EXPERT REPORT

ESTIMATION OF COSTS TO PERFORM CLEANUP AT THE

ASARCO EL PASO SMELTER

ON BEHALF OF

THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Prepared by

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I. Introduction

This is the expert report of James Shih-Hong Sher, P.E.[1] that identifies additional cleanup activities, provides supporting documentation, and presents cost estimates to perform certain cleanup actions at the ASARCO El Paso smelter located at 2301 West Paisano Drive, El Paso, Texas. The cleanup actions presented in this report are in accordance with the Agreed Order, dated August 28, 1996, of the Texas Natural Resource Conservation Commission (TNRCC), predecessor agency to the Texas Commission on Environmental Quality (TCEQ), and the Corrective Action Directive letter dated May 20, 2005. These documents outline the necessary remedial actions for an operating smelter and additional tasks that are deemed necessary since the facility is no longer operating.

II. Qualifications

EDUCATION

- Bachelors - Hydraulic Engineering - Chun-Yuan College of Science & Engineering, Chung-Li, Taiwan 1973
- Masters - Civil Engineering - University of Texas at Austin, Austin, Texas 1977
- Masters - Business Administration - American Technology University, Killeen, Texas 1980

PROFESSIONAL LICENSE

Professional Engineer - State of Texas (License No. 61418)

III. Site Background

As set forth in ASARCO's Remedial Investigation Report, the site began operations as a lead smelter in 1887, and was owned by Consolidated Kansas Smelting and Refining Company. ASARCO was formed in 1899 and this plant was one of the original smelting plants. ASARCO started producing copper in 1910, operated a Godfrey roaster for cadmium oxide production in the 1930s, and constructed a slag fuming plant for zinc recovery in 1948. ASARCO added an antimony plant in 1970. The zinc plant was closed in 1982, the lead plant was closed in 1985, the antimony plant was shut down in 1986, and the cadmium plant was shut down in 1992 (Remedial Investigation Report, 1998). Figure 1 is an aerial photograph of the ASARCO El Paso smelter site.

In February 1990, hydrocarbon was observed to be seeping into the American Canal at several locations near the site. LPST No. 094594 was assigned to the release by a predecessor agency of the TCEQ. Under agency oversight, ASARCO conducted the

[1] James Shih-Hong Sher has worked for the Texas Commission on Environmental Quality from 1992 to the present. His work there has focused on both state and federal Superfund sites, including extensive experience with groundwater treatment systems. Prior to the agency, he was a partner in a private construction company that performed primarily highway construction.

investigation, removed contaminated soil, recovered approximately 22,000 gallons of diesel and treated approximately 7,500,000 gallons of diesel-affected groundwater. This LPST No. was closed on November 15, 2000.

In March 1990, ASARCO observed visible staining adjacent to the underground piping of an 18,000-gallon diesel tank and dispenser pump. An estimated 62,291 gallons of diesel was released. LPST No. 095897 was assigned to the release by a predecessor agency of the TCEQ. Under agency oversight, the tank and all associated piping were dismantled and removed. All impacted soils have been excavated. Based on the latest report, the diesel product is limited to three monitor wells with diesel product ranging from sheen to a thickness of 0.85 feet. A system is currently in place to recover the diesel product. Dissolved-phase concentrations are stable with maximum concentrations of 0.0108 mg/L benzene.

In 1994 and 1995, after a series of compliance inspections, it was determined that unauthorized discharges of solid waste, wastewater, and storm water had occurred at the facility. The TNRCC issued an Agreed Order in August 1996. The Order required ASARCO to conduct a site characterization, define the horizontal and vertical extent of soil and groundwater contamination, and define the extent of contamination across property boundaries.

In October 1998, ASARCO completed the initial site investigation and submitted the report entitled, *ASARCO El Paso Copper Smelter Remedial Investigation Report, El Paso, Texas* Volumes I – IV.

In April 1999, the U.S. Environmental Protection Agency (EPA) and the State of Texas filed a civil enforcement action in federal district court that alleged ASARCO violated the Resource Conservation and Recovery Act (RCRA) by failing to properly manage hazardous waste and engaging in unlawful recycling practices. This action resulted in an April 1999 Consent Decree (H-99-1136). The Consent Decree directed ASARCO to complete the corrective action work at the El Paso site under the 1996 State of Texas Agreed Order.

In July 2000, ASARCO completed an additional investigation and submitted the report entitled, ASARCO *El Paso Copper Smelter Phase II Remedial Investigation Report, El Paso, Texas* Volumes I - IV

In November 2001, ASARCO completed an additional investigation and submitted the report entitled, *ASARCO El Paso Copper Smelter Phase III Remedial Investigation Report, El Paso, Texas* Volumes I - V.

In September 2003, ASARCO completed an additional investigation and submitted the report entitled, *ASARCO El Paso Copper Smelter Phase IV Remedial Investigation Report, El Paso Texas* Volumes I - II.

On May 20, 2005, the TCEQ issued a Corrective Action Directive letter outlining the necessary remedial actions for an operating smelter.

In February 2008, ASARCO submitted the report entitled, *Engineering Evaluation and Cost Analysis for Enhanced Groundwater Remediation*.

IV. Media of Concern

A. Soil

The facility is located in El Paso County on the Rio Grande floodplain at an elevation approximately 3,600 feet above mean sea level. The surface geology consists of a mix of colluvial sediments from the surrounding mountains and fluvial sediments from the Rio Grande River (Rio Grande). Typical fluvial sediments can be classified into fine to coarse grain gravel and sand with a mixture of silt and clay all of which are present at the ASARCO El Paso smelter site. The site is built over a series of arroyos which have been filled with either native soils or slag. Slag is a by-product of the smelting process and is considered a solid waste. The thickness of the slag varies across the facility to a maximum of sixty feet (see ASARCO Photograph # 2).

The elements which comprise the Constituents of Concern (COC) at the El Paso facility include arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), selenium (Se) and zinc (Zn). The most prevalent COCs are arsenic, lead, and cadmium.

The contaminated material at the site is grouped into two different categories in accordance with the TCEQ Corrective Action Directive (dated May 20, 2005). Category I materials are residual by-products typically associated with specific current and past facility operations. Category I material includes remediation waste and material that could impact human health and the environment. Category II materials are large volumes of residual by-products with lower COC concentrations than Category I materials. Category II material could become a potential contaminant source if it is not properly managed.

B. Groundwater and Surface Water

The ASARCO El Paso smelter facility is situated on the Rio Grande alluvium (i.e., fluvial sediments). The groundwater flow direction is influenced by several filled arroyos which are situated beneath the ASARCO El Paso smelter. In general, the groundwater flow direction is west towards the Rio Grande. Surface water analytical data indicates that contaminated groundwater from the smelter has already impacted the Rio Grande. Based on information from the El Paso Water Utilities Public Service Board (EPWU) web site, the EPWU serves customers inside and outside the City of El Paso and the EPWU water supply comes from three sources—one surface water source and two groundwater sources. An employee of EPWU confirmed this information as well. The surface water source is the Rio Grande. There are two surface water intakes for drinking water downstream of the ASARCO El Paso smelter. One intake obtains water from the American Canal which is located approximately two miles downstream from the smelter at the Canal Water Treatment Plant (800 Canal Street, El Paso, Texas). The American Canal, located adjacent to ASARCO, is a canal which transfers water from the Rio Grande to the Upper Rio Grande Valley. The second intake obtains water from the Riverside Canal which is located approximately 15 miles downstream from the smelter at the Jonathan Rogers Water Treatment Plant (10000 Southside Rd., El Paso, Texas).

The groundwater at the facility has arsenic, lead, and cadmium concentrations above the maximum contaminant level (MCL). MCLs are drinking water standards that address contaminant levels. In accordance with TCEQ rules at 30 Texas Administrative Code (TAC) § 290.103(26), MCL is defined as: "Maximum contaminant level (MCL)--The maximum concentration of a regulated contaminant that is allowed in drinking water before the public water system is cited for a violation." The MCL concentrations for arsenic, lead, and cadmium are 0.01 mg/L, 0.015 mg/L and 0.005 mg/L, respectively. The most prevalent COC in the groundwater is arsenic. Currently, the highest concentration of arsenic in the groundwater occurs in onsite well EP-49 with a concentration of 62.5 mg/L, which is approximately 6,200 times the MCL for arsenic. The area of contaminated groundwater is shown in Figure 5.

In the past, surface water samples collected from the Rio Grande have had arsenic concentrations above the MCL. Figure 5 displays the surface water sampling locations along the Rio Grande. Table 1 presents the surface water sampling results from the Rio Grande and the American Canal.

V. Waste Management and Remedies

The identification and selection of on-site waste management tasks is based on:

- Completion of the unfinished tasks specified in the TCEQ Corrective Action Directive (dated May 20, 2005) which includes the installation of groundwater remediation treatment systems and the long term operation and maintenance of the systems, covering 16 acres of Category II material with asphalt pavement, and construction of the fourth repository cell for remaining Category I material.

- Additional tasks are necessary if the facility is no longer in operation. These tasks include the demolition of structures, covering an additional 59.50 acres of slag with asphalt pavement, installation of a fence to enclose the facility, and placement of the slag fine and dust (minus 50) waste pile into a repository cell.

- The total cost estimate is $52,005,186.

There are a number of potential concerns when estimating the remedial costs associated with a project of this magnitude. The additional remedial costs that are included in the cost estimate are more fully discussed below.

A. Demolition of Structures

Since the plant has ceased operations, the reuse of existing buildings and structures is unlikely because different operations require different structure and building specifications. The lack of routine maintenance will accelerate the deterioration of the buildings and structures. The deterioration of the structures will pose a hazard to any unauthorized person(s) and, as is the case with the smokestacks and the bridge over Interstate Highway (IH) 10, will pose a direct hazard to the public. Demolition of the existing buildings and structures is the most cost effective remedy for long term care of the facility. Demolition will also allow TCEQ to address any contamination under or within such buildings and structures. The TCEQ proposes to remove all buildings and structures at the site.

Surface areas for demolitions were derived from measurements taken at the site. The total surface area for the steel structures on-site is 264,141 square feet (sf). The total surface area for other construction material, including brick and concrete, is 191,157 sf. The creosote wood trestle (formerly used for rail cars) is 40,025 sf. The two bridges at the site measure a combined area of 17,625 sf (8,250 sf for the bridge crossing I-10, and 9,375 sf for the bridge near the slag quarry). The TCEQ solicited engineering services from Shaw Environmental (Shaw) to assess the demolition costs for the existing buildings and structures. TCEQ staff accompanied Shaw during the field inspection and met with ASARCO onsite personnel to obtain demolition costs. Shaw provided the TCEQ with costs for the demolition, transportation and disposal.

B. Groundwater – Treatment and Hydraulic Containment

The groundwater is contaminated with arsenic, lead and cadmium. Reported concentrations of these metals in groundwater exceed the respective MCLs. Based on the surface water analytical data, the contaminated groundwater has already impacted the Rio Grande. Groundwater treatment and hydraulic containment measures are needed to stop the contaminated groundwater from discharging into the Rio Grande since it is a supplementary drinking water source for the El Paso area. Additionally, the containment measures are needed to prevent a potential exposure pathway via surface water.

<u>Groundwater Containment Measures</u>

The groundwater containment measures (Figures 5 & 6) proposed by the TCEQ include:

1. A 3,000 linear-foot slurry wall situated along the northwestern portion of the groundwater plume. The slurry wall is proposed because this area is a preferential contaminant pathway as indicated by the diesel release in 1990 (LPST 095897) and this area has the highest concentrations of metals in groundwater.

2. An extraction system consisting of a network of 80 groundwater extraction wells is proposed to contain the contaminated groundwater from migrating to the Rio Grande. The location of the proposed extraction system would be along West Paisano Drive.

Slurry Wall

A slurry wall is a sub-surface, non-structural low permeability barrier constructed underground to impede the flow of groundwater. Slurry walls are commonly used in environmental remediation to contain contaminated groundwater. A slurry wall is typically constructed by excavating a trench in conjunction with the use of bentonite slurry. The bentonite coats the sides of the trench with a thin, low permeability layer which inhibits groundwater seepage into the trench. It also forms a plane against which the weight of the slurry can push against the trench sides. The lateral pressure of the slurry against the bentonite layer on the trench wall helps to hold the trench open. The slurry stabilizes the excavation and prevents the trench from collapsing. When the excavation is complete, the trench is backfilled with an impervious mixture, which is usually a blend of soil and bentonite; soil, cement, and bentonite; or cement and bentonite. The slurry wall has very low permeability, but is not impermeable. The slurry wall design normally allows groundwater to flow through the slurry wall at a very slow velocity (i.e., a range of 10^{-8} centimeters/second).

A 3000 linear-foot slurry wall is proposed to mitigate the flow of contaminated groundwater into the Rio Grande. ASARCO's *Engineering Evaluation and Cost Analysis* report prepared by CDW (CDW report) assumes the average depth of the slurry wall is 60 feet, where the base of the slurry wall is planned to tie or "key" into the rock (see Figure 6). According to the United States Geological Survey "Geologic Atlas of the United States El Paso Folio" Folio 166, the bed rock is typically 55 feet below the river alluvium. With the minimum 2 feet key into the rock and any variation in the terrain, the TCEQ accepts the 60-foot assumption. The cost estimate from the CDW report is $590 per linear foot with $9.83 per square foot of slurry wall surface. The CDM cost estimate (i.e., $9.83 per square foot) is much lower than the quotations of $15 - $20 per square foot which were obtained by the TCEQ. The TCEQ obtained the cost quotations from two experienced slurry wall remedial contractors; Environcon (Missoula, Montana; telephone number (406) 523-1150) and Remedial Construction Services (Recon) located in Houston, Texas (telephone number (281)-955-2442). The quotations are not site specific; therefore, the estimates are generally higher when compared to the site-specific cost information prepared by CDW. The TCEQ examined the cost information and accepts the cost information from CDW.

Groundwater Extraction Wells

A groundwater extraction system involves the design and installation of a system of extraction wells capable of hydraulically influencing a volume of the aquifer (i.e., water bearing zone) that is contaminated. An inward gradient or cone of depression occurs in an aquifer when groundwater is pumped from a well. As groundwater flows into the well, the water levels in the aquifer decrease around the well. The groundwater level decline decreases with an increased distance from the well thus resulting in a conical-shaped depression radiating away from the pumping well. The pumping effect from a single well is shown on Figure 7.

When multiple cones of depression coalesce, they tend to have a combined affect on drawdown (i.e., groundwater level decline) and change the groundwater flow direction as shown on Figure 8. The groundwater levels between the extraction wells are lowered, and minimal contaminated groundwater flows past extraction wells, thus forming the hydraulic barrier. The use of extraction wells to contain the groundwater flow is a common groundwater remediation technology.

Due to the estimated length of the plume (over 5000 linear feet), TCEQ staff proposes to use 30 existing wells in conjunction with 50 additional extraction wells to prevent the contaminated groundwater from migrating to the Rio Grande. Since well yield and field pumping information is not available, the TCEQ used the 1-2 gallon per minute pumping rate assumption from the CDW report with a 60-foot average interval between each extraction well. The estimated cost for the installation of each extraction well and pump is $4,500 per well which was obtained from the CDW report.

Groundwater Treatment and Discharge

A groundwater treatment plant is needed to process and treat the contaminated groundwater extracted from the aquifer. Once the contaminated groundwater is treated to the MCL, the treated groundwater is discharged from the treatment plant.

Groundwater Treatment Technologies

Based on the engineering forum issue paper "Proven Alternatives for Aboveground Treatment of Arsenic in Groundwater" (EPA-542-S-02-002) revised October, 2002, membrane filtration, precipitation/coprecipitation, adsorption and ion exchange are four recognized technologies used to treat arsenic-contaminated water to meet the MCL.

- Adsorption. Adsorption is a two dimensional process in which one substance is attracted to and adheres on the surface of a solid substance such as activated carbon. The adsorption media is usually packed into a treatment column. As contaminated water is passed through the column, contaminants are adsorbed. This procedure is normally used as a polishing step for other water treatment processes.

- Ion Exchange. Ion exchange is a physical/chemical process in which ions are held electrostatically on the surface of a solid and are exchanged for ions of similar charge in a solution. Many metals are cations (an ion having a positive charge) that have a tendency to attract anions and/or negatively charged molecules. This process removes ions from the aqueous phase by the exchange of cations or anions between the contaminants and the exchange medium. This procedure is normally used as a polishing step for other water treatment processes.

- Membrane Filtration. Membrane filtration can remove a wide range of contaminants from water. It also produces a larger volume of residuals and tends to be more expensive than other arsenic treatment technologies. This procedure is used less frequently than precipitation/coprecipitation, adsorption, and ion exchange.

- Precipitation/Coprecipitation. Precipitation uses chemicals to transform dissolved contaminants into an insoluble solid. In coprecipitation, the target contaminant may be dissolved or in colloidal or suspended forms. Dissolved contaminants do not precipitate, but are adsorbed onto another species that are precipitated. Colloidal or suspended contaminants are removed through processes such as coagulation and flocculation then removed from the liquid phase by clarification or filtration. This technology is less sensitive to the COC concentrations in the groundwater and water chemistry than other water treatment technologies. Therefore, this procedure is the most frequently used technology to treat metals in the groundwater. It is also capable of treating water characteristics or contaminants other than arsenic, such as hardness or heavy metals. For the above reasons, the TCEQ proposes to use this technology to treat the contaminated groundwater. The general process flow chart of this technology is shown on Figure 9.

Groundwater Treatment Construction and Operation Costs

The estimated capital cost for the design and construction of a groundwater treatment system is estimated at $5,000,000, with 80 gallon per minute capacity. This cost estimate includes $4,000,000 for the building construction and treatment plant installation; $500,000 for the piping and distribution system from a series of extraction wells to the treatment plant; and $500,000 for the engineering study and design. This estimate is based on TCEQ past cost information from groundwater construction projects. This cost estimate is not significantly higher than the $4,668,000 cost estimate from the CDW report which is based on a 76 gallon per minute capacity.

In addition to the estimated capital cost above, there is a cost associated with the groundwater operation. The operation and maintenance cost for the groundwater treatment system is based on TCEQ experience where a contractor has been retained to operate a groundwater treatment system at the Precision Machine State Superfund site in Odessa, Texas. The Precipitation/Coprecipitation technology is being used for treating chromium in groundwater at the Precision Machine State Superfund site. Since the same technology is being used to treat metals in the groundwater, it is appropriate to use comparable cost information for this site. The estimated annual groundwater treatment plant operating costs, as shown in Table 4, are listed below:

- Labor costs (project managers, field technicians) at $245,954 per year;
- Sampling and waste disposal (influent and effluent sampling, sludge removal) at $115,451 per year;
- Miscellaneous costs (equipment, utilities, and plant chemicals) at $202,200.
- Reporting costs at $5,000 per year. The common practice in the corrective action program is to evaluate a groundwater treatment system and to monitor and sample groundwater wells on a semi-annual basis. The $5,000 to produce semi-annual groundwater reports includes costs associated with professionals, field technicians, draftsman, and administrative technicians.

Projected Timeframe for Groundwater Treatment Operation

The development of the groundwater treatment operation timeframe will be based on site-specific conditions such as hydrogeologic and contaminant-related factors. Groundwater modeling is a common approach in determining groundwater flow rates, contaminant transport and the projected duration of the groundwater treatment operation. The lack of site-specific information limits TCEQ's ability to estimate the timeframe for the groundwater treatment operation.

Without such site-specific information, an accepted approach is to assume that an aquifer would be restored when more than three pore volumes of contaminated groundwater was flushed out of the aquifer. This timeframe of groundwater restoration was specified in the Record of Decision (ROD) issued by the U.S. Environmental Protection Agency (EPA) dated September 18, 1986, for the Sikes Disposal Pits Federal Superfund site in Crosby, Texas and the ROD issued by U.S. EPA dated September 25, 1990, for the Texarkana Wood Preserving Federal Superfund site in Texarkana, Texas.

Pore volume is the total volume of pore space in a given volume of rock or soil/sediment. Pore volume is equivalent to the total porosity. Porosity is a percentage of void or pore space within a rock or soil/sediment. Pore volume of the contaminated groundwater in an aquifer usually relates to the volume of water that must be moved through contaminated material in order to flush the contaminants. With respect to the movement of a fluid, only the network of interconnected pore spaces is significant. In general, the greater the porosity, the more readily fluids may flow through the soil. An exception is a clay-rich soil, which usually retains fluids by capillary forces. The rate of decrease in the concentration of contaminants in a given volume of contaminated porous media is directly proportional to the number of pore volumes that can be exchanged (circulated) through the same given volume of porous media.

The groundwater table is generally 10 feet below the ground surface and the bed rock is approximately 55 feet below the ground surface. The difference between the two depths is the saturated zone. The Rio Grande alluvium is mainly comprised of sand and gravel. The porosity ranges for a sand and gravel mix from 20-35% as indicated in Table 4.2 of "Applied Hydrogeology, Second Edition" by C.W. Fetter. Since the site specific groundwater information is not available to the TCEQ, the upper range of 35% is used for this calculation.

The way to estimate the volume of the contaminated groundwater is first to determine the volume under the area of the contaminated groundwater plume which is approximately 5,184,375 square feet (sf) by 45 feet as the average depth of the saturated zone. Therefore, the total volume is 233,296,875 cubic feet (cf). Assume the water will fill all void and pore space in the saturated zone, the pore volume equals to the groundwater volume. We can derive the pore volume of 81,653,906.25 cf by using the volume under the contaminated groundwater plume (233,296,875 cf) multiplied by the porosity (35%). Since one cubic foot of water is equivalent to 7.48 gallons, we convert the pore volume into 610,771,219 gallons.

Due to operational problems and routine maintenance requirements, the groundwater treatment plant cannot operate at full capacity all the time. An 80% operational efficiency is used for the groundwater treatment operation which means the plant will treat 33,638,400 gallons of water each year (80 gpm x 80% efficiency x 60 minutes x 24 hours x 365 days). It will take the plant 54.47 years to treat three pore volumes of contaminated groundwater. The TCEQ has selected 50 years as the timeframe for the groundwater treatment plant operation.

Treated Water Discharge and Injection

Once the contaminated groundwater is treated, the treated water can be discharged to surface water or re-injected into the underground formation for reuse or disposal.

- Discharge to surface water. The facility cannot discharge the treated water into the Rio Grande or American Canal without obtaining a discharge permit from the TCEQ. Under the corrective action program, the TCEQ is required under TCEQ rules to seek public input prior to granting a discharge permit. Any delay in this process could impact the groundwater remediation.

- Re-inject into a shallow aquifer. This procedure would flush the contaminated groundwater via re-injection of treated water into the shallow aquifer as a part of the groundwater remediation strategy. If the treatment standard is met, the injection well could be a Class V injection well in accordance with Title 30 TAC Chapter 331 Subchapter H (authorization by rule). Otherwise, if the treatment standard cannot be met, the injection well would need to be a Class I injection well in accordance with Title 30 Chapter 331 Subchapters C, D and G. A potential problem encountered during the injection of contaminated groundwater is the plugging or the fouling of the injection wells. The TCEQ experienced well plugging/fouling at the Odessa Chromium I Federal Superfund site in Odessa, Texas. The well plugging was caused by the chemical incompatibility of the treated water and contaminated groundwater. No field test has been conducted for the injection rate(s) and/or a chemical compatibility study of the treated water and contaminated groundwater for ASARCO El Paso site. The main reason for not considering this option at this time is the lack of information.

- Re-inject into a deep underground formation. This procedure would re-inject treated water into a deep formation (Mesilla Bolson). This option would allow treated water to be stored in a deep formation for future use. The TCEQ considers this a favorable option because the future population growth in the region may deplete the water source and this procedure will mitigate future demands on the aquifer. Since the water chemistry in the deep formation remains constant, the well plugging/fouling problems are reduced. A cost estimate of $100,000 was obtained from a licensed Texas water well driller for the installation of an 800-foot injection well.

C. Asphalt Paving

Figure 3 displays the current asphalt paved areas and the planned asphalt paved areas that ASARCO was directed to construct for an operating smelter. If the future use of the facility is not for an operating smelter, then additional asphalt paving is needed. The additional asphalt paving is needed to cover waste and/or the soil with elevated metals to prevent direct contact and mitigate waste dust particles from blowing offsite as well as prevent contaminated storm water runoff. The paving area was estimated from ASARCO plats. Since the facility has been in operation for over 100 years, there is a high probability that contaminants may be discovered outside the investigation area. Therefore, the TCEQ intends to pave the majority of the plant area to prevent any potential exposure. Figure 4 displays the 59.5 paved area. The cross section for current light traffic asphalt pavement with 1.5” Type C asphalt and 6” cold mix and cold laid asphalt material on top of 6” crushed slag as road base material is shown on Figure 10. ASARCO estimated a $2 million cost to complete the paving of the additional 16 acres, which was required in the TCEQ’s May 20, 2005 letter. Based on the 2005 ASARCO cost estimate, the unit cost is $125,000 per acre. The TECQ cost estimate is $130,000 an acre with a 4% inflation adjustment.

D. Fencing

The installation of a fence as shown on Figure 11 is needed to enclose the northern section of the site to limit public access to the abandoned site. The length of the fence was estimated by measuring distances based on the ASARCO plat. The cost estimate for the fence is based on the measured distance multiplied by the state contracted unit cost of $25 a foot for a standard 6 foot chain link fence (See References - Documents for Cost Estimation #12).

E. Engineering and Construction of Repository Cell 4.

As part of the waste management strategy, an additional waste repository cell will need to be constructed because the third waste cell currently exceeds capacity (See ASARCO Photograph # 4). There is approximately 15,000 cubic yards of excess material from the third cell and about 25,000 cubic yards of Category I material located on the east side of I-10 that are required to be managed and contained in the proposed repository cell 4. The waste to be contained in proposed repository cell 4 is Category I waste which has elevated concentrations of metals with a high potential to leach to groundwater. Figure 2 displays

Category I material which has been excavated and identifies the remaining area that needs to be excavated. Figures 12 & 12-1 show typical cross sections of a repository cell drawing. The cell floor is comprised of a geosynthetic clay liner (GCL), a High Density Polyethylene (HDPE) geomembrane and a geocomposite drainage layer. GCL is a high performance environmental liner comprised of a layer of low-permeability sodium bentonite combined with geosynthetic carriers such as woven and/or nonwoven geotextiles and in some cases polymer geomembrane. In general, GCLs have been proven to provide better engineered performance and durability than several feet of compacted clay with a total composite thickness of less than one quarter of an inch.

The HDPE geomembrane liner is placed on top of the GCL. The combination of the GCL and HDPE liner will create a nearly impermeable barrier that surrounds the buried material. The GCL and HDPE liners prevent the material and liquid generated from the waste (if any) from leaching out of the cell. The HDPE liner has chemical and physical characteristics that are not adversely affected by the placement of waste.

A geocomposite drainage layer is then placed on top of the HDPE liner. The geocomposite layer consists of a drainage net heat that is bonded to one layer or sandwiched between two layers of geotextiles to create a single-sided or double-sided geocomposite. The drainage net provides a layer for the transmission of liquids and/or gases. The geotextile also serves as a filter and separator.

After the waste material is placed into the repository cell, a cell cover is constructed. The cover is comprised of asphalt, with soil, GCL, flexible polyethylene material, and a geocomposite drainage layer underneath the asphalt. The GCL and a flexible polyethylene material will create a nearly impermeable barrier to prevent surface water from coming in contact with the buried material. A geocomposite drainage layer is then placed on top of the polyethylene layer to ensure that any water seeping through the asphalt will drain away from the repository cell. This procedure is commonly used in landfill construction.

The cost estimate for the design and construction of repository cell 4 is based on previous repository cells constructed at the ASARCO smelter. ASARCO has constructed three (3) repository cells and placed approximately 200,000 cubic yards of material in these repository cells at a cost of approximately $6 million according to ASARCO. This relates to a unit cost of $30 per cubic yard of material. However, TCEQ staff believes that ASARCO incurred additional costs associated with these activities such as drying sludge material from the ponds and designing/constructing three (3) separate cells instead of one large cell. The TCEQ estimates a total cost of $5,848,000 to construct another cell and dispose of 303,000 cubic yards. This is a unit cost of $19.30 per cubic yard of material.

The term “minus 50” means that the particles just like a powder and are small enough to pass through a sieve size 50 (a 0.0117 inch opening), which could be subject to wind dispersion. The material from the minus 50 waste pile is subject to leaching metals to the groundwater and to wash out to the Rio Grande. The TCEQ believes the best long term remedial solution for the minus 50 waste pile is to dispose of the fines in a repository cell.

After waste removal and waste placement into repository cell 4, verification sampling and analysis is necessary to verify that all the waste was removed. Due to the size and number of different on-site excavations, an estimated 100 soil samples at a unit cost of $250 per sample/laboratory analysis will be needed to verify waste removal. The unit price is based on the Texas Commission on Environmental Quality "Remedial Investigation and Removal Service Contract" Contract No. 582-6-49221.

F. Long-Term Monitoring of Engineering Control and Groundwater

The cost estimate for long-term monitoring assumes that groundwater samples will be collected and analyzed on a semi-annual basis, using 30 monitor wells to assess the effectiveness of the groundwater treatment system. The cost per groundwater sample is estimated at $150 per sample based on the Texas Commission on Environmental Quality "Remedial Investigation and Removal Service Contract" Contract No. 582-6-49221.

The TCEQ oversight was estimated by assuming the ASARCO project will take up to 10 % of a project manager's time during the course of a year. The agency's actual cost per project manager is approximately $53 an hour. This hourly rate includes salary, insurance, office and other costs associated with a TCEQ employee. Travel cost of $1,000 per year was estimated from previous TCEQ travel costs from Austin to ASARCO El Paso.

Semi-annual site inspections are needed for the long term management strategy to verify effective waste control. The fence, asphalt cap and groundwater treatment system are included in the site inspection. The $5,000 for a contractor to produce semi-annual inspection reports includes costs associated with professionals, field technicians, draftsman, and administrative technicians

The TCEQ assumes that general maintenance/repairs for the fence and the asphalt will be needed over the lifetime of site management. Currently, the smelter operations have ceased but ASARCO staff is still managing the site. Six of eleven employees currently work as on-site security staff. The security staff patrol the perimeter 24 hours per day, 7 days per week, to ensure the security of the facility. When ASARCO no longer owns the facility, there will be no security staff and the TCEQ anticipates the perimeter fence will need to be repaired many times during the year to secure the site. Therefore, 1,300 linear feet out of 13,000 linear foot of fence is estimated for repair on an annual basis. Since the asphalt pavement will not be used for regular street traffic, the pavement should last longer than the normal 10-20 year asphalt road life cycle. The impact of weatherization on the pavement is very difficult to estimate. The TCEQ assumes that 0.5 % of the asphalt will need repair per year.

G. Trustee Management Fee

It is presently contemplated that a trustee will manage the remediation of the site through an environmental custodial trust. A possible pay schedule for these duties is shown in Table 5; however this cost will be separately negotiated with the individual chosen for the position.

H. Present Value of Annuity Calculation

The selection of the future interest rate is critical in determining the amount required to be placed into a trust fund today for future use. It is a common practice to review historical interest rates as the basis for future interest rate projections. Mr. James A. Girola with the U.S. Department of the Treasury published "Research Paper No. 2005-02 The Long-Term Real Interest Rate for Social Security" in March 30, 2005. In the conclusions, Mr. Girola states "This paper has developed alternative approaches for projecting the long-term Social Security real interest rate, including an examination of historical data and estimation of yield curves for the Treasury inflation-indexed market. The examination of historical experience back through 1870 implies that the long-term interest rate is near 3 percent." Three percent (3%) is used for the present value calculation.

The long term monitoring of engineering controls and groundwater contaminant and treatment means these functions will be performed in perpetuity. The present value calculation shown in Table 5 indicates there is no significant change on the value once it reaches 400 years; therefore, the value of 33.333 is used for the calculation.

VI. Conclusion

The primary goal of management remedies selected for the ASARCO El Paso smelter is to protect human health and the environment. Table 3 is an itemized summary of estimated remediation costs. In additional to the justifications referenced above, these cost estimates are also based on best professional judgment for a project of this size.

Estimated cost for demolition of structures	$ 8,883,799
Estimated cost for groundwater management and treatment	$ 21,868,372
Estimated cost for asphalt paving	$ 9,815,000
Estimated cost for additional fencing	$ 68,628
Estimated cost for design, construction and disposal into repository cell 4	$ 5,848,000
Estimated cost for long-term monitoring of engineering control and groundwater	$ 3,284,095
Trustee Management Fee	$ 2,237,293
TOTAL Cost of Remediation Project	$ 52,005,186

VII. List of References

DOCUMENTS FOR ENVIRONMENTAL ASSESSMENT

TCEQ Agreed Order Docket No. 96-0212-MLM-E, Assessing Administrative Penalties and Requiring Corrective Actions of ASARCO Incorporated. August, 1996

ASARCO El Paso Copper Smelter Remedial Investigation Report. Volumes I - IV October, 1998

Consent Decree Attorney General of the United States, United States Environmental Protection Agency (EPA) and the State of Texas, Civil Action No. H-99-1136 April, 1999

ASARCO El Paso Copper Smelter Phase II Remedial Investigation Report. Volumes I - IV July, 2000

ASARCO El Paso Copper Smelter Phase III Remedial Investigation Report. Volumes I - V November, 2001

ASARCO letter which includes proposed Area of Contamination (AOC) Map and analytical results. April, 2003

ASARCO El Paso Copper Smelter Phase IV Remedial Investigation Report. Volumes I - II November, 2003

TCEQ Conditional Approval and Corrective Action Directive letter for ASARCO El Paso Smelter. May 20, 2005

Remedial Waste Repository Design ASARCO Incorporated El Paso, Texas. January, 2006

DOCUMENTS FOR COST ESTIMATION

TxDot Statewide and District average low bid price Available at http://www.txdot.state.tx.us/business/avgd.htm

City of El Paso Public Work Bid Price Available at http://www.elpasotexas.gov/financial_services/bid_tabs.asp

Federal Remediation Technologies Roundtable Available at http://costperformance.org/

Texas Commission on Environmental Quality “Remedial Investigation and Removal Service Contract” Contract No. 582-6-49221

Texas Commission on Environmental Quality "Superfund Engineering Service Contract" Contract No. 582-8-79656

Federal Reserve Bank of Minneapolis for CPI & financial data Available at http://www.minneapolisfed.org/community_education/teacher/calc/hist1913.cfm

James A. Girola "The Long-Term Real Interest Rate for Social Security" Research Paper No. 2005-02, March 30, 2005 Department of Treasury Available at http://www.treasury.gov/offices/economic-policy/long_term_rates_socialsecurity.pdf

Fred Weston & Eugene F. Brigham "Managerial Finance" Six Edition, the Dryden Press, Page 257

C. W. Fetter "Applied Hydrogeology" Second Edition, Macmillan Publishing Company, Page 68

CDM "Engineering Evaluation and Cost Analysis for Expansion of ASARCO EL Paso Groundwater Remediation" February 2008

FY 06 Remedial Investigation and Removal Services Contract with SHAW Environmental, Inc. [Contract Number 582-6-49221] Pay item Number 8.04.0501-01

Environcon - 101 International Way, Missoula, MT 59808 Tel: (406) 523-1150 (Slurry Wall cost)

Remedial Construction Services (Recon),9720 Derrington, Houston, Texas 77064. Tel: (281)955-2442. (Slurry Wall cost)

EPA Publication 540/2-84-001 "Slurry Trench Construction for Pollution Migration Control" February 1984

EPA Publication 542-R-02-004 "Arsenic Treatment Technologies for Soil Waste and Water" 2002.

EPA Publication EPA-542-S-02-002 "Proven Alternatives for Aboveground Treatment of Arsenic in Groundwater" revised October, 2002

ARACDIS "Construction Technical Specifications Remedial Waste Repository Design ASARCO Incorporated El Paso, Texas" September 12, 2005

United States Geological Survey "Geologic Atlas of the United States El Paso Folio" Folio 166 published 1909.

TABLES

TABLE 1 SURFACE WATER SAMPLING RESULTS

Mean Daily Discharge rate		Standard apply to surface water		0.01	0.005	0.1	1.3	N/A	0.015	0.05	N/A
		Location	**Date**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Iron**	**Lead**	**Selenium**	**Zinc**
Rio Grande River											
0.44 m^3/s	116 Gallon/s	Sep-9 (Up Stream)	2/14/2005	0.012	0.001	0.01	0.01	0.1	0.001	0.005	0.031
		Sep-10	2/14/2005	0.048	0.001	0.01	0.01	0.1	0.001	0.0079	0.024
		Sep-11	2/14/2005	0.046	0.001	0.01	0.01	0.1	0.001	0.0089	0.02
		Sep-2	2/14/2005	0.058	0.001	0.01	0.01	0.1	0.001	0.011	0.02
		Sep-12	2/14/2005	0.057	0.001	0.01	0.01	0.1	0.001	0.011	0.02
		Sep-13 (Down Stream)	2/14/2005	0.049	0.001	0.01	0.028	0.1	0.0087	0.005	0.02
American Canal (Rio Grande Flow at 0.46 m3/s or 121 Gallon/sec)											
		Sep-7 (Up Stream)	2/8/2005	0.013	0.001	0.01	0.01	0.1	0.001	0.005	0.037
		Sep -1	2/8/2005	0.012	0.001	0.01	0.01	0.1	0.001	0.005	0.051
		Sep - 3	2/8/2005	0.019	0.001	0.01	0.01	0.1	0.001	0.005	0.038
		Sep - 6 (Down Stream)	2/8/2005	0.020	0.001	0.01	0.011	0.31	0.0046	0.005	0.032
Rio Grande River											
23.3 m^3/s	6155 Gallon/sec	Sep-9 (Up Stream)	9/1/2005	0.006	0.001	0.01	0.01	0.1	0.01	0.005	0.01
		Sep-10	9/1/2005	0.006	0.001	0.01	0.01	0.14	0.01	0.005	0.01
		Sep-11	9/1/2005	0.018	0.001	0.01	0.01	0.13	0.01	0.005	0.01
		Sep-2	9/1/2005	0.015	0.001	0.01	0.01	0.16	0.01	0.006	0.01
		Sep-12	9/1/2005	0.006	0.001	0.01	0.01	0.12	0.01	0.005	0.01
		Sep-13	9/1/2005	0.008	0.001	0.01	0.01	0.15	0.01	0.005	0.01
		Sep-4 (Down Stream)	9/1/2005	0.006	0.001	0.01	0.01	0.12	0.01	0.005	0.01
American Canal											
		Sep-7 (Up Stream)	9/1/2005	0.005	0.001	0.01	0.01	0.13	0.01	0.005	0.01
		Sep -1	9/1/2005	0.005	0.001	0.01	0.01	0.11	0.01	0.005	0.01
		Sep - 3	9/1/2005	0.005	0.001	0.01	0.01	0.11	0.01	0.005	0.01
		Sep - 6 (Down Stream)	9/1/2005	0.005	0.001	0.01	0.01	0.16	0.01	0.005	0.01
Rio Grande River											
0.69 m^3/s	182 Gallon/sec	Sep-9 (Up Stream)	2/15/2006	0.007	0.001	0.01	0.01	0.03	0.003	0.005	0.03
		Sep-10	2/15/2006	0.109	0.001	0.01	0.01	0.03	0.003	0.02	0.02
		Sep-11	2/15/2006	0.067	0.001	0.01	0.01	0.06	0.003	0.016	0.01
		Sep-2	2/15/2006	0.109	0.001	0.01	0.01	0.05	0.003	0.027	0.01
		Sep-12	2/15/2006	0.123	0.001	0.01	0.02	0.09	0.007	0.021	0.02
		Sep-13	2/15/2006	0.139	0.001	0.01	0.01	0.04	0.003	0.017	0.01
		Sep-4 (Down Stream)	2/15/2006	0.123	0.001	0.01	0.02	0.1	0.007	0.017	0.02
American Canal											
		Sep-7 (Up Stream)	2/14/2006	0.009	0.001	0.01	0.01	0.03	0.003	0.005	0.02
		Sep -1	2/14/2006	0.007	0.001	0.01	0.01	0.03	0.003	0.005	0.02
		Sep - 3	2/14/2006	0.012	0.001	0.01	0.01	0.03	0.003	0.005	0.02
		Sep - 6 (Down Stream)	2/14/2006	0.012	0.001	0.01	0.01	0.03	0.003	0.005	0.02
American Canal (Rio Grande Flow at 17.40 m3/s or 4597 G/s)											
		Sep-7 (Up Stream)	8/15/2006	0.01	0.001	0.01	0.012	1.33	0.005	0.01	0.024
		Sep -1	8/15/2006	0.01	0.001	0.01	0.016	3.87	0.005	0.01	0.031
		Sep - 3	8/15/2006	0.01	0.001	0.01	0.012	3.95	0.005	0.01	0.029
		Sep - 6 (Down Stream)	8/15/2006	0.01	0.001	0.01	0.013	4.2	0.005	0.01	0.031
Rio Grande River											
1.05 m^3/s	277 Gallon/sec	Sep-9 (Up Stream)	1/10/2007	0.0049	0.003	0.0036	0.005	0.067	0.0031	0.005	0.032
		Sep-10	1/11/2007	0.083	0.003	0.0036	0.0013	1.19	0.0031	0.005	0.0007
		SEP-10+S500	1/11/2007	0.0049	0.0003	0.0036	0.007	1.78		0.005	0.0007
		Sep-11	1/11/2007	0.0049	0.002	0.0036	0.01	2.66	0.038	0.005	0.005
		Sep-2	1/10/2007	0.099	0.003	0.0036	0.006	0.568	0.0031	0.005	0.006
		Sep-12	1/11/2007	0.178	0.003	0.0036	0.005	0.458	0.017	0.005	0.0007
		Sep-13	1/11/2007	0.178	0.003	0.0036	0.008	1.05	0.0031	0.005	0.0007
		Sep-4 (Down Stream)	1/10/2007	0.179	0.003	0.0036	0.011	0.459	0.0031	0.005	0.022
American Canal											
		Sep-7 (Up Stream)	1/10/2007	0.0049	0.003	0.0036	0.005	0.234	0.01	0.067	0.026
		Sep -1	1/10/2007	0.047	0.002	0.0036	0.006	0.394	0.0031	0.005	0.014
		Sep - 3	1/10/2007	0.071	0.002	0.0036	0.005	0.191	0.0031	0.005	0.02
		Sep - 6 (Down Stream)	1/10/2007	0.0049	0.002	0.0036	0.004	0.203	0.0031	0.005	0.018
Rio Grande River											
22.30 m^3/s	5892 Gallon/s	Sep-9 (Up Stream)	8/14/2007	0.0043	0.0014	0.005	0.009	4.21	0.0074	0.0131	0.056
		Sep-10	8/14/2007	0.0043	0.0014	0.004	0.008	3.92	0.0074	0.0131	0.041
		Sep-11	8/14/2007	0.0043	0.0014	0.005	0.012	5.45	0.0074	0.0131	0.056
		Sep-2	8/14/2007	0.0043	0.0014	0.005	0.01	4.63	0.0074	0.0131	0.074
		Sep-12	8/14/2007	0.0043	0.0014	0.004	0.01	4.15	0.0074	0.0131	0.064
		Sep-13	8/14/2007	0.0043	0.0014	0.004	0.01	4.27	0.0074	0.0131	0.059
		Sep-4 (Down Stream)	8/14/2007	0.0043	0.0014	0.005	0.011	4.35	0.0074	0.0131	0.105

TABLE 1 SURFACE WATER SAMPLING RESULTS

Mean Daily Discharge rate	Standard apply to surface water		0.01	0.005	0.1	1.3	N/A	0.015	0.05	N/A
	Location	Date	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Selenium	Zinc
American Canal										
	Sep-7 (Up Stream)	8/14/2007	0.0043	0.0014	0.004	0.009	4.27	0.0074	0.0131	0.034
	Sep -1	8/14/2007	0.0043	0.0014	0.0009	0.011	5.09	0.0074	0.0131	0.056
	Sep - 3	8/14/2007	0.0043	0.0014	0.005	0.011	4.39	0.028	0.0131	0.078
	Sep - 6 (Down Stream)	8/14/2007	0.0043	0.0014	0.005	0.012	4.9	0.0074	0.0131	0.057

Rio Grande Historical mean daily discharge average at '08-3640.00 Rio Grande (Courchesne Bridge), El Paso, TX

http://www.ibwc.state.gov/Water_Data/histflo1.htm

According to USGS web site, the gaging station on the downstream side of the Courchesne bridge, 5.6 miles upstream from the Santa Fe Street-Juarez Avenue bridge between El Paso, TX and Cd. Juarez, Chihuahua, at mile 1,249 and 1.7 miles upstream from the American Dam. Discharge is measured by the International Boundary and Water Commission.

http://pubs.usgs.gov/wri/wri014255/table2.htm

Table 2

Estimated Volume of Category I Material for Disposal

Minus 50 Slag Pile

600’x287’x40’	6,888,000 ft^3
6,888,000ft^3/27ft^3 per cubic yard	255,111 yd^3

Abrasive Blasting Area

(400’x75’x2’)/2	30,000 ft^3
30,000 ft^3/27ft^3 per cubic yard	1,111 yd^3

Estimated Area underneath process buildings and product area

298,700 sq ft.	Excavate 2 feet beneath buildings
(298,700 sq ft.) x 2’	597,400 ft^3
597,400 ft^3/27ft^3 per cubic yard	22,125 yd^3

Estimated Category I soils that are left to be excavated from May 20, 2005 directive

(400’x 350’x 5’)	700,000 ft^3
700,000 ft^3/27ft^3 per cubic yard	25,925 yd^3

TABLE 3 COST ESTIMATE WASTE MANAGEMENT

Asarco El Paso Smelter - Cost Estimate For Waste Management [Present Value Calculation]
Sitewide Evaluation - June 2008
El Paso, Texas

Item Description	Quantities	units	Unit Price	Total
Demolition of Structures [One time]				
Demolition of Structures (steel)	264,141	sq. ft.	$11	$2,905,551
Demolition of Structures (Brick and concrete)	191,157	sq. ft.	$17.50	$3,345,248
Demolition of Structures (Wood railroad trussel)	40,025	sq. ft.	$40	$1,601,000
Demolition of Structures (I-10 Bridge and Slag bridge)	17,625	sq. ft.	$16	$282,000
Demolition of two Smokestacks	1	Lump Sum	$750,000	$750,000
Subtotal of demolition of structure				
Groundwater [construction and 50 years operation]				
Construction [One time]				
Slurry Wall (Bentonite soil mix, 3 feet wide) Design and installation	3,000	feet	$590	$1,770,000
Additional Extraction Wells will use existing wells whenever possible	50	well	$4,500	$225,000
Injection Well (800 foot injection well for discharge of treated groundwater)	1	well	$100,000	$100,000
Design and Construction of Groundwater Treatment system	1	system	$5,000,000	$5,000,000
Subtotal of Groundwater construction				
Continuous operation [Use annuity factor of 25.72976 for 50 years operation]				
Operation and Maintenance	*25.72976*	Annual Cost	$563,600	$14,501,293
Monitor Well Plugging and Abandonment [0ne time charge 50 years later, using Present Value factor of 0.22811]	*0.22811*	Lump Sum	$64,800	$14,782
Semi-annual groundwater reports [2 reports per year @ $5000 per report]	25.72976	Annual Cost	$10,000	$257,298
Subtotal of Groundwater operation				**$14,773,372**
Subtotal of Groundwater construction and operation				**$21,868,372**
Asphalt Paving to manage exposure [One time]				
Acreage left to be paved from May 20, 2005 Corrective Action Directive letter	16	acres	$130,000	$2,080,000
Former Building and Process footprint	59.50	acres	$130,000	$7,735,000
Subtotal of asphalt paving				**$9,815,000**
Fencing to control access in Northern Section of the Smelter [One time]	2800	feet	$25	**$68,628**
Engineering Design and Construction of Disposal unit Repository Cell 4 [One time]				
Engineer and Construction of Cell 4 for disposal of:	1	Cell	$4,000,000	$4,000,000
Minus 50 Slag waste pile (255,111 cubic yds)				
Abrasive Blasting Area (1,111 cubic yds.)				
Soil underneath Process area (20,000 cubic yds Estimated)				
Category I soils from May 5, 2005 letter (25,000 cubic yds Estimated)				
Excavation and Disposal of material in Cell 4 [One time]	303,000	cubic yds.	$6	$1,818,000
Verification of Waste Excavation of materials to Cell 4	100	soil samples	$250	$25,000
Completion Report	1	report	$5,000	$5,000
Subtotal of design and construction of disposal unit cell 4				**$5,848,000**
Long term monitoring of engineering control and groundwater [Use annuity factor of 33.333 for perpetuity]				
Annual site inspection report is covered under the groundwater report for the first 50 years	0	reports	$0	$0
Monitoring and Sampling (Management of Waste) 30 wells biannual ($150 per sample)	*33.333*	Annual Cost	$9,000	$299,997
TCEQ Oversight	*33.333*	Annual Cost	$11,024	$367,463
TCEQ travel (once a year)	*33.333*	Annual Cost	$1,000	$33,333
Annual site inspection report [Present Value of 350 years annuity factor of 33.332]	*33.332*	Annual Cost	$5,000	$166,660
General repairs per year (Fence and Asphalt Cap)				
Assume 10% of fence is required repair [1300 lf x $25 LF]	*33.333*	Annual Cost	$32,500	$1,083,323
Assume 0.5% of 98 Acres asphalt cover is required repair [$2.00/sf x 20,000 SF]	*33.333*	Annual Cost	$40,000	$1,333,320
Subtotal of long term monitoring				**$3,284,095**
SUBTOTAL FOR WASTE MANAGEMENT				**$49,767,893**
Trustee Management				
Fee for one time charge	1	Lump Sum	$1,253,907	$1,253,907.00
Fee for 50 years groundwater operation	*25.72976*	Annual Cost	$28,680	$737,929.52
Fee for 350 yrs Long term monitoring	*33.332*	Annual Cost	$7,364	$245,456.85
Subtotal of Trustee Management Fee				**$2,237,293.00**
TOTAL FOR WASTE MANAGEMENT AND TRUSTEE COSTS				**$52,005,186.00**

Table 4

Asarco El Paso Smelter - Cost Estimate Waste Management [Present Value Calculation]
Groundwater Treatment Plant Operation & Maintenace Estimation - June 2008
El Paso, Texas

Description	Unit	Unit Price	Quantities	Sub-Total	Explanation
O&M (Routine)					
Continuous Treatment System Operation	Hour	$ 92.42	2040	$ 188,536.80	Continuous Operation of Treatment Plant (40 hours per week/51 weeks)
Repair of Treatment System	Tbn	$ 25,000.00	1	$ 25,000.00	Estimated repair costs
Project Manager	Hour	$ 124.42	12	$ 1,493.04	1 hour per month for site review
Junior Scientist	Hour	$ 59.10	24	$ 1,418.40	2 hours per month for Plant inspection site visit including travel
Field Technician	Hour	$ 48.00	306	$ 14,688.00	6 hours per week to assist groundwater treatment plant operator
			Subtotal	$ 231,136.24	
O&M (Non-Routine)					
Project Manager	Hour	$ 124.42	4	$ 497.68	
Junior Scientist	Hour	$ 59.10	25	$ 1,477.50	Research and communication of non-routine shutdowns
Groundwater Treatment Plant Operator	Hour	$ 60.88	140	$ 8,523.20	After hours (weekends and nights)
Field Technician	Hour	$ 48.00	90	$ 4,320.00	After hours (weekends and nights)
			Subtotal	$ 14,818.38	
Sample Collection and Analyses					
Influent & Effluent water Samples	Sample	$ 65.92	102	$ 6,723.84	102 weekly influent and effluent samples (2x51=102)
Bi-annual Groundwater Sample from Well using Bailer	Sample	$ 313.35	100	$ 31,335.00	quarterly pumping well samples (50x2=100)
14 Day TAT 3010/6020W RCRA Metal by ICP-MS (EPA 6020A) with Aqueous, Acid Digestion for Total Metals by ICP (EPA 3010A)	Sample	$ 116.50	242	$ 28,193.00	Influent/Effluent Sampling + Bi-annual sampling evens + QA/QC samples + Sluge sampling
TCLP collection, sampling & analysis	Sample	$ 300.00	4	$ 1,200.00	
RCRA Metals Field Test Sample Kit	Lump Sum	$ 5,000.00	1	$ 5,000.00	Cr field test kit; Daily Hach Testing of Inf/Eff and monthly testing of pumping wells
Misc for sampling events	Hour	$ 1,000.00	4	$ 4,000.00	5 hours travel for semi-annual sampling x 2 events
			Subtotal	$ 76,451.84	
Waste Handling and Disposal					
Disposal of Sludge	Lump Sum	$ 35,000.00	1	$ 35,000.00	
Miscellaneous Work - Roll-off box rental	Lump Sum	$ 4,000.00	1	$ 4,000.00	
			Subtotal	$ 39,000.00	
Reporting					
Monthly Treatment System Report	Each	$ 1,175.71	12	$ 14,108.52	Monthly O&M Report
Maps, Tables, Figures or Drawings Not Otherwise Specified	Each	$ 270.00	3	$ 810.00	Pumping (2) and Static (1) Condition GW Gradient Maps for semi annual MW gauging
Maps, Tables, Figures or Drawings Not Otherwise Specified	Each	$ 270.00	8	$ 2,160.00	Cr Concentration Map (2), Intermediate (2) and Shallow (2) Isoconcentration Maps, Recovered/Injected Map (2) (0.5 PM time, 2 hours Junior Scientist time, and 2 hours CAD Operator and includes fixed fee)
Data Review, 7-Day, All Methods, <=10 Project Samples	Each	$ 705.71	12	$ 8,468.52	Monthly Data Review of one Inf/Eff sample data package
Data Review, 7-Day, All Methods, >10 Project Samples	Each	$ 1,066.62	6	$ 6,399.72	Data Review of semi-annual MW sampling; 3 data reviews per event
Data Validation, 7-Day, Metals	Each	$ 2,070.13	4	$ 8,280.52	Data Validation of 2 Inf/Eff data packages and 2 semi-annual data packages
			Subtotal	$ 40,227.28	
Miscellaneous					
Forklift & other equipment rental	Tbn	$ 5,000.00	1	$ 5,000.00	
Shipping Costs	Tbn	$ 3,200.00	1	$ 3,200.00	Estimated shipping costs for sampling and reporting
Utilities		$ 36,000.00	1	$ 36,000.00	Estimated utility costs
Plant Chemicals (Ferrous, Caustic, HCl, Nalclear)	Tbn	$ 56,000.00	2	$ 112,000.00	
Shop/Office Supplies	Tbn	$ 2,000.00	1	$ 2,000.00	
Light Vehicle Mileage Rate	Mile	$ 0.530	7120	$ 3,773.60	
Subtotal Equipment and Materials				$ 161,973.60	
Annaul Groundwater Treatment Plant Operation Estimated Cost		**TOTAL**		**$ 563,600.00**	

TABLE 5 PRESENT VALUE & TRUSTE FEE CALCULATION

Present Value of an Annuity of $1 (PVIF $_a$)

Based on J. Fred Weston & Eugene F. Brigham "Managerial Finance" Six Edition

$A_{N/r} = \$1\ [\ 1- (1+ r)^{-N} / r]$ Where N = Period; r = Interest rate

Years / Interest Rate	1.00%	2.00%	**3.00%**	4.00%
10	9.4713	8.98259	8.5302	8.1109
20	18.04555	16.35143	14.87747	13.59033
30	25.80771	22.39646	19.60044	17.29203
40	32.83469	27.35548	23.11477	19.79277
50	39.19612	31.42361	**25.72976**	21.48218
60	44.95504	34.76089	27.67556	22.62349
70	50.16851	37.49862	29.12342	23.39451
80	54.88821	39.74451	30.20076	23.91539
90	59.16088	41.58693	31.00241	24.26728
100	63.02888	43.09835	31.59891	24.505
200	86.33136	49.04734	33.24309	24.9902
300	94.94655	49.8685	33.32864	24.99981
350	96.92731	49.95114	33.33226	24.99997
400	98.13168	49.98185	**33.33309**	25
500	99.30926	49.99749	33.33332	25

The long term monitoring and maintenance will be performed in perpetuity, there is no significant change on the vaule once it reaches 400 years. Therefore, the value of 33.333 is used for perpetuity.

Present Value of $1 (PVIF) $P_o = \$1\ [\ 1/(1+ r)^{N}]$ Where N = Period; r = Interest rate

Years / Interest Rate	1.00%	2.00%	**3.00%**	4.00%
10	0.90529	0.82035	0.74409	0.67556
20	0.81954	0.67297	0.55368	0.45639
30	0.74192	0.55207	0.41199	0.30832
40	0.67165	0.45289	0.30656	0.20829
50	0.60804	0.37153	**0.22811**	0.14071

Trustee Fee Calculation

According to National Associationof Bankruptcy Trustee for the following fee information:

Dollar Range	Amount	Compesnate Rate	Fee	Accumulated Fee
First $5,000	$5,000	25.00%	$1,250	
$5,000 - $50,000	$45,000	10.00%	$4,500	$5,750
$50,000 - $1,000,000	$950,000	5.00%	$47,500	$53,250
Above $1,000,000		3.00%		

Managmenet Amount	$41,021,909			Management Fee
First $1,000,000				$53,250
Amount above $50,000	$40,021,909	3.00%	$1,200,657	$1,253,907
Managmenet Amount	$82,274			Management Fee
First $50,000				$5,750
Amount above $50,000	$32,274	5.00%	$1,614	$7,364
Managmenet Amount	$655,874			Management Fee

The first $82,274 is covered by the 400 years O&M, the remaining $491,326 is subjected the management fee @ 5%

Amount above $82274	$573,600	5.00%	$28,680	$28,680

FIGURES

ASARCO

Figure 1

Figure 2 Category I Material Location Map

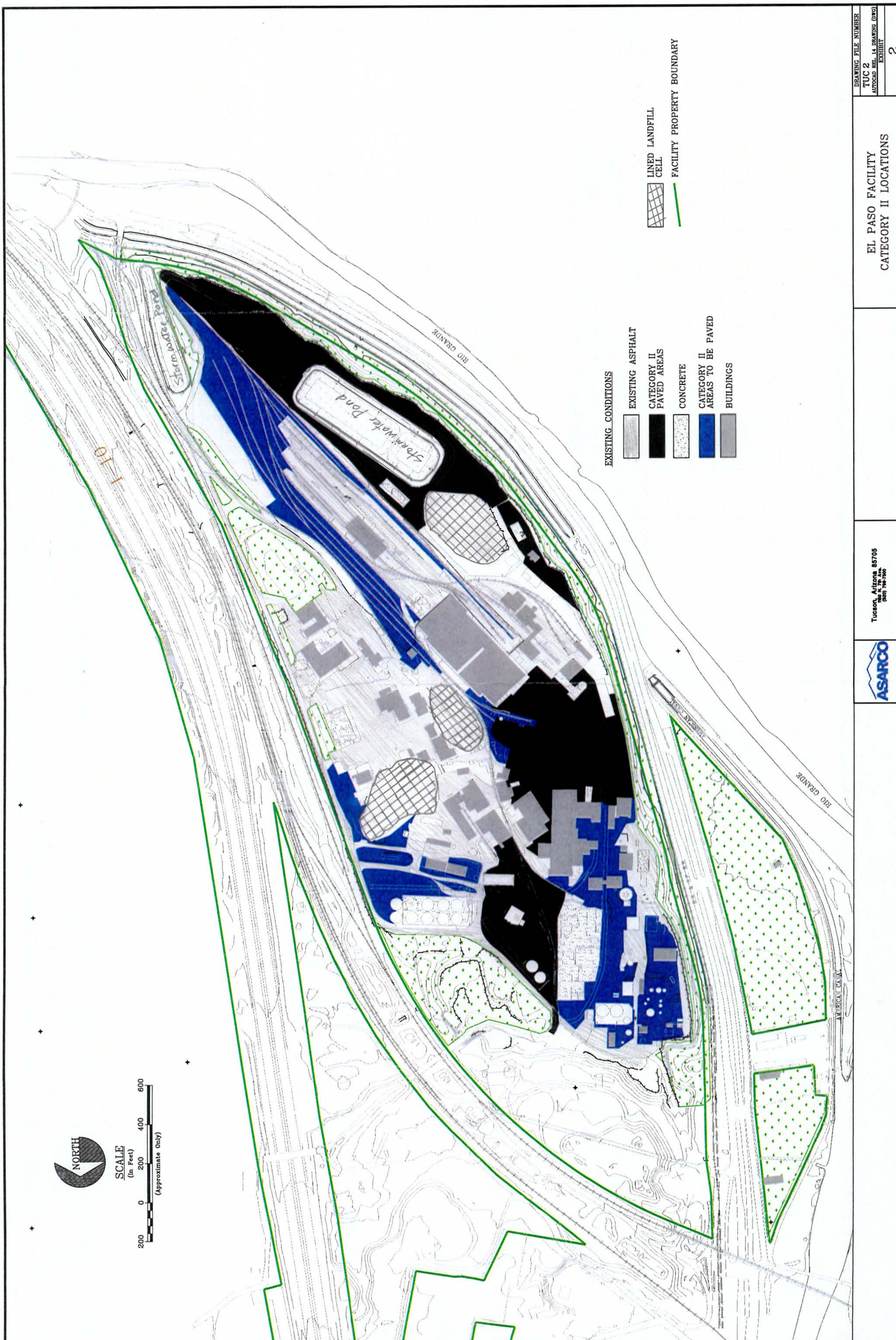
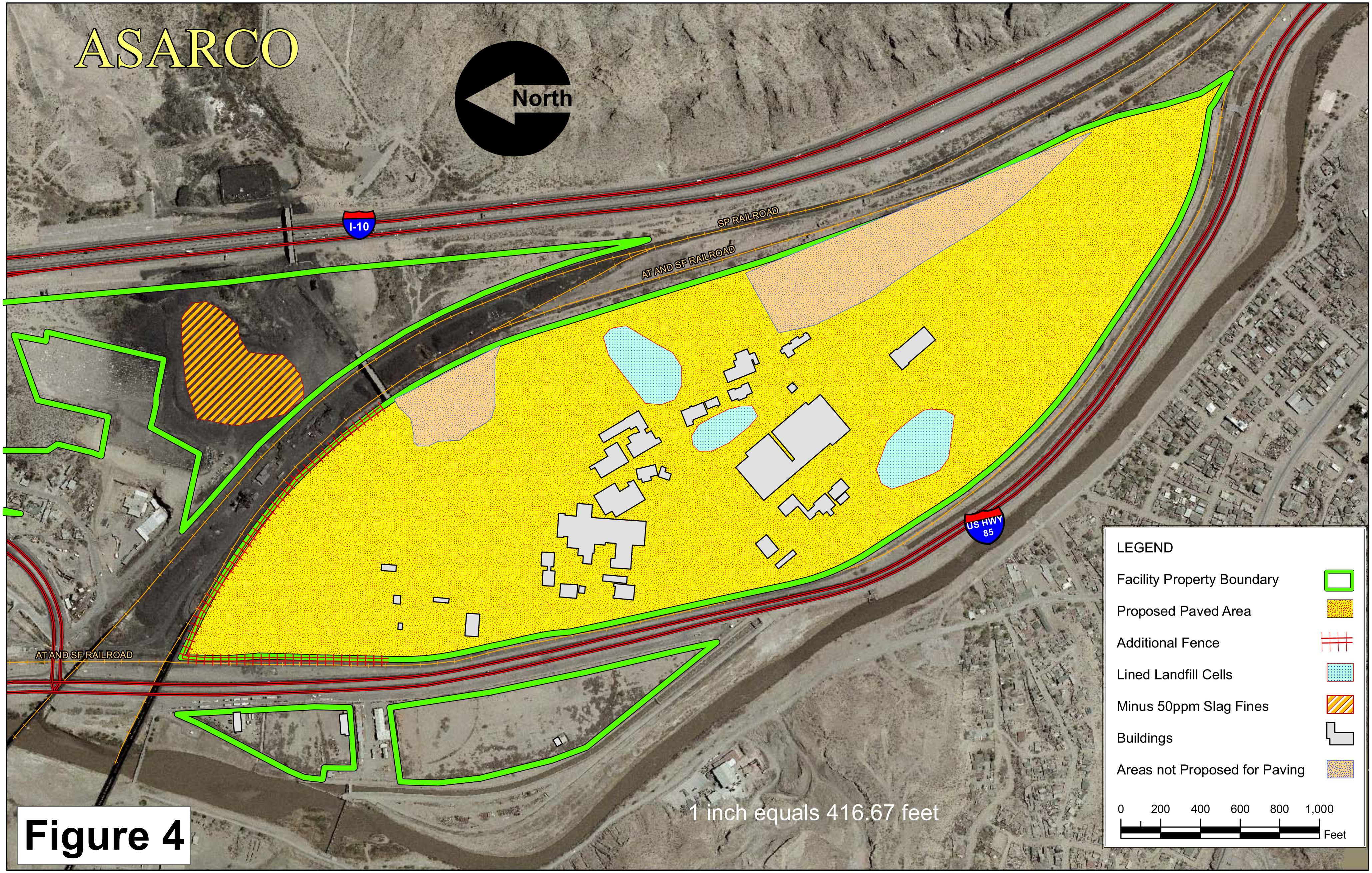
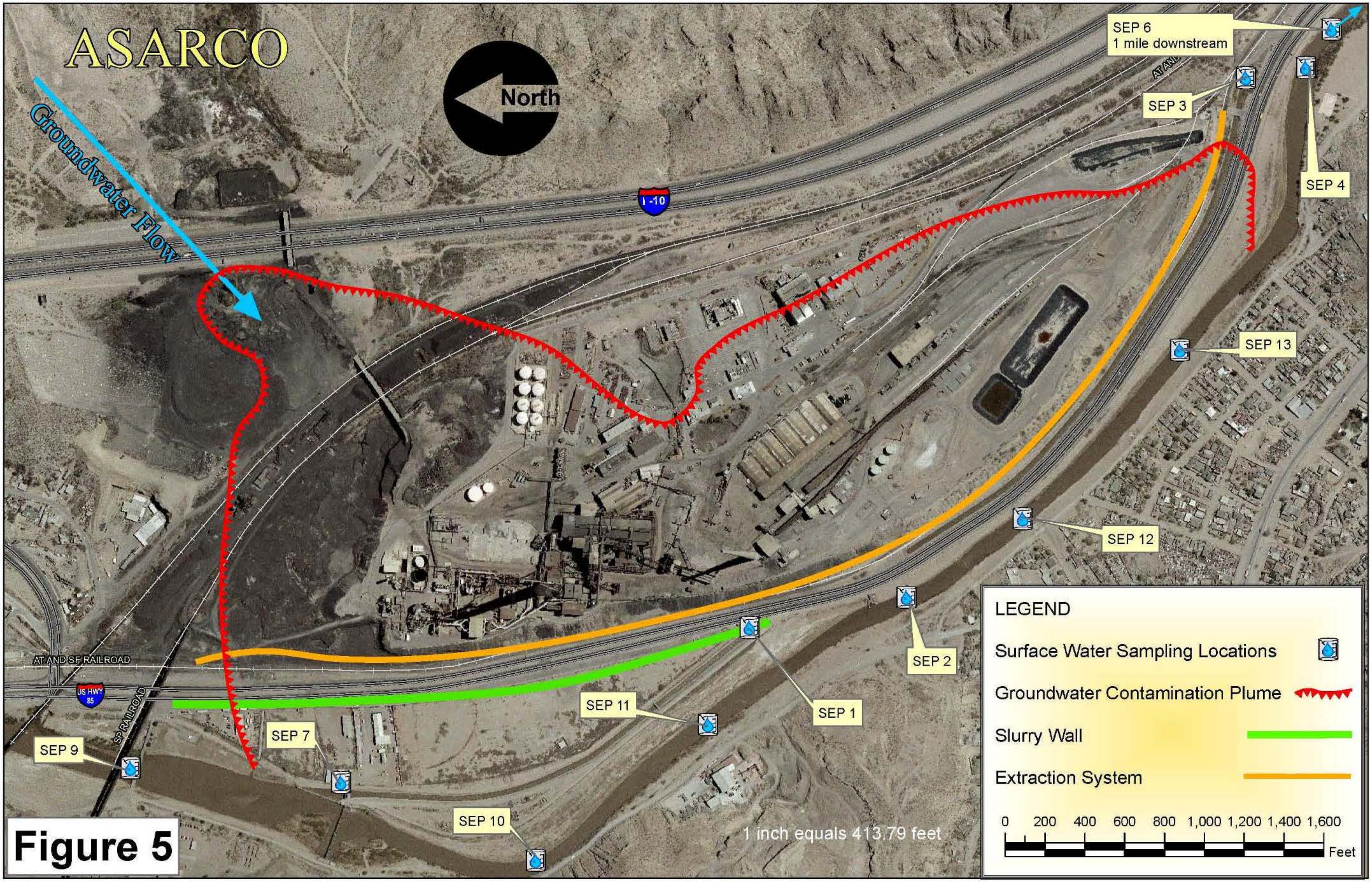


Figure 3 Category II and Asphalt Paving Location Map


ASARCO
North
I-10
SP RAILROAD
AT AND SF RAILROAD
AT AND SF RAILROAD
US HWY 85
1 inch equals 416.67 feet
LEGEND
Facility Property Boundary
Proposed Paved Area
Additional Fence
Lined Landfill Cells
Minus 50ppm Slag Fines
Buildings
Areas not Proposed for Paving
0 200 400 600 800 1,000
Feet
Figure 4


ASARCO
North
Groundwater Flow
I-10
SEP 6
1 mile downstream
SEP 3
SEP 4
SEP 13
SEP 12
SEP 2
SEP 1
SEP 11
SEP 7
SEP 9
SEP 10
AT AND SF RAILROAD
US HWY 85
SP RAILROAD
1 inch equals 413.79 feet
LEGEND
Surface Water Sampling Locations
Groundwater Contamination Plume
Slurry Wall
Extraction System
0 200 400 600 800 1,000 1,200 1,400 1,600
Feet
Figure 5

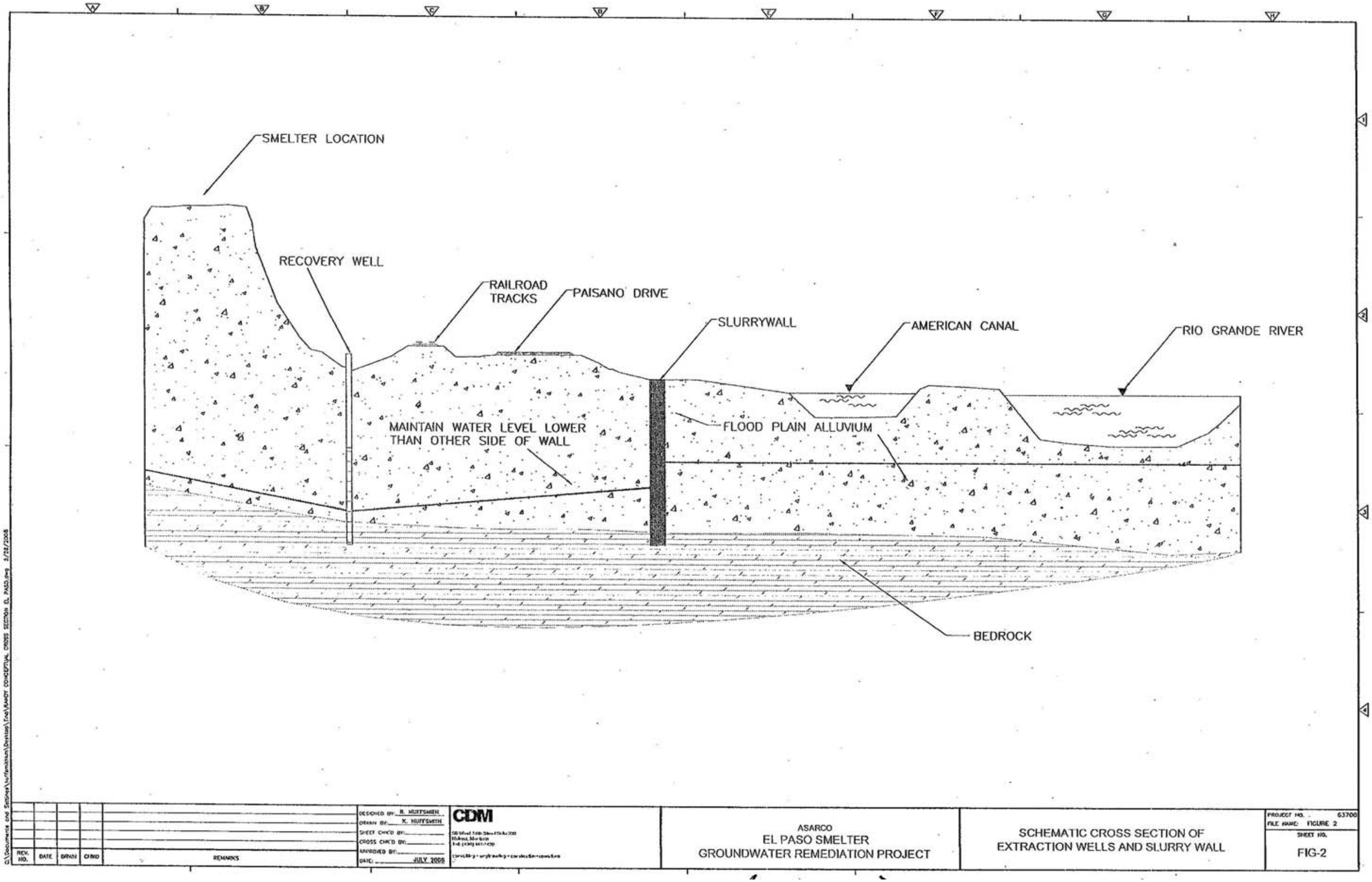

SMELTER LOCATION
RECOVERY WELL
RAILROAD TRACKS
PAISANO DRIVE
SLURRYWALL
AMERICAN CANAL
RIO GRANDE RIVER
MAINTAIN WATER LEVEL LOWER THAN OTHER SIDE OF WALL
FLOOD PLAIN ALLUVIUM
BEDROCK
REV. NO.
DATE
DRWN
CHKD
REMARKS
DESIGNED BY: R. HUFFSMITH
DRAWN BY: K. HUFFSMITH
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JULY 2008
CDM
ASARCO
EL PASO SMELTER
GROUNDWATER REMEDIATION PROJECT
SCHEMATIC CROSS SECTION OF
EXTRACTION WELLS AND SLURRY WALL
PROJECT NO. 63700
FILE NAME: FIGURE 2
SHEET NO.
FIG-2

FIGURE 6

SHAPE OF SINGLE WELL DRAWDOWN

NO PUMPING

PUMPING WITH CONE OF DEPRESSION

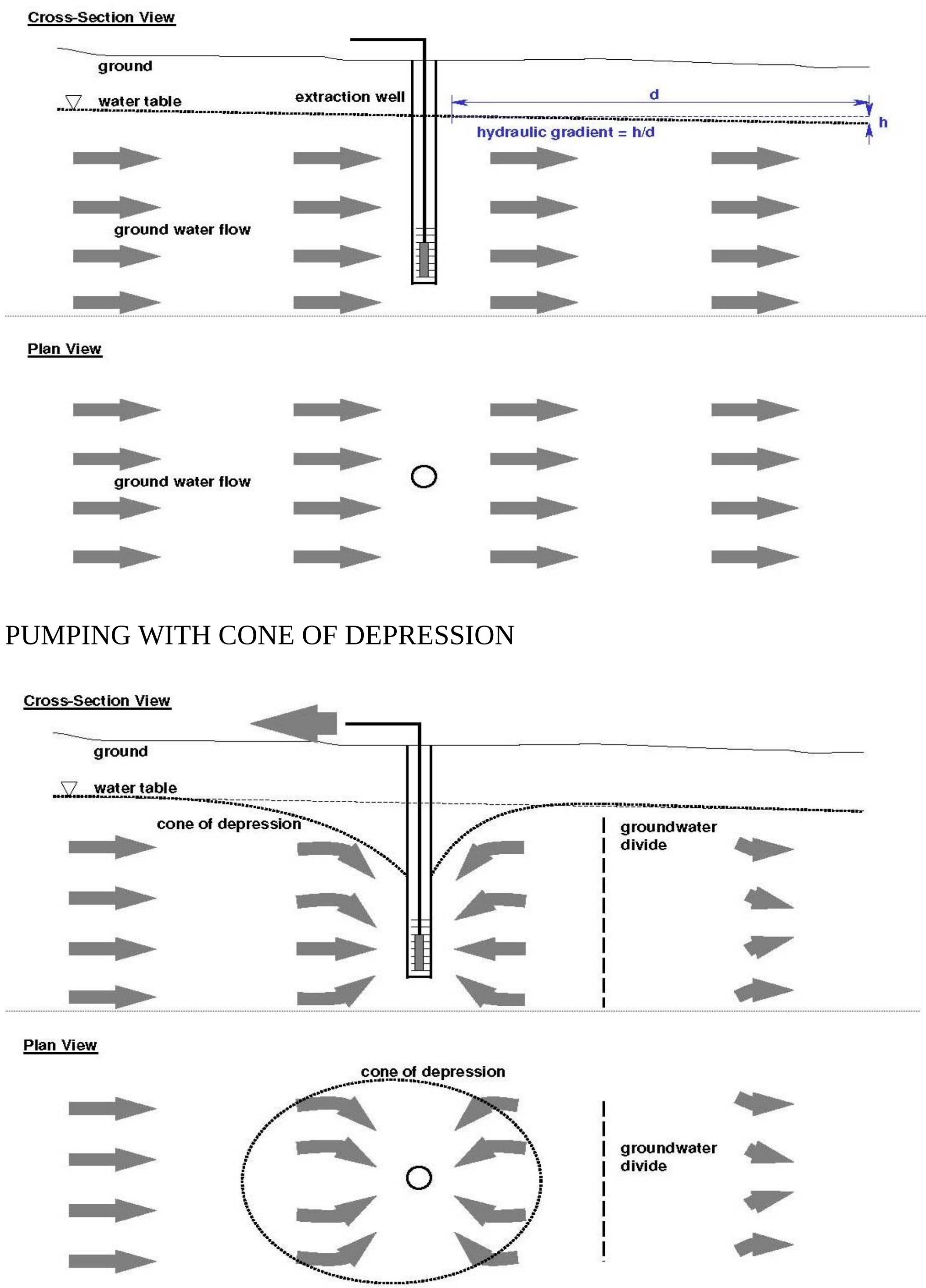
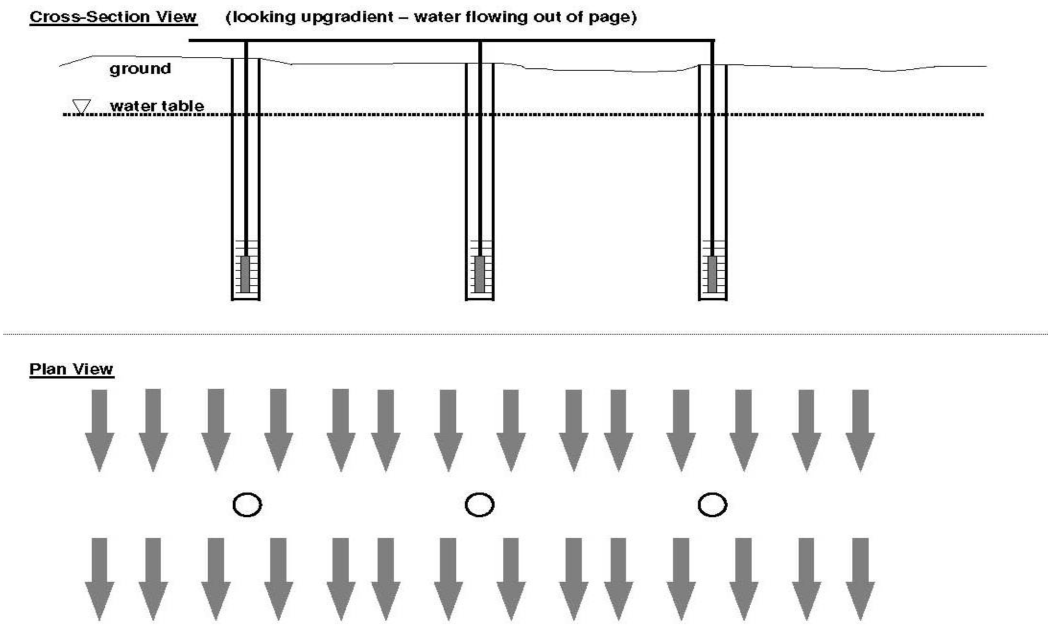


Figure 7

SHAPE OF MULTIPLE WELLS DRAWDOWN

NO PUMPING



PUMPING WITH CONE OF DEPRESSION

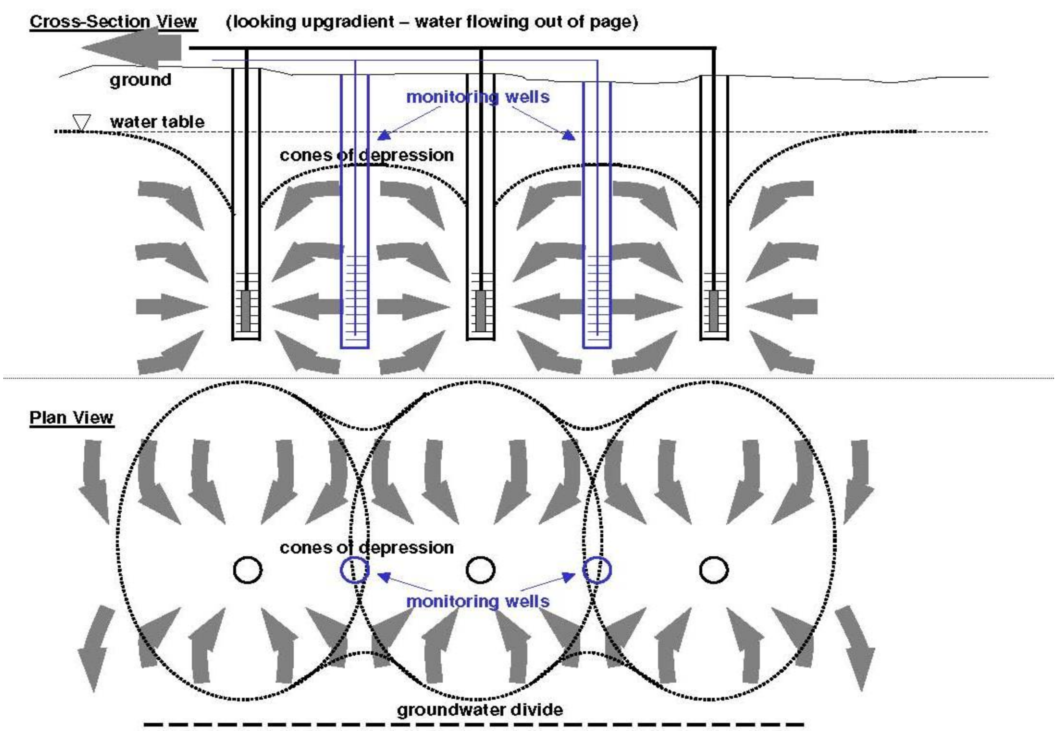
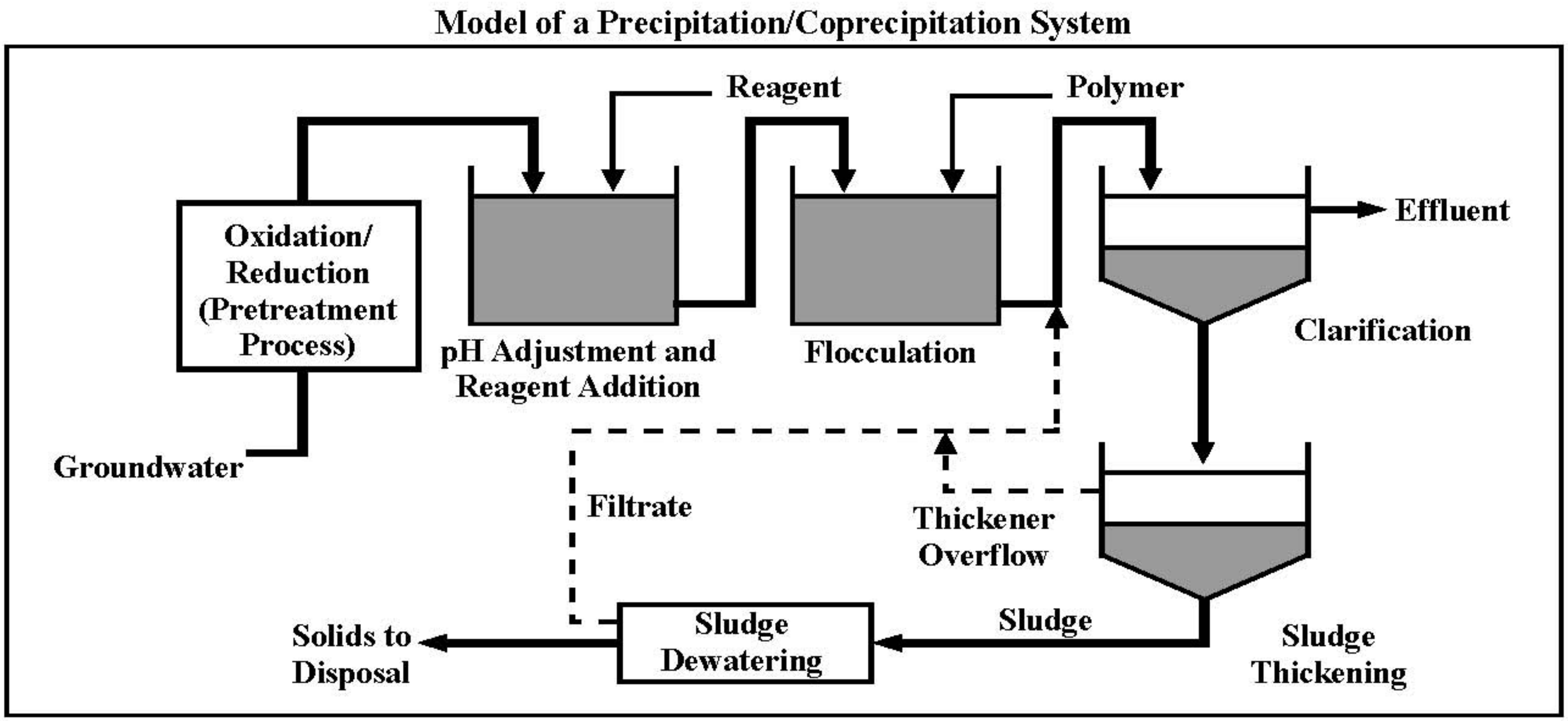


Figure 8

MODEL OF A PRECIPITATION/COPRECIPITATION WATER TREATMENT SYSTEM PROCEE FLOW CHART

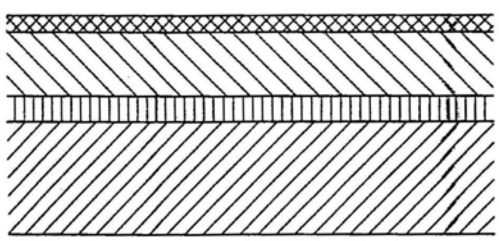


This drawing is obtained from EPA Publication 542-R-02-004 "Arsenic Treatment Technologies for Soil Waste and Water" 2002.

Figure 9

ASPHALT PAVING CROSS SECTION
(Provided by ASARCO EL Paso Plant)

	LAYERED THICKNESS (INCHES)	S_{cf}	SN
HOT MIX ASPHALTIC CONCRETE TYPE-C	1.5	0.44	0.66
P.O.M.-A COLD MIX/COLD LAID	4.0	(ASSUMED) 0.30	1.20
LOW PERMEABLE COLD MIX/COLD LAID OVER ASPHALT MEMBRANE	2.0	(ASSUMED) 0.28	0.56
LIME TREATED SUBGRADE (VERSABIND)	6.0	(ASSUMED) 0.14	0.84
		WSN =	3.26

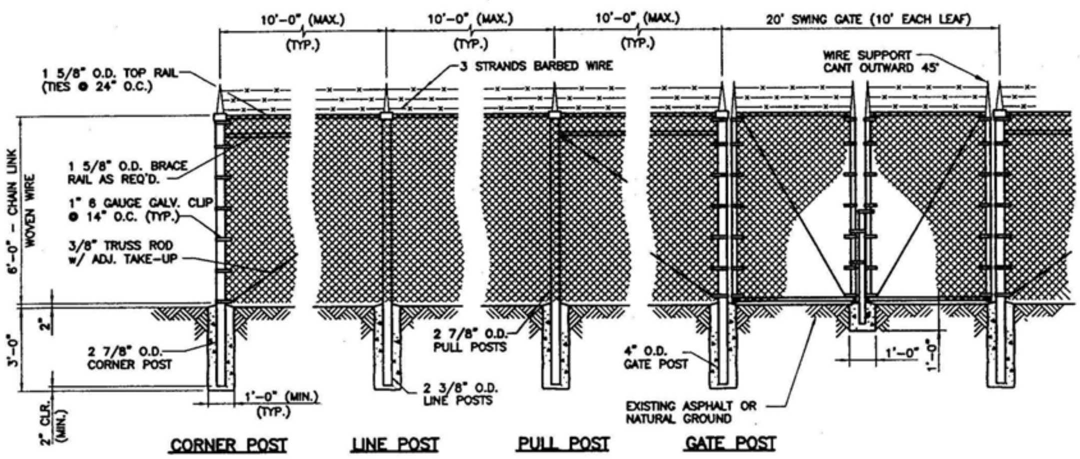


NOTE: GEOGRID TENSAR CAPITOL BX-1100 MAY BE USED IN PLACE OF LIME TREATED SUBGRADE.

Raba Kistner Engineering • Testing • Environmental Facilities • Infrastructure	LIGHT TRAFFIC RECOMMENDED PAVEMENT CROSS-SECTION	PROJECT No.: ASF05-245-01 FIGURE 3

Figure 10

CHAIN LINK FENCE CROSS SECTION



NOTES:

1. REFER TO SECTION 02831 FOR PRODUCT AND INSTALLATION REQUIREMENTS.

TNRCC

FIGURE 02831–01

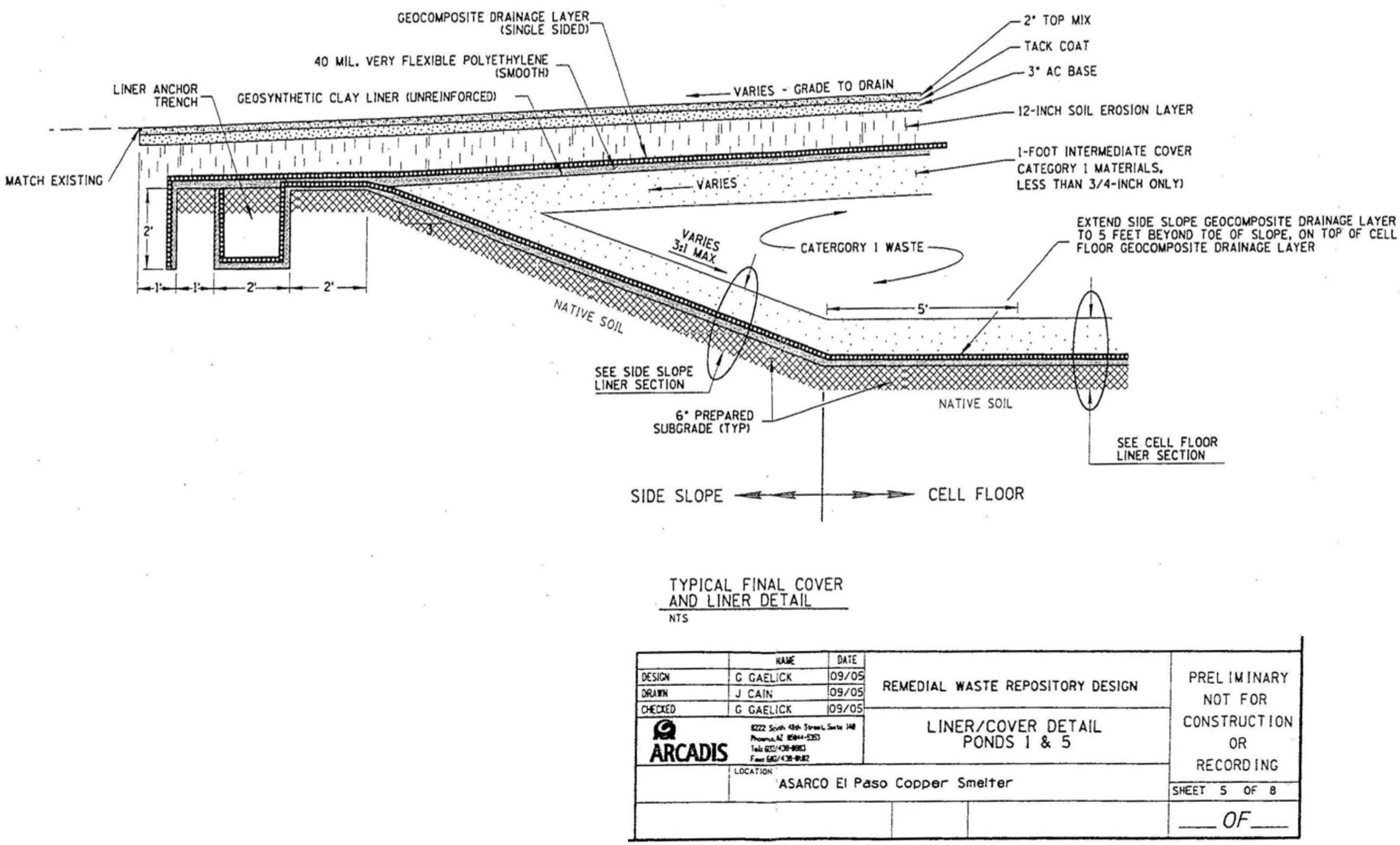
TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

CHAIN LINK FENCE INSTALLATION

REVISION:	FILE:	SCALE:
04–17–2000	02831–01	NTS

Figure 11

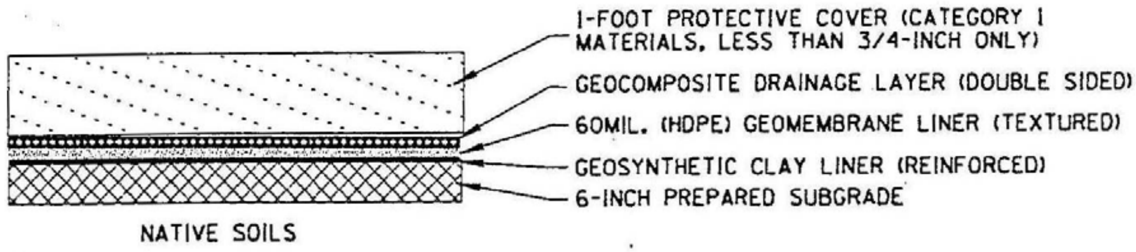
TYPICAL REPOSITORY CELL LINER DESIGN



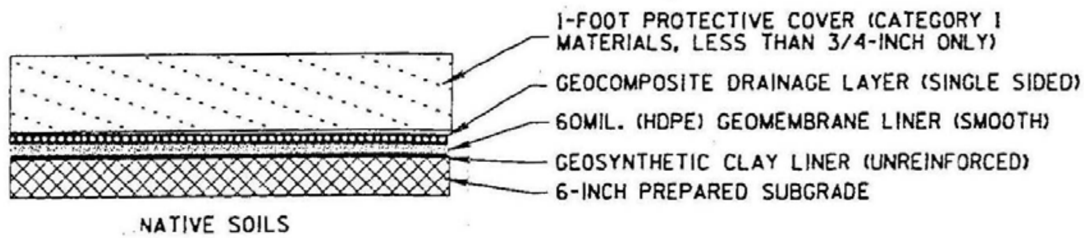
ARCADIS "Remedial Waste Repository Design ASARCO Incorporated El Paso, Texas" September 12, 2005

Figure 12

TYPICAL REPOSITORY CELL LINER CROSS SECTION



TYPICAL LINER
SECTION (SIDE SLOPE)

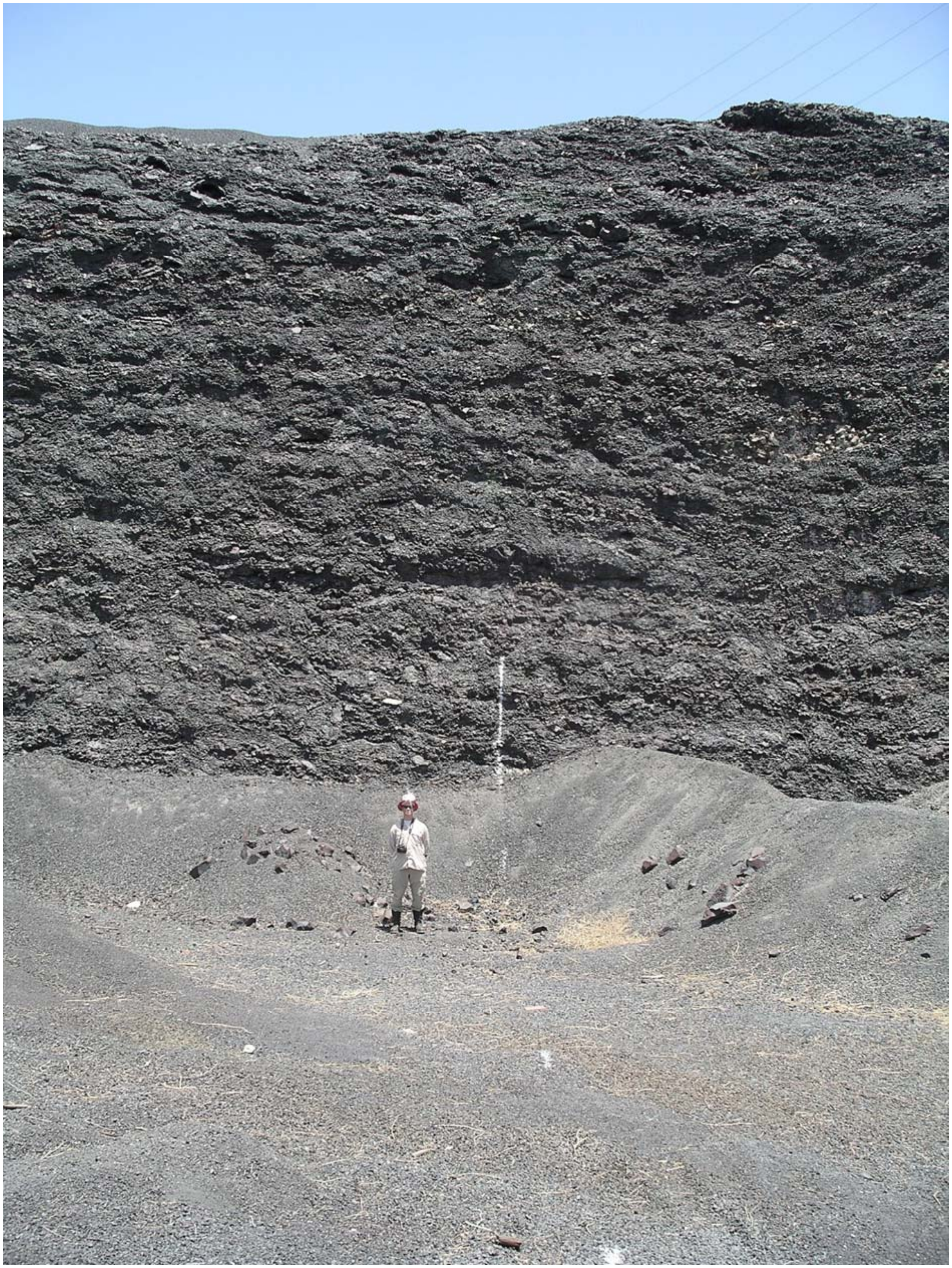


TYPICAL LINER
SECTION (CELL FLOOR)

ARCADIS "Remedial Waste Repository Design ASARCO Incorporated El Paso, Texas" September 12, 2005
Figure 12-1

ASARCO PHOTOGRAPHS

Looking southeast at northern section of the ASARCO Smelter along Paisano Drive.



2. Looking east at exposed slag in northern section of the ASARCO smelter.

3. Looking southwest at minus 50 slag/dust and fines pile in foreground and the ASARCO smelter in background.

4. Looking at the third cell. The top of the waste material is approximately 14 feet above the ground which is over the design capacity.