(1))							
Document variance from the default exposure factors (§350.74(j)(2)(L))							
Document the use of a non-default soil exposure area (§350.51(l)(3)&(4))							
Document WCU exclusion area (§350.33(f)(2))							
Document establishing a PMZ (§350.33(f)(4)(C)(I))		X			X		4 months after RAP Approval
Document the demonstration of technical impracticability (§350.33(f)(3)(F))							
Relocation of soils containing COCs for reuse (§350.36(b)(4) and (c)(4))							

[1] Check the appropriate box(es) to indicate the type of institutional control required for the proposed response action.
[2] Specify date or amount of time after RAP approval.

Complete this worksheet if an institutional control will be used as part of the response action. Include a draft of the proposed institutional controls in Appendix 4. Provide a list of landowners from whom landowner concurrence will be requested, as necessary, in Appendix 5.
Specify the property for which this applies. Plant Site, Parker Brothers Arroyo, and Floodplain Assessment Areas
Repeat this worksheet for each different property for which an institutional control will be used.

Institutional Control	Type of Institutional Control[1]				Property Ownership		Anticipated Filing Date[2]
	Deed Notice	Restrictive Covenant	VCP Certificate of Completion	Equivalent zoning or governmental ordinance	Check if pertinent tract of land is owned by the person	Check if the pertinent tract of land is owned by an innocent owner or operator	
Document use of commercial/industrial land use (§350.31(g))		X			X		3 months after Approval of Soil RACR
Document use of physical or institutional control under Remedy Standard B §350.31(g))		X			X		3 months after Approval of Soil RACR
Document notice of on-going long term response action (§350.31(h))		X			X	X	3 months after Approval of Soil RACR
Document use of occupational inhalation criteria as RBELs (§350.74(b)(1))							
Document variance from the default exposure factors (§350.74(j)(2)(L))							
Document the use of a non-default soil exposure area (§350.51(l)(3)&(4))							
Document WCU exclusion area (§350.33(f)(2))		X			X		4 months after RAP Approval
Document establishing a PMZ (§350.33(f)(4)(C)(I))		X			X	X	4 months after RAP Approval
Document the demonstration of technical impracticability (§350.33(f)(3)(F))							
Relocation of soils containing COCs for reuse (§350.36(b)(4) and (c)(4))							

[1] Check the appropriate box(es) to indicate the type of institutional control required for the proposed response action.
[2] Specify date or amount of time after RAP approval.

Institutional Control	RAP Worksheet 2.4 WS2.4 - Page 34 of 38	
Associated Information: Appendices 4, 5	ID No.: SWR No. 31235	Report Date: August 2016

Complete this worksheet if an institutional control will be used as part of the response action. Include a draft of the proposed institutional controls in Appendix 4. Provide a list of landowners from whom landowner concurrence will be requested, as necessary, in Appendix 5.
Specify the property for which this applies. East Paisano Sliver and West Paisano Sliver Parcels
Repeat this worksheet for each different property for which an institutional control will be used.

Institutional Control	Type of Institutional Control[1]				Property Ownership		Anticipated Filing Date[2]
	Deed Notice	Restrictive Covenant	VCP Certificate of Completion	Equivalent zoning or governmental ordinance	Check if pertinent tract of land is owned by the person	Check if the pertinent tract of land is owned by an innocent owner or operator	
Document use of commercial/industrial land use (§350.31(g))		X			X		3 months after Approval of Soil RACR
Document use of physical or institutional control under Remedy Standard B §350.31(g))							3 months after Approval of Soil RACR
Document notice of on-going long term response action (§350.31(h))		X			X		3 months after Approval of Soil RACR
Document use of occupational inhalation criteria as RBELs (§350.74(b)(1))							
Document variance from the default exposure factors (§350.74(j)(2)(L))							
Document the use of a non-default soil exposure area (§350.51(l)(3)&(4))							
Document WCU exclusion area (§350.33(f)(2))							
Document establishing a PMZ (§350.33(f)(4)(C)(I))		X			X		4 months after RAP Approval
Document the demonstration of technical impracticability (§350.33(f)(3)(F))							
Relocation of soils containing COCs for reuse (§350.36(b)(4) and (c)(4))							

[1] Check the appropriate box(es) to indicate the type of institutional control required for the proposed response action.
[2] Specify date or amount of time after RAP approval.

Complete this worksheet if an institutional control will be used as part of the response action. Include a draft of the proposed institutional controls in Appendix 4. Provide a list of landowners from whom landowner concurrence will be requested, as necessary, in Appendix 5.
Specify the property for which this applies. TxDOT Property associated with I-10, Hwy 375, and Paisano Drive
Repeat this worksheet for each different property for which an institutional control will be used.

Institutional Control	Type of Institutional Control[1]				Property Ownership		Anticipated Filing Date[2]
	Deed Notice	Restrictive Covenant	VCP Certificate of Completion	Equivalent zoning or governmental ordinance	Check if pertinent tract of land is owned by the person	Check if the pertinent tract of land is owned by an innocent owner or operator	
Document use of commercial/industrial land use (§350.31(g))		X				X	3 months after Approval of Soil RACR
Document use of physical or institutional control under Remedy Standard B §350.31(g))		X				X	3 months after Approval of Soil RACR
Document notice of on-going long term response action (§350.31(h))		X				X	3 months after Approval of Soil RACR
Document use of occupational inhalation criteria as RBELs (§350.74(b)(1))							
Document variance from the default exposure factors (§350.74(j)(2)(L))							
Document the use of a non-default soil exposure area (§350.51(l)(3)&(4))							
Document WCU exclusion area (§350.33(f)(2))							
Document establishing a PMZ (§350.33(f)(4)(C)(I))		X				X	4 months after RAP Approval
Document the demonstration of technical impracticability (§350.33(f)(3)(F))							
Relocation of soils containing COCs for reuse (§350.36(b)(4) and (c)(4))							

[1] Check the appropriate box(es) to indicate the type of institutional control required for the proposed response action.
[2] Specify date or amount of time after RAP approval.

Institutional Control	RAP Worksheet 2.4 WS2.4 - Page 36 of 38	
Associated Information: Appendices 4, 5	ID No.: SWR No. 31235	Report Date: August 2016

Complete this worksheet if an institutional control will be used as part of the response action. Include a draft of the proposed institutional controls in Appendix 4. Provide a list of landowners from whom landowner concurrence will be requested, as necessary, in Appendix 5.
Specify the property for which this applies. Union Pacific Railroad
Repeat this worksheet for each different property for which an institutional control will be used.

Institutional Control	Type of Institutional Control[1]				Property Ownership		Anticipated Filing Date[2]
	Deed Notice	Restrictive Covenant	VCP Certificate of Completion	Equivalent zoning or governmental ordinance	Check if pertinent tract of land is owned by the person	Check if the pertinent tract of land is owned by an innocent owner or operator	
Document use of commercial/industrial land use (§350.31(g))		X				X	
Document use of physical or institutional control under Remedy Standard B §350.31(g))		X				X	
Document notice of on-going long term response action (§350.31(h))		X				X	3 months after Approval of Soil RACR
Document use of occupational inhalation criteria as RBELs (§350.74(b)(1))							
Document variance from the default exposure factors (§350.74(j)(2)(L))							
Document the use of a non-default soil exposure area (§350.51(l)(3)&(4))							
Document WCU exclusion area (§350.33(f)(2))							
Document establishing a PMZ (§350.33(f)(4)(C)(I))		X				X	4 months after RAP Approval
Document the demonstration of technical impracticability (§350.33(f)(3)(F))							
Relocation of soils containing COCs for reuse (§350.36(b)(4) and (c)(4))							

[1] Check the appropriate box(es) to indicate the type of institutional control required for the proposed response action.
[2] Specify date or amount of time after RAP approval.

Institutional Control	RAP Worksheet 2.4 WS2.4 - Page 37 of 38	
Associated Information: Appendices 4, 5	ID No.: SWR No. 31235	Report Date: August 2016

Complete this worksheet if an institutional control will be used as part of the response action. Include a draft of the proposed institutional controls in Appendix 4. Provide a list of landowners from whom landowner concurrence will be requested, as necessary, in Appendix 5.
Specify the property for which this applies. Burlington Northern/Santa Fe Railroad
Repeat this worksheet for each different property for which an institutional control will be used.

Institutional Control	Type of Institutional Control[1]				Property Ownership		Anticipated Filing Date[2]
	Deed Notice	Restrictive Covenant	VCP Certificate of Completion	Equivalent zoning or governmental ordinance	Check if pertinent tract of land is owned by the person	Check if the pertinent tract of land is owned by an innocent owner or operator	
Document use of commercial/industrial land use (§350.31(g))		X				X	3 months after Approval of Soil RACR
Document use of physical or institutional control under Remedy Standard B §350.31(g))		X				X	3 months after Approval of Soil RACR
Document notice of on-going long term response action (§350.31(h))		X				X	3 months after Approval of Soil RACR
Document use of occupational inhalation criteria as RBELs (§350.74(b)(1))							
Document variance from the default exposure factors (§350.74(j)(2)(L))							
Document the use of a non-default soil exposure area (§350.51(l)(3)&(4))							
Document WCU exclusion area (§350.33(f)(2))							
Document establishing a PMZ (§350.33(f)(4)(C)(I))		X				X	4 months after RAP Approval
Document the demonstration of technical impracticability (§350.33(f)(3)(F))							
Relocation of soils containing COCs for reuse (§350.36(b)(4) and (c)(4))							

[1] Check the appropriate box(es) to indicate the type of institutional control required for the proposed response action.
[2] Specify date or amount of time after RAP approval.

Institutional Control	RAP Worksheet 2.4 WS2.4 - Page 38 of 38	
Associated Information: Appendices 4, 5	ID No.: SWR No. 31235	Report Date: August 2016

Complete this worksheet if an institutional control will be used as part of the response action. Include a draft of the proposed institutional controls in Appendix 4. Provide a list of landowners from whom landowner concurrence will be requested, as necessary, in Appendix 5.
Specify the property for which this applies. International Boundary Water Commission American Dam Operations Site
Repeat this worksheet for each different property for which an institutional control will be used.

Institutional Control	Type of Institutional Control[1]				Property Ownership		Anticipated Filing Date[2]
	Deed Notice	Restrictive Covenant	VCP Certificate of Completion	Equivalent zoning or governmental ordinance	Check if pertinent tract of land is owned by the person	Check if the pertinent tract of land is owned by an innocent owner or operator	
Document use of commercial/industrial land use (§350.31(g))		X					3 months after Approval of Soil RACR
Document use of physical or institutional control under Remedy Standard B §350.31(g))		X					3 months after Approval of Soil RACR
Document notice of on-going long term response action (§350.31(h))		X				X	3 months after Approval of Soil RACR
Document use of occupational inhalation criteria as RBELs (§350.74(b)(1))							
Document variance from the default exposure factors (§350.74(j)(2)(L))							
Document the use of a non-default soil exposure area (§350.51(l)(3)&(4))							
Document WCU exclusion area (§350.33(f)(2))							
Document establishing a PMZ (§350.33(f)(4)(C)(I))		X				X	4 months after RAP Approval
Document the demonstration of technical impracticability (§350.33(f)(3)(F))							
Relocation of soils containing COCs for reuse (§350.36(b)(4) and (c)(4))							

[1] Check the appropriate box(es) to indicate the type of institutional control required for the proposed response action.
[2] Specify date or amount of time after RAP approval.