DRAFT ENVIRONMENTAL IMPACT STATEMENT

Proposed Tailings Storage Facility
Ray Mine – Pinal County, Arizona

File No. SPL-2011-1005-MWL

January 29, 2016

US Army Corps of Engineers

Arizona - Nevada Office
3636 N. Central Avenue
Phoenix, Arizona 85012-1939

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, U.S. ARMY CORPS OF ENGINEERS
3636 N CENTRAL AVENUE, SUITE 900
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January 29, 2016

Draft Environmental Impact Statement

Ray Mine Tailings Storage Facility: Pinal County, Arizona
File No. SPL-2011-01005-MWL

REGULATORY DIVISION

Dear Reader:

Enclosed for your review is the draft environmental impact statement (EIS) for the Ray Mine tailings storage facility (TSF) project. This document describes the environmental effects associated with issuance of a permit by the U.S. Army Corps of Engineers (Corps) under Section 404 of the Clean Water Act that would allow for the proposed construction, operation and closure of a new tailings storage facility in the Ripsey Wash drainage area located about ten miles northwest of the community of Kearny in Pinal County, Arizona. The proposed facility would ultimately contain an estimated 750 million tons of fill and tailings generated by future production from the Ray Concentrator at the Ray Mine, which is owned and operated by ASARCO LLC (Asarco).

The U.S. Army Corps of Engineers (Corps) is the lead agency in the preparation of this draft EIS and now invites Federal agencies, State and local governments, Native American Tribes, interested organizations, and the public to comment on this draft EIS. Comments stating concerns, issues, suggestions, or any other information that are presented relating to this document will be used to guide the preparation of the final EIS and Record of Decision (ROD). Comments received in response to this solicitation, including names and addresses of those who comment, will become part of the public record for this project.

The comment period will extend for 45 days from the publication of the Notice of Availability of the draft EIS in the *Federal Register*, and comments must be received by the Corps no later than March 14, 2016. It is important that you clearly articulate your concerns and contentions, and include your name, address, telephone number, your organization, and “Ray Mine Tailings Storage Facility Draft EIS” and the file number (SPL-2011-01005-MWL) in the subject line of your comments.

Please address written comments to Michael Langley, Senior Project Manager, at the U.S. Army Corps of Engineers, Arizona-Nevada Office, 3636 N. Central Avenue, Suite 900, Phoenix, Arizona 85012-1939; telephone (602) 230-6953 or email comments to: Michael.W.Langley@usace.army.mil.

During the 45-day public review period, the Corps will host a public meeting to solicit comments on this draft EIS. This meeting will be conducted on the evening of **February 24, 2016**, at the Ray Elementary School Cafeteria in Kearny, Arizona. The meeting will be scheduled for 6:00 p.m. to 9:00 p.m.; a presentation will be provided by the Corps starting at 6:30 pm, followed by an opportunity to provide oral comments for the record.

Thank you for your interest in this project.

Sincerely,

Michael W. Langley
Senior Project Manager

FACT SHEET

Project Title:	Ray Mine Tailings Storage Facility
Document:	Draft Environmental Impact Statement
Corps File No:	SPL-2011-01005-MWL
Issue Date:	January 29, 2016
Project Location:	About 10 miles northwest of the community of Kearny in Pinal County, Arizona
Proponent:	Asarco LLC 5285 E. Williams Circle – Suite 2000 Tucson, Arizona 85711
Lead Agency:	U.S. Army Corps of Engineers Arizona-Nevada Office 3636 N. Central Avenue, Suite 900 Phoenix, Arizona 85012-1939
Lead Agency Contact:	Mr. Michael Langley Senior Project Manager Email: Michael.W.Langley@usace.army.mil
Cooperating Agencies:	Environmental Protection Agency Bureau of Land Management Bureau of Indian Affairs - San Carlos Irrigation Project

Abstract:
This environmental impact statement (EIS) has been prepared in response to a Section 404 permit application that Asarco LLC (Asarco) submitted to the U.S. Army Corps of Engineers (Corps) for the construction and operation of a new tailings storage facility (TSF) that would impact Ripsey Wash and other ephemeral washes located approximately four miles southwest of the present tailings facility at the Ray Mine. Because Ripsey Wash and certain of its tributary drainages are considered "waters of the United States" by the Corps, Asarco must obtain Corps approval to construct and operate a TSF in this drainage. Based on its current mine plan and identified mineral resources of the site, Asarco expects that Ray Mine operations could continue for approximately another 50 years. Asarco has determined the need to store 750 million tons of tailings generated at the Ray Concentrator. Tailings are the finely-ground rock material produced by the milling process, which separates copper-bearing minerals from non-economic material. The existing Elder Gulch TSF is nearing capacity and cannot accommodate this expected quantity of tailings. Further upward expansion of the Elder Gulch TSF within its current footprint is not considered feasible give safety and stability concerns. Asarco will require a new TSF to be fully operational within the next five to seven years to facilitate long-term operations.

This EIS documents the environmental analysis of the proposed new tailings storage facility, discusses the purpose and need for the proposed project, evaluates alternatives, identifies environmental baseline and background conditions within and surrounding the project area, describes environmental impacts, and considers management and mitigation measures associated with proposed tailings storage.

Comment Period:

The Corps welcomes comments on this draft EIS, but written comments must be postmarked by **March 14, 2016**. Please address any written comments to the U.S. Army Corps of Engineers, Arizona-Nevada Office, 3636 N. Central Avenue, Suite 900, Phoenix, Arizona 85012-1939: Attention: Michael Langley. Comments can also be emailed to Michael.W.Langley@usace.army.mil.

EXECUTIVE SUMMARY

1.0 INTRODUCTION

In March 2013, ASARCO LLC (Asarco) submitted a Section 404 permit application to the U.S. Army Corps of Engineers (Corps) for the construction and operation of a new tailings[1] storage facility (TSF) that would receive tailings generated at the Ray Mine, which is an existing open pit copper mine located in Pinal County, Arizona about 10 miles northwest of the community of Kearny and approximately 65 miles southeast of the city of Phoenix. See **Figure ES-1, General Location Map**.

Figure ES-1, General Location Map

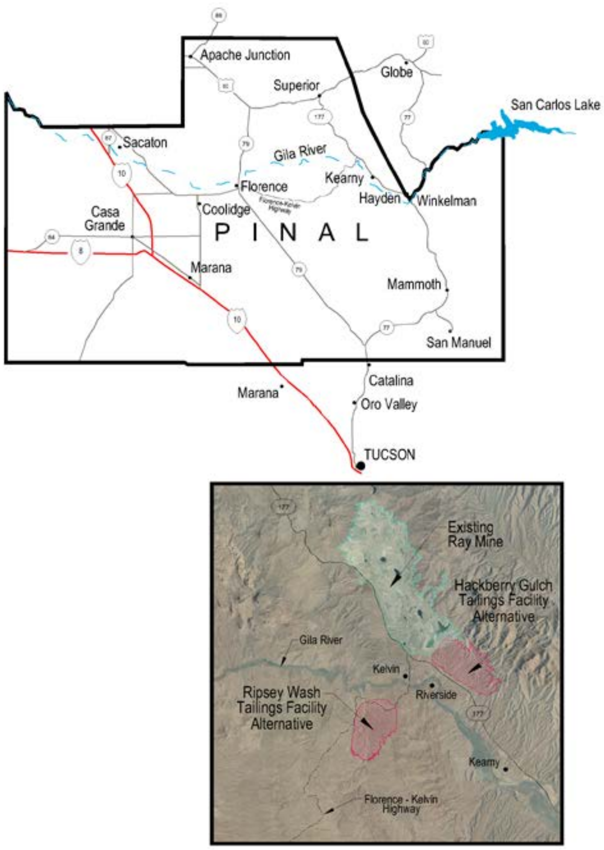

Figure ES-1
General Location Map

[1] Tailings are the finely-ground rock material produced by the milling process, which separates copper-bearing minerals from non-economic material. Tailings should not be confused with overburden or development rock (sometimes referred to as waste rock), which is non-mineralized or uneconomic mineralized material excavated in order to access the copper-bearing ore that is mined and processed to generate a profit.

Asarco's proposed TSF site is located in Ripsey Wash, approximately four miles southwest of the existing Elder Gulch TSF, the present site being used at the Ray Mine for tailings disposal.

The Corps required a permit application for the proposed Ripsey Wash TSF to comply with regulations promulgated under Section 404 of the Clean Water Act, as the Corps has determined the Ripsey Wash drainage and other ephemeral washes within the proposed Project footprint are "waters of the United States" and subject to Corps jurisdiction. Asarco, as the Applicant, is proposing to place fill material within Waters of the United States, which triggers the requirement for a Section 404 permit.

With the Section 404 permit application submittal, the Corps determined that an environmental impact statement (EIS) would be prepared to comply with the National Environmental Policy Act (NEPA) and that they would be the lead agency for NEPA compliance. The EIS would be completed in accordance with procedures specified by Council on Environmental Quality (CEQ) regulations for NEPA (40 CFR §1500 – 1508), CEQ guidance, the Corps' NEPA Implementation Procedures for the Regulatory Program (33 CFR Part 325, Appendix B), and South Pacific Division's Standard Operating Procedure for Preparing and Coordinating EIS Documents (12509-SPD).

On August 26, 2013, the Corps published their Notice of Intent (NOI) to prepare an EIS for this Project in the *Federal Register*. A 60-day EIS scoping process was initiated to solicit comments about the Project from the general public, businesses, special interest groups, Native American tribes and government agencies. This comment period was originally slated to end on October 28, 2013; however, with the October 2013 shut-down of portions of the federal government, the Corps extended the scoping comment period for another 21 days, until November 18, 2013.

The Corps held two public scoping meetings: one on September 24, 2013 at the Ray Elementary School in Kearny (Arizona) and the other on September 25, 2013 at the Performing Arts Center at the Apache Junction High School in Apache Junction (Arizona). About twenty people attended both meetings. The Corps provided a court recorder at both meetings for verbal comments, but none were given. Twenty two letters and emails were received during the EIS scoping process.

The Bureau of Land Management (BLM)[2], and the Bureau of Indian Affairs - San Carlos Irrigation Project (SCIP)[3], and the Environmental Protection Agency (EPA)[4] are NEPA cooperating agencies with the Corps on this EIS. These agencies have defined regulatory requirements and/or special expertise associated with the Project and NEPA.

[2] Because approximately 0.3 miles of tailings and reclaim water pipelines, a portion of the re-route for the Arizona National Scenic Trail (Arizona Trail), and rock material for reclamation would involve BLM administered lands and minerals, the BLM will use this EIS to support their decision-making processes.

[3] The proposed Project would involve the relocation of a portion of an existing 69 kilovolt (kV) electric transmission line that is owned and managed by SCIP. Given the proposed relocation, SCIP will use this EIS to support their decision-making process involved with the possible relocation of the electric transmission line.

[4] EPA has an independent reviewer role for all EIS documents published by federal agencies. In addition, based on its jurisdiction by law and special expertise associated with the Clean Water Act and Clean Air Act, EPA is a NEPA cooperating agency with the Corps on this EIS.

2.0 PURPOSE AND NEED

Based on its current mine plan for the Ray Mine and the identified mineral resource of the site, Asarco expects that Ray Mine operations could continue for approximately another 50 years.[5] Asarco has determined the need to create additional tailings storage to support up to approximately 750 million tons of material (tailings and embankment material).

Asarco's basic project purpose is mine tailings disposal, which is not water-dependent.[6] The Project's purpose is the development of tailings disposal capacity that will allow the full utilization of the mineral resource at the Ray Mine, using infrastructure and processes already in existence at the mine.[7]

3.0 DECISION FRAMEWORK

At the close of the Draft EIS review and comment period, the Corps will consider comments submitted and will respond to those comments in a Final EIS. The cooperating agencies will assist the Corps with comments pertinent to areas of their jurisdiction and expertise. The Final EIS will reflect changes or updates that result from the comments received on the Draft EIS.

After the release of the Final EIS, the Corps will issue a Record of Decision (ROD) regarding its decision on the Proposed Action. In the ROD, the Corps may decide to:

- Issue a 404 permit with or without special conditions on the Project described in the applicant's 404 permit application,
- Deny the 404 permit request, or
- Allow the applicant to withdraw the 404 permit application.

Similarly, after the release of the Final EIS, the BLM and SCIP will each issue individual RODs regarding decisions on those Project features or actions involved under their jurisdiction.

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[5] Actual mine life depends on a variety of factors, including the price of copper and the cost of production (which can change with changes in technology). Thus, the current estimate of mine life and reserves could change over time.

[6] As a general rule, the basic purpose of the project must be known to determine if the project is water-dependent (i.e., requires access to, or siting within, a special aquatic site in order to fulfill its basic purpose). If a proposed project is not water-dependent and would impact a special aquatic site (e.g., a wetland), then there is a strong regulatory presumption that practicable alternatives that do involve special aquatic sites are available, and that such alternatives have less adverse impact on the aquatic ecosystem. 40 C.F.R §230.10(a)(3); Army Corps of Engineers Standard Operating Procedures for the Regulatory Program, page 15 (July 2009).

[7] See U.S. Army Corps of Engineers Standard Operating Procedures (SOP) for the Regulatory Program, page 15 (July 2009). The Corps SOP states that "the overall project purpose is used to evaluate less environmentally damaging practicable alternatives" and "must be specific enough to define the applicant's needs, but not so restrictive as to constrain the range of alternatives that must be considered under the 404(b)(1) guidelines."

4.0 ISSUES AND CONCERNS

- The EIS scoping process produced a number of issues and concerns, which are summarized below:
- Aesthetics and Visual Resources: Identify Project-related impacts to visual resources;
- Air Quality and Climate: Identify Project-related air quality impacts;
- Cultural Resources: Identify cultural resources and conduct Native American consultation;
- Geology and Geochemistry: Identify the potential for acid rock drainage and metals transport from the proposed TSF;
- Surface Water Hydrology: Identify any water quality and quantity impacts to the Gila River as a result of the proposed TSF;
- Groundwater Hydrology: Identify any impacts to groundwater quality and hydrology within and surrounding the proposed TSF area;
- Land Use: Identify land disturbance;
- Noise: Identify noise impacts;
- Recreation: Identify impacts to recreational activities and opportunities;
- Roads and Transportation: Address Project construction and operations traffic impacts;
- Socioeconomics: Address the social, economic and lifestyle effects on residents in the local communities surrounding the Ray Mine;
- Soils: Identify site soil resources and adequacy for reclamation;
- Vegetation: Address Project-related impacts to vegetation;
- Waters of the US: Address Project-related impacts to waters of the US; and,
- Wildlife: Identify impacts to wildlife and wildlife habitats.

5.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

The discussion of alternatives is the foundation of the EIS process (see *40 CFR §1502.14*).

The Corps focused its assessment of TSF alternatives on where and how to develop tailings disposal capacity for 750 million tons of tailings, which would accommodate future operations at the Ray Mine and meet the purpose and need for the Project.

The Corps explored and evaluated various ideas and options during the selection and development of TSF alternatives for this draft EIS. To assist in the process, the Corps met numerous times with Asarco, representatives of cooperating and interested government agencies, visited the existing Ray Mine on many occasions to review current tailings disposal practices, and scrutinized the area surrounding the mine for possible TSF sites.

The Corps has documented the analysis in compliance with guidelines established under the Clean Water Act [40 CFR Part 230 Section 404(b)(1)] for avoidance and minimization of impacts to jurisdictional Waters of the U.S. The results of the Corps' analysis is provided in a July 17, 2015 study entitled *Alternative Screening and Clean Water Act Section 404(b)(1) Alternatives Analysis.*

The TSF alternatives to be considered in detail for this EIS are the no-action alternative, the proposed action TSF in Ripsey Wash, and the Hackberry Gulch TSF.

5.1 NO ACTION ALTERNATIVE

NEPA regulations (40 CFR §1502.14(d)) require that EIS alternative analyses "include the alternative of no action". This alternative will serve as a baseline to compare the effects of the proposed action alternatives. Under the no-action alternative, the Corps would deny the 404 permit or Asarco would withdraw the application, and Asarco's proposal for the construction and operation of a new TSF would not go forward.

5.2 RIPSEY WASH TSF ALTERNATIVE – PROPOSED ACTION

The Ripsey Wash TSF presents the actions proposed by Asarco. This proposed facility would be located within the valley or basin area created by Ripsey Wash (and its tributaries) south of its confluence with the Gila River and approximately four miles southwest of the existing Elder Gulch TSF. See **Figure ES-2, Site Plan Layout for Ripsey Wash TSF Alternative.**

Similar to the ongoing tailings disposal operations at the existing Elder Gulch TSF, the Ripsey Wash TSF would be designed and operated as a closed-circuit (zero surface water discharge) facility. Asarco would continue to pump tailings material as slurry from the existing Ray Concentrator at the Ray Mine through an existing pipeline to the existing thickener, where the tailings would be "thickened". This process would remain unchanged from the existing operation.

As part of pre-tailings disposal construction activities, Asarco would construct two starter dams for the Ripsey Wash TSF. The first and largest of the starter dams would be approximately 150 feet high and located in Ripsey Wash near where the Florence-Kelvin highway currently crosses the wash; approximately 5 million cubic yards of alluvium and colluvium and Ruin Formation granite bedrock would be used to construct this starter dam. The second starter dam would be approximately 65 feet high and located in an unnamed drainage on the eastern side of the facility; approximately 400,000 cubic yards of alluvium/colluvium and Ruin granite material would also be used to construct this starter dam. The crest elevation of both starter dams would reach approximately 2,050 feet above mean sea level (amsl).

A new pipeline, pumping booster station, a lined drain-down tailings containment pond, a bridge across the Gila River, and other supporting infrastructure would be needed to transport tailings from the existing thickener to the Ripsey Wash TSF. Tailings would be discharged from spigots around the perimeter of the tailings areas, and water would accumulate at the rear of the TSF and would be pumped back to the Ray Concentrator via pipelines for reuse in the milling process. See **Figure ES-3, Process Flow Sheet for Ripsey Wash TSF Alternative**.

A 6.8-mile segment of the Arizona National Scenic Trail (Arizona Trail) would need to be relocated to allow construction activities and operations of the Ripsey Wash TSF. A 6.4-mile bypass would be constructed to the east of the Ripsey Wash TSF; this routing would conform to the original objectives of the Arizona Trail, which were to establish and maintain a diverse and scenic trail across the state of Arizona.

Various aspects of Ripsey Wash TSF are summarized in **Table ES-1, Summary of Ripsey Wash TSF Alternative**.

Figure ES-2, Site Plan Layout for Ripsey Wash TSF Alternative

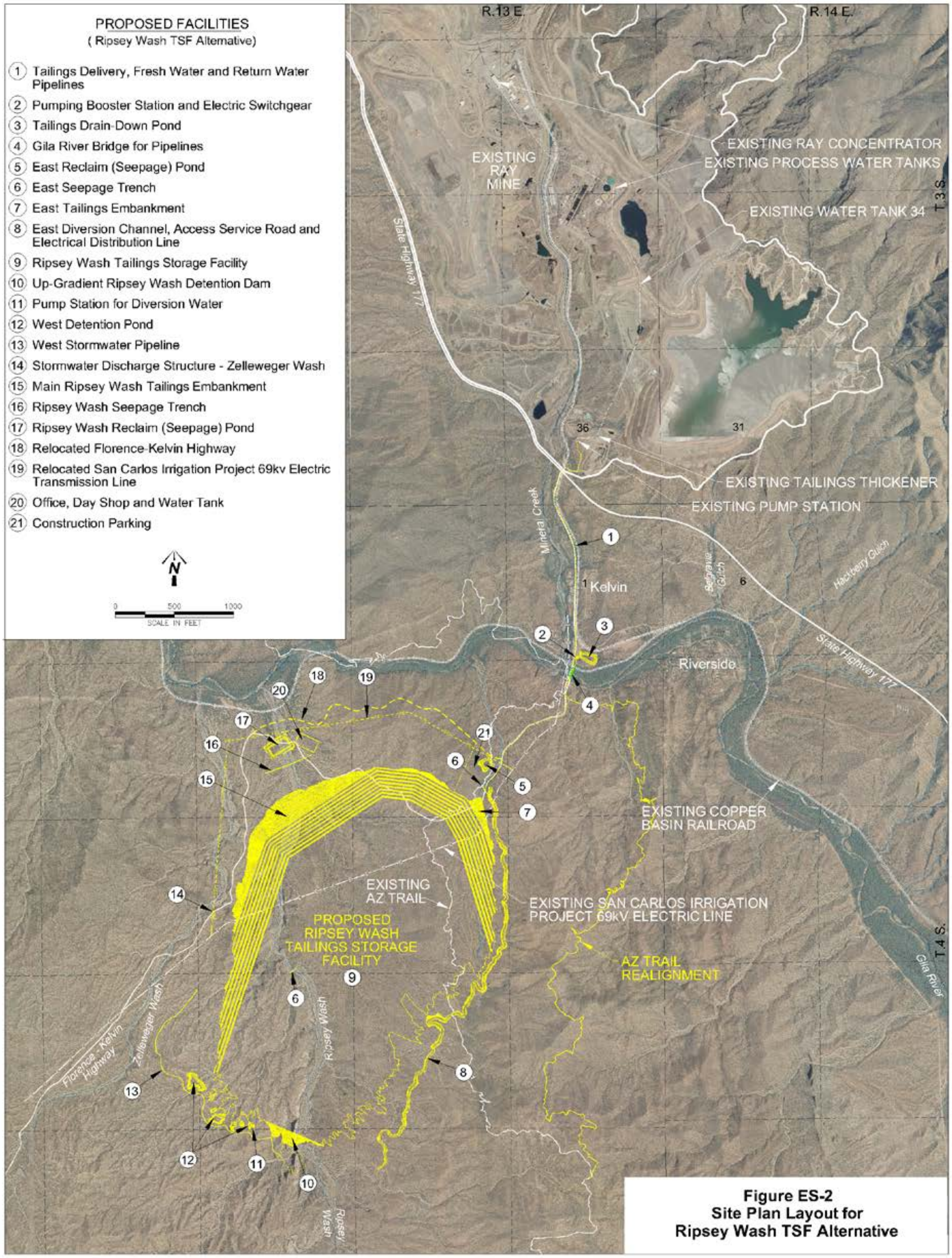
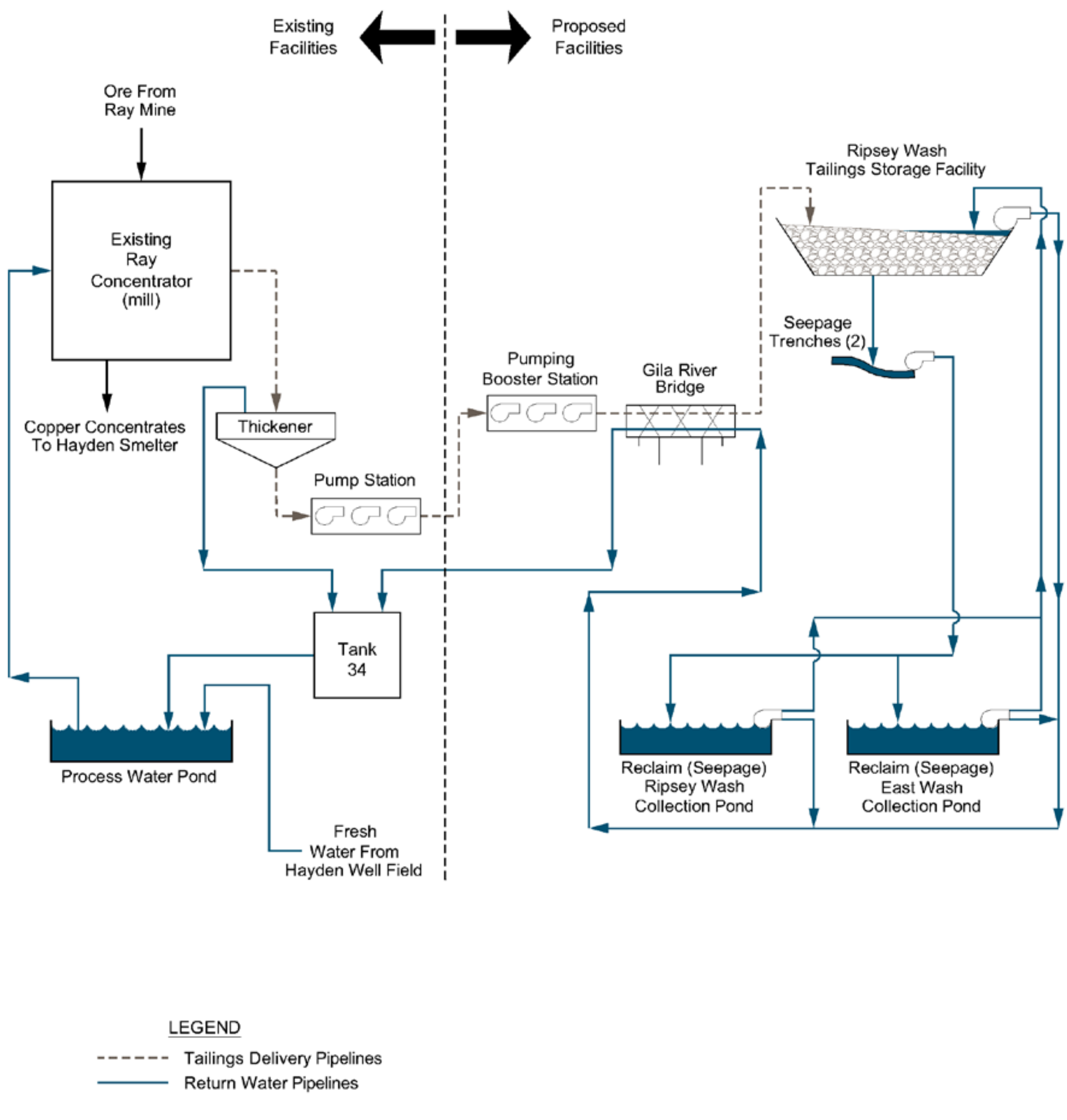


Figure ES-3, Process Flow Sheet for Ripsey Wash TSF Alternative



Note: See Figure ES-2, Site Plan Layout for Ripsey Wash TSF Alternative.

Figure ES-3
Process Flow Sheet for Ripsey Wash TSF Alternative

Table ES-1, Summary of Ripsey Wash TSF Alternative

BASIC CRITERIA FOR FULL CAPACITY		
Overall Facility Capacity (million tons)	750	
Final Tailings Embankment Crest Elevation (feet above mean sea level)	2,440	
Final Tailings Embankment Height (feet)	625	
Number of Washes Needing Starter Dam Embankments	2	
Rock Material Required for Starter Dam Embankments (million tons)	5.2	
Length of Tailings and Water Pipelines (feet/miles)	23,100/4.4	
ESTIMATED SURFACE AREA DISTURBANCE AT FULL CAPACITY (ACRES)		
Tailings Storage Facility	1,974	
Stormwater Diversion Infrastructure	123	
Onsite TSF Infrastructure	388	
Offsite TSF Infrastructure	41	
Florence-Kelvin Highway Realignment	22	
Florence-Kelvin Highway Paving	10	
Arizona Trail Re-alignment(1)	4	
SCIP 69kV Power Line Re-alignment	12	
Total	2,574	
PROPOSED CONCEPTUAL MITIGATION AREA FOR WATERS OF US (ACRES)		
Sites A,B,C and D (San Pedro River Valley)	97.9	
Sites E (Gila River Valley)	124.9	
Total	222.8	
LAND OWNERSHIP/ADMINISTRATION AT FULL CAPACITY	**ACRES**	**PERCENTAGE (%)**
Private	48	1.9%
State of Arizona(2)	2,517	97.7%
Bureau of Land Management(3)(4)	9	0.4%
Total	2,574	100%
WATER OF THE UNITED STATES		**ACRES**
Area of Direct Waters of U.S. Disturbance at Full Capacity		130.23
Area of Indirect Disturbance to Waters of the U.S.		4.13
Area of Jurisdictional Wetlands Disturbance at Full Capacity		0

Notes:

(1) Under an amendment to the National Trails System Act that established the Arizona Trail, the U.S. Secretary of Agriculture is the administering agency of the Arizona Trail, in consultation with the U.S. Secretary of Interior. For the re-aligned section of the Arizona Trail on BLM-administered lands, the BLM is the management agency, while on state and private lands, Pinal County is the managing agency under a trail right-of-way granted to Pinal County by ASLD.

(2) This figure represents that the Ripsey Wash TSF site is currently located on lands owned and administered by the state of Arizona (through its Department of State Lands). Asarco is pursuing the purchase of these lands from the state, and that purchase would transfer this ownership to "private property." The sale by Arizona State Land Department would be completed through an open auction process, the date for which is pending.

(3) Disturbance includes estimated three acres on BLM-administered for the re-routed Arizona Trail and trailhead, and approximately six acres for tailings/water return pipelines and re-routed SCIP powerline rights-of-way.

(4) The area designated is for BLM surface administered lands. Approximately 2,300 acres of BLM mineral administered estate exist beneath the area to be used for the Ripsey Wash TSF, there are no known locatable minerals in this estate; however, salable minerals excavated from within a portion of the footprint of the proposed TSF would be used for construction of the starter dam and as cover material during concurrent reclamation and as part of final closure. The BLM would need to authorize a mineral material sale for that rock material.

(5) See Appendix J, Conceptual 404 Mitigation Plan

5.3 HACKBERRY GULCH TSF ALTERNATIVE

The Hackberry Gulch TSF Alternative would be located south-southeast of the existing Elder Gulch TSF. See **Figure ES-4, Site Plan Layout Hackberry Gulch TSF**.

The Hackberry Gulch TSF would be designed and operated as a closed circuit (zero surface water discharge) facility. See **Figure ES-5, Process Flow Sheet Hackberry Gulch TSF**.

Most of the Hackberry Gulch TSF construction, operational, and closure techniques and practices would be the same or similar to those currently used at the existing Elder Gulch TSF or proposed for use at the Ripsey Wash TSF.

A new pipeline would be needed to pump tailings from the existing thickener to the proposed Hackberry Gulch TSF. In addition, a new service/access road would be required around the base of the existing Elder Gulch TSF to provide routing for the new pipeline and to access the new pumping booster station and lined drain-down containment pond, as well as the seepage trenches, reclaim ponds and related facilities located in the seven washes within the Hackberry Gulch TSF. From the new pumping booster station, tailings would be pumped up to the TSF and discharged from spigots that surround the perimeter of the tailings areas, and decant water that accumulates at the back of the Hackberry Gulch TSF would be pumped back to the Ray Concentrator via pipelines for reuse in the milling process.

As part of pre-tailings storage construction activities, Asarco would construct a large, elongated starter dam for the Hackberry Gulch TSF that would cross several washes. This long starter dam would be required because the Hackberry Gulch TSF would be a “side-hill” facility (unlike the Ripsey Wash TSF which is essentially a “valley-fill” facility). The crest elevation of the starter dam would reach approximately 2,150 feet above mean sea level (amsl).

This starter dam embankment would serve as the base to retain tailings materials for the centerline embankment construction. Approximately 8 million cubic yards of material would be used to construct this starter dam.

Conventional construction equipment, such as front end loaders, off-highway trucks, and bulldozers, would be used for starter dam construction. Due to the numerous washes that dissect the Hackberry Gulch TSF, multiple temporary haul roads would be needed within and external to, the footprint of the tailings impoundment for construction equipment and activity.

To promote long-term safety and to minimize the ingress and egress of traffic from TSF development and operational onto State Highway 177, an overpass bridge for State Highway 177 would be constructed to link TSF project activities on the northeast and southeast sides of the highway. This overpass would allow highway traffic to continue without interference from Asarco personnel and equipment as they access the planned four reclaim ponds and the monitoring/pumpback wells that would be located on the southwest side of the Hackberry Gulch TSF.

Various aspects of Hackberry Gulch TSF Alternative are summarized in **Table ES-2, Summary of Hackberry Gulch TSF Alternative**.

Figure ES-4, Site Plan Layout for Hackberry Gulch TSF Alternative

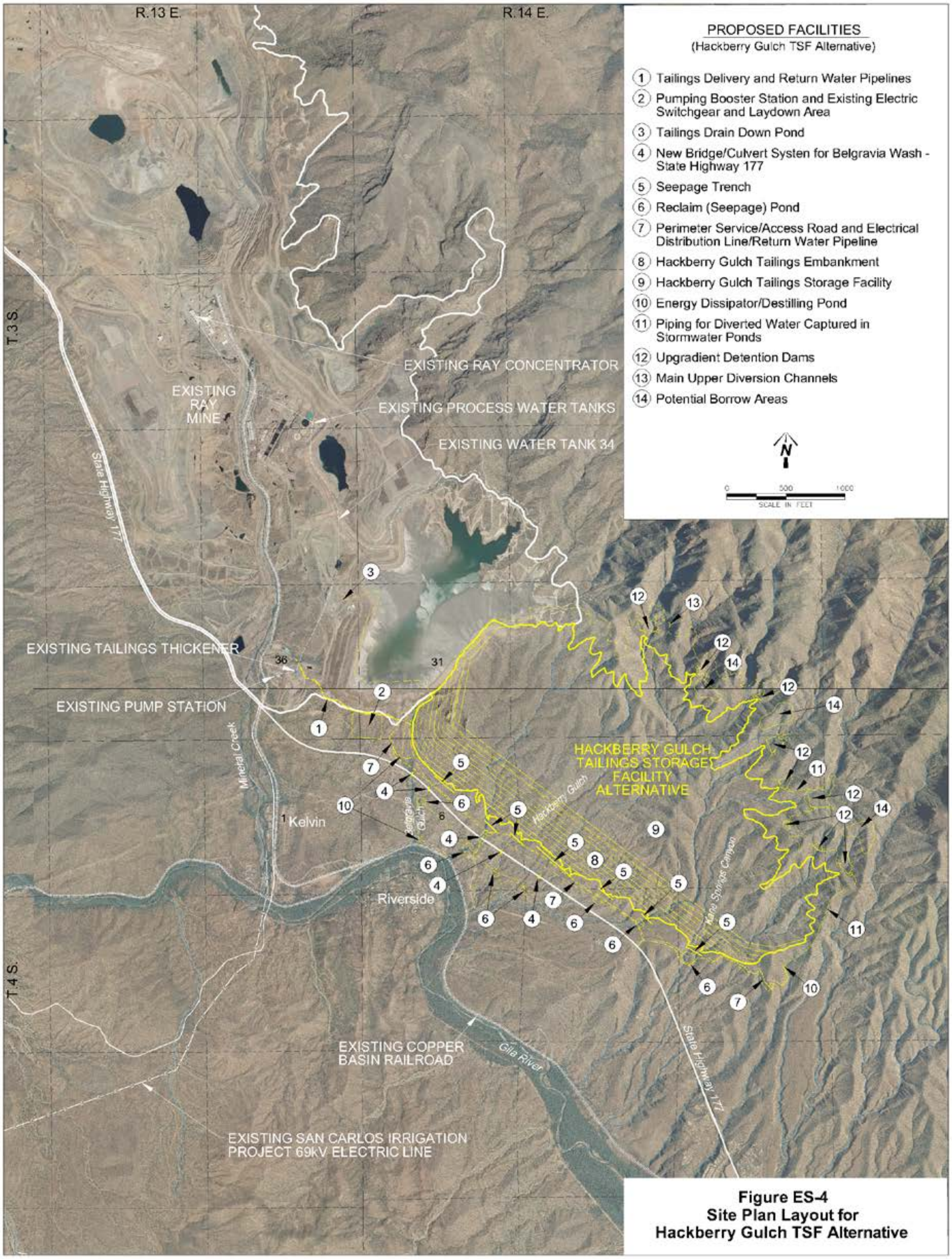
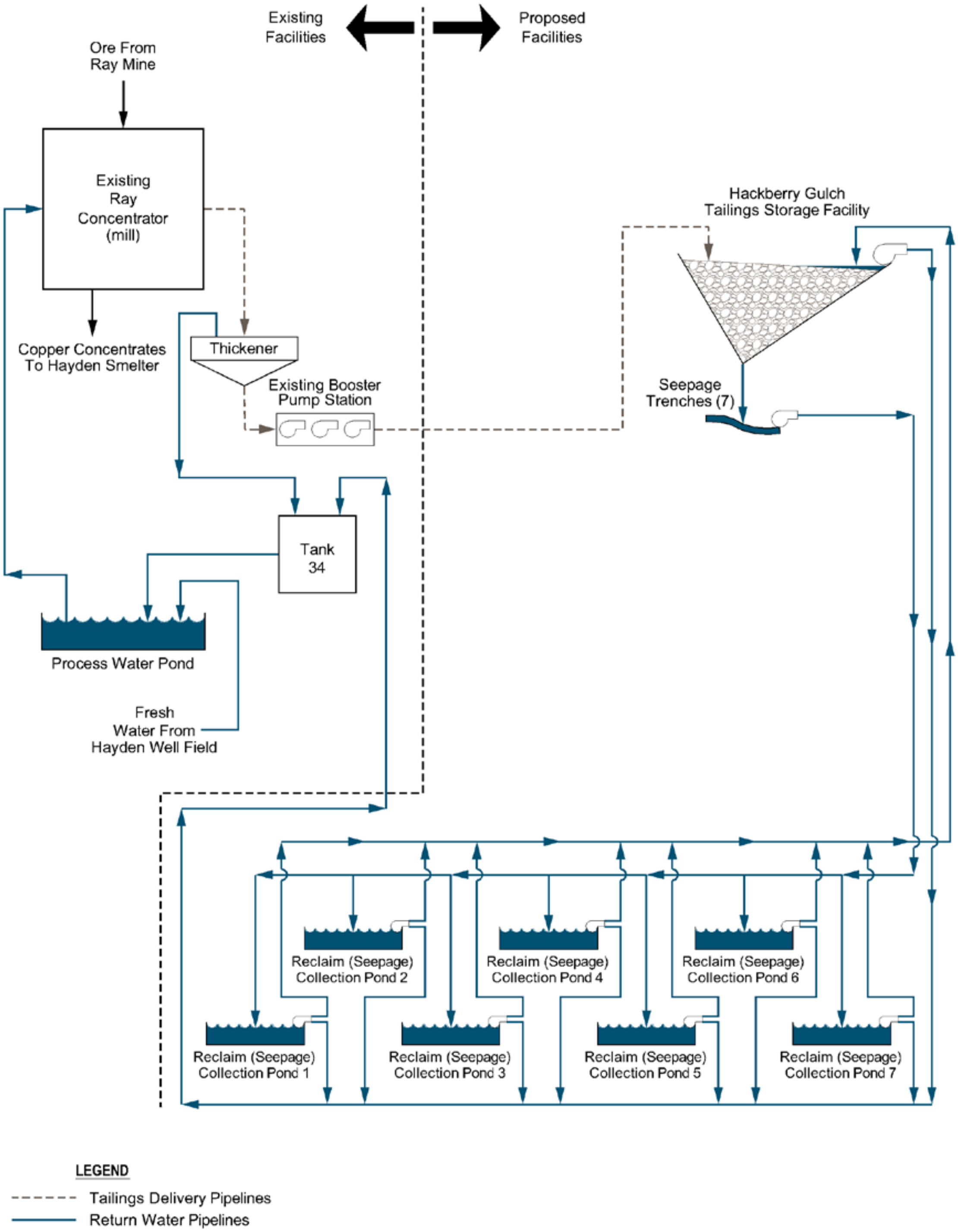


Figure ES-4
Site Plan Layout for
Hackberry Gulch TSF Alternative

Figure ES-5, Process Flow Sheet for Hackberry Gulch TSF Alternative



Note: See Figure ES-4, Site Plan Layout for Hackberry Gulch TSF Alternative.

Figure ES-5
Process Flow Sheet for Hackberry Gulch TSF Alternative

Table ES-2, Summary of Hackberry Gulch TSF Alternative

BASIC CRITERIA FOR FULL CAPACITY		
Overall Facility Capacity (million tons)		750
Final Tailings Embankment Crest Elevation (feet above mean sea level)		2,535
Final Tailings Embankment Height (feet)		610
Number of Washes Needing Starter Dam Embankments		7
Rock Material Required for Starter Dam Embankments (million tons)		8.2
Length of Tailings and Water Pipelines (feet/miles)		4,620/0.9
ESTIMATED SURFACE AREA DISTURBANCE AT FULLCAPACITY (ACRES)		
Tailings Storage Facility		1,996
Stormwater Diversion Infrastructure		116
Onsite TSF Infrastructure		96
Offsite TSF Infrastructure		28
Borrow Areas		54
Total		2,290
PROPOSED CONCEPTUAL MITIGATION AREA FOR WATERS OF US (ACRES)		
Sites A,B,C and D (San Pedro River Valley)		97.9
Sites E (Gila River Valley)		124.9
Total		222.8
LAND OWNERSHIP/ADMINISTRATION AT FULL CAPACITY	**ACRES**	**PERCENTAGE (%)**
Private	1,141	49.9%
State of Arizona(1)	0	0.0%
Bureau of Land Management	1,149	50.1%
Total	2,290	100%
WATERS OF THE UNITED STATES(2)		**Acres**
Area of Direct Waters of U.S. Disturbance at Full Capacity (Estimated)		51.70
Area of Indirect Disturbance to Waters of the U.S. at Full Capacity (Estimated)		19.80
Area of Jurisdictional Wetlands Disturbance at Full Capacity (Estimated)		0.62

Notes:

(1) The Hackberry Gulch site is partially located on lands administered by the Bureau of Land Management (BLM). Asarco is currently pursuing a land exchange with the BLM such that the Hackberry Gulch TSF would be located on "private property" owned by Asarco. The BLM Ray Land Exchange is pending. The placement of tailings at this site is independent of the land exchange. If the exchange is finalized, the facility would be Asarco property. If the land exchange does not occur, Asarco would file a Section 3809 plan of operation with the BLM for the facility.

(2) A formal delineation of Waters of the U.S. was not performed for this alternative. The extent of Waters of the U.S. was estimated from a review of aerial photography of the alternative footprint and some limited fieldwork.

5.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED EVALUATION

The Corps focused its formulation of TSF alternatives on where and how to develop tailings storage capacity for 750 million tons of tailings, which would accommodate future operations at the Ray Mine and meet the purpose and need for the project (see Section 2.0, Purpose and Need). In addition, the Corps conducted public scoping to determine the range of issues to be addressed in the EIS, and these issues helped shape the assessment of TSF alternatives (see Section 4.0, Issues and Concerns).

The Corps explored and evaluated various ideas and options during the selection and development of TSF alternatives for this Draft EIS. To assist in the process, the Corps met numerous times with Asarco, representatives of cooperating and interested government agencies, visited the existing Ray Mine on many occasions to review current tailings storage practices, and scrutinized the area surrounding the mine for possible TSF sites.

The Corps considered a number of possible TSF alternatives, but many TSF alternatives were eliminated from consideration because they could not meet the purpose and need for the project, did not address important issues, or were impractical or unreasonable. Tthe Corps has eliminated the following TSF alternatives from detailed evaluation in the draft EIS:

- Tailings storage within the Ray Mine open pit;
- Underground tailings storage;
- Ray Concentrator storage of tailings at multiple sites;
- Remote tailings storage (with off-site shipment and processing of ore material);
- Tailings storage in Devils Canyon;
- Tailings storage near community of Hayden;
- Tailings storage near Granite Mountain/Copper Butte;
- Tailings storage on the west side of the Ray Mine;
- Dewatered tailings storage (“dry-stack” tailings storage; and,
- Various location alternatives at the Ripsey Wash and Hackberry Gulch sites.

These alternatives dropped out during the alternatives screening process for various reasons or did not pass the practicability test consistent with the Clean Water Act Section 404(b)(1) guidelines that the Corps requires for 404 permits. The Corps has documented the alternative analysis in compliance with guidelines established under the Clean Water Act [40 CFR Part 230 Section 404(b)(1)] for avoidance and minimization of impacts to jurisdictional Waters of the U.S. This document is found with the Draft EIS as **Appendix B, Alternative Screening and Section 404(b)(1) Alternatives Analysis**.

6.0 ENVIRONMENTAL ANALYSIS

6.1 AIR QUALITY/CLIMATE

6.1.1 Existing Conditions

The area around the Ripsey Wash and Hackberry TSF sites has a subtropical desert climate.

Average daily temperatures in this region range from an average maximum low of around 31°F in January to an average maximum highs approaching 99°F in July. Temperatures in the winter can dip below freezing (32°F), while summertime temperatures often climb above 100°F.

Annual average precipitation is typically around 13 to 14 inches, with most amounts occurring during July and August, which are part of the Arizona “monsoon season”. The summertime rain can be sporadic and locally intense, often associated with passing thunderstorms.

The average annual pan evaporation rate measured at the town of Winkelman, which is approximately 14 miles southeast of the Ray Mine, was nearly 96 inches for the period of record 1942 to 1980. The climate of the Southwest[8] is changing. According to the EPA, the average annual temperature over the last century has increased about 1.5°F, and the average annual temperature is projected to climb an additional 2.5°F to 8°F by the end of this century.

6.1.2 Environmental Consequences

Project activities of the Ripsey Wash or the Hackberry Gulch TSF would create fugitive dust and gaseous emissions, primarily during the construction activities, but these emissions would be localized and are not expected to cause any impacts to the existing ambient air quality of the region. With the exceptions of a portable crushing facility that may be required for initial construction and localized windblown emissions from disturbed areas during windy days, emissions would primarily be from mobile sources (such as front end loaders, off-highway trucks, bulldozers and various support vehicles).

Vehicles and construction equipment used for TSF activities would use diesel and gasoline, and the combustion of these fuels would create greenhouse gases. However, the greenhouse gas emissions generated from the Project would have a negligible effect on climate change.

6.2 SOILS

6.2.1 Existing Conditions

Soil characteristics in the area of the Ripsey Wash and Hackberry Gulch TSF are related to where they are developing, which involve fan terraces, hills/mountains and floodplains. Given the presence of coarse fragments and shallow depths, the suitability for the majority of the soils overlying the Ripsey Wash and Hackberry Gulch TSF sites is rated as “poor” for reclamation.

6.2.2 Environmental Consequences

With the exception of soil materials beneath within the starter embankments of the Rispey Wash or Hackberry Gulch TSF, which would be removed during construction and used for the construction of the starter dams, site soils would be buried by tailings and during the construction of various TSF support facilities, such as detention dams and diversion structures, seepage trenches, and reclaim ponds. As a result, the productivity of these soils, in terms of vegetation production, would be permanently lost.

Because soils within the proposed TSF sites are classified as “poor” quality as a source of “topsoil” for reclaiming disturbed sites, their loss would not have a major impact on post TSF closure and reclamation.

6.3 GEOLOGY AND GEOCHEMISTRY

6.3.1 Existing Conditions

The Ripsey Wash TSF site is underlain by the Ruin granite formation, which is generally classified as quartz monzonite and consists primarily of coarse-grained, porphyritic granite and aplite porphyry. The Ruin granite has been intruded by numerous porphyry dikes of Laramide age. The Tertiary-age San Manuel formation lies unconformably over the Ruin granite and is a sequence of sedimentary rocks comprised of a upper member of massive, poorly-sorted boulder conglomerate and a lower member of

[8] The Southwest is bordered by the Pacific Ocean to the west, the Rocky Mountains to the east, and Mexico to the south. It includes the state of Arizona.

well- defined tuffaceous sandstone. Erosion of bedrock surfaces has led to the development of pediment surfaces and deposits of alluvium and gravel within the area's drainages.

The Hackberry Gulch TSF site is underlain by the Big Dome Formation, which consists of gradational and inter-fingering conglomerate and tuff beds. Only isolated covers of Quaternary colluvium and alluvium are found in the area, primarily within the drainages that bisect the Hackberry Gulch TSF site.

The ore materials processed at the Ray Concentrator are and will continue to be comprised mainly of Diabase and Pinal Schist. The following geochemical tests were performed to characterize the tailings geochemistry (solids and liquids), along with the borrow materials to be used for the construction of TSF starter dams:

(1) X-ray diffraction to identify tailings mineralogy;
(2) Acid Base Accounting (ABA) to quantify acid neutralization potential (ANP) and acid generating potential (AGP);
(3) Water quality analyses of existing tailings liquids and decant water from the Elder Gulch TSF;
(4) Meteoric Water Mobility Procedure (MWMP) tests on tailings and borrow materials to assess potential leachate quality; and,
(5) Humidity Cell Tests (HCT) to simulate weathering and to allow for prediction and characterization of potential leachate quality.

6.3.2 Environmental Consequences

The rock material from which copper is extracted would become the tailings that would be deposited in either the Ripsey Wash or Hackberry Gulch TSF sites. This deposition would cover the existing geologic structure and lithology of the site, and result in permanent changes to the topography of the area.

The results of geochemistry characterization and testing on tailings and borrow materials reveal a low potential to impact groundwater or surface water, with the design and operational safeguards proposed for the TSF. Kinetic testing revealed a low potential for any acid generation from tailings materials and confirmed that alluvium material to be used for construction activities are not acid-generating. The meteoric water mobility testing on both tailings and alluvium material also revealed that possible dissolution and mobilization of minerals from these materials are low.

6.4 SURFACE WATER HYDROLOGY

6.4.1 Existing Conditions

The proposed Ripsey Wash and Hackberry Gulch TSF sites are located within the Basin and Range physiographic province of Arizona, which is characterized by few perennial streams and low rainfall.

The Gila River is the principal drainage in the region. It is tributary to the Colorado River and has its headwaters in New Mexico. The Gila River near the Ray Mine is confined in a channel with steep, earthen banks generally composed of mixed gravel, cobble and rock. Bank stability is low, and sloughing is commonly observed. The drainage area of the Gila River at its confluence with the Colorado River is approximately 60,000 square miles.

The San Carlos Reservoir, located approximately 40 miles upstream of the Ray Mine, impounds the Gila River behind the Coolidge Dam, which is operated for SCIP to meet downstream water demands. Annual flows in the Gila River near the Ray Mine are extremely variable because of natural variability, withdrawals for irrigation, and water discharge regulation from the Coolidge Dam.

Surface drainages within both TSF sites are ephemeral and flow only in response to precipitation events. These ephemeral drainages are known locally as “dry washes.”

The Ripsey and Zelleweger washes, along with an unnamed wash designated Eastern Wash located to the east of Ripsey Wash, are the main tributary drainages to the Gila River at the Ripsey Wash TSF site. These washes are generally braided, sandy-bottomed channels interspersed with upland vegetation and cacti. The washes can carry heavy sediment loads downstream toward the Gila River. Tributaries to these washes tend to have relatively confined channels but form large, broad alluvial fan deposits at the confluences with the main channels.

At the Hackberry TSF site, Belgravia Wash, Hackberry Gulch, Kane Springs Canyon, and several unnamed ephemeral washes are tributary to the Gila River. These ephemeral drainages are smaller, steeper and more incised than the Ripsey and Zelleweger washes.

6.4.2 Environmental Consequences

The construction and operation of the Ripsey Wash TSF would remove runoff potential from approximately 16% of the Ripsey Wash drainage basin and approximately 20% of the East Wash drainage basin. Similarly, the Hackberry Gulch TSF and supporting infrastructure would remove runoff potential from ten different ephemeral watersheds, ranging from 1% in the G Wash to 78% in B Wash. However, the overall runoff loss to the Gila River from either TSF would be negligible, amounting to about 0.02% of the of the Gila River watershed.

The TSF at either site would be operated as zero surface water discharge facility, with any direct precipitation and runoff captured in the tailings impoundment being pumped back to the Ray Concentrator for reuse. Seepage through the tailings themselves and the underlying alluvium material beneath the TSF would be captured by down-drainage seepage trenches and routed to lined reclaim ponds, where the water would be pumped back to the tailings impoundment or to the Ray Concentrator for reuse. As tailings consolidate over time during operations, the permeability of the tailings materials themselves are expected to decrease and lessen the amount of infiltration through the tailings.

With the planned construction and operation, there would be no water quality impacts to the drainages down-gradient of a Ripsey Wash or Hackberry Gulch TSF, including to the Gila River. The geochemical testing of tailings materials revealed a low potential for acid generation and confirmed that the alluvium material to be used for construction activities are not acid-generating. The meteoric water mobility testing on both tailings and alluvium material also revealed a low probability for dissolution and mobilization of minerals from these materials.

6.5 WATERS OF THE U.S.

6.5.1 Existing Conditions

No perennial or intermittent waters were found to occur within the footprints of either the Ripsey Wash or Hackberry Gulch TSF sites. The Gila River is a perennial stream that occurs adjacent to both TSF sites, but neither TSF footprint extends into the river’s corridor.

No seeps or springs were found at the Ripsey Wash TSF site. No isolated open water or vegetated wetlands occur within Ripsey Wash where the TSF is proposed. The only wetlands in the vicinity of the Ripsey Wash TSF site are adjacent to the Gila River, but outside of the TSF footprint.

Five wetland areas (including one or more seeps at each wetland) are found within the boundaries of the Hackberry Gulch TSF site. The five wetland areas exhibit seasonal or perennial surface water saturation and support wetland vegetation. Wetlands are also present along the Gila River adjacent to Hackberry Gulch TSF footprint.

6.5.2 Environmental Consequences

The Ripsey Wash TSF alternative would result in the direct disturbance of approximately 134.36 acres of jurisdictional ephemeral drainages that would be filled, excavated, dewatered or subject to surficial disturbances resulting in the loss or significant modification of their form, functions and values.

Implementation of Hackberry Gulch TSF alternative would result in the direct disturbance through filling, excavation or various construction activities of approximately 71.50 acres of Waters of the U.S., which include ephemeral drainages and wetlands for which their form, functions and values would be lost or significantly modified. The wetlands that would be impacted under this alternative are classified as “special aquatic sites” under the 404(b)(1) guidelines (40 CFR Part 230).

6.6 GROUNDWATER HYDROLOGY

6.6.1 Existing Conditions

Groundwater at the TSF sites is limited but occurs in both bedrock and in Quaternary sediments.

The regional bedrock has varying degrees of groundwater and its flow direction generally mirrors topography, from the mountains to the valley floors and then down-drainage. There can be preferential flow locally along fracture and fault systems in the bedrock. Fracture systems are influenced by structural episodes of faulting and folding, which have sheared, foliated or lineated the bedrock.

Quaternary sediments are found along the Gila River and many of its main tributary watersheds. The unconsolidated Quaternary sediments are formed by a mixture of clays, silts, sands and gravels. These alluvial sediments are recharged by infiltration of precipitation, by flow losses from drainages, and by discharge from the bedrock groundwater systems. The regional surface and groundwater systems are interdependent, and, in general, groundwater contributes in some areas to the Gila River baseflow (gaining reach), while surface flow in the Gila River contributes to groundwater recharge (losing reach) in other areas. Seasonal variation in this interrelationship is common.

The Ripsey Wash TSF site is located in the Donnelly Wash Groundwater Basin, which is a small 293 square mile basin in the northwestern portion of the Southeastern Arizona Groundwater Planning Area.

The Hackberry Gulch TSF site is located in the northern portion of the Lower San Pedro Groundwater Basin, which is a 1,624 square mile basin on the western side of the Southeastern Arizona Groundwater Planning Area.

6.6.2 Environmental Consequences

Construction and operation of either TSF site would decrease and eventually eliminate recharge to the Quaternary deposits from the footprint area of the TSF. The down-gradient seepage trenches are designed and would be constructed to capture groundwater movement through the Quaternary deposits beneath the TSF, and this water would be returned to the Ray Concentrator for reuse. This activity would eliminate recharge to the Gila River. The loss of recharge to the Gila River Quaternary deposits would be less than 0.02% of Gila River basin recharge.

Bedrock groundwater recharge from the TSF would be limited, given the relatively low hydraulic conductivities of bedrock. Once tailings encompass the full footprint of the TSF, infiltration into the underlying alluvium and bedrock would be further reduced because the tailings themselves have low permeability, and some water would be entrapped within the tailings.

In addition, upon closure, when no more tailings are being pumped to the TSF, any remaining water on the surface of the TSF or precipitation that falls onto the tailings surface would be subjected to the high evaporation rates that occur in the semi-arid climate in this part of Arizona.

6.7 LAND USE

6.7.1 Existing Conditions

The dominant land use in the vicinity of the Ripsey Wash and Hackberry Gulch TSF sites is mining. Other land uses within the region are recreation, residential use and agriculture (cattle grazing).

Copper mining has occurred in this area since the 1880s, a period extending for over 130 years. Early mining in this area was completed by underground techniques; however, by 1955 all major underground mining had ceased in the area around the current Ray Mine. The Ray Mine, which is an existing open-pit copper mine, began operations in 1952 and has been the prominent mine in the area since that time.

Other than the Arizona Trail, there are no developed recreational facilities within the areas to be used for either TSF. However, there are dispersed outdoor recreational activities that include hunting, four-wheeling, mountain biking, hiking, picnicking, camping, horseback riding, rock-hounding, fishing, river floating and water play in the Gila River, and general sightseeing. There is an existing network of primitive roads in the region that provide access for dispersed recreational activities.

A mixture of federal, state and private lands occurs in this area. Asarco owns and controls much of the private lands within and adjacent to the existing Ray Mine. Surface ownership at the Ripsey Wash TSF site may change to Asarco with the proposed forthcoming sale (auction)[9] of state lands at Ripsey Wash site and to Asarco from federal ownership at the Hackberry Gulch TSF site with pending Asarco-BLM land exchange.[10]

6.7.2 Environmental Consequences

Although mining has historically occurred in this region, the construction and operation of a new TSF would introduce a noticeable land use change within the immediate area. On a more regional basis, a new TSF at the Ray Mine would not change overall land uses in Pinal County.

The construction and operation of TSF sites would cause permanent impacts to rangeland, wildlife habitat, and dispersed recreation on land uses within the footprint of the TSF. Available livestock forage would be lost in the grazing allotment areas that would be affected by the construction and operation of the TSF. Site access restrictions would occur during this time frame, primarily because of land

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[9] An auction is expected to occur during the first quarter of 2016.

[10] Since 1994, Asarco has been engaged with the BLM on the Ray Land Exchange, which would transfer BLM-managed land within and surrounding the Ray Mine to Asarco in exchange for other desirable lands that would be provided to the BLM by Asarco. This land exchange is separate and distinct from the Asarco permitting work for a new TSF, but a portion of the lands that would be used for a Hackberry Gulch TSF alternative are included in the proposed land exchange.

ownership patterns; it is expected that only sparse vegetation would reemerge on the area where tailings are placed, and not to the conditions that currently exist. The closed tailings site would never have the species composition or density of vegetation that exists today.

With the construction and operation of the Ripsey Wash TSF, a 6.8-mile segment of the existing Arizona Trail would be lost, but plans have been made to replace this segment of trail with a 6.4-mile segment to the east of the proposed Ripsey Wash TSF site. The existing trailhead on the Florence-Kelvin Highway would also be replaced with a new trailhead near the intersection of Riverside Road and the Florence-Kelvin Highway.

6.8 NOISE

6.8.1 Existing Conditions

Both TSF sites are located in relatively unpopulated and remote areas. Background noise levels range from near 30 dBA to approximately 80 dBA, depending on road traffic, wind, and wildlife activity (birds singing).

In general, the Ripsey Wash TSF site would be relatively quiet, with periodic noise from wind and/or thunderstorm activity being the principal sound sources. Traffic along the Florence-Kelvin highway would generate periodic noise. There could also be localized noise from off-highway vehicles (OHVs) using the two-track roads in the area, from the occasional over flight by jet aircraft and from train noise generated by the Copper Basin Railroad that operates north of the site.

The proposed Hackberry Gulch TSF site is located adjacent to the existing Ray Mine and the Elder Gulch TSF, as well as being directly adjacent to State Highway 177. Portions of the proposed Hackberry Gulch TSF would be located on either side of this highway. There are permanently occupied residences and human receptors in the communities of Riverside and Kelvin, which are within approximately one mile of the proposed Hackberry Gulch TSF site. Current noise at the site is principally associated with traffic on State Highway 177, as operations at the Elder Gulch TSF principally involve electric pump stations and minor equipment. Other noise would include train noise from the Copper Basin Railroad that operates to the west of the proposed Hackberry Gulch TSF. This site, like the proposed Ripsey Wash TSF site, would also be subjected to noise from wind and thunderstorm activity.

6.8.2 Environmental Consequences

Noise impacts associated with either TSF would be short-term and primarily occur during early site development and construction activities, an estimated three year period that would include road building, starter dam construction, seepage trench installation, detention dam and diversion ditch construction, and miscellaneous pipeline and utility installation.

Expected noise levels for construction is expected to peak at approximately 85 to 90 dBA at 50 feet; this noise level corresponds to the type of equipment to be used for this activity. Noise levels should attenuate to near background noise levels within a mile of project work; this would depend on the topography, time of day, wind conditions, and the level of ambient noise at the location of the listener.

Some blasting may be necessary during construction work, and this would only occur during daylight hours. It is assumed that typical surface-delay blasting methods would be used. Blasting would generate a single noise that would probably be heard several miles from the blast site. The blast noise would be similar to that from thunder or a sonic boom.

With the Ripsey Wash TSF, recreationists and hikers using the re-aligned Arizona Trail would be exposed to some increased noise levels, in particular during the construction of the detention dam up-drainage of the Ripsey Wash TSF and the diversion channel structure on the east side of the proposed TSF.

The nearest residence to the Hackberry Gulch TSF site is about 1,200 feet away. The communities of Riverside and Kelvin are less than a half mile from the lower portions of the Hackberry Gulch TSF site. Residents of Riverside and Kelvin would be subject, during daylight hours, to construction noise that could reach 30 dBA over background levels.

6.9 RECREATION

6.9.1 Existing Conditions

The recreation opportunities within and immediately adjacent to the TSF sites are dispersed in nature. The one exception is the Arizona Trail, a portion of which is located within the eastern section of the proposed Ripsey Wash TSF site.

Dispersed recreational activities include hunting, hiking, camping, mountain biking, scenic driving, wildlife-viewing, OHV use, fishing, and rock collecting. Areas that support recreation in the region range from very primitive backcountry lands to developed facilities, including BLM designated wilderness areas, Arizona Game and Fish Department (AGFD) Game Management Units, Forest Service designated campgrounds and picnic areas, hiking trails, and off-highway vehicle (OHV) routes. Many of the larger communities in the region provide more formal recreation opportunities, such as parks, ball fields, golf courses, rodeo arenas and fairgrounds.

6.9.2 Environmental Consequences

Dispersed recreational opportunities such as OHV riding, camping and hunting would be affected by the construction and operation of the either the Ripsey Wash or Hackberry Gulch TSF.

Under the Ripsey Wash TSF, the Arizona Trail would be lost within and immediately adjacent to the TSF footprint. Relocation of the Arizona Trail would require replacing approximately 6.8 miles of existing trail with about 6.4 miles of new trail construction primarily along the eastern slopes of the Tortilla Mountains and about 0.2 miles of shared use along Riverside Drive.

Approximately 10.2 miles of OHV trails and several dispersed campsites would be eliminated with the Ripsey Wash TSF, and approximately 4.9 miles of primitive roads and several dispersed campsites would be eliminated within the Hackberry Gulch TSF footprint, primarily the Old Kelvin road. The Old Ray road is located adjacent to the Hackberry Gulch TSF may also need to be closed once the TSF operation reaches its full extent; closure of the Old Ray road would eliminate access to the abandoned Grey Horse Mine, a popular OHV destination and rock hounding attraction.

6.10 CULTURAL RESOURCES

6.10.1 Existing Conditions

The Corps established a permit area of potential effects for the Ripsey Wash TSF that identifies a physical area for evaluation of direct and indirect effects to historic properties.

Thirty four archaeological sites have been recorded within the Ripsey Wash permit area that would be directly affected by the construction and operation of the TSF facilities. Twenty-three of these sites are considered eligible for listing on the National Register of Historic Places (NRHP), while the others are not considered eligible.

A formal permit area was not established for the Hackberry Gulch TSF alternative; however, an analysis area was developed that included the footprint for this TSF and all supporting infrastructure.

Approximately 57% of the Hackberry Gulch TSF analysis area has been previously inventoried. Within this area, 85 sites were recorded. Six of those sites were determined to be NRHP-eligible by the SHPO, and an additional 25 were recommended as eligible. The SHPO determined that two sites are not eligible, and an additional 14 sites were recommended as ineligible. Seven sites were not evaluated for eligibility, and 31 of these sites did not have their eligibility status recorded.

The Corps also initiated tribal consultation with 14 Native American tribes in September of 2013, requesting their participation in the Section 106 consultation process. The tribes were provided the opportunity to review and comment on cultural resources documentation that had been completed to date. The Corps received replies from four tribes expressing an interest in participating with the consultation process: Gila River Indian Community, Tohono O'odham Nation, Hopi Tribe, and White Mountain Apache Tribe. Tribal consultation will be ongoing as the project progresses through the 404 permit review process.

6.10.2 Environmental Consequences

There are 23 NRHP-eligible sites located within the Ripsey Wash TSF permit area, and one site (the Florence-Kelvin highway bridge, known locally as the Kelvin Bridge) is already on the NRHP (Kelvin Bridge). Implementation of the Ripsey Wash TSF would adversely affect the NRHP-eligible sites located within the footprint for the TSF, but the Kelvin Bridge would not be affected by the project.

Based on the number of resources previously recorded in the Hackberry Gulch TSF analysis area, it is reasonable to expect that additional sites would be potentially impacted by the construction and operation of the Hackberry Gulch TSF. Additional surveys, eligibility determinations, testing, data recovery, and consultation with the SHPO and tribes would be required if this alternative were implemented. Construction and operation of the Hackberry Gulch TSF alternative would have an adverse direct effect on an unknown number of NRHP-eligible properties. The adverse effects to these sites would result because they would be located within the construction footprint for the TSF and related facilities. This would cause an unavoidable effect of tailings disposal or excavation during construction of the facility. Mitigation would probably be required to minimize an adverse effect. Even after the footprint of the Hackberry Gulch TSF site is fully surveyed and historic properties documented, the potential would exist for the discovery of previously unknown resources during construction and operation. To address this contingency, mitigation would be required.

6.11 SOCIOECONOMICS

6.11.1 Existing Conditions

The proposed Ripsey Wash and Hackberry Gulch TSF sites are located in Pinal County.

The eastern part of Pinal County has a long history with copper mining, milling and smelting. Most households in eastern Pinal County identify with making a living from the copper industry, and these communities continue to obtain economic benefits from the high wage jobs associated with the copper mining, milling and smelting business.

As of 2010 census, the population of Pinal County was 375,770 people, making it the third most populous county in Arizona. For the ten year period between 2000 and 2010, Pinal County population increased by nearly 110%. The majority of this population increase was located in the western portion of the county and resulted from suburban growth from the greater Phoenix area; however, over that same 20 year period, the populations of the communities of Kearny, Superior, Hayden and Winkelman have decreased.

The percentage of the population over 16 not in the labor force is higher in Kearny, Superior, Gold Canyon, Hayden and Winkelman than that for the state of Arizona (38.6% not in the labor force). Statewide unemployment rate is around 6%. Kearny has an unemployment rate less than 3%.

Kearny has median household income similar to the entire state, while Gold Canyon has a higher income and Superior, Hayden and Winkelman have lower median household incomes that the state average. Median earnings for individuals employed in mining have the highest for any reported earnings category.

6.11.2 Environmental Consequences

The construction of a new TSF is estimated to provide up to 200 jobs to the Pinal County workforce during the estimated three years of construction activity, but employment levels would return to current levels once TSF operations commence, as the new TSF is simply designed to replace the current Elder Gulch TSF and would be operated with the current on-site workforce.

Construction jobs would have a negligible effect on the population of Kearny and other local communities because of the temporary duration of construction and because most of the expected construction workers are assumed to already live in Pinal County. Given the temporary nature of the construction work, any individuals who are presently living outside of the region would probably not uproot themselves or their families to move to Kearny for the short duration of the construction activity.

The construction and operation of the Ripsey Wash or Hackberry Gulch TSF would not have a measurable effect on the community and public services of Kearny and other Pinal County communities. No permanent increase in local population is expected as a result of the proposed TSF; thus, there would be no influx of families, causing an increase in students for the local school systems. The existing law enforcement and fire protection personnel would continue to handle situations that arise.

6.12 TRANSPORTATION

6.12.1 Existing Conditions

The main highways within the region used by Asarco employees, contractors and suppliers are U.S. Highway 60, Arizona State Highway (SR) 177, and the Florence-Kelvin highway.

U.S. Highway 60 is the main artery that connects the Apache Junction and Phoenix metro area with points east, including the towns of Superior and Globe.

SR 177 is a two-lane asphalt highway that connects Superior and Winkleman (about 32 miles). The Ray Mine complex is accessed from SR 177.

The Florence-Kelvin highway is a 32-mile two-lane Pinal County road that connects SR 179 (about three miles south of the town of Florence) with SR 177 near the Ray Mine. For approximately 12 miles east of

SR 179, the Florence-Kelvin highway is paved with asphalt, but the remaining 20 miles is unpaved, including the portion that crosses Ripsey Wash.

6.12.2 Environmental Consequences

Under either TSF action alternative, overall average daily traffic (ADT) levels on SR 177 would increase by approximately 5% during peak construction, which includes an approximate 15% ADT increase in the truck volume.

As one of the first aspects of Ripsey Wash TSF construction, Asarco would construct a new routing (approximately 2.1 miles in length) of the Florence-Kelvin highway to the north and northeast of the TSF. This new road segment would paved with asphalt, meet required Pinal County road standards, and replace an approximate 1.8 mile long segment of the current Florence-Kelvin highway. This would reroute traffic away from Ripsey Wash TSF construction and greatly improve the condition of the Florence Kelvin highway.

Construction of the Hackberry Gulch TSF would impact traffic flow on SR 177 for an estimated 9 to 12 months with the installation of box culverts and a maintenance vehicle underpass. This construction work would necessitate speed limit reductions and traffic detours. In addition, given the proximity of SR 177 to the proposed Hackberry Gulch TSF work, traffic would be periodically stopped for certain construction activities, including blasting. These traffic delays could impact employees and contractors who commute on SR 177 from Kearny, Hayden and Winkelman, as well as non-Ray Mine traffic on SR 177, which includes local residents.

6.13 VEGETATION

6.13.1 Existing Conditions

The upland vegetation communities at both the Ripsey Wash TSF and the Hackberry Gulch TSF sites are characteristic of the Paloverde-Cacti-Mixed Shrub series of the Arizona Upland Subdivision of the Sonoran Desertscrub.

6.13.2 Environmental Consequences

The vegetation resources at either TSF site would be removed from the base of the impoundment dams and adjunct facilities (access roads, pump stations, etc.), and there would be an incremental burial of vegetation communities with tailings disposal. Portions of the vegetation communities subject to eventual burial may remain viable until the entire TSF floor is covered with tailings. Final reclamation would involve covering the tailings area with rock. Although the area might naturally revegetate to some degree, the site would not recover to the vegetative composition or density that currently exists.

6.14 VISUAL RESOURCES

6.14.1 Existing Conditions

The TSF project areas are located on the eastern edge of the Sonoran Desert subdivision of the Basin and Range Physiographic Province, which is characterized by its elongated, roughly parallel mountain ranges alternating with flat, closed (undrained) desert basins. The mountain ranges generally trend north-south and can be up to 100 miles in length. Typical landforms include creosote flats, bajada slopes, rugged mountains and steep walled canyons. Prominent landscape features in the region include the Pinal Mountains, Mineral Mountains, Dripping Springs Mountains, Tortilla Mountains, White Canyon, the Rincon and Copper Butte.

The region is primarily rural in character, with a generally natural, intact landscape. Residential communities include Superior, Kearny, Kelvin, Riverside, Hayden, and Winkelman. The Ray Mine and its associated infrastructure are visible for about five miles along SR 177.

6.14.2 Environmental Consequences

The Ripsey Wash and the Hackberry TSF projects would present visual contrasts with the natural landscape, visible from portions of the Florence-Kelvin Highway, SR 177, the Arizona Trail, and OHV routes in the vicinity of the TSF site.

The Ripsey Wash TSF would be visible to travelers on the Florence-Kelvin highway for a total distance of about 5.4 miles, to users of the realigned Arizona Trail for a distance of about 7.6 miles, and to travelers on SR 177 for a distance of about 1.7 miles.

Some of the high-elevation OHV trails east of SR 177 in the Dripping Springs Mountains would have views of the Ripsey Wash TSF, and this TSF would be visible on some of the lower elevation OHV trails along the Florence-Kelvin Highway.

The Ripsey Wash TSF would be visible in the background view from the White Canyon Wilderness Area, but views of the TSF site from the wilderness would be from relatively inaccessible areas with rugged and steep terrain that are expected to have limited public visitation.

The Hackberry Gulch TSF would be highly visible to travelers on SR 177 for a total distance of 7.8 miles and to travelers on the Florence-Kelvin highway for approximately 3.1 miles.

The community of Riverside would have a permanent panoramic view of the Hackberry Gulch TSF site, but views from the community of Kelvin would be mostly screened by vegetation. Under the Hackberry Gulch TSF alternative, the Arizona Trail would remain in its existing location, but there would be some visibility of the Hackberry Gulch TSF from this trail.

6.15 WILDLIFE

6.15.1 Existing Conditions

The topography, vegetation and water sources within the Ripsey Wash and Hackberry Gulch TSF sites create a diversity of habitats and habitat features that support a variety of terrestrial wildlife species.

Mammal game species potentially residing in or near the two TSF sites include: collared peccary or javelina, mule deer and mountain lion.

A variety of mammalian predators and furbearers are likely to inhabit the two TSF sites, including the coyote, gray fox, bobcat, hooded skunk, western spotted skunk, striped skunk, raccoon, ringtail, white-nosed coati and American. Other mammal species expected to inhabit area include the rock squirrel, Harris antelope squirrel, white-throated woodrat, desert cottontail and black-tailed jackrabbit.

Several species of raptors are known to occur in the region of the two TSF sites. Most are present as year-round residents, but a few species, the zone-tailed hawk and elf owl, are present only as summer residents. Turkey vulture occurs as both a summer and year-round resident. Other possible year-round residents include prairie falcon, American peregrine falcon, Cooper's hawk, sharp-shinned hawk, Harris's hawk, red-tailed hawk, golden eagle (*Aquila chrysaetos*), barn owl, great horned owl and western screech owl.

Waterbirds include ducks, geese, wading birds, sandpipers, and other species dependent on aquatic habitats and associated shorelines and wetlands. Suitable habitat for waterbirds within the area of the two TSF sites is restricted primarily to the Gila River.

Upland gamebirds include the Gambel's quail, mourning dove, and white-winged dove. A number of songbird and other bird species associated with Sonoran Desertscrub communities may occur within the two TSF areas; these include greater roadrunner, gila woodpecker, common raven, canyon wren, rock wren, cactus wren, curve-billed thrasher, phainopepla, black-throated sparrow, northern cardinal and pyrrhuloxia.

Reptile occurrences would be similar for the two TSF sites and include zebra-tailed lizard, ornate tree lizard, regal horned lizard, reticulate Gila monster and western diamondback rattlesnake.

Two federally listed species were identified as having the potential to occur within or near the TSF sites; they are the southwestern willow flycatcher (endangered), and the yellow-billed cuckoo (threatened).

6.15.2 Environmental Consequences

General effects on wildlife for either the Ripsey Wash TSF or the Hackberry Gulch TSF would be the physical loss of habitat, habitat fragmentation and isolation displacement of wildlife, increased competition of wildlife, impacts to special wildlife habitats, and impacts to threatened, endangered and sensitive species.

Construction and operations of the TSF would result in permanent loss of habitat. Direct impacts to wildlife habitats would occur from grading for infrastructure, removal of borrow material, and the progressive burial of vegetation and wildlife habitat features by tailings disposal. Habitat loss through tailings deposition would occur incrementally over the life of the facility within the tailings impoundment. Because of this incremental loss, portions of wildlife habitats subject to eventual burial by tailings may remain viable to some extent as the TSF footprint is progressively covered with tailings.

The most common wildlife responses to noise and human presence are avoidance and accommodation. Displacement is unavoidable in the short-term and long-term under both TSF alternatives, and this displacement has the potential to be the most significant effect on wildlife. Avoidance of disturbed areas would result in wildlife displacement from an area larger than the actual disturbed sites. The extent of this displacement would be related to the duration, magnitude and the visual prominence of the activity, as well as the extent of construction and operational noise levels above existing background levels.

Some segments of the Gila River and adjacent riparian habitat are close enough to the TSF facility to create indirect impacts during construction and operation on wildlife populations using the Gila River corridor, including the southwestern willow flycatcher (endangered) and the yellow-billed cuckoo (threatened), but such indirect impacts are expected to be minor.

7.0 COMPARISON OF ALTERNATIVES

Table ES-3, Summary of Effects by Alternative, summarizes the effects of alternatives. The intensity of the impact is based on how the alternative would affect each resource. General terms used to describe impact intensity in this table are:

- **None –** No impact
- **Negligible** – An impact at the lowest levels of detection with barely measurable consequences.
- **Minor** – An impact with little loss of resource integrity and with changes that are small, localized, and of little consequence.
- **Moderate** – An impact that would alter the resource but not modify overall resource integrity, or an impact that could be mitigated successfully in the short term.
- **Major** – An impact that would be substantial, highly noticeable, and long term.

Table ES-3, Summary of Effects by Alternative

ENVIRONMENTAL PARAMETER	NO ACTION ALTERNATIVE	RIPSEY WASH TSF (PROPOSED ACTION)	HACKBERRY GULCH TSF
Aesthetics and Visual Resources			
Visual effects for residents of Kearny, Kelvin and Riverside	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	None - View of TSF blocked by Tortilla Mountains.	Major - View of TSF would be a permanent feature for residences.
Visual effects for travelers on State Highway 177	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Minor – visible in middleground for about 1.7 miles along this highway.	Major – permanent foreground and middleground view for 7.8 miles.
Visual effects for travelers on the Florence-Kelvin highway	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Major - permanent foreground and middleground view for 5.4 miles.	Major - permanent foreground and middleground view for 3.1 miles.
Visual effects for recreational users in the area, particularly those on the Arizona Trail	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Major - permanent and middleground view for 7.6 miles north of Gila River.	Major - permanent foreground and middleground view for 4.6 miles.
Air Quality and Climate			
Compliance with federal and Pinal County air quality standards	Not applicable – proposed tailings facilities would not be constructed.	Compliance expected.	Compliance expected. More total emissions than Ripsey Wash TSF.

ENVIRONMENTAL PARAMETER	NO ACTION ALTERNATIVE	RIPSEY WASH TSF (PROPOSED ACTION)	HACKBERRY GULCH TSF
Fugitive dust emissions (Construction) Annual Average for 3 Years PM_{10} $PM_{2.5}$ Construction PM_{10} by year	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	90.0 tons/year 7.5 tons/year Yr. 1 – 85 tons/year Yr. 2 – 94 tons/year Yr. 3 – 90 tons/year	64 tons/year 6 tons/year Yr. 1 – 18 tons/year Yr. 2 – 98 tons/year Yr. 3 – 76 tons/year
Fugitive dust emissions (Centerline Tailings Operations) Annual Average for PM_{10} $PM_{2.5}$	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	12.0 tons/year 2.0 tons/year	20 tons/year 3 tons/year
Fugitive dust emissions (Upstream Tailings Operations) Annual Average for PM_{10} $PM_{2.5}$	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	16 tons/year 2 tons/year	18 tons/year 3 tons/year
Gaseous emissions (Initial Development and Site Construction) Annual Average for 3 Years NO_X VOC CO SO_2 CO_2 CH_4 N_2O	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	18 tons/year 3 tons/year 39 tons/year <.1 tons/year 2,978 tons/year <.1 tons/year <.1 tons/year	18 tons/year 3 tons/year 28 tons/year <0.1 tons/year 2,273 tons/year <0.1 tons/year <0.1 tons/year
Gaseous emissions (Centerline Tailings Operations) Annual Average for 3 Years NO_X VOC CO SO_2 CO_2 CH_4 N_2O	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	<1 tons/year <1 tons/year 3 tons/year <1 tons/year 168 tons/year <0.1 tons/year <0.1 tons/year	0.3 tons/year 0.1 tons/year 3 tons/year <1 tons/year 183 tons/year <0.1 tons/year <0.1 tons/year
Gaseous emissions (Upstream Tailings Operations) Annual Average for 3 Years NO_X VOC CO SO_2 CO_2	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	<1 tons/year <1 tons/year 3 tons/year <1 tons/year 168 tons/year <0.1 tons/year	0.3 tons/year 0.1 tons/year 2 tons/year <1 tons/year 182 tons/year <0.1 tons/year

ENVIRONMENTAL PARAMETER	NO ACTION ALTERNATIVE	RIPSEY WASH TSF (PROPOSED ACTION)	HACKBERRY GULCH TSF
CH_4 N_2O		<0.1 tons/year	<0.1 tons/year
Windblown emissions to residents of Kelvin and Riverside	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Negligible because TSF blocked from these communities by Tortilla Mountains	Moderate to Major, especially during windy days.
Visibility effects to any Class I areas in the vicinity of project	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Negligible. Closest Class I area is Superstition Mountains Wilderness area located about 12 miles from TSF site.	Same as Proposed Action.
Climate change effects	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Negligible TSF CO_2 emissions represent 0.00001% of worldwide CO_2 levels	Negligible TSF CO_2 emissions represent 0.000015% of worldwide CO_2 levels
Cultural and Historic Resources			
Effects to pre-historic and historic properties listed or eligible for listing on the National Register of Historic Places	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Direct effect to 20 NRHP-eligible sites to be disturbed	Unknown. Only 57% of tailings footprint surveyed for cultural resources. In that 57% surveyed area, 31 NRHP-eligible or recommended as being eligible by SHPO.
Potential to affect cultural resources, reserved rights, trust issues, traditional cultural properties, and other responsibilities of Native American tribes	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	None	None
Geochemistry			
Potential for tailings and construction borrow materials to generate acid rock drainage	None – proposed TSF would not be constructed.	Negligible – geochemical testing, including Meteoric Water Mobility Procedure Testing and 52-week Humidity Cell Testing revealed no acid rock drainage potential.	Same as Proposed Action.

ENVIRONMENTAL PARAMETER	NO ACTION ALTERNATIVE	RIPSEY WASH TSF (PROPOSED ACTION)	HACKBERRY GULCH TSF
Potential to leach metals from tailings	None – proposed TSF would not be constructed.	Negligible – geochemical testing, including Meteoric Water Mobility Procedure Testing and 52-week Humidity Cell Testing revealed no acid rock drainage potential.	Same as Proposed Action.
Geotechnical			
Potential for TSF failure	Not applicable – proposed tailings facilities would not be constructed.	Negligible with proper design, construction and operation.	Same as Proposed Action.
Engineering Design and Construction Complexity	Not applicable – proposed tailings facilities would not be constructed.	"Valley-fill" placement of tailings allows for limited seepage control facilities. Ample space is available for installation of support infrastructure, such as seepage trenches and reclaim ponds.	Seepage control required in seven incised drainages – difficult to install and maintain. Need to install overpass and box culverts on State Highway 177, with facilities on both sides of highway. Down-gradient reclaim ponds in incised drainages and limited room between these facilities and Gila River. Complex up-gradient diversion and detention dam infrastructure in steep topography. Major engineering logistics associated with working on either side of State Highway 177.
Surface Water Hydrology and Watershed Resources			
Alteration of existing hydrologic systems by direct disturbance	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Remove 16% of runoff potential from Ripsey Wash and 20% of runoff potential from East Wash.	Loss of runoff potential from following drainages at Hackberry Gulch TSF site: • Hackberry Gulch: 24% • Kane Springs Canyon: 15% • Belgravia Wash: 43% • B Wash: 78% • C Wash: 77% • E Wash: 46% • F Wash: 11%

ENVIRONMENTAL PARAMETER	NO ACTION ALTERNATIVE	RIPSEY WASH TSF (PROPOSED ACTION)	HACKBERRY GULCH TSF
			• G Wash: 1% • H Wash: 2%
Potential for increased down-drainage sediment levels	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Minor with proper controls, except if intense rainstorms that exceed design storm event used for control measures.	Same as Proposed Action.
Alteration of downstream flow rates and any changes in the downstream water chemistry in the Gila River	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Negligible. TSF footprint about 0.02% of Gila River watershed at confluence of Zelleweger Wash (immediately down-drainage of TSF.	Negligible. TSF footprint about 0.02% of Gila River watershed at USGS Kelvin gaging station (immediately down-drainage of TSF).
Impacts on existing surface water rights or uses	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Negligible-Minor. No known springs or seeps in TSF footprint. Five stock watering tanks to be affected, but these tanks would be located on Asarco lands if ASLD sale is consummated.	Major. TSF would obliterate two springs, eleven seeps, two wetland areas, and one stock watering tank.
Waters of the U.S.			
Direct impacts to Waters of the U.S. (acres) Wetland Perennial/Intermittent Ephemeral	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	130.23 acres 0 acres 0 acres 130.23 acres	51.70 acres 0.62 acres 1.65 acres 49.43 acres
Indirect impacts to Waters of the U.S. (acres)	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	4.13 acres	19.80 acres
Impact to Linear Feet of waters of the U.S. Total Linear Impact to waters of the U.S. within Watersheds.	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	168,490 feet 1.7%	228,325 feet 2.3%

ENVIRONMENTAL PARAMETER	NO ACTION ALTERNATIVE	RIPSEY WASH TSF (PROPOSED ACTION)	HACKBERRY GULCH TSF
Potential changes in the functions and values of down-drainage wetlands and waters of the U.S. along Gila River.	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Unlikely to change functions and values of down-drainage wetlands and waters of the U.S. along Gila River. TSF footprint about 0.02% of Gila River watershed at confluence of Zelleweger Wash (immediately down-drainage of TSF).	Same as Proposed Action. TSF footprint about 0.02% of Gila River watershed at USGS Kelvin gaging station (immediately down-drainage of TSF).
Groundwater Hydrology			
Potential to alter existing down-gradient groundwater hydrologic systems by tailings disposal	None – proposed tailings facilities would not be constructed.	Negligible with proper design, construction and operation.	Negligible with proper design, construction and operation.
Changes in down-gradient alluvial or bedrock groundwater chemistry from tailings disposal	None – proposed tailings facilities would not be constructed.	Minor with proper design, construction and operation. Modeling indicates down-gradient compliance with Arizona Aquifer Water Quality Standards.	Minor with proper design, construction and operation. Down-gradient compliance with Arizona Aquifer Water Quality Standards is expected.
Effectiveness of Seepage Control	Not applicable – proposed tailings facilities would not be constructed.	Good given "valley-fill" nature of TSF. Two seepage control points down-gradient (Ripsey Wash and East Wash) keyed to low-permeability Ruin Granite formation. Control of seepage expected with design safeguards for Hackberry Fault.	Difficult given "side-hill" construction and incised nature of seven drainages where seepage control would be implemented.
Impacts on existing groundwater wells registered with Arizona Department of Water Resources	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Minor as most wells owned or controlled by Asarco. 13 wells to be eliminated within TSF footprint. 18 wells located down-gradient (within 0.5 miles). Most wells for Asarco exploration or for baseline monitoring purposes. CHECK	Major as many wells not controlled by Asarco. 19 wells to be eliminated within TSF footprint. 23 wells located down-gradient (within 0.5 miles). Possible impact to 7 private (non-Asarco) down-gradient wells. CHECK
Land Use			
Total operational disturbance area (acres)	None – proposed tailings facilities would not be constructed.	2,574 acres	2,290 acres
Total operational disturbance by ownership (acres/%) Private State BLM	None – proposed tailings facilities would not be constructed.	48 acres / 1.9% 2,517 acres / 97.7% 9 acres / 0.4%	1,141 acres / 49.9% 0 acres / 0% 1,149 acres / 50.1%

ENVIRONMENTAL PARAMETER	NO ACTION ALTERNATIVE	RIPSEY WASH TSF (PROPOSED ACTION)	HACKBERRY GULCH TSF
Effects on livestock grazing in the area	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Minor to grazing allotments. Remove land from following allotments: A Diamond: 2,381 acres or about 11.5% of allotment; and Rafter Six: 149 acres - about .06% of allotment.	Minor to grazing allotments. Remove land from following allotments :Rafter Six: 2,267 acres or about 8.4% of allotment; and Troy: 23 acres or about .04% of allotment.
Changes in future (post-project) land use	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Irreversible from present condition. Tailings would be covered with rock so substantial lower value for wildlife use and dispersed recreation values.	Same as Proposed Action.
Noise			
Construction Noise Effects	None – proposed tailings facilities would not be constructed.	Minor to residents of Kelvin and Riverside that are over one mile from proposed TSF site. Noise would be blocked by Tortilla Mountains, but some noise during construction of pipeline, pumping station, and supply trucks. Closest residence = 2,000 feet (Noise blocked by Tortilla Mtns.)	Moderate to major to residents of Kelvin and Riverside, as some residents within 0.25 mile of construction activities. Persistent daylight noise levels could increase up to 30 dBA over background noise levels for up to three years. Closest residence = 500 feet (noise not blocked)
Operation Noise Effects	None – proposed tailings facilities would not be constructed.	Negligible to residents of Kelvin and Riverside.	Minor to moderate to residents of Kelvin and Riverside.
Noise effects on wildlife	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Minor to moderate. Some displacement expected during construction activities. Construction of pipeline bridge could affect species along Gila River.	Minor to moderate. Some displacement expected during construction activities.
Noise effects on recreational users, especially on ARIZONA TRAIL	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Moderate during construction and closure. Minor during operations. During construction, hikers on Arizona Trail would be exposed to some noise during construction of Ripsey Wash detention dam and East Wash diversion channel. During closure, noise associated with rock placement over tailings.	Negligible. Limited construction or operational noise to hikers on Arizona Trail.

ENVIRONMENTAL PARAMETER	NO ACTION ALTERNATIVE	RIPSEY WASH TSF (PROPOSED ACTION)	HACKBERRY GULCH TSF
Noise effects to worker health and safety	Not applicable – proposed tailings facilities would not be constructed.	Negligible with appropriate hearing protection.	Same as Proposed Action.
Accidents and Spills			
Potential of possibility of accident that would necessitate an emergency response	None – proposed tailings facilities would not be constructed.	The probability of accidents always exists, but incident level is expected to be minor given safety awareness and safety precaution measures.	Same as Proposed Action.
Potential for an accidental spill of tailings or other substances that could impact the environment, especially to the Gila River.	None – proposed tailings facilities would not be constructed.	Minor. Double tailings pipeline across Gila River planned, and tailings drain-down pond will be in place in event of problem or maintenance. Spill control contingency plans required by APP by Arizona DEQ in place to handle accidents and spills.	Same as Proposed Action.
Recreation			
Disruption to developed recreational facilities, such as the Arizona Trail	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Moderate - Direct impact to Arizona Trail which must be relocated. Existing Arizona Trail to be replaced: 6.8 miles. New construction of Arizona Trail: 6.4 miles. Length of new Arizona Trail with views of Ripsey Wash TSF: 1.2 miles. No other developed recreation facilities in proposed Ripsey Wash TSF footprint.	None - no disturbance to Arizona Trail. No developed recreation facilities in proposed Hackberry Gulch TSF footprint.
Disruption to undeveloped or dispersed recreation opportunities, such as off-road recreation and hunting.	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Minor to Moderate. Off-road recreationists would no longer be able to travel in Ripsey Wash where covered by TSF footprint. Displacement of hunting to areas outside of TSF footprint. Primitive road access would remain available in upper reaches of Ripsey Wash drainage area including lands acquired by Asarco.	Minor to moderate. Displacement of off-road use and hunting to areas outside of TSF footprint. Primitive road access would remain available in upper reaches of Hackberry Gulch drainage area.

ENVIRONMENTAL PARAMETER	NO ACTION ALTERNATIVE	RIPSEY WASH TSF (PROPOSED ACTION)	HACKBERRY GULCH TSF
Potential disruption to visitors in White Canyon Wilderness area	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Minor. TSF would be visible from White Canyon Wilderness.	None. View blocked by Tortilla Mountains.
Roads / Transportation			
Potential disruption to road use/ traffic on the State Highway 177	Negligible. Area would continue to be exposed to increased recreation activity.	Minor. There would be an estimated additional 115 vehicles per day using SR 177 at peak construction. This would mean an approximate 15% ADT increase in the truck volume over existing conditions during peak construction	Moderate to Major. Traffic estimates the same as Proposed Action. Expect delays for box culvert and overpass installation during construction. Delays also during construction when blasting required. High visibility of highway and TSF construction activities could distract drivers.
Potential disruption to road use and traffic on the Florence-Kelvin highway	Negligible. Area would continue to be exposed to increased recreation activity.	Minor to Moderate. Limited current traffic. A potential 50% increase in traffic during construction. Only minor increased traffic during operations. Re-routing of Florence-Kelvin highway should have negligible effect on traffic as re-route would be located in different right-of-way than existing road. Replace 1.8 miles of gravel county road Construct new 2.1 miles of paved road	None expected
Maintenance impacts to State Highway 177	None – proposed tailings facilities would not be constructed.	None expected.	Minor. Installation of box culverts and overpass would require detours and long-term maintenance.
Maintenance impacts to Florence-Kelvin highway	None – proposed tailings facilities would not be constructed.	Minor. Re-route of Florence-Kelvin highway to be paved with asphalt, which would lessen annual maintenance of new road stretch.	None expected
Potential for accidents with any increased construction and operational road use	None – proposed tailings facilities would not be constructed.	Minor. Limited traffic on Florence-Kelvin highway.	Minor. Drivers could be distracted by highway and TSF construction activities.
Socioeconomics			

ENVIRONMENTAL PARAMETER	NO ACTION ALTERNATIVE	RIPSEY WASH TSF (PROPOSED ACTION)	HACKBERRY GULCH TSF
Employment	Not applicable – proposed tailings facilities would not be constructed.	Moderate during construction with potential for 200 additional workers (peak). Negligible to minor during operations with potential for slight increase in employment (up to 10 workers) over current Ray Mine workforce.	Same as Proposed Action.
Impacts to housing, utilities, public services and present lifestyles in local communities	Negligible. Area would continue to be exposed to increased recreation activity.	Negligible. Local communities and infrastructure should handle construction workforce.	Same as Proposed Action.
Soils			
Availability of soils for reclamation	Not applicable – proposed tailings facilities would not be constructed.	Lack of suitable soils for reclamation. No soil salvage planned.	Same as Proposed Action.
Potential of increased soil erosion and sedimentation	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Minor with proper controls, except if intense rainstorms exceed stormwater control features.	Same as Proposed Action.
Vegetation			
Impacts to vegetation communities	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Major. All vegetation to be removed (beneath tailings dams, drain-down ponds, and reclaim ponds), grubbed during installation of roads, or buried by tailings materials.	Same as Proposed Action.
Potential impacts to US Fish & Wildlife Service threatened and endangered plant species	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Unlikely to affect habitat for Acuna cactus (USFWS endangered species). Nearest known species over 7 miles away.	Same as Proposed Action. Nearest known Acuna cactus over 13 miles away.
Potential impacts to BLM sensitive plant species	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Possible impact to Pina Indian mallow (*abutilon parishii*) but nearest know species is 14 miles away	Same as Proposed Action. Nearest known Pina Indian mallow is over 9 miles away.

ENVIRONMENTAL PARAMETER	NO ACTION ALTERNATIVE	RIPSEY WASH TSF (PROPOSED ACTION)	HACKBERRY GULCH TSF
Potential spread of noxious weeds	Potential exists. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	No weeds found during field investigations, but weeds can have an aggressive nature and invade disturbed areas.	Same as Proposed Action.
Wildlife			
Impacts to wildlife habitat	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Major. Direct impact to 2,574 acres at full build-out of tailings facilities. Some avoidance by wildlife of adjacent habitat likely during construction.	Major. Direct impact to 2,290 acres at full build-out of tailings facilities. Some avoidance by wildlife of adjacent habitat likely during construction.
Changes in wildlife use patterns	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Some displacement of wildlife expected during construction.	Same as Proposed Action.
Potential impacts to wildlife species of concern to Arizona Game and Fish Department	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	California leaf-nosed bat and Pocketed free-tail bat may use abandoned mine features located with proposed TSF footprint. Project development could result in loss of a few individual species if abandoned mine features are destroyed while occupied by these species.	Loss of perennial springs and associated surface water areas within TSF footprint would destroy suitable habitat for lowland leopard frog. No abandoned mine features affected by this alternative, so no roosting habitat in these features would be disturbed, thus unlikely to affect California leaf-nosed bat and Pocketed free-tail bat.
Potential impacts to US Fish & Wildlife Service threatened and endangered wildlife species	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	The Southwestern willow flycatcher (endangered) and Yellow-billed cuckoo (threatened) are known to occur within or adjacent to TSF. A biological assessment (BA) will be assembled to address possible impacts to these species and to propose mitigation measures for their protection from the development and operation of the TSF.	Same as Proposed Action.

ENVIRONMENTAL PARAMETER	NO ACTION ALTERNATIVE	RIPSEY WASH TSF (PROPOSED ACTION)	HACKBERRY GULCH TSF
Potential impacts to BLM sensitive wildlife species	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Minor to Moderate. The following BLM sensitive species that may use habitat within or adjacent to the proposed TSF footprint: • Desert purple martin • Gilded flicker • Golden eagle • California leaf-nosed bat • Cave myotis • Greater Western bonneted bat • Townsend's big-eared bat. • Banner tailed kangaroo rat • Peregrine falcon	Same as Proposed Action.
Impacts to fisheries in Gila River	Negligible. Area would continue to be exposed to natural geomorphic processes or other disturbances associated with recreation and ranch management.	Negligible. Site development and operations unlikely to have any adverse effects on fish and other aquatic species populations in the Gila River.	Same as Proposed Action.

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1.0 PURPOSE OF AND NEED FOR ACTION

1.1 INTRODUCTION

ASARCO LLC (Asarco) plans to construct and operate a new tailings[1] storage facility (TSF) to receive tailings generated at the Ray Mine, which is an existing open pit copper mine located in Pinal County, Arizona about 10 miles northwest of the community of Kearny and approximately 65 miles southeast of the city of Phoenix. See **Figure 1, General Location Map**.

Asarco's proposed TSF site is located in Ripsey Wash, approximately four miles southwest of the existing Elder Gulch TSF, the present site being used at the Ray Mine for tailings storage.

The TSF as proposed by Asarco would be constructed primarily on lands that are either currently owned by Asarco or would be owned by Asarco presumably after completion of a pending land sale with the Arizona State Lands Department (ASLD). A relatively small portion of the proposed TSF infrastructure (a tailings pipeline, a return-water pipeline, a re-routed existing 69kV electric transmission line) and a re-route of a segment of the Arizona National Scenic Trail (Arizona Trail) would be constructed on lands administered by the Bureau of Land Management (BLM).

In March 2013, Asarco submitted a permit application (that was subsequently revised) to the U.S. Army Corps of Engineers (Corps) for the proposed Ripsey Wash TSF to comply with regulations promulgated under Section 404 of the Clean Water Act. This permit is required because the Corps has determined the Ripsey Wash drainage and other ephemeral washes within the proposed project footprint are "Waters of the United States" and subject to Corps jurisdiction under Section 404 of the Clean Water Act. Asarco, as the applicant, is proposing to place fill material within waters of the United States, which triggers the requirement for a 404 permit.

With the 404 permit application submittal, the Corps determined that an environmental impact statement (EIS) would be prepared to comply with the National Environmental Policy Act (NEPA). The Corps is the lead agency for the EIS preparation work. The Environmental Protection Agency (EPA), the BLM, and the Bureau of Indian Affairs - San Carlos Irrigation Project (SCIP) are formal NEPA cooperating agencies on this EIS.

This EIS documents the environmental analysis of the proposed Ripsey Wash TSF, evaluates alternatives, describes environmental impacts, and considers management and mitigation measures associated with the Proposed Action. This EIS also provides a forum for public review and comment on the project and highlights the associated relevant issues, as determined during the NEPA scoping process for the project.

Additional information about the EIS preparation process for the Ripsey Wash tailings storage facility is set forth in **Appendix A, The NEPA Process**.

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[1] Tailings are the finely-ground rock material produced by the milling process, which separates copper-bearing minerals from non-economic material. Tailings should not be confused with overburden or development rock (sometimes referred to as waste rock), which is non-mineralized or uneconomic mineralized material excavated in order to access the copper-bearing ore that is mined and processed to generate a profit.

1.2 SCOPE AND CONTENT OF THE DRAFT EIS

1.2.1 Scope of Analysis

The Corps has completed this EIS in accordance with procedures specified by Council on Environmental Quality (CEQ) regulations for NEPA (40 CFR §1500 – 1508), CEQ guidance, the Corps' NEPA Implementation Procedures for the Regulatory Program (33 CFR Part 325, Appendix B), and South Pacific Division's Standard Operating Procedure for Preparing and Coordinating EIS Documents (12509-SPD).

The NEPA scope of analysis is normally defined by 33 CFR 325, Appendix B, which states "the district engineer should establish the scope of the NEPA document to address the impacts of the specific activity regarding the DA (Department of the Army) permit and those portions of the entire project over which the district engineer has sufficient control and responsibility to warrant federal review".

The Corps has identified the scope of analysis for the federal review of the Asarco's proposed alternative to consist of impacts to waters of the U.S. that would be associated with construction of the new TSF and all related components. The scope of the analysis also includes the review of a possible relocation of a 69-kV powerline owned and operated by SCIP, the placement of certain TSF-related infrastructure, the reroute of a segment of the Arizona Trail that would involve lands managed and administered by the BLM, and the implementation of compensatory mitigation at multiple locations in the project region. In addition, the Corps has identified the indirect and cumulative effects within the scope of federal control that could occur as a result of Asarco's proposed alternative.

While operational impacts in upland areas are outside the geographic jurisdiction of the Corps, NEPA requires the Corps to fully disclose potentially significant indirect and cumulative effects occurring as a result of the permit action. Therefore, the Corps is preparing this EIS for the construction and operation of Asarco's proposed alternative in its entirety, from where new infrastructure (i.e., tailings and return water pipelines) tie to the existing infrastructure such as the existing thickener tanks.

The Ray Mine has existing infrastructure associated with its milling activities at the Ray Concentrator and the existing Elder Gulch TSF. No changes to the mining or milling (concentration) processes are being considered in the EIS analysis, which focuses on the proposed new Ripsey Wash TSF and possible TSF alternatives. The ongoing open-pit mining, leach operations and milling activities would remain the same under all alternatives, and any TSF action alternative (including the proposed action alternative) would be supported by the existing Ray Mine operations, which include continued mining, development rock removal and storage, leaching and operation of the SX-EX facility, milling at the Ray Concentrator, some ore haulage by railroad to the Hayden Concentrator, and concentrate transport from the Ray Concentrator to the Hayden smelter by railroad.

Many of the Ray Mine on-site facilities and infrastructure associated with the existing Elder Gulch TSF would continue to be used in the future for the proposed action and any other alternative. Activities of the Ray Mine upstream of the existing thickener tanks are not being considered as connected actions and thus not included in the analysis of direct and indirect effects associated with the Applicant's proposed action. Rather, these facilities, along with the rest of the Ray Mine operations, are being considered as part of the cumulative impact analysis.

The Corps does not consider the pending BLM Asarco Ray Land Exchange (Ray Land Exchange) as a connected action with respect to the proposed TSF, and this land exchange is addressed as part of the cumulative impact analysis within this EIS. The proposed new TSF project has been separately planned by Asarco to address a different purpose and need, and the TSF project and the Ray Land Exchange have independent utility and can be implemented independently from each other. The proposed TSF project does not trigger the Ray Land Exchange or visa versa.

The purpose of the Ray Land Exchange is to allow Asarco to obtain fee simple title to land in the vicinity of the Ray Mine for the purpose of greater title certainty and to consolidate Asarco's private land holdings. The exchange was not intended to acquire fee title to land for additional tailings storage, nor is such fee title necessary for seeking additional tailings storage under the General Mining Law of 1872, as amended (Mining Law). Even if a TSF alternative site is identified in this EIS that includes some of the Selected Lands identified in the proposed Ray Land Exchange, Asarco would have the right under the Mining Law to use the site for tailings storage or other mining-related activities, even if the Ray Land Exchange was not completed, provided that Asarco obtain all required permits and approvals.

1.2.2 Intended Uses of this EIS

This EIS has been prepared in accordance with applicable federal environmental regulations, policies, and laws to inform federal decision-makers regarding the potential environmental impacts of the issuance of a 404 permit for the Applicant's Proposed Alternative and other alternatives. As an information document, an EIS does not recommend approval or denial of a project. This draft EIS is being provided to the public for review, comment, and participation in the analysis process. After public review and comment, a final EIS will be prepared. The final EIS will include responses to comments on the draft EIS received from agencies, organizations, and individuals. The final EIS will be used by the Corps to support decision-making on the applicant's 404 permit application.

1.3 PURPOSE AND NEED

As documented in **Appendix B, Alternative Screening and Clean Water Act Section 404(b)(1) Alternative Analysis**, current mine plans for the Ray Mine anticipate milling approximately 850 million tons of sulfide ore over the currently project remaining life of the mine[2] (estimated at roughly 50 years based on the presently identified resources and production rates).[3]

Currently, sulfide ore from the Ray Mine is processed at two facilities, the onsite Ray Mine Concentrator and the offsite Hayden Concentrator located approximately 20 miles away. The milling of approximately 850 million tons of sulfide ore is anticipated to result in the production of approximately 850 million dry tons of tailings, less the mineral extracted (less than two percent of total).

For planning purposes, the amount of tailings storage required is estimated to be the amount of sulfide ore that would be processed through the life of mine (850 million tons). The Elder Gulch facility at the Ray Mine has the capacity to accept approximately 100 million more dry tons of tailings before it reaches capacity. The Hayden tailings facilities have approximately 200 million tons of remaining capacity. This leaves a need for approximately 550 million dry tons of additional tailings storage capacity based on current projects or ore resources.

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[2] The projected mine life depends on a variety of factors, including the price of copper and the cost of production (which can change with changes in technology). Thus the current estimate of mine life and available resources may change over time.

[3] The Ray Mine also produces oxide ore, from which copper is extracted through leaching rather than milling and smelting. The production of copper from oxide ore through leaching does not result in tailings.

Considering the trends of the past 40 years, which generally have allowed for lower cost recovery of ore and thus have resulted in an increase in resources by allowing lower grade ore to be processed profitably, and considering the world demand as discussed above, it is reasonable to predict that additional resources will be delineated at the Ray Mine and that additional tailings storage capacity will be required. In addition, a tailings facility generally requires the construction of a starter dam or embankment using rock as an initial step prior to tailings deposition.

In order to allow for possible additional resources identified in the future, and to account for starter dam or embankment construction, the Applicant has estimated for the purposes of this analysis that the new TSF may need to accommodate an additional roughly 200 million dry tons of material, for a total capacity or roughly 750 million tons. **Table 1-1, Future Tailings Storage Capacity Needs for Ray Mine**, summarizes the need for tailings storage capacity for the Ray Mine.

Table 1-1, Future Tailings Storage Capacity Needs for Ray Mine

Storage Requirement	Amount (million tons)
Total estimated sulfide ore resource (life of mine)	850
Remaining tailings storage capacity at Elder Gulch TSF	100
Remaining estimated tailings storage capacity at Hayden TSF	200
Tailings storage shortfall	550
Contingency capacity for changed market conditions and/or future technologies for mining and to account for the starter dam and embankment construction	200
Total Requirement	**750**

Therefore, the Applicant's purpose and need for the Project is to create additional tailings storage to support up to approximately 750 million tons of material (mill tailings produced by the Ray Mine Concentrator and embankment material). Capacity to deposit approximately 750 million tons is approximately 45,000 tons per day (tpd), representing the maximum design capacity of the current Ray Mine Concentrator, has been assumed in analyzing tailings transport requirements.

The Applicant's basic project purpose is mine tailings storage, which is not water-dependent.[4] The Applicant's overall project purpose is the development of tailings storage capacity that will allow the full utilization of the mineral resource at the Ray Mine, using infrastructure and processes already in existence at the mine.[5]

1.4 DECISION FRAMEWORK

The Corps is the NEPA lead agency responsible for completion of this EIS, which is being prepared to support the Corps' decision-making process for the requested 404 permit. The agency has followed

[4] As a general rule, the basic purpose of the project must be known to determine if the project is water-dependent (i.e., requires access to, or siting within, a special aquatic site in order to fulfill its basic purpose). If a proposed project is not water-dependent and would impact a special aquatic site (e.g., a wetland), then there is a strong regulatory presumption that practicable alternatives that do involve special aquatic sites are available, and that such alternatives have less adverse impact on the aquatic ecosystem. 40 C.F.R §230.10(a)(3); Army Corps of Engineers Standard Operating Procedures for the Regulatory Program, page 15 (July 2009).

[5] See U.S. Army Corps of Engineers Standard Operating Procedures (SOP) for the Regulatory Program, page 15 (July 2009). The Corps SOP states that "the overall project purpose is used to evaluate less environmentally damaging practicable alternatives" and "must be specific enough to define the applicant's needs, but not so restrictive as to constrain the range of alternatives that must be considered under the 404(b)(1) guidelines."

specific procedures that began with scoping and data collection and continued with analysis of data and evaluation of alternatives.

The Corps will consider comments on the draft EIS submitted by the public, interested organizations and government agencies and will respond to those comments in a final EIS. As appropriate, the final EIS will reflect changes or updates that result from the comments received on the draft EIS.

After the release of the final EIS, the Corps will issue a Record of Decision (ROD) regarding its decision on the Proposed Action. In the ROD, the Corps may decide to:

- Issue a 404 permit with or without special conditions on the project described in the applicant's 404 permit application,
- Deny the 404 permit request, or
- Allow the applicant to withdraw the 404 permit application.

1.5 AGENCY RESPONSIBILITIES AND JURISDICTIONS

A number of federal, state and local permits, easements and rights-of-way (ROWs) are or could be required for the construction and operation of a new TSF at the Ray Mine. See **Appendix C, Agency Jurisdictions (Regulatory Framework)**.

Preparation of an EIS and the actual permitting processes are related but distinctly separate. An EIS is designed to examine possible alternatives and to discuss environmental effects. The permitting or approval processes give individual government decision makers the authority to grant, conditionally grant, or deny individual permit applications. Permits can be granted with requirements and conditions to eliminate and/or mitigate specific adverse impacts pursuant to their individual regulations and guidelines.

1.5.1 U.S. Army Corps of Engineers

The Corps, as the NEPA lead agency, will use this EIS to support its decision on an application for a 404 permit from Asarco. This EIS provides an analysis of the proposed alternative submitted by Asarco in their 404 permit application along with an analysis of other alternatives, including the No Action Alternative. This EIS also provides the 404(b)(1) alternatives analysis required for evaluation of a 404 permit. See **Appendix B, Alternative Screening and Clean Water Act Section 404(b)(1) Alternative Analysis**.

1.5.2 Bureau of Land Management

Although the only Asarco-proposed operational activity on BLM-administered lands would be the installation and use of approximately 1,500 feet (or about 0.3 miles) of the tailings and reclaim water pipelines for the Proposed Action, the BLM is a NEPA cooperating agency on this EIS and would use this EIS to support their decision-making processes.

Under the Proposed Action, the Applicant would require a BLM right-of-way grant for the segment of the tailing delivery and reclaim water pipelines that would cross their administered surface lands. In addition, if the Corps issues a 404 permit for the Proposed Action in Ripsey Wash, Asarco proposes to reroute the Arizona National Scenic Trail (Arizona Trail)[6]. The BLM must approve any portion of a relocated Arizona Trail that would cross their administered surface lands.

Where Asarco proposes to quarry rock material from BLM-administered mineral estate for construction, concurrent reclamation (i.e., rock cover on the outer slope of the tailings embankment) and/or closure (i.e., rock cover material over the tailings), the BLM would need to authorize a mineral material sale for that rock material.

Other BLM approvals may be required depending on whether any alternatives considered in detail in this EIS involve the use or crossing of BLM administered surface lands and mineral estate.[7]

1.5.3 San Carlos Irrigation Project—Bureau of Indian Affairs

Under the Proposed Action, the Applicant must relocate a portion of an existing 69 kilovolt (kV) electric transmission line that traverses Ripsey Wash. This line is owned and managed by the San Carlos Irrigation Project (SCIP), an entity that is organized under the Western Region office of the U.S. Bureau of Indian Affairs. SCIP is a NEPA cooperating agency on this EIS and would use this EIS to support their decision-making process involved with the relocation of the electric transmission line.

1.5.4 Environmental Protection Agency

EPA has an independent reviewer role for all EIS documents published by federal agencies. In addition, based on its jurisdiction by law and special expertise associated with the Clean Water Act and Clean Air Act, EPA is a NEPA cooperating agency with the Corps on this EIS.

1.6 SCOPING AND PUBLIC INVOLVEMENT

Asarco's March 2013 submittal of an initial 404 permit application to the Corps initiated action under NEPA regulations. As required by NEPA (40 CFR §1501.7), the Corps provided for an early and open process to determine the scope of the issues to be addressed and the extent of the environmental analysis necessary for an informed decision on the proposed Ripsey Wash TSF.

On August 26, 2013, the Corps published their Notice of Intent (NOI) to prepare an EIS for this Project in the *Federal Register*. The Corps allowed for a 60-day comment period to end on October 28, 2013. However, with the October 2013 shut-down of portions of the federal government, the Corps extended the scoping comment period for another 21 days, until November 18, 2013.

In addition to the notice in the *Federal Register*, the Corps also placed public notices in local newspapers (*East Valley Tribune*, *Arizona Silver Belt*, and *Copper Area News*) on September 4, 11 and 18, 2013. These notices announced the Corp's plans to prepare an EIS for the proposed TSF, along with the time and place for the public scoping meetings where the public and interested parties could learn more about the project and provide comments to the Corps.

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[6] The Arizona National Scenic Trail (Arizona Trail) traverses north-south across Arizona from Mexico to Utah and was designated as a National Scenic Trail by the Omnibus Public Land Management Act of 2009. It links deserts, mountains, canyons, communities and people.

[7] For example, in the event that the Hackberry Gulch TSF alternative is selected and the Ray Land Exchange does not proceed, the BLM would need to authorize a modification to Asarco's mine plan of operations to incorporate the construction, operation and closure of the Hackberry Gulch TSF.

The Corps held two public scoping "open house" meetings: one on the evening of September 24, 2013, at the Ray Elementary School in Kearny (Arizona) and the other on the evening of September 25, 2013 at the Performing Arts Center at the Apache Junction High School in Apache Junction (Arizona). About twenty people attended both meetings. The Corps provided a court recorder at both meetings for verbal comments, but none were given.

The Corps met with EPA at its offices in San Francisco (California) on September 10, 2013 to discuss the project and solicit input. The Corps also hosted an informational meeting on September 26, 2013 at its Phoenix (Arizona) office for agencies interested in Asarco's proposal and to obtain input on the project and proposed EIS work.

The Corps received a total of 22 letters and emails during the scoping process. Commenters included the EPA, the USDA Forest Service, the Arizona Department of Game and Fish (AGFD), Arizona Trail Association, Sierra Club, Gila River Indian Community, White Mountain Apache Tribe, Tohono O'Odham Nation, and numerous individuals.

Scoping documents, containing more detail about the scoping process for the Ray Mine tailings storage facility project EIS, are on file at the Corps Office in Phoenix, Arizona and can be found at http://www.spl.usace.army.mil/Missions/Regulatory/ProjectsPrograms.aspx.

1.7 IDENTIFICATION OF ISSUES

The scoping process produced a number of issues and concerns, which are described below.

1.7.1 Aesthetics and Visual Resources

Identify project-related impacts to visual resources. The area of concern includes how the proposed new TSF might affect the viewshed[8] for: (1) residents of Kearny, Kelvin and Riverside; (2) travelers on State Highway 177 and the Florence-Kelvin highway; and, (3) recreational users in the area, particularly those on the Arizona Trail.

1.7.2 Air Quality and Climate

Identify project-related air quality impacts. Areas of concern include: (1) compliance with federal and state air quality standards; (2) the effects on air quality from fugitive dust and gaseous emissions; (3) visibility effects to any Class I areas in the vicinity of project; and, (4) possible climate change impacts related to the project.

1.7.3 Cultural Resources

Identify cultural resources and conduct Native American consultation. The areas of concern include: (1) the effects to pre-historic and historic cultural resources listed or eligible for listing on the National Register of Historic Places; and, (2) the potential to affect cultural resources, reserved rights, trust issues, traditional cultural properties, and other responsibilities of Native American tribes.

[8] This will include items such as changes to scenic quality, viewing distance and visual sensitivity.

1.7.4 Geology, Geochemistry and Geotechnical

Identify the potential for acid rock drainage and metals transport from the proposed TSF. Address the stability of the proposed TSF. The areas of concern include; (1) short and long-term impacts to the Gila River; (2) potential for release of metals into groundwater from tailings; and, (3) the stability of the TSF.

1.7.5 Surface Water Hydrology

Identify any water quality and quantity impacts to the Gila River as a result of the proposed TSF. Address possible impacts to Zelleweger Wash if up-drainage flows from Ripsey Wash are diverted into this wash. The areas of concern include: (1) the alteration of existing hydrologic systems by direct disturbance; (2) the potential for increased sediment levels; (3) the alteration of downstream flow rates and any changes in the downstream water chemistry in the Gila River; and (4) any impacts on existing surface water rights.

1.7.6 Groundwater Hydrology

Identify any impacts to groundwater quality and hydrology within and surrounding the proposed TSF area. The areas of concern include: (1) the potential to alter existing groundwater hydrologic systems by tailings disposal; (2) changes in alluvial and bedrock groundwater chemistry as a result of tailings disposal; and (3) any impacts on existing groundwater rights.

1.7.7 Land Use

Identify land disturbance. Areas of concern include: (1) the acreage of disturbance on federal, state and private lands; (2) the effects on livestock grazing in the area; (3) the effects on the recreational setting of the area; and (4) changes in future (post-project) land use.

1.7.8 Noise

Identify noise impacts. Areas of concern include: (1) level of noise from construction traffic and development activities; (2) level of noise during operations; (3) compliance with federal, state and local noise standards; (4) disruptions caused by noise to recreational users and wildlife.

1.7.9 Public and Worker Health and Safety

Protect worker health and safety. Areas of concern include: (1) health and safety risks from the construction and operation of a TSF; (2) the possibility of an accident that would necessitate an emergency response; and (3) the potential for an accidental spill of tailings or other substances that could impact the environment, especially to the Gila River.

1.7.10 Recreation

Identify impacts to recreational activities and opportunities. Areas of concern include: (1) disruption to recreational opportunities along the Arizona Trail (the only developed recreation site within the project area) and (2) disruption to undeveloped recreation activities such as off-road recreation and hunting.

1.7.11 Roads / Transportation

Address project construction and operations traffic impacts. Areas of concern include: (1) the amount of road use and traffic on the Florence-Kelvin highway and State Highway 177; (2) amount of project-related road maintenance demands during operation; and (3) potential for accidents with any increased road use.

1.7.12 Socioeconomics

Address the social, economic and lifestyle effects on residents in the local communities surrounding the Ray Mine. Areas of concern include project-related construction and operational impacts to the demographics of local communities surrounding the Ray Mine, include impacts to employment, income, housing, utilities, public service, tax and government revenues, and present lifestyles.

1.7.13 Soils

Identify site soil resources and adequacy for reclamation. Areas of concern include: (1) the availability of soils for reclamation; and (2) the potential of increased soil erosion and sedimentation from construction and operational activities.

1.7.14 Vegetation

Address project-related impacts to vegetation. Areas of concern include: (1) the impacts to vegetation communities by the project; (2) the impacts on any threatened, endangered, and candidate plant species as identified by the U.S. Fish and Wildlife Service; (3) the impacts to any BLM sensitive plant species; and, (4) the control of noxious weeds.

1.7.15 Waters of the U.S.

Address project-related impacts to waters of the U.S. Areas of concern include: (1) the impacts to waters of the U.S.; and (2) changes in the functions and values of on-site jurisdictional waters of the U.S. from tailings disposal operations.

1.7.16 Wildlife

Identify impacts to wildlife and wildlife habitats. Areas of concern include (1) the impacts to wildlife habitat, such as the physical loss of habitat and a reduction in diversity and habitat effectiveness; (2) the impacts to wildlife species found in the area, including those species listed in the Arizona Game and Fish Department's *Species of Greatest Conservation Need* (SGCN) and *Species of Economic and Recreational Importance* (SERI); (3) the impacts on any threatened, endangered, and candidate wildlife species as identified by the U.S. Fish and Wildlife Service; and, (4) the impacts to any BLM sensitive wildlife species.

1.8 CONCERNS OUTSIDE THE SCOPE OF THIS ANALYSIS

Table 1-2, Issues Considered but not Analyzed in Detail, presents those resources or elements of the environment that are not expected to be encountered or affected by the construction and operation of a proposed TSF at the Ray Mine.

Table 1-2, Issues Considered but not Analyzed in Detail

RESOURCE	RATIONALE
Area of Critical Environmental Concerns	No areas of critical environmental concerns[9] as identified by the BLM would be impacted by Asarco's proposed TSF project.
Prime or Unique Farmlands	None present.
Wild and Scenic Rivers	None present.
Woodland/Forestry	None present.
Fuels and Fire Management	Negligible at the proposed TSF site.
Roadless Areas	None.
Mineral Resources	Condemnation drilling revealed no mineralized resources beneath the location of the proposed TSF.[10]
Paleontology	No fossil resources known to exist in the site's geologic formations.
Wild Horses and Burros	None present.

1.9 REGIONAL ACTIVITY

The Ray Mine TSF project occurs in a region that contains a number of active or proposed mining operations. See **Appendix D, Regional Activity**.

Regional activities include the ongoing and planned mining activities at the Ray Mine, the Hayden Concentrator, the Hayden Smelter, and the proposed Resolution Copper Project. In addition, other economic development activities (e.g., ranching, the Copper Basin Railroad), dispersed recreation, transportation and conservation activities occur within the region that create the larger regional context within which the Ray Mine TSF Project is proposed. Since 1994, Asarco has been engaged with the BLM on the Ray Land Exchange, which would transfer BLM-managed land within and surrounding the Ray Mine to Asarco in exchange for other lands that would be provided to the BLM by Asarco. These activities are considered in Chapter 4, Cumulative Effects.

[9] Areas of critical environmental concern present a conservation ecological program managed by the BLM and was addressed in the 1976 Federal Lands Policy and Management Act (FLPMA).

[10] Asarco's condemnation drilling program, while reflective of no copper mineralization occurs at the TSF sites, cannot be considered definitive for possible future, currently unknown market conditions for potential minerals and rocks that currently have no economic use. Federal mineral estate would be covered by both the Ripsey Wash TSF and the Hackberry Gulch alternative. Both the Ripsey Wash and the Hackberry Gulch TSF sites would remain open to mineral entry whether or not a TSF is constructed; however, the construction of tailings facilities over the federal mineral estate may effectively preclude future mineral resource development beneath the facilities.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 INTRODUCTION

The discussion of alternatives is the foundation of the EIS process (see *40 CFR §1502.14*).

The Corps focused its formulation of TSF alternatives on where and how to develop tailings storage capacity for 750 million tons of tailings, which would accommodate future operations at the Ray Mine and meet the purpose and need for the project, which is described in Section 1.3, Purpose and Need. In addition, as explained in Section 1.6, Scoping and Public Involvement, the Corps conducted public scoping to determine the range of issues to be addressed in the EIS, and these issues helped shape the assessment of TSF alternatives.

The Corps explored and evaluated various ideas and options during the selection and development of TSF alternatives for this draft EIS. To assist in the process, the Corps met numerous times with Asarco, representatives of cooperating and interested government agencies, visited the existing Ray Mine on many occasions to review current tailings storage practices, and scrutinized the area surrounding the mine for possible TSF sites.

The Corps has documented the analysis in compliance with guidelines established under the Clean Water Act [40 CFR Part 230 Section 404(b)(1)] for avoidance and minimization of impacts to jurisdictional waters of the U.S. The results of the Corps' analysis is provided in **Appendix B, Alternative Screening and Clean Water Act Section 404(b)(1) Alternative Analysis**.

The TSF alternatives to be considered in detail for this EIS are the no-action alternative, the proposed action TSF in Ripsey Wash, and the Hackberry Gulch TSF. Details of each TSF alternative are set forth in the following subsections.

2.2 NO ACTION ALTERNATIVE

NEPA regulations (40 CFR §1502.14(d)) require that EIS alternative analyses "include the alternative of no action". This alternative will serve as a baseline to compare the effects of the proposed action alternatives. Under the no action alternative, the Corps would deny the 404 permit, or Asarco would withdraw the application, and Asarco's proposal for the construction and operation of a new TSF would not go forward.

2.3 RIPSEY WASH TSF: PROPOSED ACTION

The Ripsey Wash TSF presents the actions proposed by Asarco as described in their 404 permit application. This alternative is labeled as "Ripsey Wash No. 3" in **Appendix B, Alternative Screening and Clean Water Act Section 404(b)(1) Alternative Analysis**, and is considered one of two practicable alternatives within the context of the Clean Water Act.

In addition to the 404 permit application submitted to the Corps, Asarco has also submitted an Aquifer Protection Plan (APP) permit application to the Arizona Department of Environmental Quality (DEQ) for the Ripsey Wash TSF site; this APP permit application includes detailed engineering designs and provides the basis for the descriptions below. This proposed facility would be located within the valley or basin area created by Ripsey Wash (and its tributaries) south of its confluence with the Gila River and approximately four miles southwest of the existing Elder Gulch TSF. See **Figure 2, Site Plan Layout - Ripsey Wash TSF**.

2.3.1 Tailings Operation and Placement Overview

Similar to the ongoing tailings storage operations at the existing Elder Gulch TSF, the Ripsey Wash TSF would be designed and operated as a closed-circuit (zero surface water discharge) facility. Asarco would continue to pump tailings material as slurry from the existing Ray Concentrator through an existing pipeline to the existing thickener, where the tailings would be “thickened”. This process would remain unchanged from the existing operation.

A new pipeline, pumping booster station, a lined drain-down tailings containment pond, a bridge across the Gila River, and other supporting infrastructure would be needed to transport tailings from the existing thickener to the Ripsey Wash TSF. Tailings would be discharged from spigots around the perimeter of the tailings areas, and water would accumulate at the rear of the TSF and would be pumped back to the Ray Concentrator via pipelines for reuse in the milling process. See **Figure 3, Process Flow Sheet - Ripsey Wash TSF**.

Various aspects of Ripsey Wash TSF are summarized in **Table 2-1, Summary of Ripsey Wash TSF Alternative**.

2.3.2 Pre-Tailings Construction

Prior to tailings placement in a Ripsey Wash TSF, Asarco must complete tasks that include:

- Relocation of the Florence-Kelvin highway;
- Relocation of the SCIP 69 kV electric transmission line;
- Construction of surface supporting facilities, including an office, shop, warehouse, workers’ change facility, septic system, water tank, and distribution powerline.
- Construction of a detention dam, diversion channels and piping infrastructure to route any runoff from undisturbed areas above the Ripsey Wash TSF around the facility. This work would also involve the installation of energy dissipaters at the outfall locations of the diversion channels and piping network;
- Construction of a pumping booster station and lined drain-down tailings containment pond on north side of Gila River;
- Construction of pipeline bridge over the Gila River;
- Placement of new tailings and reclaim water pipelines from the existing thickener, across the Gila River bridge, to the Ripsey Wash TSF;
- Allowance for public access to the upper reaches of Ripsey Wash using existing roads;
- Removal of soil and vegetation from the areas of the starter dams;
- Construction of starter dams, seepage trenches and pump-back wells in Ripsey Wash and an unnamed wash to the east of Ripsey Wash;
- Construction of lined reclaim ditches and lined reclaim ponds down-drainage of the starter dams and seepage trenches;
- Installation of monitoring wells down-drainage of the seepage trenches and reclaim ponds; and,
- Establishment of compensatory mitigation sites and implementation of mitigation activities.

Specifics of these tasks are discussed in the following subsections, and an estimated timeline for this construction activity is set forth in Section 2.3.13, Tentative Construction, Operation and Closure Schedule.

Table 2-1, Summary of Ripsey Wash TSF Alternative

BASIC CRITERIA FOR FULL CAPACITY		
Overall Facility Capacity (million tons)	750	
Final Tailings Embankment Crest Elevation (feet above mean sea level)	2,440	
Final Tailings Embankment Height (feet)	625	
Number of Washes Needing Starter Dam Embankments	2	
Rock Material Required for Starter Dam Embankments (million tons)	5.2	
Length of Tailings and Water Pipelines (feet/miles)	23,100/4.4	
ESTIMATED SURFACE AREA DISTURBANCE AT FULL CAPACITY (ACRES)		
Tailings Storage Facility	1,974	
Stormwater Diversion Infrastructure	123	
Onsite TSF Infrastructure	388	
Offsite TSF Infrastructure	41	
Florence-Kelvin Highway Realignment	22	
Florence-Kelvin Highway Paving	10	
Arizona Trail Re-alignment(1)	4	
SCIP 69kV Power Line Re-alignment	12	
Total	2,574	
PROPOSED CONCEPTUAL MITIGATION AREA FOR WATERS OF US (ACRES)		
Sites A,B,C and D (San Pedro River Valley)	97.9	
Sites E (Gila River Valley)	124.9	
Total	222.8	
LAND OWNERSHIP/ADMINISTRATION AT FULL CAPACITY	**ACRES**	**PERCENTAGE (%)**
Private	48	1.9%
State of Arizona(2)	2,517	97.7%
Bureau of Land Management(3)(4)	9	0.4%
Total	2,574	100%
WATER OF THE UNITED STATES		**ACRES**
Area of Direct Waters of U.S. Disturbance at Full Capacity		130.23
Area of Indirect Disturbance to Waters of the U.S.		4.13
Area of Jurisdictional Wetlands Disturbance at Full Capacity		0

Notes:

(1) Under an amendment to the National Trails System Act that established the Arizona Trail, the U.S. Secretary of Agriculture is the administering agency of the Arizona Trail, in consultation with the U.S. Secretary of Interior. For the re-aligned section of the Arizona Trail on BLM-administered lands, the BLM is the management agency, while on state and private lands, Pinal County is the managing agency under a trail right-of-way granted to Pinal County by ASLD.

(2) This figure represents that the Ripsey Wash TSF site is currently located on lands owned and administered by the state of Arizona (through its Department of State Lands). Asarco is pursuing the purchase of these lands from the state, and that purchase would transfer this ownership to "private property." The sale by Arizona State Land Department would be completed through an open auction process, the date for which is pending.

(3) Disturbance includes estimated three acres on BLM-administered for the re-routed Arizona Trail and trailhead, and approximately six acres for tailings/water return pipelines and re-routed SCIP powerline rights-of-way.

(4) The area designated is for BLM surface administered lands. Approximately 2,300 acres of BLM mineral administered estate exist beneath the area to be used for the Ripsey Wash TSF, there are no known locatable minerals in this estate; however, salable minerals excavated from within a portion of the footprint of the proposed TSF would be used for construction of the starter dam and as cover material during concurrent reclamation and as part of final closure. The BLM would need to authorize a mineral material sale for that rock material.

(5) See Appendix J, Conceptual 404 Mitigation Plan

2.3.2.1 Florence-Kelvin Highway

The Florence-Kelvin highway is a 32-mile long, two-lane road that connects State Highway 79 south of the town of Florence to State Highway 177 near the community of Kelvin and near the entrance to the Ray Mine. Approximately 12 miles of this highway is paved with asphalt from its junction with State

Highway 79 (near Florence) but the remaining portion is a graveled surface roadway. This road is maintained by Pinal County.

An approximate 1.8-mile long segment of the Florence-Kelvin highway would be eliminated in the area of the proposed Ripsey Wash TSF, and a new segment, approximately 2.1-miles in length, would be re-routed and re-constructed to the north and northeast of the tailings facility. Asarco has discussed proposed road realignment and received tentative approval of its relocation from Pinal County Road Department officials. The proposed relocation would be paved with asphalt and would meet the required standards of Pinal County. The location of the proposed relocated route is shown on **Figure 2, Site Plan Layout - Ripsey Wash TSF**, and a typical roadway section is provided as **Figure 7, Typical Utility Corridor and Roadway Section**.

2.3.2.2 Electric Transmission Line (69 kilovolts)

The SCIP (San Carlos Irrigation Project) owns and maintains a 69 kilovolt (kV) electric transmission line that crosses through the area of the Ripsey Wash TSF. Approximately 2.3 miles of the existing transmission line would be eliminated and replaced by an approximate 3.2-mile long transmission line would be re-constructed around the north side of the Ripsey Wash TSF. The proposed relocation would meet the required standards of SCIP. The location of the proposed relocated 69 kV electric transmission lines is shown on **Figure 2, Site Plan Layout - Ripsey Wash TSF**.

2.3.2.3 Arizona National Scenic Trail

The Arizona National Scenic Trail (Arizona Trail) is a recreational and scenic trail that is approximately 800 miles long and crosses Arizona from Mexico to Utah. See Section 3.9, Recreation.

As shown on **Figure 2, Site Plan Layout - Ripsey Wash TSF**, a 6.8-mile segment of the Arizona Trail would need to be relocated to allow construction activities and operations of the Ripsey Wash TSF.

A working group comprised of representatives of Pinal County, Arizona Trail Association, BLM, Forest Service, Corps (through its EIS third-party contractor), and Asarco was formed to assess possible relocation alternatives for the Arizona Trail around the proposed Ripsey Wash TSF. This working group held numerous discussions in 2013 and 2014 about the relocation issue, and a trail contractor (Southwest Trail Solutions) was retained to scout possible bypass routes on both the east and west side of the proposed Ripsey Wash TSF.

After consideration of the findings presented by the trail contractor and internal deliberations, the working group recommended a 6.4-mile bypass to the east of the Ripsey Wash TSF should be constructed if this alternative is selected. An eastside routing would conform to the original objectives of establishing and maintaining a diverse and scenic trail across the state of Arizona. The recommendations from the working group regarding the relocation of the Arizona Trail has been accepted as part of the Ripsey Wash TSF proposed action. Asarco will relocate the Arizona Trail during the later stage of site construction or during early operation as the existing Arizona Trail would not be directly impacted for several years after initial tailings deposition within the Ripsey Wash TSF: therefore, immediate relocation as part of initial construction would not be necessary.

Additional discussion about the process followed by the working group and its subsequent recommendation is set forth in **Appendix G, Arizona Trail Relocation Analysis**.

2.3.2.4 Support Infrastructure

Given the distance to the main facilities at the Ray Mine, Asarco would require limited surface facilities to support the proposed Ripsey Wash TSF construction and operations. These facilities may include an office, workers' change facility, maintenance shop/warehouse, along with employee and equipment parking areas, water tank and distribution system for dust control, potable use and fire protection, sanitary waste system, and electric distribution switchgear. The proposed facility area is shown on **Figure 2, Site Plan Layout - Ripsey Wash TSF**.

2.3.2.5 Detention Dams and Diversion Structures

Measures to be used for stormwater control are discussed in **Appendix I, Applicant Project Mitigation.**

As part of pre-tailings storage construction activities, Asarco would construct a detention dam in Ripsey Wash up-drainage of the proposed TSF, along with diversion channels to divert stormwater from the undisturbed watershed areas around the proposed facility. See **Figure 2, Site Plan Layout - Ripsey Wash TSF**.

The purpose of this detention dam structure would be to prevent up-drainage Ripsey Wash runoff from entering into the tailings impoundment area. This detention dam structure would be initially designed to handle flows from a 500-year, 24-hour storm event during operation of the TSF. In the unlikely event of a greater storm event, this detention dam structure would be installed with an emergency spillway that would allow flow in excess of the design storm event to discharge into the tailings impoundment. Upon permanent closure of the Ripsey Wash TSF, the detention dam would be raised about 10 feet to detain the stormwater volume from the probable maximum precipitation (pmp) event and would remain as a permanent feature. Asarco would continue to divert water from this system after closure.

Water that is intercepted by this detention dam would be routed around the Ripsey Wash TSF by pumping through a piping system for discharge into Zelleweger Wash, a drainage located to the west of Ripsey Wash. There would also be a series of smaller interceptor detention dams and diversion channels on the west side of the Ripsey Wash TSF that would serve to intercept up-drainage stormwater flow. When stormwater collects behind these detention dams, Asarco, through its pumping and pipeline infrastructure, would control the water release volume to prevent erosion in Zelleweger Wash.

To intercept stormwater flow on the east side of the proposed Ripsey Wash TSF, Asarco would construct an approximate 16,000-foot (about 3-mile long) diversion channel, which would be designed to handle flow from a 100-year, 24-hour storm event. The location of this channel is shown on **Figure 2, Site Plan Layout - Ripsey Wash TSF**. Flow intercepted by this diversion channel would be routed to an unnamed wash to the east of the facility.

Through managed pumping of any stormwater that collects behind the detention dam and the use of an energy dissipater at the outfall location, Asarco would control discharge velocity to reduce the potential for down-drainage erosion in Zelleweger Wash. Similarly, Asarco would use energy dissipater mechanisms to control stormwater flow velocity within the east side diversion ditch and at the outfall of this diversion ditch into the unnamed drainage on the northeast side of the Ripsey Wash TSF.

2.3.2.6 Tailings Starter Dams

As part of pre-tailings storage construction activities, Asarco would construct two starter dams for the Ripsey Wash TSF. The first and largest of the starter dams would be approximately 150 feet high and located in Ripsey Wash near where the Florence-Kelvin highway currently crosses the wash;

approximately 5 million cubic yards of alluvium and colluvium and Ruin Formation granite bedrock would be used to construct this starter dam. The second starter dam would be approximately 65 feet high and located in an unnamed drainage on the eastern side of the facility; approximately 400,000 cubic yards of alluvium/colluvium and Ruin granite would also be used to construct this starter dam. The crest elevation of both starter dams would reach approximately 2,050 feet (amsl). **See Figure 2, Site Plan Layout - Ripsey Wash TSF**.

These two starter dam embankments would provide the base to retain tailings for the centerline embankment construction technique described in Section 2.3.3.1, Centerline Construction.

The alluvium and colluvium material are found mainly in the bottom of Ripsey Wash and the unnamed wash to the east of Ripsey Wash, and range from a few feet on the sides of the washes to depths approaching 100 feet in the center of Ripsey Wash.

The starter dams would consist of earth/rock embankments to create the initial "holding basin" for tailings storage. Rock material to be used to create the embankments would consist of both alluvium/colluvium material and Ruin Formation granite that would be removed up-drainage of the starter dams and from inside what would become the ultimate footprint of the Ripsey Wash TSF.

It is anticipated that some drilling and blasting would be required to aid in the removal of Ruin Formation granite, and a portable crusher plant would be utilized during starter dam construction activities to size and screen material for associated facility infrastructure (e.g., bedding material for the liners used under the down-drainage centerline embankment, seepage ditches, and reclaim ponds).

2.3.2.7 Hackberry Fault Seepage Mitigation

As explained in Section 3.3, Geology and Geochemistry, and Section 3.6, Groundwater Hydrology, the west side of the proposed Ripsey Wash TSF is underlain by the Hackberry fault, which is expressed as a zone of fractures and breccia, that have a higher permeability than the surrounding bedrock.

Prior to the construction of the starter dam in the area of the Hackberry fault zone, Asarco would remove vegetation material for the length of the fault zone, both beneath the starter dam and up drainage of the starter dam along the "trace" of the fault zone within the footprint of the proposed tailings impoundment. In addition, Asarco would remove much of the alluvial material above the "trace" of the fault zone within the planned footprint of the TSF and would use this alluvial material for construction of the starter dam. Asarco would also compact this area using a vibratory compactor or similar machine.

Immediately down-gradient of the fault zone, still within the footprint of the tailings impoundment area, Asarco would construct a containment dam approximately perpendicular to the starter dam. At this site, both the up-drainage side of the starter dam (for the length of the fault zone) and the up-drainage of the inside containment dam would be lined with an 80-mil HDPE (or equivalent) liner.

A cut-off wall would be constructed up-gradient of the fault zone (still within the footprint of the tailings impoundment area) where any runoff would be routed around the fault zone through a new channel. See **Figure 4, Hackberry Fault Seepage Mitigation**.

Up-gradient of the internal containment dam, and immediately up-gradient of the "trace" of the fault zone, Asarco would begin placement of tailings material such that the tailings fines (or "slimes") would act to seal the surface above the fault zone to prevent seepage under the starter dam at the site where it intersects the Hackberry fault zone.

Asarco plans to install a monitoring well down-gradient of the tailings embankment within the Hackberry fault zone to serve as a point of compliance with the Arizona DEQ APP. The purpose of this down-gradient well would be to characterize and monitor groundwater conditions within the fault zone during operations and as part of post-closure activities.

2.3.2.8 Seepage Trenches

Down-gradient of the starter dams, Asarco plans to install seepage trenches to intercept any water seepage that might migrate under the tailings facility through the alluvium material located above the bedrock. See **Figure 2, Site Plan Layout - Ripsey Wash TSF**.

The trenches would be excavated into bedrock. Alluvium material depths range from a few feet on the outer reaches of the washes to approximately 100 feet in the middle of the Ripsey Wash drainage. Pumps and piping would be installed in the seepage trenches to route any collected water to a lined reclaim pond. See **Figure 5, Schematic for Seepage Trenches and Reclaim Ponds**.

2.3.2.9 Reclaim Ponds

Down-gradient of the seepage trenches, Asarco plans to install reclaim ponds. See **Figure 2, Site Plan Layout - Ripsey Wash TSF**.

These reclaim ponds would be constructed with an engineered double-liner system, using synthetic liner material (80 mil HDPE or equivalent) and have leak detection systems incorporated into their design and operation. The area around these ponds would be fenced. Asarco would be able to pump water from these reclaim ponds to the Ray Concentrator (for reuse) or to the tailings impoundment. See **Figure 5, Schematic for Seepage Trenches and Reclaim Ponds**.

2.3.2.10 Monitoring Wells

Asarco would also maintain or install monitoring wells down-gradient of the tailings embankment to serve as points of compliance with the Arizona DEQ APP. See **Figure 30, Groundwater Hydrology – Ripsey Wash TSF** and **Figure 31, Groundwater Hydrology – Hackberry Wash TSF**. The purpose of these down-gradient wells would be to characterize and monitor groundwater conditions before construction, so that monitoring conducted during and after operations can assess what effect, if any, operation of the TSF has on down-gradient groundwater quality.

2.3.2.11 Pumping Booster Station and Tailings Drain-Down Pond

Asarco would construct a pumping station, electric switchgear facility, and a drain-down pond at the low point of the tailings pipeline routing (north of the Gila River near of the Florence-Kelvin highway). See **Figure 2, Site Plan Layout - Ripsey Wash TSF**.

From this location, the pumping booster station would push tailings through a pipeline across the Gila River and uphill to the Ripsey Wash TSF. Asarco would also line (80-mil HDPE or equivalent) the tailings drain-down pond at this site to contain tailings from the pipeline, should an emergency necessitate that situation. This pond would be designed and constructed to hold more than the total volume of tailings potentially contained in the tailings pipeline from the Ray Concentrator to the Ripsey Wash TSF.

The electric switchgear facility at this site would provide the energy to operate the tailings pumping booster station, as well as various other pumps to be used at the Ripsey Wash TSF (e.g., seepage trench pumps, reclaim pond pumps, decant water pumps at the rear of the tailings impoundment).

During construction, this site would also serve as a parking area for construction workers and equipment, as well as a storage area for construction-related materials and supplies, such as pipeline segments, culverts, liner material, and pumps.

2.3.2.12 Pipeline Bridge over Gila River

Asarco would build a bridge across the Gila River for the specific and sole purpose of supporting the tailings and return water pipelines to and from the Ripsey Wash TSF. In addition, a water supply pipeline could also be installed across the bridge to provide site water needed for dust control, domestic use, and fire protection. These pipelines would be elevated above the Gila River and associated wetlands and the Copper Basin Railroad tracks on the north side of the river. See **Figure 6, Gila River Tailings/Return Water Pipeline Bridge**.

Where they cross the Gila River, the pipelines would be sleeved within a larger-diameter, second pipe designed to contain any leaks or spills. The bridge would be slightly sloped so any spillage or leakage would be directed toward the drain-down pond on the north side of the Gila River and the bridge. The gradient (or slope) on the pipelines across the bridge would be such that low points are avoided and positive drainage maintained back to the drain-down pond in the event of any spill or leak. Asarco plans to continuously monitor pipeline pressures and flow rates to detect any pressure drops, at which time the pipelines could be shut down and drained, thus allowing maintenance.

2.3.2.13 Tailings and Water Pipelines

Tailings would be conveyed to the Ripsey Wash TSF though contained overland slurry pipelines that would parallel the return water pipeline that would convey water from the tailings impoundment back to the Ray Concentrator. The proposed pipeline routing is shown on **Figure 2, Site Plan Layout - Ripsey Wash TSF**, and **Figure 7, Typical Utility Corridor & Roadway Sections**.

The tailings pipeline would be installed from the existing thickener, would cross beneath State Highway 177 and would parallel the Florence-Kelvin highway (crossing the Gila River on the bridge discussed above) en route to the Ripsey Wash TSF. The decant water pipeline and a fresh water line would be placed adjacent to the tailings pipelines and would follow the same right-of-way back to the existing thickener, where it would be connected to a pipeline that returns water to the existing Tank 34. This tank presently receives decant water from the existing Elder Gulch TSF.

Additional discussion about pipelines is set forth in Section 2.3.4, Tailings Delivery System.

2.3.2.14 Public Access to Upper Ripsey Wash

The construction of the Ripsey Wash TSF would eliminate existing public access within and 500 feet beyond the proposed footprint of the facility and related infrastructure in the area of construction and operation of the Ripsey Wash TSF. Future public access into the upper reaches of Ripsey Wash from the Florence-Kelvin highway would be via existing two-track roads on the west side of the proposed TSF. There are several existing two-track roads that would remain open to the public from the Florence-Kelvin highway that pass through Zelleweger Wash, across the divide between Zelleweger and Ripsey washes, and then reconnect with Ripsey Wash up-drainage of the site of the detention pond to be constructed for the Ripsey Wash TSF.

2.3.3 Tailings Embankment Construction Methods

Two distinct methods of tailings embankment construction would be used during the course of operation at the Ripsey Wash TSF. These methods would be centerline and upstream construction.

2.3.3.1 Centerline Construction

Centerline embankment construction is a common construction method used for tailings facilities. At the Ripsey Wash TSF, tailings would be cycloned and spigotted off the crest of the starter dams. The centerline of the embankment would be maintained as fill and progressive raises would occur on both the beaches (up-drainage side) and the downstream face of the embankment. See **Figure 9, Centerline Tailings Embankment Construction**.

Cyclones are simple mechanical devices used to separate coarse and fine particles from the tailings slurry through centrifugal force. Essentially, cyclones work on the same principle as gravity-based separation devices, except that centrifugal acceleration forces are many times that of gravity.

As the tailings slurry enters the cyclone (under pressure), the fine particles and most of the water would rise to the top outlet. The coarse tailings particles would spiral downward through a conical section of the cyclone and exit the bottom. The overflow is referred to as the separated fine fraction, (often referred by miners as “slimes”) while the underflow is known as the sand fraction or “sands.” See **Figure 9, Centerline Tailings Embankment Construction**.

The overflow (fines or slimes) would be discharged into the tailings impoundment, while the underflow (coarse material or sands) would be used to construct the tailings embankment. The sands readily drain and would be shaped by a bulldozer to form a down-drainage slope configuration of approximately 3H:1V.

The centerline embankment would be underlain by a lined (60-80 mil HDPE liner or equivalent) drain system that would allow drainage of water through cycloned sand or coarse material portion of the tailings, which would allow the maintenance of a low phreatic surface in the embankment section. Seepage from the tailings embankment would be collected by a series of finger and blanket drains within the footprint of the embankment and would be conveyed through a lined containment ditch into a lined reclaim pond located down-drainage of the ultimate embankment footprint. See **Figure 2, Site Plan Layout - Ripsey Wash TSF**.

The centerline tailings embankment would be raised in lifts of cycloned tailings concurrent with the actual filling of the tailings impoundment. As each embankment is raised in height, the footprint of the embankment would be expanded down-drainage. Accordingly, the down-gradient embankment underdrain system would also be expanded.

When the centerline construction reaches an elevation approximately 2,200 feet (amsl), Asarco would switch to an upstream method of tailings storage. Upstream construction techniques would be initiated when the tailings impoundment is large enough so that the coarse sand fraction of the tailings has sufficient time to dry or “set-up”, thus allowing the upstream construction technique to commence.

Once centerline construction is completed, Asarco would cover the down-gradient embankment with rock as part of concurrent reclamation activities. See Section 2.3.12, Ripsey Wash TSF Closure and Reclamation.

2.3.3.2 Upstream Construction

The upstream method of tailings storage is currently employed by Asarco at the Elder Gulch TSF and is also a commonly-used method for tailings embankment construction in low risk seismic areas, such as Arizona. **Figure 10, Upstream Tailings Embankment Construction**, illustrates the process of upstream construction used at the Ray Mine.

In the upstream method, tailings would be discharged from spigots around the crest of the tailings embankment. This would be an activity similar to the centerline method, but the cyclone used for centerline construction would no longer be used. The deposition of tailings would develop a wide tailings beach area composed mainly of coarse tailings material. This beach would become the foundation for the next lift. The coarse fraction of the tailings would settle closest to the spigots, while the fines would migrate with water toward the decant pond at the back of the tailings impoundment. It is the coarse fraction that would be used to construct the next lift.

Once the surface of the tailings beach has sufficiently dried to support equipment, a tracked excavator[11] would maneuver itself onto the wide tailings beach area (approximately 40 feet from the outside toe of the next lift to be constructed) to initiate the next lift. This machine would then begin to dig and place excavated tailings in a long windrowed stockpile that would parallel the crest of the existing dam perimeter.

Following behind the progression of the excavator, a bulldozer[12] would be used to flatten the stockpile of coarse tailings to achieve the 10-foot height required for the next lift in the tailings embankment. The bulldozer would shape the outer (down-drainage) side of the tailings to form a 2H:1V slope. Piping would then be added to extend the tailings outfall spigots to the top of the new lift so that tailings storage could continue behind the newly-constructed lift.

After three 10-foot lifts, Asarco would leave a 60-foot wide bench, or set-back, before beginning the next 10-foot lift. This 60-foot wide bench would provide a working platform for the tailings delivery pipeline, which would be moved from the previous 60-foot wide bench. This new 60-foot wide bench would also serve as an access road for Asarco personnel and equipment. In addition, this set-back would lessen the overall slope of the tailings embankment to 3H:1V.

To reduce potential for windblown dust, Asarco would spray a binding agent or tackifier[13] on the outside slope of the tailings embankment. After every third lift (with the completion of the 60-foot wide setback, Asarco would cover the lower outside embankment slope with rock material. This rock material would be removed from a borrow source within the footprint of the TSF and hauled to the crest of the completed slope. A bulldozer would be used to push the material down slope to cover the tailings embankment. This activity would be part of the concurrent reclamation practices discussed in

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[11] At the Elder Gulch TSF, Asarco currently utilizes a Cat 375 Excavator with an extended boom for long reach. The Cat 375 Excavator or a similar machine would be used for upstream tailings construction work at the Ripsey Wash TSF.

[12] At the Elder Gulch TSF, Asarco currently utilizes a Cat D6 LGP (low ground pressure) bulldozer to construct and shape the next 10-foot lift of the tailings facility. A Cat D6 LGP dozer or a similar machine would be used for upstream tailings construction work at the Ripsey Wash TSF.

[13] The same tackifier that is currently being used to reduce wind-blown tailings at the Elder Gulch TSF would be used for the Ripsey Wash TSF.

Section 2.3.12, Ripsey Wash TSF Closure and Reclamation. See **Figure 7, Typical Utility Corridor & Roadway Sections**.

2.3.3.3 Quality Control and Quality Assurance

The tailings facility would be designed and constructed under the direction and seal of qualified Arizona registered professional engineers. Foundation preparation and embankment construction would be completed under a quality control and quality assurance program.

2.3.4 Tailings Delivery System

Tailings would be pumped though a contained slurry pipeline to the Ripsey Wash TSF from a new pumping booster station, located on the north side of the Gila River. The tailings slurry and water return pipelines would be high density polyethylene (HDPE) and/or high-strength steel, with welded joints to ensure long-term operational integrity, and the pipelines would be installed (buried) in a trench parallel to or within the Florence-Kelvin highway.

Asarco would build a bridge to convey the pipelines over the Gila River; this bridge would be adjacent to a new road bridge to be constructed by Pinal County for the Florence-Kelvin highway. See **Figure 6, Gila River Tailings/Return Water Pipeline Bridge**. The tailings slurry and water return pipelines would be sleeved across the bridge within a larger diameter pipe (pipes-in-pipe) as protection in the event of a pipeline break. Additional break protection would be provided by the lined drain-down pond discussed in Section 2.3.2.11, Pumping Booster Station and Tailings Drain-Down Pond.

A 0.3 mile (approximately 1,500 feet) long segment of the tailings (and return-water) pipeline(s) would cross lands administered by the BLM. See **Figure 8, BLM Land Ownership – Pipelines and Arizona Trail**.

On the west side of the Gila River bridge crossing, the tailings and return-water pipelines would be buried either in the shoulder or beneath the driving surface of the Florence-Kelvin highway. See **Figure 7, Typical Utility Corridor & Roadway Sections**.

At road crossings, such as State Highway 177, the pipelines would be sleeved within a larger diameter pipe, and culverts (pipe-in-pipe) would be installed. The gradient on the pipelines would be such that low points are avoided and positive drainage maintained from the existing thickener to the tailings pumping station on the north side of the Gila River, and from the tailings booster pumping station to the Ripsey Wash TSF.

2.3.5 Tailings Facility Operation

The tailings facility would be designed and operated as a zero-surface water discharge facility, which is the same method used at the existing Elder Gulch TSF. To achieve a zero-discharge surface water facility, all runoff is captured on-site and not allowed to flow off-site. Captured water would be pumped and recycled for use at the Ray Mine.

Tailings would be discharged from spigots that surround the perimeter of the tailings storage facility and a tailings beach would be created using thin-layer, sub-aerial deposition techniques. See **Figure 11, Tailings Facility Operation**.

The tailings discharge operations would focus on directing water to the rear of the facility to allow a pool of water to form from which decanted water would be pumped back to the Ray Concentrator. As tailings beaches form, spigot discharges would progress around the perimeter of the facility, and this action would promote drying and increased density of the tailings.

2.3.6 Tailings Facility Support Facilities

The Ripsey Wash TSF would require miscellaneous infrastructure to support operations. This infrastructure would include site support and service roads, power supply for pumps, and a quarry or borrow area for concurrent reclamation and closure rock material.

2.3.6.1 Site Support and Service Roads

Asarco would use existing roads to the extent practical to access the proposed Ripsey Wash TSF. The tailings delivery and return water pipelines would parallel the Florence-Kelvin highway from the mine property to the TSF, and this highway would serve as the primary access road to the Ripsey Wash TSF.

Temporary construction roads would be used to haul rock material for the starter dam embankment construction, but they would be mainly located within the footprint of the overall construction and disturbance area for the TSF.

An access service road would be constructed and maintained along the top of the tailings embankment for the pipeline that would deliver tailings. Another access service road would be constructed and maintained around the upper perimeter of the tailings impoundment for the return water pipelines. As the TSF expands upward, Asarco would establish new perimeter access service roads. These perimeter access roads would typically be around 15 to 20 feet wide.

2.3.6.2 Power Supply and Distribution

Electric power would be needed for the tailings pumping booster station on the north of the Gila River, the water pumps at the reclaim ponds below the tailings embankment, and at the decant water pond at the back side of the tailings impoundment. Asarco would install electric switchgear at the pumping booster station and would construct distribution lines from this site to serve pumping facilities at the Ripsey Wash TSF (e.g., the pumps at the detention pond, the tailings return-water pond, the reclaim ponds, and the pump-back wells).

Electric distribution line structures would be single pole structures constructed to Rural Utilities Service (RUS) standards (or equivalent). Asarco would use Avian Power Line Interaction Committee (APLIC) raptor-deterring design measures and/or grounded hardware (or equivalent), as well as insulating or cover up materials, for perch management.

New electric distribution power line construction would involve an estimated 15 to 20 pole structures per mile. New temporary two-track roads, along with existing roads, would be used to gain access for line construction and maintenance.

2.3.6.3 Rock Quarry

Rock used for the starter dam construction would come from within the footprint of the Ripsey Wash TSF. Asarco plans to use inert alluvial material and/or inert, non-mineralized granitic rock. This rock material has been characterized and determined to be non-acid-generating. See Section 3.3, Geology and Geochemistry.

As part of concurrent reclamation, Asarco plans to put rock on the face of the Ripsey Wash TSF embankment, starting after the centerline construction phase is completed, and followed periodically on the slopes created by upstream construction (after three lifts are completed). Asarco would use inert, non-mineralized granitic conglomerate rock, again from a borrow source (or quarry) located within the footprint of the planned TSF. Asarco would remove rock material from the quarry as needed and haul it in off-highway trucks for placement on the embankment slopes.

Rock from within the footprint of the TSF would also be used for final closure activities, e.g., covering the tailings impoundment area after the permanent closure of the TSF. Asarco would extract rock material from a quarry area within the footprint of the TSF (prior to closure) and stockpile the material around the perimeter of the impoundment area. Removing rock material from within the footprint of the existing facility would limit disturbance and add tailings storage capacity to the TSF.

Quarrying of rock from the federal mineral estate would require an approved material sale from the BLM as discussed in **Appendix C, Agency Responsibilities (Regulatory Framework)**.

2.3.7 Water Use and Management

Water is required to operate the Ray Concentrator and is (and would continue to be) required to pump the tailings slurry to the Ripsey Wash TSF.

Asarco has water rights under the Globe Equity Decree, *United States v. Gila Valley Irrigation District*, Globe Equity No. 59 (June 29, 1935) that currently support and would continue to support operation of the Ray Concentrator and pumping of tailings to the TSF. Water for the Ray Concentrator and operation of the existing Elder Gulch TSF and the proposed Ripsey Wash TSF is and would continue to be delivered to the Ray Mine via an existing buried pipeline that originates from the Hayden well field located at the confluence of the Gila and San Pedro rivers near the communities of Hayden and Winkelman, approximately 20 miles southeast of the Ray Mine.

The Ray Concentrator is currently and would continue to be operated as a closed-circuit, zero-surface water discharge facility. Process water is presently and would continue to be recycled within the system rather than allowed to be discharged into the environment.

Tailings are and would continue to be pumped as slurry to the TSF, where the decanted water would be returned to the Ray Concentrator. Some process water would naturally evaporate.

After the decant water clarifies (tailings settle out), Asarco would begin to recycle water from TSF return-water pond, and the TSF would attain full operational status. However, due to the evaporation and retention of residual water within the tailings, fresh water makeup would continue to be required at the Ray Concentrator throughout the life of the project. Seasonal precipitation and temperature would also play a role in the amount of water recycled to the Ray Concentrator from the TSF.

As Asarco approaches the final cessation of operations, as much water as practical would be drawn from the TSF return-water pond, and less fresh water would be added to the system to reduce the size of the return-water pond. Upon conclusion of Ray Concentrator operations, no additional water from the concentrator would be introduced to the TSF, and any remaining ponded water in the return-water pond at the TSF would be allowed to evaporate naturally, or evaporation would be enhanced through the use of evaporators as part of final closure activities.

2.3.8 Stormwater Management

Upstream of the TSF, Asarco would construct diversion channels and detention ponds as described in Section 2.3.2.5, Detention Dams and Diversion Structures. Asarco would also maintain a stormwater pollution prevention plan (SWPPP) to address on-site stormwater runoff, in accordance with the Arizona

Mining Multi-Sector General Permit (MSGP) issued by the Arizona DEQ. See **Appendix C, Agency Responsibilities (Regulatory Framework)** and **Appendix I, Applicant Project Mitigation**.

2.3.9 Work Force Requirements

The construction phases for the Ripsey Wash TSF would require an estimated workforce that would range from approximately 50 to 190 people for the estimated three year construction period[14]. It is projected that 50% of this workforce would be hired locally.

As the project construction work phases out, Asarco would use approximately the same workforce that currently operates and maintains the Elder Gulch TSF to assume the operation and maintenance requirements for the Ripsey Wash.

About half-way through the operation of the Ripsey Wash TSF, Asarco would require an earthmoving construction workforce of 15 to 20 people to move and stockpile cover rock (granitic conglomerate) for final closure. It is expected that 75% of this workforce would be hired locally.

Decommissioning and final closure at the end of the project life would require approximately 20 to 30 people. Asarco would manage this work using a contractor that specializes in earthmoving. It is expected that 95% of this workforce would be hired locally.

2.3.10 Environmental Management and Mitigation

Presuming that the Ripsey Wash TSF is implemented, Asarco would employ and maintain environmental management and mitigation measures to minimize environmental effects during TSF construction, operations and closure activities. See **Appendix I, Applicant Project Mitigation**. Available measures are dictated in part by the nature and scope of a TSF. Some of these measures would be standard practices or would result from permit approvals for the site. See **Appendix C, Agency Responsibilities (Regulatory Framework)**.

2.3.10.1 Waters of the U.S.

Asarco would implement compensatory mitigation for the functional losses associated with impacts to jurisdictional waters of the U.S. The plan has been provided as **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**. A detailed plan would be finalized prior to issuance of the Section 404 permit and compliance with that plan would be required as a special condition of the 404 Permit. Asarco would follow the June 9, 2008 compensatory mitigation regulations where unavoidable functional losses occur as a result of TSF construction and operation.

2.3.10.2 Stormwater – Erosion and Sediment Control Measures

Asarco would maintain a stormwater pollution prevention plan (SWPPP) for the TSF site. Stormwater features would include diversion ditches, culverts, sediment traps, stormwater basins, etc. Surface water diversion ditches would route upgradient storm water around the TSF. Diversions would be constructed and maintained around disturbed areas to minimize erosion. See **Figure 2, Site Plan Layout – Ripsey Wash TSF**.

[14] Construction activities would include the relocation of the Florence Kelvin highway and the realignment of the Arizona Trail.

2.3.10.3 Water Resources

Asarco would comply with the "best available demonstrated control technology" (BADCT) management practices and requirements of the APP that would be issued by the Arizona DEQ. These measures would include the installation of seepage trenches, reclaim ponds and pump-back wells to capture infiltration through or beneath the TSF embankments, along with the construction of diversion structures and facilities that would route stormwater around the TSF.

2.3.10.4 Air Quality

Asarco and its contractors involved in construction activities would comply with applicable Pinal County air quality regulations. Air quality mitigation practices would be used to control fugitive dust generation. These practices would include spraying of a tackifier on the downslope face of the TSF and periodic watering of site access roads.

2.3.10.5 Cultural and Historic Resources

Cultural resources inventory surveys have been conducted by Asarco contract archaeologists under guidance from the Arizona State Historic Preservation Office (SHPO), Arizona State Lands Department (ASLD), and the BLM (on any BLM-administered lands). A Historic Properties Treatment Plan (HPTP) will be developed to ensure that any adverse effects of the project on NRHP-eligible sites will be mitigated. A Memorandum of Agreement (MOA) will be developed that will detail the implementation of the HPTP and provide protection for any inadvertent discovery of cultural materials during construction.

2.3.10.6 Wildlife

Two avian species found in habitat along the Gila River have been listed under the Endangered Species Act (ESA); these are the southwestern willow flycatcher (endangered) and the yellow-billed cuckoo (threatened). Mitigation measures would be developed as part of the Biological Assessment (BA) that would be prepared in consultation with the U.S. Fish and Wildlife Service (USFWS). The following are mitigation that would be used to lessen potential impacts to these species:

- Construction of the pipeline bridge over the Gila River would occur outside the nesting seasons of the southwestern willow flycatcher and yellow-billed cuckoo to preclude inadvertent disturbance of breeding birds and occupied nests and possible incidental take of eggs and young.
- Monitoring of southwestern willow flycatcher and yellow-billed cuckoo breeding and nesting activity along the Gila River near the Ripsey Wash or Hackberry Gulch TSF sites would continue during the project construction and for an appropriate period following completion of construction. The duration of monitoring following construction completion would be determined in consultation with the USFWS.
- Prior to construction during the avian nesting season, vegetation in these areas would be cleared prior commencement of the nesting season and scheduled disturbance. This measure would prevent birds from nesting in areas slated for disturbance during the nesting season and preclude the incidental take of occupied nests and violation of the Migratory Bird Treaty Act (MBTA).

2.3.11 Environmental Monitoring

Asarco would implement environmental monitoring measures required by permits and approvals issued for the TSF, most prominently, the APP issued by Arizona DEQ. As part of the APP, Asarco would conduct groundwater monitoring in wells down-gradient of the TSF facilities to monitor groundwater conditions at this site during construction, operations and closure.

2.3.12 Ripsey Wash TSF Closure and Reclamation

Closure and reclamation will be implemented in compliance with federal, state and local requirements. The overall purpose of closure and site reclamation is to prevent undue or unnecessary post-project environmental degradation and restore disturbed areas to be compatible with surrounding landscape.

Asarco's closure and reclamation plan for the Ripsey Wash TSF would include permanent decommissioning and closure, removing support facilities and infrastructure (such as pumps and piping, reclaim and drain-down ponds, facility parking and storage areas), re-contouring the TSF to establish drainage off the site, and placing rock material over the surface of the TSF to reduce the potential for wind and water erosion. In Arizona, under the jurisdiction of the Arizona State Mine Inspector, closure and site reclamation must consider public safety, which would include stable landforms. APP closure requirements would also apply; these focus on reducing the potential for future discharges to groundwater. Additional discussion on regulatory requirements on closure and reclamation is set forth in **Appendix C, Agency Responsibilities (Regulatory Framework)**.

There are many discussions and opinions amongst government and industry experts on the best way to close a TSF for a copper mine in Arizona, and tailings closure technology and practices are evolving and improving. Asarco expects the TSF to function well into the future (50+ years) and would take advantage of future opportunities to explore new closure and reclamation techniques when the time comes to implement site closure and reclamation.

2.3.12.1 Ripsey Wash TSF Concurrent Reclamation

Reclamation completed during active operations is termed "concurrent" reclamation. Concurrent reclamation is designed to provide permanent, low-maintenance achievement of reclamation goals.

Asarco plans to place approximately one foot of rock material on the down-drainage slope of the Ripsey Wash tailings embankment after the centerline construction work is finished and Asarco transitions to up-stream tailings embankment construction. At this point, the face of the centerline tailings embankment would be ready for rock placement work as the embankment slope would remain a permanent feature. This rock material would minimize wind and/or water erosion of the embankment outslope.

Asarco also plans to conduct concurrent reclamation on the slopes of the Ripsey Wash upstream tailings embankment. Approximately one foot of rock material would be placed on the final slope created after three individual lifts are made and the set-back is completed on the third lift. See Section 2.3.3.2, Upstream Construction.

For the Ripsey Wash TSF, the final cover rock material would be granitic material excavated from the borrow area within the tailings impoundment footprint.

Conventional construction equipment would be used for this activity. Front-end loaders would excavate and load off-highway trucks that would transport and deposit the rock material on the bench area above the tailings embankment outslope. Bulldozers would be used to spread the rock over the embankment outslope.

2.3.12.2 Ripsey Wash TSF Temporary Cessation

Although a temporary cessation of the Ripsey Wash TSF operations is not planned and cannot be predicted, circumstances beyond Asarco's control could require temporary cessation of operations. Cyclical production trends or slow-downs are unpredictable due to circumstances that included fluctuation in precious metals prices, labor disputes or costs, production costs, taxes, company profitability, and effects of political, regulatory and economic events.

During any temporary shutdown of the Ripsey Wash TSF, Asarco would continue to implement operational and environmental maintenance activities to ensure the Ripsey Wash TSF meets permit stipulations and requirements for environmental protection. Environmental monitoring requirements would continue, as outlined in the appropriate permit approvals, specifically the Aquifer Protection Permit (APP) issued and overseen by the Arizona DEQ. Environmental reports would be submitted in a timely manner. Regardless of the operating status of the mining, appropriate monitoring would continue until compliance with permanent closure requirements is attained. The Arizona DEQ is responsible to ensure that Asarco complies with the terms and conditions of the APP, even during periods of temporary cessation.

2.3.12.3 Permanent Ripsey Wash TSF Closure Plan

At the permanent cessation of milling operations, Asarco would dewater, close and reclaim the Ripsey Wash TSF. Their primary objectives for TSF closure are:

(1) Implement closure procedures that would prevent potential adverse impacts to human health or the environment;
(2) Execute a cost-effective and reliable closure strategy that would minimize future maintenance requirements; and,
(3) Prevent impacts to the surface and groundwater hydrology of the site, particularly with respect to the Gila River.

A general description of the proposed tailings facility closure procedures is set forth in the following.

2.3.12.3.1 Elimination of Water from Ripsey Wash TSF Supernatant Pool

As permanent closure approaches, Asarco would minimize the amount of excess water within the Ripsey Wash TSF decant pond. Upon closure, Asarco would allow the remaining water in the TSF to evaporate. This would cause the surficial layers of the tailings to dry and gain strength, which in turn would allow equipment to operate on the tailings surface for rock material placement. Spray evaporators could be used to enhance evaporation of the existing decant pond(s). It is estimated that 7 to 10 years might be required to achieve final drying and settlement of the tailings material.

2.3.12.3.2 Permanent Water Diversion

A permanent diversion channel would remain on the east side of the Ripsey Wash TSF. This diversion structures would be installed as part of the original construction to route flows. In addition, Asarco would continue to maintain and operate the detention dams and stormwater pumping and piping system designed to route stormwater around the west side of the Ripsey Wash. See **Figure 12, Final Reclamation Topography – Ripsey Wash TSF**.

2.3.12.3.3 Limited Grading of Tailings Surface

Given the inherent operating nature of a TSF, drainage within the actual tailings impoundment would travel on a gentle slope (e.g., approximately 1%) from the embankment back to the rear area of the impoundment (the area of the decant pond); however, the settled and dried tailings surface might not have that consistent slope across the impoundment areas but rather might form an undulating surface.

The final surface to the tailings would probably require some shaping to eliminate the potential for ponding and to provide positive stormwater drainage off the impoundment and into the permanent diversion channels. Construction equipment, such as scrapers and bulldozers would be used to reshape the tailings.

For the Ripsey Wash TSF, the tailings surface would be graded to achieve drainage to the east to the permanent diversion channel (constructed prior to operation of the TSF) that would connect to the unnamed wash on the east side of the facility. See **Figure 12, Final Reclamation Topography – Ripsey Wash TSF**.

2.3.12.3.4 Rock Material Cover

Asarco plans to place approximately one foot of rock material over the TSF once final grading is completed. This rock material would minimize wind and/or water erosion of the tailings material.

For the Ripsey Wash TSF, the final cover rock material would be granitic conglomerate excavated from the borrow area within the tailings impoundment footprint. Prior to facility closure, Asarco would excavate and stockpile this rock material along the perimeter and within the footprint of the TSF; this rock material would then be available for final cover material.

Conventional construction equipment would be used for this activity. Front-end loaders would excavate and load off-highway trucks that would transport and deposit the rock material on the graded tailings surface. Bulldozers would be used to spread the rock material to the desired final thickness.

Quarrying of rock from the federal mineral estate would require an approved material sale from the BLM as discussed in **Appendix C, Agency Responsibilities (Regulatory Framework)**.

2.3.12.3.5 Re-vegetation

Asarco does not plan for any active revegetation plan (such as seeding) for the Ripsey Wash TSF, but rather would allow the rocked tailings area to naturally re-vegetate.

2.3.12.3.6 Closure and Post-Closure Plans and Cost Estimate

Prior to permanent closing of the TSF, Asarco would notify the Arizona DEQ and submit a final closure plan to this agency within 90 days of the notification. This closure plan would include methods, as necessary, to control the discharge of pollutants from the TSF, including operation of any pumpback systems and long-term maintenance of any stormwater diversion structures or channels, as well as methods to secure the TSF and the schedule for implementation of the closure plan and post-closure plan. Post-closure maintenance of stormwater control structures and diversions around the TSFs may be required in perpetuity, and monitoring would be conducted until the approved closure performance standards have been achieved and deemed successful by the Arizona DEQ.

The statutory and regulatory authority of the Arizona DEQ, Arizona State Mine Inspector, and BLM[15] would require Asarco to execute financial assurance agreements as part of any plan and permit approvals from these agencies. These financial assurances would be in the form of closure and post-closure (reclamation and environmental performance) securities to ensure that sufficient funds or a sufficient commitment would be available to the agencies to close the TSF in the event that Asarco would be unable or unwilling to meet closure or post-closure obligations under the terms and conditions of plan and permit approvals issued by the previously mentioned agencies.

The statutory and regulatory authority of the Arizona DEQ requires that individual APPs also include a cost estimate for closure and post-closure of a TSF. The Arizona State Mine Inspector likewise requires estimates and financial assurance for closure and post-closure under the Arizona Mined Land Reclamation Program. The estimated costs must be based upon the submitted and approved closure and post-closure plans or strategies, and these costs must be produced by an engineer, controller or accountant. The applicant must demonstrate to the satisfaction of the Arizona DEQ that sufficient monies are available to properly close the TSF and conduct post-closure monitoring and other measures called for in the closure strategy or plan to minimize the potential for discharges from the facility.

No tailings facility construction work or tailings storage operations can commence without approval of the APP by the Arizona DEQ and a financial assurance agreement between Asarco and the Arizona DEQ that ensures that sufficient closure and post-closure funds would be available for the oversight and implementation of decommissioning and closure of the TSF. The APP statute and regulations require that the financial assurance be maintained throughout the life of the permit, and that the permittee periodically demonstrate that it still is being maintained. The statute also requires that the costs be periodically verified, including adjusted for inflation. A.R.S. § 49-243(N)(2)-(4) (as amended in 2014).

2.3.13 Tentative Construction, Operation and Closure Schedule

Asarco plans to begin construction work on a new TSF facility and the associated infrastructure upon completion of the NEPA process and receipt of required approvals and permits. See **Figure 13, Tentative Construction, Operation & Closure Schedule - Ripsey Wash TSF.**

2.4 HACKBERRY GULCH TSF ALTERNATIVE

The Hackberry Gulch TSF Alternative would be located south-southeast of the existing Elder Gulch TSF. See **Figure 14, Site Plan Layout - Hackberry Gulch TSF**. This alternative is labeled as “Hackberry Gulch No. 2” in **Appendix B, Alternative Screening and Clean Water Act Section 404(b)(1) Alternative Analysis**, and is considered one of two practicable alternatives within the context of the Clean Water Act.

Most of the Hackberry Gulch TSF construction, operational, and closure techniques and practices would be the same or similar to those currently used at the existing Elder Gulch TSF or proposed for use at the Ripsey Wash TSF. Where these techniques and practices differ, they are addressed in this section.

[15] The requirement for a reclamation performance financial guarantee is a fundamental component of the BLM regulations (43 CFR 3809) that govern mining operations on BLM-administered lands. It is not clear whether the BLM would require a financial guarantee for the tailings and return water pipelines that would cross the BLM-administered lands as part of the Ripsey Wash TSF alternative.

2.4.1 Tailings Operation and Placement Overview

The Hackberry Gulch TSF would be designed and operated as a closed circuit (zero surface water discharge) facility. See **Figure 15, Process Flow Sheet - Hackberry Gulch TSF**.

Asarco would continue to pump tailings material as slurry from the existing Ray Concentrator through an existing pipeline to an existing thickener facility, where the tailings will be "thickened". This process would remain unchanged from the existing operation.

A new pipeline would be needed to pump tailings from the existing thickener to the proposed Hackberry Gulch TSF. In addition, a new service/access road would be required around the base of the existing Elder Gulch TSF to provide routing for the new pipeline and to access the new pumping booster station and lined drain-down containment pond, as well as the seepage trenches, reclaim ponds and related facilities located in the seven washes within the Hackberry Gulch TSF. From the new pumping booster station, tailings would be pumped up to the TSF and discharged from spigots that surround the perimeter of the tailings areas, and decant water that accumulates at the back of the Hackberry Gulch TSF would be pumped back to the Ray Concentrator via pipelines for reuse in the milling process.

Various aspects of Hackberry Gulch TSF Alternative are summarized in **Table 2-2, Summary of Hackberry Gulch TSF Alternative**.

2.4.2 Pre-Tailings Construction

Prior to tailings placement in a Hackberry Gulch TSF, Asarco must complete tasks that include:

- Construction of detention dams, diversion channels and piping infrastructure to route any runoff from undisturbed areas above the Hackberry Gulch TSF around the facility. This work would also involve the installation of energy dissipaters at the outfall locations of the diversion channels and piping network;
- Construction of an overpass bridge for State Highway 177 between tailings impoundment on the northeast side of this highway and seepage trenches/reclaim ponds on southwest side of the highway;
- Installation of box culverts under State Highway 177 for passage of stormwater and reclaim water. Multiple culverts would be required at each affected drainage to segregate stormwater from lined seepage ditches that connect the tailings embankment to the reclaim ponds;
- Construction of starter dams and seepage trenches in the seven washes that dissect the Hackberry Gulch TSF and that are tributary to the Gila River;
- Construction of lined ditches and reclaim ponds down-drainage of the seepage trenches and starter dams;
- Construction of a pumping booster station and lined drain-down tailings containment pond;
- Installation of monitoring wells down-drainage of the seepage trenches and reclaim ponds; Placement of new tailings and reclaim water pipelines from the existing thickener to the Hackberry Gulch TSF; and,
- Establishment of compensatory mitigation sites and implementation of mitigation activities.

Specifics of these tasks are set forth in the following subsections.

Table 2-2, Summary of Hackberry Gulch TSF Alternative

BASIC CRITERIA FOR FULL CAPACITY		
Overall Facility Capacity (million tons)	750	
Final Tailings Embankment Crest Elevation (feet above mean sea level)	2,535	
Final Tailings Embankment Height (feet)	610	
Number of Washes Needing Starter Dam Embankments	7	
Rock Material Required for Starter Dam Embankments (million tons)	8.2	
Length of Tailings and Water Pipelines (feet/miles)	4,620/0.9	
ESTIMATED SURFACE AREA DISTURBANCE AT FULLCAPACITY (ACRES)		
Tailings Storage Facility	1,996	
Stormwater Diversion Infrastructure	116	
Onsite TSF Infrastructure	96	
Offsite TSF Infrastructure	28	
Borrow Areas	54	
Total	2,290	
PROPOSED CONCEPTUAL MITIGATION AREA FOR WATERS OF US (ACRES)		
Sites A,B,C and D (San Pedro River Valley)	97.9	
Sites E (Gila River Valley)	124.9	
Total	222.8	
LAND OWNERSHIP/ADMINISTRATION AT FULL CAPACITY	**ACRES**	**PERCENTAGE (%)**
Private	1,141	49.9%
State of Arizona(1)	0	0.0%
Bureau of Land Management	1,149	50.1%
Total	2,290	100%
WATERS OF THE UNITED STATES(2)		**Acres**
Area of Direct Waters of U.S. Disturbance at Full Capacity (Estimated)		51.70
Area of Indirect Disturbance to Waters of the U.S. at Full Capacity (Estimated)		19.80
Area of Jurisdictional Wetlands Disturbance at Full Capacity (Estimated)		0.62

Notes:

(1) The Hackberry Gulch site is partially located on lands administered by the Bureau of Land Management (BLM). Asarco is currently pursuing a land exchange with the BLM such that the Hackberry Gulch TSF would be located on “private property” owned by Asarco. The BLM Ray Land Exchange is pending. The placement of tailings at this site is independent of the land exchange. If the exchange is finalized, the facility would be Asarco property. If the land exchange does not occur, Asarco would file a Section 3809 plan of operation with the BLM for the facility.

(2) A formal delineation of Waters of the U.S. was not performed for this alternative. The extent of Waters of the U.S. was estimated from a review of aerial photography of the alternative footprint and some limited fieldwork.

2.4.2.1 Detention Dams and Diversion Structures

As part of pre-tailings storage construction activities, Asarco would construct detention dams and diversion channels to divert stormwater from the undisturbed watershed areas above the proposed Hackberry Gulch TSF around the facility. See **Appendix I, Applicant Project Mitigation**.

Asarco would install detention dams in the washes up-drainage of the ultimate footprint of the Hackberry Gulch TSF. See **Figure 14, Site Plan Layout - Hackberry Gulch TSF**.

The purpose of these detention dam structures would be to prevent up-drainage stormwater runoff from entering into the tailings impoundment area. These detention dam structures would be designed to handle flows from a 500-year, 24-hour storm event. In the unlikely event of a greater storm event, these detention dam structures would be installed with emergency spillways that would allow flow in excess of the design storm event to discharge into the tailings impoundment.

Stormwater that is intercepted by these detention dam structures would be routed around the Hackberry Gulch TSF by pumping through a piping system and/or by routing through stormwater diversion channels for discharge into either Belgravia Wash on the northwest side of the Hackberry Gulch TSF or into an unnamed drainage on the southeast side of the TSF. Both of these drainages are tributary to the Gila River. See **Figure 14, Site Plan Layout - Hackberry Gulch TSF**.

The stormwater diversion channel would be approximately 22,000 feet (about 4.2 miles) in length and would be designed to handle flows from a 100-year, 24-hour storm event. In the unlikely event of a greater storm event, there would be several emergency spillways installed along the diversion channel that would allow overflow into the tailings impoundment. The location of the diversion channel is shown on **Figure 14, Site Plan Layout - Hackberry Gulch TSF**.

Flow intercepted by this diversion channel would be routed for discharge into Belgravia Wash, located on the northwest side of the proposed Hackberry Gulch TSF.

To slow discharge velocity to reduce the potential for down-drainage erosion from released stormwater, Asarco would control the flow of water through its pumping from the detention dams up-drainage of the Hackberry Gulch TSF and would install energy dissipater facilities within the diversion channel above Belgravia Wash and at the outfall to the drainage in aforementioned unnamed drainage on the southeast side of the Hackberry Gulch TSF.

Stilling basins would be installed to dissipate energy in the flows in the diversion channels. One basin would be installed on the north side of State Highway 177, and the second one would be installed at the end of Belgravia Wash prior to its confluence with the Gila River. See **Figure 14, Site Plan Layout - Hackberry Gulch TSF**.

2.4.2.2 State Highway 177 Overpass Bridge

To promote long-term safety and to minimize the ingress and egress of traffic from TSF development and operational onto State Highway 177, an overpass bridge for State Highway 177 would be constructed to link TSF project activities on the northeast and southeast sides of the highway. This overpass would allow highway traffic to continue without interference from Asarco personnel and equipment as they access the planned four reclaim ponds and the monitoring/pumpback wells that would be located on the southwest side of the Hackberry Gulch TSF. See **Figure 14, Site Plan Layout - Hackberry Gulch TSF**.

This overpass bridge would be constructed as part of initial TSF construction and would be designed to meet Arizona Department of Transportation (DOT) standards. A typical view of this overpass bridge is shown on **Figure 16, Typical Overpass Bridge for State Highway 177**. Sufficient clearance and width would be required to allow Asarco equipment and vehicles to pass beneath the highway. There would also need to be adequate allowance for stormwater passage and the separate lined ditches for seepage water from the TSF to the lined reclaim pond.

During bridge construction, a temporary detour would be established to allow normal traffic to continue on State Highway 177. This detour would require placement of a temporary culvert in the drainage for stormwater flow and a compacted and graded fill for the roadway. Signage and flag persons would be assigned to the project until the new overpass bridge is completed.

2.4.2.3 Box Culverts beneath State Highway 177

A series of box culverts would be placed under State Highway 177 to allow segregated stormwater passage under Highway 177 and around the reclaim ponds. A separate lined ditch for seepage water and water that comes into contact with the tailings embankment will be constructed from the TSF to the lined reclaim pond. These box culverts would be installed as part of initial TSF construction and would be designed to meet Arizona DOT standards. The locations for these new culverts are shown on **Figure 17, Conceptual Box Culverts for State Highway 177**.

2.4.2.4 Tailings Starter Dam

As part of pre-tailings storage construction activities, Asarco would construct a large, elongated starter dam for the Hackberry Gulch TSF that would cross several washes. This long starter dam would be required because the Hackberry Gulch TSF would be a “side-hill” facility (unlike the Ripsey Wash TSF which is essentially a “valley-fill” facility). The crest elevation of the starter dam would reach approximately 2,150 feet above mean sea level (amsl).

The starter dam embankment would serve as the base to retain tailings materials for the centerline embankment construction. Approximately 8 million cubic yards of material would be used to construct this starter dam. Rock material to be used to create the embankment would consist of both alluvium/colluvium material and Big Dome Formation conglomerate that would be removed up-drainage of the starter dam and from inside what would become the ultimate footprint of the Hackberry Gulch TSF.

It is anticipated that some drilling and blasting would be required to aid in the removal of conglomerate, and a portable crusher plant would be utilized during starter dam construction activities to size and screen material for construction of associated facility infrastructure (e.g., bedding material for the liners used under the down-drainage centerline embankment, seepage ditches, and reclaim ponds).

Conventional construction equipment, such as front end loaders, off-highway trucks, and bulldozers, would be used for starter dam construction. Due to the numerous washes that dissect the Hackberry Gulch TSF, multiple temporary haul roads would be needed within and external to, the footprint of the tailings impoundment for construction equipment and activity.

2.4.2.5 Seepage Trenches

Down-gradient of the starter dams, Asarco would install seepage trenches in each of the seven washes that dissect the area of the proposed Hackberry Gulch TSF. See **Figure 14, Site Plan Layout - Hackberry Gulch TSF**. The seepage trenches would be similar in design to those proposed for the Ripsey Wash TSF.

These trenches would be designed to intercept any water that might pass under the tailings facility through the alluvium material above the bedrock. Pumps and piping would be installed in the seepage trenches to route any collected water to lined reclaim ponds that would be located down-gradient of the seepage trenches.

2.4.2.6 Reclaim Ponds

Asarco would install reclaim ponds in each of the seven affected washes down gradient of the seepage trenches. See **Figure 14, Site Plan Layout - Hackberry Gulch TSF**.

Given the juxtaposition of State Highway 177 with the proposed toe on the northwest side of the Hackberry Gulch TSF, four of the reclaim ponds must be located on west side of State Highway 177. Box culverts would be installed under State Highway 177 to route seepage water to these reclaim ponds. See Section 2.4.2.3, Box Culverts Beneath State Highway 177. This construction would involve trenching through the highway to install the box culverts. The other three seepage ponds could be located on the east side of State Highway 177.

These seven reclaim ponds would be constructed with an engineered double-liner system, using synthetic liner material (80 mil HDPE or equivalent) and have leak detection systems incorporated into their design and operation. The area around these ponds would be fenced. Asarco would be able to pump water from the reclaim ponds to the Ray Concentrator (for reuse) or to the tailings impoundment. The seepage trenches would be similar in design as the ones proposed for the Ripsey Wash TSF.

2.4.2.7 Monitoring Wells

Asarco would also maintain or install monitoring wells down-gradient of the seven reclaim ponds. These wells would be used to monitor groundwater quality below the seepage trenches and reclaim ponds.

2.4.2.8 Pumping Booster Station and Tailings Drain-Down Pond

Asarco would construct a pumping booster station and electric switchgear facility on the northeast corner of the proposed Hackberry Gulch TSF. The existing outer gulch drain down pond would be used in the event the tailings pipeline requires draining. See **Figure 14, Site Plan Layout - Hackberry Gulch TSF**.

From this location, the pumping booster station would pump tailings uphill to the Hackberry Gulch TSF. The drain-down pond is designed and constructed to hold the volume of tailings potentially contained in the tailings pipeline from the Ray Concentrator to the Hackberry Gulch TSF.

The electric switchgear facility at this site would provide the energy to operate the pumping booster station, as well as the various other pumps at the Hackberry Gulch TSF (e.g., seepage trench pumps, reclaim pond pumps, water pumps for the decant pool that forms at the rear at the tailings impoundment).

During construction, this site would also serve as a storage area for construction-related materials and supplies, such as storage area for construction-related materials and supplies, such as pipeline segments, culverts, liner material, and pumps.

2.4.2.9 Tailings and Water Pipelines

Tailings would be pumped to the Hackberry Gulch TSF though a contained overland slurry pipeline that would parallel the return water pipeline that would send water from the tailings facility back to the Ray Concentrator. The proposed routing is shown on **Figure 14, Site Plan Layout - Hackberry Gulch TSF**.

The tailings pipeline would be installed from the existing thickener and along the new access road in route to the Hackberry Gulch TSF. The return water pipeline would be placed adjacent to the tailings pipeline and would follow the same right-of-way back to the Ray Mine project site and would connect to the existing Tank 34, which presently receives decant water from the Elder Gulch TSF.

Additional discussion about pipelines is set forth in Section 2.4.4, Tailings Delivery System.

2.4.3 Tailings Embankment Construction Methods

Construction of the Hackberry Gulch TSF would use the same two distinct methods of tailings embankment construction planned for Ripsey Wash TSF. These methods are centerline and upstream construction.

2.4.3.1 Centerline Construction

The centerline embankment construction techniques planned for a Hackberry Gulch TSF would be the same as proposed for the Ripsey Wash TSF. See Section 2.3.3.1, Centerline Construction and **Figure 9, Centerline Tailings Embankment Construction**. When the centerline construction reaches an elevation of approximately 2,300 feet (amsl), Asarco would switch to an upstream method of tailings storage.

2.4.3.2 Upstream Construction

This would be the same as currently used at the existing Elder Gulch TSF and as proposed for the Ripsey Wash TSF. See Section 2.3.3.2, Upstream Construction and **Figure 10, Upstream Tailings Embankment Construction**.

2.4.3.3 Quality Control and Quality Assurance

This would be the same as the proposed Ripsey Wash TSF. See Section 2.3.3.3, Quality Control and Quality Assurance.

2.4.4 Tailings Delivery System

Tailings would be pumped though a contained slurry pipeline to the Hackberry Gulch TSF from a new pumping booster station, located on the northwest side of the TSF. The tailings slurry and water return pipelines would be high density polyethylene (HDPE) and/or high-strength steel, with welded joints to ensure long-term operational integrity. The tailings and return-water pipelines would be placed on the surface or, where determined necessary for safety, buried either in the shoulder or beneath the driving surface of site access roads. This would be similar to those proposed for the Ripsey Wash TSF Alternative. See **Figure 7, Typical Utility Corridor & Roadway Sections.**

2.4.5 Tailings Facility Operation

The tailings facility would be designed and operated as a zero-surface water discharge facility. This would be the same operation as currently used at the existing Elder Gulch TSF and as proposed for the Ripsey Wash TSF. See Section 2.3.5, Tailings Facility Operation.

2.4.6 Tailings Facility Support Facilities

The Hackberry Gulch TSF would require miscellaneous infrastructure to support operations. This would include site support and service roads, power supply for pumps, and quarries or rock material borrow areas for concurrent reclamation and closure rock material.

2.4.6.1 Site Support and Service Roads

Asarco would construct a new access road to the Hackberry Gulch TSF near the toe of the existing Elder Gulch TSF. The tailings and return water delivery pipelines would parallel this new road.

Other roads would be required to access the up-gradient detention dams and diversion channels, as well as roads to be used to haul rock material for the starter dam embankment construction. In addition, access roads would be required on both the east and west side of State Highway 177 to access the reclaim ponds and the monitoring and pump-back wells. A new overpass bridge would be constructed to link TSF operations on both sides of the highway to allow Asarco personnel and equipment to access facilities without having ingress/egress on the highway.

An access service road would be constructed and maintained along the top of the tailings embankment for the tailings delivery pipeline. Another access service road would be constructed and maintained around the upper perimeter of the tailings impoundment for the return water pipelines. As the TSF expands upward, Asarco would establish new perimeter access service roads. These perimeter access roads would typically be around 15 to 20 feet wide.

2.4.6.2 Power Supply and Distribution

Electric power would be needed for the tailings pumping booster station on the northwest side of the Hackberry Gulch TSF, the water pumps at the reclaim ponds below the tailings embankment, and at the decant water ponds in the TSF impoundment. Asarco would install electric switchgear at the pumping booster station and would construct distribution lines from this site to serve pumping facilities at the Hackberry Gulch TSF (e.g., the pumps at the detention ponds, the seepage trench pumps, the reclaim ponds down-gradient of the seepage trenches). The distribution line structures would be the same as discussed in Section 2.3.6.2, Power Supply and Distribution.

2.4.6.3 Rock Quarries

As part of concurrent reclamation, Asarco would place rock on the face of the Hackberry Gulch TSF embankment, starting after the centerline construction phase is completed, and followed periodically on the slopes created by upstream construction (after three lifts are completed). Because the Hackberry Gulch TSF is relatively long and narrow, and side-hill constructed facility, there is limited ability to excavate closure rock from within the TSF footprint. For concurrent and final reclamation, Asarco would use Big Dome Formation conglomerate rock from borrow sources (or quarries) outside the footprint of the planned TSF. See **Figure 14, Site Plan Layout - Hackberry Gulch TSF**.

2.4.7 Water Use and Management

Water use and management for the Hackberry Gulch TSF would be the same as proposed for the Ripsey Wash TSF. See Section 2.3.7, Water Use and Management.

2.4.8 Stormwater Management

Upstream of the TSF, Asarco would construct a diversion channel, pipelines, and detention dams as described in Section 2.4.2.1, Detention Dams and Diversion Structures. This would be similar to the Ripsey Wash TSF where water is routed or pumped around the Hackberry Gulch TSF. See **Appendix I, Applicant Project Mitigation**.

2.4.9 Work Force Requirements

The construction, operation and closure workforce requirements for the Hackberry Gulch TSF would essentially be the same as estimated for the proposed Ripsey Wash TSF. See Section 2.3.9, Work Force Requirements.

2.4.10 Environmental Management and Mitigation

If the Hackberry Gulch TSF is implemented, Asarco would employ and maintain environmental management and mitigation measures which would be the same or similar to those discussed in Section 2.3.10, Environmental Management and Mitigation. Also see, **Appendix I, Applicant Project Mitigation**.

2.4.11 Environmental Monitoring

Asarco would implement environmental monitoring measures required by permits and approvals issued for the Hackberry Gulch TSF, most prominently, an APP issued by Arizona DEQ. As part of an APP, Asarco would conduct groundwater monitoring in wells down-gradient of the TSF facilities to monitor groundwater conditions at this site during construction, operations and closure.

2.4.12 Hackberry Gulch TSF Closure and Reclamation

Asarco's closure and reclamation plan for the Hackberry Gulch TSF would be similar to the plans for the Ripsey Wash TSF set forth in Section 2.3.12, Ripsey Wash TSF Closure and Reclamation.

2.4.12.1 Hackberry Gulch TSF Concurrent Reclamation

The concurrent reclamation plans for the Hackberry Gulch TSF would be the same as Asarco plans for the Ripsey Wash TSF. Asarco would place approximately one foot of rock material on the down-drainage slope of the tailings. The final cover rock material used at the Hackberry Gulch TSF would be Big Dome Formation conglomerate excavated from the rock quarries to the north and east of the tailings impoundment footprint.

2.4.12.2 Hackberry Gulch TSF Temporary Cessation

Temporary cessation of the Hackberry Gulch TSF is not planned, but circumstances beyond Asaroc's control could require such action. If temporary cessation occurred for the Hackberry Gulch TSF, it would be handled as set forth in Section 2.3.12.2, Ripsey Gulch TSF Temporary Cessation.

2.4.12.3 Permanent Hackberry Gulch TSF Closure Plan

Permanent closure plans for the Hackberry Gulch TSF would be similar to the plans for the Ripsey Wash TSF, which are set forth in Section 2.3.12.3, Permanent Ripsey Wash TSF Closure Plan.

For the Hackberry Gulch TSF, a permanent diversion channel would remain on the north and northwest side of the facility. This diversion structures would be installed as part of the original construction to route flows. Asarco would continue to maintain and operate the detention dams and stormwater pumping and piping system designed to route stormwater around the southeast side of the Hackberry Gulch TSF.

As part of permanent closure of the Hackberry Gulch TSF, the tailings surface would be graded to achieve drainage to the north to the permanent drainage channel (constructed prior to operation of the TSF) that connects to the Belgravia Wash. See **Figure 18, Final Reclamation Topography – Hackberry Gulch TSF**.

Asarco plans to place approximately one foot of rock material over the Hackberry Gulch TSF once final grading is completed. This rock material would minimize wind and/or water erosion of the tailings material. Final cover rock material for this action would be Big Dome Formation conglomerate excavated from the rock quarries to the north and east of the tailings impoundment footprint.

Quarrying of rock from the federal mineral estate would require an approved material sale from the BLM as discussed in **Appendix C, Agency Responsibilities (Regulatory Framework)**.

Asarco does not plan for any active revegetation plan (such as seeding) for the Hackberry Gulch TSF, but rather will allow the rocked tailings area to naturally re-vegetate.

Hackberry Gulch permanent closure notice requirements, along with submittal of final closure and post-closure plans to the Arizona DEQ would follow the same procedures as addressed in Section 2.3.12.3.6, Closure and Post-Closure Plans and Cost Estimate.

2.4.13 Tentative Construction, Operation and Closure Schedule

Asarco would begin construction work on the Hackberry Gulch TSF and the associated infrastructure upon completion of the NEPA process and receipt of required approvals and permits. The schedule would be similar to that proposed in **Figure 19, Tentative Construction, Operation and Closure Schedule – Hackberry Gulch TSF**.

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED EVALUATION

The Corps considered a number of possible TSF alternatives, but many TSF alternatives were eliminated from consideration because they could not meet the purpose and need for the project, did not address important issues, or were impractical or unreasonable.

Based on the detailed assessment set forth in **Appendix B, Alternative Screening and Clean Water Act Section 404(b)(1) Alternative Analysis**, the Corps has eliminated the following TSF alternatives from detailed evaluation in the draft EIS:

- Tailings storage within the Ray Mine open pit;
- Underground tailings storage;
- Ray Concentrator storage of tailings at multiple sites;
- Remote tailings storage (with off-site shipment and processing of ore material);
- Tailings storage in Devils Canyon;
- Tailings storage near community of Hayden;
- Tailings storage near Granite Mountain/Copper Butte;
- Tailings storage on the west side of the Ray Mine;
- Dewatered tailings storage ("dry-stack" tailings storage); and,
- Various location alternatives at the Ripsey Wash and Hackberry Gulch sites.

These alternatives dropped out during the alternatives screening process for various reasons or did not pass the practicability test consistent with the Clean Water Act Section 404(b)(1) guidelines that the Corps requires for 404 permits.

3.0 ENVIRONMENTAL ANALYSIS

This EIS chapter describes both the existing conditions of and the environmental consequences to the area and resources, based on the alternatives described in Chapter 2.

For ease of presentation and comparison, the analysis discussions are separated into individual resource areas, such as air quality, soils, geology, surface water, groundwater, etc. Resource specialists compiled existing and available environmental baseline and background information, communicated with government agencies, interacted with technical specialists working for Asarco, visited the proposed tailings alternative sites, and conducted on-the-ground reconnaissance surveys to corroborate information.

Although the anticipated environmental effects of alternatives were analyzed for each resource discipline, impact analyses emphasized those disciplines that relate to the key issues and concerns identified in Chapter 1. Some effects are expressed in quantitative terms, others in qualitative terms.

Impact descriptions under each resource area are divided into the following categories:

- Effects of the no action alternative;
- Effects of the Ripsey Wash TSF alternative (Asarco's proposed action); and,
- Effects of the Hackberry Gulch TSF alternative.

Impacts are evaluated for the alternatives and are defined as follows:

- Direct impacts - Those effects that occur at the same time and in the same general location as the activity causing the effects. For example, TSF construction and operation would have a direct impact on soils and vegetation within the footprint of the facility.
- Indirect impacts - Those effects that occur at a different time or different location than the activities to which the effects are related. For example, traffic from non-work trips made by construction workers that might reside in the region during TSF construction.
- Cumulative impacts - Those effects that result from the incremental impact of the action alternatives when added to other past, present and reasonably foreseeable actions. For example, TSF construction would add to the visual effects created by the existing Ray Mine, the area's highways and roads, the Copper Basin Railroad, electric utility lines, and the structures and housing in nearby residential communities.

Potential impacts can also be described as adverse or beneficial. Adverse means a negative change from desired conditions or appearance, while beneficial would be a positive change in the condition or appearance of a resource.

Impacts can be described in terms of their potential duration.

- Short-term impacts - Those effects that occur for a limited time. For example, the noise from the equipment used to construct starter dams and seepage trenches would be short-term.
- Long-term impacts – Those effects that last beyond operation and closure of the TSF and may not regain their pre-construction conditions for a long period of time. For example, impacts to vegetation would be long-term, as the natural revegetation processes would be slow and may never return the disturbed site to pre-construction conditions.

- Permanent impacts – Those effects where resources would be lost or those effects that would change the site forever. For example, the final topography created by tailings placement would create a permanent change to the landscape of the area.

The intensity of the impact is based on how the proposed project would affect each resource. The levels used to generally describe impact intensity are:

- **Negligible** – An impact at the lowest levels of detection with barely measurable consequences.
- **Minor** – An impact with little loss of resource integrity and with changes that are small, localized, and of little consequence.
- **Moderate** – An impact that would alter the resource but not modify overall resource integrity, or an impact that could be mitigated successfully in the short term.
- **Major** – An impact that would be substantial, highly noticeable, and long term.

Mitigation and monitoring measures that would be required for project permitting or that are voluntarily included as part of the proposed activities are considered in the discussion of effects. By design, each the Ripsey Wash and Hackberry Gulch TSF alternatives have built-in mitigation in the form of standard or special stipulations that would be added under various permit approvals. Effective mitigation avoids, minimizes, rectifies, reduces or compensates for potential impacts. After mitigation is applied, any unavoidable adverse effects to each resource area addressed.

3.1 AIR QUALITY/CLIMATE

Identify project-related air quality impacts*. Areas of concern include: (1) compliance with federal and state air quality standards; (2) the effects on air quality from fugitive dust and gaseous emissions; (3) visibility effects to any Class I areas in the vicinity of project; and, (4) possible climate change impacts related to the project.*

3.1.1 AFFECTED ENVIRONMENT

3.1.1.1 Regional Climate

The area around the Ripsey Wash and Hackberry TSF sites has a subtropical desert climate.

The monsoon season, characterized by high temperatures, high winds and rainfall, begins in early July and lasts until mid-September. Moisture-bearing winds from the Gulf of Mexico sweep into the region from the southeast. April, May, and June are the months with the greatest number of clear days and least precipitation. Winter months when the air is calmest are subject to temperature inversions.

Climate data for the area is provided in **Table 3-1, Temperature, Precipitation and Pan Evaporation**. Average daily temperatures in this region range from an average maximum low of around 31°F in January to an average maximum highs approaching 99°F in July. Temperatures in the winter can dip below freezing (32°F), while summertime temperatures often climb above 100°F.

Table 3-1, Temperature, Precipitation and Pan Evaporation

Parameter	Source	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (°F)	1	60.9	64.1	68.5	76.4	86.1	95.6	97.7	95.4	92.3	82.5	69.8	61.6	79.2
	2	64.2	68.2	73.3	81.0	89.5	99.2	99.3	96.7	93.6	84.4	72.6	64.1	82.2
Average Min. Temperature (°F)	1	43.2	45.4	48.2	54.4	62.7	72.0	75.7	74.2	71.2	62.0	51.1	44.0	58.7
	2	31.2	33.8	38.5	42.9	49.9	59.8	69.5	67.8	60.6	47.6	36.6	30.8	47.4
Average Daily Temperature (°F)	1	52.0	54.7	58.4	65.4	74.4	83.8	86.7	84.8	81.7	72.3	60.5	52.8	69.0
	2	47.7	50.9	55.9	61.9	69.7	79.5	84.4	82.2	77.1	65.9	54.6	47.5	64.8
Average Total Precipitation (in)	1	2.00	1.98	2.02	0.80	0.34	0.26	1.91	2.80	1.48	1.18	1.41	2.11	18.30
	2	1.36	1.06	0.98	0.46	0.32	0.30	2.04	2.69	1.31	1.03	0.86	1.38	13.79
	3	1.72	1.56	1.29	0.43	0.24	0.17	1.40	2.12	0.94	0.80	0.97	1.58	13.21
	4	1.59	1.35	1.58	0.53	0.27	0.19	1.42	2.19	1.35	1.22	1.10	1.63	14.41
Average Pan Evaporation (in)	5	3.12	4.03	7.00	9.98	12.4	13.9	11.19	9.84	9.56	7.51	4.31	2.94	95.78

Source:

[1] Superior, AZ, 1920-2006—Source: www.wrcc.dri.edu/cgi-bin/cliMAIN.pl/az8348
[2] Winkelman 6 S, AZ, 1893-1980—Source: www.wrcc.dri.edu/cgi-bin/cliMAIN.pl/az9420
[3] Kearny, AZ, 1984-2013—Source: www.wrcc.dri.edu/cgi-bin/cliMAIN.pl/az4590
[4] Winkelman 6 S, AZ, 1893-1980—Source: www.wrcc.dri.edu/cgi-bin/cliMAIN.pl/az9420
[5] Winkelman 6 S, AZ, 1942-1980—Source: www.wrcc.dri.edu/htmlfiles/westevap.final.html

Annual average precipitation is typically around 13 to 14 inches, with most amounts occurring during July and August, which are part of the aforementioned monsoon season. The summertime rain can be sporadic and locally intense, often associated with passing thunderstorms.

The Ripsey Wash and Hackberry Gulch TSF sites are located in complex terrain where winds are strongly affected by local topography, the time of day, and the season. Winds typically flow down the Gila River valley during the cooler night-time hours, but the general wind direction generally follows a north-south pattern during the day. High wind and gusts can occur during the monsoon season, associated with approaching thunderstorms, and these high winds and gusts, especially over desert areas, can lead to substantial fugitive dust.

The average annual pan evaporation rate measured at the town of Winkelman, which is approximately 14 miles southeast of the Ray Mine, was nearly 96 inches for the period of record 1942 to 1980. See **Table 3-1, Temperature, Precipitation and Pan Evaporation**.

3.1.1.2 Climate Change

The climate of the Southwest[16] is changing. According to the US Environmental Protection Agency (EPA) (www.epa.gov/climatechange/impacts-adaptation/southwest.html), the average annual temperature over the last century has increased about 1.5°F, and the average annual temperature is projected to climb an additional 2.5°F to 8°F by the end of this century (USGCRP, 2009). Warming in the Southwest is projected to be greatest in the summer.

3.1.1.3 Air Quality Regulatory Framework

The Federal Clean Air Act (CAA), as amended in 1990, established ambient air quality standards and the regulatory agencies to enforce these standards. EPA has developed National Ambient Air Quality Standards (NAAQS) for six principal pollutants to protect the public health (primary standards), as well as, to protect the public welfare (secondary standards) from any known or anticipated adverse effects. These six principal pollutants are generally referred to as “criteria” air pollutants. The list of “criteria” air pollutants includes ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (less than ten microns in aerodynamic diameter (PM_{10}) and particulate matter less than 2.5 micron in aerodynamic diameter ($PM_{2.5}$), and lead (Pb).

Table 3-2, National, State of Arizona and Pinal County Ambient Air Quality Standards, summarizes the regulatory standards for these pollutants as established by EPA. Also provided within the table are the ambient air quality standards established by the State of Arizona and Pinal County. Under the provisions of the CAA, states and counties that have been delegated regulatory authority by EPA can adopt the EPA NAAQS or develop their own ambient air standards. Enforcement of the NAAQS for projects and activities in Pinal County is the responsibility of Pinal County, to which Arizona DEQ has delegated such authority.

The CAA requires the designated NAAQS enforcement agencies to specify air quality control regions (or portions thereof) as either “attainment/maintenance” or “non-attainment” with respect to each criteria pollutant, based on whether the air quality region complies with the established NAAQS, and to prepare and maintain air pollution control plans with strategies to improve air quality. These plans are referred to as State Implementation Plans (SIPs).

EPA has promulgated, and the State of Arizona has adopted, by reference, Prevention of Significant Deterioration (PSD) regulations to prevent deterioration of air quality in areas that are in attainment with the NAAQS. These regulations establish maximum allowable increases in concentration of a pollutant (increment) above a baseline concentration in an area for both Class I (national parks and other pristine areas) and Class II (most of the analysis region) areas. The nearest Class I area to the Ripsey Wash and Hackberry Gulch TSF sites is the Superstition Wilderness Area (approximately 12 miles north), of the Ray Mine.

[16] The Southwest is bordered by the Pacific Ocean to the west, the Rocky Mountains to the east, and Mexico to the south. It includes the state of Arizona.

Table 3-2, National, State of Arizona and Pinal County Ambient Air Quality Standards

Pollutant	Averaging Time	National		Arizona	Counties
		Primary	Secondary	Primary (unless noted)	Primary (unless noted)
Ozone (O_3)	1 hour	None	None	0.12 ppm	None
	8 hour	0.075 ppm	Same as Primary	0.075 ppm	0.08 ppm
Carbon Monoxide (CO)	1 hour	35 ppm	None	35 ppm	35 ppm
	8 hour	9 ppm	None	9 ppm	9 ppm
Nitrogen Dioxide (NO_2)	1 hour	100 ppb	None	100 ppb	None
	Annual	0.053 ppm	Same as Primary	0.053 ppm	0.053 ppm
Sulfur Dioxide (SO_2)	1 hour	75 ppb	None	75 ppb	None
	3 hour	None	0.5 ppm	0.5 ppm[(3)]	0.5 ppm[(2)]
	24 hour	None	None	0.14 ppm	0.14 ppm
	Annual	None	None	0.03 ppm	0.03 ppm
Particulate Matter (as PM_{10})	24 hour	150 µg/m^3	Same as Primary	150 µg/m^3	150 µg/m^3
	Annual	None	None	None	50 µg/m^3
Particulate Matter (as $PM_{2.5}$)	24 hour	35 µg/m^3	Same as Primary	35 µg/m^3	None
	3-year average of weighted annual mean concentration	None	None	None	15 µg/m^3
	Annual	12 µg/m^3	15 µg/m^3	15 µg/m^3	None
	3-year average of 98th percentile of 24-hour concentrations	None	None	None	65 µg/m^3
Lead	Quarterly Arithmetic Mean	None	None	None	1.5 µg/m^3
Lead	Rolling 3-Month Average	0.15 µg/m^3	Same as Primary	0.15 µg/m^3	None

Notes:
(1) Arizona Administrative Code, Title 18, Chapter 2, Article 2.
(2) Pinal County Code of Regulations, Chapter 2, Article 1.
(3) Secondary Standard.

The Ray Mine is located in an area that is non-attainment for PM_{10}. Therefore, increment consumption and PSD review would not apply. The facility is subject to non-attainment new source review.

3.1.1.4 Regional Air Quality

The existing air quality conditions for Ripsey Wash and Hackberry Gulch TSF sites are primarily the result of meteorological conditions and existing emission sources in the region. The TSF sites are located in an area where ambient air quality slightly exceeds the PM_{10} standard; this area, referred to as the "Hayden, AZ" area, is currently classified as "non-attainment" for PM_{10} emissions.

PM_{10} monitoring was conducted in the town of Kearny for nearly three years (2009 – 2011) by Pinal County. The highest PM_{10} value from this monitoring was 51 µg/m^3, which is a value that slightly exceeds the Pinal County AAQS for PM_{10}, which is 50 µg/m^3.

3.1.1.5 Air Permitting Requirements for Industrial Sources

Industrial sources in Pinal County must secure a Construction Permit from the Pinal County Air Quality Control District prior to commencing construction of any source that has the potential to emit regulated air pollution. See **Appendix C, Agency Responsibilities (Regulatory Framework)**. Asarco currently has a Title V Operating Permit from Pinal County to operate the Ray Mine; this permit includes the operation of the existing tailings facility.

3.1.2 ENVIRONMENTAL CONSEQUENCES

3.1.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. Air quality of the region would remain under the influence of industrial sources (Hayden smelter) and existing land use trends, which include mining, traffic in local communities and on SR 177, the Florence-Kelvin highway and other roads, and continued recreational use, such as OHV traffic, hunting, camping, hiking and sightseeing. This part of Arizona is currently classified as the Hayden area for non-attainment for the PM_{10} standard under the NAAQS and, with current and anticipated land use trends, would probably retain its designation.

3.1.2.2 Effects of the Ripsey Wash TSF Alternative

Project activities of the Ripsey Wash TSF would create fugitive dust and gaseous emissions, both from vehicular traffic and use of heavy equipment for construction, operational and closure activities. With the exceptions of a portable crushing facility that may be required for initial construction and localized windblown emissions from disturbed areas during windy days, emissions would primarily be from mobile sources rather than those classified as stationary sources.

3.1.2.2.1 Ripsey Wash TSF Fugitive and Gaseous Emissions

Fugitive dust emissions are represented for PM_{10} and $PM_{2.5}$. These emissions would result from heavy equipment (primarily during initial construction and final closure work) and site support vehicles (such as pick-up trucks, vans, and supply trucks).

The estimated annual PM_{10} and $PM_{2.5}$ fugitive dust emissions for the Ripsey Wash TSF are set forth in **Table 3-3, Estimated Fugitive Dust Emissions for Ripsey Wash TSF**.

For comparison purposes, the Arizona DEQ projected that the PM_{10} emissions for Pinal County in 2007 to be approximately 51,000 tons per year, with the principal source for these emissions from traffic on county roads. EPA’s National Emissions Inventory (NEI) estimated that the 2005 $PM_{2.5}$ emissions for Pinal County to be 4,210 tons per year, with open burning and agriculture crop tilling and livestock dust being the principal sources for these emissions. These Pinal County PM_{10} and $PM_{2.5}$ values are found in the March 2010 report entitled *Arizona Air Quality Designations Technical Support Document – Boundary Recommendations for the Pinal County 24-hour PM_{10} - Nonattainment Area*. The estimated maximum annual Ripsey Wash TSF PM_{10} and $PM_{2.5}$ emissions would be less than 0.2% of those reported for Pinal County.

Table 3-3, Estimated Fugitive Dust Emissions for Ripsey Wash TSF(1)

	PM_{10} (tons per year)	$PM_{2.5}$ (tons per year)
Initial Site Preparation and Construction		
Year 1	85	7
Year 2	94	7
Year 3	92	8
Annual Average	90	7.5
Centerline Tailings Operations		
Annual Average	12	2
Upstream Tailings Operations		
Annual Average	16	2
Closure and Reclamation(2)		
Annual Average	9	2

Notes:

(1) Source: ERM Consultants. 2014.

(2) There will be minimal Asarco activity at the site following closure and reclamation (mainly periodic maintenance of pumps for water diversion infrastructure). Any air emissions during this activity would be negligible.

The highest annual fugitive dust emissions (specifically PM_{10} and $PM_{2.5}$ in this case) and gaseous emissions would be generated during early site development and construction activities, which are estimated to take approximately three years and would utilize equipment such as drills, front end loaders, trucks, bulldozers, excavators, and motor graders. The early site development and construction work would involve road building, detention dam and diversion ditch installation work, construction of tailings starter dams, and installation of seepage trenches and seepage collection ponds.

Tailings disposal operations would generate PM_{10} and $PM_{2.5}$ fugitive dust and gaseous emissions, although at a reduced level from those during early site development and construction work. These emissions would be generated from traffic on unpaved roads, from ongoing centerline and upstream tailings dam construction using equipment such as bulldozers and excavators (long-reach backhoes), and from wind erosion on the tailings surface.

Final closure and reclamation activities would generate PM_{10} and $PM_{2.5}$ fugitive dust emissions from final grading work and placement of rock material over the tailings impoundment, using equipment such as front end loaders, trucks, bulldozers, excavators, and motor graders. There would also be windblown fugitive dust from the closed tailings impoundment, which would lessen once rock is placed on tailings surface.

Gaseous emissions would result from the fuel combustion in the on-site support vehicles and heavy equipment used to support TSF construction, operations and closure. Gaseous emissions include oxides of nitrogen (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), volatile organic compounds (VOC), carbon dioxide (CO_2), methane (CH_4) and nitrogen oxide (N_2O), the later three considered greenhouse gases that contribute to global warming. All gaseous emissions result from mobile equipment; there are no gaseous emissions associated with stationary sources for this project.

The estimated annual gaseous emissions for the Ripsey Wash TSF are set forth in **Table 3-4, Estimated Gaseous Emissions for Ripsey Wash TSF**.

Table 3-4, Estimated Gaseous Emissions for Ripsey Wash TSF(1)

	NO_X (tons/yr)	VOC (tons/yr)	CO (tons/yr)	SO_2 (tons/yr)	CO_2 (tons/yr)	CH_4 (tons/yr)	N_2O (tons/yr)
Initial Site Preparation and Construction							
Year 1	4	2.5	35	<1	2607	<0.1	<0.1
Year 2	27	4	47	<1	3605	<0.2	<0.1
Year 3	23	3	35	<1	2721	<0.1	<0.1
Annual Average	18	3	39	<1	2978	<0.1	<0.1
Centerline Tailings Operations							
Annual Average	<1	<1	3	<1	168	<0.1	<0.1
Upstream Tailings Operations							
Annual Average	<1	<1	3	<1	168	<0.1	<0.1
Closure and Reclamation							
Shaping Work	2	1	19	<0.1	1378	<0.1	<0.1
Rock Placement	1	<1	9	<0.1	745	<0.1	<0.1
Source: ERM Consultants. 2014.							

EPA's NEI estimated that the 2005 NO_X, SO_2 and VOC emissions for Pinal County were 12,545,757, and 9,217 tons per year, respectfully. The primary sources for these emissions are:

- NO_X – vehicle combustion of diesel and gasoline;
- SO_2 – diesel combustion; and,
- VOC – vehicle combustion of gasoline.

The estimated annual Ripsey Wash TSF gaseous emissions for initial site preparation and construction as compared to Pinal County emissions would be approximately 0.1% for NO_X, 0.001% for SO_2, and 0.03% for VOC.

The release of hazardous air pollutants (HAPs), such as benzene, toluene and formaldehyde, would be negligible for the Ripsey Wash TSF (ERM 2014). See **Table 3-5, Estimated Annual or Total Hazardous Air Pollutants (HAPs) for Ripsey Wash TSF**.

HAPs would result from the combustion of fuel in on-site vehicles and heavy equipment, as well as from windblown dust. EPA defines HAPS as toxic pollutants or air toxics, which could cause cancer or other health issues. Major sources are defined as those having the potential to emit 10 tons per year of any individual HAP or 25 tons per year of any combination of HAPs. If HAP emissions qualify as major sources, a project can be subject to Maximum Available Control Technology (MACT), but the proposed TSF construction, operational and closure/reclamation activities would not qualify as major sources and therefore would not be subject to MACT standards. HAP emissions from the Ripsey Wash TSF would not create any adverse effects on regional air quality, nor should they cause any short-term or long-term health problems.

Table 3-5, Estimated Annual Hazardous Air Pollutants (HAPS) for Ripsey Wash TSF

	Initial Site Preparation and Construction	Operations (Centerline Construction)	Operations (Upstream Construction)	Closure and Reclamation
Benzene	<0.01	<0.02	<0.04	<0.01
Toluene	<0.01	<0.01	<0.02	<0.01
Xylenes	<0.01	<0.01	<0.01	<0.01
Formaldehyde	<0.01	<0.02	<0.05	<0.01
Acetaldehyde	<0.01	<0.01	<0.03	<0.01
Acrolein	0	0	0	0
Naphtha	0	0	0	0
Source: ERM Consultants. 2014.				

Ozone formation due to atmosphere transformation of NO_x and SO_2 from either TSF action alternative would be negligible. NO_x and SO_2 can react in the atmosphere with ammonia to form "secondary particles" that form a haze that can impact visibility at locations distant from the emission source. However, the TSF emissions that cause regional haze are low and would dissipate within a short distance from the TSF sites given the relatively rugged terrain that surrounds both sites. Therefore, the NO_x and SO_2 emissions from the TSF action alternatives would have a low or negligible effect on regional haze.

No adverse effects are expected to air quality from the relocation of the Arizona Trail or the work in the areas proposed for waters of the U.S. mitigation. See **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**.

Most of the new Arizona Trail would be constructed or cleared using manual labor, although there may be the short-term need for small equipment such as a skid-steer or compact track loader and a compact excavator to assist in constructing switchbacks or moving large rocks for the relocated trail. This equipment would create some minor fugitive and gaseous emissions, but these emissions would be short-term, localized and negligible.

As explained in **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**, Mitigation Sites A, B, C, D and E would require active management to enhance the riparian habitat values; this action would primarily involve fencing and seeding. A mechanical posthole digger mounted on an off-road vehicle would be used for fence construction. A farm tractor with a cultivator and a drill seed would be used for seeding, although hand seeding could also be used. For Mitigation Site E, and where needed on other proposed mitigation sites to remove tamarisk, a bulldozer (Caterpillar D6 or equivalent) would probably be used to clear and grub burned trees and stumps. The equipment used for riparian habitat improvements would produce some minor fugitive and gaseous emissions, but these emissions would be short-term, localized and negligible.

3.1.2.2.2 Indirect Impacts Associated with Ripsey Wash TSF Alternative

Indirect air quality impacts associated with the Ripsey Wash TSF alternative would be short-term and negligible, primarily associated with vehicular traffic of contractor employees and their families that might reside in the region during the early construction phase of the project. It is expected that such traffic would be scattered throughout surrounding communities, such as Kearny, Hayden, Superior, Gold Canyon and Apache Junction, and would not be concentrated in the vicinity of the proposed TSF sites.

3.1.2.2.3 Climate Change Associated with Ripsey Wash TSF Alternative

According to the EPA (http://www.epa.gov/climatechange/basics), human activities over the past century have released large amounts of greenhouse gases (CO_2, CH_4 and N_2O) into the atmosphere. EPA purports that the majority of greenhouse gases come from use of fossil fuels, deforestation, industrial processes and agricultural practices.

Greenhouse gases act like a blanket around Earth, trapping energy in the atmosphere and causing it to warm. This phenomenon is called the greenhouse effect and is natural and necessary to support life on Earth. However, the buildup of greenhouse gases can change the Earth's climate and result in effects to the Earth’s ecosystems.

Vehicles and construction equipment used for TSF activities would use diesel and gasoline, and the combustion of these fuels would create greenhouse gases. Although the greenhouse gas emissions generated from the Ripsey Wash TSF would have a negligible effect on climate change, these emissions would contribute incrementally to climate change.

CO_2 is the greenhouse gas commonly presumed to be the foremost contributor to climate change. Construction, operational and closure activities at the TSF would contribute CO_2 and other greenhouse gases to the atmosphere, with the highest annual CO_2 emissions occurring during year 2 of construction. These projected TSF greenhouse gases would incrementally contribute to the estimated worldwide production of greenhouse gases. See **Table 3-6, Projected Ripsey Wash TSF CO_2 Emissions Comparison**.

Table 3-6, Projected Ripsey Wash TSF CO2 Emissions Comparison

Source Category	Estimated Annual CO_2 Emissions (tons per year)	Percentage of Worldwide Total
Ripsey Wash TSF[1]	3,605	0.00001%
State of Arizona[2]	100,600,000	0.026%
United States[3]	7,194,000,000	18.9%
Total Worldwide[4]	38,030,000,000	100.0%

Notes:

(1) Source: ERM Consultants 2014. For comparison purposes, the table shows the highest annual estimated CO_2 emission for the Ripsey Wash TSF, reported for Year 2 of the project. Other years of the project would have lesser CO_2 emissions.

(2) From State Energy CO_2 Emissions, US Environmental Protection Agency, for Arizona 2012. www.epa.gov/statelocalclimate/documents/pdf/CO2FFC_2012.pdf. For consistency, this volume of emissions was converted to tons from the metric tonnes that were reported in the reference.

(3) EPA 2012 estimate. www.epa.gov/cimatechange/ghgemissions/usinventoryreport.html. For consistency, this volume of emissions was converted to tons from the metric tonnes that were reported in the reference.

(4) Reported 2012 CO_2 emissions from PBL Netherlands Environmental Assessment Agency, Trends in Global CO_2 Emissions 2013 Report. For consistency, this volume of emissions was converted to tons from the metric tonnes that were reported in the reference.

3.1.2.3 Effects of the Hackberry Gulch TSF Alternative

The air quality effects of the Hackberry Gulch TSF would essentially be the same as described in Section 3.1.2.2, Effects of the Ripsey Wash TSF Alternative.

3.1.2.3.1 Hackberry Gulch TSF Fugitive and Gaseous Emissions

The estimated annual PM_{10} and $PM_{2.5}$ fugitive dust emissions for the Hackberry Gulch TSF are set forth in **Table 3-7, Estimated Fugitive Dust Emissions for Hackberry Gulch TSF**.

Table 3-7, Estimated Fugitive Dust Emissions for Hackberry Gulch TSF[1]

	PM_{10} (tons per year)	$PM_{2.5}$ (tons per year)
Initial Site Preparation and Construction		
Year 1	18	2
Year 2	98	8
Year 3	76	7
Annual Average	64	6
Centerline Tailings Operations		
Annual Average	20	3
Upstream Tailings Operations		
Annual Average	18	3
Closure and Reclamation[2]		
Annual Average	11	2

Notes:
(1) Source: ERM Consultants. 2014.
(2) There will be minimal Asarco activity at the site following closure and reclamation (mainly periodic maintenance of pumps for water diversion infrastructure). Any air emissions during this activity would be negligible.

Fugitive dust emissions are represented for PM_{10} and $PM_{2.5}$. These emissions would result from heavy equipment (primarily during initial construction and final closure work) and site support vehicles (such as pick-up trucks, vans, and supply trucks).

Similar to the Ripsey Wash TSF Alternative, the highest annual fugitive dust emissions (specifically PM_{10} and $PM_{2.5}$ in this case) and gaseous emissions would be generated during early site development and construction activities, which are estimated to take approximately three years for the Hackberry Gulch TSF Alternative and would utilize equipment such as drills, front end loaders, trucks, bulldozers, excavators, and motor graders. The early site development and construction work would involve road building, detention dam and diversion ditch installation work, construction of tailings starter dams, and installation of seepage trenches and seepage collection ponds.

Tailings disposal operations would generate PM_{10} and $PM_{2.5}$ fugitive dust and gaseous emissions, although at a reduced level from those during early site development and construction work. These emissions would be generated from traffic on unpaved roads, from ongoing centerline and upstream tailings dam construction using equipment such as bulldozers and excavators (long-reach backhoes), and from wind erosion on the tailings surface.

Final closure and reclamation activities would generate PM_{10} and $PM_{2.5}$ fugitive dust emissions from final grading work and placement of rock material over the tailings impoundment, using equipment such as front end loaders, trucks, bulldozers, excavators, and motor graders. There would also be windblown fugitive dust from the closed tailings impoundment, which would lessen once rock is placed on tailings surface.

Although the Florence-Kelvin highway, the SCIP 69 kV electric transmission line and Arizona Trail would not require relocation under this alternative, the PM_{10} and $PM_{2.5}$ for Year 2 of the Hackberry Gulch TSF construction would be higher than the Year 2 emissions generated for the Ripsey Wash TSF. These elevated emissions would result because of a higher volume of rock material needed to construct the required Hackberry Gulch TSF starter dam and the greater number of seepage trenches and reclaim ponds to be installed.

Given the proximity of the Hackberry Gulch TSF to State Highway 177 and the communities of Kelvin and Riverside, fugitive dust emissions (particularly on windy days during site construction work) could create short-term adverse effects to travelers on this highway and residents in these communities.

The estimated annual gaseous emissions for the Hackberry Gulch TSF are set forth in **Table 3-8, Estimated Gaseous Emissions for Hackberry Gulch TSF**.

Table 3-8, Estimated Gaseous Emissions for Hackberry Gulch TSF(1)

	NO_X (tons/yr)	VOC (tons/yr)	CO (tons/yr)	SO_2 (tons/yr)	CO_2 (tons/yr)	CH_4 (tons/yr)	N_2O (tons/yr)
Initial Site Preparation and Construction							
Year 1	1	<0.1	9	<0.1	817	<0.1	<0.1
Year 2	35	5	47	<0.1	2815	<0.1	<0.1
Year 3	18	3	27	<0.1	2186	<0.1	<0.1
Annual Average	18	3	28	<0.1	2273	<0.1	<0.1
Centerline Tailings Operations							
Annual Average	0.3	0.1	2	4	183	<0.1	<0.1
Upstream Tailings Operations							
Annual Average	0.3	0.1	2	4	182	<0.1	<0.1
Closure and Reclamation							
Shaping Work	2	<0.1	14	<0.1	2535	<0.1	<0.1
Rock Placement	2	1	19	<0.1	1370	<0.1	<0.1
Source: ERM Consultants. 2014.							

EPA's NEI estimated that the 2005 Pinal County emissions were 12,545 tons per year for NO_X, 757 tons per year for SO_2, and 9,217 tons per year for VOC. The primary sources for these emissions are:

- NO_X – vehicle combustion of diesel and gasoline;
- SO_2 – diesel combustion; and,
- VOC – vehicle combustion of gasoline.

The estimated average annual Hackberry Gulch TSF gaseous emissions for initial site preparation and construction when compared to Pinal County 2005 emissions would be approximately 0.1% for NO_X, 0.02% for SO_2, and 0.03% for VOC.

The release of HAPs, such as benzene, toluene and formaldehyde, would be negligible for the Hackberry Gulch TSF alternative (ERM 2014) and would not cause any short-term or long-term health problems. See **Table 3-9, Estimated Annual or Total Hazardous Air Pollutants (HAPs) for Hackberry Gulch TSF**.

Table 3-9, Estimated Annual Hazardous Air Pollutants (HAPS) for Hackberry Gulch TSF

	Initial Site Preparation and Construction	Operations (Centerline Construction)	Operations (Upstream Construction)	Closure and Reclamation
Benzene	<0.04	<0.02	<0.04	<0.05
Toluene	<0.01	<0.01	<0.02	<0.02
Xylenes	<0.01	<0.02	<0.01	<0.02
Formaldehyde	<0.012	<0.02	<0.06	<0.07
Acetaldehyde	<0.01	<0.01	<0.04	<0.04
Acrolein	0	0	0	0
Naphtha	0	0	0	0
Source: ERM Consultants. 2014.				

Ozone formation due to atmosphere transformation of NO_x and SO_2 from either TSF action alternative would be negligible. NO_x and SO_2 can react in the atmosphere with ammonia to form "secondary particles" that form a haze that can impact visibility at locations distant from the emission source. However, the TSF emissions that cause regional haze are low and would dissipate within a short distance from the TSF sites given the relatively rugged terrain that surrounds both sites. Therefore, the NO_x and SO_2 emissions from the TSF action alternatives would have a low or negligible effect on regional haze.

No adverse effects are expected to air quality as a result of the work in the areas proposed for waters of the U.S. mitigation. As explained in **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**, the proposed five mitigation sites would require active management to enhance the riparian habitat values; this action would primarily involve fencing and seeding. A mechanical posthole digger mounted on an off-road vehicle would be used for fence construction, and a farm tractor with a cultivator and a drill seed would be used for seeding, although hand seeding could also be used. For Mitigation Site E, and where needed on other mitigation sites for tamarisk removal, a bulldozer (Caterpillar D6 or equivalent) would probably be used to clear and grub burned trees and stumps. The equipment used for riparian habitat improvements would produce some minor fugitive and gaseous emissions, but these emissions would be short-term, localized and negligible

3.1.2.3.2 Indirect Impacts Associated with Hackberry Gulch TSF Alternative

Indirect air quality impacts associated with the Hackberry Gulch TSF Alternative would be similar to those associated with the Ripsey Wash TSF Alternative. See Section 3.1.2.2.2, Indirect Impacts Associated with Ripsey Wash TSF Alternative. Indirect air quality impacts would be short-term and negligible, primarily associated with vehicular traffic of contractor employees might move reside in the region for the initial site preparation and construction phase of the project. It is expected that such traffic would be scattered throughout surrounding communities, such as Kearny, Hayden, Superior, Gold Canyon and Apache Junction, and would not be concentrated in the vicinity of the proposed TSF sites.

3.1.2.3.3 Climate Change Associated with Hackberry Gulch TSF Alternative

The discussion about climate change as related to the Hackberry Gulch TSF would be similar to the discussion associated with the Ripsey Wash TSF Alternative. See Section 3.1.2.2.3, Climate Change Associated with the Ripsey Wash TSF Alternative. Also see **Table 3-10, Projected Hackberry Gulch TSF CO^2 Emissions Comparison**.

Table 3-10, Projected Hackberry Gulch TSF CO2 Emissions Comparison

Source Category	Estimated Annual CO_2 Emissions (tons per year)	Percentage of Worldwide Total
Hackberry Gulch TSF(1)	2,815	0.00001%
State of Arizona(2)	100,600,000	0.026%
United States(3)	7,194,000,000	18.9%
Total Worldwide(4)	38,030,000,000	100.0%

Notes:

(1) Source: ERM Consultants 2014. For comparison purposes, the table shows the highest annual estimated CO_2 emission for the Hackberry Gulch Wash TSF, reported for Year 2 of the project. Other years of the project would have lesser annual CO_2 emissions.

(2) From State Energy CO_2 Emissions, US Environmental Protection Agency, for Arizona 2012. www.epa.gov/statelocalclimate/documents/pdf/CO₂FFC_2012.pdf. For consistency, this volume of emissions was converted to tons from the metric tonnes that were reported in the reference.

(3) EPA 2012 estimate. www.epa.gov/cimatechange/ghgemissions/usinventoryreport.html. For consistency, this volume of emissions was converted to tons from the metric tonnes that were reported in the reference.

(4) Reported 2012 CO_2 emissions from PBL Netherlands Environmental Assessment Agency, Trends in Global CO_2 Emissions 2013 Report. For consistency, this volume of emissions was converted to tons from the metric tonnes that were reported in the reference.

3.2 SOILS

Identify site soil resources and adequacy for reclamation. *Areas of concern include: (1) the availability of soils for reclamation; and (2) the potential of increased soil erosion and sedimentation from construction and operational activities.*

3.2.1 AFFECTED ENVIRONMENT

The soil data and interpretations used to describe the existing edaphic conditions of the proposed Ripsey Wash and Hackberry Gulch TSF sites were primarily obtained from the document entitled *Soil Survey of Eastern Pinal and Southern Gila Counties, Arizona* (McGuire 2009).[17] Additional information regarding soil chemical characteristics, erosion susceptibility, and soil suitability ratings were obtained as adjunct information associated with this survey (Wilson, 2014a and 2014b).

Table 3-11, Pertinent Soil Baseline Characteristics, provides information about soil mapping units that are greater than 10 acres within the proposed disturbed areas. The distribution of soils is shown on **Figure 21, Soils Map**.

Table 3-11, Pertinent Soil Baseline Characteristics

FAN TERRACES (MIXED FAN ALLUVIAL PARENT MATERIAL)						
	Map Unit 9: Bucklebar – Hayhook complex, 1 to 10% slopes Ripsey Wash Alternative = 128 acres		**Map Unit 27: Delnort – Nahda complex, 3 to 20% slopes Hackberry Gulch Alternative = 144 acres**		**Map Unit 92: Stagecoach – Delnorte complex, 5 to 45% slopes Ripsey Wash Alternative = 12 acres Hackberry Gulch Alt = 93 acres**	
Unit component (% of unit)	Bucklebar (45)	Hayhook (35)	Delnort (50)	Nahda (40)	Stagecoach (55)	Delnorte (35)
Soil Depth (inches)	60	60	13 (petrocalci c horizon)	24 (petrocalci c horizon)	60	13 (petrocalci c horizon)
Soil Texture Range	sl-scl-cl	sl	vgrsl	vgrcl-vgrc	xcosl-xgrsl	vgrsl-vcosl
Drainage Class	well	well	somewhat excessive	well	somewhat excessive	well
Available Water Capacity (AWC)	very high	moderate	very low	low	very low	very low
Runoff Class	medium	very low	high	medium	medium	very high
pH Range	6.6-6.8	6.6-7.6-8.2	8.0-8.2+	7.0-7.6+	7.6-8.0	7.8-8.2+
Wind/Water Erosion Hazard	m-h/m	included	l-m/l	included	not susceptible/l	included
Soil Productivity (lbs. per acre· air dry)	538	included	500	included	368	included
Ecological Site Name p.z. = precip.	Loamy Upland, 10-13” p.z.	Sandy Loam Upland, 10-13” p.z.	Limy Upland, 10-13” p.z.	Clay Loam Upland, 10-13” p.z.	Limy Sloped, 10-13” p.z.	Limy Slopes, 10-13” p.z.
Source of Topsoil / Limitation(s) / Comments	good/moderate clay content @ 9”	good/pH @ 28”	poor/coarse fragments, pH	poor/coarse fragments	poor/coarse fragments, slope	poor/coarse fragments, pH

[17] This document is available at www.websoilsurvey.sc.egov.usda.gov/App/Homepage.html. The National Resource Conservation Service (NRCS) was denied access by private landowners to approximately 550 acres of the Hackberry Gulch TSF site. Therefore, no soil mapping was completed across this acreage (Map Unit 28).

FAN TERRACES (MIXED FAN ALLUVIAL PARENT MATERIAL)				
	Map Unit 96: Topawa very gravelly loam, 2 to 20% slopes Ripsey Wash Alternative = 394 acres	**Map Unit 48: Gran-Rock outcrop-Pantano complex, 20 to 60% slopes Ripsey Wash Alternative = 486 acres Hackberry Gulch Alternative = 1,065 acres**		
Unit component (% of unit)	Topawa (80)	Gran (65)	Rock outcrop (20)	Pantano (15)
Soil Depth (inches)	60	14 (weathered granite)	Rock outcrop consists of barren rock as ledges and near vertical cliffs of granite as well as soils less than 4.0 inches to bedrock.	15 (weathered granite)
Soil Texture Range	xgrsc-xgrsl	vgrsl-vgrc		vgrsl-xgrsl
Drainage Class	well	well		well
Available Water Capacity (AWC)	low	very low		very low
Runoff Class	high	very high		very high
pH Range	6.6-8.0	6.4-6.6		7.6-7.8
Wind/Water Erosion Hazard	l-m/l	l-m/l		included
Soil Productivity (lbs. per acre· air dry)	500	378		included
Ecological Site Name p.z. = precip.	Loamy Upland, 10-13" p.z.	Shallow Hills, 10-13" p.z.		Shallow Hills, 10-13" p.z.
Source of Topsoil / Limitation(s) / Comments	poor/coarse fragments	poor/clay content, slope		poor/slope, coarse fragments

FLOODPLAINS (MIXED STREAM ALLUVIUM)		
	Map Unit 78: Queencreek soils and Riverwash, 0 – 5% slopes Ripsey Wash Alternative = 221 acres	
Unit component (% of unit)	Queencreek (variable)	Riverwash
Soil Depth (inches)	60.0	River wash consists of very deep, excessively drained, stratified sands, gravels, and cobbles. Unstable, subject to flooding and does not support vegetation due to constant scouring and shifting conditions.
Soil Texture Range	xgrsi-vgrs	
Drainage Class	excessive	
Available Water Capacity (AWC)	very low	
Runoff Class	negligible	
pH Range	7.6-7.8	
Wind/Water Erosion Hazard	not susceptible/l	
Soil Productivity (lbs. per acre· air dry)	0	

FLOODPLAINS (MIXED STREAM ALLUVIUM)	
	Map Unit 78: Queencreek soils and Riverwash, 0 – 5% slopes **Ripsey Wash Alternative = 221 acres**
Ecological Site Name p.z. = precip.	Sandy Wash 10-13" p.z.
Source of Topsoil / Limitation(s) / Comments	poor/texture, coarse fragments

HILLS AND MOUNTAINS (SLOPE ALLUVIUM AND/OR GRANITIC OR LIMESTONE RESIDUUM)							
	Map Unit 15: Cellar – Anklam – Rock outcrop complex, 20 to 70% slopes **Ripsey Wash Alternative = 380 acres**			**Map Unit 55: Holguin-Rock outcrop Complex, 15 to 60% slopes** **Hackberry Gulch Alt = 194 acres**		**Map Unit 40: Fig family – Topock complex, 5 to 50% slopes** **Ripsey Wash Alt = 638 acres**	
Unit component (% of unit)	Cellar (45)	Anklam (30)	Rock outcrop (20)	Holguin (50)	Rock outcrop (35)	Fig family (55)	Toprock (35)
Soil Depth (inches)	11 (bedrock)	14 (weathered granite)	Rock outcrops consists of barren rock occurring as ledges and nearly vertical cliffs of limestone bedrock as well as soils less than 4.0 inches to bedrock.	15 (limestone bedrock)	Rock outcrop consists of barren rock that occurs as ledges and nearly vertical cliffs of limestone bedrock as well as soils less than 4.0 inches to bedrock.	16 (weathered granite)	24 (weathered granite)
Soil Texture Range	vgrsl	grsl-grscl		vgrl-vcocl		grsl-vgrsl	grsl-sc-grsc
Drainage Class	somewhat excessive	well		well		well	well
Available Water Capacity (AWC)	very low	very low		very low		very low	very low
Runoff Class	very high	very high		very high		very high	very high
pH Range	6.8-7.6	6.4-7.2		7.8		6.6-6.8	6.2
Wind/Water Erosion Hazard	l-m/l	included		not susceptible/l		l-m/l	included
Soil Productivity (lbs. per acre· air dry)	513	included		382		650	included
Ecological Site Name p.z. = precip.	Shallow Hills, 10-13" p.z.	Shallow Hills, 10-13" p.z.		Limestone Hills, 12-16" p.z.		Shallow Hills, 10-13" p.z.	Shallow Hills, 10-13" p.z.
Source of Topsoil / Limitation(s) / Comments	poor/coarse fragments, depth	poor/coarse fragments, slope		poor/coarse fragments, depth		poor/slope, coarse fragments, depth	poor/clay content, slope

HILLS AND MOUNTAINS (SLOPE ALLUVIUM AND/OR GRANITIC OR LIMESTONE RESIDUUM)		
Map Unit 17: Cellar – Rock outcrop complex, 2 to 20% slopes Ripsey Wash Alternative = 12 acres		
Unit component (% of unit)	Cellar (60)	Rock outcrop (30)
Soil Depth (inches)	6 (granite bedrock)	Rock outcrop consists of barren rock that occurs as outcroppings and boulder piles of granite and where the depth of soil is less than 4.0 inches to bedrock.
Soil Texture Range	vgrsl	
Drainage Class	somewhat excessive	
Available Water Capacity (AWC)	very low	
Runoff Class	very high	
pH Range	6.8-7.6	
Wind/Water Erosion Hazard	l-m/l	
Soil Productivity (lbs. per acre· air dry)	513	
Ecological Site Name p.z. = precip.	Granitic Hills 10-13 p.z.	
Source of Topsoil / Limitation(s) / Comments	Poor/coarse fragments, depth	

Notes:

(1) Soil characteristics and interpretations are included in this table for soil map units within the proposed disturbed areas and for soil map units that are greater than 10 acres in size within that disturbed areas.

(2) vgrs = very gravelly sand, sl = sandy loam, grsl = gravelly sandy loam, vgrsl = very gravelly sandy loam, xgrsl = extremely gravelly sandy loam, vcosl = very cobbly sandy loam, xcosl = extremely cobbly sandy loam, vgrl = very gravelly loam, scl = sandy clay loam, grscl = gravelly sandy clay loam, cl = clay loam, vgrcl = very gravelly clay loam, vcocl = very cobbly clay loam, sc = sandy clay, grsc = gravelly sandy clay, vgrc = very gravelly clay, xgrsc = extremely gravelly sandy clay, xgrc = extremely gravelly clay

(3) l = low, m = moderate, h = high

(4) Soil chemical and physical date taken from: 1.) McGuire C.E., W. A. Sveltlik, Jr. and C. A. Prink. 2009. Soil Survey of Eastern Pinal and Southern Gila Counties, Arizona. Natural Resources Conservation Service. www.nrcs.usda.gov. 357 pp. + appendices and maps. 2.) Wilson, r. Personal Communication. State Resources Inventory Coordinator. Natural Resources Conservation Service. April 4, 2014. 3.) Wilson, R. Personal Communication. State Resources Inventory Coordinator. Natural Resources Conservation Service. April 17, 2014.

(5) The NCRS was denied access to Map Unit 28 at the Hackberry Gulch TSF site. There are approximately 550 acres of Map Unit 28 at the Hackberry Gulch Alternative site. No information on this mapping unit available.

3.2.1.1 General Soil Characteristics

Soil characteristics vary according to where they are developing. Three general areas are considered:

- Fan terraces;
- Hills and mountains; and,
- Floodplains.

3.2.1.1.1 Soils Overlying Fan Terraces

These soils are developing in mixed fan alluvial parent materials on slopes typically ranging from 1 to 20 percent, though slopes up to 45 percent can occur and are present in comparatively moderate acreages on both the Ripsey Wash and Hackberry Gulch TSF. Soil depths range from 60+ inches to bedrock and from 13 to 24 inches to a cemented (petrocalcic) horizon. Rock fragments (gravels, cobbles, and/or stones) typically overlie 80 to 95 percent of the soil surface. Soil textures are highly variable ranging from sandy loams to very gravelly clays to extremely cobbly sandy loams with a higher percentage of profile rock fragments most common. These soils are typically well to somewhat excessively drained, have very low to moderate available water capacities, and medium to very high runoff potentials with no flooding hazard. Soil pH values range from 6.2 to 8.2+. The productivity of these soils ranges from 368 to 538 air-dry lb/acre and includes all vegetation whether or not palatable to livestock.

3.2.1.1.2 Soils Overlying Hills and Mountains

Soils overlying hill and mountain features are developing in slope alluvium and residuum geologic materials on slopes ranging from 5 to 70 percent, with steeper slopes most common. These are the most common and dominant soils at both the Ripsey Wash and Hackberry TSF sites. They are typically 11 to 16 inches deep over weathered granite bedrock. The soil surface is overlain with 60 to 80 percent rock fragments. Soil textures range from very gravelly sandy loams to extremely gravelly sandy loams to sandy clays. Rock outcrops make up a notable percentage of the majority of the units mapped. Well drained soils with very low available water capacities and very high runoff potentials are the norm. Soil pH values range from 6.2 to 7.8. The productivity of these soils ranges from 378 to 650 air-dry lb/acre.

With a minor exception of the area immediately adjacent to the Gila River, the entire proposed realignment of the Arizona Trail lies within Map Unit 40.

3.2.1.1.3 Soils Overlying Floodplains

Floodplain soils have been mapped at both the Ripsey Wash and Hackberry Gulch TSF sites. These soils are developing in mixed stream alluvium at 0 to 5 percent slopes and are typically 60+ inches deep. Rock fragments typically cover up to 85 percent of the surface. Soil profile textures range from extremely gravelly sandy loams to very gravelly sands resulting in a very low available water capacity and excessive drainage characteristics. The flooding hazard is frequent and brief from July through September. The profile pH ranges from 7.6 to 7.8. The U.S. Natural Resource Conservation Service (NRCS) does not recognize the map unit delineated across these floodplains as having a reportable productivity value.

The soils of all map units overlying the Ripsey Wash and Hackberry Gulch TSF sites are non-saline (1.0 mmhos/cm) and non-sodic (Sodium Adsorption Ratio = 0.0).

3.2.1.2 Reclamation Suitability of Soils

The suitability for topsoil is rated as “poor” for the majority of the soils of the map units overlying the Ripsey Wash and Hackberry Gulch TSF sites. Floodplain soils are considered to be a poor source of topsoil due to texture and coarse fragment surface cover and profile content. Soils of hills and mountains are typically of poor quality due to surficial and profile coarse fragment content as well as a shallow depth to bedrock or weathered granite. Soils of the fan terraces are also typically rated as a poor source of topsoil due to the presence of coarse fragments with the exception of Map Unit 9 at the Ripsey Wash TSF site. Map Unit 9 soils are rated as “good” having a low coarse fragment content, gentle slopes and moderate profile textures.

3.2.1.3 Erosion Hazards of Soils

In terms of the wind erosion potential of in-place soils, the soil map units overlying the alternatives have been classed in Wind Erodibility Groups (WEG) 3, 5, 6 and 8. Map Unit 9 has a “moderate” to “high” susceptibility rating (WEG 3). WEG 5 and 6 can be considered to have “low” to “moderate” wind erosion potentials based on their profile textures and clay content. Map Units 15, 27, 40, 48 and 96 fall into this group. WEG 8 includes soils that are not susceptible to wind erosion due to rock fragments occurring across the soil surface. Map Units 55, 78 and 92 are classed as WEG 8 soils.

Soil susceptibility to sheet and rill erosion by water is based on the "K-factor for whole soil" as determined by soil texture, organic matter, soil structure, and saturated hydraulic conductivity. K-factors range from 0.02 to 0.69. With all other factors (i.e. slope angle and length, climate, conservation practices, etc.) being equal, the higher the K-factor the greater susceptibility to erosion. K-factors whole soil for the map units overlying the Ripsey Wash and Hackberry Gulch TSF sites range from 0.05 to 0.24. All but one map unit have calculated K-factors of 0.15 or less resulting in a "low" susceptibility. Map Unit 9 has a K-factor of 0.24 with a "low" to "moderate" susceptibility to sheet and rill erosion.

3.2.2 ENVIRONMENTAL CONSEQUENCES

3.2.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. The soil overlying these sites would continue to develop and support the existing vegetation communities and land uses at present soil productivity levels. Barring any foreseeable future developments or changes in grazing policies, future soil impacts would parallel historic impacts.

3.2.2.2 Effects of the Ripsey Wash TSF Alternative

The Ripsey Wash TSF construction and operation would directly impact soils in the area of disturbance. See **Table 2-1, Summary of Ripsey Wash TSF Alternative**. Site soils would be buried by tailings and from the construction of various TSF support facilities, such as diversion structures, seepage trenches, and reclaim ponds. As a result, the productivity of these soils, in terms of vegetation production, would be permanently lost.

Soil materials beneath the starter embankments of the Rispey Wash TSF would be removed during the construction phase and used during the construction of the starter dam. Soils up-gradient of the starter dam would be covered with tailings as tailings are incrementally deposited within the TSF. Any soil material exposed on the surface up-gradient of the tailings embankment and tailings storage area would be exposed on the surface and be subject to natural erosion through time until covered by tailings.

Because soils within the proposed TSF sites are typically classed as "poor" quality as a source of "topsoil" for reclaiming disturbed sites, their loss would not have a major impact on post TSF closure establishment of vegetation.

Only a small area of soils would be disturbed with the re-route of the Arizona Trail (see **Table 2-1, Summary of Ripsey Wash TSF Alternative**), and efforts were made to reduce the impacts to soils via route selection. Trail widths would typically average approximately three feet though somewhat greater widths would be required at switchbacks. Proposed trail grades would be kept to 3 to 7 percent, although grades ranging from 10 to 14 percent would be necessary where the natural topography is steep. Soil stabilization techniques including retaining walls, water bars and constructed drains to control water are planned. These techniques have been used on the existing Arizona Trail and have been successful in stabilizing the affected soils. However, some rills and small gullies are likely to develop in the trail re-route area as a result of the erosive forces of incident precipitation combined with trail use. These impacts should be limited in scope, and widely intermittent along the trail given the planned trail design criteria. In the direct traffic area of the planned trail, soils would be compacted and vegetation productivity lost.

No adverse effects are expected to soils as a result of the work in the areas proposed for waters of the U.S. mitigation. See **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**. If it rains or floods during the clearing and grubbing of the burned tamarisk trees from Mitigation Site E or after the various lands under all mitigation sites (A through E) has been cultivated and newly seeded, there could be some minor short-term and localized soil erosion, but the potential for this situation would be low, and any associated effects would be limited. As part of the mitigation work, stormwater management BMPs would be implemented as required under a SWPPP for the areas, and these BMPs would limit any adverse effects. With the completion of the 404 mitigation work, there would be a beneficial effect to the soils in the mitigation areas (i.e., decrease in the potential for soil erosion, improvement in vegetative cover, etc.).

Indirect impacts to soils would be limited to potential offsite sedimentation resulting from soil erosion occurring during TSF construction and operation.

3.2.2.3 Effects of the Hackberry Gulch TSF Alternative

The effects resulting from the proposed project activities would be essentially the same for this alternative as addressed in Section 3.2.2.2, Effects of the Ripsey Wash TSF Alternative, with the exception of the discussion on the Arizona Trail, which would remain in its existing location under this alternative. Estimated disturbance for the Hackberry Gulch TSF is set forth in **Table 2-2, Summary of Hackberry Gulch TSF Alternative**.

There would be no adverse effects to soils from the mitigation work at the proposed for waters of the U.S. mitigation areas for the same reasons set forth in Section 3.2.2.2, Effects of Ripsey Wash TSF Alternative

3.3 GEOLOGY, GEOTECHNICAL AND GEOCHEMISTRY

Identify the potential for acid rock drainage and metals transport from the proposed TSF. Address the stability of the proposed TSF and other associated structures. *The areas of concern include; (1) short and long-term impacts to the Gila River; (2) potential for release of metals into groundwater from tailings; and, (3) the stability of the TSF.*

3.3.1 AFFECTED ENVIRONMENT

3.3.1.1 Ripsey Wash TSF Site Geology

The general geology of the area within and surrounding the Ripsey Wash TSF site is shown on **Figure 22, Geology - Ripsey Wash TSF.** A typical geologic cross-section through the proposed Ripsey Wash TSF site is shown as **Figure 23, Schematic Geologic Cross-Section - Ripsey Wash TSF**.

3.3.1.1.1 Ripsey Wash TSF Site Bedrock

The Ripsey Wash TSF site is underlain by the Ruin granite formation of Precambrian age (Schmidt 1971). This formation consists primarily of coarse-grained, porphyritic granite and aplite porphyry. Although the composition of this formation can vary, the Ruin granite is generally classified as quartz monzonite.

The Ruin granite has been intruded by numerous porphyry dikes of Laramide age. These dikes average about 50 feet in thickness, but can range in thickness from several inches to nearly 150 feet. They form sinuous paths that can be several miles in length are commonly terminated and/or offset by mid-Tertiary faults (Schmidt 1971).

The Tertiary-age San Manuel formation lies unconformably over the Ruin granite and intrusive dikes. This formation is a thick sequence of sedimentary rocks separated into an upper member of massive, poorly-sorted boulder conglomerate and a lower member of well-defined tuffaceous sandstone.

3.3.1.1.2 Ripsey Wash TSF Site Quaternary Deposits

Erosion of bedrock surfaces contemporaneous with the tectonism associated with the Basin and Range physiographic period has led to the development of present-day pediment surfaces and deposits of alluvium and gravel within the area's drainages. Quaternary deposits at the site consist of two units:

- Older Gravels (Qog) – comprised of sand, gravel and cobbles with some silt found on gently-sloping sediment surfaces and terraces, and channels in the San Manuel Formation; and,
- Alluvial Deposits (Qal) – comprised of sand and gravel with varying amounts of silt and boulders found in Ripsey Wash and its tributaries, Zelleweger Wash, and the Gila River.

3.3.1.1.3 Ripsey Wash TSF Site Geologic Structure

The dominant geologic structure at the Ripsey Wash TSF site is the San Manuel Formation graben, whose long axis generally trends north-northwest, following Ripsey Wash. This graben was formed and is bounded by the Ripsey fault on the east and the Hackberry fault on the west. See **Figure 22, Geology - Ripsey Wash TSF**. Both are normal faults of post-Larmide age; they trend approximately N 30°W with a 40° dip to the west and are only locally exposed at the surface.

Within the Ripsey fault zone, the Ruin granite is highly to moderately weathered near the surface but becomes less weathered at depth. The Ripsey fault appears to be tight with no open fractures.

The Ruin granite within the Hackberry fault is decomposed to highly weathered, locally sheared and brecciated, and contains soft fault gouge. Similarly, the tuffaceous sandstone (lower member of the San Manuel Formation) within the Hackberry fault zone also ranges from slightly to highly weathered, and is soft to very soft (AMEC, 2014).

3.3.1.2 Hackberry Gulch TSF Site Geology

The general geology of the area within and surrounding the Hackberry Gulch TSF site is shown on **Figure 24, Geology - Hackberry Gulch TSF.**

3.3.1.2.1 Hackberry Gulch TSF Site Bedrock

The Hackberry Gulch TSF site is underlain by the Big Dome Formation of late Miocene age and is exposed throughout the TSF area with only isolated covers of Quaternary colluvium and alluvium within the major drainages. The Big Dome Formation is estimated be nearly 1,000 feet thick (Cornwall and Krieger, 1975) and consists of gradational and inter-fingering conglomerate and tuff beds.

The conglomerates consist of a well-cemented matrix of alluvium, colluvium, and gravel. The matrix is comprised of pebbles, cobbles, and boulders are of Precambrian schist, granite, sedimentary rocks, and diabase; Paleozoic sedimentary and limestone rocks; and Mesozoic and Tertiary volcanic rocks. Many beds or lenses are packed with pebbles in a sandy matrix.

3.3.1.2.2 Hackberry Gulch TSF Site Quaternary Deposits

Compared to the Ripsey Gulch TSF site, Quaternary deposits are limited. Portions of lower Hackberry Gulch, Kane Spring Canyon, and other ephemeral washes at and west-southwest of the TSF site are overlain by thin (generally less than 10 feet) veneers of pediment and older gravels. The pediment gravels consist of clayey to sandy gravel with considerable cobbles and boulders. The older gravels are composed largely of limestone pebbles, cobbles, and small boulders. The older gravels were deposited mainly in channels incised into conglomerates after development of the Gila River drainage (Cornwall and Krieger, 1975).

3.3.1.2.3 Hackberry Gulch TSF Site Geologic Structure

The Big Dome formation forms a north to northwest trending asymmetrical synclinal structure with the axis occurring beneath the western face of the Hackberry Gulch TSF site. Bedding is discontinuous with no single horizon traceable along the strike for any substantial distance.

A number of small and large scale fractures are located within the Big Dome formation, typically trending in a northwest-southeast direction. Many of these fractures are essentially perpendicular to the washes and drainages that dissect the Hackberry Gulch TSF site.

3.3.1.3 Geotechnical Considerations

Seismic (or earthquake) activity in this region of Arizona is low.

U.S. National Seismic Hazard Maps (NSHM) have been assembled by the United States Geologic Survey (USGS). These maps and supporting data are science-based products on earthquake ground motions that are used for building codes and risk assessments. These hazard maps are an important component of seismic design regulations for buildings, bridges, highways, railroads and other structures, including mine tailings facilities. The NSHM depict earthquake ground-shaking exceedance levels for various probabilities over a 50-year time period.

Asarco has retained AMEC, a professional engineering contractor, to design the Ripsey Wash TSF. This engineering firm reviewed NSHM as part of their design process to ensure tailings embankment stability. A geotechnical analysis, prepared by AMEC, has been included in the APP permit application that Asarco submitted to the Arizona DEQ, and this agency is responsible to approve the overall design of the tailings facility to ensure long-term stability.

3.3.1.4 Geochemistry

This section documents test methods used for geochemical characterization, as well as summarizes results for the geochemical testing of the tailings (both solids and liquids) that are proposed for placement in a future TSF at the Ray Mine. The assessment for tailings geochemistry focused on the potential for the formation of acid rock drainage (ARD) and the possibility that certain metals could be generated in the tailings leachates, which could impact surrounding groundwater and surface water quality. A discussion of geochemical characterization results including associated analytical laboratory data can be referred to in Geochemical Characterization Report prepared by AMEC Environmental and Infrastructure, Inc. (AMEC 2014) and Humidity Cell Test Results (52 Weeks) Geochemical Characterization (AMEC 2015).

ARD, also commonly known as acid mine drainage (AMD), refers to acidic water that is created when sulfide minerals are exposed to air and water and, through a natural chemical reaction, produce sulfuric acid. The Global Acid Rock Drainage (GARD) Guide defines acidic water as having a pH less than 6 (http://www.gardguide.com); (Hutchison and Ellison, 1992) demarcate acidic water as having a pH less than 4.5. Low pH (acidic) water has the potential to mobilize heavy metals.

For tailings to generate ARD and/or leach contaminants, several conditions must be present:

(1) Sufficient sulfide material must be present in the tailings to react chemically to form acid leachate at a rate faster than can be neutralized by any alkaline compounds contained in the

tailings. Ore delivered to the Ray Concentrator contains three main sulfide minerals: chalcopyrite, chalcocite, and pyrite. Chalcopyrite is the dominant copper sulfide, and chalcocite is the subordinate copper sulfide. Pyrite occurs in association with both chalcopyrite and chalcocite. In addition to the three sulfides, limited amounts of iron oxide are present in the Ray Mine ore as a result of weathering;

(2) There must be pathways for oxygen and water to contact the sulfide minerals. Sulfides form under anoxic (oxygen-poor) conditions and, when exposed to an oxic (oxygen-rich) environment (such as would occur during ore processing) can become unstable and break down chemically. This can result in the production of acidity;
(3) The tailings must contain metals or other substances that can be leached under the environmental conditions present at the site; and,
(4) A mechanism (usually water) must be present to transport any acidity and/or contaminants away from the source material and into the surrounding environment.

The objectives for the tailings geochemical characterization work were as follows:

(1) Characterize the geochemical properties of the tailings to be placed in a future TSF;
(2) Characterize the geochemical properties of the borrow materials that would be used to construct starter dams, seepage trenches, and other components of the TSF; and,
(3) Provide information to assess potential environmental impacts to groundwater and surface water from tailings solids, tailings liquids, and construction and reclamation borrow materials.

The following geochemical tests were performed to characterize the tailings geochemistry (solids and liquids) and borrow materials to be used for the construction of TSF starter dams:

(1) X-ray diffraction to identify tailings mineralogy;
(2) Acid Base Accounting (ABA) to quantify acid neutralization potential (ANP) and acid generating potential (AGP);
(3) Water quality analyses of existing tailings liquids and decant water from the Elder Gulch TSF;
(4) Meteoric Water Mobility Procedure (MWMP) tests on tailings and borrow materials to assess potential leachate quality; and,
(5) Humidity Cell Tests (HCT) to simulate weathering and to allow for further prediction and characterization of potential leachate quality.

The geochemical testing and characterization conformed to the requirements presented in the Arizona Mining Guidance Manual for Best Available Demonstrated Control Technology (BADCT) and the Arizona DEQ Quality Management Plan. In addition, the characterization work adhered to the geochemical guidance by the International Network for Acid Prevention (INAP) and Mine Environment Neutral Drainage (MEND).

Materials sampled consisted of tailings (solids and liquids) that are representative to those that would be placed for storage in a future TSF and the borrow materials that would be used in construction. Borrow materials from both the proposed Ripsey Wash and Hackberry Gulch TSF sites were included. Understanding the geochemical behavior of the borrow materials and their interactions with the tailings was considered important to assess potential off-site impacts to water quality.

3.3.1.4.1 Ore Types

Ore processed at the Ray Concentrator is comprised of four rock types:

1. Diabase – The major rock-forming minerals in this unit are hornblende, plagioclase and biotite; minor minerals are magnetite and quartz. Other minerals that occur in small quantities (less than 5 percent) are chlorite, ilmenite, apatite, hematite, montmorillonite, sphene and epidote.
2. Pinal Schist - The major rock-forming minerals in this unit are quartz, orthoclase, plagioclase, sericite and biotite.
3. Sedimentary Rocks – The rock units include the Pioneer Formation; Dripping Springs Quartzite; and the Scanlan, Barnes, Whitetail, Gila and Big Dome conglomerates. These units are comprised of limestone, siltstone, sandstone, and conglomerate material.
4. Porphyry Rocks – The rock units include Granite Mountain porphyry, Ruin granite, diorite porphyry, rhyodacite and dacite. The major rock-forming minerals in this unit are quartz, orthoclase, plagioclase, biotite and sericite.

After copper has been extracted and concentrated at the Ray Concentrator, the remaining rock types would form the tailings material. As shown in **Table 3-12, Comparison of Past and Future Ore Types**, the major rock types milled in the past and the major rock types to be mined in the future are very similar, with Diabase and Pinal Schist accounting for 82% of the rock types that have been historically milled versus 84% projected for future milling.

Table 3-12, Comparison of Past and Future Ore Types(1)

Ore Types	Concentrator History (1994-2012) (%)	Future Estimate (2014-2042)(3) (%)
Diabase	52	57
Pinal Schist	30	27
Sedimentary Rocks		
Pioneer Formation	9	5
Dripping Springs Quartzite	5	4
Porphyry Rocks		
Granite Mountain Porphyry	2	4
Ruin Granite	2	3
Other(2)	<1	<1
Total	100	100

Notes:

(1) From AMEC Environmental & Infrastructure, Inc. (2013).

(2) Other ore types range from 0.44% to 0.02% of total and include Scanlin conglomerate, Barnes conglomerate, Gila/Big Dome conglomerate, Apache leap tuff and various porphyry dike rocks.

(3) Projections from Asarco Ray Mine Engineering Department.

3.3.1.4.2 Sampling and Testing Strategy

Sampling and testing procedures for the proposed Ripsey Wash TSF were outlined in the Geochemical Characterization Sampling and Analysis Plan prepared by AMEC Environmental and Infrastructure, Inc. (AMEC, 2013). The geochemistry sampling and testing program centered on tailings materials, tailings water, and borrow material that would be used for construction and reclamation purposes.

3.3.1.4.2.1 Tailings Material

Geochemical testing was conducted on tailings generated from Diabase and Pinal Schist, the two rock types that comprise the largest percentages of future tailings. Based on past ABA testing results (AMEC 2013), Diabase and Pinal Schist also have the highest acid generating potential (AGP). Tailings samples were collected from the Ray Concentrator, and the collection was coordinated with mine operations to assure the target rock type was being processed at the time of collection. Sixteen discreet samples of each rock type were collected for ABA testing. Two composite samples were generated for MWMP and HCT from eight individual discreet samples to assure representative samples for both Diabase and Pinal Schist. To further simulate representative tailings, Diabase and Pinal Schist samples were composited in the percentages expected to be present in the TSF.

3.3.1.4.2.2 Tailings Water

To determine the quality of water in the tailings pond, four samples[18] of actual tailings slurry water were collected from the tailings stream at the same time the tailings solids were collected. The tailings decant water quality is set forth in **Table 3-13, Tailings Water Analyses** (AMEC 2014). These analyses show that the existing tailings water quality complies with the Arizona Aquifer Water Quality Standards (AAWQS).

Table 3-13, Tailings Water Analyses

ANALYTE[(1)]	DIABASE 1	DIABASE 2	PINAL SCHIST 1	PINAL SCHIST 2	DECANT	AAWQS[(5)]
Field Measurements[(2)]						
pH	10.7	7.3	7.5	10.6	6.0	---
Electrical Conductivity	1,705	3,064	3,346	1,882	3,303	---
Temperature	79.2	71.4	83.5	71.1	49.5	---
General Inorganics[(3)]						
Alkalinity as $CaCO_3$	48	21	23	27	28	---
Biocarbonate Alkalinity as $CaCO_3$	<6	21	23	<6	28	---
Carbonate Alkalinity as $CaCO_3$	43	<6	<6	24	<6	---
Hydroxide Alkalinity as $CaCO_3$	<6	<6	<6	<6	<6	---
Calcium	630	470	570	610	560	---
Chloride	190	160	200	230	180	---
Fluoride	3.2	3.3	3.6	3.6	2.9	4
Magnesium	<2	39	44	44	35	---
Nitrate as N	NA	4.9	8.5	4.0	2.9	10
Nitrite as N	NA	0.33	0.99	0.38	0.58	1
Nitrate-Nitrite as N	4.4	5.2	9.5	4.4	3.5	10
Potassium	60	44	65	70	47	---
Sodium	390	350	420	350	360	---
Sulfate	2200	2000	2400	2200	2100	---
Total Dissolved Solids	3600	3200	3800	3300	3500	---
Dissolved Metals[(3)]						
Antimony	0.0046	<0.0021	<0.003	<0.0042	<0.0021	0.006
Arsenic	0.0039	<0.0018	<0.003	<0.0036	<0.0036	0.05
Barium	0.076	0.095	0.071	0.056	0.050	2
Beryllium	<0.001	<0.0002	<0.001	<0.0002	<0.0002	0.004
Cadmium	<0.001	<0.0005	<0.001	<0.0005	<0.0005	0.005
Chromium	0.011	0.01	<0.01	<0.0012	<0.0012	0.1
Cobalt	<0.04	<0.0009	<0.04	<0.0009	<0.0009	---
Copper	<0.01	0.087	<0.01	<0.0062	<0.0062	---

[18] Two samples of tailings slurry water were taken when Diabase ore was being processed; Diabase #1 was taken on November 8, 2013, Diabase #2 on January 9, 2014. Two samples of tailings slurry water were taken when Pinal Schist ore was being processed; Pinal Schist 1 on October 29, 2013 and Pinal Schist on December 18, 2013.

ANALYTE[1]	DIABASE 1	DIABASE 2	PINAL SCHIST 1	PINAL SCHIST 2	DECANT	AAWQS[5]
Field Measurements[2]						
Lead	<0.015	<0.0073	<0.015	<0.0073	<0.0073	0.05
Manganese	<0.01	0.23	0.14	<0.0022	0.14	---
Mercury	<0.0005	<0.00003	<0.0005	<0.00003	<0.00003	0.002
Nickel	<0.01	<0.0014	<0.01	<0.0014	<0.0014	0.1
Selenium	0.026	0.016	0.019	0.017	0.013	0.05
Thallium	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
Zinc	<0.05	<0.0052	<0.05	<0.0052	<0.0052	---
Radiochemicals[4]						
Gross Alpha	2.0±0.9	3.0±1.8	<1.0	3.3±1.3	0.6±0.2	5
Radium 226 + Radium 228	1.4±0.1	<0.7	1.2±0.1	1.0±0.3	1.4±0.9	15
Total Uranium	<1.6	2.9±0.4	3.4±0.5	<0.4	1.2±0.3	---

Notes:
(1) Parameters are same as required by Arizona DEQ under existing Ray Mine Consolidated Aquifer Plan (APP) permit.
(2) The pH, electrical conductivity (EC) and temperature were measured at the time of collection. The pH in standard unity (s.u.); EC in microsiemens per centimeter (us/cm); and temperature in degrees Centigrade (^oF).
(3) General inorganics and dissolved metals reported in milligrams per liter (Mg/l).
(4) Radiochemicals reported in picoCuries per liter (pCi/l).
(5)AAWQS are Arizona Aquifer Water Quality Standards set by Arizona DEQ.

3.3.1.4.3 Borrow Materials

Samples of alluvium and bedrock materials that would be used in the TSF construction and for reclamation were collected for analysis using standard penetration testing (SPT) methods and open-end drive samples. Bedrock samples were collected using diamond coring methods and grab samples from outcrops exposed within the proposed TSF footprint. Two samples for each of the following rock types were collected and tested as part of the alluvium and borrow material analytical program for the TSF sites[19]:

- Quaternary alluvium
- Quaternary older gravels
- Tertiary cobble conglomerate
- Tertiary tuffaceous sandstone
- Precambrian Diabase
- Precambrian ruin granite
- Big Dome conglomerate

3.3.1.4.4 X-Ray Diffraction

Samples of both Diabase and Pinal Schist were analyzed by Asarco's Bruker D2 Phaser X-Ray Diffraction (XRD) Spectrometer to identity the mineralogy of the material. The Diabase analyses detected the presence of the acid-neutralizing mineral Calcite and the acid-generating minerals Alunite and Pyrite. The Pinal Schist analyses detected the presence of the acid-neutralizing mineral Calcite and the acid-generating minerals Alunite, Pyrite and Chalcopyrite.

3.3.1.4.5 Acid Base Accounting

Acid base accounting (ABA) is a geochemical analytical procedure that assesses the acid-generating potential (AGP) and acid-neutralizing potential (ANP) of the material being analyzed. AGP is a

[19] All samples, except for the Big Dome conglomerate were taken at the Ripsey Wash TSF site. The Big Dome conglomerate samples were taken at the Hackberry Gulch TSF site.

determination of acidity based upon the amount of pyritic sulfur present in the sample while ANP is a measure of the carbonate available to neutralize that acidity. Because it provides no information about the speed (or kinetic rate) with which acid generation or neutralization might proceed, ABA is recognized as "static testing" and used as a screening tool to assess whether kinetic testing is needed to further characterize the potential for acid generation.

ABA averages and ranges for the various tested materials are summarized in **Table 3-14, ABA Values for Tailings and Alluvium/Borrow Materials**.

Table 3-14, ABA Values for Tailings and Alluvium/Borrow Materials

	TAILINGS			RIPSEY WASH		HACKBERRY GULCH
	Diabase[(1)]	Pinal Schist[(2)]	Composite[(3)]	Alluvium[(4)]	Borrow[(5)]	Big Dome[(6)]
Paste pH (standard units)						
Average	8.3	8.1	8.2	8.3	8.5	8.3
Range	8.13-8.41	7.85-8.30	8.21-8.25	8.3-8.38	7.92-9.79	8.13-8.40
Pyritic Sulfur (%)						
Average	1.28	0.70	0.98	<0.01	0.11	<0.01
Range	1.05-1.79	0.38-1.39	0.82-1.13	<0.01	<0.01-0.95	<0.01
Acid Neutralizing Potential (ANP) as $TCaCO_3/KT$						
Average	39.0	29.7	36.5	11.3	36.7	29.6
Range	27.0-52.0	12.2-54.6	34.2-38.8	9.2-13.3	13.3-91.8	17.6-41.6
Acid Generating Potential (AGP) as $TCaCO_3/KT$						
Average	40.0	21.8	30.5	<0.3	3.5	<0.3
Range	32.8-55.9	11.9-43.4	25.6-35.3	<0.3	<0.3-29.7	<0.3
Net Neutralizing Potential (NNP) as $TCaCO_3/KT$						
Average	-1.0	+7.81	+6.1	+12.3	+33.5	+29.3
Range	-18.9 to +6.0	-5.3 to +14.7	+3.5 to +8.6	+9.2 to +13.3	+13.3 to +62.1	+17.3 to +41.3
Acid Neutralizing Potential (ANP) to Acid Generating Potential (AGP) Ratio						
Average	1.0:1	1.4:1	1.2:1	37.5:1	81.3:1	98.7:1
Range	0.6:1 to 1.3:1	0.7:1 to 2.2:1	1.1:1 to 1.3-1	30:1 to 44:1	3.1:1 to 181:1	58:1 to 138:1

Notes:

(1) Seven individual tailings samples derived from the Diabase rock type were collected and tested.
(2) Eight individual tailings samples derived from the Pinal Schist rock type were collected and tested.
(3) There were two composite tailings samples comprised of 65% Diabase and 35% Pinal Schist.
(4) Alluvium sample consisted of two samples of Quaternary alluvium (Qal).
(5) Borrow material consisted of two samples of Quaternary older gravels (Qog), two samples of Tertiary cobble conglomerate (tcg), two samples of Tertiary tuffaceous sandstone (Trt), two samples of Precambrian Diabase (Pdb), and

	TAILINGS	RIPSEY WASH	HACKBERRY GULCH
two samples of Precambrian ruin granite (prg). (6) Only minor amounts of alluvium material would be used for Hackberry TSF starter dam. Two samples of the Big Dome conglomerate (Bd) were sampled and tested.			

Based on guidance from the Arizona Mining BADCT[20] Guidance Manual issued by the Arizona DEQ, the following criteria were used to interpret the ABA results:

- The potential for acid generation using the ratio of ANP to AGP has a tiered classification:
  - ✓ If the ratio is greater than 3:1, there is a low risk for acid rock drainage (ARD);
  - ✓ If the ratio is between 3:1 and 1:1, uncertainty arises and there is a potential for ARD; or,
  - ✓ If the ratio is less than 1:1, it is likely acid generation would occur.
- The potential for acid generation using the Net Neutralizing Potential (NNP), which is calculated by subtracting AGP from ANP, has a tiered classification:
  - ✓ If the NNP is greater than +20 tons of calcium carbonate per 1,000 tons of rock ($TCaCO_3/KT$), the material is considered non-acid generating;
  - ✓ If the NNP is between -20 and +20 $TCaCO_3/KT$, the material is considered to be potentially acid generating; or,
  - ✓ If the NNP is less than -20 $TCaCO_3/KT$, the material is considered to be acid generating.

Although not specifically addressed in the Arizona Mining BADCT Guidance Manual, paste pH is also an indicator of readily available acidity and can be used in conjunction with total pyritic sulfur content and ANP/AGP ratios as another assessment tool. If the paste pH is greater than 5.5 (s.u.) with a pyritic sulfur content less than 0.3%, there is a low risk for ARD to develop.

Although most of the tailings samples had a paste pH greater than 8, all of the tailings samples had pyritic sulfur content in excess of 0.3%, which indicates there is a potential for acid generation. Similarly, the average ANP/AGP ratios for tailings ranged from 1:1 to 1.4:1, which also puts the tailings materials in the uncertain area for acid generation. In addition, based on the NNP classification, where the NNP values for the tailings samples ranged from -18.9 to +14.7, the tailings would be considered "potentially acid generating". Given that the various ABA tailings sample values appear in the inconclusive or potential category of acid generation, further kinetic testing of the tailings was warranted and undertaken (See Section 3.3.1.4.7, Humidity Cell Testing).

All borrow material samples had a paste pH greater than 8, and all of these samples, with the exception of the Precambrian Diabase samples taken in the Ripsey Wash TSF area, had negligible pyritic sulfur. The two Precambrian Diabase samples had pyritic sulfur contents of 0.95% and 0.09%; however, the ANP/AGP ratios for this rock type were greater than 3:1, and NPP classifications were in excess of +20 $TCaCO_3/KT$, which indicate a low potential for acid generation.

The Quaternary alluvium samples reported NNP values ranging from +9 to +13.3 $TCaCO_3/KT$, but the ANP/AGP ratios for these rock types averaged nearly 37.5:1, well above the 3:1 ratio for acid generation, and indicative of very high neutralization potential.

[20] BADCT is the acronym for Best Available Demonstrated Control Technology.

The ABA results for the all the samples of borrow rock types, which comprise the materials to be used for Ripsey Wash and Hackberry Gulch TSF construction (especially the starter TSF dams) and for cover material for reclamation activities, reveal negligible potential for acid generation.

3.3.1.4.6 Meteoric Water Mobility Procedure

The Meteoric Water Mobility Procedure (MWMP) using ASTM E2242-12a standard is a short term leach test used to evaluate the potential for dissolution and mobility of certain constituents from a rock sample by meteoric water. The MWMP was developed in the state of Nevada in the 1980s as part of mine waste characterization programs, and this test is now an American Society for Testing and Materials (ASTM) procedure. ASTM E2242-12a was the test procedure used on actual Ray Mine tailings samples, as well as the borrow materials that would be used for TSF starter dam construction and reclamation cover material (AMEC 2014).

3.3.1.4.6.1 Tailings Materials

MWMP tests were completed on composite samples of Diabase and Pinal Schist tailings, and combined composite tailings samples represented by 65% Diabase and 35% Pinal Schist. Given the low permeability of tailings, the MWMP required a “bottle roll” instead of a single pass column leach. The bottle roll testing procedure allowed for full mixing of the sample with simulated meteoric water before extraction, ensuring that the sample surface area was exposed for possible dissolution and constituent mobilization. MWMP averages for the various tailings materials are summarized in **Table 3-15, Meteoric Water Mobility Procedure Results for Tailings**.

MWMP tailings analytical results were compared to Arizona Aquifer Water Quality Standards, Elder Gulch tailings decant and tailings slurry water quality. MWMP concentrations of metals and radiochemical parameters were either below detectable limits or similar in quality to decant and tailings slurry water quality. There was no significant difference in concentrations between rock types or variations of rock type composites. Tailings MWMP results indicate that the probability for dissolution and mobilization from a single exposure to meteoric water is low. The results indicate that the sample leachates comply with Arizona Aquifer Water Quality Standards.

3.3.1.4.6.2 Borrow Materials

MWMP tests were also completed on composite samples of the Ripsey Wash alluvium and borrow material rock types that would be used for construction (e.g., starter dam) and reclamation (e.g., cover rock material). Samples of these rock types were crushed and screened to produce a size less than or equal to 2 inches and then tested using a single pass column leach.

Two Quaternary alluvium (Qal) samples were averaged and summarized individually and selected for HCT as this material would comprise the base of the tailings impoundment. Two Quaternary older gravel (Qog) samples were also averaged and summarized individually as it was the only borrow material with uncertain acid generating potential. All other borrow material samples were averaged and presented together. The MWMP average concentrations of metals for the Ripsey Wash alluvium and borrow materials were generally below detectable limits, and the results of the testing indicate compliance of the leachates with Arizona Aquifer Water Quality Standards. MWMP averages for the alluvium and borrow materials are summarized in **Table 3-16, Meteoric Water Mobility Procedure Results for Ripsey Wash Alluvium and Borrow Materials**.

Table 3-15, Meteoric Water Mobility Procedure Results for Tailings

ANALYTE	DIABASE(4)	PINAL SCHIST(5)	TOTAL COMPOSITE(6)	ELDER GULCH DECANT(7)	TAILINGS SLURRY WATER(7)	AAWQS
pH(1)	7.6	7.8	7.8	6.0	9.0	---
General Inorganics (2)						
Alkalinity as $CaCO_3$	26	26	26	28	30	---
Biocarbonate Alkalinity as $CaCO_3$	26	26	26	28	14	---
Carbonate Alkalinity as $CaCO_3$	<6.0	<6.0	<6.0	<6	20	---
Hydroxide Alkalinity as $CaCO_3$	<6.0	<6.0	<6.0	<6	<6.0	---
Calcium	467	567	560	560	570	---
Chloride	37	45	40	180	195	---
Fluoride	0.85	0.93	0.87	2.9	3.4	4
Magnesium	19	30	26	35	32	---
Nitrate as N	<1.0	<1.0	<1.0	2.9	5.8	10
Nitrite as N	<1.0	<1.0	<1.0	0.58	0.57	1
Nitrate-Nitrite	<2.0	<2.0	<2.0	3.5	5.9	10
Potassium	34	48	39	47	60	---
Sodium	143	130	140	360	380	---
Sulfate	1500	1800	1750	2100	2200	---
Total Dissolved Solids	2400	2800	2750	3500	3500	---
Dissolved Metals(2)						
Antimony	<0.003	<.003	<0.006	<0.0021	0.0035	0.006
Arsenic	<0.003	<0.006	<0.006	<0.0036	0.012	0.05
Barium	0.053	0.041	0.05	0.050	0.075	2
Beryllium	<0.001	<0.001	<0.001	<0.0002	<0.001	0.004
Cadmium	<0.001	<0.001	<0.001	<0.0005	<0.001	0.005
Chromium	<0.01	<0.01	<0.01	<0.0012	0.008	0.1
Cobalt	<0.04	<0.04	<0.04	<0.0009	<0.04	---
Copper	<0.01	<0.01	<0.01	<0.0062	0.028	---
Lead	>0.015	>0.015	>0.015	<0.0073	<0.015	0.05
Manganese	0.053	0.123	0.074	0.14	0.096	---
Mercury	<0.0002	<0.0002	<0.0002	<0.00003	<0.0005	0.002
Nickel	<0.01	<0.01	<0.01	<0.0014	<0.01	0.1
Selenium	0.0066	0.0067	0.0067	0.013	0.02	0.05
Thallium	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
Zinc	<0.05	<0.05	<0.05	<0.0052	<0.05	---
Radiochemicals(3)						
Radium 226 + Radium 228	<0.5	<0.5	<0.5	0.6±0.2	1.1±0.2	5
Gross Alpha	1.17±0.5	1.03±0.5	2.5±0.5	1.4±0.9	2.3±1.3	15
Total Uranium	2.7±0.6	3.5±0.6	1.5±0.6	1.2±0.3	2.1±0.5	---

Notes:

(1) The pH in standard units. Measure in lab for MWMP testing. Tailings slurry and decant pH measure in field.
(2) General inorganics and dissolved metals reported in milligrams per liter (mg/l).
(3) Radiochemicals reported in picoCuries per liter (pCi/l).
(4) Three composite samples of Diabase were tested and averaged.
(5) Three composite samples of Pinal Schist were tested and averaged.
(6) There were two composite tailings samples comprised of 65% Diabase and 35% Pinal Schist.
(7) See **Table 3-13, Tailings Water Analyses.**

Table 3-16, Meteoric Water Mobility Procedure Results for Ripsey Wash Alluvium and Borrow Materials

Analyte	Ripsey Wash Alluvium (Qal)	Ripsey Wash Borrow (Qog)[4]	Ripsey Wash Borrow Material[5]	AAWQS
General Inorganics [1]				
Alkalinity as $CaCO_3$	71	99	34	---
Biocarbonate Alkalinity as $CaCO_3$	<6.0	99	34	---
Carbonate Alkalinity as $CaCO_3$	71	<6.0	<6.0	---
Hydroxide Alkalinity as $CaCO_3$	<6.0	<6.0	<6.0	---
Calcium	17	21	4.7	---
Chloride	16	40	4.2	---
Fluoride	2.5	2.9	0.6	4
Magnesium	2.2	2.8	<2.0	---
Nitrate-Nitrite as N[2]	<2.0	<2.0	<2.0	10
Potassium	<2.0	<2.0	2.2	---
Sodium	36	76	15	---
Sulfate	28	61	8.2	---
Total Dissolved Solids	180	320	67	---
Dissolved Metals[1]				
Antimony	<0.003	<0.003	0.0044	0.006
Arsenic	0.0101	0.0225	0.0056	0.05
Barium	0.11	0.119	0.137	2
Beryllium	<0.001	<0.001	<0.001	0.004
Cadmium	<0.001	<0.001	<0.001	0.005
Chromium	<0.01	<0.01	<0.01	0.1
Cobalt	<0.04	<0.04	<0.04	---
Copper	<0.01	0.012	<0.01	---
Lead	<0.015	<0.015	<0.015	0.05
Manganese	<0.010	0.017	0.010	---
Mercury	<0.0002	<0.0002	<0.0002	0.002
Nickel	<0.01	<0.01	<0.01	0.1
Selenium	<0.002	<0.002	0.0039	0.05
Thallium	<0.001	<0.001	<0.001	0.002
Zinc	<0.05	<0.05	<0.05	---
Radiochemicals[3]				
Radium 226 + Radium 228	<0.5	<0.05	<0.05	5
Gross Alpha	0.9±1.3	2.4±1.0	0.8±0.4	15
Total Uranium	3.7±0.7	1.7±0.5	4.8±0.5	---

Notes:

(1) General inorganics and dissolved metals reported in milligrams per liter (mg/l).
(2) Nitrate and nitrate were not analyzed separately because of laboratory holding times.
(3) Radiochemicals are reported in picoCuries per liter (pCi/l)
(4) These results are the average of the results from two two Quaternary old gravels (Qog) samples.
(5) These results are the average from two samples of Tertiary tuffaceous sandstone (Trt), two samples of Precambrian Diabase (Pdb), and two samples of Precambrian ruin granite (Prg).

3.3.1.4.7 Humidity Cell Testing

Humidity cell testing (HCT) using ASTM D5744-13 is the most widely used test to mimic natural oxidation reactions of the field setting. The HCT was designed to enhance or accelerate the rate of acid generation in sulfide-bearing materials. HCT better evaluate variables such as reaction rates and the availability of neutralizing alkalinity at mid-range pHs than ABA. Consequently, they are useful to determine whether materials having uncertain ABA acid generating status (ANP:AGP ratios between 3:1

and 1:1 or net APP values between -20 and +20 TCaCO3/KT) are likely to generate acid. See ABA testing discussed in Section 3.3.1.4.5, Acid Base Accounting.

HCT were performed on Ray Mine tailings samples and Ripsey Wash alluvium samples by McClelland Laboratories, Inc. in Sparks, Nevada (AMEC 2015). Standard HCT were completed on six samples, four samples of tailings and two samples of alluvium. The tailings samples consisted of one composite of two individual Diabase samples, a composite of two individual Pinal Schist samples and two separate composites each containing 65% Diabase and 35% Pinal Schist tailings. Two samples of Quaternary Alluvium were also tested as this material would comprise the base of the tailings impoundment. Splits of the six samples were also subjected to a modified HCT. The modified HCT was designed to simulate interactions of the tailings and alluvium materials with actual tailings decant water to more accurately represent field conditions. The samples included for HCT are summarized in the following list:

(1) Composite sample of Diabase tailings (D1/D2 Comp)
(2) Composite sample of Pinal Schist tailings (P1/P2 Comp)
(3) Composite sample of 65% Diabase and 35% Pinal Schist (D65/P35-1 Comp)
(4) Composite sample of 65% Diabase and 35% Pinal Schist (D65/P35-2 Comp)
(5) Composite sample of Quaternary alluvium (Qal-1)
(6) Composite sample of Quaternary alluvium (Qal-2)

The six samples listed above were tested using both standard and modified methods for a period of 10 weeks, resulting in 12 sets of analytical results. HC testing was continued on Samples D65/P35-1 Comp, D65/P35-2 Comp, D65/P35-2 Comp (mod) and Qal-1 (mod) from Weeks 11 through 52. Leachate samples were collected and tested for pH, sulfate, calcium, magnesium, iron, acidity, alkalinity, electrical conductivity and oxidation/reduction potential on a weekly basis.

Leachate samples were also collected during weeks 0, 1, 2, 4, 6, 8 and 10 for all of the tests and additionally at weeks 12, 16 and monthly thereafter for the remaining tests conducted for 52 weeks. These samples were analyzed for an additional suite of parameters, the same suite as used to characterize the tailings water (see **Table 3-13, Tailings Water Analyses**) and the same as MWMP samples were subjected to consisting of general inorganics, dissolved metals and radiochemicals.

HCT are generally conducted in a 4-inch inner diameter (ID) by 8-inch cell with samples crushed to a size of -1/4 inch. The alluvium samples were tested in this manner. The tailings samples consisted of very finely grained material that did not require crushing and required a larger diameter cell size of 8 inch ID by 4 inch to ensure full percolation and exposure of water to material surfaces.

HCT procedures subject the individual sample to alternating cycles of dry and moist air for a six day period to simulate precipitation cycles then are saturated with deionized water on the seventh day. Water percolates through the sample then is collected for analyses. The modified HCT followed the same alternating dry and moist air cycle but was saturated with Elder Gulch tailings decant water in place of deionized water as it was felt this would more accurately represent field conditions. The Elder Gulch tailings decant water used for the modified HCT work was also similar in quality to the average tailings water quality data.

Tailings ABA results indicated an uncertain potential for acid generation. HCT results however for all twelve tests indicate that the tailings and the alluvium are non-acid generating. Ranges for select weekly parameters are summarized in **Table 3-17, Weekly Humidity Cell Test (HCT) Results for Tailings and Alluvium Materials**. The pH was neutral for all tests. Redox potential was oxidizing, as materials exposed to air and water would be in the field. Iron concentrations were low. Sulfate concentrations were variable and more pronounced in the modified tests. Acidity concentrations were low and consistently less than alkalinity concentrations.

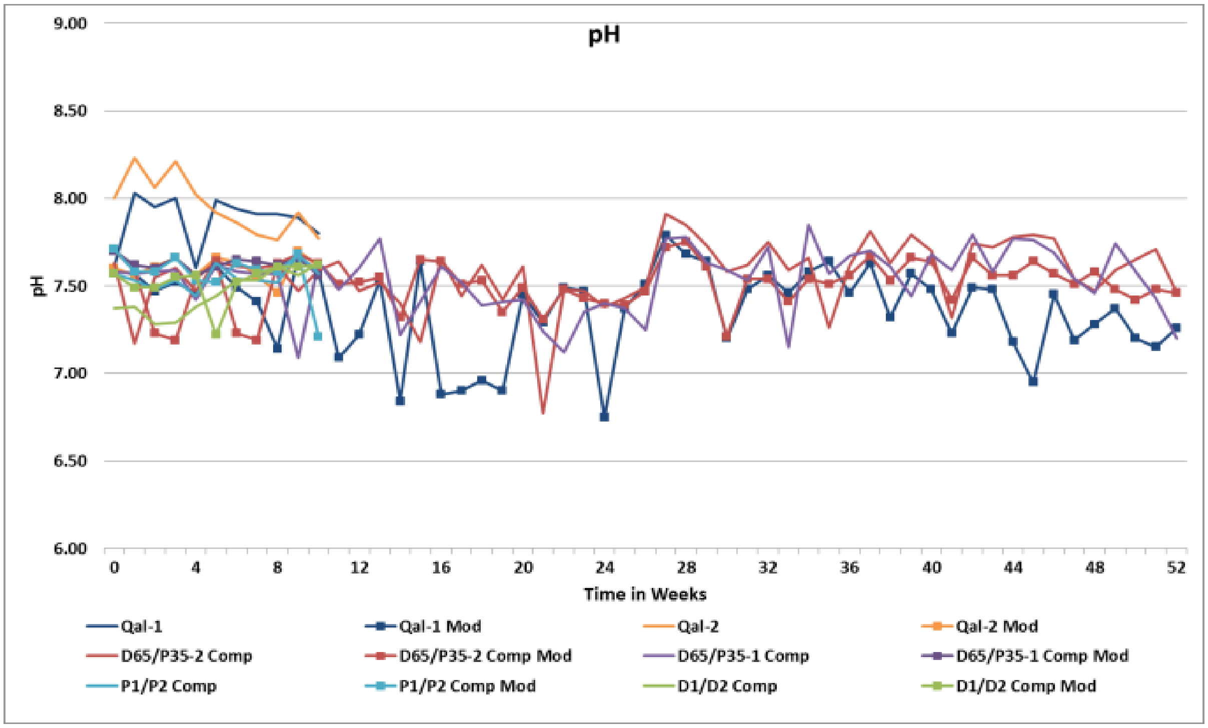
Table 3-17, Weekly Humidity Cell Test (HCT) Results for Tailings and Alluvium Materials

	pH (SU)	Redox (mV)	Iron (mg/l)	Sulfate (mg/l)	Acidity (mg/l)	Alkalinity (mg/l)
52 Week Tests						
D65/P35-1 Comp	7.09-7.85	139-388	<0.1-1.7	10-2700	0-6	13-49
D65/P35-2 Comp	6.77-7.91	143-390	<0.1-0.7	10-3100	0-6	12-55
D65/P35-2 Comp Mod	7.19-7.75	179-400	<0.1-3.8	1000-3600	0-20	29-67
Qal-1 Mod	6.75-7.79	178-383	<0.1-2.4	1000-3500	0-10	25-46
10 Week Tests						
D1/D2 Comp	7.28-7.63	137-333	<0.1-1.3	500-2900	0-4	20-38
D1/D-2 Comp Mod	7.22-7.62	133-360	<0.1-0.8	1400-3800	0-12	44-52
P1/P2 Comp	7.44-7.68	134-338	<0.1-1.3	1000-2800	0-4	29-37
P1/P2 Comp Mod	7.21-7.71	187-348	<0.1-0.7	800-3800	0-13	47-56
D65/P35-1 Comp Mod	7.56-7.7	179-347	<0.1-1.4	1200-3300	0-4	46-53
Qal-1	7.6-8.03	119-307	<0.1-<0.1	1-8	0-0	30-45
Qal-2	7.76-8.23	175-329	<0.1-<0.1	1-42	0-0	32-71
Qal-2 Mod	7.46-7.7	182-342	<0.1-0.6	1800-3300	0-1	37-52

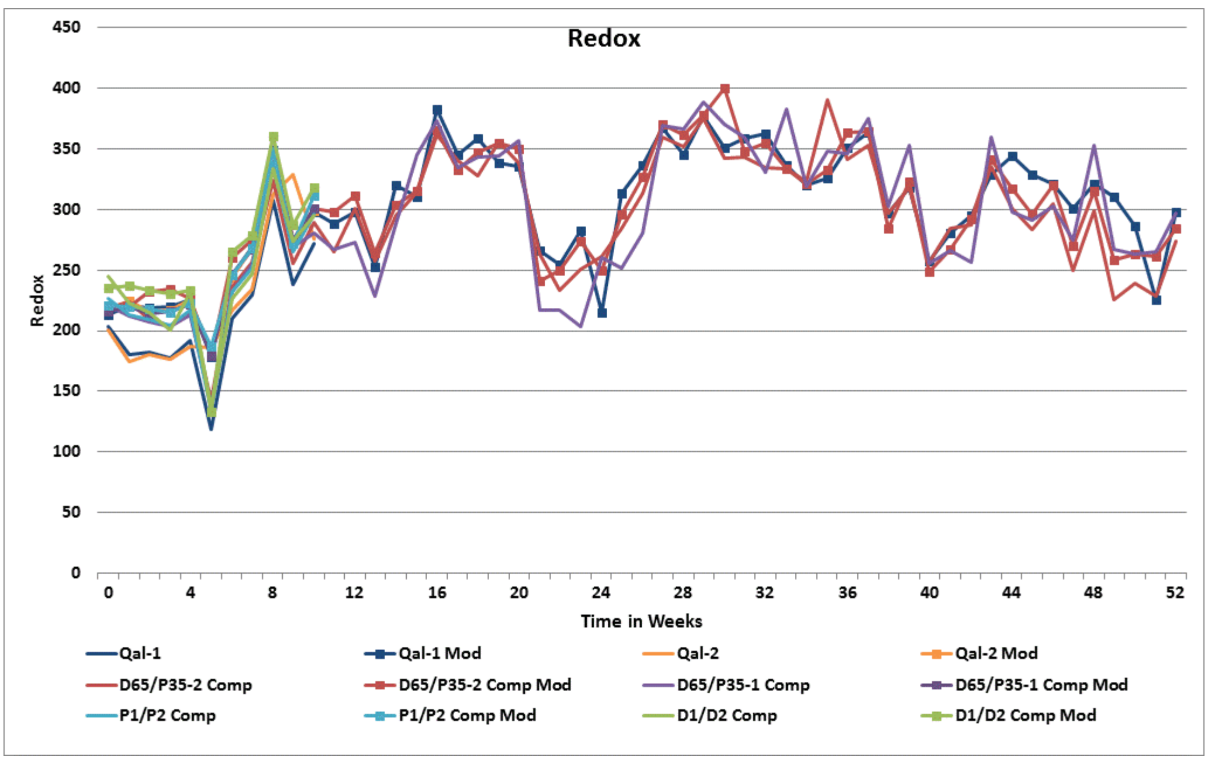
HCT weekly results evaluated over time from test initiation to end also support that both the tailings and alluvium material are non-acid generating as illustrated in **Graphs 3-1 – 3-6**. The graphical representation of the change in concentrations over time is presented with the ten week tests on a separate axis from the 52 week tests so trends are also apparent for the shorter duration tests. Sample results measured below detectable limits were plotted with concentrations at the detection limit. Concentration trends were similar regardless whether the test was run for ten weeks or 52 weeks.

The pH remained neutral throughout testing. Redox potential was oxidizing and did not reach levels necessary to oxidize sulfidic minerals (>450mV). Redox potential did not follow an increasing trend over time but peaked and then dropped during testing for all twelve tests. Iron concentrations followed a similar trend to redox potential with highest concentrations generally occurring mid testing. Iron concentrations were generally below detectable limits in the alluvium samples as would be expected based upon mineralogy. Sulfate concentrations were highest at the beginning of testing and followed a decreasing trend as testing progressed. Sulfate concentrations were generally higher in the modified tests and was attributable to the higher concentration of sulfate in the decant water as compared to deionized water. Sulfate concentrations were notably lower in the standard HCT alluvium samples. Acidity was not detectable or concentrations decreased over time, whereas alkalinity concentrations were variable with no increasing or decreasing trends, remaining in excess of acidity throughout testing.

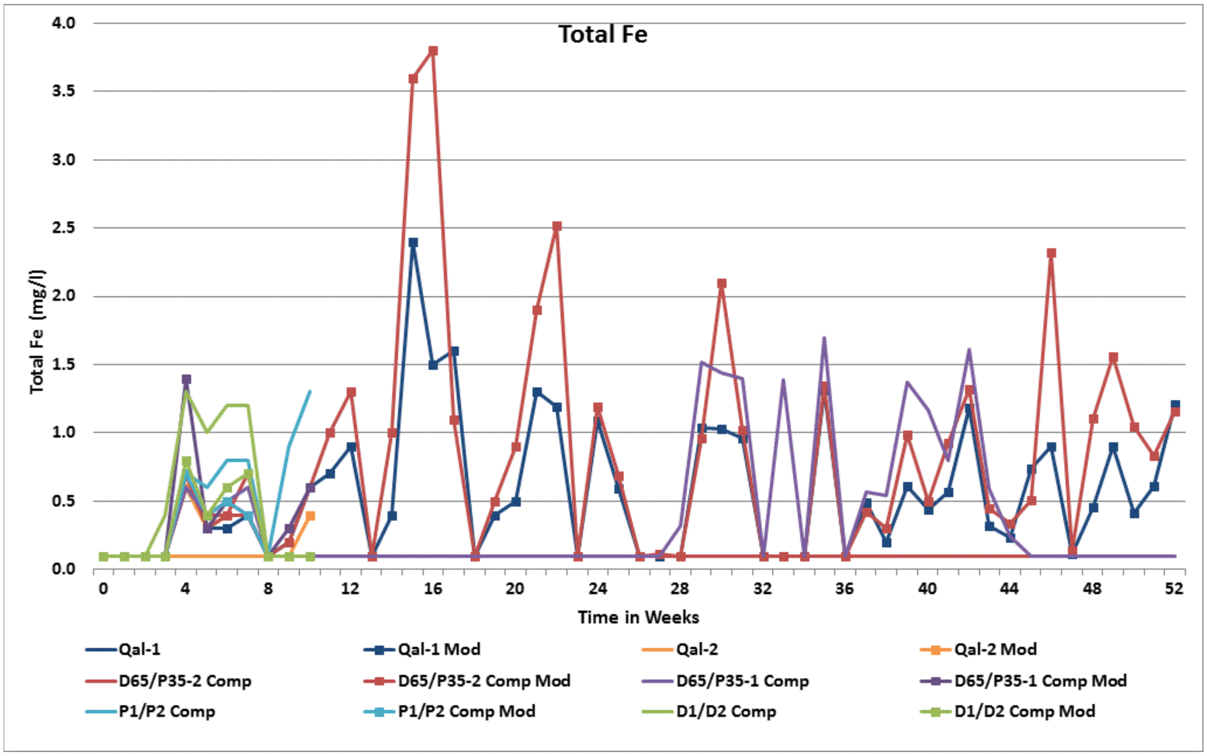
Graph 3-1, pH



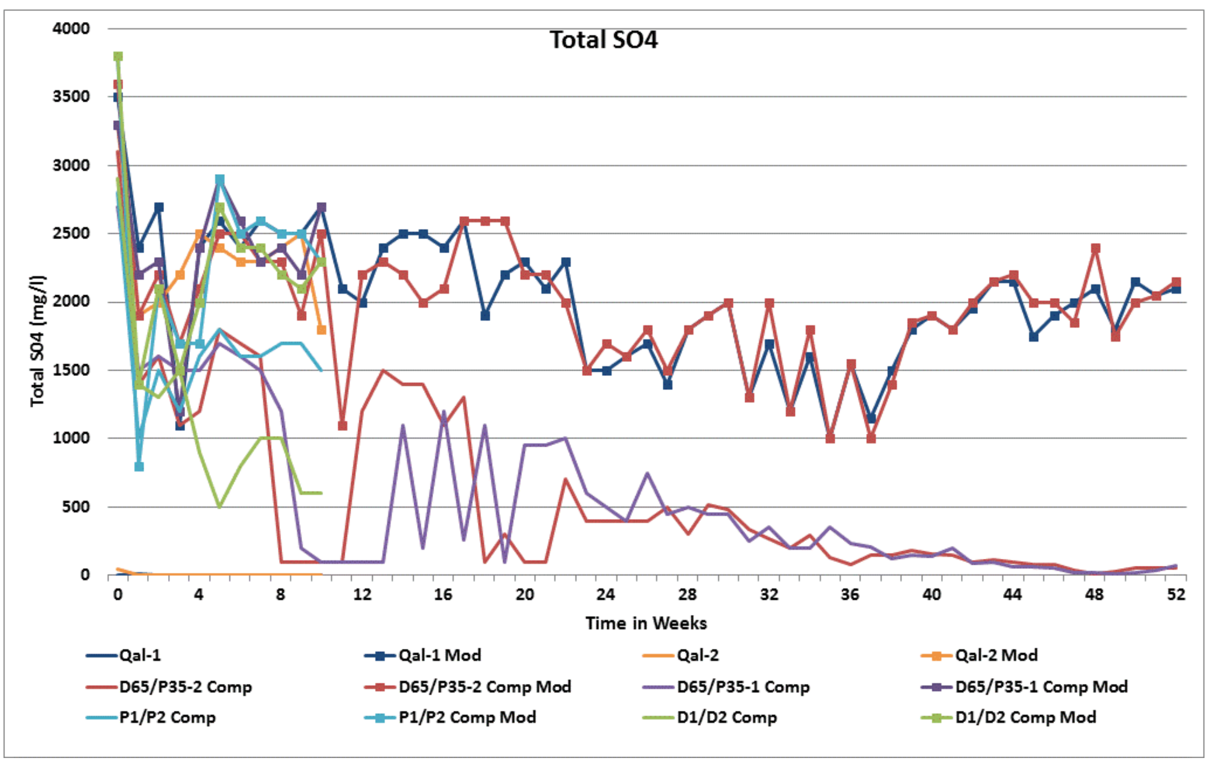
Graph 3-2, Redox



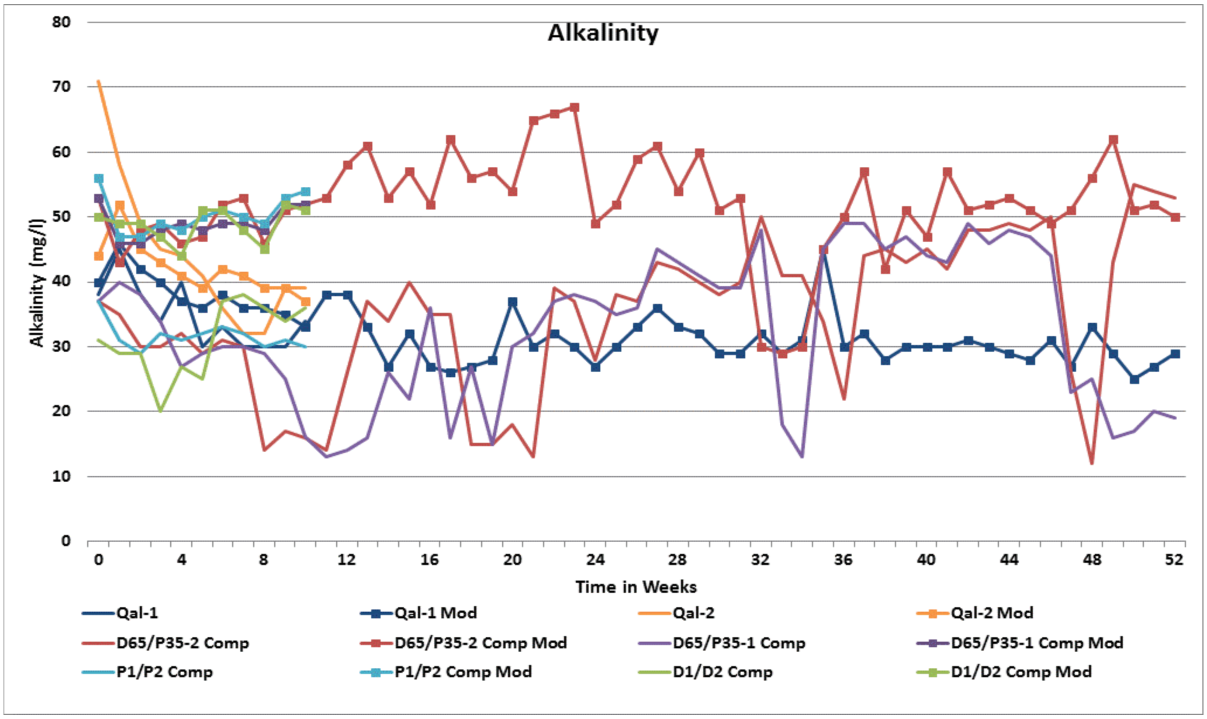
Graph 3-3, Total Iron



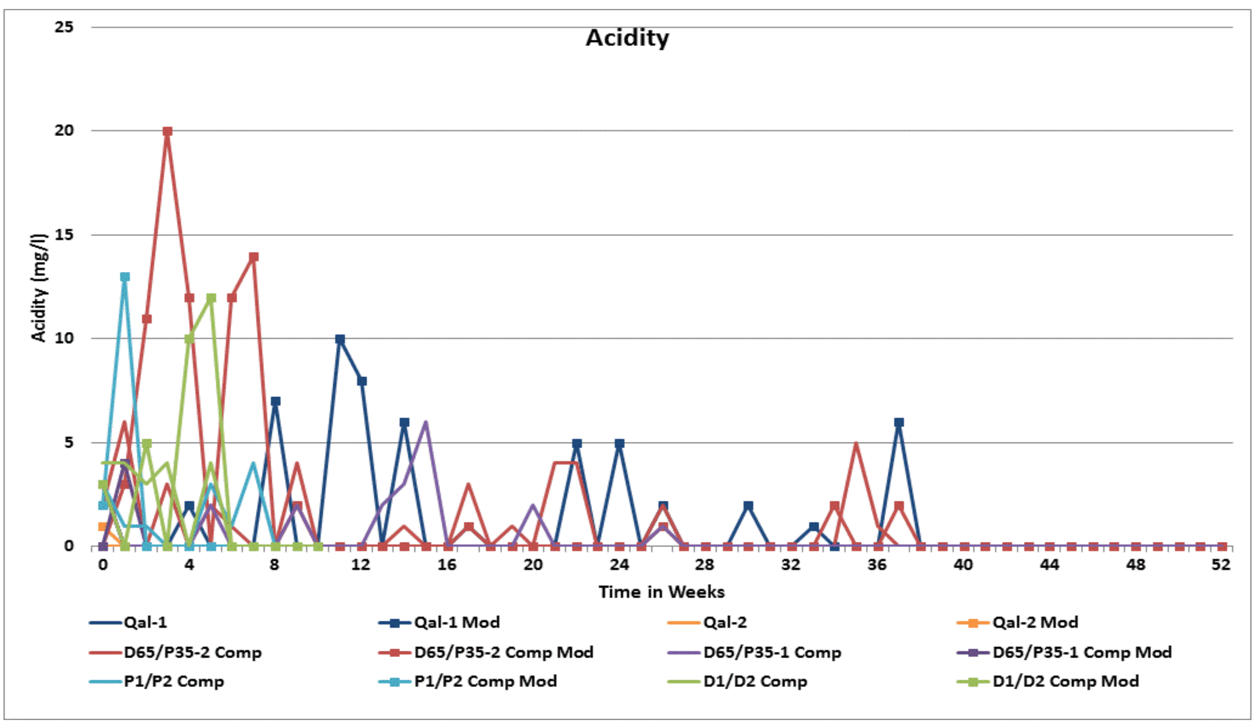
Graph 3-4, Total Sulfate



Graph 3-5, Alkalinity



Graph 3-6, Acidity



HCT also consisted of sampling for an additional suite of analytical parameters that are summarized in **Table 3-18, Dissolved Metals Humidity Cell Test (HCT) Results for Tailings and Alluvium Materials.**

Additional analytical sampling for HCT was conducted to evaluate the potential for dissolution and mobility from tailings and alluvium materials. The suite of analytical parameters is detailed in **Table 3-13, Tailings Water Analyses**, consisting of general inorganics, dissolved metals and radiochemicals. General inorganic results are not discussed further as weekly sampling results described above cover several of those parameters. Radiochemicals were only analyzed at test initiation because subsequent extract volumes were not sufficient for the required analytical method. All radiochemical results obtained were compliant with AAWQS. Minimum and maximum dissolved metals concentrations and corresponding method detection limits (MDL) are presented in **Table 3-18, Dissolved Metals Humidity Cell Test (HCT) Results for Tailings and Alluvium Materials.**

MDLs varied during testing and at times were greater than the constituent AAWQS. The higher detection limits were due to dilution required at the laboratory because of matrix interference. After week 8 of testing, analytical methods were switched in order to obtain lower MDLs. Minimum and maximum MDLs are presented to illustrate the differences. There were two measurable exceedances of the AAWQs during the 52 weeks of testing. Week 1 extract from Sample D65/P35-1 Comp exceeded the AAWQS of 0.05 mg/l for arsenic with a result of 0.062 mg/l. Week 12 extract from alluvium material Sample Qal-1(mod) exceeded the AAWQS of 0.006 mg/l for antimony with a result of 0.0064 mg/l.

All other results were below their respective AAWQS. Dissolved metals concentrations form extract solutions were evaluated for trends in concentration changes over time. There were no observable increasing concentration trends during the course of testing. Concentrations remained stable or slightly decreased as testing progressed indicating low metals mobility. Concentrations of barium, copper, manganese, nickel, selenium and zinc were slightly higher in the modified tests but still well below the AAWQS. Antimony and arsenic the two parameters with concentrations above the AAWQS are presented respectively in **Graphs 3-7** and **3-8**. Sample results measured below detectable limits were plotted with concentrations at the method detection limit.

Antimony concentration changes over time are presented in **Graph 3-7**. There was one measured exceedance of the AAWQS that occurred at week 12 in the alluvium modified test, sample Qal-1 mod. All other results for this sample were well below the AAWQS with no observable concentration trend. It appears that antimony concentrations peaked near the beginning of testing however, the spikes on the graph occur where less than detectable results are plotted at the detection limit. This occurred at weeks one, six and 40 when MDLs of 0.012 mg/l and 0.006 mg/l were used due to sample dilution. Other than the one exceedance, concentrations of antimony were less than the AAWQS and stable throughout testing in both standard and modified tests for both tailings and alluvium samples.

Table 3-18, Dissolved Metals Humidity Cell Test (HCT) Results for Tailings and Alluvium Materials

Analyte	Tailings[(1)]		Alluvium[(2)]		Method Detection Limit		AAQWS
	Min	Max	Min	Max	Min	Max	
Dissolved Metals							
Antimony	0.00034	0.0052	0.00027	0.0064	<0.0021	<0.012	0.006
Arsenic	0.00083	0.062	0.0015	0.012	<0.0007	<0.012	0.05
Barium	0.0021	0.06	0.028	0.084	<0.01	<0.1	2
Beryllium	<0.0002	<0.001	<0.0002	<0.001	<0.0002	<0.001	0.004
Cadmium	0.00011	0.00054	0.00014	0.00022	<0.0001	<0.001	0.005
Chromium	0.0005	0.024	0.0075	0.011	<0.0005	<0.025	0.1
Cobalt	0.00047	0.0019	<0.0003	<0.04	<0.0003	<0.05	---
Copper	0.00092	0.042	0.0012	0.016	<0.003	<0.01	---
Lead	0.00012	0.015	0.00013	0.025	<0.0001	<0.015	0.05
Manganese	0.0016	0.42	0.0011	0.076	<0.0008	<0.1	---
Mercury	<0.00002	<0.0002	<0.00003	<0.0002	<0.00002	<0.0002	0.002
Nickel	0.00039	0.15	0.0014	0.022	<0.01	<0.01	0.1
Selenium	0.00026	0.016	0.012	0.015	<0.002	<0.008	0.05
Thallium	<0.0002	0.00024	<0.0002	<0.004	<0.0002	<0.004	0.002
Zinc	0.0055	0.031	0.0062	0.025	<0.01	<0.05	---

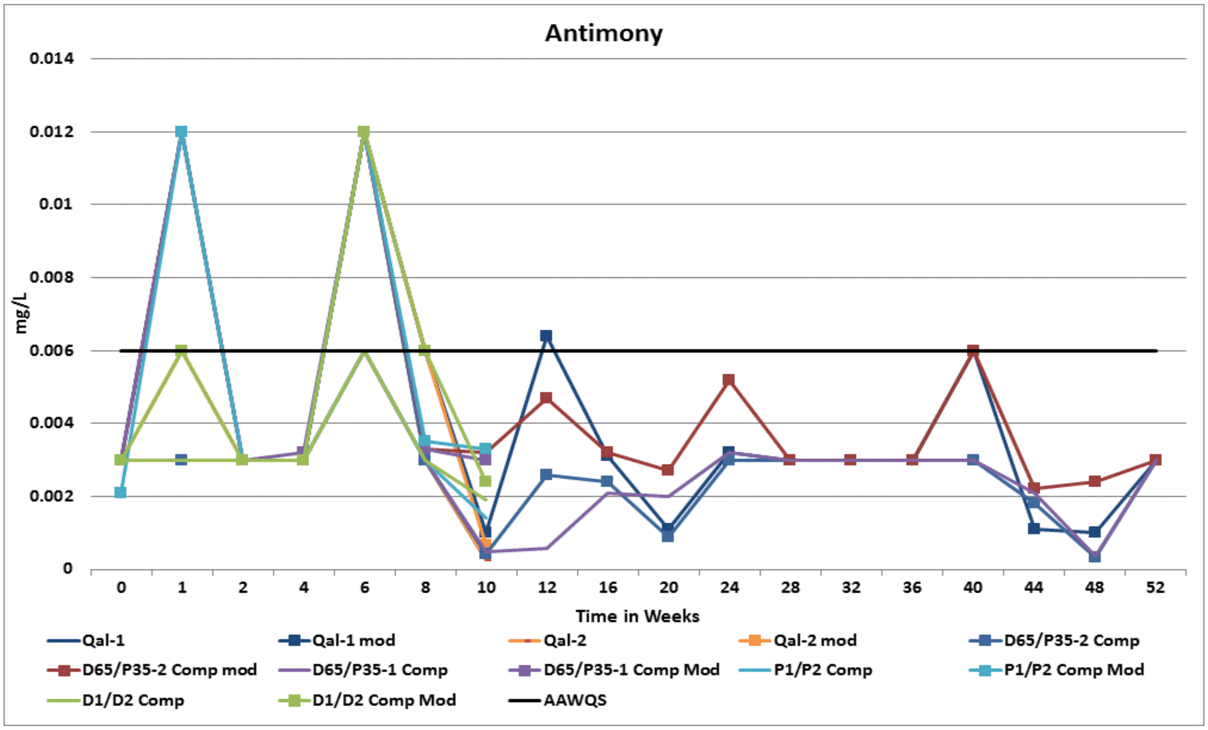
Notes:

(1) Tailings minimum and maximums were evaluated from standard and modified test samples D1/D2 Comp, P1/P2 Comp, D65/P35-1 Comp and D65/P35-2 Comp.

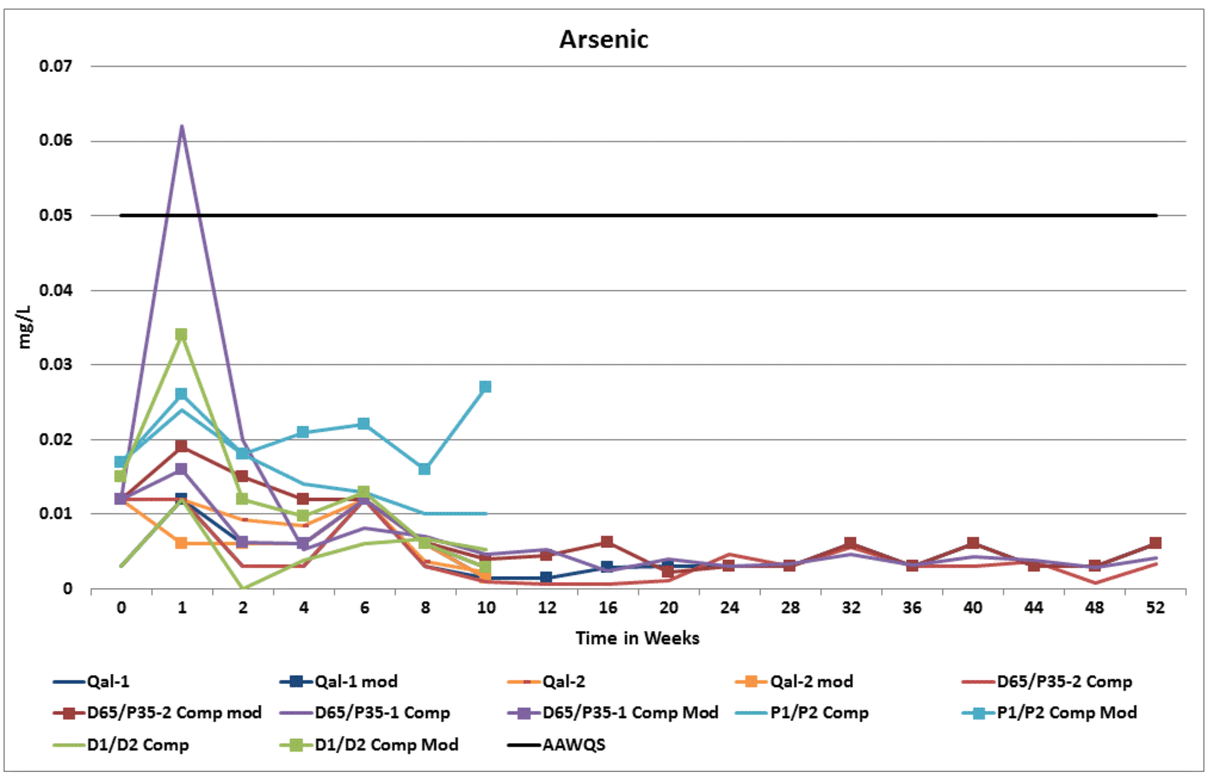
(2) Alluvium minimums and maximums were evaluated from standard and modified test samples Qal-1 and Qal-2.

Arsenic concentration changes over time are presented in **Graph 3-8**. There was one exceedance of the AAWQS that occurred at week one in a standard test composite tailings sample of 65% Diabase and 35% Pinal Schist, sample D65/P35-1 Comp. Arsenic followed a slight decreasing trend in concentration over time for all but one sample. Sample P1/P2 Comp mod, a modified test on a composite tailings sample of Pinal Schist had slightly variable concentrations. Other than the one exceedance concentrations of arsenic were less than the AAWQS in all tests.

Graph 3-7, Antimony



Graph 3-8, Arsenic



Understanding the geochemical behavior of the tailings and their interactions with the alluvium was considered important to assess potential off-site impacts to water quality. HCT were performed to characterize the acid rock drainage potential and leachability of the tailings and alluvium materials. The amounts of sulfide materials present in the tailings placed them in the uncertain acid generating range. However, kinetic testing indicated that that the tailings would not generate acid and the potential for dissolution is low in a natural-weathering environment. Kinetic testing also indicated that the alluvium was not acid generating and did not increase the potential for dissolution and mobility. The use of Elder Gulch TSF decant water for the modified testing did not appear to have a significant effect on the test results with the possible exception of higher sulfate, fluoride, nitrate as N, barium, copper, manganese, nickel, selenium and zinc concentrations associated with the decant water solution.

3.3.2 ENVIRONMENTAL CONSEQUENCES

3.3.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. The surface geology of these sites would remain and would not be covered with tailings material. The possibility of a moderate earthquake remains; however, given the local geological conditions of the area, any large scale slope instabilities and mass wasting are not likely.

3.3.2.2 Effects of the Ripsey Wash TSF Alternative

The rock material from which copper is extracted would become the tailings that would be deposited in the Ripsey Wash TSF site. This deposition would cover the existing geologic structure and lithology of the site. The approval of the Ripsey Wash TSF would result in permanent changes to the topography of the area. The TSF would create long-term, permanent transformation of the existing topography. The visual aspects of the Ripsey Wash TSF are discussed in Section 3.14, Visual Resources.

The results of geochemistry characterization and testing for the tailings materials to be placed in the Ripsey Wash TSF and for the borrow materials to be used to construct starter dams and other TSF components are set forth in Section 3.3.1.4, Geochemistry. The purpose of this work was to assess the potential environmental impacts to groundwater and surface water. The results of this testing work reveal that there is a low potential to impact groundwater or surface water, with the design and operational safeguards proposed for the TSF. Kinetic testing of tailings revealed a low potential for any acid generation from tailings materials and confirmed that alluvium material to be used for construction activities are not acid-generating. The meteoric water mobility testing on both tailings and alluvium material also revealed that the probability for dissolution and mobilization of leaching minerals from these materials is low. Additional information about water quality effects is set forth in Section 3.4, Surface Water Hydrology, and Section 3.6, Groundwater Hydrology.

Slope stability of the Ripsey Wash TSF is not expected to pose a credible risk. Tailings pore pressures, elevated phreatic surfaces, and earthquake induced accelerations are aspects of the TSF that require due consideration and design, but they are not inordinate for the Ripsey Wash TSF. However, this assessment is the responsibility of Asarco and must be reviewed and approved by the Arizona DEQ for the site's APP permit.

Geologic events, such as earthquakes, could result in damage to the Ripsey Wash TSF, and the damage or destruction would vary depending on the severity of the event. The release of tailings into the environment could result from the occurrence of a major geologic event. The damage, destruction or tailings contamination would vary depending on the severity of the event and could lead to direct and indirect impacts. Although it is possible for an earthquake to occur in this region of Arizona, the potential for damage to the TSF and the release of tailings material to down-gradient drainages, including the Gila River, would be remote if proper TSF engineering design, construction and operation is implemented.

Possible catastrophic consequences associated with a tailings dam failure from an earthquake event greater than the MCE are discussed in Section 3.16, Accidents and Spills. If an earthquake of great magnitude occurred in this area, with or without the development of either the Ripsey Wash TSF, it would probably result in severe property destruction, loss of electric and other utility services, and possible loss of life. There has never been a tailings dam failure at the Ray Mine, but tailings accidents are possible.

No adverse effects are expected to geology or geochemistry as a result of the relocation of the Arizona Trail or the work in the areas proposed for waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**). There are no major landform alterations or mine-related activities that would occur in these areas that would generate any adverse effects

3.3.2.3 Effects of the Hackberry Gulch TSF Alternative

Even though the Hackberry Gulch TSF site has different geology than the Ripsey Wash TSF site, the geologic, geochemistry and geotechnical effects would be essentially the same as discussed in Section 3.3.2.2, Effects of the Ripsey Wash TSF Alternative. However, the design, construction and operation of the Hackberry Gulch TSF are and would be more complicated than the Ripsey Wash TSF given the multiple and incised watersheds involved at the Hackberry Gulch TSF site.

There would be no adverse effects to geology or geochemistry from the mitigation work at the proposed for waters of the U.S. mitigation areas for the same reasons set forth in Section 3.3.2.2, Effects of Ripsey Wash TSF Alternative. Under this alternative, the Arizona Trail would not relocated, so there would be no impacts to this trail.

3.4 SURFACE WATER HYDROLOGY

Identify any water quality and quantity impacts to Gila River and other surface waters as a result of the proposed tailings storage facility. Address possible impacts to Zelleweger Wash if up-drainage flows from Ripsey Wash are diverted into this wash. *The areas of concern include: (1) the alteration of existing hydrologic systems by direct disturbance; (2) the potential for increased sediment levels; (3) the alteration of downstream flow rates and any changes in the downstream water chemistry in the Gila River; and (4) any impacts on existing surface water rights.*

3.4.1 AFFECTED ENVIRONMENT

3.4.1.1 Regional Setting

The proposed Ripsey Wash and Hackberry Gulch TSF sites are located within the Basin and Range physiographic province of Arizona, which is characterized by few perennial streams and low rainfall. See Section 3.1, Air Quality/Climate.

The Gila River is the principal drainage in the region. See **Figure 25, Regional Surface Water**. It is tributary to the Colorado River and has its headwaters in New Mexico. The drainage area of the Gila River at its confluence with the Colorado River is approximately 60,000 square miles (Huckleberry 1996).

The San Carlos Reservoir, located approximately 40 miles upstream of the Ray Mine, impounds the Gila River behind the Coolidge Dam, which is operated for SCIP to meet downstream water demands. SCIP releases an average of approximately 260,000 acre-feet per year from the San Carlos Reservoir to the

Gila River and water levels in the reservoir are subjected to considerable fluctuations (AWDR 2009). A hydroelectric station generated electricity for SCIP at the Coolidge Dam until 1983 when a flood rendered the station inoperable. See **Figure 27, Hydrologic Unit Boundaries**.

Downstream of the Ray Mine, SCIP operates the Ashurst-Hayden Diversion Dam, which is located on the Gila River about 10 miles east of the town of Florence. SCIP diverts water from the Gila River at this facility to meet irrigation water demands. Below this diversion dam, the Gila River is typically dry until it reaches its confluence with the Salt River near Phoenix.

Since 1911, the United States Geological Survey (USGS) has maintained a stream gaging station on the Gila River near the town of Kelvin. The drainage area of the Gila River at this gage is approximately 18,000 square miles. Annual flows in the Gila River at this gage are extremely variable because of natural variability, withdrawals for irrigation, and water discharge regulation from the Coolidge Dam. See **Table 3-19, Gila River Flow at USGS Kelvin (AZ) Gaging Station (USGS 09474000)**.

Table 3-19, Gila River Flow at USGS Kelvin (AZ) Gaging Station (USGS 09474000)

	Water Year 2014	Water Years 1911 -2014
Annual total (cfs) (1)	79,610	-
Annual mean (cfs) (2)	218.1	491.7
Highest annual mean (cfs)	-	3,281
Lowest annual mean (cfs)	-	69.0
Highest daily mean (cfs)	1,050 (Sep 22)	105,000 (January 20,1916)
Lowest daily mean (cfs)	2.80 (November 6)	0 (June and July 1913, August 2000, June, July and August 2002, September, October, November 2003, October, November 2007, October, November 2011, June, July, August, November 2012, June, July 2013
Annual runoff (cfs per square mile)	0.012	0.027
Annual runoff (inches)	0.164	0.372

Notes:

(1) The sum of the daily mean values of discharge for the year.

(2) The arithmetic mean of the individual daily mean discharges for the year noted or for the designated period of record.

Source: USGS 2014

The Gila River is an example of a dry-land river that is relatively unstable and prone to changes in channel configuration because of flood events. In the 1870’s, the Gila River was contained in a single, relatively wide, sandy channel with little vegetation. Periods of flooding in 1905 and 1926 created several branching channels within the wide floodplain. A subsequent dry period in the 1930s, that followed the completion of the Coolidge Dam in 1928, caused a decline in large flood events downstream of the Coolidge Dam and resulted in the development of a heavily vegetated flood plain with a single, narrow, low flow channel. A flood in October 1983 with a peak discharge at the Kelvin station of 100,000 cfs and relatively short duration did not produce any long-lasting changes to the channel configuration. However, a January 1993 flood with a peak discharge at Kelvin of 74,290 cfs and a relatively long duration resulted in dramatic changes in the Gila River channel configuration (Huckleberry 1996).

The Gila River near the Ray Mine is confined in a channel with steep banks along most of the corridor from the Kelvin gage downstream to the river's confluence with Zelleweger Wash. Some portions of the channel's banks are composed of bedrock, but generally they are earthen with mixed gravel, cobble and rock. Bank stability is low, and sloughing is commonly observed (WestLand 2013).

The Federal Emergency Management Agency (FEMA) has mapped floodplains along the Gila River (FEMA 2014). The National Flood Hazard Layer (NFHL), which FEMA updates monthly, delineates the 1-percent-annual-chance flood event to determine the 100-year floodplain for drainages in the U.S. The Gila River near the Ray Mine has a 100-year floodplain that ranges from approximately 0.1 to 0.7 miles in width. See **Figure 25, Regional Surface Water**. Most of the Gila River floodplain in this area is designated as Zone A[21], but there are sections near the communities of Riverside and Kearny that are designated as Zone AE[22].

The only major tributary to the Gila River between the Coolidge Dam and the Ashurst-Hayden Diversion Dam is the San Pedro River. See **Figure 25, Regional Surface Water**. The San Pedro River has a drainage area of nearly 4,500 square miles and joins the Gila River near the town of Hayden, downstream of the Coolidge Dam and about 20 miles upstream of the Ray Mine. Portions of the San Pedro River are perennial. Water is diverted for irrigation from the San Pedro River; however, the river is undammed. Asarco owns property along the floodplain of the lower San Pedro River. Along a 40-mile stretch of upper San Pedro River, the BLM manages nearly 57,000 acres of public land at the San Pedro Riparian National Conservation Area, with its goal to protect and enhance the desert riparian habitat.

3.4.1.2 Regional Surface Water Quality

Federal regulations ensure the protection of water resources under the Safe Drinking Water Act (SDWA) and the Clean Water Act (CWA). The roles of government agencies that oversee or regulate surface water resources in Arizona are discussed in **Appendix C, Agency Responsibilities (Regulatory Framework)**.

ADEQ has developed surface water quality standards that define water quality goals for Arizona and provide the basis for controlling discharge of pollutants to surface waters. The Ripsey Wash and Hackberry Gulch TSF sites are located within along a segment of the Gila River for which the ADEQ has delineated beneficial uses that include fish consumption (FC), full body contact (FBC), aquatic and wildlife use in warm water (A&WW), agriculture – livestock (AgL), and agriculture – irrigation (AgI).

Section 303(d) of the CWA requires each state to develop a list of water bodies with one or more of the designated beneficial uses that are impaired by pollutants. A 19.8 mile segment of the Gila River from its confluence at the San Pedro River to its confluence with Mineral Creek is listed on the Arizona 303(d) list as impaired for suspended sediment concentration (ADEQ 2014). This classification applies to the Gila River near the Hackberry Gulch TSF site but not at the Ripsey Wash TSF site, as the Ripsey Wash TSF site is located downstream of the confluence of Mineral Creek and the Gila River.

[21] FEMA defines Zone A as those areas subject to inundation by the 1-percent-annual-chance flood event generally determined by approximate methodologies. Because detailed hydrologic analyses have not been performed, no base flood elevations (BFEs) or flood depths are shown on FEMA maps.

[22] FEMA defines Zone AE as those areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. BFEs or flood depths are shown on FEMA maps.

Mineral Creek from Devil's Canyon to the confluence with the Gila River is listed on the Arizona 303(d) list as impaired for dissolved copper, dissolved oxygen, and selenium. Impaired reaches are shown on **Figure 25, Regional Surface Water.** The Gila River downstream of the Mineral Creek confluence is not impaired.

Water quality data were obtained from the National Water Quality Monitoring Council data portal (NWQMC 2015). Two stations were located for the Gila River at Kelvin in the NWQMC data set. The USGS station 09474000 has a period of record from 1974 through 2006. Arizona DEQ (station number 21ARIZ_WQX-MGGLR313.73) has a period of record from 2008 to 2009.

Table 3-20, Gila River Water Quality from USGS Kelvin (AZ) Gaging Station (USGS 09474000) presents a summary of the data obtained by query from the NWQMC dataset. Inorganic constituents, such as calcium, magnesium, etc., have been measured routinely at this gaging station from the mid-1950s, with metals being measured from the mid-1970s. No data are available from this station after 2006. Method detection limits were higher in earlier data, but have become lower in more recent data as analytical equipment has become more sensitive.

Table 3-20, Gila River Water Quality from USGS Kelvin (AZ) Gaging Station (USGS 09474000)

Constituents (in mg/l unless noted)	Min	Median	Mean	Max	Number measurable results(1)	Number of samples with non detect	Percent sample with measurable concentration	Period of record
Antimony, Dissolved	0.00015	0.0005	0.00043	0.0005	5	12	29%	2001-2006
Arsenic, Dissolved	0.001	0.004	0.0042	0.0096	1483	0	100%	1974-2006
Barium, Dissolved	0.04	0.068	0.085	0.3	24	3	89%	1977-2004
Beryllium, Dissolved(2)	0.00003	0.0005	0.00036	0.0005	0	17	0%	2001-2006
Cadmium, Dissolved(3)	0.00002	0.00025	0.0007	0.01	5	28	15%	1974-2006
Chromium, Dissolved(3)	0.0005	0.0005	0.0042	0.02	5	24	17%	1974-2004
Chromium, Recoverable	0.0005	0.01	0.051	0.75	25	28	47%	1974-2006
Copper, Dissolved	0.001	0.003	0.0052	0.02	18	7	72%	1974-2006
Lead, Dissolved (4)(5)	0.00004	0.001	0.0007	0.001	3	22	12%	1974-2006
Manganese, Dissolved	0.0017	0.005	0.115	2.48	53	25	68%	1974-2004
Manganese, Recoverable	0.08	0.41	2.873	36	65	0	100%	1974-2006
Mercury, Dissolved	0.000005	0.00005	0.00013	0.0005	5	36	12%	1974-2006
Nickel, Dissolved	0.0005	0.001	0.0011	0.002	10	3	77%	1980-2004
Selenium, Dissolved	0.0005	0.0005	0.00086	0.003	15	23	39%	1974-2004
Selenium, total	0.0003	0.0005	0.00093	0.003	26	32	45%	1976-2006
Thallium, Dissolved	0.001	0.001	0.001	0.001	0	12	0%	2001-2004
Zinc, Dissolved(6)	0.0009	0.01	0.017	0.15	30	11	73%	1974-2006
Calcium, Dissolved	24.2	108	142	989	1032	0	100%	1950-2006
Magnesium, Dissolved	5.9	24	30	180	1032	0	100%	1950-2006
Potassium, Dissolved	1.2	6.6	7.661	42	363	0	100%	1950-2006
Carbonate, Total	(7)							
Fluoride, Dissolved	0.1	1	1	2.5	436	0	100%	1950-2006
Fluoride, total	(7)							
Sulfate, Dissolved	10	196	284	1840	502	0	100%	1950-2006

Constituents (in mg/l unless noted)	Min	Median	Mean	Max	Number measurable results(1)	Number of samples with non detect	Percent sample with measurable concentration	Period of record
Sulfate, Total	(7)							
Nitrogen, mixed forms (NH3), (NH4), organic, (NO2) and (NO3), Dissolved	0.125	0.425	0.58	1.8	33	15	69%	1977-1998
Hardness, Ca-Mg(8)	(7)							
Hardness, Ca-Mg, Total	(7)							
Total hardness -- SDWA NPDWR, mg/l CaCO3(9)	84.6	370	477	2600	1033	0	100%	1950-2006
Suspended sediment concentration (SSC), Suspended	5	417.5	11096	200000	326	0	100%	1960-2006

Notes:

(1) One half of the detection limit was used for calculations for constituents reported as less than detection.

(2) Not detected in any samples.

(3) No detection limit listed in data from 1974-1980. Not used for statistics.

(4) Notations in data suggesting "detected, not quantified" from 1974 - 1981. Not used for statistics

(5) No detection limit listed for data from 1975-1979. Not used for statistics

(6) No detection limit listed for data from 1975-1977. Not used for statistics

An additional two years of data have been collected by Arizona DEQ at their station designated 21ARIZ_WQX-MGGLR313.73, Gila River at Kelvin. Data from the period 2008 through 2009 are summarized in **Table 3-21, Gila River Water Quality from Kelvin (AZ) Gaging Station (Arizona DEQ-21ARIZ-WQX-MGGLR313.73)**.

Table 3-21, Gila River Water Quality from Kelvin (AZ) Gaging Station (Arizona DEQ-21ARIZ-WQX-MGGLR313.73)

Constituents (in mg/l unless noted)	Min	Median	Mean	Max	Number measurable results (1)	Number of samples with Non detect	Percent sample with measurable concentration	Period of record
Antimony, Dissolved(2)	0.0025	0.0025	0.0025	0.0025	0	22	0%	2008-2009
Arsenic, Dissolved(2)	0.0025	0.0025	0.0033	0.005	0	22	0%	2008-2009
Barium, Dissolved	(3)							
Beryllium, Dissolved(2)	0.00025	0.00025	0.00025	0.00025	0	22	0%	2008-2009
Cadmium, Dissolved(4)	0.00025	0.00025	2.23	49	1	21	5%	2008-2009
Chromium, Dissolved	(3)							
Chromium, total(2)	0.005	0.005	0.005	0.005	0	28	0%	2008-2009
Copper, Dissolved	0.0001	0.0038	0.0036	0.0056	16	17	48%	2008-2009
Lead, Dissolved	0.000025	0.000055	0.001038	0.0025	16	17	48%	2008-2009

Constituents (in mg/l unless noted)	Min	Median	Mean	Max	Number measurable results (1)	Number of samples with Non detect	Percent sample with measurable concentration	Period of record
Manganese, Dissolved	(3)							
Manganese, total	0.11	0.3	0.311	0.65	28	0	100%	2008-2009
Mercury, Dissolved(5)	0.00000025	0.00000025	3.07E-05	0.0001	5	28	15%	2008-2009
Nickel, Dissolved	(3)							
Selenium, Dissolved	(3)							
Selenium, total(2)	0.0025	0.0025	0.0025	0.0025	0	28	0%	2008-2009
Thallium, Dissolved	(3)							
Zinc, Dissolved(2)	0.025	0.025	0.025	0.025	0	23	0%	2008-2008
Calcium, Dissolved	49	58	81.17857	200	28	0	100%	2008-2009
Magnesium, Dissolved	17	18	26.04	63	28	0	100%	2008-2009
Potassium, Dissolved	5.1	5.2	5.8	7.7	4	0	100%	2008-2009
Carbonate, Total	1	1	1.86	3	12	16	43%	2008-2009
Fluoride, Dissolved	(3)							
Fluoride, total	0.96	1.2	1.15	1.3	28	0	100%	2008-2009
Sulfate, Dissolved	(3)							
Sulfate, total	90	120	207.86	650	28	0	100%	2008-2009
Nitrogen, mixed forms (NH3), (NH4), organic, (NO2) and (NO3), Dissolved	(3)							
Hardness, Ca-Mg(6)	200	220	327	790	10	0	100%	2008-2009
Hardness, Ca-Mg, total	200	230	310.87	760	23	0	100%	2008-2009
Total hardness -- SDWA NPDWR, mg/l CaCO3 (7)	200	210	311.74	790	23	0	100%	2008-2009
Suspended sediment concentration (SSC), Suspended	2.5	15	37.23	91	34	9	79%	2008-2009

Notes:

(1) One half of the detection limit was used for calculations for constituents reported as less than detection.

(2) Not detected in any samples.

(3) No results for this parameter included in dataset.

(4) Only one measureable result listed in dataset. Reported as 49 mg/l on 5-13-2009.

(5) No detection limit listed for data from 1975-1977. Not used for statistics. Maximum value is half detection limit for one result with detection limit of 0.0002 mg/l. Maximum value for 5 results were all 1.4 ng/l or 0.0000014 mg/l.

(6) No fraction identified in dataset.

(7) SDWA NPDWR - Safe Drinking Water Act, National Primary Drinking Water Regulations

Source: Data from NWQMC 2015. National Water Quality Monitoring Center at www.waterqualitydata.us.

Water quality data from these tables were not compared to water quality standards because of the large number of parameters that were as not detected and a wide range of reported detection limits.

3.4.1.3 Ripsey Wash TSF Site Surface Water Hydrology

Surface drainages within the Ripsey Wash TSF site are ephemeral and flow only in response to precipitation events. The Ripsey and Zelleweger washes, along with an unnamed wash designated Eastern Wash on **Figure 26, Surface Water Features - Ripsey Wash TSF** and located to the east of Ripsey Wash, are tributary to the Gila River. These washes are generally braided, sandy-bottomed channels interspersed with upland vegetation and cacti. The washes can carry heavy sediment loads downstream toward the Gila River. Tributaries to these washes tend to have relatively confined channels but form large, broad alluvial fan deposits at the confluences with the main channels. **Table 3-22, Drainage Characteristics - Ripsey Wash TSF Site**, provides watershed information.

Table 3-22, Drainage Characteristics - Ripsey Wash TSF Site

Wash Name	Drainage Area (square miles)	Basin Length (miles)	Approximate Maximum Elevation (feet amsl)	Approximate Minimum Elevation (feet amsl)	Basin Slope (ft/mile)
Ripsey Wash	18.1	10.0	3920	1740	218
Zelleweger Wash	4.2	9.0	3170	1740	158
Eastern Wash	2.2	1.6	3400	1740	1018

Ripsey Wash is the largest watershed at the Ripsey Wash TSF Site. Soils in the watershed range from clay loam to coarse loam; see Section 3.2, Soils. The average vegetative cover of Ripsey Wash is approximately 20%. Section 3.12.1.1, Upland Vegetation Communities, includes discussion of the upland vegetation communities found in Ripsey Wash. Soil types and vegetative cover percentages used for peak storm runoff modeling are described in Section 3.4, Surface Water Hydrology.

Zelleweger Wash is located directly west of Ripsey Wash, and this watershed is 25% of the size of Ripsey Wash. The Zellweger Wash basin slope is less than that at Ripsey Wash. The type of soils, vegetation, and percent vegetative cover in Zelleweger Wash are similar to Ripsey Wash.

The Eastern Wash has a much steeper basin slope than either Ripsey Wash or Zelleweger Wash. The type of soils, vegetation, and percent vegetative cover in this unnamed wash are similar to those in Ripsey and Zelleweger Washes.

Ripsey Wash and Zelleweger Wash have FEMA designated floodplains that are narrow and range from 0.03 to 0.1 miles wide. The floodplains extend approximately three to four miles up-drainage from their confluence with the Gila River. See **Figure 25, Regional Surface Water**, and **Figure 26, Surface Water Features - Ripsey Wash TSF**.

3.4.1.4 Hackberry Gulch TSF Site Surface Water Hydrology

Hackberry Gulch, Kane Springs Canyon, Belgravia Wash, and several unnamed ephemeral washes are tributary to the Gila River. See **Figure 28, Site Drainages - Hackberry Gulch TSF**. These ephemeral drainages are smaller, steeper and more incised than the Ripsey and Zelleweger washes. **Table 3-23, Drainage Characteristics - Hackberry Gulch TSF Site**, provides watershed information.

Table 3-23, Drainage Characteristics - Hackberry Gulch TSF Site

Wash Name	Drainage Area (square miles)	Basin Length (miles)	Approximate Maximum Elevation (feet amsl)	Approximate Minimum Elevation (feet amsl)	Basin Slope (ft/mile)
Hackberry Gulch	2.9	4.6	4289	1800	536
Kane Springs Canyon	3.0	5.8	4289	1800	427
Belgravia Wash	0.5	1.2	2260	1800	380
B Wash	1.0	2.2	2920	1800	519
C Wash	0.5	2.0	2480	1800	340
D Wash(1)	0.9	0.7	2120	1800	457
E Wash	1.1	2.8	2920	1800	394
F Wash	0.7	2.3	2560	1800	335
G Wash	0.6	1.7	2320	1800	313
H Wash	0.3	1.8	2461	1800	361

Notes:

Watershed D located entirely downstream of the Hackberry Gulch TSF.

Soil and vegetative types for the watersheds at the Hackberry Gulch TSF Site are similar to those at the Ripsey Wash TSF Site, but the average percent vegetative cover is about 30%. Soil types and vegetative cover percentages used for peak storm runoff modeling are described in Section 4.4, Surface Water.

There are no FEMA designated floodplain areas associated with drainages at the Hackberry Gulch TSF site.

3.4.1.5 Surface Water Rights

Water use in Arizona is administered by the ADWR and surface water resources for Arizona are listed in the ADWR database, "SWRfilingActive" (ADWR, 2014). It should be noted that registering a water right with the ADWR does not necessarily mean that the right was exercised and that there is a developed water resource at that location. In addition, locations given in ADWR are usually only as accurate as a quarter of a quarter of a quarter section, or the center point of a ten acre parcel. In some cases, the locations are only accurate to the center point of a 40-acre parcel. For water rights locations where nothing was found on the surface, it is likely that no water source had been developed.

There are no in-stream flow rights on the Gila River near the Ray Mine. Registered water rights within drainages affected by the Ripsey Wash and Hackberry Gulch TSF sites are discussed below.

3.4.1.5.1 Ripsey Wash TSF Site

Surface water rights from the ADWR database for the Ripsey Wash, Zelleweger Wash and Eastern Wash are tabulated in **Table 3-24, Surface Water Rights - Ripsey Wash TSF Site**, and their locations are shown on **Figure 26, Surface Water Features - Ripsey Wash TSF Site**.

No springs or seeps were identified within the proposed footprint of the Ripsey Wash TSF. There is a spring, located about a mile up-drainage (south) of the proposed facility that provides water to several livestock watering points that are located within the proposed tailings footprint.

Table 3-24, Surface Water Rights - Ripsey Wash TSF Site

Basin Name	Located within TSF Footprint	Surface Water Feature	Application Numbers for this Location	Holder	Located in Field (1)	Visible Water (1)	Use
Zelleweger Wash	No	ADWR 1	1935 - 91661	ASLD	No	Unknown	Wildlife
Zelleweger Wash	No	ADWR 2	1933 - 91659	ASLD	No	Unknown	Wildlife
Eastern Wash	No	ADWR 3	1924	ASLD	No	Unknown	Wildlife
Ripsey Wash	Yes	Stock 2 (2)	2838	Private	Yes	Yes	Stock watering
Ripsey Wash	No	ADWR 4	105036 - 96589	BLM	No	Unknown	Wildlife
Ripsey Wash	Yes	Tank 3	1929 - 91656 - 2129	ASLD	Yes	No	Wildlife - Stock watering
Ripsey Wash	No	Spring	1932 - 2838	ASLD	Yes	Yes	Wildlife
Ripsey Wash	Yes	ADWR 5	1926	ASLD	No	Unknown	Wildlife
Ripsey Wash	Yes	Stock 1 (2)	1928	ASLD	Yes	No (3)	Wildlife
Ripsey Wash	Yes	ADWR 6	104877	ASLD	No	Unknown	Stock watering
Ripsey Wash	Yes	Tank 1	1930 - 2127-91657	ASLD	Yes	No	Wildlife
Ripsey Wash	Yes	Tank 2	1931 - 2127-91658	ASLD	Yes	No	Wildlife
Ripsey Wash	Yes	Stock 3 (2)	1925	ASLD	Yes	No	Wildlife
Ripsey Wash	No	ADWR 7	2017 - 2839	ASLD	No	Unknown	Wildlife
Ripsey Wash	No	ADWR 8	2018 - 2128	ASLD	No	Unknown	Wildlife
Ripsey Wash	No	ADWR 9	2019	ASLD	No	Unknown	Wildlife
Ripsey Wash	No	ADWR 10	17435	BLM	No	Unknown	Wildlife

Notes:

(1) Based on field work by WestLand (WestLand 2014a).

(2) Fed by a spring, located about a mile up-drainage (south) of the proposed footprint area of the RIpsey Wash TSF.

(3) No visible water at time of site visit. Valve closed.

3.4.1.5.2 Hackberry Gulch TSF Site

Surface water rights from the ADWR database for the Hackberry Gulch TSF and surrounding areas are tabulated in **Table 3-25, Surface Water Rights - Hackberry Gulch TSF Site**.

There are several springs or seeps within or adjacent to the proposed footprint of the proposed Hackberry Gulch TSF. The springs are found in Hackberry Gulch, in areas where bedrock is exposed in the bottom of the channel. Surface flow from these springs and quickly disappear into alluvium. Seeps are located in Kane Springs Gulch, Belgravia Wash, and in separate, unnamed drainages that discharge directly to the Gila River. See **Figure 28, Site Drainages – Hackberry Gulch TSF**.

Table 3-25, Surface Water Rights - Hackberry Gulch TSF Site

Basin Name	Located within TSF footprint	Surface Water Feature	Application numbers for this location	Holder	Located in Field(1)	Visible Water (1)	Use
Hackberry Gulch	Yes	ADWR 11	21184	Private	No	Unknown	Stock watering
Hackberry Gulch	Yes	Seep 1 (2)	None found	-	Yes	No	-
Wash B	Yes	Seep 2	20748	BLM	Yes	Yes	Recreation
Wash B	Yes	Seep 3 (2)	None found	-	Yes	Yes	-
Belgravia Wash	Yes	Seep 4 (2)	None found	-	Yes	No	-
Kane Springs Canyon	Yes	Seep 5	21174	Private	Yes	Yes	Stock watering
Wash E	Yes	Seep 6 (2)	None found	-	Yes	Yes	-
Hackberry Gulch	Yes	Seep 7	20707	BLM	Yes		Recreation
Hackberry Gulch	Yes	Spring 1 (2)	None found	-	Yes	Yes	-
Hackberry Gulch	Yes	Spring 2	21185	Private	Yes	Yes	Stock watering
Hackberry Gulch	No	ADWR 12	68737	Private	No	Unknown	Stock watering
Hackberry Gulch	No	ADWR 13	90066 -68736	BLM	No	Unknown	Stock watering
Hackberry Gulch	No	ADWR 14	90058	BLM	No	Unknown	Stock watering
Hackberry Gulch	No	ADWR 15	68738	Private	No	Unknown	Stock watering
Kane Springs Canyon	No	ADWR 16	21177	Private	No	Unknown	Stock watering
Kane Springs Canyon	No	ADWR 17	90241	BLM	No	Unknown	Stock watering
Hackberry Gulch	No	ADWR 18	68762	Private	No	Unknown	Stock watering
Wash E	No	ADWR 19	21173	Private	No	Unknown	Stock watering
Kane Springs Canyon	No	ADWR 20	20714	BLM	No	Unknown	Recreation
Kane Springs Canyon	No	ADWR 21	20705	BLM	No	Unknown	Recreation
Kane Springs Canyon	No	ADWR 22	90245	BLM	No	Unknown	Stock watering
Kane Springs Canyon	No	ADWR 23	68748	Private	No	Unknown	Stock watering
Kane Springs Canyon	No	ADWR 24	68742	Private	No	Unknown	Stock watering
Kane Springs Canyon	No	ADWR 25	68747	Private	No	Unknown	Stock watering
Kane Springs Canyon	No	ADWR 26	20746	BLM	No	Unknown	Recreation
Kane Springs Canyon	No	ADWR 27	90242	BLM	No	Unknown	Stock watering
Kane Springs Canyon	No	ADWR 28	68749	Private	No	Unknown	Stock watering
Kane Springs Canyon	No	ADWR 29	17437	BLM	No	Unknown	Wildlife
Kane Springs Canyon	No	ADWR 30	68740	Private	No	Unknown	Stock watering
Kane Springs Canyon	No	ADWR 31	17448 - 68756	BLM	No	Unknown	Wildlife

(1) Based on field work by WesLand (WestLand 2014a).

(2) Spring or seep found in field, no corresponding ADWR water right.

3.4.2 ENVIRONMENTAL CONSEQUENCES

3.4.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. The surface water systems of these sites would remain as current and would not be covered with tailings material. Ranch management activities (livestock grazing) and dispersed recreation would continue in the area of the proposed TSF sites, but these activities would not have any significant effects on the surface water hydrologic systems of the area.

3.4.2.2 Effects of the Ripsey Wash TSF Alternative

The construction and operation of the Ripsey Wash TSF would remove runoff potential from approximately 16% of the Ripsey Wash drainage basin and approximately 20% of the East Wash drainage basin during the operation of the Ripsey Wash TSF. See **Table 3-26, Ripsey Wash TSF Affected Drainage Areas**.

Table 3-26, Ripsey Wash TSF Affected Drainage Areas

	Total Drainage Area (sq. miles)	Drainage Area within TSF (sq. miles)	Percentage of Watershed covered by TSF
Ripsey Wash	18.1	2.90	16%
East Wash (unnamed tributary)	2.2	0.43	20%
Gila River at Zelleweger Wash	18,040	3.33	0.02%

The possible runoff loss to the Gila River hydrologic system with the construction and operation of the Ripsey Wash TSF would be negligible. At the confluence of Zelleweger Wash and the Gila River (immediately downstream of the TSF), the TSF footprint would amount to about 0.02% of the of the Gila River watershed.

Development and construction activities (seepage trench installation, reclaim and drain-down pond construction, detention dam and diversion channel construction, and installation of tailings and return water pipelines) are potential sources of soil erosion and increased sediment loading in the area washes.

The potential for erosion and sediment loading below disturbed areas would be the greatest during the initial construction period. During actual TSF operations, the potential for erosion would decrease due to reduced site activity and the placement of rock rip-rap in diversion channels and outfalls.

Erosion rates above background conditions would be expected even with the implementation of BADT sediment control measures; especially in the upland areas.

Intense rainfall (which implies heavy runoff) would increase the potential for sediment loading during severe thunderstorms common in the region. The reduction of infiltration and concentration of flows from roads or other compacted areas could result in localized erosion and deposition, especially during the initial construction period.

For the most part, sediment would be stored in the upland areas and in ephemeral channels, but a portion of this sediment could be transported to the Gila River during intense storm events. The amount of sediment would depend largely on the effectiveness of the erosion control practices.

The Ripsey Wash TSF alternative would alter the surface water regime of ephemeral watersheds where the TSF would be constructed and would cause a reduction in down-drainage flow in those ephemeral washes during construction and operations.

Under the terms and conditions of an APP permit, a TSF would be operated as a zero surface water discharge facility, with any direct precipitation and runoff captured in the tailings impoundment being pumped back to the Ray Concentrator for reuse. Seepage through the tailings themselves and the underlying alluvium material beneath the TSF would be captured by down-drainage seepage trenches and routed to lined reclaim ponds, where the water would be pumped back to the tailings impoundment or to the Ray Concentrator for reuse. As tailings consolidate over time during operations, the permeability of the tailings materials themselves are expected to decrease and lessen the amount of infiltration through the tailings. See Section 3.6, Groundwater Hydrology.

With proper design construction and operation of the Ripsey Wash TSF, there should be no water quality impacts to the down-gradient drainages, including the Gila River. As discussed in Section 3.3.1.4, Geochemistry, the kinetic testing of tailings materials revealed a low potential for any acid generation from tailings materials and confirmed that the alluvium material to be used for construction activities are not acid-generating. The meteoric water mobility testing on both tailings and alluvium material also revealed that there is a low probability for dissolution and mobilization of leaching minerals from these materials. Monitoring wells down-gradient of the TSF would serve as points of compliance for an APP permit.

None of the direct precipitation falling within the tailings impoundment footprint would report to the down-drainage ephemeral washes or the Gila River. In addition, the SWPPP will address pollution prevention of surface water by capturing runoff from the disturbed areas during construction of the TSF and from embankment faces during operations, such that sediment discharge to the Gila River or other waters of the U.S. would be minimized.

A system of diversion channels would be constructed to divert up-gradient flows resulting from precipitation events away from the tailings impoundment area and into existing drainages down-gradient of the TSF. The diversion of these flows through diversion channels could result in bank erosion and lateral channel migration in undisturbed ephemeral drainages down-drainage of the outlets of these diversion channels. This could lead to increased sediment loading in these washes and the Gila River.

Detention ponds would also be constructed to prevent up-gradient stormwater runoff from entering the tailings impoundment area, and these up-gradient structures would delay the release of stormwater runoff to downstream ephemeral washes, which would reduce the down-drainage peak discharge and limit down-drainage erosion potential with reduced flow velocities at the outfalls. With the reduction of up-gradient stormwater runoff and sediment load, the existing sediment transport regime for the Ripsey TSF site would essentially remain in balance. Because of the time lag between detention and release, it is anticipated that much of the suspended sediment in the runoff would settle out, so stormwater released from detention facilities would yield lower sediment concentrations than natural uncontrolled runoff. These controlled stormwater releases would not affect the down-drainage geomorphology of the Gila River.

Upon permanent TSF closure, water remaining within the tailings impoundment would evaporate, allowing the surface layers of the tailings to dry and be graded for post-project drainage. Rock material would be placed onto the regraded surface of the tailings impoundment. The resulting topography would allow post-closure drainage off the impoundment through an engineered outfall, but post-closure runoff is expected to be limited for most typical precipitation events given relatively flat surface of the regraded tailings impoundment surface and high evaporation rates.

If accidental spills of diesel fuel or tailings were to occur, there could be impacts to surface water. If such a release occurred, impacts to the ephemeral washes in the area would likely be minor and short-term because of the lack of perennial surface flow and the prompt control and countermeasures that would occur per the SPCC plan (for fuel or oil spills) or per the APP Contingency Plan (for tailings spill). Additional discussion of accidental spills and possible impacts are discussed in Section 4.16, Accidents and Spills.

The possibility of a partial or catastrophic failure of the TSF is extremely remote but two failure modes are discussed in Section 3.16, Accidents and Spills. These failure modes are (1) an earthquake-induced embankment failure and (2) a breach by overtopping.

The Ripsey Wash TSF would not impact any springs, as there are no known springs within the TSF footprint or within 0.5 miles up-gradient of the facility, to the Gila River. This TSF would affect five stock water tanks registered to the Arizona DSL. Asarco is in the process of acquiring the land and water rights where these tanks are located. Regardless of ownership, the potential impact from removal or relocation of the stock watering tanks would be negligible.

Some erosion and sediment could result, especially during intense storms, during the re-route construction of the Florence-Kelvin highway, the SCIP 69 kV electric transmission line and the new re-routed segment of the Arizona Trail. The potential for erosion would be greatest during construction and create minor impact to surface water drainages.

The Arizona Trail reroute would be predominantly hand constructed, except where benching or removal of heavy vegetation is required. Light machinery would be employed for benching and vegetation removal tasks. Trail construction would end at the ordinary high water mark of all drainages encountered along the trail alignment. Trail users will walk across the ephemeral drainages and reconnect to constructed trail on the other side of the drainage. This method of construction would create negligible impact from erosion and sedimentation to existing drainages.

No adverse effects are expected to either the Gila River or the San Pedro River as a result of Arizona Trail relocation and the work in the areas proposed for waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**). If it rains or floods during the clearing and grubbing of the burned tamarisk trees from Mitigation Site E or after the various lands under Mitigation Sites A through E has been cultivated and newly seeded, there could be some minor short-term and localized soil erosion, but the potential for sedimentation reaching either the Gila River or the San Pedro River would be low, and any associated effects would be limited. As part of the mitigation work, stormwater management BMPs would be implemented as required under a SWPPP for the areas, and these BMPs would limit any adverse effects. With the completion of the 404 mitigation work, there would be a beneficial effect to the mitigation areas that would result in a decrease in the potential for soil erosion, coupled with an improvement in vegetative cover.

3.4.2.3 Effects of the Hackberry Gulch TSF Alternative

The Hackberry Gulch TSF and supporting infrastructure would remove varying runoff potential from ten different ephemeral watersheds. See **Table 3-27, Hackberry Gulch TSF Affected Drainage Areas**. Approximately 30% of the runoff potential would be lost from combined area of these watersheds.

The possible runoff loss to the Gila River hydrologic system with the construction and operation of the Hackberry Gulch TSF would be negligible. At the USGS Kelvin gaging station (immediately downstream of the TSF), the TSF footprint would amount to about 0.02% of the of the Gila River watershed.

Development and construction activities for the Hackberry Gulch TSF would be similar to the Ripsey Wash TSF Alternative and would have the same effect on sediment and erosion as described in Section 3.4.2.2, Effects of the Ripsey Wash TSF Alternative. BADT sediment control measures would be implemented; however, erosion rates above background conditions would still be expected.

Table 3-27, Hackberry Gulch TSF Affected Drainage Areas

	Drainage Area (sq. miles)	Drainage Area within TSF (sq. miles)	Percentage of Watershed covered by TSF
Hackberry Gulch	2.9	0.70	24%
Kane Springs Canyon	3.0	0.45	15%
Belgravia Wash	0.5	0.23	43%
B Wash	1.0	0.81	78%
C Wash	0.5	0.37	77%
E Wash	1.1	0.52	46%
F Wash	0.7	0.07	11%
G Wash	0.6	0.01	1%
H Wash	0.3	0.01	2%
Total Hackberry TSF Site	10.6	3.17	30%
Gila River at Kelvin	18,011	3.17	0.02%

Alternation of the surface water regime of ephemeral channels in the vicinity of the TSF would cause a reduction in down-drainage flow during construction and operation of the TSF.

Similar to the Ripsey Wash TSF, the Hackberry Gulch TSF would also be operated as a zero surface water discharge facility. Direct precipitation and runoff captured in the tailings impoundment would be pumped back to the Ray Concentrator for reuse. Seepage through the tailings and the underlying alluvium material beneath the TSF would be captured down-drainage in seepage trenches and routed to lined reclaim ponds, where the water would be pumped back to the tailings. With proper construction and operation, there should be no water quality impacts to the down-gradient drainages, including the Gila River. Monitoring wells down-gradient of the TSF would serve as points of compliance for an APP permit.

A diversion channel planned for construction at closure of the Elder Gulch TSF would be modified and be routed between the Elder Gulch TSF and the Hackberry Gulch TSG. The current alignment would have traversed the Hackberry Gulch TSF.

The Hackberry Gulch TSF would obliterate two springs, eleven seeps, two wetland areas, and one stock watering tank. The potential impact from the removal of the stock watering tank would be negligible, as it could be relocated, but the impact to the springs, seeps and wetland areas within the footprint of the TSF would be adverse and irreversible.

Similar to the discussion in Section 3.4.2.2, Effects of Ripsey Wash TSF Alternative, there are no adverse effects expected to occur to either the Gila River or the San Pedro River as a result of the work in the areas proposed for waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**). If it rains or floods during the clearing and grubbing of the burned tamarisk trees from Mitigation Site E or after the various lands under Mitigation Sites A through E has been cultivated and newly seeded, there could be some minor short-term and localized soil erosion, but the potential for sedimentation reaching either the Gila River or the San Pedro River would be low, and any associated effects would be limited. As part of the mitigation work, stormwater management BMPs would be implemented as required under a SWPPP for the areas, and these BMPs would limit any adverse effects. With the completion of the 404 mitigation work, there would be a beneficial effect to the mitigation areas that would result in a decrease in the potential for soil erosion, coupled with an improvement in vegetative cover.

3.5 WATERS OF THE U.S.

Address project-related impacts to waters of the U.S. *Areas of concern include: (1) the impacts to waters of the U.S.; and (2) changes in the functions and values of on-site jurisdictional waters of the U.S. from tailings disposal operations.*

3.5.1 AFFECTED ENVIRONMENT

3.5.1.1 Jurisdictional Determination – Ripsey Wash TSF Site

A jurisdictional determination (delineation) was completed for the Ripsey Wash TSF site. The delineation work was completed by WestLand (a consultant retained by Asarco), and the work 1987 and 2008 followed guidelines promulgated by the U. S. Army Corps of Engineers. The Corps found the WestLand report to be accurate and complete and approved the jurisdictional determination in February 2013.

Ordinary High Water Mark (OHWM) determinations were made based on direct measurement, a hydrologic analysis completed for Ripsey Wash (JE Fuller 2012), and aerial photo interpretation. Drainages less than 1,000 feet long and having an average width of less than or equal to four feet were classified as erosional features and non-jurisdictional. Drainages exhibiting an OHWM were found to have a significant nexus to the Gila River and are classed as jurisdictional. At the Corps' request, WestLand broadened the area of analysis for the delineation to include the portion of the Gila River downstream from the proposed TSF site. Also, per Corps direction, WestLand employed a wetland determination methodology along the Gila River corridor using on-site and off-site quantitative and qualitative data. Only a very small part of the project footprint (the proposed pipeline bridge over the Gila River) intersects the Gila River, which would not be disturbed under this alternative.

WestLand prepared an additional report presenting the results of a surface water features survey to support the permitting process (WestLand 2014d) that included more specific information with regard to wetlands within the Ripsey Wash TFS footprint and associated facilities.

3.5.1.1.1 Perennial and Intermittent Waters

No perennial or intermittent waters were found to occur within the footprint for the Ripsey Wash TSF site. The Gila River is a perennial stream that occurs immediately adjacent to some components of the project, but the project footprint does not extend into the stream corridor.

3.5.1.1.2 Ephemeral Waters

With the exception of the Gila River, all surface water drainages at the Ripsey Wash TSF site are ephemeral and known locally as "dry washes". They are typically braided, sand-bottom systems interspersed with upland vegetation, cacti and can carry heavy sediment loads to the Gila River. They flow only in response to significant precipitation events. The major washes are Ripsey Wash and Zelleweger Wash, which are both tributary to the Gila River. Smaller tributaries to Ripsey Wash and Zelleweger Wash exhibit moderate to high gradients, are bedrock-dominated, and of limited length. No waters of the U.S. were found along the proposed realigned Arizona Trail.

A functional assessment was prepared for the Ripsey Wash area that is included with **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**. This report contains an assessment of the ephemeral washes. Ephemeral drainages were sorted into three classes of ephemeral water features based on the frequency of flow and the size of the drainage. A qualitative functional assessment was performed for these waters based on eleven functions (four hydrologic functions, two chemical functions, and five biotic functions. A qualitative approach was used because there are no approved quantitative methods available for use in this region.

Table 3-28, Waters of the U.S. - Ripsey Wash TSF Footprint, provides a summary of the classes of ephemeral waters located within the Ripsey Wash TSF footprint. In addition, the total score for each class is provided as determined in the functional assessment.

Table 3-28, Waters of the U.S. - Ripsey Wash TSF Footprint

Classification	Acres	Functional Score(1)
Ephemeral Class 1	68.03	28
Ephemeral Class 1	45.90	24
Ephemeral Class 1	20.45	17

3.5.1.1.3 Wetlands

No seeps or springs were found at the Ripsey Wash TSF site. No isolated open water or vegetated wetlands occur within Ripsey Wash where the TSF is proposed. The only wetlands in the vicinity of the project consist of adjacent wetlands along the Gila River outside of the project footprint.

3.5.1.1.4 Compensatory Mitigation Sites

Five mitigation sites have been identified for potential use for compensatory mitigation. These sites and the activities planned for each site are discussed in **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**. A functional assessment was conducted at each of these sites as part of the process for calculating mitigation for the loss of waters of the U.S. See **Table 3-29, Summary of Functional Values for Each Mitigation Site**.

Table 3-29, Summary of Functional Values for Each Mitigation Site

Mitigation Site	Functional Score(1)
PZ Ranch Site A	36
PZ Ranch Site B	28
PZ Ranch Site C	32
PZ Ranch Site D	34
Site E (Preservation component)	48
Site E (Restoration Component)	37
Note: (1) Total functional scores ranges from 0 to 55 points (5 points maximum per function)	

3.5.1.2 Potential Waters of the U. S. - Hackberry Gulch TSF Site

No formal jurisdictional determination report has been made by the Corps for the Hackberry Gulch TSF site. Existing information and data along with some field verification were used to assess this site and estimate the extent of jurisdictional waters for the purpose of comparison with the Applicant's proposal (WestLand 2014e).

The field wetland delineations completed by WestLand followed approved Corps procedures (U. S. Army Corps of Engineers 1987, 2008). Other sources of information including data gathered during previous on-site surveys, U.S. Geological Survey topographic maps, and aerial photos were accessed to aid in the development of this analysis.

3.5.1.2.1 Perennial and Intermittent Waters

Field surveys indicate the presence of smaller drainages that have perennial or intermittent flows on the Hackberry Gulch TSF site. These areas are not part of a delineated wetland. **Table 3-30, Potential Waters of the U.S. - Hackberry Gulch TSF Footprint**, summarizes potential waters of the U.S. for the Hackberry Gulch TSF Alternative site.

Table 3-30, Potential Waters of the U.S. - Hackberry Gulch TSF Footprint

Classification	Acres	Functional Score$^{(1)}$
Ephemeral Class 1	0	NA
Ephemeral Class 2	49.86	22
Ephemeral Class 3	21.65	15
Perennial/Intermittent Class	1.65	17
Wetland Class	0.62	41

Note:

(1) Total functional scores ranges from 0 to 55 points (5 points maximum per function)

3.5.1.2.2 Ephemeral Waters

Within the alternative footprint, there are ephemeral drainages that would likely be considered waters of the U.S. These drainages were classified into the same three categories used for the Ripsey Wash TSF Alternative.

3.5.1.2.3 Wetlands

Five wetland areas (including one or more seeps at each wetland), two springs, and six small seeps that did not support wetland vegetation evaluated within the boundaries of the Hackberry Gulch TSF site. The five wetland areas exist at the Hackberry Gulch TSF site and exhibit seasonal or perennial surface water saturation and support wetland vegetation. See **Figure 43, Vegetation Map**.

Wetland A is located in an eastern tributary of Hackberry Gulch and exhibits wetland conditions approximately 300 feet down channel that support the wetland species of velvet ash and netleaf hackberry (*Celtis reticulata*).

Wetland B exhibits wetland conditions for approximately 3,800 feet in tributaries and the main channel of Belgravia Wash. Wetland B includes four identified seeps and supports narrow strands of riparian vegetation including Fremont cottonwood, Goodding's willow, southern cattail (*Typha domingensis*) and spikerush (*Eleocharis* sp.).

Wetlands C, D, and E are located near SR 177 west of the Hackberry Gulch TSF site in unnamed tributaries to Belgravia Wash. These smaller wetlands support variable stands of Fremont cottonwood, Goodding's willow, tamarisk and seepwillow.

Of the two springs found, one is located on the main channel of Hackberry Gulch and one is found in a tributary of Hackberry Gulch. Both springs support stands of Fremont cottonwood and tamarisk, but are not considered wetlands.

3.5.1.2.4 Compensatory Mitigation Sites

Potential mitigation sites for this alternative would be the same as described above for the Ripsey Wash TSF Alternative. See Section 3.5.1.1.4, Compensatory Mitigation Sites.

3.5.2 ENVIRONMENTAL CONSEQUENCES

3.5.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. Wetlands and other waters of the U.S. on site would retain their current form, functions, and values into the foreseeable future.

3.5.2.2 Effects Specific to the Ripsey Wash TSF Alternative

The Ripsey Wash TSF alternative would result in the direct disturbance of approximately 134.36 acres of jurisdictional ephemeral drainages that would be filled, excavated, dewatered, or subject to surficial disturbances resulting in the loss or significant modification of their form, functions and values. The functions and values of these resources, as described in **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**, would be completely lost from implementation of this alternative, while washes subject to dewatering effects would lose a portion of their functions and values. Some value would be retained as these washes would not be directly impacted by ground disturbing activities but would still provide smaller scale ecological function.

These impacts would be mitigated through the implementation of the compensatory mitigation plan, See **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**. In this plan, the applicant has identified five mitigation sites located along the lower San Pedro River near its confluence with the Gila River, and two sites along the Gila River that would provide compensatory mitigation for the loss of functions and values associated with the impacted ephemeral washes. Preservation and restoration of aquatic resources at these sites have been proposed to address mitigation. The mitigation requirements for this project were calculated using the Corps' South Pacific Division procedures for determining mitigation ratios for compensatory mitigation. Qualitative methods were used to assess the functions and values of the impacted ephemeral drainages and the compensatory mitigation sites. After mitigation ratios were applied to the proposed impacts, compensatory requirements were calculated. The proposed mitigation plan is expected to fully compensate for the loss of aquatic resources under this alternative based on a preliminary review by the Corps.

No effects are expected to waters of the U.S. as a result of the relocation of the Arizona Trail or from work in the areas proposed for waters of the U.S. mitigation because there is no work proposed in waters of the U.S. (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**). With the completion of the 404 mitigation work, there would be improvement to the waters of the U.S. in the mitigation areas.

3.5.2.3 Effects Specific to the Hackberry Gulch TSF Alternative

Implementation of Hackberry Gulch TSF alternative would result in the direct disturbance through filling, excavation, or various construction activities of approximately 71.50 acres of waters of the U.S. The waters of the U.S. within the disturbance footprint for this alternative include ephemeral drainages and wetlands for which their form, functions and values would be lost or significantly modified. The wetlands that would be impacted under this alternative are classified as "special aquatic sites" under the 404(b)(1) guidelines (40 CFR Part 230).

Per these guidelines (40 CFR 230.10[a][3]), there is a rebuttable presumption that practicable alternatives are presumed to have a less adverse impact on the aquatic ecosystem than alternatives that do impact special aquatic sites. This presumption is part of the consideration for determining the Least Environmentally Damaging Practicable Alterative (LEDPA), which the Corps must select for a permit. See **Appendix B, Alternative Screening and Clean Water Act Section 404(b)(1) Alternative Analysis.**

Impacts to aquatic resources under this alternative would be mitigated in a similar fashion as the Ripsey Wash TSF Alternative. Using the functions and values calculated for the aquatic resources that would be lost and the mitigation ratio-setting checklist required by the South Pacific Division, the Applicant would provide sufficient compensatory mitigation to fully mitigate for the loss of aquatic resources under this alternative. Potentially, the same five mitigation sites could be used to provide for mitigation under this Alternative, but a separate plan would have to be develop by the Applicant in consultation with the Corps.

No effects are expected to waters of the U.S. as a result of the work in the areas proposed for waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**). With the completion of the 404 mitigation work, there would be improvement to the waters of the U.S. in the mitigation areas.

3.6 GROUNDWATER HYDROLOGY

Identify any impacts to groundwater quality and hydrology within and surrounding the proposed TSF area. *The areas of concern include: (1) the potential to alter existing groundwater hydrologic systems by tailings disposal; (2) changes in alluvial and bedrock groundwater chemistry as a result of tailings disposal; and (3) any impacts on existing groundwater rights.*

3.6.1 AFFECTED ENVIRONMENT

Groundwater within the Ripsey Wash and Hackberry Gulch TSF sites occurs in both bedrock and in Quaternary sediments. The geology of these alternatives is discussed in Section 3.3, Geology and Geochemistry.

The regional bedrock has varying degrees of groundwater and its flow direction generally mirrors topography, from the mountains to the valley floors and then down-drainage. There can be preferential flow locally along fracture and fault systems in the bedrock. Fracture systems are influenced by structural episodes of faulting and folding, which have sheared, foliated or lineated the bedrock.

Quaternary sediments are found along the Gila River and many of its tributary watersheds. The unconsolidated Quaternary sediments are formed by a mixture of clays, silts, sands and gravels. These alluvial sediments are recharged by infiltration of precipitation, by flow losses from drainages, and by discharge from the bedrock groundwater systems. The regional surface and groundwater systems are interdependent, and, in general, groundwater contributes in some areas to the Gila River baseflow (gaining reach), while surface flow in the Gila River contributes to groundwater recharge (losing reach) in other areas. Seasonal variation in this interrelationship is common.

The Ripsey Wash and Hackberry Gulch TSF sites are located in the western portion of the Southeastern Arizona Groundwater Planning Area (Anderson, Greethy and Tucci, 1992). This Planning Area has fourteen groundwater basins, which are characterized by alluvial basins in gently sloping valleys separated by mountain ranges. The various basin locations are illustrated on **Figure 29, Groundwater Basins of the Southeastern Arizona Planning Area**.

Groundwater accounts for approximately 84% of the water supply demand in the Southeastern Arizona Groundwater Planning Area (ADWR, 2009).

3.6.1.1 Ripsey Wash TSF Site

The Ripsey Wash TSF site is located in the Donnelly Wash Groundwater Basin, which is a small 293 square mile basin in the northwestern portion of the Southeastern Arizona Groundwater Planning Area. See **Figure 29, Groundwater Basins of the Southeastern Arizona Planning Area**. There have been exceedances of drinking water standards in this basin for arsenic, fluoride and nitrates (ADWR, 2009).

The Gila River flows east to west through this basin and is drained by numerous washes, including Ripsey and Zelleweger washes. See Section 3.4, Surface Water. In general, groundwater flow follows surface water drainage patterns, flowing toward the Gila River. At the Ripsey Wash TSF site, the direction of groundwater movement is northward toward the Gila River, at a gradient of approximately 3.5 feet per 100 feet (or about 0.035 ft/ft). See **Figure 30, Groundwater Hydrology - Ripsey Wash TSF**.

Eleven monitoring wells and nineteen piezometers were used at the Ripsey Wash TSF site to evaluate the hydrogeological characteristics of the site and to monitor groundwater quantity and quality. See **Figure 30, Groundwater Hydrology - Ripsey Wash TSF.**

Monitoring well information, including depth to groundwater, is summarized in **Table 3-31, Monitoring Well Information – Ripsey Wash TSF Site**.

Table 3-31, Monitoring Well Information – Ripsey Wash TSF Site (1)(2)

Well ID	MW-1	MW-1A	MW-1B	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
Total Well Depth (ft)	200	80	172	72	265	141	161	250	345	180	70
Depth to Bedrock (ft)	18	71	71	0	85	8.5	8	90	20	30	64
Static Water Level (ft)(2)	89	56	62	44	154	32	65	96	97	80	Dry
Completion of Well	bedrock	alluvial	bedrock	bedrock	bedrock	bedrock	bedrock	bedrock	bedrock	bedrock	alluvial

Notes:

(1) See Figure 30, Groundwater Hydrology - Ripsey Wash TSF, for monitoring well locations.

(2) Static water levels measured in February 2014.

Information about the piezometers, including their specific purposes and depths to groundwater, is set forth in **Table 3-32, Piezometer Information – Ripsey Wash TSF Site**.

Table 3-32, Piezometer Information – Ripsey Wash TSF Site (1)(2)

Piezometer ID	Total Depth (ft)	Depth to Bedrock (ft)	Static Water Level (ft)	Purpose of Piezometer
P-1	127	50	Dry	Investigate the hydrogeological conditions along the alignment of the proposed seepage collection trench in Ripsey Wash.
P-2	136	44	49	Same as P-1.
P-3	122	27	N/A	Same as P-1.
P-4	142	104	Dry	Same as P-1.
P-5	142	93	Dry	Same as P-1.
P-6	127	54	Dry	Same as P-1.
P-7	81	12	44	Same as P-1.
P-8	100	97	90	Same as P-1.
P-9	178	2	140	Investigate the thickness of the Tertiary deposits along the west side of the proposed Ripsey Wash TSF and to characterize conditions along the Hackberry Fault.
P-10	168	37	113	Same as P-9.
P-11	79	14	18	Investigate the hydrogeological conditions at the proposed cut off wall in the East Wash drainage.
P-12	79	21	24	Same as P-11.
P-13	180	14	139	Same as P-9.
P-14	94	19	66	Same as P-9.
P-15	179	35	69	Same as P-9.
P-16	199	5	NM	Characterize subsurface conditions along the Ripsey Fault trend.
P-17	99	5	NO	Same as P-16.
P-18	64	16	NO	Same as P-11.
P-19	80	10	NM	Same as P-11.

Notes:

(1) See Figure 30, Groundwater Hydrology - Ripsey Wash TSF, for piezometer locations.

(2) Static water levels measured in February 2014 for all piezometers except P-14 and P-15, which were measured in March 2014.

(3) Abbreviations:

N/A = not applicable

NM = not measured

NO = not observed

3.6.1.1.1 Bedrock Hydrogeology and Groundwater Quality at Ripsey Wash TSF Site

Groundwater was encountered in all of the bedrock monitoring wells and most of the piezometer wells at the Ripsey Wash TSF site (AMEC, 2014).

Pump tests[23] were conducted in bedrock wells (except MW-1B and MW-2), and these tests revealed low groundwater yields, at rates averaging 0.25 to 3.6 gallons per minute (gpm). See **Table 3-33, Pump Test Results - Ripsey Wash TSF**. MW-1B and MW-2 were not tested because of extremely low yields from these wells (<0.005 gpm). Due to the limited yields from the tested wells, the pumping portion of the tests ranged from one to four hours, at which time the wells were pumped dry.

[23] Step-discharge and/or constant-rate discharge, single well pumping tests were performed (AMEC 2014).

Table 3-33, Pump Test Results - Ripsey Wash TSF (1)

Well ID(2)	Bedrock Unit	Average Pump Rate (gpm)	Hydraulic Conductivity(3) (cm/s)	Transmissivity(4) (gpd/ft)
MW-1	Ruin Granite	1.5	1.37×10^{-5}	12.6
MW-3	Lower Member of San Manuel and Ruin Granite	3.6	1.33×10^{-4}	138.5
MW-4	Upper Member of San Manuel	0.25	6.72×10^{-7}	1.7
MW-5	Ruin Granite	1.2	3.02×10^{-6}	5.7
MW-6	Upper Member of San Manuel	1.8	1.19×10^{-6}	6.4
MW-7	Ruin Granite	1.5	1.98×10^{-6}	6.7
MW-8	Lower Member of San Manuel	1.4	3.50×10^{-6}	7.2

Notes:

(1) Source: AMEC 2014

(2) See Figure 30, Groundwater Hydrology - Ripsey Wash TSF, for monitoring well locations.

(3) Hydraulic conductivity is the ease with which water can move through rock pore spaces and fractures, and depends on the permeability of the material and the amount of saturation.

(4) Transmissivity is the rate at which water is transmitted through rock under a unit hydraulic gradient, which is approximately 3.5 ft per 100 ft (or 0.035 ft/ft) for the Ripsey Wash TSF site.

(5) Abbreviations:

gpm = gallons per minute

cm/s = centimeters per second

gpd/ft = gallons per day per foot

The pumping test results for the bedrock wells were relatively consistent, with the exception of the results for MW-3, which was advanced through the Hackberry Fault zone. As explained in Section 3.3, Geology and Geochemistry, this fault zone underlies the western portion of the Ripsey Wash TSF and occurs along the contact between the Lower Member of the San Manuel Formation and the Ruin Granite.

Packer tests were conducted in borings within and surrounding the Ripsey Wash TSF site to obtain hydraulic conductivity values for the bedrock. The tests revealed relatively low hydraulic conductivity values in the overall (non-fractured) bedrock. See **Table 3-34, Hydraulic Conductivities of Bedrock Units - Ripsey Wash TSF Site**.

Table 3-34, Hydraulic Conductivities of Bedrock Units - Ripsey Wash TSF Site(1)(2)

Bedrock Unit	Hydraulic Conductivity (cm/sec)		
	Maximum	Minimum	Average
Ruin granite	8.49×10^{-5}	5.06×10^{-7}	1.10×10^{-5}
Diabase	6.06×10^{-7}	1.01×10^{-7}	3.45×10^{-5}
Lower Member San Manuel	3.87×10^{-4}	2.20×10^{-7}	3.60×10^{-5}
Upper Member San Manuel	1.06×10^{-6}	1.21×10^{-7}	6.06×10^{-7}

Notes:
Source: AMEC 2014.
These hydraulic conductivity values represent (non-fractured) bedrock and do not include values for Hackberry Fault zone.
Abbreviation:
cm/s = centimeters per second

Based on packer tests in piezometers P-9, P-13, P-14 and P-15, the Hackberry Fault zone has greater permeability values than the overall bedrock. See **Table 3-35, Hydraulic Conductivities of the Hackberry Fault Zone - Ripsey Wash TSF Site.** This fault zone provides a preferential pathway for groundwater movement through bedrock.

Table 3-35, Hydraulic Conductivities of the Hackberry Fault Zone - Ripsey Wash TSF Site

Bedrock Unit	Hackberry Fault Hydraulic Conductivity (cm/sec)		
	Maximum	Minimum	Average
Ruin Granite	1.6 x 10^{-4}	1.6 x 10^{-4}	4.77 x 10^{-5}
Lower Member San Manuel	4.23 x 10^{-4}	5.83 x 10^{-6}	3.94 x 10-4
Notes: Source: AMEC 2014			

Based on packer tests in piezometers P-16 and P-17, the Ripsey Fault zone, which underlies the eastern portion of the Ripsey Wash TSF site, has hydraulic conductivity values similar to those of the overall non-fractured bedrock. See **Table 3-36, Hydraulic Conductivities of the Ripsey Fault Zone - Ripsey Wash TSF Site**. These values indicate that the Ripsey Fault zone does not act as a preferential pathway for groundwater movement.

Table 3-36, Hydraulic Conductivities of the Ripsey Fault Zone - Ripsey Wash TSF Site

Bedrock Unit	Ripsey Fault Hydraulic Conductivity (cm/sec)		
	Maximum	Minimum	Average
Ruin Granite	8.5 x 10^{-5}	1.9 x 10^{-6}	1.2 x 10^{-5}

The bedrock underlying the Ripsey Wash TSF site is recharged by infiltration of precipitation, which is estimated to be 5 to 15% of annual precipitation. Infiltration from local washes contributes to recharge, but all washes in the Ripsey Wash TSF site are ephemeral, so infiltration is seasonal. Bedrock water is mostly under unconfined conditions and, as explained previously, can be affected by fault zones, in particular the Hackberry Fault zone.

Groundwater quality data from MW-1B though MW-8 at the Ripsey Wash TSF site are presented in **Table 3-37, Groundwater Quality - Ripsey Wash TSF Site**.

Table 3-37, Groundwater Quality - Ripsey Wash TSF Site

Analyte(1)	MW-1A	MW-1B	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	AAWQS(5)
Field Measurements(2)										
pH	7.1	8.0	7.6	6.2	6.8	6.5	7.2	6.6	7.4	---
Electrical Conductivity	2730	1648	2772	1530	1030	1150	780	2880	590	---
Temperature	76.3	77.4	77.4	84.2	79.6	87.3	90.9	85.6	89.7	---
General Inorganics(3)										
Alkalinity as $CaCO_3$	260	50	200	180	230	280	230	90	170	---
Biocarbonate Alkalinity as $CaCO_3$	260	50	200	180	230	280	230	90	160	---
Carbonate Alkalinity as $CaCO_3$	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	10	---
Hydroxide Alkalinity as $CaCO_3$	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	---
Calcium	260	79	77	180	87	130	94	270	13	---
Chloride	260	120	140	180	30	120	40	69	35	---
Fluoride	1.7	2.2	4.6	1.5	1.3	1.7	1.1	2.6	6.3	4
Magnesium	36	8.8	12	29	45	27	2.2	130	7.5	---

Analyte[1]	MW-1A	MW-1B	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	AAWQS[5]
Nitrate as N	0.55	<0.2	0.3	11	2.9	0.84	<0.2	0.50	0.46	10
Nitrite as N	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.80	<0.2	1
Nitrate-Nitrite as N	0.55	<0.2	<0.2	11	2.9	0.84	<0.40	1.3	0.46	10
Potassium	2.8	4.9	11	3.5	<2.0	15	3.2	10	5.2	---
Sodium	330	300	500	66	54	76	140	240	110	---
Sulfate	930	670	1000	340	240	150	57	1900	24	---
Total Dissolved Solids	2100	1200	1900	1000	610	650	480	2800	420	---
Dissolved Metals[3]										
Antimony	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.006
Arsenic	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.005	0.05
Barium	0.024	0.032	0.05	0.013	<0.01	0.14	<0.01	0.096	<0.01	2
Beryllium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.016	0.012	0.1
Cobalt	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	---
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---
Lead	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.05
Manganese	0.012	0.082	0.021	0.044	0.085	0.89	0.13	0.41	0.021	---
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.002
Nickel	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.1
Selenium	<0.002	<0.002	0.0022	0.0085	0.0036	<0.004	<0.004	0.0024	<0.002	0.05
Thallium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
Zinc	<0.05	<0.05	<0.05	<0.05	0.34	0.064	0.053	0.93	<0.05	---
Radiochemicals[4]										
Gross Alpha	2.6±7.7	<0.4	0.7±0.2	<1.0	<1.0	0.8±2.2	<1.0	<1.0	<1.0	5
Radium 226 + Radium 228	<0.7	0.8±0.3	1.6±0.3	<0.4	<0.5	1.8±0.5	<0.7	0.7±0.1	<0.5	15
Total Uranium	87.8±3.3	62.0±2.0	57.1±1.9	33.5±1.5	18.0±1.0	17.2±1.0	35.1±1.5	320.2±6.2	58.3±3.7	---

Notes:

(1) Parameters are same as required by Arizona DEQ under existing Ray Mine Consolidated Aquifer Plan (APP) permit.
(2) The pH, electrical conductivity (EC) and temperature were measured at the time of collection. The pH in standard units (s.u.); EC in microsiemens per centimeter (us/cm); and temperature in degrees Fahrenheit (^{o}F).
(3) General inorganics and dissolved metals reported in milligrams per liter (mg/l).
(4) Radiochemicals reported in picoCuries per liter (pCi/l).
(5) AAWQS are Arizona Aquifer Water Quality Standards set by Arizona DEQ.
(6) Samples taken on February 26, 2014 and analyzed by Test America, Inc.

Field analyses indicate that groundwater sampled from the bedrock wells are near neutral, with pH values ranging from 6.2 to nearly 8.0 and electrical conductivities ranging from 780 to 2880 microsiemens per centimeter (µs/com). Groundwater temperatures in these wells were warm and ranged from 76.3^{o}F to 90.9^{o}F.

Total dissolved solids (TDS) levels in the bedrock ranged from 420 to 2800 mg/l, and dissolved trace metal concentrations were mostly near or below analytical detection limits. Similar to other reported groundwater analyses for the Donnelly Wash Groundwater Basin (ADWR 2009), there were exceedances of Arizona Aquifer Water Quality Standards (AAWQS) for fluoride (MW-2 and MW-8) and for nitrate (MW-3).

Analysis of gross alpha and Radium 226+Radium 228 showed that background radioactivity of Ripsey Wash TSF groundwater is below AAWQS and near detection limits.

3.6.1.1.2 Alluvial Hydrogeology and Groundwater Quality at Ripsey Wash TSF

Alluvial groundwater is found in the Quaternary sediments along the Gila River and in the alluvial sediments in Ripsey Wash, near the contact between the alluvial material and the underlying bedrock. No groundwater was found in the alluvial sediments in either the East Wash or Zelleweger Wash (AMEC, 2014).

Based on geotechnical and hydrogeological drilling at the site, the thickness of the alluvial deposits in Ripsey Wash reach approximately 100 feet, while the thickness of alluvial deposits in the East Wash reach approximately 21 feet.

Depths to groundwater in MW-1A and P-8, which are located in Ripsey Wash, are set forth in **Table 3-31, Monitoring Well Information – Ripsey Wash TSF Site**, and **Table 3-32, Piezometer Information – Ripsey Wash TSF Site**. Saturated thicknesses in these wells were less than 20 feet. Monitoring well MW-9, located in Zelleweger Wash, is dry. The pump test on MW-1A revealed high average hydraulic conductivity for the alluvial sediments in Ripsey Wash at 4.6 x 10^{-2} cm/sec, with an estimated transmissivity of 14,744 gpd/ft (AMEC, 2014).

The alluvial sediments in the Gila River and tributary washes are recharged by precipitation, direct infiltration from flows in the drainages, and inflow from bedrock groundwater. Groundwater flow in the alluvial sediments follows the local topography.

Groundwater quality data for alluvial well MW-1A are presented in **Table 3-37, Groundwater Quality - Ripsey Wash TSF Site**. No parameters exceeded AWQS in the analyses of water from MW-1A, and groundwater analyses for water from this well are similar to those analyses for bedrock groundwater.

3.6.1.1.3 Existing Groundwater Wells at Ripsey Wash TSF Site

Based on ADWR data, there are 39 registered wells located within 0.5 miles of the Ripsey Wash TSF and supporting infrastructure (site roads, diversion structures, pipelines, drain-down pond, seepage trenches, reclaim ponds, etc.). See **Table 3-38, Registered Wells within 0.5 Miles of Ripsey Wash TSF Site**.

Table 3-38, Registered Wells within 0.5 Miles of Ripsey Wash TSF Site

Well Number	ADWR Registry ID	Well Owner	Well Type	Well Depth	Well Location
RW-1	220883	Asarco	Monitor	NR	Down-gradient of TSF
RW-2	220887	Asarco	Monitor	NR	TSF Footprint
RW-3	220891	Asarco	Monitor	NR	Down-gradient of TSF
RW-4	902827	Asarco	Geotechnical	NR	TSF Footprint
RW-5	914144	Asarco	Exploration	1000	Down-gradient of TSF
RW-6	914632	Asarco	Monitor	NR	Down-gradient of TSF
RW-7	914664	Asarco	Monitor	NR	TSF Footprint
RW-8	914665	Asarco	Monitor	NR	TSF Footprint
FW-9	914474	Asarco	Monitor	127	Down-gradient of TSF
RW-10	914475	Asarco	Monitor	138	Down-gradient of TSF
RW-11	914476	Asarco	Monitor	122	Down-gradient of TSF
RW-12	914479	Asarco	Monitor	127	Down-gradient of TSF
RW-13	914481	Asarco	Monitor	70	Down-gradient of TSF
RW-14	220884	Asarco	Monitor	NR	Down-gradient of TSF
RW-15	220885	Asarco	Monitor	NR	TSF Footprint
RW-16	220886	Asarco	Monitor	NR	TSF Footprint

Well Number	ADWR Registry ID	Well Owner	Well Type	Well Depth	Well Location
RW-17	220888	Asarco	Monitor	NR	TSF Footprint
RW-18	220889	Asarco	Monitor	NR	TSF Footprint
RW-19	220890	Asarco	Monitor	NR	Up-gradient of TSF
RW-20	220892	Asarco	Monitor	NR	TSF Footprint
RW-21	615335	ASLD	Exempt	37	TSF Footprint
RW-22	807260	ASLD	Exempt	NR	Down-gradient of TSF
RW-23	807261	ASLD	Exempt	NR	Down-gradient of TSF
RW-24	914663	Asarco	Monitor	NR	TSF Footprint
RW-25	914666	Asarco	Monitor	NR	Down-gradient of TSF
RW-26	914667	Asarco	Monitor	NR	Down-gradient of TSF
RW-27	914696	Asarco	Monitor	NR	TSF Footprint
RW-28	914447	Asarco	Monitor	122	TSF Footprint
RW-29	914478	Asarco	Monitor	142	Down-gradient of TSF
RW-30	914480	Asarco	Monitor	100	Down-gradient of TSF
RW-31	500041	Asarco	Exempt	250	Near tailings pipeline
RW-32	518060	Asarco	Exploration	675	Near tailings pipeline
RW-33	521218	Asarco	Exploration	20	Near tailings pipeline
RW-34	524869	Asarco	Exploration	NR	Near tailings pipeline
RW-35	617421	Asarco	Exempt	NR	Near tailings pipeline
RW-36	807138	Asarco	Exploration	102	Near tailings pipeline
RW-37	645330	Hunt	Exempt	32	Near drain-down pond
RW-38	645887	Morrow	Exempt	65	Down-gradient of TSF (A-Diamond Ranch)
RW-39	593519	Bradford	Exempt	57	Down-gradient of TSF (A-Diamond Ranch)

Notes:

(1) Source: Arizona Department of Water Resources (ADWR) (2014).

(2) Abbreviations: NR= not reported.

Thirty three of these wells have been installed and are owned by ASARCO; these wells were installed as part of Asarco's geological, geotechnical, and hydrogeological work for the Ripsey Wash TSF. The remaining six (non-Asarco) wells are classified as "exempt" by ADWR, which allows for domestic and/or livestock use of the groundwater.[24]

The six (non-Asarco) wells are as follows:

- Well RW-21 (ADWR Registration No. 615335) – located within the footprint of the Ripsey Wash TSF. The well is owned by the ASLD and is 37 feet deep.
- Well RW-22 (ADWR Registration No. 807260) – located down-gradient of the Ripsey Wash TSF on the north side of the Florence-Kelvin highway. The well is also owned by the ASLD, was drilled in 1976, but its depth is not reported. A field survey revealed the well is abandoned (WestLand, 2014a).
- Well RW-23 (ADWR Registration No. 807261) – located down-gradient from the Ripsey Wash TSF on the south side of Florence-Kelvin highway. The well is also owned by ASLD, was drilled in 1976, but its depth is not reported. The well is active, supplying water to a holding tank and watering trough (WestLand, 2014a).

[24] The "exempt" category allows for a maximum pumping rate of 35 gpm.

- Well RW-37 (AWDR Registration No. 645330) – located north of the Gila River and east of the proposed drain-down pond. The well is privately-owned, was drilled in 1971, and is 32 feet deep.
- Well RW-38 (ADWR Registration No. 645887) – located on the A-Diamond Ranch. It is privately-owned, was drilled in the early 1980s, and is 65 feet deep.
- Well RW-39 (ADWR Registration No. 593519) – located on the A-Diamond Ranch. It is privately-owned, was drilled in 2002, and is 57 feet deep.

If the State lands in and around the Ripsey Wash TSF site are sold by auction to Asarco, the above-listed ASLD wells would be transferred to Asarco. Similarly, Asarco has an option on the A-Diamond Ranch, and these wells would be transferred to Asarco, if the option is exercised. The remaining non-Asarco well is located on the north side of the Gila River, approximately 0.4 miles upstream and up-gradient from the proposed drain-down pond.

3.6.1.2 Hackberry Gulch TSF Site

The Hackberry Gulch TSF site is located in the northern portion of the Lower San Pedro Groundwater Basin, which is a 1,624 square mile basin on the western side of the Southeastern Arizona Groundwater Planning Area. See **Figure 29, Groundwater Basins of the Southeastern Arizona Planning Area**.

The San Pedro River flows northward in this basin and joins the Gila River in the vicinity of the community of Winkleman. From that confluence, the Gila River flows northward. In general, similar to the Donnelly Wash Basin (and other basins in the Southeastern Groundwater Planning Area), groundwater flow follows surface water drainage patterns, flowing toward the San Pedro River, and then to the Gila River. There have been some exceedances of drinking water standards in this basin for arsenic, antimony, beryllium, cadmium, lead, nitrates, radionuclides, and total dissolved solids (ADWR, 2009).

3.6.1.2.1 Bedrock Hydrogeology and Groundwater Quality at Hackberry Gulch TSF Site

Groundwater occurs in the conglomerate and tuff members of the Big Dome Formation at depths ranging from a few feet in incised gulches to several hundred feet in upland areas.

The conglomerate units appear to be hydraulically confined, with artesian heads approximately 40 feet above the top of the water bearing units (SHB, 1989). The artesian pressures signify that the conglomerate or tuff units are recharged from higher elevations of the Dripping Spring Formation and that their vertical hydraulic conductivities are lower than their horizontal hydraulic conductivities.

Similar to the Ripsey Wash TSF site, groundwater in the bedrock at the Hackberry Gulch TSF site is recharged by infiltration. Although bedrock groundwater movement is influenced by localized fault and fracture systems that are perpendicular to the topography at the Hackberry Gulch TSF site, the overall regional groundwater flow direction is toward the Gila River.

The hydraulic gradient for the Hackberry Gulch TSF site is projected to be 8 feet per 100 feet (or 0.08 ft/ft), which is the pre-construction hydraulic gradient estimated for the adjacent (and existing) Elder Gulch TSF that has similar geology to the Hackberry Gulch TSF site.

Hydraulic conductivities of the Big Dome Formation conglomerates were determined from past packer testing in the vicinity of the Elder Gulch TSF (SHB, 1989). They range from 4.6×10^{-4} cm/sec to 5.5×10^{-6} cm/sec, and average approximately 2.5×10^{-5} cm/sec. These values are similar to the bedrock hydraulic conductivities at the Ripsey Wash TSF site.

Background water quality data were obtained from five USGS wells located down-gradient from the Hackberry Gulch TSF site, as shown on **Figure 31, Groundwater Hydrology - Hackberry Gulch TSF**. Groundwater quality data for these are presented in **Table 3-39, Groundwater Quality - Hackberry TSF Site**.

Table 3-39, Groundwater Quality - Hackberry TSF Site

Analyte	USGS-AZ D-04-1416CBB 1985(2)	USGS-AZ D-04-1416CBC 1990(2)	USGS-AZ D-04-1407ABC 1952-65(2)	USGS-AZ D-04-1407BBB 1990(2)	USGS-AZ D-04-1406CDC 1985(2)	AAWQS(3)
Field Measurements(4)						
pH	7.5	8.8	7.4	7.2	7.2	---
Electric Conductivity	516	950	4017	4330	3310	---
Temperature	81.5	84.2	77.7	73.4	69.8	---
General Inorganics(5)						
Alkalinity as $CaCO_3$	205	210	349	312	295	---
Total Hardness	158	14.9	901	1360	890	---
Calcium	35	4.1	204	330	240	---
Chloride	20	82	879	900	560	---
Fluoride	0.4	0.3	1.9	0.6	1.2	4
Magnesium	17	1.1	71	130	70	---
Nitrate as N	NA	NA	1.7	NA	NA	10
Potassium	5.6	2.1	NA	5.5	7.4	---
Sodium	42	190	453	460	340	---
Sulfate	17	130	386	830	610	---
Total Dissolved Solids	154	283	1137	1462	1051	---
Dissolved Metals(5)						
Arsenic	0.001	0.002	NA	0.001	0.004	0.05
Barium	0.22	0.021	NA	ND	0.071	2
Beryllium	ND	ND	NA	ND	ND	0.004
Cadmium	ND	ND	NA	ND	ND	0.005
Cobalt	ND	ND	NA	0.001	ND	---
Copper	0.01	0.001	NA	0.001	0.02	---
Lead	ND	0.001	NA	ND	ND	0.05
Manganese	0.013	0.002	NA	0.01	0.031	---
Molybdenum	ND	0.006	NA	0.007	0.01	---
Zinc	190	7	NA	10	20	---

Notes:

(1) Source: National Water Quality Monitoring Council, Water Quality Portal. This is a cooperative service sponsored by the USGS, EPA and the National Water Quality Monitoring Council (NWQMC). www.waterqualitydata.us. The database did not identify well depths or completion details. See Figure 31, Groundwater Hydrology - Hackberry Gulch TSF.

(2) Year(s) sampled.

(3) AAWQS are Arizona Aquifer Water Quality Standards set by Arizona DEQ.

(4) The pH, electrical conductivity (EC) and temperature were measured at the time of collection. The pH in standard units (s.u.); EC in microsiemens per centimeter (us/cm); and temperature in degrees Fahrenheit (^oF).

(5) General inorganics and dissolved metals reported in milligrams per liter (mg/l).

(6) Abbreviations:

- NA = not analyzed
- ND = not detected. Detection limit not reported in database.

3.6.1.2.2 Alluvial Hydrogeology and Groundwater Quality at Hackberry Gulch TSF

Similar to the Ripsey Wash TSF site, alluvial groundwater is found in the Quaternary sediments along the Gila River. Given the small areal extent and limited thicknesses of alluvial sediments within the Hackberry Gulch TSF site, it is expected that the volume of water contained in these sediments is low. The direction of flow in these deposits follows surface topography. Hydraulic conductivities of the Quaternary deposits typically range between 1 x 10^{-3} and 1 x 10^{-5} cm/sec (Freeze and Cherry, 1979).

3.6.1.2.3 Existing Groundwater Wells at Hackberry Gulch TSF Site

Based on ADWR data, there are 42 registered wells located within 0.5 miles of the Hackberry Gulch TSF and supporting infrastructure (site roads, diversion structures, pipelines, seepage trenches, reclaim ponds, etc.). See **Table 3-40, Registered Wells within 0.5 Miles of Hackberry Gulch TSF Site**.

Table 3-40, Registered Wells within 0.5 Miles of Hackberry Gulch TSF Site

Well Number	ADWR Registry ID	Well Owner	Well Type	Well Depth	Well Location
HW-1	529319	Southwest Gas Corp	Exploration	105	Down-gradient of TSF
HW-2	627462	Sanchez	Exempt	60	TSF Footprint
HW-3	641992	Guilliams	Exempt	54	TSF Footprint
HW-4	642519	Wixom	Exempt	65	Down-gradient of TSF
HW-5	645205	Taylor	Exempt	52	TSF Footprint
HW-6	803149	McNees	Exempt	60	TSF Footprint
HW-7	647746	Hoyt	Exempt	35	Down-gradient of TSF
HW-8	646209	Henley	Exempt	55	Down-gradient of TSF
HW-9	646210	Payton	Exempt	56	Down-gradient of TSF
HW-10	649441	London	Exempt	52	TSF Footprint
HW-11	646286	Leyba	Exempt	40	Down-gradient of TSF
HW-12	648733	Hatfield	Exempt	32	TSF Footprint
HW-13	646769	Fraley	Exempt	35	Down-gradient of TSF
HW-14	646770	Baca	Exempt	47	Down-gradient of TSF
HW-15	649234	Hayes	Exempt	32	TSF Footprint
HW-16	646462	Sisemore	Exempt	230	TSF Footprint
HW-17	809560	Pfahl	Exempt	420	Down-gradient of TSF
HW-18	809596	Stein	Exempt	85	Down-gradient of TSF
HW-19	526274	Asarco	Exploration	NR	Down-gradient of TSF
HW-20	527945	Asarco	Exploration	NR	Down-gradient of TSF
HW-21	529600	Asarco	Monitor	NR	Down-gradient of TSF
HW-22	529601	Asarco	Monitor	NR	Down-gradient of TSF
HW-23	529602	Asarco	Monitor	NR	TSF Footprint
HW-24	531832	Asarco	Monitor	300	Down-gradient of TSF
HW-25	533677	Asarco	Monitor	160	Down-gradient of TSF
HW-26	533678	Asarco	Monitor	200	TSF Footprint
HW-27	535160	Asarco	Monitor	NR	Down-gradient of TSF
HW-28	534346	Asarco	Monitor	205	TSF Footprint
HW-29	549782	Asarco	Monitor	83	TSF Footprint
HW-30	549783	Asarco	Monitor	23	TSF Footprint
HW-31	915124	Asarco	Monitor	300	Down-gradient of TSF
HW-32	915125	Asarco	Monitor	258	Down-gradient of TSF
HW-33	915126	Asarco	Monitor	40	TSF Footprint
HW-34	915365	Asarco	Monitor	NR	TSF Footprint
HW-35	915366	Asarco	Monitor	NR	TSF Footprint
HW-36	915367	Asarco	Monitor	NR	TSF Footprint

Well Number	ADWR Registry ID	Well Owner	Well Type	Well Depth	Well Location
HW-37	915368	Asarco	Monitor	NR	TSF Footprint
HW-38	219671	Morris Land & Cattle	Exempt	500	TSF Footprint
HW-39	540818	Tucker	Exempt	320	Down-gradient of TSF
HW-40	543984	Weeks	Exempt	365	Down-gradient of TSF
HW-41	549930	O'Hara	Exempt	360	Down-gradient of TSF
HW-42	637740	Santos Ranch	Exempt	565	Down-gradient of TSF

Notes:
(1) Source: Arizona Department of Water Resources (ADWR) (2014).
(2) Abbreviations: NR= not reported.

Nineteen of these wells have been installed and are owned by ASARCO; these wells were installed for geological and monitoring. Twenty-two of the remaining (non-Asarco) wells are classified as "exempt" by ADWR, which allows for domestic and/or livestock use of the groundwater. One well is registered to Southwest Gas Company and registered for exploration.

Of the twenty three wells not owned by Asarco, nine are located within or immediately adjacent to the footprint of the Hackberry Gulch TSF and fourteen are located down-gradient of the Hackberry Gulch TSF. Of the down-gradient wells, seven are completed in Gila River Quaternary deposits, and seven are completed in bedrock.

3.6.2 ENVIRONMENTAL CONSEQUENCES

3.6.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. Ranch management activities (livestock grazing) and dispersed recreation would continue in the area of the proposed TSF sites, but these activities would not have any significant effect on groundwater.

3.6.2.2 Effects of the Ripsey Wash TSF Alternative

3.6.2.2.1 Potential Impacts to Groundwater Hydrology

The Ripsey Wash TSF is essentially a "valley-fill" facility where most of the tailings would be contained in the basin (or valley) that is the lower watershed of Ripsey Wash. For this type of facility, the controls and containment for groundwater (predominantly alluvial groundwater) can be concentrated in the seepage trench within Ripsey Wash immediately down-gradient of the tailings impoundment. This "valley-fill" nature of the Ripsey Wash lessens the number of control and containment points for groundwater seepage from the tailings facility.

Construction and operation of the Ripsey Wash TSF would decrease and eventually eliminate recharge to the Quaternary deposits within the TSF. The down-gradient seepage trenches in Ripsey Wash and the East Wash would be designed and constructed to capture groundwater movement through the Quaternary deposits beneath the TSF, and this water would be returned to the Ray Concentrator for reuse. This activity would eliminate recharge to the Gila River alluvium from the two aforementioned washes. The loss of recharge would be proportional to the surface area covered by the TSF as compared to the watershed area of the Gila River up-drainage of its confluence with Zelleweger Wash. At this location, the loss of potential recharge to the Gila River Quaternary deposits would be less than 0.02% of Gila River basin recharge.

Shallow groundwater flows in the Quaternary alluvium from undisturbed areas up-gradient of the TSFs are limited but would be intercepted by detention dams that would be excavated through Quaternary deposits and keyed into bedrock. Intercepted groundwater would comingle with stormwater runoff, which would be routed around the TSF and released into ephemeral washes adjacent to the tailings facilities. Much of this diverted water would probably re-infiltrate into the alluvial deposits in the wash where it is released.

Bedrock groundwater recharge from the TSF would be limited, given the relatively low hydraulic conductivities of bedrock. Once tailings encompass the full footprint of the TSF, infiltration into the underlying alluvium and bedrock would be further reduced because the tailings themselves have low permeability, and some water would be entrapped within the tailings (Hutchison and Ellison, 1992). In addition, upon closure, when no more tailings are being pumped to the TSF, any remaining water on the surface of the tailings facility or precipitation that falls onto the tailings surface would be subjected to the high evaporation rates that occur in the semi-arid climate that exists in this part of Arizona.

No effects are expected to the groundwater hydrology of the area as a result of the relocation of the Arizona Trail or from work in the areas proposed for waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**). The trail construction and mitigation activities do not require any well construction or direct groundwater use and will not result in any discharges that would affect groundwater resources.

3.6.2.2.2 Potential Impacts to Groundwater Quality

The potential for degradation of groundwater quality from tailings leachate or tailings dam construction materials would be low, for two reasons.

First, the meteoric water mobility testing on both tailings and alluvium material revealed that the probability for dissolution and mobilization of leaching minerals from these materials is low. Test results were compared to the tailings decant water quality and it was determined that the results are similar. See **Table 3-13, Tailings Water Analyses**, and **Table 3-15, Meteoric Water Mobility Procedure Results for Tailings**. Moreover, analytical results show that the existing tailings water quality and simulated leachate water quality comply with the Arizona Aquifer Water Quality Standards (AAWQS). In addition, no acid generation from tailings or alluvium materials is expected based on kinetic testing discussed in Section 3.3.4, Geochemistry. See **Table 3-17, Weekly Humidity Cell Test (HCT) Results for Tailings and Alluvium Materials**, and **Table 3-18, Dissolved Metals Humidity Cell Test (HCT) Results for Tailings and Alluvium Materials**.

Second, groundwater modeling (AMEC 2014) showed alluvial groundwater movement through Quaternary deposits beneath the footprint of the Ripsey Wash TSF, but this seepage would be intercepted and captured by down-drainage seepage trenches in Ripsey Wash and East Wash and routed to a lined reclaim pond, where the water would be pumped back to the tailings impoundment or to the Ray Concentrator for reuse. These controls would prevent any water quality impacts to the Gila River. Similarly, with safeguards in place as described in Section 2.3.2.7, Hackberry Fault Seepage Mititgation, there should be negligible groundwater seepage through or along the Hackberry Fault, and into Zelleweger Wash (AMEC 2014).

Under the terms and conditions of an APP permit and Surface Water Pollution Prevention Plan (SWPPP) developed under the AZPDES permit, a TSF would be operated as zero surface water discharge facility, with any direct precipitation and runoff captured in the tailings impoundment being pumped back to the Ray Concentrator for reuse. Although some of the direct precipitation falling within the tailings impoundment footprint, along with some water in the tailings decant ponds, would infiltrate into underlying alluvium material, seepage through the tailings embankment would be captured by down-drainage seepage trenches and routed to lined reclaim ponds, where the water would be pumped back to the tailings impoundment or to the Ray Concentrator for reuse. These controls would prevent any water quality impacts to the Gila River.

An accidental spill from a tailings pipeline rupture or from a fueling accident involving diesel fuel is unlikely, but they could cause temporary and local groundwater contamination at the site of the spill. The impacts would likely be minor and short-term given the control and countermeasures that would be implemented as per the site's SPCC plan and contingency plans required by the Arizona DEQ as part of the APP permit. Additional discussion of accidental spills and possible impacts are discussed in Section 3.16, Accidents and Spills.

The APP permit for the Ripsey Wash TSF Site would require compliance monitoring along the groundwater compliance boundary down-gradient of the TSF. As shown on **Figure 30, Groundwater Hydrology - Ripsey Wash TSF**, compliance wells MW-1A, MW-1B, MW-2, and MW-3 would be monitored for water levels and groundwater quality in accordance with the APP permit. Should a performance standard be exceeded, mitigation measures prescribed in the APP permit would be implemented.

3.6.2.2.3 Potential Impacts to Groundwater Rights

Existing groundwater wells located within the disturbance footprint of the proposed TSF footprint would be directly impacted. Existing shallow groundwater wells located in the Quaternary deposits immediately down-gradient of the TSF sites might be impacted by construction and operation of the tailings facilities due to potential loss of yield. Down-gradient bedrock wells are not expected to be impacted.

As set forth in Section 3.6.1.1.3, Existing Groundwater Wells at Ripsey Wash TSF, there are 39 wells within 0.5 miles of the Ripsey Wash TSF (see **Table 3-38, Registered Wells within 0.5 Miles of Ripsey Wash TSF Site**) and these wells are segregated as follows:

- Within Ripsey Wash TSF Footprint: 13
- Up-Gradient of Ripsey Wash TSF Footprint: 1
- Down-Gradient of Ripsey Wash TSF: 18
- Near Tailings Pipeline: 7

Thirty three of the 39 wells were installed by Asarco for exploration (condemnation drilling), geotechnical or hydrologic monitoring purposes. With the exception of one well, Asarco would control these wells once the State lands are purchased from ASDL and Asarco exercises its options for the private property (A-Diamond Ranch). The only well not in the process of being acquired by Asarco is located north of the Gila River and approximately 0.4 miles upstream and up-gradient from the proposed drain-down pond. This well would not be impacted by Ripsey Wash TSF activities.

The 13 wells within the footprint of the Ripsey Wash TSF would be abandoned prior to tailings disposal; this would include several ASDL wells used for livestock watering, but these wells would be transferred to Asarco as part of the expected land package purchase.

The capture of alluvial groundwater by the seepage trench in Ripsey Wash down-gradient of the TSF (coupled with the closed-circuit operation of the TSF where tailings decant water would be returned to the Ray Concentrator) would cause a loss of groundwater recharge to the alluvium material down-gradient of the facility. The diminished recharge could cause a reduction in yields from down-gradient wells, but this effect should be negligible to the wells on the A-Diamond Ranch which are completed in Quaternary deposits along the Gila River.

3.6.2.3 Effects of the Hackberry Gulch TSF Alternative

3.6.2.3.1 Potential Impacts to Groundwater Hydrology

The Hackberry Gulch TSF is essentially a “side-hill” facility where the tailings would be contained on a “hillside” which is dissected by multiple drainages. For this type of facility, controls and containment for groundwater (predominantly alluvial groundwater) must be placed in the seven main drainages that are intersected by the tailings embankment. The “side-hill” nature of the Hackberry Gulch TSF would complicate the overall construction of the TSF and necessitates the installation of seepage trenches and reclaim water ponds in major down-gradient drainages, plus expanded monitoring. Although the primary fracture pattern in the Big Dome conglomerate formation occurs generally parallel to the axis of the Hackberry Gulch TSF tailings embankment, there could be leakage along secondary fracturing perpendicular to the primary fracturing or along sand-pebble lenses in the conglomerate that express themselves as uncontrolled seepage in areas external to the seepage trenches that are located in the seven drainages. In this situation, any seeps would have to be captured and routed to the down-gradient reclaim water ponds, where the water would be allowed to evaporate and/or returned to the tailings facility itself.

Like the Ripsey Wash TSF, construction and operation of the Hackberry Gulch TSF would decrease and eventually eliminate recharge to the Quaternary deposits within the TSF footprint and down-drainage of the TSF. The down-gradient seepage trenches would be designed and constructed capture groundwater movement through the Quaternary deposits beneath the TSF, and this water would be returned to the Ray Concentrator for reuse. This activity would eliminate recharge to the Gila River alluvium from the seven washes that dissect the site.

The potential impacts to shallow and bedrock groundwater recharge and flow direction would be similar to those described for the Ripsey Wash TSF site.

No effects are expected to the groundwater hydrology in the areas proposed for waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**). The mitigation activities do not require any well construction or direct groundwater use and will not result in any discharges that would affect groundwater resources.

3.6.2.3.2 Potential Impacts to Groundwater Quality

The potential impacts to groundwater quality would be the same as those described for the Ripsey Wash TSF.

Similar to the Ripsey Wash TSF, should the Hackberry Gulch TSF be selected for tailings disposal, an APP permit for the TSF would be required. Such a permit would require groundwater monitoring along a compliance boundary, as well as requisite mitigation measures should a performance standard be exceeded as part of monitoring of compliance wells.

3.6.2.3.3 Potential Impacts to Groundwater Rights

As set forth in Section 3.6.1.2.3, Existing Groundwater Wells at Hackberry Gulch Wash TSF, there are 42 wells within 0.5 miles of the Hackberry Gulch TSF. See **Table 3-40, Registered Wells within 0.5 Miles of Hackberry Gulch TSF Site.** These wells are segregated as follows:

- Within Ripsey Wash TSF Footprint: 19
- Up-Gradient of Ripsey Wash TSF Footprint: 0
- Down-Gradient of Ripsey Wash TSF: 23

Nineteen of the 42 wells were installed by Asarco for exploration (condemnation drilling), geotechnical or hydrologic monitoring purposes. The remaining 23 wells are mainly owned by individuals or commercial (non-Asarco) entities.

Of the wells not owned by ASARCO, nine are located within the footprint of the proposed Hackberry Gulch TSF. These would be abandoned, so the water yield from these wells would be permanently lost. Seven of the non-Asarco wells are located immediately down-gradient of the TSF. Although these wells are probably completed in the Quaternary deposits along the Gila River, the yield from these wells could be compromised by a reduction of recharge to Gila River Quaternary deposits from the construction and operation of the Hackberry Gulch TSF.

The likelihood of private well yields down-gradient from the TSF being compromised is primarily a function of whether the down-gradient wells are, or are not, completed in Quaternary deposits that are in direct hydraulic communication with the Gila River. If they are, the significance would likely be low, because the loss of recharge to the Gila River Quaternary deposits from removal of recharge from the TSF footprint area would be small relative to the recharge from the entire Gila River drainage basin. Specifically, at the USGS Kelvin gaging station (immediately downstream of the TSF), the loss of potential recharge to the Gila River Quaternary deposits would be less than 0.02% of Gila River basin recharge. Conversely, if the wells down-gradient from the TSF are not completed in Quaternary deposits that are in direct hydraulic communication with the Gila River, the likelihood of yield loss would be high.

3.7 LAND USE

Identify land disturbance. *Areas of concern include: (1) the acreage of disturbance on federal, state and private lands; (2) the effects on livestock grazing in the area; (3) the effects on the recreational setting of the area; and (4) changes in future (post-project) land use.*

3.7.1 AFFECTED ENVIRONMENT

The dominant land use in the vicinity of the Ripsey Wash and Hackberry Gulch TSF sites is mining. Other land uses within the region are recreation, residential use, and agriculture (cattle grazing). Specifics about land uses in the area are set forth in **Appendix D, Regional Activity**.

3.7.1.1 Land and Mineral Ownership

A mixture of federal, state and private lands occurs in this area. Private lands, as well as those lands administered by the BLM and the ASLD, are shown on **Figure 32, Surface Ownership**. Asarco owns and controls much of the private lands within and adjacent to the existing Ray Mine.

Surface ownership at the Ripsey Wash TSF site may change to Asarco with the proposed forthcoming sale (auction) of state lands at Ripsey Wash site by the ASLD and to Asarco from federal ownership at the Hackberry Gulch TSF site with pending Asarco-BLM land exchange. See **Appendix D, Regional Activity**.

Similar to surface ownership, there is a mixture of federal, state and private mineral ownership in this area. See **Figure 33, Ripsey Wash Alternative Mineral Estate**, and **Figure 33, Hackberry Gulch**

Alternative Mineral Estate . Asarco owns or controls the mineral lands within the areas being considered for TSF.

3.7.1.2 Mining

Copper mining has occurred in this area since the 1880s, a period extending for over 130 years. Early mining in this area was completed by underground techniques; however, by 1955 all major underground mining had ceased in the area around the current Ray Mine. The Ray Mine, which is an existing open-pit copper mine, began operations in 1952 and has been the prominent mine in the area since that time.

The areas within and adjacent to the Ray Mine have been explored since the late 1880s and early 1900s, and numerous old test pits, mine adits (tunnels), and shallow shafts are found scattered throughout the region. Most of the public lands in this area are open to mineral entry, mineral leasing and mineral sales, except for the White Canyon Wilderness Area.

3.7.1.3 Agricultural Activities

Cattle grazing is an established and long-term land use in the area. Portions of several BLM grazing allotments are found within the area of the Ray Mine and the proposed Ripsey Wash and Hackberry TSFs. See **Figure 35, Grazing Allotments**, and **Table 3-41, Grazing Allotment Summary**.

Table 3-41, Grazing Allotment Summary

BLM Grazing Allotment Number	Allotment Name	Current Public Land (acres)	Other Areas (acres)	Total Area (acres)	Total AUMs on Public Land	Acres per AUM	AUMs per Arce	Current Grazing System
6067	Rafter Six	15,962	10,999	26,961	1,668	16.16	0.062	DR
6016	Troy	5,319						
6120	A Diamond	6,566	14,213	20,779	696	29.85	0.034	DR
Note: DR stands for Deferred Rotation								

Some range improvements, such as fencing and livestock watering facilities (wells, tanks, pipelines, cross, impoundments or stock tanks), salt licks, corals and gathering areas, have been made to the grazing allotments in this region.

With the exception for water access at designated locations to the Gila River, livestock grazing is subject to seasonal restrictions from most of the riparian zones along the Gila River on BLM administered lands in accordance with a 2003 USFWS Biological Opinion (US Fish and Wildlife Service 2003).

3.7.1.4 Residential Use

Residential use in the immediate vicinity of the Ray Mine is concentrated in the communities of Kearny, Kelvin, and Riverside, with scattered development along the Gila River south of the operation. The A Diamond Ranch is located south of Florence-Kelvin highway, near the confluence of Ripsey Wash with the Gila River. There are no existing or planned residences or houses within the areas to be directly physically disturbed for the Ripsey Wash or the Hackberry Gulch TSFs.

3.7.1.5 Recreation

Recreation is another land use in the area and is discussed in more detail in Section 3.9, Recreation.

A segment of the Arizona Trail traverses the area proposed for development and operation of the Ripsey Wash TSF. Background on the discussions and the proposed plan to relocate a section of Arizona Trail are set forth in **Appendix G, Arizona Trail Relocation Analysis**.

Other than the Arizona Trail, there are no developed recreational facilities operated by the BLM, Forest Service, ASLD, or Pinal County within the areas to be used for either the Ripsey Wash or Hackberry Gulch TSFs. However, there are dispersed outdoor recreational activities that occur in this area that include hunting, four-wheeling, mountain biking, hiking, picnicking, camping, horseback riding, rock-hounding, fishing, river floating and water play in the Gila River, and general sightseeing. There is an existing network of primitive roads that provide access for dispersed recreational activities.

The White Canyon Wilderness area (approximately 5,773 acres) was designated by Congress in 1990. This wilderness area is located approximately two miles west of the Ray Mine, four miles north of the proposed Ripsey Wash TSF, and six miles northwest of the proposed Hackberry Gulch TSF.

The White Canyon Area of Critical Environmental Concern (ACEC) is adjacent to the White Canyon Wilderness area and was established because of its scenic, wildlife, and cultural values. The White Canyon ACEC is addressed in the BLM's Phoenix Resource Management Plan (RMP), dated September 1989, and includes approximately 1,920 acres of BLM administered lands and 480 acres of State lands.

3.7.1.6 Utilities and Transportation

SCIP owns and operates a 69 kV electric transmission line that crosses the area proposed for use by the Ripsey Wash TSF. The transmission line structures are wooden H-poles.

The Copper Basin Railroad is a 54-mile long Arizona short-line railroad that is owned by Asarco and operates from a connection with the Union Pacific Railroad at Magma Junction to an interchange connection with the San Manuel Railroad near the town of Hayden. The railroad principally parallels the Gila River but has an approximate seven mile branch line that connects to the Ray Mine. The railroad serves the Ray Mine, transporting ore material to the Hayden Concentrator and copper concentrates to the Hayden Smelter and returning sulfuric acid from the Hayden Smelter to the Ray Mine.

State Highway 177 (SR 177) is a two-lane, asphalt state highway that connects the towns of Superior on the north and the communities of Hayden/Winkelman on the south. SR 177 passes adjacent the communities of Kelvin, Riverside and Kearny. A 15-mile long stretch of SR 177 (between mileposts 149 and 164) is designated as the Copper Corridor Scenic Road West, which is an Arizona scenic road. This scenic corridor was established in October 2008, offers views of high desert ecology and the Ray Mine operations, and traverses the Hackberry Gulch TSF project area and the proposed Ripsey Wash TSF tailings and return water pipeline corridor.

The Florence-Kelvin highway is a 32-mile long, two-lane road that connects State Highway 79 south of the town of Florence to State Highway 177 near the community of Kelvin and near the entrance to the Ray Mine. Approximately 16 miles of this highway is paved with asphalt from its junction with State Highway 79 (near Florence) but the remaining portion is a graveled surface roadway. This road is maintained by Pinal County. As explained in Section 2.3.2.1, Florence-Kelvin highway, a segment of this highway would be permanently re-routed and re-constructed to the north and northeast of the proposed Ripsey Wash TSF to allow for construction and operation of the proposed tailings facility.

3.7.1.7 Land Use Plans and Policies

Pinal County has a Comprehensive Plan, which outlines how and where the County should grow and develop over time (Pinal County 2009). The Comprehensive Plan is not a regulatory document and does not grant entitlements. However, it is a plan for future growth to assist and guide the Pinal County Planning and Zoning Commission and the Board of Supervisors in the pursuit of "coordinated, adjusted and harmonious development of unincorporated areas of Pinal County."

The proposed Ripsey Wash and Hackberry Gulch TSF sites (and the Ray Mine itself) are located in an area designated in the Pinal County Comprehensive Plan as "Open Space". This designation reflects the Pinal County Open Space and Trails Master Plan that was adopted by Pinal County in 2007 (Pinal County 2007). The Open Space vision in this plan is stated as follows:

> *Residents value large connected open spaces and unique plans of Pinal County, not only as part of their quality of life, but as an important resource to sustain the region's immense wildlife habitat and corridors. From majestic mountains rising from the desert floor in the west to the high desert and rugged mountain terrain to the east, enjoyment of and respect for natural surroundings is a part of why people choose to live and visit Pinal County.*

The Arizona Trail is located within this area and has been recognized in the Pinal County Open Space and Trails Master Plan as one of the regional trail corridors in the County. As such, the Corps coordinated with Pinal County as to the relocation of a segment of the Arizona Trail should the Ripsey Wash TSF site be selected as the preferred alternative. See Section 3.9, Recreation, and **Appendix G, Arizona Trail Relocation Analysis**.

Proposed facilities and activities associated with the Ripsey Wash and Hackberry Gulch TSF sites that are located on BLM-administered lands are addressed in the BLM Phoenix Resource Management Plan (RMP), dated September 1989 (Bureau of Land Management 1989). This RMP is a BLM land management guide. Use of BLM lands requires authorization by the BLM. The BLM uses guidance in the RMP to make land use planning decisions. Within the Ripsey Wash TSF project area, the BLM administers the Arizona Trail north of the Florence-Kelvin Highway, including sections across State land under a temporary right of entry, while permanent trail right-of-way acquisition is being finalized.

Portions of the Ripsey Wash TSF site are located within the BLM Middle Gila Canyons Area Travel and Transportation Management Plan area. Travel route designations include existing primitive roads and the Arizona Trail. See Section 3.9, Recreation.

The BLM administers the Arizona Trail north of the Florence-Kelvin highway, including sections across Arizona STL under a temporary right of entry. The BLM is pursuing a permanent right-of-way acquisition, whereupon the Arizona Trail right-of-way would be 15 feet wide and would be held by the United States.

3.7.2 ENVIRONMENTAL CONSEQUENCES

3.7.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. The land use at the Ripsey Wash or Hackberry Gulch TSF sites would not change. Current land use trends in the region would continue, including mineral exploration, mining, livestock grazing activities and recreational use.

3.7.2.2 Effects of the Ripsey Wash TSF Alternative

Although mining has historically occurred in this region, the construction and operation of the Ripsey Wash TSF facility would introduce a noticeable land use change within the immediate area. On a more regional basis, a new TSF at the Ray Mine would not change other land uses in Pinal County.

Acreage disturbance for the Ripsey Wash TSF are set forth in **Table 2-1, Summary of Ripsey Wash TSF**.

The construction and operation of TSF sites would cause permanent impacts to rangeland, wildlife habitat, and dispersed recreation on land uses within the footprint of the Ripsey Wash TSF. Available livestock forage would be lost in the grazing allotment areas that would be affected by the construction and operation of the TSF. Site access restrictions would occur during this time frame, primarily because of land ownership patterns; it is expected that only sparse vegetation would reemerge on the area where tailings are placed, and not to the conditions that currently exist. The closed tailings site would likely never have the species composition or density of vegetation that exists today.

Post-project land use of the area where tailings are placed would be quite different from pre-project land uses, and the area, being covered with rock material, would lack long-term value for wildlife habitat, dispersed recreation and livestock grazing. Placement of rock material over the tailings facility would be employed for site stability.

A 6.8-mile segment of the existing Arizona Trail would be lost, but plans have been made to replace this segment of trail with a 6.4-mile segment to the east of the proposed Ripsey Wash TSF site. The existing trailhead on the Florence-Kelvin Highway would also be replaced with a new trailhead near the intersection of Riverside Road and the Florence-Kelvin highway. See **Figure 41, Proposed Trailhead & Parking**.

Two BLM grazing allotments (the A Diamond and Rafter Six allotments) would be affected by the Ripsey Wash TSF. See **Table 3-42, Grazing Allotment Impact - Ripsey Wash TSF.**

Table 3-42, Grazing Allotment Impact - Ripsey Wash TSF

Allotment Name and BLM Designation Number	Estimated Allotment Area (acres)	Allotment Areas Physically Disturbed by Ripsey Wash TSF (acres)	Percentage of Allotment Directly Disturbed
A Diamond (06120)	20,779	2,425	11.5%
Rafter Six (06067)	26,961	149	0.06%

Asarco plans to purchase acreage for the Ripsey Wash TSF from the ASLD. This would mean that land would be transferred from state of Arizona ownership to private ownership. Arizona would benefit financially from the sale of this land.

The relocation of the Arizona Trail and the fencing and general upgrade (seeding and removal of tamarisk) of the riparian habitat within the proposed mitigation areas would not create any noticeable land use change in the areas of the relocated trail and the mitigation sites (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**).

No indirect effects are expected.

3.7.2.3 Effects of the Hackberry Gulch TSF Alternative

The land-use effects of the Hackberry Gulch TSF would essentially be the same as described in Section 3.7.2.2, Effects of the Ripsey Wash TSF Alternative. Acreage disturbance for the Hackberry Gulch TSF are set forth in **Table 2-2, Summary of Hackberry Gulch TSF**.

Two BLM grazing allotments (the Rafter Six and Troy allotments) would be affected by this alternative. See **Table 3-43, Grazing Allotment Impact - Hackberry Gulch TSF.**

Table 3-43, Grazing Allotment Impact - Hackberry Gulch TSF

Allotment Name and BLM Designation Number	Estimated Allotment Area (acres)	Allotment Areas Physically Disturbed by Ripsey Wash TSF (acres)	Percentage of Allotment Directly Disturbed
Rafter Six (06067)	26,961	2,267	8.4%
Troy (06016)	5,319	23	0.04%

Asarco is currently working with the BLM on a land exchange that would involve the BLM-administered lands, including the site proposed for the Hackberry Gulch TSF. The work on this land exchange has been underway since 1994. Transfer of BLM-administered land to Asarco would mean that the federal land would become private ownership. The BLM would benefit from this land exchange by receiving other acreages in the state of Arizona deemed valuable for scenic, wildlife, and recreation purposes. See **Appendix D, Regional Activity**.

The fencing and general upgrade (seeding and removal of tamarisk) of the riparian habitat within the proposed mitigation areas would not create any noticeable land use change in the areas of the mitigation sites (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**).

3.8 NOISE

Identify noise impacts. *Areas of concern include: (1) level of noise from construction traffic and development activities; (2) level of noise during operations; (3) compliance with federal, state and local noise standards; (4) disruptions caused by noise to recreational users and wildlife.*

3.8.1 AFFECTED ENVIRONMENT

3.8.1.1 General Overview

Noise is defined as an unwanted, disturbing sound. The impact of a noise source depends on the levels and characteristics of background sounds, as well of the characteristics of the actual sound. Sound is transmitted through the atmosphere as low-intensity pressure waves. People can detect sounds differently and can respond to a wide range of sound intensities and frequencies.

The logarithmic decibel (dB) scale is used to indicate the intensity of sound. To measure sound on a scale that approximates the way people hear, more emphasis must be placed on those sound frequencies (or pitch) that people hear. EPA recommends the use of “A-weighted” sound pressure levels, expressed as A-weighted decibels of dBA, for analyzing community noise issues.

The threshold of human hearing is set at 0 dBA. Quiet whispers and birdcalls produce about 25 to 40 dBA. Emergency vehicles can reach as high as 100 dBA, while if standing close to a jet airplane the sound may reach 140 dBA.

The range of everyday sounds is shown on **Table 3-44, Typical Range of Common Sounds**.

Table 3-44, Typical Range of Common Sounds

Noise Source	A-Weighted Sound Level (dBA)
Military Jet airplane (at 50 feet)	140
Commercial jet Airplane (at 200 feet)	120
Emergency Vehicle (at 100 feet)	100
Power (gas) Lawn Mower	100
Motorcycle (at 25 feet)	90
Diesel truck, 40 mph (at 50 feet)	90
Garbage Disposal (3 feet)	80
Passenger Car, 65 mph (25 feet)	70
Vacuum Cleaner (at 3 feet)	70
Normal Conversation (at 5 feet)	60
Traffic (at 100 feet)	50
Bird Calls (at 50 feet)	40
Soft Whisper (at 5 feet)	30
Library (at 25 feet)	20
Hearing threshold	0

The noise level of sound is measured in decibels on a logarithmic scale. A doubling of sound pressure corresponds to a noise increase of 3 dBA. For example, a single bulldozer typically produces about 85 dBA of noise at a distance of 50 feet from the dozer. Therefore, two identical dozers operating side-by-side (with each producing 85 dBA) produces a theoretical noise level of 88 dBA.

Many factors determine whether an increase in the noise level above the existing background is “audible”. The most important factor is the nature of the new noise source as compared to the nature of the background noise. In the case of proposed Ripsey Wash TSF, the noise caused by construction activities would be different from the rural, open-space sounds, so relatively small increases in noise levels caused by mechanical equipment would be noticeable. This would be slightly different at the proposed Hackberry Gulch TSF site, which is located adjacent to the Ray Mine (Elder Gulch TSF) and State Highway 177.

3.8.1.2 Background Conditions

The proposed Ripsey Wash TSF site is located in an unpopulated and relatively remote area. Background noise levels range from near 30 dBA to approximately 80 dBA, depending on road traffic, wind, and wildlife activity (birds singing). See **Table 3-45, Background Noise Levels**.

The closest residence to the actual TSF site is the A-Diamond Ranch, for which Asarco has an option to purchase. In general, the Ripsey Wash TSF site would be relatively quiet, with wind and/or thunderstorm activity being the principal sound sources. Traffic along the Florence-Kelvin highway would generate noise. There could also be localized noise from off-highway vehicles (OHVs) using the two-track roads in the area, as well as the occasional over flight by jet aircraft and train noise from the Copper Basin Railroad that operates north of the site.

Table 3-45, Background Noise Levels (1)

Location	A-Weighed Sound Level (dBA)
Highway 177 at Proposed Hackberry Gulch TSF	33 – 35 (at approximately 60 feet from highway – no traffic)
	60 -70 (passing car at approximately 60 feet from highway)
Highway 177 near Elder Gulch TSF	32 – 26 (at approximately 25 feet from highway – no traffic)
	80 (semi-truck passing at approximately 25 feet from highway)
	70 (passing car at approximately 25 feet from highway)
Highway 177 at junction with Florence-Kelvin highway	40 – 43 (at approximately 100 feet from highway – no traffic)
	75 (semi-truck passing at approximately 100 feet from highway)
	70 (passing car at approximately 100 feet from highway)
Florence-Kelvin highway in community of Kelvin	50-54 (at edge of highway: birds singing in nearby trees)
	80 (passing car at edge of highway)
Florence-Kelvin highway at Ripsey Wash	30-50 (in middle of road - no traffic but wind gusts and sporadic bird singing)
Florence-Kelvin highway west of bridge over Gila River	38-50 (in middle of road - no traffic but wind gusts and sporadic bird singing)
Florence-Kelvin highway on bridge over Gila River	43-45 (in middle of bridge – Gila River flowing; some sporadic bird singing)
Note: Noise readings made on February 25, 2015 using a handheld NM102 noise meter.	

The proposed Hackberry Gulch TSF site is located adjacent to the existing Ray Mine and the Elder Gulch TSF, as well as being directly adjacent to State Highway 177. Portions of the proposed Hackberry Gulch TSF would be located on either side of this highway. There are permanently occupied residences and human receptors in the communities of Riverside and Kelvin, which are within approximately one mile of the proposed Hackberry Gulch TSF site. Current noise at the site is principally associated with traffic on State Highway 177, as operations at the Elder Gulch TSF principally involve electric pump stations and minor equipment. Other noise would include train noise from the Copper Basin Railroad that operates to the west of the proposed Hackberry Gulch TSF. This site, like the proposed Ripsey Wash TSF site, would also be subjected to wind and thunderstorm activity.

3.8.1.3 Noise Ordinances or Regulations

Pinal County has noise regulations, but these are principally focused on projects and activities in urban areas, not at mine operations that are located in remote, unpopulated areas.

In 1974, EPA established a 24-hour average level of 55 dBA as a guideline threshold for acceptable environmental noise. This level is used as a general basis for evaluating effects from noise when no other local, county or state standards have been established. Typically, this guideline level would be directed at areas where people live and work, not the remote region found for the Ripsey Wash and Hackberry Gulch sites; however, this 55 dBA threshold level would serve as a general target level by which to assess noise levels for the TSF construction and operation.

TSF construction, operation and closure/reclamation would be under the jurisdiction of the Mine Safety and Health Administration (MSHA). This federal agency requires worker hearing protection for noise levels that exceed 90 dBA. See **Table 3-46, Permissible Occupations Noise Exposures**.

Table 3-46, Permissible Occupational Noise Exposures

SOUND LEVEL (dBA)	DURATION (HR/DAY)
90	8
92	6
95	4
97	3
100	2
102	1.5
105	1
110	0.5
115	<0.25
Source: U.S. Department of Labor, “Occupational Noise Exposure”, Code of Federal Regulations, Title 29, Part 1926.	

3.8.2 ENVIRONMENTAL CONSEQUENCES

3.8.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. Noise levels in the area would continue at background levels, affected by time of day, topography, wind speed and direction, nearby mining activities, traffic from SR 177 and the Florence-Kelvin highway, railroad traffic, recreational activities (such as OHV travel), and general rangeland management.

3.8.2.2 Effects of the Ripsey Wash TSF Alternative

Noise impacts associated with the Ripsey Wash TSF site would be short-term and primarily occur during early site development and construction activities, an estimated three year period that would include road building, starter dam construction, seepage trench installation, detention dam and diversion ditch construction, and miscellaneous pipeline and utility installation.

Sources of operational noise would include periodic trips to the site by Asarco personnel, tailings slurry and reclaim water pumps, and a small number of earthmoving equipment associated with centerline tailings construction or raising of the lifts for upstream tailings construction.

Expected noise levels for construction is expected to peak at approximately 85 to 90 dBA at 50 feet; this noise level corresponds to the type of equipment to be used for this activity. See **Table 3-47, Equipment Noise Levels**.

Table 3-47, Equipment Noise Levels

Equipment	dBA Rating(1)
Drills	80-90
Loaders	75-90
Bulldozers	75-90
Graders	80-85
Haul Trucks	75-85
Electric Pumps	40-50
Crew and Supply Trucks	45-65
Note: (1) As projected at 50 feet from the source.	

The inverse square law of noise states that noise decreases (attenuates) by 6 dBA for every doubling of distance. Because not all construction equipment operates continuously or at full load, it is assumed that the high end of normal equipment noise level would be 90 dBA at 50 feet. Using the propagation formulation, average noise levels would be expected to drop to 84 dBA at 100 feet, 79 dBA at 200 feet, 73 dBA at 400 feet, 67 dBA at 800 feet, 61 dBA at 1,600 feet and 55 dBA at 3,200 feet.

Noise levels should attenuate to near background noise levels within a mile of the project work; this would depend on the topography, time of day, wind conditions, and the level of ambient noise at the location of the listener. It should be noted that mechanical noise is noticeable even when it is slightly above the natural background or ambient noise levels.

Some blasting may be necessary during construction work, and this would only occur during daylight hours. It is assumed that typical surface-delay blasting methods would be used. Blasting would generate a single noise of around 120 dBA at 50 feet, which would probably be heard several miles from the blast site. Many people associate blast noise with that of thunder or a sonic boom.

The community of Riverside and Kelvin are approximately 1.3 miles from the proposed Ripsey Wash TSF site. The nearest residence to the Ripsey Wash TSF (other than the A Diamond Ranch, which is controlled by Asarco) is about 1.1 miles away. See **Figure 51, Nearby Residents – Ripsey Wash TSF**.

The communities of Riverside and Kelvin (including the nearest residence) are separated from the proposed Ripsey Wash TSF site by the north-south trending Tortilla Mountains. The ridge of mountains (coupled with the distance) would effectively screen Riverside and Kelvin residents from noise associated with the Ripsey Wash TSF, although blasting noise may be audible during construction.

Residents of Kelvin and Riverside, along with recreationists and travelers, would be exposed to increased traffic noise the Florence-Kelvin highway, mainly during the construction work. See Section 3.12, Transportation. Truck traffic would be sporadic during daylight hours and would cause a noise level of approximately 80 dBA at about 50 feet from the road. Upon completion of construction, traffic noise levels would return to near current levels.

The residents of Riverside and Kelvin would also be exposed to noise from the installation of the tailings slurry and reclaim water pipelines that would parallel the Florence-Kelvin highway, the construction of the pipeline bridge across the Gila River, the relocation of and the asphalt-paving work on the Florence-Kelvin highway, and the construction of the tailings pumping station on the north side of the Gila River (directly south of the community of Kelvin). These noise impacts would be temporary and short term. During operations, noise levels from the electric pumping facilities on the north side of the Gila River would be negligible to the residents of Riverside and Kelvin. Closure and reclamation noise would also be negligible to Riverside and Kelvin residents.

The headquarter buildings and structures for the A Diamond Ranch are located near the confluence of Ripsey Wash and the Gila River, and they are the nearest residential property to the Ripsey Wash TSF site. At present, Asarco has an option to purchase this property and would exercise that option if the Ripsey Wash TSF is selected for construction. The A Diamond Ranch is approximately .6 miles from the proposed starter dam in Ripsey Wash and about a mile from any blasting activities. At this distance, it is expected that noise levels would be negligible as normal equipment and facility construction noise would attenuate to background levels before reaching these buildings, although it is expected that blasting noise would be audible at this site (similar to noise created by thunder).

Recreationists and hikers using the re-aligned Arizona Trail would be exposed to some increase in noise levels, in particular during the construction of the detention dam up-drainage of the Ripsey Wash TSF and the construction of the diversion channel structure on the east side of the proposed TSF. Hikers might also experience some blasting noise during the initial construction period. Blasting noise would be short-term and temporary.

The effect of noise on wildlife is generally avoidance and accommodation. See Section 3.15, Wildlife.

No adverse noise effects are expected as a result of the relocation of the Arizona Trail or the riparian habitat improvement work in the areas proposed for waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**).

Most of the new Arizona Trail would be constructed or cleared using manual labor, although there may be the short-term need for small equipment such as a skid-steer or compact track loader and a compact excavator to assist in constructing switchbacks or moving large rocks for the relocated trail. This equipment and the work to construct the new trail would create minor amounts of noise, but the noise levels would be temporary and localized, and there are no sensitive receptors in close proximity to the proposed new routing of the Arizona Trail.

As explained in **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**, all or portions of Mitigation Sites A, B, C and D would require active management to enhance the riparian habitat values; this action would be primarily fencing and seeding. A mechanical posthole digger mounted on an off-road vehicle would be used for fence construction, and a farm tractor with a cultivator and a drill seed would be used for seeding, although hand seeding could also be used. For Mitigation Site E and where needed on other sites to remove tamarisk, a bulldozer (Caterpillar D6 or equivalent) would be used to clear and grub burned trees and stumps. The equipment used for riparian habitat improvements would produce noise, but the noise levels would be temporary and localized, and there are no sensitive receptors in close proximity to the proposed mitigation sites.

Indirect noise effects are expected to be negligible and would result from additional non-work related trips by new construction workers that might reside in the area. This increase in activity is expected to be minor and dispersed throughout communities of Apache Junction, Gold Canyon, Superior, Kearny, Hayden and Winkelman.

3.8.2.3 Effects of the Hackberry Gulch TSF Alternative

Similar to the discussion in Section 3.8.2.2, Effects of the Ripsey Wash TSF Alternative, noise impacts associated with the Hackberry Gulch TSF site would be short-term and primarily occur during early site development and construction activities, an estimated three year period that would include starter dam construction, seepage trench installation, detention dam and diversion ditch construction, and miscellaneous pipeline and utility installation.

Sources of operational noise would include periodic trips to the site by Asarco personnel, tailings slurry and reclaim water pumps, and a small number of earthmoving equipment associated with centerline tailings construction or raising of the lifts for upstream tailings construction. Expected noise levels for construction is expected to peak at approximately 85 to 90 dBA at 50 feet

The nearest residences to the Hackberry Gulch TSF site are about .2 mile away, directly across SR 177 from the proposed TSF; because there is no natural or artificial buffer, these residences are likely to be impacted by noise from the Hackberry Gulch TSF throughout its life. See **Figure 52, Nearby Residents – Hackberry Gulch TSF**.

The main community of Riverside is approximately a half mile from the lower portions of the proposed Hackberry Gulch TSF site (in particular, the areas to be used for collection ponds), and the community of Kelvin is approximately three quarters of a mile from the proposed Hackberry Gulch TSF site. Residents of Riverside and Kelvin would be subject, during daylight hours, to construction noise that could reach 30 dBA over background levels. The level of the noise would depend on the weather, wind direction, time of day, and line of site to the activity. Construction-related blasting noise would be clearly audible at residences in both Riverside and Kelvin; such noise would last a few seconds and would be similar to the noise from thunder or a sonic boom.

During operations and closure reclamation, noise levels would also be negligible to Riverside and Kelvin residents as such noise levels would attenuate to near background noise levels.

Recreationists and hikers using the re-aligned Arizona Trail would not be exposed to noise levels from the construction, operation and closure/reclamation of the Hackberry Gulch TSF. The effect of noise on wildlife is generally avoidance and accommodation. See Section 3.15, Wildlife.

Similar to the discussion in Section 3.8.2.2, Effects of the Ripsey Wash Alternative, any noise effects associated with the equipment used for fencing, seeding and clearing tamarisk as part of the waters of the U.S. mitigation work set forth **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**, would be short-term and localized, and there are no sensitive receptors in close proximity to the proposed mitigation sites.

Indirect noise effects are expected to be negligible, similar to the discussion in Section 3.8.2.2, Effects of the Ripsey Wash TSF Alternative.

3.9 RECREATION

Identify impacts to recreational activities and opportunities. *Areas of concern include: (1) disruption to recreational opportunities along the Arizona Trail (the only developed recreation site within the project area) and (2) disruption to dispersed recreation activities such as off-road recreation and hunting.*

3.9.1 AFFECTED ENVIRONMENT

The recreation opportunities within and immediately adjacent to the Ripsey Wash and Hackberry Gulch TSF sites are dispersed in nature. The one exception is the Arizona Trail, a portion of which is located within the eastern section of the proposed Ripsey Wash TSF site.

Recreational information included in this section is based on discussions with federal, state, regional, and local government agencies and organizations, as well as recreation data compiled by WestLand for the region within and surrounding the RIpsey Wash and Hackberry Gulch TSF sites (WestLand 2014). Field investigations were also conducted within the area, principally site visits to the Arizona Trail and associated trailheads.

3.9.1.1 Recreation Management

Most of the land proposed for use as the Ripsey Wash TSF is currently owned by the state of Arizona and managed by ASLD. Asarco is working with ASLD to purchase this land. Although ASLD is not mandated or funded to provide outdoor recreation facilities on state trust lands, they sell use permits to those interested in recreating on trust land. Camping, hiking, horseback riding, and other non-consumptive recreational activities are allowed by permit on publicly accessible ASLD rangeland. Permits are also available to allow OHV's to cross State Trust Lands temporarily on open, existing routes. Permits are not required for hunters or anglers in possession of a valid hunting or fishing license (AORCC 2012, p. 48).

Lands at the Hackberry Gulch TSF site are presently a combination of private and public ownership, with the public lands being managed by the BLM. Asarco is working with the BLM on a land exchange that would include the public lands located in the area where the Hackberry Gulch TSF would be located; this land exchange is separate from this EIS. BLM management of recreation on BLM-administered lands in this area is guided by the 1989 Phoenix Regional Management Plan (RMP) (BLM 1989). Because there are no Recreation Management Areas designated by the 1989 RMP for either TSF site, the BLM manages their lands in this area to meet basic recreation and resource stewardship needs. Although recreation is not emphasized, recreation activities, except those in conflict with the primary land uses, may occur unless the land is closed to public use (BLM 2011).

The 1989 RMP also limited OHV use on BLM-administered lands to existing roads and trails, except for areas identified as closed or where travel would be limited to specifically designated roads and trails. In 2012, the BLM adopted The Middle Gila Canyons Transportation and Travel Management Plan, which contains an inventory of roads, primitive roads, and trails in the Middle Gila Canyons region and establishes designations for their use and maintenance. This 2012 plan covers BLM-administered lands north and west of the Florence-Kelvin highway, designating the OHV routes in this area as primitive routes. Primitive routes are open to motorized vehicles year round (BLM 2010).

Pinal County plans for and maintains recreation facilities throughout the county, including OHV routes and portions of the Arizona Trail. The 2007 Pinal County Open Spaces and Trails Master Plan identifies the goals and objectives for the attainment of open space, trails, and regional parks. The plan identifies 399,300 acres of existing or planned open space, 802,400 acres of proposed open space, 25,900 acres of restricted use open space, and 168,700 acres of regional parks.

Congress assigned administration of the Arizona Trail to the Secretary of Agriculture, which delegated overall administration to the Forest Service. The Forest Service is responsible for establishment of an advisory council for trail management and the development of a trail-wide comprehensive management plan (CMP). The nature and purposes of the trail are established through the CMP, which is developed in coordination with the national trail managing agencies and includes goals designed to safeguard the trail's nature and purposes. A public engagement process conducted in 2012 provided preliminary input towards the development of the CMP. (White, 2014)

The trail managing agency consists of the public agency or landowner with the authority and /or responsibility for decision making for lands through which the trail passes. Within and immediately adjacent to the Ripsey Wash TSF site, the BLM and Pinal County are the designated trail managers. A 3.6-mile portion of the Arizona Trail within the vicinity of the Ripsey Wash TSF site is located on a trail easement held by Pinal County through ASLD land, while the remaining portions of the trail are managed by the BLM. The Arizona Trail Association, a non-profit private organization, assists the public agencies in managing the trail by coordinating volunteers, developing public awareness and support for the trail, encouraging and coordinating management of the trail project, and raising funds on behalf of the trail (ATA 2014).

3.9.1.2 Regional Recreation Settings and Facilities

The majority of public land in this region is open to recreational use that includes hunting, hiking, camping, mountain biking, scenic driving, wildlife-viewing, OHV use, fishing, and rock collecting. Areas that support recreation in the region range from very primitive backcountry lands to developed facilities, including BLM designated wilderness areas, AGFD Game Management Units, Forest Service designated campgrounds and picnic areas, hiking trails, and OHV routes. Many of the larger communities in the region provide more formal recreation opportunities, such as parks, ball fields, golf courses, rodeo arenas, and fairgrounds. See **Figure 36, Regional Recreation Resources**.

3.9.1.2.1 Wilderness Areas

There are several wilderness areas in this region. See **Appendix D, Regional Activity**.

The closest wilderness is the White Canyon Wilderness Area, which is located approximately four miles from the Ripsey Wash TSF site and about six miles from the Hackberry Gulch TSF site. Two prominent topographical features characterize this wilderness area, White Canyon, with its eroded formations and numerous side canyons, and the Rincon, a large escarpment located near the area's southern boundary. Due to its steep terrain, the White Canyon Wilderness Area has only one developed hiking trail.

3.9.1.2.2 Non-Motorized Trails

The region provides opportunities for non-motorized activities, including hiking, biking, and horseback riding. Trails include a hiking trail in the White Canyon Wilderness, a trail at Devils Canyon, a network of trails near the Pinal Mountain campgrounds, and the Arizona Trail. Shorter recreational trails are found in the region at Cross Canyon, Apache Leap, and the Boyce Thompson Arboretum.

The Arizona Trail is located on the eastern side of the proposed Ripsey Wash TSF site and provides a recreation opportunity for overnight trips and day use. Designated in 2009 and completed in 2011, the Arizona Trail is over 800 miles long and stretches from Mexico to Utah, showcasing the state's mountain ranges, canyons, forests, wilderness areas, historic sites, copper mining operations, communities, and people (ATA 2014).

The Ripsey Wash segment of the trail forms part of the trail's 24-mile Tortilla Mountains Passage, one of four passages that make up the 93-mile Pickett Post to Tiger Mine section of trail.

The Ripsey Wash segment provides a transition between the open desert landscape to the south of Ripsey Wash and the mountainous terrain north of the Gila River (Redfield 2014). The trail traverses the bottomland of Ripsey Wash, followed by a climb into the Tortilla Mountains and across the Gila River via the historic Florence-Kelvin highway bridge. This trail section has varied topography, including views over the Tortilla Mountains towards the east and views down into Ripsey Wash. Much of the northern four miles of the trail has views of the existing Ray Mine.

Two trailheads, both managed by Pinal County, provide access to the Tortilla Mountains passage of the Arizona Trail:

- The Freeman Trailhead, located southwest of the town of Dudleyville; and,
- The Florence-Kelvin Highway Trailhead, located within the Ripsey Wash TSF site.

In addition, the BLM maintains the Kelvin Trail Access, located just north of the Tortilla Mountains Passage on the north side of the Gila River, about one-third mile west of the Florence-Kelvin highway. This site provides access for higher clearance vehicles.

3.9.1.2.3 Off-Highway Vehicle Trails

The region's rugged terrain and network of primitive roads makes it popular for recreational OHV use. See **Figure 36, Regional Recreation Resources**.

Within the Ripsey Wash TSF site, the Ripsey Wash OHV trail connects the Florence-Kelvin Highway to the town of Kearny and a network of trails near the Old Ripsey Mine to the south. Pinal County's Open Space and Trails Master Plan indicates several trails within the area. The county's intent is to work with the managing agencies to preserve these corridors and improve existing trails in order to provide a connected system of county-wide trails. The plan shows an OHV trail traversing the Ripsey Wash TSF site along the Florence-Kelvin highway, designed to provide a connection between the trails north and south of the Gila River. See **Figure 37, Existing Recreation Resources, Ripsey Wash Project Area**, and **Figure 38, Existing Recreation Resources, Hackberry Gulch Project Area**.

3.9.1.2.4 Hunting

The region provides a broad base of hunting opportunities due to its large extent of public lands and diversity in elevation, terrain, and vegetation.

The Ripsey Wash TSF site is located within Game Management Unit (GMU) 37B, most of which is BLM or ASLD-managed land. Principal game species likely to be found are javelina, mule deer, and Gambel's quail. Secondary game species likely to occur are desert cottontail and dove.

The Hackberry Gulch TSF site is located within GMU 37B and 24A. Game species in these GMUs include javelina, mule deer, white-tailed deer, mountain lion, desert cottontail, dove, and Gambel's quail. Only public lands at this site are available to the general public for hunting.

3.9.1.2.5 Fishing and Boating

The region provides several resources for fishing. Sunfish, catfish, and largemouth bass can be caught in the Gila and San Pedro rivers (AGFD 2014a). The AGFD regulates Kearny Lake for bass, trout, and catfish. The BLM maintains two developed recreation sites (the Christmas and Shores Recreation Areas) that support fishing activities in the Gila River north of Winkelman along SR 77 (BLM 2013). Recreational boating and floating activity is relatively light, but does occur in the Gila River during the higher flow seasons, which provides Class 1 and 2 whitewater. Undeveloped access points are found near the Florence-Kelvin highway bridge, at Cochran, and at Whitlow Ranch (BLM 2010).

3.9.1.2.6 Campgrounds and Picnic Areas

There are no developed campsites found within or adjacent to the Ripsey Wash or Hackberry TSF sites; however, these areas do have several dispersed campsites and fire-rings.

The Forest Service manages several developed campgrounds in the Pinal Mountains within the Tonto National Forest, north and northeast of the TSF sites; these include the Kellner Campground, Cherry Flat, Sulfide del Rey, Pioneer Pass, and Upper Pinal and Pinal Recreation Areas. The Tonto National Forest also maintains camping facilities along the Gila-Pinal Scenic Route (east of the town of Superior), at Devils Canyon and Oak Flat campgrounds. The closest developed campground to the Ripsey and Hackberry TSF sites is 13 miles away. The Forest Service also manages several day-use areas, including Capitan Pass and Icehouse CCC picnic areas. The closest day-use area to either of the TSF sites is Capitan Pass, which is 13 miles northeast of the Hackberry TSF site.

3.9.1.2.7 Scenic Highways

SR 177 is a designated state scenic highway, known as the Copper Corridor West. The Copper Corridor West spans 32 miles from Superior to Hayden/Winkelman. Natural landforms visible along SR 177 include Picketpost Mountain, Dripping Springs Mountains, Mineral Mountains, the Tortilla Mountains, and the Gila River. The Ray Mine and Hayden Smelter complexes are considered part of the corridor's scenic attractions (ADOT Undated). Asarco has established a public overlook off SR 177 for viewing of the Ray Mine.

Other state designated scenic roads in the region include the Copper Corridor East, a 38-mile segment of SR 77, and the Gila-Pinal Scenic Road, a 26-mile segment of US Highway 60. SR 177, SR 77, SR 79, and US Highway 60 make up a 148-mile scenic loop (ADOT Undated and ADOT 1989).

3.9.1.2.8 Other Regional Recreation Facilities

Founded in 1920, the Boyce Thompson Arboretum is a 323-acre Arizona State Park, known as Arizona's oldest and largest botanical garden. The Arboretum is located west of the town of Superior, approximately 15 miles from the Ripsey TSF site and 16 miles from the Hackberry TSF site.

Kearny Lake and two BLM-developed recreation sites located along the Gila River (Christmas and Shores Recreation Areas) attract visitors for kayaking, picnicking, camping, and bird watching (BLM 2013; Town of Kearny Undated).

The Kearny Golf Course is a popular recreation site located west of Kearny Lake.

The A Diamond Ranch headquarters operates as a guest lodge, offering eco-tourism activities to visitors interested in southwestern ranching experiences.

Rock collecting is another recreational activity in the region. Rock collecting areas closest to the two TSF sites include the abandoned Finch Mine, located north of Hayden, and the abandoned Gray Horse Mine located immediately east of the Hackberry Gulch TSF site. Access to this historic mine is gained through the Hackberry Gulch TSF site via an OHV trail leading from Old Ray Road (Bearce 2006).

OHV trails provide access to several other popular features, including a water source known as the Artesian Well and the Coke Ovens, located south of the White Canyon Wilderness. People also travel through the Ripsey Wash TSF site to access the abandoned Old Ripsey Mine (BLM 1999).

3.9.1.3 Recreation Use Levels and Trends

Demographic data indicates a growing demand for recreational facilities in Arizona. The Ripsey Wash and Hackberry Gulch TSF sites are located within a two-hour drive from Phoenix.

The 2013 Draft Statewide Comprehensive Outdoor Recreation Plan (SCORP) reported Arizona as having the eighth fastest rate of population growth in the country. Pinal County has experienced a doubling of population between 2000 and 2012, making it the second fastest growing county in the U.S. Although most growth has occurred west of Interstate 10, the Pinal County cities of Florence and Oracle Junction are also experiencing growth. Arizona is a major annual destination for millions of visitors, with 2011 tourism expenditures near $18 billion (AORCC 2012).

The 2010 National Survey on Recreation and the Environment indicates overall growth in both the number of people participating in outdoor recreation and in the number of participation days. The survey shows that 69% of residents in the western states are visiting recreation and historic sites on public lands. Arizona data show state park visitation has declined overall from 2007 to 2011, but the five state parks in Pinal County have all experienced increased visitation (AORCC 2012).

Approximately 60% of the households in Pinal County report visiting a park or recreation area an average of four times in the past three months, which equates to around 430,000 visits, with 37% reporting that they traveled more than 50 miles to visit a park (Pinal County 2007).

Since recreation in the Ripsey Wash and Hackberry Gulch TSF sites is dispersed in nature, visitation data for these areas is limited. The Ripsey Wash TSF project area occupies about 8% of the Middle Gila Canyons study area, which had an estimated 65,000 to 70,000 recreational visits annually during 2003-2006. Much of this use, however, occurs closer to the urban areas west and north of Ripsey Wash (BLM 2010).

Field observations indicate that the Arizona Trail is being used for hiking, biking, and horseback riding. Observers reported seeing three groups of five to ten bikers on the trail or trailhead and a truck/horse trailer parked in the trailhead during eight days in the field (Purcell 2014, ECA 2014). Observers during the peak season noted the Florence-Kelvin highway (Arizona Trail) Trailhead as fully occupied, with many vehicles from other states or Canada (Nelson 2014, Redfield 2014). The trail attracts international attention, as evidenced by international orders for the Arizona Trail Guidebook (Nelson 2014).

Ripsey Wash is used for camping, hunting, and OHV use. Hunting pressure is relatively light within the Tortilla Mountains, used primarily by local residents (AGFD 2014b). OHV riding is very popular in this region (as well as throughout Arizona), with an estimated 22 percent of the state population participating. The number of registered OHV vehicles in Arizona more than doubled between 2006 and 2011 and is forecasted to continue to grow (AORCC 2012).

The BLM Middle Gila Canyons Transportation Management Plan study area is one of several destinations in Arizona that provides opportunities for OHV use. Traffic sampling in 2007 indicated an annual average of 17.6 vehicles per day and peak daily traffic of 41 vehicles on the Cochran Road, located about three miles west of the Ripsey Wash TSF site. More recent sampling indicated increases in volume (BLM 2010). OHV riding in Ripsey Wash is popular with Kearny residents via the Hackberry Wash trail west of town. OHV use also occurs within the Hackberry Gulch TSF site along several routes, one of which leads to the abandoned Gray Horse Mine.

3.9.1.4 Recreational Opportunity Spectrum Classification

The BLM uses the recreation opportunity spectrum (ROS) system to incorporate recreation planning into their land use management process. The ROS continuum describes the existing conditions that define a land area's capability and suitability for providing a particular range of recreation experience opportunities. Once ROS designations are established, any proposed alterations to the landscape can be evaluated based on their potential to change the ROS designation. The 1989 RMP did not establish ROS designations for the BLM-administered areas within or adjacent to the TSF sites, so this document establishes ROS classes for the two TSF sites based on collected data. See **Table 3-48, Recreational Opportunity Spectrum Classes**.

Table 3-48, Recreational Opportunity Spectrum Classes

ROS	Class Description
Primitive	Opportunity for isolation from man-made sights, sounds, and management controls in an unmodified natural environment. Only facilities essential for resource protection are available. A high degree of challenge and risk are present. Visitors use outdoor skills and have minimal contact with other users or groups. Motorized use is prohibited.
Semi-Primitive Non-Motorized	Some opportunity for isolation from man-made sights, sounds, and management controls in a predominantly unmodified environment. Opportunity to have a high degree of interaction with the natural environment, to have moderate challenge and risk and to use outdoor skills. Concentration of visitors is low, but evidence of users is often present. On-site managerial controls are subtle. Facilities are provided for resource protection and the safety of users. Motorized use is prohibited.
Semi-Primitive Motorized	Some opportunity for isolation from man-made sights, sounds, and management controls in a predominantly unmodified environment. Opportunity to have a high degree of interaction with the natural environment, to have moderate challenge and risk and to use outdoor skills. Concentration of visitors is low, but evidence of other area users is present. On-site managerial controls are subtle. Facilities are provided for resource protection and the safety of users. Motorized use is permitted.
Roaded Natural	Mostly equal opportunities to affiliate with other groups or be isolated from sights and sounds of man. The landscape is generally natural with modifications moderately evident. Concentration of users is low to moderate, but facilities for group activities may be present. Challenge and risk opportunities are generally not important in this class. Opportunities for both motorized and non-motorized activities are present. Construction standards and facility design incorporate conventional motorized uses.
Roaded Modified	Similar to the Roaded Natural setting, except this area has been heavily modified (roads or recreation facilities). This class still offers opportunity to have a high degree of interaction with the natural environment and to have moderate challenge and risk and to use outdoor skills.
Rural	Area is characterized by a substantially modified natural environment. Opportunities to affiliate with others are prevalent. The convenience of recreation sites and opportunities are more important than a natural landscape or setting. Sights and sounds of man are readily evident, and the concentration of users is often moderate to high. Developed sites, roads, and trails are designed for moderate to high uses.
Urban	Area is characterized by a substantially urbanized environment, although the background may have natural-appealing elements. High levels of human activity and concentrated development, including recreation opportunities are prevalent. Developed sites, roads and other recreation opportunities are designed for high use.

Although much of the land within the two TSF sites is either ASLD-managed land or privately owned and thus not subject to BLM management prescriptions, ROS designations were developed to provide a consistent means to analyze project-related impacts on recreation resources.

Based on the above analysis of existing recreation facilities and use patterns, the ROS for the majority of the Ripsey Wash TSF project area (24,455 acres) would be considered Semi-Primitive Motorized due to its natural setting, combined with the extensive OHV activity in the area. Semi-Primitive Motorized settings are landscapes that are generally natural in appearance, but which are easily accessible, experience motorized use, and may be within sight or sound of human improvements.

The portion of the Arizona Trail corridor north of the Gila River (2,750 acres) would be considered "Semi-Primitive Non-Motorized" due to the relative lack of OHV trails and human improvements.

The portion of the Ripsey Wash TSF site within one-half mile of the Florence-Kelvin highway (6,862 acres) would be considered “Roaded Natural”, since most of the road corridor is relatively natural except for several livestock improvements and several electric transmission lines (including the 69kV SCIP electric transmission line) that are visible from the Florence-Kelvin highway. The only Roaded Modified setting is in the northeast corner of the project area (3,257 acres) where the existing Ray Mine dominates the view (defined as the portions of the mine viewshed within two miles of the mine). See **Figure 37, Existing Recreation Resources, Ripsey Wash Project Area**.

Within the Hackberry Gulch TSF project area, the landscape is generally natural with a relatively low concentration of users. The 26,185 acres of Semi-Primitive Motorized ROS setting include areas outside the existing Ray Mine Viewshed or where the mine may be visible but does not dominate the area’s visual character. Roaded Modified ROS settings include areas in which views of the existing Ray Mine dominate or lie within one-half mile of SR 177 (11,790 acres). See **Figure 38, Existing Recreation Resources, Hackberry Gulch Project Area**.

3.9.2 ENVIRONMENTAL CONSEQUENCES

3.9.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. Current dispersed recreation uses of the area would continue, including hunting, camping, OHV travel, hiking, etc. The Arizona Trail would remain in its current location.

3.9.2.2 Effects of the Ripsey Wash TSF Alternative

Construction and operational activities associated with the Ripsey Wash TSF would have direct effects on recreational activities in the project area. The Arizona Trail and dispersed recreational opportunities, such as OHV routes, campsites, and hunting resources, would be lost within and immediately adjacent to the TSF footprint. Approximately 10.2 miles of OHV trails would be eliminated with this alternative, including the northern portion of the Ripsey Wash Trail and the portion of the Florence-Kelvin highway to be paved. Eight informal, dispersed campsites within the Ripsey Wash TSF footprint would also be eliminated. Other lands within 500 feet of project facilities will remain open to the public. See **Figure 39, Recreation Resources, Ripsey Wash Alternative**.

The TSF would displace dispersed recreational use to other areas, especially during construction when new workers and their families might create an increase in local recreation activity. Recreation from the project areas is most likely to be displaced to lands north of the Gila River, to OHV routes south and west of the TSF site, or to the Dripping Springs Mountains. Because of the limited additional work force needed for TSF operation, decommissioning and final closure, this effort would not create any noticeable additional demand on recreation opportunities in this area.

Increased construction traffic on SR 177 or the Florence-Kelvin highway could have a minor effect on scenic driving. Construction noise could also affect recreational users in the immediate vicinity of the activity. Night sky effects would be minimal and localized as most construction activities would be conducted during daylight hours. Traffic and noise during TSF operations are expected to have a negligible effect on recreational users in the area. Night sky effects during TSF operations would be negligible given the limited need for lighting at the site.

Travelers who use the Florence-Kelvin highway for scenic driving or to access dispersed recreation areas could have a diminished recreation experience due to views of the TSF. Approximately one mile of the realigned highway, however, would have views of the Gila River canyon, improving the recreation experience. Construction of a proposed pull off along this section of highway would also benefit scenic driving.

Some of the higher elevations within the White Canyon Wilderness Area are within the TSF viewshed, but recreational use of these areas is minimal due to the steep terrain and difficult access. Portions of the Forest Service trails and campgrounds in the Pinal Mountains are also within the project viewshed, but the TSF would be over 15 miles away and thus would not impact the recreational experience of those using these facilities.

Development of the Ripsey Wash TSF would require relocation of a portion of the Arizona Trail, as well as the trailhead maintained by Pinal County on the Florence-Kelvin highway. Pinal County, the BLM, the Forest Service, the Arizona Trail Association, and Asarco worked together to identify trail selection criteria and possible new routes for the portion of the Arizona Trail that would be eliminated by the construction and operation of the Ripsey Wash TSF. This group agreed on a recommendation to the Corps for preferred route relocation on the south and east side of the TSF. See **Appendix G, Arizona Trail Relocation Analysis**.

Relocation of the Arizona Trail would require replacing approximately 6.8 miles of existing trail with about 6.4 miles of new trail construction primarily along the eastern slopes of the Tortilla Mountains and about 0.2 miles of shared use along Riverside Drive. Of the 6.8 miles of trail to be replaced, 5.1 miles are on state land. Pinal County holds the ROW for the 3.6 miles of state-owned trail located south of the Florence-Kelvin Highway. The BLM is in the process of acquiring the ROW on the 1.51 miles of state-owned trail north of the highway. The remaining 1.7 miles of trail to be replaced are on the BLM portion of trail north of the state land boundary. After construction and operation of the TSF, a total of 3.3 miles of trail located within the footprint or within 500 feet of project facilities will be closed to public use (1.0 miles on BLM ROW and 2.2 miles on County ROW). The remaining 3.6 miles of trail would be available for continued public use as spur trails if the BLM or County decides to continue the maintenance during TSF construction and operation.

Trail users along the new route would experience panoramic views of the Gila River Valley and the Dripping Springs Mountains, and thus the scenic quality of the trail experience should not be reduced by the relocation. The relocated trail would be located almost entirely within BLM-managed land (81%), compared to the existing trail which is almost entirely within ASLD land (75%). Asarco plans to construct the realigned trail after construction of the new Florence-Kelvin highway re-route, before the tailings would encroach on the existing trail. During the rerouting of the Florence-Kelvin highway, there would be some disruption to the trail where it intersects the construction. Once the road is completed, trail users would have to cross the new road section until completion of the new trail.

The trailhead would be relocated to the intersection of Riverside Drive and the Florence-Kelvin highway. Trail users would be able to cross the Gila River via the existing historic bridge, which will remain for pedestrian/equestrian use after completion of the new bridge[25]. The former highway approaches to the existing bridge, between Riverside Road and the turnoff for the BLM access north of the river (Centurion Road), will remain to reduce pedestrian/vehicular conflicts, in particular recreational users of the Arizona trail. See **Figure 41, Proposed Trailhead & Parking**.

[25] Construction of the new Florence-Kelvin highway bridge across the Gila River is a joint project of Pinal County and Arizona DOT. It is not part of the Ray Mine TSF project.

The Ripsey Wash TSF would alter the ROS setting in portions of the project area. About 6,437 acres of existing Semi-Primitive Motorized setting and 3,363 acres of the Roaded Natural setting along the Florence-Kelvin Highway would change to a Roaded Modified setting, because the TSF would dominate the view. The recreational setting of about 1,306 acres of the Semi-Primitive Non-Motorized setting north of the Gila River would also change to a Roaded Modified setting. Section 3.14, Visual Resources, provides more detailed description of visual impacts from the Arizona Trail and other recreation facilities.

The sites proposed for waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**) have no or limited present recreation value due to their condition and location on private property. The fencing of the proposed mitigation areas to preclude livestock grazing, wood harvesting and off-vehicle access would produce no impact to local or regional recreation activities because of the relatively small area involved with the proposed mitigation sites, their location on private property, and the adjacent public lands in this region that are available for outdoor recreation activities.

3.9.2.3 Effects of the Hackberry Gulch TSF Alternative

As with the Ripsey Wash TSF, dispersed recreational opportunities such as OHV riding, camping and hunting would be affected by the construction and operation of the Hackberry Gulch TSF. The Hackberry Gulch TSF would cause the loss of approximately 4.9 miles of primitive roads within the TSF footprint, primarily the Old Kelvin road, and disrupt access to primitive roads outside the TSF footprint. Several informal, dispersed campsites within the project footprint would be lost. The Old Ray road is located adjacent to the TSF and may also need to be closed once the TSF reaches its full extent; closure of the Old Ray road would eliminate access to the abandoned Grey Horse Mine, a popular OHV destination and rock hounding attraction. Other lands located 500 feet from project facilities will remain open to the public.

Loss of these roads would affect dispersed recreation opportunities and would result in displacement of recreation users to other areas, most likely to higher elevations within the Dripping Springs Mountains or to other primitive roads or OHV routes accessed from SR 177, such as the trails east of Kearny. Without these roads and trails, OHV riders would need to travel to the northern or eastern side of the Dripping Springs Mountains to gain access to these areas east of the Hackberry Gulch TSF site.

Construction traffic on SR 177 and noise generated during construction and operation would have similar effects as the Ripsey Wash TSF. Night sky effects during construction and operations are also expected to be similar to those for the Ripsey Wash TSF.

The Hackberry Gulch TSF would also affect the scenic views from recreation resources and SR 177. See Section 3.14, Visual Resources.

The Hackberry Gulch TSF would expand the portion of the project area designated as Roaded Modified ROS from 11,790 to 17,499 acres, since opportunities to interact with the natural environment (outside the TSF) would continue, but the industrialized character of the TSF would dominate the view. The existing 26,185 acres of Semi-Primitive Motorized setting would be reduced to 20,475 acres. These include areas outside the TSF viewshed or within the viewshed, but where the view would be relatively intermittent or where the TSF would not dominate the view (defined as areas over two miles from the TSF). See **Figure 40, Recreation Resources, Hackberry Gulch Alternative,** and Section 3.14, Visual Resources, for viewshed discussion.

Similar to the discussion in Section 3.9.2.2, Effects of the Ripsey Wash Alternative, recreation effects associated with the waters of the U.S. mitigation work set forth in **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**, would be negligible.

3.10 CULTURAL RESOURCES

Identify cultural resources and conduct Native American consultation. *The areas of concern include: (1) the effects to pre-historic and historic cultural resources listed or eligible for listing on the National Register of Historic Places; and, (2) the potential to affect cultural resources, reserved rights, trust issues, traditional cultural properties, and other responsibilities of Native American tribes.*

3.10.1 AFFECTED ENVIRONMENT

This section provides an analysis of cultural resources, including historical and archeological resources, for the proposed Ripsey Wash and Hackberry Gulch TSF alternatives. Historical resources are buildings, structures, sites, places, or objects generally associated with the time period from the beginning of the written recording of history to the present time. Archaeological resources may include both prehistoric remains and remains dating to the historical period. Prehistoric (or Native American) archaeological resources are physical properties resulting from human activities that predate written records.

This section provides a description of the regulatory context with respect to cultural resources, background information related to this project, a summary of the cultural resources investigations that have been conducted for this project, and an overview of the consultation activities between the Corps and relevant Native American tribes. A summary of the prehistoric and historic context for the project area is provided in **Appendix H, Cultural History**.

3.10.1.1 Background

3.10.1.1.1 Regulatory Context

Section 106 of the National Historic Preservation Act (NHPA) of 1966 (36 CFR 800, Section 106), as amended, requires that the lead federal agency with jurisdiction over a project must consider adverse effects to historic properties. The Corps has established procedures for complying with this requirement for 404 permit applications through 33 CFR Part 325, Appendix C: Procedures for the Protection of Historic Properties.

Compliance with Section 106 requires a sequence of steps, often referred to as the "Section 106 process." The steps include:

- Identify the "area of potential effects" (APE) for the project;
- Identify historical or archaeological resources within the affected area;
- Evaluate the eligibility of resources for listing on the National Register of Historic Places (NRHP);
- Determine the level of effect of the undertaking on eligible properties; and,
- Consult with concerned parties and develop a memorandum of agreement (MOA) on avoidance, minimization, or mitigation of adverse effects on eligible properties.

As defined in the NHPA (36 CFR 800.16(d)), an APE "is the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if such properties exist. The area of potential effects is influenced by the scale and nature of the undertaking and may be different for different kinds of effects caused by the undertaking."

Federal agencies define the APE for cultural resources in consultation with the SHPO. The Corps uses the term "permit area" See (33 CFR Part 325, Appendix C) instead of APE, which is defined as "those areas comprising the waters of the U.S. that will be directly affected by the proposed work or structures and uplands directly affected as a result of authorizing the work or structures."

Cultural resources are evaluated for their eligibility for inclusion on the NRHP based on a set of criteria detailed in the National Historic Preservation Act (NHPA) to serve as "an authoritative guide to be used by federal, state, and local governments, private groups and citizens to identify the Nation's cultural resources and to indicate what properties should be considered for protection from destruction or impairment" (36 CFR 60.2). The eligibility criteria are as follows:

- Criterion A: Are associated with events that have made a significant contribution to the broad patterns of our history; or,
- Criterion B: Are associated with the lives of persons significant in our past; or,
- Criterion C: Embody the distinctive characteristics of a type, period, or method of construction, or that possess high artistic values, or that represent a significant distinguishable entity whose components may lack individual distinction; or,
- Criterion D: Have yielded or may be likely to yield, information important to history or prehistory.

The criteria for eligibility to the NRHP provide the basis for evaluation and subsequent management of cultural resources in the permit area. The term "historic property" is used in this EIS to identify a property that is listed in the NRHP or which has been determined to be eligible for listing in the National Register. The eligibility of a property is determined in consultation between the Corps and other federal agencies, the SHPO and/or Tribal Historic Preservation Officer (THPO) (as appropriate).

Effects of the proposed undertaking on eligible properties are determined by the federal lead agency, in this case, the Corps. The lead federal agency will consult with the SHPO and/or the THPO and request concurrence. In addition, the federal lead agency will consult with other federal agencies with land management responsibilities within the APE. Consultation with the SHPO and/or THPO is requested for evaluations and recommendations with respect to NRHP eligibility and adverse effects.

In situations where a federal undertaking will have an adverse effect on historic properties, a Historic Properties Treatment Plan (HPTP) is developed that describes how a project proponent will avoid, minimize, or mitigate adverse effects. An MOA is also developed that makes reference to the HPTP and spells out the responsibilities of all the parties who are signatories to the agreement and identifies concurring parties. Concurring parties may include other stakeholders that do not have a financial or regulatory role in the project and they are not signatories to the MOA.

3.10.1.1.2 Related Projects

The Ripsey Wash TSF, which is the alternative proposed and preferred by Asarco, is contingent on the purchase of state-owned land by Asarco from the ASLD. The lengthy land auction/purchase process with ASLD has a number of required preliminary steps involving pre-sale activities such as inventories of biological and cultural resources, condemnation drilling, etc.

Prior to the submittal of a 404 permit application to the Corps in 2013, Asarco had conducted cultural resources surveys and was in the process of performing data recovery activities for known sites located within the prospective sale parcel, consistent with state cultural resources laws. The ASLD requires complete data recovery of cultural resources prior to the auction and sale of state-owned land. These activities have been performed, in part, in coordination and consultation with both the ASLD and the Arizona SHPO.

Data recovery activities had not been completed when Asarco submitted their 404 permit application, and they were suspended at the Corps' request once the application was submitted and Section 106 requirements were triggered within the permit area.

3.10.1.2 Permit Area

As described above, the Corps established a permit area for the proposed Ripsey Wash TSF alternative that identifies a physical area for evaluation of direct and indirect effects to historic properties. See **Figure 53, Ripsey Wash Area of Potential Effect**. The SHPO was also consulted regarding the permit area established by the Corps. The permit area has been determined to consist of the entire physical footprint associated with the Ripsey Wash TSF and associated infrastructure and facilities. The APE includes approximately a 100-foot-wide buffer from the edges of the project footprint, and extends along affected washes downstream of this TSF to their confluence with the Gila River. In addition, the Corps has included the realigned segment of the ANST and compensatory mitigation sites within the permit area because of their direct connection to the project.

A permit area was not established for the Hackberry Gulch TSF Alternative; however, an analysis area was developed that included the alternative footprint for this TSF and its supporting infrastructure.

3.10.1.3 Cultural Resource Investigations

3.10.1.3.1 Ripsey Wash TSF Site

WestLand (Asarco's consultant) has conducted cultural resource surveys both in support of Asarco's acquisition of State lands for the proposed project and for the larger permit area associated with the 404 permit application. WestLand prepared a summary document that details the previous investigations that have occurred within the permit area and provides a summary of the status of each archaeological site (Jerla 2013).

Table 3-49, Previous Cultural Resource Survey Projects within the Ripsey Wash TSF Permit Area, summarizes the previous cultural resources survey projects within the permit area. One additional survey project for the mitigation sites is pending preparation of the survey report.

Table 3-49, Previous Cultural Resource Survey Projects within the Ripsey Wash TSF Permit Area

Agency No.		Company	Project Name	Project Type
1963-8.ASM	1	ASM Cultural Resources Management Division	Buttes Dam Site Survey	Class III Survey
1973-2.ASM	2	ASM Cultural Resources Management Division	Buttes Reservoir Survey	Class III Survey
1975-5.ASM	3	ASM Cultural Resources Management Division	Buttes Reservoir Phase II	Phase II Data Recovery
1990-178.ASM	4	SWCA Inc.	ASARCO Tailings Pipeline	Class III Survey

Agency No.		Company	Project Name	Project Type
1993-369.ASM	5	Unknown	Unknown	Class III Survey
1995-127.ASM	6	Archaeological Research Services, Inc.	State Route 177/Kearny-Ray	Class III Survey
1997-59.ASM	7	AZTLAN	Arizona Trail Survey	Class III Survey
1997-416.ASM	8	SWCA Inc.	Mineral Creek Survey	Class III Survey
1998-213.ASM	9	Dames and Moore	Arizona Trail Archaeological Survey	Class III Survey
2003-1172.ASM	10	Gila River Indian Community, CRMP	SCIP Survey of Power Line near Riverside	Class III Survey
2003-1178.ASM	11	Gila River Indian Community, CRMP	SCIP Survey of Coolidge-Hayden 69-kV Power Line	Class III Survey
2003-1201.ASM	12	Gila River Indian Community, CRMP	SCIP Historical Assessment of Power Line in Vicinity of Riverside	Class III Survey
2007-19.ASM	13	Logan Simpson Design, Inc.	AZ Trail White Canyon Passage	Class III Survey
WRI 203.20	14	WestLand	ASARCO Tailings Dam Class	Class III Survey
WRI 203.20	15	WestLand	Archaeological Data Recovery and NRHP Eligibility Evaluation Plan for 28 Sites on Arizona State Trust Land in the Northern Tortilla Mountains	Data Recovery and Eligibility Plan
WRI 203.23	16	WestLand	Ripsey Wash Drill Pads	Class III Survey
WRI 203.25	17	WestLand	Ripsey Wash Pipeline Survey	Class III Survey
SWCA 6369-187	18	SWCA Inc.	Phases I and II Data Recovery Plan for Portion of AZ V:13:33(ASM)	Phases I and II Data Recovery Plan
SWCA 6369-187	19	SWCA Inc.	Living along the Gila River: Results of Archaeological Investigations at AZ V:13:33(ASM)	Phases I and II Data Recovery
SWCA 6369-076	20	SWCA Inc.	A Cultural Resources Survey of Approx. 8 Acres along Kelvin Bridge	Class III Survey
ASM ACC 1111	21	Donald Tuohy	Archaeological Survey and Excavation in theGila River Channel between Earven Dam Site and Buttes Reservoir Site, Arizona	Phase II Data Recovery
WRI 203.25	22	WestLand	Cultural Resources Inventory in Support of Projects for the Ray Mine near Kelvin, Pinal County, Arizona	Class III Survey

Source: Jerla 2013

WestLand has conducted pre-404 application data recovery and eligibility evaluation activities within the APE in accordance with the Data Recovery Plan coordinated with/approved by the SHPO and ASLD. The fieldwork obligations defined in the Data Recovery Plan have been fully implemented except for Phase II data recovery work at four sites (AZ U:16:21[ASM], AZ U:16:350[ASM], AZ U:16:351[ASM], and AZ U:16:394[ASM]), which cannot occur until consultation under the NHPA has been completed. Subsequent to Asarco's submittal of the 404 permit application for the TSF project, the Corps requested that Asarco stop performing data recovery actions until the Corps could define the project permit area and conduct NHPA Section 106 and tribal consultation, as appropriate.

3.10.1.3.2 Hackberry Gulch TSF Site

WestLand conducted an assessment of known cultural resources projects, located within the proposed Hackberry Gulch TSF site (King 2014). Thirty investigations have been previously conducted in this area though most of these studies are greater than 10 years old and only examined about 57% of the analysis area. See **Table 3-50, Cultural Resource Surveys within the Hackberry Gulch Analysis Area**.

Table 3-50, Cultural Resource Survey Projects within the Hackberry Gulch Analysis Area

Project No.		Project Name	Company
1963-8.ASM	**1**	Buttes Dam Site Survey	Arizona State Museum
1973-2.ASM	**2**	Buttes Reservoir	Arizona State Museum
1975-5.ASM	**3**	Buttes Reservoir Phase II	Arizona State Museum
1990-178.ASM	**4**	Asarco Pipeline Project	SWCA, Inc.
1990-179.ASM	**5**	Asarco Survey	SWCA, Inc.
1990-200.ASM	**6**	Asarco Alternatives	SWCA, Inc.
1991-224.ASM	**7**	Kearny Survey	Cultural and Environmental Systems, Inc.
1992-291.ASM	**8**	Route 177 Winkelman to Kearny	Archaeological Research Services
1993-369.ASM	**9**	EMA Survey	SWCA, Inc.
1995-127.ASM	**10**	State Route 177 Kearny and Ray	Archaeological Research Services
1997-258.ASM	**11**	Asarco Surveys	SWCA, Inc.
1997-416.ASM	**12**	Mineral Creek Survey	SWCA, Inc.
2003-1172.ASM	**13**	SCIP Survey of Powerline near Riverside	Gila River Indian Community
2003-1178.ASM	**14**	SCIP Survey of Coolidge-Hayden 69-kV Powerline	Gila River Indian Community
2003-1201.ASM	**15**	SCIP Historical Assessment and Documentation of Powerline in the Vicinity of Riverside	Gila River Indian Community
AZ-000114	**16**	BLM Grazing Lease Site Assessment, Middle Gila River	BLM Tucson Field Office
BLM-020-98-01	**17**	San Carlos Irrigation Project, Powerline	BLM Phoenix Field Office
BLM-024-95-20	**18**	Kearny Waterline Right-of-way	BLM Phoenix Field Office
BLM-060-MG-00-9	**19**	BLM Fence Line Survey (A-H Dam to 2 Mi. East of Cochran)	BLM Tucson Field Office
BLM-060-MG-00-10	**20**	Battle Ax Segment Fence Line Survey	BLM Tucson Field Office
BLM-060-MG-00-11	**21**	BLM Fence Line Survey: LEN Segment	BLM Tucson Field Office
BLM-17-85	**22**	Asarco Alternatives	SWCA, Inc.
BLM-17-32	**23**	Mining Plan	BLM Phoenix Field Office
BLM-17-50	**24**	Unknown	Not recorded
BLM-17-77	**25**	Asarco Survey	BLM Phoenix Field Office

Project No.		Project Name	Company
BLM-95-19	**26**	Unknown	Not recorded
WRI 203.25	**27**	Ripsey Wash Pipeline Survey	WestLand
WRI 203.29	**28**	Belgravia Pipeline Survey	WestLand
WRI 203.33	**29**	Belgravia Block Survey	WestLand
WRI 203.33	**30**	Belgravia Additional Class III Survey	WestLand
Source: King 2014			

3.10.1.4 Archaeological Sites

3.10.1.4.1 Ripsey Wash TSF Permit Area

Thirty-five archaeological sites were originally recorded within the portion of the permit area directly associated with the TSF facilities. Two of these sites (AZ V:13:6 (ASM) and AZ V:13:33 (ASM)) were originally recorded as separate sites and have since been incorporated into one site (under AZ V:13:33 (ASM)); therefore, there are 34 total sites within the permit area. Of these 34 sites, one site, the Kelvin Bridge, is listed on the NRHP. Twenty-three of the sites are considered eligible for listing on the NRHP, and ten sites are not considered eligible. Of the remaining 23 sites, data recovery activities (Phase I and Phase II) were completed at 12 sites prior to the 404 permit application submission as part of the land sale process. One of the 23 sites does not require additional data recovery work beyond Phase I testing.

The east and west bypass routes for the Arizona Trail were surveyed for the presence of cultural resources. The survey indicated the presence of eleven total sites, four that were previously known and confirmed and seven that were newly recorded. The survey also found 20 isolated occurrences. Of the eleven sites, two were previously determined to be NRHP-eligible by the SHPO. Eight sites are recommended as ineligible and one site's eligibility could not be determined. The isolated occurrences are recommended as ineligible.

The compensatory mitigation sites were each surveyed for cultural resources, and no such resources were found.

3.10.1.4.2 Hackberry Gulch TSF Site.

As noted previously, approximately 57% of the analysis area has been previously surveyed and most of the previous surveys conducted in this area are more than 10 years old. Within the area surveyed, 85 sites were previously recorded. Six of those sites were determined to be NRHP-eligible by the SHPO, and an additional 25 were recommended as eligible. The SHPO determined two sites to be not eligible, and an additional 14 sites were recommended as ineligible. Seven sites were not evaluated for eligibility, and 31 of these sites did not have their eligibility status recorded. There are two NRHP-listed sites located within five miles of the analysis area (Florence-Kelvin highway bridge over the Gila River and the SR 177 bridge over Mineral Creek).

In addition to these sites, the WestLand study noted that a review of General Land Office (GLO) plats and USGS quadrangle maps indicated 63 discrete historical features that meet the minimum threshold for being considered archaeological sites. Six of these features have already been recorded and are accounted for above.

Based on the number of sites previously recorded for just over half of the analysis area and the number of probable unrecorded features, it is likely that substantially more sites exist within the unsurveyed portion of the Hackberry Gulch analysis area.

3.10.1.5 Consultation and Coordination with SHPO

Asarco has previously conducted cultural resources surveys within the portion of the proposed Ripsey TSF site to be purchased from ASLD. In addition, a substantial amount of testing and data recovery has occurred within the sale parcel prior to Asarco submitting their 404 permit application. Up until the time the 404 permit application was submitted, these activities had all been conducted in consultation with ASLD staff and the Arizona SHPO in accordance with state law. Once the application was submitted to the Corps, these activities were ceased within the permit area at the Corps' request pending completion of Section 106 consultation.

The Corps initiated Section 106 consultation with the SHPO on September 23, 2013. The consultation letter to the SHPO indicated the Corps' determination that historic properties will be adversely affected if the proposed action is implemented. In addition, the consultation letter requested concurrence on NRHP eligibility recommendations for five sites that had not yet been reviewed by the SHPO.

The SHPO replied to the Corps on October 7, 2014 concurring with the Corps' determination of adverse effect to historic properties. The SHPO also concurred with the eligibility determinations provided for the five sites in question. The SHPO deferred concurrence on future treatment recommendations for sites with previous Phase I testing work until such time the Phase I results are reviewed by the SHPO. Consultation with the SHPO will continue as the project progresses through the 404 permit review process.

3.10.1.6 Native American Consultation

The Corps also initiated tribal consultation with 14 Native American tribes on September 23, 2013, requesting their participation in the Section 106 consultation process. The tribes were provided the opportunity to review and comment on cultural resources documentation that had been completed to date for the proposed action. In addition, the Corps asked the tribes to identify any Traditional Cultural Properties (TCPs) that may exist in the project vicinity.

The Corps received replies from four tribes expressing an interest in participating with the consultation process: Gila River Indian Community, Tohono O'odham Nation, Hopi Tribe, and White Mountain Apache Tribe. Tribal consultation will be ongoing as the project progresses through the 404 permit review process.

3.10.2 ENVIRONMENTAL CONSEQUENCES

3.10.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. Cultural resources would continue to be exposed to natural geomorphic processes or other disturbances associated with current and expected future recreation and ranch management activities in this area.

3.10.2.2 Effects of the Ripsey Wash Alternative

There are 23 NRHP-eligible sites located within the permit area associated with the proposed action and one site that is already on the NRHP (Kelvin Bridge). Implementation of the Ripsey Wash TSF would adversely affect all of these NRHP-eligible sites except one because the sites are either located within the footprint for the TSF or would be affected indirectly by the project. The Florence-Kelvin highway bridge (known locally as the Kelvin bridge) over the Gila River is located within the permit area for the proposed action but would not be affected by the project.

Archaeological sites that were originally located on the ASLD sale parcel were either fully or partially mitigated prior to submission of the 404 permit application through performing eligibility determinations, performing Phase I and II data recovery activities, and consulting with SHPO throughout this process. Therefore, some of the impacted sites have already been mitigated. **Table 3-51, Summary of Cultural Impacts and Mitigation Status for Ripsey Wash TSF Permit Area**.

Table 3-51, Summary of Cultural Impacts and Mitigation Status for Ripsey Wash TSF Permit Area

Sites (ASM)	Location	Mitigation Status	Type of Impact
AZ U:16:21	Within former ASLD sale parcel	Partially mitigated previously (Phase I)	Directly impacted
AZ U:16:23	Within former ASLD sale parcel	Mitigated previously	Directly impacted
AZ U:16:26	Within former ASLD sale parcel	Not previously mitigated	Directly impacted
AZ U:16:299	Privately owned	Not previously mitigated	Directly impacted
AZ U:16:345	Within former ASLD sale parcel	Mitigated previously	Directly impacted
AZ U:16:346	Within former ASLD sale parcel	Mitigated previously	Directly impacted
AZ U:16:347	Within former ASLD sale parcel	Mitigated previously	Directly impacted
AZ U:16:348	Within former ASLD sale parcel	Mitigated previously	Directly impacted
AZ U:16:349	Within former ASLD sale parcel	Mitigated previously	Directly impacted
AZ U:16:350	Within former ASLD sale parcel	Partially mitigated previously (Phase I incomplete)	Directly impacted
AZ U:16:351	Within former ASLD sale parcel	Partially mitigated previously (Phase I)	Directly impacted
AZ U:16:390	Within former ASLD sale parcel	Mitigated previously	Directly impacted
AZ U:16:392	Within former ASLD sale parcel	Mitigated previously	Not impacted
AZ U:16:394	Within former ASLD sale parcel	Not previously mitigated	Directly impacted
AZ U:16:395	Within former ASLD sale parcel	Mitigated previously	Indirect impacted
AZ U:16:428	BLM-managed	Not previously mitigated	Indirect impacted
AZ V:13:7	Privately owned	Not previously mitigated	Directly impacted
AZ V:13:33	Privately owned	Not previously mitigated	Directly impacted
AZ V:13:71	Privately owned	Not previously mitigated	Directly impacted
AZ V:13:138	Privately owned	Not previously mitigated	Directly impacted
AZ V:13:211	Within former ASLD sale parcel	Mitigated previously	Directly impacted
AZ V:13:220	Within former ASLD sale parcel	Mitigated previously	Directly impacted
AZ V:13:221	Within former ASLD sale parcel	Mitigated previously	Directly impacted

Construction and operation of the proposed Ripsey Wash TSF would have an adverse direct effect on the 23 historic properties that are eligible for listing on the NRHP. See **Table 3-51, Summary of Cultural Impacts and Mitigation Status for Ripsey Wash TSF Permit Area**. The adverse effects to these sites would result because of their location within the construction footprint for the TSF and related facilities. This is an unavoidable effect of implementation for this alternative. Although some of these impacted properties have been previously mitigated through data recovery, the proposed action would result in either capping of the sites (permanent burial) or complete removal from excavation, which is considered an adverse impact. Mitigation would be required to minimize this adverse effect for those sites that were not previously mitigated under separate circumstances. An HPTP will be developed to provide a research and methodological framework for mitigating the adverse effects of the project on cultural resources. The HPTP will also provide methods to monitor and mitigate adverse effects for inadvertent discoveries during construction.

Although the permit area has been completely surveyed for cultural resources, the potential exists for the discovery of previously unknown resources during construction of the Ripsey Wash TSF and the new Arizona Trail alignment. To address this issue, mitigation is required.

The permit area for the Ripsey Wash TSF includes a pipeline corridor extending from the proposed TSF site northward across the Gila River to the thickener, which is part of the concentrator facilities at Ray Mine. A pipeline bridge, separate from both the existing Kelvin Bridge National Register Property would be constructed over the Gila River in the future by Asarco to accommodate the required pipelines. This pipeline bridge would not use or require modification to any of the structural components associated with Kelvin Bridge and would be built as a separate structure. Impacts on the Kelvin Bridge would be limited to a change in the visual context for the existing bridge that would likely not be noticeably when compared to the much larger roadway bridge that is being constructed under a separate project. The proposed roadway bridge will be constructed between the historic bridge and the proposed pipeline bridge. For these reasons, impacts are expected to be minimal. No mitigation is required.

The Arizona Trail alignments contain 11 archaeological sites, some of which are eligible or have undetermined eligibility for the NRHP. Although relocation of a segment of the Arizona Trail would occur in an area where these sites exist, construction of the new alignment can be accomplished without disturbing known archaeological sites.

Construction and operation of the Ripsey Wash TSF would have an adverse indirect effect on two historic properties that are eligible for listing on the NRHP. See **Table 3-51, Summary of Cultural Impacts and Mitigation Status for Ripsey Wash TSF Permit Area**. The adverse indirect effects to these sites would result because of their location along Zelleweger Wash, which would receive additional redirected stormwater flow. This could cause increased bank erosion and lateral channel migration that could adversely affect these sites as they are located in close proximity to the bank crests for Zelleweger Wash. This is an unavoidable effect of implementation for the Ripsey Wash TSF. Although one of these sites (AZ:U:16:395[ASM]) has been previously mitigated through data recovery, the proposed Ripsey Wash TSF would result in capping of the site from permanent burial or complete removal from excavation activities, which is considered an adverse impact. Coordination with the SHPO will be conducted to determine appropriate mitigation requirements to minimize this expected adverse effect for the site (AZ U:16:428[ASM]), because it has not been previously mitigated under separate circumstances.

There are no known traditional cultural properties within the project footprint.

No adverse effects are expected to occur to cultural resources in the corridor proposed for the relocation of the Arizona Trail and waters of the U.S. mitigation (**Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**). A corridor of the proposed re-alignment of the Arizona Trail has been surveyed for cultural resources, and none were found that would be affected with the realignment. Similarly, the five sites proposed for waters of the U.S mitigation were also surveyed for the presence of cultural resources, and none were found.

No indirect effects to cultural resources are expected to occur under the Ripsey Wash TSF alternative.

3.10.2.3 Effects of the Hackberry Gulch TSF Alternative

Only about 57% of the Hackberry Gulch TSF alternative footprint has been surveyed to date. Within the area previously surveyed, there are 31 sites that are either NRHP-eligible or recommended as NRHP eligible. Based on the number of resources previously recorded in this area, it is reasonable to expect that additional sites would be potentially impacted by the construction and operation of the Hackberry Gulch TSF. A substantial amount of additional surveys, eligibility determinations, testing, data recovery, and consultation with the SHPO and tribes would be required if this alternative were implemented.

Construction and operation of the Hackberry Gulch TSF alternative would have an adverse direct effect on an unknown number of NRHP-eligible properties. The adverse effects to these sites would result because of their location within the construction footprint for the TSF and related facilities. This is an unavoidable effect of implementation for this alternative because it would result in the capping of the sites from complete permanent burial or excavation during construction of the facility. Mitigation is required to minimize this adverse effect.

Even after the footprint of the Hackberry Gulch TSF site is fully surveyed and historic properties documented, the potential would exist for the discovery of previously unknown resources during construction and operation. To address this contingency, mitigation is required. An HPTP will be developed to provide a research and methodological framework for mitigating the adverse effects of the project on cultural resources. The HPTP will also provide methods to monitor and mitigate adverse effects for inadvertent discoveries during construction.

There are no known traditional cultural properties within the project footprint.

No adverse effects are expected to occur to cultural resources in the corridor proposed for the relocation of the Arizona Trail and waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**). A corridor of the proposed re-alignment of the Arizona Trail has been surveyed for cultural resources, and none were found that would be affected with the realignment. Similarly, the five sites proposed for waters of the U.S mitigation were also surveyed for the presence of cultural resources, and none were found.

No indirect effects to cultural resources are expected to occur under the Hackberry Gulch TSF alternative.

3.11 SOCIOECONOMICS

Address the social, economic and lifestyle effects on residents in the local communities surrounding the Ray Mine. *Areas of concern include project-related construction and operational impacts to the demographics of local communities surrounding the Ray Mine, include impacts to employment, income, housing, utilities, public service, tax and governmental revenues, and present lifestyles.*

3.11.1 AFFECTED ENVIRONMENT

The proposed Ripsey Wash and Hackberry Gulch TSF sites are located in Pinal County. The County seat is Florence. Pinal County covers an estimated 5,374 square miles and was carved out of neighboring Maricopa County and Pima County in 1875.

This section provides an overview the socioeconomic conditions of Pinal County, with particular focus on the communities of Kearny, Superior, Gold Canyon, Hayden, and Winkelman. Other communities in the vicinity of the TSF sites are Kelvin and Riverside, although little to no data are available for these small communities. To aid comparison of the nearby communities, statistics from both the state of Arizona and the entire Pinal County are included.

3.11.1.1 Population and Demographics

As of 2010 census, the population of Pinal County was 375,770 people, making it the third most populous county in Arizona. At the 2000 census, the population of Pinal County was 179,727 people. Census populations for 1990 through 2010 for Arizona, Pinal County, Kearny and other nearby communities are set forth in the **Table 3-52, Historic Population**.

Table 3-52, Historic Population

Place	1990	2000	% Change 1990-2000	2010	% Change 2000-2010
Arizona	3,665,228	5,130,632	40%	6,392,017	25%
Pinal County	116,379	179,727	54%	375,770	109%
Kearny	2,262	2,249	(-1%)	1,950	(-13%)
Superior	3,501	3,254	(-7%)	2,837	(-13%)
Gold Canyon	NA	6,029	NA	10,159	(67%)
Hayden	909	892	(-2%)	662	(-26%)
Winkelman	676	443	(-34%)	353	(-20%)
Source: U.S. Department of Commerce, Bureau of the Census					

For the ten year period between 2000 and 2010, Pinal County population increased by nearly 110%. The majority of this population increase is located in the western portion of the county and results from suburban growth from the greater Phoenix area and northward from the Tucson area.

However, over that same 20 year period, the populations of the communities of Kearny, Superior, Hayden and Winkelman have decreased. This changes tend to parallel changes in employment activity, individuals leaving the smaller towns to relocate in other areas, and new employees (particularly at Ray Mine) deciding to live closer to the Phoenix metropolitan area.

Arizona and Pinal County expect population growth into the future, with projected population growth in Pinal County predicted to be more than double the overall statewide rate. See **Table 3-53, Population Trends**.

Table 3-53, Population Trends

Place	2010 (x 1000)	2020 (x 1000)	2030 (x 1000)	2040 (x 1000)	2050 (x 1000)	Total Growth (2010-2050)	Average Annual Growth (2010-2050)
Arizona	6,392	7,225 – 7,698	8,156 – 9,419	8,997 - 11,236	9,708 – 13,164	206%	5.2%
Pinal County	376	465 - 517	596 - 752	767 – 1,076	962 - 1,480	439%	11.0%
Source: (1) U.S. Department of Commerce, Bureau of the Census (2) Arizona Department of Administration, Office of Employment and Population Statistics: Arizona State and County Population Projections, 2012-2050: Methodology Report, December 7, 2012.							

The demographic characteristics for the area are set forth in **Table 3-54, General Demographic Characteristics: 2010**.

Table 3-54, General Demographic Characteristics: 2010

Subject	Arizona	Pinal County	Kearny	Superior	Gold Canyon	Hayden	Winkelman
Population	6,392,017	375,770	1,950	2,837	10,159	662	353
Veterans	530,693	NR[3]	NR	NR	NR	NR	NR
Sex							
Female (%)	50.3%	47.5%	50.7%	50.5%	51.9%	51.1%	49.6%
Male (%)	49.7%	52.5%	49.3%	49.5%	48.1%	48.9%	50.4%
Age							
Under 5 years (%)	7.1%	8.0%	6.0%	6.0%	2.5%	6.9%	5.4%
Under 20 years (%)	28.4%	28.7%	29.0%	26%	11.3%	29.7%	24.3%
65 years & over (%)	13.8%	13.9%	19.8%	19.6%	38.6%	18.4%	27.0%
Median Age (years)	35.9	35.3	41.8	45.0	60.9	40.0	46.5
Population by Race							
White (%)[1]	73.0%	72.4%	83.2%	70.5%	94.6%	63.9%	60.6%
Black or African American (%)[1]	4.1%	4.6%	0.5%	0.6%	1.0%	0.0%	0.6%
American Indian (%)[1]	4.6%	5.6%	0.8%	2.0%	0.4%	0.2%	3.7%
Asian (%)[1]	2.8%	1.7%	0.4%	0.6%	0.8%	0.3%	0.6%
Native Hawaiian and other Pacific Islander (%)[1]	0.2%	0.4%	0.1%	0.0%	0.1%	0.0%	0.0%
Some Other Race (%)	11.9%	11.5%	11.6%	22.5%	1.4%	34.0%	31.4%
Two or More Races (%)	3.4%	3.8%	3.4%	3.8%	1.6%	1.7%	3.1%
Population by Ethnicity							
Hispanic or Latino (%)[2]	29.6%	28.5%	41.6%	68.5%	5.5%	84.4%	82.4%
Not Hispanic or Latino (%)	70.4%	71.5%	58.4%	31.5%	94.5%	15.6%	17.6%

Source: U.S. Department of Commerce, Bureau of the Census
Notes:
(1) Includes persons reporting only one race.
(2) Hispanics may be of any race, so also are included in applicable race categories.
(3) NR means Not Reported.

The data reports a considerably older population living in the community of Gold Canyon than the rest of Pinal County or Arizona. This reflects the migration of retirees to this area.

The populations of Superior, Kearny, Hayden and Winkelman are also somewhat older than state and county averages, pointing to the general economic stagnation and in overall population decline in these communities of the past 20 years. Simply, many younger people are migrating from these towns in search of other employment or educational opportunities.

Hispanic residents represent the largest minority/ethic group in Arizona and Pinal County at slightly less than 30%. The communities of Kearny, Superior, Hayden and Winkelman have Hispanic populations greater than the statewide and Pinal County averages, while the Hispanic population in the Gold Canyon is considerably less than those averages.

3.11.1.2 Housing

Current household size in this area ranges from 2.20 persons per household in Gold Canyon to 2.71 persons per household in Hayden. See **Table 3-55, Housing Status: 2010**. Only Hayden has a higher average household size than reported for Arizona and Pinal County.

Table 3-55, Housing Status: 2010

Housing Status	Arizona	Pinal County	Kearny	Superior	Gold Canyon	Hayden	Winkelman
Total Housing Units	2,844,526	159,222	878	1,465	6,874	301	163
Occupied	2,380,990	125,590	756	1,103	4,888	236	136
Percent Occupied	83.7%	78.9%	86.1%	75.3%	71.1%	78.4%	83.4%
Owner Occupied	1,571,687	95,629	616	797	4,358	190	99
Population in Owner-Occupied	4,134,117	254,864	1,589	2,079	8.807	514	250
Average Household Size of Owner-Occupied	2.63	2.67	2.58	2.61	2.02	2.71	2.53
Renter-Occupied	809,303	29,961	140	306	530	46	37
Population in Renter-Occupied	2,118,516	94,661	361	758	1,352	148	103
Average Household Size of Renter-Occupied	2.62	3.16	2.58	2.48	2.55	3.22	2.78
Vacant	463,536	33,632	122	362	1,986	65	27
Vacant for Rent	120,490	4,887	23	79	123	3	8
Vacant for Sale	64,407	5,660	23	37	202	1	2
Vacant for Seasonal or recreational use	184,327	15,499	26	53	1,487	6	3
Homeowner Vacancy Rate (%)	3.9%	5.5%	3.6%	4.4%	4.4%	0.5%	2.0%
Rental Vacancy Rate (%)	12.9%	13.9%	14.1%	20.3%	18.3%	6.1%	17.8%

Kearny has a higher occupancy percentage than Arizona and Pinal County, but the towns of Superior and Gold Canyon report lower occupancy percentages than the state or county.

Average rental vacancy rates are higher in Kearny, Superior, Gold Canyon and Winkelman than the Arizona and Pinal County averages, but the average rental vacancy rate in Hayden is less than half of the statewide and county averages.

3.11.1.3 Employment

The percentage of the population over 16 not in the labor force is higher in Kearny, Superior, Gold Canyon, Hayden and Winkelman than that for the state of Arizona (38.6% not in the labor force). Statewide unemployment rate is 6%. Kearny has the lowest unemployment rate at 2.7%. See **Table 3-56, Employment (2008-2012)**.

Table 3-56, Employment (2008-2012)[(1)]

Subject	Arizona	Pinal County	Kearny	Superior	Gold Canyon	Hayden	Winkelman
EMPLOYMENT							
Population 16 Years and Older							
Total	4,967,615	281,615	1,878	2,364	9,430	601	361
Percentage	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Employed Civilian Labor Force							
Total	2,733,537	1131.512	907	999	3,754	287	126
Percentage	55.0%	46.7%	48.3%	42.3%	39.8%	47.8%	34.9%
Armed Forces							
Total	19,750	348	0	0	0	0	0

Subject	Arizona	Pinal County	Kearny	Superior	Gold Canyon	Hayden	Winkelman
EMPLOYMENT							
Percentage	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Unemployed							
Total	296,132	17,028	51	106	358	32	28
Percentage	6.0%	6.0%	2.7%	4.5%	3.8%	5.3%	7.8%
Not in Labor Force							
Total	1,918,196	132,727	920	1,259	5,138	282	207
Percentage	38.6%	47.1%	49.0%	53.3%	56.4%	46.9%	57.3%
INDUSTRY							
Agriculture, Forestry and Mining							
Percentage	1.4%	3.9%	32.9%	16.8%	1.0%	36.2%	40.5%
Construction							
Percentage	7.2%	7.5%	2.9%	6.1%	8.2%	4.2%	11.9%
Manufacturing							
Percentage	7.5%	10.1%	4.1%	1.2%	6.7%	12.2%	4.0%
Wholesale Trade							
Percentage	2.5%	2.2%	2.0%	0.3%	4.2%	0.0%	0.0%
Retail Trade							
Percentage	12.3%	11.5%	6.2%	9.8%	11.0%	3.1%	0.0%
Transportation and Warehousing, and Utilities							
Percentage	4.9%	5.0%	2.6%	4.4%	2.8%	0.0%	0.0%
Information							
Percentage	1.9%	2.0%	2.2%	3.2%	3.4%	0.0%	0.0%
Finance , Insurance and Real Estate							
Percentage	8.0%	6.6%	3.2%	2.6%	11.3%	0.0%	2.4%
Professional, Scientific, Management and Administrative							
Percentage	11.4%	8.7%	4.9%	7.7%	13.1%	9.1%	3.2%
Educational Services and Health Care							
Percentage	21.8%	20.4%	16.1%	18.9%	20.2%	13.6%	24.6%
Arts, Entertainment, Recreation, Accommodation and Food Services							
Percentage	10.5%	8.8%	8.9%	6.9%	5.8%	0.0%	0.0%
Other Services, Except Public Administration							
Percentage	4.9%	4.1%	2.0%	5.9%	6.0%	4.9%	0.0%
Public Administration							
Percentage	5.7%	9.2%	12.1%	16.1%	6.2%	16.7%	13.5%
CLASS OF WORKERS							
Private Wage and Salary Workers							
Percentage	78.4%	73.8%	73.6%	59.6%	73.2%	68.6%	64.3%
Government Workers							
Percentage	15.4%	20.9%	24.5%	34.1%	12.4%	30.3%	33.3%
Self-Employed in Own Not Incorporated Business Workers							
Percentage	6.1%	5.1%	1.9%	4.3%	14.2%	1.0%	2.4%
Unpaid Family Workers							
Percentage	0.1%	0.2%	0.0%	2.0%	0.2%	0.0%	0.0%

Source: U.S. Department of Commerce, Bureau of the Census, 2008-2012 American Community Service

Notes:

(1) Employment rates are averaged over a 5-year period from 2008-2012.

3.11.1.4 Income

Overall average per capita income in Pinal County is lower that the statewide average per capita income, and Hayden is considerably lower than the statewide average. See **Table 3-57, Income (in 2012 Inflation-Adjusted Dollars)**.

Table 3-57, Income (in 2012 Inflation-Adjusted Dollars)

Subject	Arizona	Pinal County	Kearny	Superior	Gold Canyon	Hayden	Winkelman
Per Capita Income	$25,571	$20,901	$22,506	$19,962	$40,042	$12,927	$18,155
Household Income and Benefits							
Total Households	2,357,158	122,746	804	1,066	4,828	210	120
Less than $10,000	7.4%	7.2%	6.0%	16.3%	3.4%	6.7%	10.0%
$10 - $14,999	5.2%	4.1%	4.5%	3.9%	2.5%	4.3%	6.7%
$15 - $24,999	11.0%	10.6%	12.3%	13.0%	6.4%	30.0%	7.5%
$25 - $34,999	11.2%	11.3%	13.1%	11.7%	9.8%	8.1%	14.2%
$35 - $49,999	15.0%	16.7%	13.4%	14.5%	10.8%	23.3%	16.7%
$50 - $74,999	18.9%	22.6%	19.9%	15.2%	26.1%	11.0%	20.8%
$75 - $99,999	12.0%	12.8%	9.3%	12.9%	11.7%	16.7%	10.0%
$100 - $149,999	12.0%	10.6%	9.3%	8.8%	19.1%	0.0%	14.2%
$150 - $199,999	3.9%	2.6%	1.4%	2.7%	5.1%	0.0%	0.0%
$200,000 or More	3.5%	1.6%	1.6%	0.8%	5.0%	0.0%	0.0%
Median Household Income	$50,256	$50,164	$50,556	$38,722	64,927	37,778	$38,846
Source: U.S. Department of Commerce, Bureau of the Census, 2008-2012 American Community Survey							

Median household income is similar for the entire state, Pinal County and Kearny, with a higher reported median household income for Gold Canyon and lower median household incomes for Superior, Hayden and Winkelman. See **Table 3-57, Income (in 2012 Inflation-Adjusted Dollars)**.

Median earnings for individuals employed in mining (with the exception of Hayden) have the highest for any reported earnings category. See **Table 3-58, Median Earnings by Industries for Individuals**.

Table 3-58, Median Earnings by Industries for Individuals

Subject	Arizona	Pinal County	Kearny	Superior	Gold Canyon	Hayden	Winkelman
Median Earnings for Civilian Employed Population 16 Years and Over							
	$32,270	$34,036	$32,391	$29,214	$39,207	$25,243	$28,333
Agriculture, Forestry, Fishing and Hunting							
	$23,105	$25,817	-	-	-	-	-
Mining							
	$58,202	$52,555	$53,802	$51,667	$85,694	$30,192	$49,125
Construction							
	$32,846	$40,228	$33,182	$27,596	$46,250	-	$80,156
Manufacturing							
	$47,642	$44,782	$50,865	-	$71,974	$25,865	-
Wholesale Trade							
	$40,755	$40,483	$39,000	-	$17,167	-	-
Retail Trade							
	$22,437	$21,287	$7,500	$12,500	$29,958		-
Transportation and Warehousing, and Utilities							
	$42,494	$42,500	$53,750	$55,357	$38,984	-	-
Information							

Subject	Arizona	Pinal County	Kearny	Superior	Gold Canyon	Hayden	Winkelman
	$41,398	$41,407	$25,714	$14,615	$108,315	-	-
Finance and Insurance							
	$43,402	$40,870	$22,500	-	$105,552	-	-
Real Estate and Rental & Leasing							
	$33,052	$31,689	-	-	$4,417	-	$2,500
Professional, Scientific, Management and Administrative							
	$34,519	$35,647	$31,111	$19,620	$27,188	$13,833	-
Educational Services							
	$34,331	$33,248	$32,566	$29,934	$29,471	$20,208	$6,932
Health Care and Social Assistance							
	$33,435	$32,045	$31,146	$40,625	$44,655	-	$6,750
Arts, Entertainment, Recreation, Accommodation and Food Services							
	$16,203	$16,201	$20,451	$6,494	$28,516	-	-
Other Services, Except Public Administration							
	$21,916	$24,735	$12,500	$10,938	$33,542	$20,909	-
Public Administration							
	$47,157	$45,308	$38,472	$44,271	$32,411	-	$27,639
Source: U.S. Department of Commerce, Bureau of the Census, 2008-2012 American Community Survey							

3.11.1.5 Environmental Justice

In 1994, the President of the United States issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations. The objectives of the Executive Order include developing federal agency implementation strategies, identifying minority and low-income populations where proposed federal actions could have disproportionately high and adverse human health and environmental effects, and encouraging the participation of minority and low-income populations in the NEPA process.

There are two types of data that must be reviewed to evaluate environmental justice effects: minority populations and poverty levels. Minority and income data for census tracts located within the project area were obtained from the most recent 2010 census. Countywide statistics for Pinal County were reviewed to determine the percentage of the population not classified as Caucasian and the percentage classified as Hispanic. Using the county average for comparison, each of the census tracts in the area was evaluated to determine whether the minority and/or Hispanic population percentages were greater than the county average. If a census tract percentage exceeded the county average, the tract was evaluated for environmental justice effects based on its minority population. In addition, the percentage of the population living below the poverty line was determined both for Pina County and the census tracts/block groups near the project site.

Table 3-59, Minority and Low Income Populations for Pinal County and the Project Area, provides a summary of relevant data for Pinal County and for the project area (Census Tracts 23 (Block Groups 1, 2, and 3). The percentage of Hispanic and low income populations in the project area is higher than Pinal County levels and is subject to review under Executive Order 12898. Although the affected area Hispanic population (Census Tract 23) is greater than the Pinal County Hispanic population, there appears to no disproportionate impacts.

Table 3-59, Minority and Low Income Populations for Pinal County and the Project Area

Population	Geographic Area	
	Comparison Population Pinal County (% of Total Population)	**Affected Area Census Tract 23 Block Groups 1, 2, and 3 (% of Total Population)**
Ethnic Groups		
Total Population	375,770	2,420
White	72.4%	59.4%
Black/African American	4.6%	0.6%
Native American	5.6%	1.0%
Asian	1.7%	0.3%
Pacific Islander	0.4%	0.0%
Hispanic (any race)	28.5%	**38.7%**
Low Income		
Population below poverty level	15.2%	**16.1%**
Source: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml; accessed October 14, 2014		

3.11.1.6 Social Values

The eastern part of Pinal County has a long history with copper mining, milling and smelting. The town of Kearny was developed by Kennecott in the 1950s when the company decided that underground mining had to give way to surface mining, and the old mining towns of Ray and Sonora had to be abandoned to advance the development and operation of the Ray Mine. The towns of Hayden and Winkelman developed around the copper smelting business.

Most households in eastern Pinal County identify with making a living from the copper industry, and these communities continue to obtain economic benefits from the high wage jobs associated with the copper mining, milling and smelting business. Most residents in these communities tend to value economic opportunity as represented by mining and related activities, but some raise concerns about the impacts of such activity on land use and recreation.

As explained in Section 3.10.2, Population and Demographics, the towns of Kearny, Hayden and Winkelman have experienced a decline in population over the past decade. Even with this decline in population, based on the public comments received during scoping, most residents of this area still view mining and smelting activities as having a positive effect on the quality of life because of economic stimulus and job opportunities.

3.11.2 ENVIRONMENTAL CONSEQUENCES

3.11.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. Selection of the no action alternative would forgo an opportunity for construction employment and income, as well as long-term economic activity from the Ray Mine and income for Pinal County and Arizona.

3.11.2.2 Effects of the Ripsey Wash TSF Alternative

3.11.2.2.1 Employment

The construction of the Ripsey Wash TSF would result in increased employment in Pinal County during the three years of construction activity, but employment levels would return to approximate current levels once TSF operations commence, as the two action alternatives are simply designed to replace the current Elder Gulch TSF and would be operated with the current on-site workforce.

Given the relative short-term nature of the construction activity, there would be negligible adjustments to the current indirect employment opportunities available in Kearny or other local communities.

3.11.2.2.2 Income

The three years of construction work for the Ripsey Wash TSF would add to Pinal County income. Actual wages would vary for the workers depending on job skills and job assignments, but construction workers for mine related activities in Arizona are generally some of the highest paid construction workers in Arizona.

The construction work on the Ripsey Wash TSF is estimated to provide up to 200 jobs to the Pinal County workforce, although most of these jobs would be short-term (less than three years). Asarco states that the company is committed to hiring as many local people as possible, and most of the construction workforce is expected to come from Pinal County.

The transition from the existing Elder Gulch TSF to a new TSF would allow existing TSF-related operational jobs to remain consistent with current levels. Thus, there would be no increase in overall income as a result of operation of the Ripsey Wash TSF site.

Closure activities, similar to construction, would have a minor effect on income because it is assumed that most of the closure workers would already live in Pinal County.

3.11.2.2.3 Population

Construction jobs would have a negligible effect on the population of Kearny and other local communities because of the temporary duration of construction and because most of the expected construction workers are assumed to already live in Pinal County. Given the temporary nature of the construction work, any individuals who are presently living outside of the region would probably not uproot themselves or their families to move to Kearny for the short duration of the construction activity.

The transition from the existing Elder Gulch TSF to a new TSF would allow existing TSF-related operational jobs to remain consistent with current levels. Thus, there would be no increase in population in Kearny or other local communities as a result of operation of either the Ripsey Wash or Hackberry Gulch TSF sites.

Closure activities, similar to construction, would have a negligible effect on the population of Kearny and other local communities because of the temporary ration of closure activities and because most of the expected workers are assumed to already live in Pinal County.

3.11.2.2.4 Housing

The construction and operation of the Ripsey Wash TSF would have a negligible effect on permanent housing in Kearny and other local communities. Most of the expected construction workers are assumed to already live in Pinal County. There would be ample hotel and rental accommodations for any of the “outside" construction workers in Kearny, Gold Canyon, or Apache Junction.

3.11.2.2.5 Community and Public Service

The construction and operation of the Ripsey Wash TSF would not have a measurable effect on the community and public services of Kearny and other Pinal County communities. With no permanent increase in local population as a result of the proposed TSF, there would be no influx of families, thus no increase in students for the local school systems. The existing law enforcement and fire protection personnel would continue to handle situations that arise. There is potential for accidents with construction workers, but the local and regional medical and hospital facilities should be adequate if there was a need for their services. The water supply and wastewater facilities of Kearny and other local communities would have capacity to handle any increase of construction workers in the community.

3.11.2.2.6 Social Values

The area around the communities of Kearny, Hayden and Winkelman has a long history of copper mining and smelting, and consequently residents are familiar with this industry and its economic benefits. The combination of familiarity and knowledge of economic benefit create a climate of general community acceptance and support for continued operation of this industry in the area. Combined with this general climate of acceptance are resident attitudes and values that my diminish support or create opposition for a particular development proposal, especially if residents perceive that such development might impact water quality or degrade the quality of recreation. These attitudes and values are evident in the comments submitted in response to the Corps scoping process for the Asarco TSF project.

Objections to the Asarco TSF project would typically be related to concern over unknown changes, loss of personal or local control, concern for long-term well-being of the environment, and protection of life style. Those who opposed the TSF express concern that water quality and quantity could be negatively impacted within and adjacent to the project. This is coupled with concerns about aesthetic qualities of the environment (such as air pollution, noise, and impact to recreation).

Those who support the Asarco TSF project related to continued or expanded employment opportunities and economic benefit to the region. Also identified are interests in providing jobs for area youth and maintaining an ongoing tradition of copper mining in the area.

3.11.2.2.7 Environmental Justice

No effects on environmental justice would be expected for the Ripsey Wash TSF. Although there are disproportionately minority and low-income populations identified within the general vicinity of the Ray Mine, there is no difference in the two locations with respect to environmental justice. The construction and operation of a new TSF would not have an adverse effect on environmental justice populations and would therefore not contribute to any cumulative effects to such populations in the region.

3.11.2.3 Effects of the Hackberry Gulch TSF Alternative

The socioeconomic effects of the Hackberry Gulch TSF alternative would be essentially the same as addressed in Section 3.11.2.2, Effects of the Ripsey Wash TSF Alternative. There would be little variation in the socioeconomic effects between Hackberry Gulch TSF and the Ripsey Wash TSF. The primary differences would be in physical design and the amount of construction activity required, with Hackberry Gulch having a more complex design and construction undertaking.

3.12 TRANSPORTATION

Address project construction and operations traffic impacts*. Areas of concern include: (1) the amount of road use and traffic on the Florence-Kelvin Highway and State Highway 177; (2) amount of project-related road maintenance demands during operation; and (3) potential for accidents with any increased road use.*

3.12.1 AFFECTED ENVIRONMENT

The transportation analysis includes US Highway 60, State Highway 177, the Florence-Kelvin highway, and local unpaved and two-track roads within or adjacent to the areas to be disturbed by either the proposed Ripsey Wash or Hackberry Gulch TSF sites. The main highways within the region are used by Asarco employees, contractors and suppliers, and are shown on **Figure 42, Highways & Roads**.

Traffic loads/traffic counts are identified by average daily traffic (ADT). ADT is defined as the measure of traffic over a 24-hour period and is determined by counting the number of vehicles passing a specific point on a particular road from either direction.

The Arizona Department of Transportation (DOT) estimates ADT values based on actual traffic counts made at various locations. See **Table 3-60, Traffic Counts**.

Table 3-60, Traffic Counts

Location of Traffic Counts	Year	Average Daily Traffic (All Vehicles)	Average Daily Traffic (Commercial Vehicles)	
			Single Truck	Combo Truck
U.S. 60 in Apache Junction	2012 2010	53,344 54,000	2,073 2,214	944 918
U.S. 60 at junction with SR 79	2012 2011	14,736 14,500	740 739	943 493
SR 177 at junction with US 60	2012 2010	4,048 4,100	207 254	139 143
SR 177 at junction with Florence-Kelvin Hwy (near Ray Mine)	2012 2010	3,052 3,100	198 192	210 109
SR 177 in Winkleman	2012 2010	4,720 4,100	279 209	304 139

Source: Arizona DOT traffic logs, 2014 (www.azdot.gov)
Note: No recent traffic counts are available for the Florence-Kelvin highway. In a Gila River Bridge Design report, Arizona DOT estimates ADT in 1989 was less than 200 vehicles per day in 2012

3.12.1.1 U.S. Highway 60

U.S. Highway 60 is the main artery that connects the Apache Junction and Phoenix metro area with points east, including the towns of Superior and Globe. From Apache Junction eastward toward Superior (approximately 29 miles), U.S. Highway 60 is an asphalt, four-lane divided highway. About seven miles west of Superior, U.S. Highway 60 narrows to an asphalt two-lane road. For Ray Mine employees and suppliers who are located in the Phoenix metro area, U.S. Highway 60 is the main road used to access Arizona State Highway 177, whose junction is located in Superior.

3.12.1.2 Arizona State Highway 177

Arizona State Highway (SR) 177 is a two-lane asphalt highway that connects Superior and Winkleman (about 32 miles). The Ray Mine complex is accessed from SR 177. In 2008, Arizona designated a 15-mile portion of the highway (from mile post 149 to mile post 164) as the “Copper Canyon Scenic Route.

3.12.1.3 Florence-Kelvin Highway

The Florence-Kelvin highway is a 32-mile two-lane Pinal County road that connects SR 179 (about three miles south of the town of Florence) with SR 177 near the Ray Mine. For approximately 16 miles east of SR 179, the Florence-Kelvin highway is paved with asphalt, but the remaining 16 miles is unpaved, including the portion that crosses Ripsey Wash.

The Florence-Kelvin highway crosses the Gila River near the community of Kelvin. Current ADT levels for this road at Kelvin are estimated to range from approximately 200 to 500 (personal communication with Chris Pfahl of Asarco).The existing bridge is a one-lane, weight-limited structure built in 1928. Pinal County and the Arizona DOT are planning to construct a new two-lane bridge adjacent to the existing bridge in 2015 (personal communication with Pinal County on April 2, 2014). This planned bridge construction is independent of the work associated with Asarco's proposed Ripsey Wash TSF.

3.12.1.4 Project Site Roads

Unpaved roads connect the community of Riverside with State Highway 177 and the Florence-Kelvin highway. There are also numerous two-track and dirt roads throughout this region. The two-track roads are mainly used for OHV recreation, although they are also used to access grazing allotments and mining claims in the region.

3.12.2 ENVIRONMENTAL CONSEQUENCES

3.12.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. Current traffic patterns and volumes on State Highway 177 and the Florence-Kelvin highway would be expected to continue at current levels, but could increase or decrease depending on the level of mining and recreation activity in the area.

3.12.2.2 Effects of the Ripsey Wash TSF Alternative

Under the Ripsey Wash TSF alternatives, traffic levels on SR 177 would increase during early development and construction activity, which is slated to last an estimated three years. This work would involve the transport of construction employees, equipment and supplies.

Construction employment would vary, but peak at about 200 workers. It is assumed that many of the construction employees would either carpool or van pool; this would be analogous to that of the existing Ray Mine workforce. To assess the traffic load increase on SR 177 during peak construction, the following assumptions were made:

- 50% of peak 200 workforce in van pools with 10 people per van: 10 vehicles;
- 25% of peak 200 workforce to car pool with 2 people per vehicle: 25 vehicles;
- 25% of peak 200 workforce with only one person per vehicle: 50 vehicles; and,
- Supply trucks per day (piping, fuel, liner material, etc.): 30 vehicles.

With these assumptions, there would be an additional 115 vehicles per day using SR 177 at peak construction. Current SR 177 traffic load at its intersection with the Florence-Kelvin highway is approximately 3,000 ADT, which includes about 200 trucks. Therefore, the overall increase in traffic volume would be less than 5% during peak construction. There would be a 15% ADT increase in the truck volume during peak construction.

As one of the first aspects of Ripsey Wash TSF construction, Asarco would construct a new routing (approximately 2.1-miles in length) of the Florence-Kelvin highway to the north and northeast of the tailings facility. This new road segment would paved with asphalt, meet required Pinal County road standards, and replace an approximate 1.8-mile long segment of the current Florence-Kelvin highway. This would reroute traffic away from Ripsey Wash TSF construction and greatly improve the condition of the Florence Kelvin highway.

During construction of the Ripsey Wash TSF, traffic levels on the Florence-Kelvin highway (from its junction with SR 177 to the TSF work site – about three miles) would increase 25 to 50%. At peak construction (lasting approximately 6-9 months), there would be an estimated increase of 115 vehicles on this road leading to the Ripsey Wash TSF site. No ADT levels for the Florence-Kelvin highway are available from Pinal County or ADOT, but it is estimated that current ADT levels for this section of the Florence-Kelvin highway range from approximately 200 to 500 (personal communication with Chris Pfahl at Asarco). The project increase in construction traffic would be short-term and should not affect normal traffic patterns for residents of Riverside and Kelvin who use this road.

During construction, the installation of the tailings slurry and reclaim water pipelines under the road or in the shoulder of the Florence-Kelvin highway, some traffic delays would occur, but such delays would be short-term (only one to two months). Traffic might be confined to one lane of traffic during this work.

The current Arizona Trail trailhead parking lot located off the Florence Kelvin highway would be eliminated with Ripsey Wash TSF construction, but Asarco would construct a new parking lot for the Arizona Trail near the intersection of the Florence-Kelvin highway and Riverside Drive, adjacent to the Florence-Kelvin highway bridge over the Gila River. See Section 3.9, Recreation.

Following construction, and throughout operation of the Ripsey Wash TSF, SR 177 and Florence-Kelvin highway traffic volume would return to near pre-construction ADT. Even with a few additional personnel required for the operation of the Ripsey Wash TSF, there would be no noticeable effect on the traffic load of the Florence-Kelvin highway. With Pinal County/ADOT's plans to build a new bridge across the Gila River and Asarco's plans to upgrade and asphalt approximately three miles of the Florence-Kelvin highway, traffic flow and safety would be improved over the existing road.

Under TSF closure, additional traffic load would be expected for SR 177 (approximaterly 1 to 2% over pre-construction levels) and the Florence Kelvin highway (approximately 10-15% over pre-construction levels), but this load would be of less duration and less volume than projected for the construction period.

Primitive roads located within the proposed TSF footprint, including the road in Ripsey Wash itself, would be closed to public access and would eventually be covered with tailings. There would continue to be public access on various primitive roads to the upper reaches of Ripsey Wash during construction and operation, as well as during closure/reclamation and post closure of the Ripsey Wash TSF. See Section 3.9, Recreation, for discussion on access road locations.

There are no federal, state or Pinal County transportation routes or facilities that would be affected by the construction of the new section (relocated portion) of the Arizona Trail. Similarly, there are no transportation routes or facilities that would be affected by the fencing and general upgrade (seeding and removal of tamarisk) of the riparian habitat within the proposed waters of the U.S. mitigation areas (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**).

Indirect effects SR 177 and the Florence-Kelvin highway would be negligible.

3.12.2.3 Effects of the Hackberry Gulch TSF Alternative

Under the Hackberry Gulch TSF alternative, traffic levels on SR 177 would be the same as discussed in Section 3.12.2.2, Effects of the Ripsey Wash TSF Alternative.

Under the construction of the Hackberry Gulch TSF, traffic on SR 177 would be impacted for an estimated 9 to 12 months with the installation of box culverts and a maintenance vehicle underpass. This construction work would necessitate speed limit reductions and traffic detours on SR 177.

Given the proximity of SR 177 to the proposed Hackberry Gulch TSF work, traffic would be periodically stopped for certain construction activities, including blasting. These traffic delays could impact employees and contractors who commute on SR 177 from Kearny, Hayden and Winkelman, as well as non-Ray Mine traffic on SR 177, which includes local residents.

For approximately three miles, SR 177 would straddle the Hackberry Gulch TSF on the east and related-support facilities (seepage trenches and seepage collection ponds) on the west. Travelers on SR 177 could be distracted by maintenance vehicle underpass and culvert construction work for SR 177 associated with the construction activities of the Hackberry Gulch TSF.

Primitive roads located within the TSF footprint would be closed to public access and would eventually be covered with tailings. Alternative access on other primitive roads would be available in areas east of the TSF for the public.

There would be no adverse effects to transportation from the mitigation work at the proposed for waters of the U.S. mitigation areas for the same reasons set forth in Section 3.12.2.2, Effects of Ripsey Wash TSF Alternative.

Indirect effects to SR 177 would be negligible.

3.13 VEGETATION

Address project-related impacts to vegetation. *Areas of concern include: (1) the impacts to vegetation communities by the project; (2) the impacts on any threatened, endangered, and candidate plant species as identified by the U.S. Fish and Wildlife Service; (3) the impacts to any BLM sensitive plant species; (4) the control of noxious weeds.*

3.13.1 AFFECTED ENVIRONMENT

Vegetation baseline studies were conducted to provide a description of the existing vegetation community conditions of the Ripsey Wash and Hackberry Gulch TSF sites. The baseline reports were designed to provide data on plant community structure and composition characteristics.

The vegetation communities were determined based on aerial and satellite imagery, data from existing vegetation surveys, and field visits. Plant association (vegetation community) names were based on the U. S. National Vegetation Classification System (USNVC 2013).

Table 3-61, Pertinent Characteristics of Vegetation Communities, presents descriptive information for the vegetation communities mapped at the Ripsey Wash and Hackberry Gulch TSF sites. Vegetation communities are shown on **Figure 43, Vegetation Map**.

Table 3-61, Pertinent Characteristics of Vegetation Communities

Vegetation Community Name	Location Across Project Site	Dominant Species/Features	Comments
Ripsey Wash TSF Alternative			
Saguaro/Paloverde-Jojoba/Mixed Cacti Shrub-land (SPJM)	Ubiquitous across various topographies and geologic parent materials; the dominant community	Saguaro, foothills paloverde, jojoba	A wide variety of cacti are present; southern aspects support a greater diversity of species.
Saguaro/Ocotillo/Jojoba/Triangle-leaf Bursage Shrubland (SOJB)	Limited to central portion of TSF site immediately east of Ripsey Wash	Saguaro, foothills paloverrde, jojoba, triangle-leaf bursage	Limited acreage but second most common community in Analysis area; includes old river channels overlain with soils and gravel.
Ocotillo/Paloverde/Mixed Shrubland (OPM)	Restricted to few northern-facing granitic slopes adjacent to Gila River	Ocotillo	Limited Acreage; common shrubs include Mojave buckwheat, triangle-leaf bursage.
Saguaro/Crucifixion Thorn-Paloverde/Mixed Cactus Shrubland (SCPM)	Extremely limited acreage west of TSF site	Crucifixion thorn, foothills paloverde are the dominant emergents.	Not likely to be impacted by proposed alternative activities.
Tuffaceous Sandstone Outcrop (TSO)	Limited acreage along western side of Ripsey Wash	Rock outcrop, various species including perennial grasses	Sparse to moderately vegetated; vegetation typically found in rock fractures and soil accumulations.
Paloverde/Catclaw-Burrowbush-Desert Broom Xenoriparian Washes (PCBX)	Dry washes including Ripsey Wash, Zelleweger Wash and tributaries	Foothills paloverde, catclaw acacia, netleaf hackberry	Vegetation fairly homogenous; typical of dry desert washes.
Riparian Vegetation (RIP)	Near Mouth of Mineral Creek and along the Gila River	Fremont cottonwood, Gooding's willow, tamarisk, mesquite	Additional shrub species present include catclaw acacia, seepwillow and desert hackberry.
Mesquite-Blue Paloverde Shrubland (MVP)	Limited to a flood terrace along Mineral Creek	Velvet mesquite, blue paloverde	Understory species include broom snakeweed, and southern goldenbush; much of the former terrace has been disturbed.
Hackberry Gulch TSF Alternative			
Saguaro/Paloverde-Jojoba/Mixed Cacti/Shrubland	Ubiquitous across various topographies and geologic parent materials; the dominant community	Saguaro, foothills paloverde, jojoba	A wide variety of cacti are present; southern aspects support a greater diversity of species.
Saguaro/ Ocotillo/Paloverde-Jojoba Shrubland	A significant, continuous acreage northeast of TSF site at higher elevations	Saguaro, ocotillo	At elevations ranging from approximately 2,300 to 2700 ft.
Saguaro/Paloverde-Jojoba/Triangle-leaf Bursage Shrubland	Broad, nearly level ridge tops southeast of Hackberry Gulch	Foothills paloverde, triangle-leaf bursage	Saguaros more dense in this community than other areas, cactus species vary widely depending upon locale.
Saguaro/Paloverde/Teddybear Cholla Shrubland	Northeast of TSF site	Foothills paloverde, teddybear cholla	At highest elevation of Analysis Area; from 2,600 to 2,800 ft.
Ocotillo/Paloverde-Mixed Shrubland	Limited acreage and distribution; isolated locations in eastern portion of TSF site	Ocotillo	Most common on north-facing slopes; near absence of saguaro and cacti species.

Vegetation Community Name	Location Across Project Site	Dominant Species/Features	Comments
Sonoran Riparian Deciduous Woodlands	Associated with riparian zones along Gila River and limited reaches of Gila River tributaries	Gooding's willow, Fremont cottonwood, seepwillow, tamarisk	Uncommon with a restricted distribution associated with springs, seeps, mesic sites, and wetlands.
Gila River Riparian Vegetation (Riparian Zone)	Along both banks of the Gila River	Freemont cottonwood, Goddin's willow, tamarisk, mesquite	Hydroriparian and mesoriparian vegetation characteristic; grass-like wetland species locally present.
Paloverde/Cat-claw-Burrobush-Desert Broom Xenoriparian Washes	Along dry washes and drainages including Hackberry Gulch and Kane Spring Canyon	Highly variable depending upon locale and site characteristics	Vegetation typical of dry, desert washes; upper drainages show evidence of scouring by water.
Conglomerate Outcrop	Minor acreage in northwest portion of TSF site	Barren conglomerate outcrops	Vegetation sparse; when present, vegetation typically limited to foot paloverde.
Arizona National Scenic Trail Reroute – Eastern Alignment			
Saguaro/Paloverde-Jojoba/Mixed Cacti Shrub-land (SPJM)	Ubiquitous along this trail reroute alternative	Saguaro, foothills paloverde, jojoba, creosote bush	A wide variety of cacti are present.
Source: WestLand 2014a and 2014b.			

3.13.1.1 Data Collection Methodologies

Vegetation field surveys were conducted for the Ripsey Wash TSF site in 2011, 2012, 2013 and 2014 (WestLand 2014a). Vegetation density, vegetation composition and noxious weed data were initially compiled in 2011 (WestLand 2011). Information and data regarding total vegetation volume (TVV)[26] of woody species were collected and compiled in 2013 to support the assessment of functions and values associated with jurisdictional Waters of the U. S. at the Ripsey Wash TSF site (WestLand 2013a).

Vegetation field surveys were completed for the Hackberry Gulch TSF site in 2013 and 2014 (WestLand 2014b). Vegetation data for this area was collected in 1990 (SWCA 1991), and this information was supplemented by additional field work in 2013 (WestLand 2014c). WestLand visited SWCA evaluation areas at the Hackberry Gulch TSF site in 2013 and confirmed that the species composition extant was similar to that observed in 1990 and remained applicable to the Hackberry Gulch TSF site.

3.13.1.2 Upland Vegetation – Ripsey Wash TSF Site

The upland vegetation at the Ripsey Wash TSF site is characteristic of the Paloverde-Cacti-Mixed Shrub series of the Arizona Upland Subdivision of the Sonoran Desertscrub. The riparian vegetation communities were characteristic of the Sonoran Interior Strands classification. Eight vegetation communities were identified at the site. See **Table 3-61, Pertinent Characteristics of Vegetation Communities**, and **Figure 43, Vegetation Map**.

The Saguaro/Paloverde-Jojoba/Mixed Cacti Shrubland community is the dominant upland community established across the majority of the site and supports a variety of woody and cacti species. The Paloverde/Catclaw-Burrowbush-Desert Broom Xenoriparian Washes unit represents the dry washes characteristic of the drainages within Ripsey Wash, Zelleweger Wash and their tributaries. Wetlands

[26] TVV is reported as "cubic meters of vegetation per square meter of surface area" (m^3/m^2) and measures vegetation density.

and riparian vegetation is mapped as the Riparian Vegetation Unit and is present along the banks of the Gila River.

The average upland total (woody) vegetation volume (TVV) calculated across upland vegetation community types equaled 0.55 m^3/m^2. Upland woody species richness, or the total number of upland species encountered in the analysis plots during the field surveys equaled 30 species. The dominant plant species in the uplands, and the percent of the total TVV each species accounted for, were foothill paloverde (*Parkinsonia microphylla*) at 26.5 %, jojoba (*Simmondsia chinensis*) at 19.3 %, and catclaw acacia (*Sennigalia greggii*) at 11.1%. These species plus desert hackberry (*Celtis pallida*) and whitethorn acacia (*Vachillia constricta*) accounted for 76 % of the TVV of the evaluated uplands. Based on the evaluation of three representative sample plots, it was estimated that an average of approximately 19 saguaro (*Carnegia gigantia)* plants per acre exist in the uplands of the Ripsey Wash TSF site.

The average TVV measured for the riparian vegetation community was 0.48 m^3/m^2. Species richness equaled 27 species. The Xenoriparian riparian vegetation community was divided into three classes for field evaluation based on watershed size. The "small" category (watersheds less than 50 acres in size) exhibited a mean TVV value of 0.42m^3/m^2 and a woody species richness of 19 species in the sample plots. "Medium" watersheds (ranging in size from 50-200 acres) posted a mean TVV value of 0.48m^3/m^2. A total of 18 species were tallied in all plots examined. For "large" riparian watersheds (watersheds greater than 200 acres in size), a mean TVV of 0.52 m^3/m^2 was recorded with a total of 21 species found in the sample plots. Dominant woody species across all watersheds included foothills paloverde, catclaw acacia, whitethorn acacia, and desert hackberry. The TVV volumes for these dominant species, in terms of the percent of total TVV in each watershed type, ranged from 22.7% to 29.6 %, 8.1% to 15.6 %, 9.4% to 18.2 % and 9.2 to16.9 % , respectively. These four species, along with jojoba and velvet mesquite (*Prosopsis velutina*), comprised approximately 72 to 80 % of the total TVV of the three watershed size classifications.

3.13.1.3 Upland Vegetation – Hackberry Gulch TSF Site

Vegetation communities at the Hackberry Gulch TSF site are mapped within the Arizona Upland Subdivision of the Sonoran Desertscrub biotic community. A narrow riparian zone (including small wetland areas) with inclusions of the Sonoran Riparian Deciduous Woodland and Sonoran Riparian Scrubland occurs along the Gila River. Sonoran Interior Strands of Xenoriparian vegetation are present along the ephemeral drainages. Nine distinct vegetation communities were identified at the Hackberry Gulch TSF site. See **Table 3-61, Pertinent Characteristics of Vegetation Communities**, and **Figure 43, Vegetation Map**.

As for the Ripsey Wash TSF site, the Saguaro/Paloverde-Jojoba/Mixed Cacti/Shrubland vegetation type is dominant and occurs across a variety of elevations and topographic features with similar biotic characteristics. Dry washes were mapped as the Paloverde/Catclaw-Burrobush-Desert Broom Washes unit while the riparian zone was mapped as the Sonoran Riparian Deciduous Woodlands and Gila River Riparian Vegetation.

The average upland TVV was calculated as 0.35 m^3/m^2. A total of 55 woody species were found in the upland plots evaluated. The dominant species, and the percent of TVV each species accounted for, were foothills paloverde at 34.1 %, creosote bush (*Laree tridentate*) at 16.9% jojoba at 12.3% and brittlebush (*Encelia farinosa*) at 6.0%. These four species comprise approximately 70 percent of the vegetation volume of the upland vegetation types mapped. Saguaro densities were evaluated across selected areas and plots. A density of 7.5 saguaros per acre was calculated for the large sample areas and 67.5 saguaros per acre for smaller plots established in flatter areas underlain by pediment sediments.

The average TVV measured for the riparian vegetation community as a whole was 0.49 m^3/m^2; similar to that for the Ripsey Wash TSF site. Species richness equaled 40 species. The Xenoriparian riparian vegetation community was divided into three classes for field evaluation based on watershed size as for the Ripsey Wash TSF site. The small watersheds exhibited a mean TVV value of 0.57m^3/m^2. Woody species richness was 26 species across the sample plots. Medium watersheds exhibited a mean TVV value of 0.48m^3/m^2, identical to that found for the Ripsey Wash TSF site. A total of 21 species were tallied in all plots evaluated. For large riparian watersheds, a mean TVV of 0.47 m^3/m^2 was calculated with a total of 33 species found in the sample plots.

Species dominance across the three watershed types was more variable than for the Ripsey Wash TSF site. Foothills paloverde was the sole dominant species occurring in all watershed types at the hackberry Gulch TSF site accounting for 12.6 to 24.9 % of the TVV values. Velvet mesquite (7.4 and 10.0%), whitethorn acacia (5.8 and 6.7%), and tamarisk (*Tamarix* sp.) (7.2 and 9.9%) are dominant in two of the three watershed types. With respect to other dominant species, seepwillow (*Baccharis salicifolia*) at 14.7% and Goodding's willow (*Salix gooddingii*) at 13.0% are dominants in small watersheds. Fremont cottonwood (*Populus fremontii*) at 39.6% is a major contributor to TVV values in medium watersheds and velvet ash (*Fraxinus velutina*) is a notable dominant in larger watersheds at 18.5%.

Pima County uses TVV values to classify Xenoriparian habitat quality to implement the county's riparian protection ordinance. The values calculated for both the Ripsey Wash and Hackberry Gulch TSF sites fall into *Xeroriparian Class D* (least dense, spare density).

3.13.1.4 Upland Vegetation – Arizona National Scenic Trail Reroute – Eastern Alignment

The vegetation community occurring along this alignment option is the Saguaro/Paloverde-Jojoba/Mixed Cacti Shrubland. Specific vegetation analyses were not conducted for this approximate 4.0 acre proposed disturbance. However, the vegetative characteristics of this community parallel those described for the Ripsey Wash and Hackberry TSF sites.

3.13.1.5 Threatened, Endangered and Sensitive Vegetation Species

A screening analyses was conducted to determine the potential for any USFWS-listed threatened and endangered species and BLM-listed sensitive species to be present on the Ripsey Wash and Hackberry Gulch TSF sites and surrounding areas including a reach of the Gila River and a portion of Belgravia Wash (WestLand 2014f and 2014g; WestLand 2014f and 2014g).

A variety of data sources were reviewed for these screening analyses including various USFWS, BLM and AGFD species lists, documents, species abstracts, previous pertinent biological surveys, and other pertinent literature (WestLand 2014f, 2014g, 2014h and 2014i). The determination of the potential for a species to be present at either the Ripsey Wash or Hackberry TSF site was based on:

- An evaluation of the known distribution and elevation ranges for a listed species;
- A review of the known habitat requirements of each species;
- Field observations and pertinent habitat descriptions;
- A review of previous occurrence records; and,
- A comparison of these data with the conditions present on site.

As a result of these analyses, the potential presence of each listed species was determined to fall into one of four categories including "present", "possible", "unlikely", or "none".

3.13.1.6 USFWS-Listed Vegetation Threatened and Endangered Species.

The screening analyses identified three endangered plant species that are listed as occurring in Pima County in the vicinity of the Ripsey and Hackberry TSF sites as listed below. The Acuna cactus is the only species that might potentially occur across the proposed Ripsey Wash (WestLand 2014f) and Hackberry Gulch (WestLand 2014h) TSF sites though its presence is highly unlikely.

- Arizona hedghog cactus (Echinocereus triglochidiatus var. arizonicus);
- Nichol Turk's head cactus (*Echinocactus horizonthalonius* var. *nocholii*); and,
- Acuna cactus (Echinomastus [Sclerocactus] erectocentrus var. acunensis).

3.13.1.6.1 Arizona hedghog cactus (Echinocereus triglochidiatus var. arizonicus)

No suitable habitat conditions were found for this species at either the Ripsey Wash or Hackberry Gulch TSF sites, which are outside the known geographic range of this species and below its recognized elevational range of 3,300 to 6,300 feet. Similarly, no critical habitat for this species is found in the proposed TSF sites.

3.13.1.6.2 Nichol Turk's head cactus (Echinocactus horizonthalonius var. nocholii)

No suitable habitat conditions were found for this species at either the Ripsey Wash or Hackberry Gulch TSF sites, as these species typically grows on limestone bedrock and limestone-derived soils at elevations from 2,000 to 3,600 feet. There is no suitable limestone substrate in the Ripsey Wash TSF site. Limestone bedrock and limestone-derived soils do exist in the northeast edge of the Hackberry Gulch TSF site, but the proposed TSF disturbed area is approximately 55 miles from the closest known populations of this species. Similarly, no critical habitat for this species is found in the proposed TSF sites.

3.13.1.6.3 Acuna cactus (Echinomastus [Sclerocactus] erectocentrus var. acunensis)

The potential for this species to occur at the TSF sites is considered to be "unlikely". Although this species grows on a wide variety of bedrock substrates ranging from granite and diorite to ryolite and tuff at elevations ranging from 1,300 to 2,000 feet, specific habitat requirements incorporating these geologic units are not well defined. WestLand did not detect the presence this species during the company's survey work on either alternative TSF site or the Arizona National Scenic Trail eastern reroute option . The nearest known populations of this species are over two miles to the southwest and twelve miles to the west-northwest of the Ripsey Wash TSF site and approximately ten to fifteen miles southwest and west of the Hackberry Gulch TSF site. Critical habitat has been proposed for this species, but none of this designated habitat is located at either the Ripsey Wash or Hackberry Gulch TSF sites.

3.13.1.7 BLM-Listed Vegetation Sensitive Species

The screening analyses conducted for sensitive species listed by the BLM Gila District determined that there was one plant species potentially occurring within limited habitat of both the Ripsey Wash and Hackberry Gulch TSF sites, and an additional three species might potentially occur across the Hackberry Gulch TSF site (WestLand 2014g and 2014i). Species presence classifications included none, "unlikely" or "possible" given site characteristics.

The sensitive species potentially present are discussed below.

3.13.1.7.1 Pima Indian mallow (*Abutilon parishii*)

This species is classed as “possibly” present at both TSF sites, which are within the species’ known geographic and elevation ranges and where suitable Sonoran desertscrub habitat is present. It is known to be present in Mineral Hills about 14 miles from the Ripsey Wash TSF site and in the Dripping Spring Mountains about 10 miles east of the Hackberry Gulch TSF site. The acreage of habitat suitable for supporting this species is notably small at both sites and any impact would not result in a trend to federal listing or a loss of viability.

3.13.1.7.2 Aravaipa sage (*Salvia amissa*)

The potential for this species to occur at the Hackberry Gulch TSF site is considered “unlikely”. Small areas of suitable habitat, in the form of isolated springs supporting velvet ash, are present near the northeast edge of the proposed Hackberry Gulch TSF site. However, the closest known existing population of this species is located about 29 miles southeast of this site.

3.13.1.7.3 Aravaipa woodfern (Thelypteris puberula var. sonorensis)

Suitable habitat for this species may be present at isolated springs associated with moist soil in the shade of boulders northeast of the Hackberry Gulch TSF site, but the closest known population of this species is east of the town of Superior about 11 miles north of the Hackberry Gulch TSF site. Therefore, the presence of this species is considered to be “unlikely”.

3.13.1.7.4 Giant sedge (*Carex ultra* var. *spissa*)

The potential for this species to occur within the Hackberry Gulch TSF site is classed as “unlikely”, although the Hackberry Gulch TSF site is within the known geographic range for this species. Suitable habitat may be present in the form of moist soil near isolated perennially wet springs and undulating rocky-gravelly terrain. However, the closest known population of this species is located about 30 miles southeast of the Hackberry Gulch TSF site.

3.13.2 ENVIRONMENTAL CONSEQUENCES

3.13.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. Endemic vegetation communities would continue to mature at natural rates, subject to climatic variations. Vegetation communities would continue to be subject to existing grazing and current dispersed recreation use.

3.13.2.2 Effects of the Ripsey Wash TSF Alternative

3.13.2.2.1 Upland Vegetation

Direct impacts to the upland vegetation resource (including Xenoriparian communities) include the immediate removal of all vegetation at the base of the impoundment dam and adjunct facilities (access roads, pump stations, etc., and the incremental burial of vegetation communities overlaying the TSF footprint. The contribution of these communities to the surrounding ecosystem would be lost. Portions of the vegetation communities subject to eventual burial may remain viable for variable time periods until the entire TSF floor is covered with tailings.

The realignment and paving of the Florence – Kelvin Highway and the realignment of the Arizona Trail also contribute to the acreage of vegetation removed. To a lesser extent, the 69-kV transmission line realignment would have a small foot print of vegetation removal at support structure sites. Approximately 2,574 acres of surface disturbance would result. See **Table 2-1, Summary of Ripsey Wash TSF Alternative.**

Approximately four acres of vegetation would be eliminated through construction of the Arizona Trail. The trail reroute is designed to avoid the removal of any saguaro cactus. Dust deposition on nearby desert vegetation from construction and operations activities may result in the loss of adjacent plant vigor due to reduced capability of photosynthesis from reduced light availability. These effects would be minor and would be minimized by proposed dust control measures during construction. Blowing dust in the desert is a common phenomenon during windy days because of the sparse vegetative cover.

Loss of vegetation translates into loss of wildlife habitat, and some species may be dislocated due to the change in habitat availability with vegetation community loss. See Section 3.15, Wildlife. Increased erosion potential of exposed soils is discussed in Section 3.2, Soils.

No adverse effects are expected to vegetation as a result of the work in the areas proposed for waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**). The proposed fencing and general upgrade (seeding and removal of tamarisk) of the riparian habitat within the proposed mitigation sites would improve the vegetation resources in the mitigation areas.

3.13.2.2.2 Threatened, Endangered, Candidate, and BLM Sensitive Plant Species

One threatened, endangered and candidate species, Acuna cactus, listed by the USFWS, was determined to be present west of the Ripsey Wash TSF but unlikely to occur on site due to its limited distribution (WestLand 2014f and 2014h). See **Table 3-62, Plant Species of Special Concern.**

The nearest surveyed occurrences of the Acuna cactus are over seven miles from the Ripsey Wash. Field surveys did not record any plants in the project area. No impact to this species is anticipated under the Ripsey Wash TSF alternative.

Table 3-62, Plant Species of Special Concern

Common Name	Scientific Name	Category	Potential to Occur	Range
Acuna cactus	*Echinomastus erectocentrus* var. *acunensis*	USFWS Endangered	unlikely	Gravel ridges; small knolls up 30% slope
Aravaipa sage	*Salvia amissa*	BLM Sensitive Gila District	possible but unlikely	narrow range, floodplain terraces in shady canyons
Aravaipa woodfern	*Thelypteris puberula* var. *sonorensis*	BLM Sensitive CO River District	possible but unlikely	few scattered springs
Giant sedge	*Carex spissa* var. *ultra*	BLM Sensitive Phoenix & Gila Districts	possible but unlikely	springs
Pima Indian mallow	*Abutilon parishii*	BLM Sensitive Gila District	possible	rocky slopes, good condition desert mts.

BLM Sensitive Species in the Gila District with a potential to occur in the vicinity of the project area are summarized in **Table 3-62, Plant Species of Special Concern**.

Pima Indian Mallow (*Abutilon parishii)* could potentially be affected by the Ripsey Wash TSF alternative, however the nearest surveyed occurrences is 14 miles from the Ripsey Wash area. Impacts would be limited to a notably small fraction of the total potential habitat available for this species. Any potential impacts would be to individual plants but such impacts are not likely to trend toward a federal listing or loss of viability (WestLand 2014 g and 2014l).

3.13.2.2.3 Noxious Weeds

Weed infestations could occur in areas disturbed by project operations, given their aggressive nature. No noxious weeds were found during fieldwork. (WestLand 2011).

3.13.2.3 Effects of the Hackberry Gulch TSF Alternative

This alternative would result in approximately 2,290 acres of surface disturbance, the vast majority of which currently supports vegetation communities. See **Table 2-1, Summary of Hackberry Gulch TSF Alternative**. As a result, the effects of this alternative in terms of direct and indirect impacts such as vegetation productivity/habitat loss, blowing dust, noxious weeds, etc. are the same as for the Ripsey Wash TSF. The Arizona Trail would not be disturbed under this alternative.

The nearest surveyed occurrences for Acuna cactus (USFWS endangered species) is over 13 miles from Hackberry Gulch area. BLM Sensitive Species in the Gila District with a potential to occur in the vicinity of the project area are summarized in **Table 3-62, Plant Species of Special Concern**.

Pima Indian Mallow (*Abutilon parishii)* could potentially be affected by the Hackberry Gulch TSF alternative, however the nearest surveyed occurrence is over nine miles from the Hackberry Gulch area. Impacts would be limited to a notably small fraction of the total potential habitat available for this species. Any potential impacts would be to individual plants but such impacts are not likely to trend toward a federal listing or loss of viability (WestLand 2014 g and 2014l).

No adverse effects are expected to vegetation as a result of the work in the areas proposed for waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**). The proposed fencing and general upgrade (seeding and removal of tamarisk) of the riparian habitat within the proposed mitigation sites would improve the vegetation resources in the mitigation areas.

3.14 VISUAL RESOURCES

Identify project-related impacts to visual resources. *The area of concern includes how the proposed new tailings storage facility might affect the view for: (1) residents of Kearny, Kelvin and Riverside; (2) travelers on State Highway 177 and the Florence-Kelvin highway; and, (3) recreational users in the area, particularly those on the Arizona Trail.*

3.14.1 AFFECTED ENVIRONMENT

This section focuses on the inventory and characterization of the visual resources potentially affected by the construction and operation of the proposed Ripsey Wash and Hackberry Gulch TSF sites and the proposed corridor for the relocated Arizona Trail.

3.14.1.1 Management Framework and Methodology

Most of the land at the proposed Ripsey Wash TSF site is owned by the state of Arizona and managed by ASLD; Asarco is working with ASLD to purchase this land. The proposed route for the relocated Arizona Trail traverses a combination of private lands and public lands managed by the BLM lands. Lands at the Hackberry Gulch TSF site are a combination of private and public ownership, with the public lands being managed by the BLM. Asarco is working with the BLM lands on a land exchange involving public lands that would include a portion of the Hackberry Gulch TSF. The land exchange is not a part of the proposed TSF project and thus is only being considered in the cumulative effects analysis of this EIS.

The BLM has established procedures for managing visual resources (BLM 1984), consisting of its visual resource management (VRM) system. The BLM VRM system was used to assess existing visual conditions of the BLM lands within the two project areas. The VRM system consists of a Visual Resource Inventory (VRI) analysis, designation of VRM objectives, and analysis of the compatibility of proposed development with VRM objectives.

The VRI analysis is based on scenic quality, viewer sensitivity, and viewing distance. Scenic quality is defined by the BLM as the aesthetic appeal of each Scenic Quality Rating Unit (SQRU), which are delineated based on similar visual characteristics, such as topography, color, and vegetation. Scenic Quality is expressed as Class A, B, or C Scenic Quality Rating (SQR). BLM criteria for evaluating scenic quality consist of the relative variety created by the study area's landform, vegetation patterns, water, and colors, as well as the relative scarcity of the landscape and the contribution of adjacent scenery, such as mountain backdrops. Cultural modifications are also considered, which can detract from the scenery in the form of a negative intrusion or improve the scenic quality. Class A scenery typically has the highest degree of scenic quality, which harmoniously combines and results in a high level of aesthetic appeal. Level C scenery has the lowest degree of scenic quality (BLM 1986a).

Viewer sensitivity, ranked as high, medium or low, is a measure of public concern for scenic quality, based on the type of users, amount of use, level of public interest, adjacent land uses, and special area designation. A high sensitivity rating would occur in places where scenic quality is a major concern for most users and/or where use levels are relatively high. Distance of view is considered through the delineation of three distance zones: foreground-middleground (less than three to five miles away from sensitive viewing locations), background (between five and 15 miles away), and seldom seen zones (over 15 miles away or not visible) (BLM 1986a).

Once visual values are inventoried, landscapes are assigned to one of four VRI classes, which represent the relative value of visual resources. Class I VRI is only assigned to areas where a management decision has been made previously to maintain a natural landscape, such as national wilderness areas. Classes II, III, and IV are assigned based on a combination of scenic quality, sensitivity level, and distance zones. VRI classes are informational in nature, providing the basis for considering visual values in the RMP process, but do not establish management direction.

On BLM-administered lands, the VRI classes are considered with other resource values in the Resource Management Planning (RMP) process, which designates visual resource management (VRM) objectives for each area. The VRM objectives provide standards for evaluating proposed projects' effects on visual resources. In cases where the RMP has not established VRM classes, as in the case of the Ripsey Wash and Hackberry Gulch project areas, the BLM uses the Class III VRM as an interim VRM class. **Table 3-63, BLM Visual Resource Management Classes**, provides the definitions of the VRM classes. The nearest Class I area is the White Canyon Wilderness Area, located approximately four miles north of the proposed Ripsey Wash TSF site.

Table 3-63, BLM Visual Resource Management Classes

Class I Objective	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II Objective	Class II Objective. The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
Class III Objective	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV Objective	The objective of this class is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

For this visual resource analysis, the BLM visual inventory process (VRI) was used to describe existing conditions on BLM lands. The Class III VRM objective was then used to compare the effects of the two action alternatives and the no-action alternatives within BLM-managed lands. **Appendix E, Visual Simulations,** provides the detailed VRI analyses and associated maps. On non-BLM-administered lands, the visual resources were described in terms of scenic quality, viewer sensitivity, and distance zones. The alternatives' effects on visual resources within these lands were evaluated in terms of their visibility from sensitive resources, duration of impact, distance from sensitive viewing areas, and degree of contrast with the existing landscape generated by the alternative.

The degree of contrast with the existing landscape is evaluated based on the BLM contrast rating system. The degree to which a project feature affects the visual quality of a landscape depends in part on the visual contrast created between a project and the existing landscape. The basic design elements of form, line, color, and texture are used to make this comparison and to describe the visual contrast and thereby the visual impact created by the project (BLM 1986b). **Appendix E, Visual Simulations**, provides the contrast rating forms completed for the two TSF sites (WestLand Resources 2014a).

3.14.1.2 Regional Landscape Character

The Ripsey Wash and Hackberry Gulch TSF project areas are located on the eastern edge of the Sonoran Desert subdivision of the Basin and Range Physiographic Province (AORCC 2012). The Basin and Range Province is characterized by its elongated, roughly parallel mountain ranges alternating with flat, closed (undrained) desert basins. The mountain ranges generally trend north-south and can be up to 100 miles in length. Typical landforms include creosote flats, bajada slopes, rugged mountains, and steep walled canyons. Prominent landscape features in the region include the Pinal Mountains, Mineral Mountains, Dripping Springs Mountains, Tortilla Mountains, White Canyon, the Rincon, and Copper Butte. The predominant vegetation communities consist of the Lower Colorado River Valley and the Arizona Upland subdivisions of the Sonoran Desertscrub biotic community. A riparian community follows the Gila and San Pedro River floodplains.

Scenic quality is considered important to those who visit the region's many recreation resources, including the Tonto National Forest Service, BLM lands, the Arizona Trail, and two wilderness areas. The closest wilderness area to the project site is the White Canyon Wilderness.

The region is primarily rural in character, with a generally natural, intact landscape. Residential communities include Superior, Kearny, Kelvin, Riverside, Hayden, and Winkelman. The Ray Mine and its associated infrastructure are visible for about five miles along SR 177. The Hayden mill and smelter complex, and its associated tailings facilities, are also visible from SR 177.

Transportation corridors include U.S. 60, SR 177, also known as the Copper Corridor West, the Florence-Kelvin highway, and the Copper Basin Railroad. Other cultural modifications to the landscape include transmission lines, microwave towers, irrigation canals, historic town sites and mines, isolated ranch houses, and range improvements, such as tanks, pipelines, fences, and windmills.

3.14.1.3 Local Area Visual Character

3.14.1.3.1 Landscape Description

The landscape within and adjacent to the Ripsey Wash TSF site is dominated by the Tortilla Mountains to the east, rising 1700 feet from elevation 1800 feet amsl to over 3500 feet amsl. To the north, the Gila River Canyon creates a curvilinear form, marked by its riparian vegetation. Ripsey Wash runs north-south along the base of the Tortilla Mountains, punctuated by small peaks and bajadas. Compared to the more open desert landscape to the west, the terrain is relatively rugged, dissected by deeply incised finger ridges separated by steep-walled gullies. The area is located in the Arizona Upland subdivision of the Sonoran Desert scrub, characterized by the paloverde-cacti-mixed shrub vegetation in the uplands and semi-riparian vegetation in Ripsey Wash and some of the ephemeral washes (WestLand 2014b).

The Ripsey Wash TSF site is relatively natural in appearance. Cultural modifications include the A-Diamond Ranch near the mouth of Ripsey Wash, the Copper Basin Railroad, and the arched span of the railroad bridge over the Gila River. Near the Ripsey Wash TSF site, the Florence-Kelvin highway is an unpaved road that crosses the Gila River on an historic, one-lane bridge. The Arizona Trail traverses the area, following the eastern side of Ripsey Wash and the north side of the Gila River. A county-maintained trailhead for the Arizona Trail is located adjacent to the Florence-Kelvin highway, south of the Gila River near Ripsey Wash. The BLM manages a trail access on the north side of the Gila River at the end of Centurion Road, about one-third mile west of the Florence-Kelvin highway. The first several miles of the Arizona Trail west of the BLM-managed trail access follow a reclaimed Asarco exploration road.

OHV trails and dispersed campsites are found throughout the area, primarily south of the Gila River, as are occasional livestock improvements. Other human modifications include the 500 kV transmission line visible in the background and the 69kV SCIP transmission line. Views of the Ray Mine are visible in the distance from the Florence-Kelvin highway looking east-northeast.

The Hackberry Gulch TSF site is dominated by the gentle bajada slopes at the lower elevations, transitioning to the steeper ridges of the Dripping Springs Mountains. The mountains provide a bold background skyline, while the Gila River floodplain creates a sinuous curve in the valley below. This site is more open than the Ripsey Wash TSF site, allowing more distant views across the Gila River valley.

Cultural modifications in the Hackberry Gulch TSF area are dominated by the Ray Mine and the existing Elder Gulch TSF. Other cultural modifications include the community of Riverside, the SR 177 corridor, and several electric distribution structures and lines. A network of OHV trails parallels the Gila River west of SR 177 and, on the east side of SR 177, provides access to the Dripping Springs Mountains. Dispersed campsites and occasional livestock improvements are also found east of SR 177.

3.14.1.3.2 Scenic Quality Evaluation

The scenic quality evaluation for the Ripsey Wash TSF Alternative is set forth in **Appendix E, Visual Simulations**.

The rolling character of the Ripsey Wash landform, although not highly distinctive, represents a visual relief from the flatter, desert landscape to the south and the open range east of the Gila River. The Tortilla Mountains to the east and ridgelines to the west provide a sense of containment to the Ripsey Wash area. Ripsey Wash has a Class C VQR, whereas the Tortilla Mountains are a Class B due to its topographic variety. The vegetation pattern in the area is fairly uniform, with relatively little variation; but, as with the landform, the ephemeral riparian and upland vegetation provide variation from the semi-desert grassland community to the south and west. The Gila River Floodplain is classified as a Level A SQR due to its relative scarcity in the region in terms of vegetation, color, and water.

Most of the cultural modifications that exist in the Ripsey project area are located within the Gila River riparian vegetation and thus not highly visible from much of the project area. The Florence-Kelvin Highway is the most visible cultural modification in the area, visible against the hillsides from primitive roads and the Arizona Trail. Being an unpaved road, the color and texture of the road are similar to some of colors/textures seen in the adjacent lands, while the curvilinear line and form are also compatible with the adjacent landscape, and thus the road does not detract significantly from the visual quality.

The Hackberry Gulch TSF project area would be a Class C VQR since it is typical of the basin and range region. The vegetation pattern and colors are relatively uniform throughout the project area. The Dripping Springs Mountains create the greatest visual variety within the Hackberry project area and are thus designated as a Class B SQR. The mountains offer relatively steep slopes dissected with numerous drainages rising above the valley floor, as well as some unique topographic features and red and purple rock formations. The cultural modifications within the Ray Mine scenic quality rating unit present a visual detraction, primarily because of the large scale and geometric form of the existing Elder Gulch TSF.

3.14.1.3.3 Sensitivity Levels

Sensitivity levels of the Ripsey Wash TSF site are considered moderate to high. Views from the Arizona Trail are of high sensitivity due to the trail's national significance, its potential for increased use in the future, and the type of users, which are generally sensitive to visual quality. Views from the Florence-Kelvin Highway would be rated a moderate concern level. Although traffic volumes on this route are relatively low, some traffic is generated by recreationists using the highway to access public lands. The OHV trails in the area would have a moderate level of sensitivity, since many of the users are concerned about scenery, but these OHV trails do not have the national recognition of the Arizona Trail.

The sensitivity level of the Hackberry Gulch TSF site is considered moderate. The status of SR 177 as a state-designated Scenic Highway, its relatively high traffic volume, and nearby OHV trails contribute to its sensitivity, but the project area is not as widely used for recreation as Ripsey Wash and has extensive cultural modifications (such as the adjacent existing Elder Gulch TSF), which contribute to its moderate sensitivity rating.

3.14.1.3.4 Viewing Distance

The Ripsey Wash and Hackberry TSF sites are both located within the foreground-middleground distance zone of two transportation corridors (SR 177 and Florence-Kelvin highway), the Arizona Trail, and local OHV routes. The Hackberry TSF would also lie within the foreground-middleground distance zone from the communities of Riverside, Kelvin, and Kearny.

3.14.1.3.5 Visual Resource Inventory (VRI) Class

Using BLM methodology for delineating VRI classes, the VRI class for the 196 acres of BLM-managed land within the Ripsey Wash SQRU is Class III. Most (56 percent) of the 18,031 acres of BLM-managed lands in the SQRU's adjacent to the Ripsey Wash project area would also be Class III due either to their Class C SQR or their location outside the foreground- middleground views from the Arizona Trail. For example, the areas south and west of Ripsey Wash are classified Class C SQR and thus would be a Level III VRI where located within the Arizona Trail foreground-middleground or Level IV within the background view from the trail or from the foreground-middleground view from the medium sensitivity viewing areas. The exception would be the Gila River floodplain and the lands north of the river, which both have a Class B SQR and thus are primarily Level II VRI lands. See **Appendix E, Visual Simulations.**

Most (81 percent) of the 2,917 acres of BLM-managed lands within the SQRU containing the Hackberry Gulch TSF site would be classified as VRI III, due to its Class C SQR and visibility within the foreground-middleground view from the Arizona Trail. The remaining 543 acres of BLM-managed lands within the Hackberry SQRU are a Class III VRI due to their location within the background view from the Arizona Trail. Most (67 percent) of the 10,624 acres of BLM-managed lands in SQRU's adjacent to the Hackberry Gulch SQRU would be a Class III since much of this area is a Class C SQR or is Class B SQR but located within the background view from the Arizona Trail.

3.14.1.4 Key Observation Points

Key Observation Points (KOPs) are publicly accessible locations from which a project would be visible and where there could be public concern for visual quality. KOPs are typically located within recreation resources, community facilities, key travel routes, or residential areas and are used to describe existing visual conditions and evaluate project-related visual effects. The criteria used to selecting KOPs are:

- Number of viewers;
- Duration of the view (e.g. miles of trail with view of project);
- Angle of view;
- Clear, unobstructed view of project features; and,
- Distance from project.

Six KOPs were selected based on viewshed analyses, field visits, and agency input, four of which are used to evaluate the contrasts generated by the Ripsey and Hackberry TSF alternatives. **See Figure 44, Key Observation Point (KOP) Locations**. All of the KOPs are located on travel corridors. Four are located on the Arizona Trail, one on the Florence-Kelvin highway, and one on SR 177. Photos of the existing conditions as seen from each KOP are set forth in **Appendix F, Visual Resource Inventory and Scenic Quality Analysis**.

3.14.1.4.1 KOP 1 – Florence-Kelvin Highway

KOP 1 is located within State Trust Land along the Florence-Kelvin highway, approximately one mile southwest of the Ripsey Wash TSF site and two miles southwest of the Ripsey Wash crossing. KOP 1 was selected for use in evaluating visual effects of the Ripsey Wash TSF.

The Florence-Kelvin Highway would be considered of moderate viewer sensitivity. Although traffic volumes on this route are relatively low (estimated to be less than 500 vehicles per day), it provides access to dispersed recreation, including numerous OHV trails, as well as the Arizona Trail. KOP 1 has an extended, relatively unobstructed view of the Ripsey Wash TSF site to the northeast.

The predominant forms within the foreground-middleground views from KOP 1 are characterized by the rolling terrain typical of the upper Sonoran Desert region. The forms are dominated by the undulating, horizontal bands of the Tortilla and Dripping Springs Mountains. The dominant lines are generally curvilinear, with diagonal lines formed by the mountain drainages. The highway forms a curving line, and the Saguaros add occasional vertical elements. The foreground-middleground color is predominantly a combination of the dark and light greens of the vegetation and light, pink tans of the exposed earth and highway. The colors of the mountains in the background become more blue-grey and a lighter value with distance. The texture of the exposed earth is fine to medium, interspersed with the coarser texture of the vegetation.

The only structures within the foreground/middleground view are the SCIP electric transmission structures and lines, which add vertical and horizontal lines to the landscape. Their dark, red-brown poles contrast with the lighter-value colors in the adjacent landscape. The existing Ray Mine is visible in the background as a lighter color. The pale green color of the dust control treatment accentuates the horizontal line of the Elder Gulch TSF, and the unpaved roads visible above the TSF create a strong color contrast.

3.14.1.4.2 KOP 2 - Arizona Trail (at Mile 4.3)

KOP 2 is located on the Arizona Trail within BLM-managed lands, about 4.3 miles west of the BLM trail access and about one mile north of the A-Diamond Ranch. See **Figure 44, Key Observation Point (KOP) Locations**.

This KOP was selected to represent views of the proposed Ripsey Wash TSF as seen from the Arizona Trail. The Ripsey TSF project site is to the south-southeast from KOP 2. This KOP would have a high viewer sensitivity rating, due to its national importance. Although relatively small in number, trail users generally have a high concern for visual quality. Trail use is expected to increase over time as it becomes more well-known, particularly by people from outside Arizona and the U.S. (Nelson 2014). This section of trail represents the most prominent view of the Ripsey Wash TSF site due to the north-south orientation of the trail and its close proximity to the proposed TSF site (slightly more than one mile away).

The existing landscape as seen from KOP 2 is characterized by rolling terrain and the rounded forms and horizontal bands created by the overlapping ridges. Vegetation creates irregularly shaped forms in the immediate foreground, transitioning to rounded clumps on the ridgeline. Dominant lines include the sinuous curves of unpaved roads visible in the foreground-middleground, the undulating line of the ridgelines and horizon, and the occasional strong verticals of the saguaro. Colors include a mix of dark and light greens, grays, and orange/yellow hues of the vegetation and the light pink/tan color of the exposed earth and road. Textures range from coarse in the immediate foreground to medium fine/patchy in the middleground and fine in the background. The only visible, cultural modifications are the Florence/Kelvin Highway and other unpaved roads.

3.14.1.4.3 KOP 3 – Arizona Trail (Jake's Overlook)

Located approximately 2.5 trail miles west of the BLM trail access and within State Trust land, KOP 3 was selected to evaluate visual effects of the proposed realignment of the Florence-Kelvin highway and SCIP electric transmission line associated with the Ripsey Wash TSF site. This KOP reveals existing views towards the south and southwest from Jake's Overlook. As discussed for KOP 2, KOP 3 would be considered of relatively high viewer sensitivity.

KOP 3 is situated within an open, relatively flat area at the end of a former mine exploration road reclaimed to form part of the trail. The BLM is considering plans to develop this location into an overlook because of its panoramic view of the surrounding mountains and Gila River floodplain. The view from KOP 3 represents the most prominent view of a relocated Florence-Kelvin highway and SCIP powerline corridor because the majority of these features would be visible.

The view from KOP 3 is dominated by the undulating, horizontal ridgelines of the background and middleground mountains silhouetted against the sky, contrasted by the diagonal lines and triangular shapes of the drainages. Floodplain vegetation creates sinuous curves along the Gila River and the lower reach of Ripsey Wash. Colors include the pale red/tan earth and the dark and light greens of the upland vegetation. The riparian vegetation has more variation in color, with pale orange, blue, and grey colors. Textures are coarse in the foreground, trending to the patchy, medium texture created by the vegetation against the exposed earth on the ridgeline. The A-Diamond Ranch and Kelvin/Riverside communities are visible in the distance, adding rectilinear forms and lines and light grey colors to the view. The historic railroad bridge visible in the foreground creates a rounded form and hard-edged line, with a medium value, blue-grey color and coarse texture created by the ironwork.

3.14.1.4.4 KOP 4 - Arizona Trail Access

KOP 4 is located at the Kelvin Trail Access, managed by the BLM and located west of the Florence-Kelvin highway. This KOP illustrates the view to the southwest from KOP 4.

This site is not considered a full trailhead, since it is not accessible for large trailers, but is an important departure point for the scenic Gila Canyons Passage of the Arizona Trail. The KOP was requested by the BLM as a means to evaluate the effects of the relocated Florence-Kelvin highway and SCIP electric transmission structures and lines. This KOP would also be considered of high viewer sensitivity. Use levels are generally highest within or near the trailheads since they are used by those individuals doing short hikes as well as thru-travelers, and the view duration is typically longer than on the trail.

The view is dominated by the triangular form of the ridgeline rising over the Gila River floodplain. The predominant lines include the undulating ridgeline sloping toward the river, the horizontal line of the valley floor, curvilinear lines of the vegetation, and the vertical saguaro. Colors are dominated by the green vegetation interspersed with the light red-tan of the earth. The floodplain vegetation is more varied in color than on the hillside, with muted yellows, ochre, orange, and the grey/lavender of the deciduous shrubs' branches. The texture is irregular and coarse in the foreground, transitioning to a medium texture as the landscape recedes.

The only cultural modifications at this KOP are the gravel surfaces and signage visible within the access area and the trail. The trail is a light tan color relative to its surroundings and is also visible on the opposite ridge, with its fill slopes creating a lighter color and finer texture than the surrounding vegetated hillside.

3.14.1.4.5 KOP 5 – State Route 177

KOP 5 is one of two KOP's selected for evaluation of the Hackberry Gulch TSF site. Located on SR 177 and within State Trust Lands, KOP 5 is about 1.5 miles north of the town of Kearny and about one mile south of the proposed TSF. KOP 4 would have an expansive view of the Hackberry Gulch TSF from SR 177 looking to the north.

SR 177 has a moderate sensitivity level. Its relatively large traffic volume (typically more than 3,000 vehicles per day) and designation by the state as the Copper Corridor West Scenic Highway is moderated by the highly modified surroundings. The bajada, or alluvial plain, transitioning to the Dripping Springs Mountains represents the view's dominant landscape character. The dominant forms are the horizontal masses formed by the middleground mountains, with steeper triangular forms of the background mountains. The dominant lines are the curvilinear hillsides in the foreground and the jagged background mountains. Colors are characterized by the light and medium-value greens and browns of the vegetation, interspersed with light red earth colors. The colors of the foreground earth are light pink/tan.

Cultural modifications consist of SR 177, electric transmission and distribution structures and lines, and the Elder Gulch TSF. These combine to create strong horizontal and vertical forms and line. The highway and guardrails create a strong triangular shape and diagonal lines. The highway adds a contrasting light grey and finer texture than its surroundings, while the power pole structures add a darker red-brown color. While the color of the Elder Gulch TSF is compatible with the adjacent landscape, it's more uniform texture and geometric form contrasts with the surroundings.

3.14.1.4.6 KOP 6 - Arizona Trail (Mile 2)

Located on the Arizona Trail within State Trust land and approximately two trail miles west of the BLM trail access, KOP 6 was selected because of its panoramic view of the existing Ray Mine and Elder Gulch TSF and the proposed Hackberry Gulch TSF site to the east.

This view is similar to the view from the community of Riverside and thus is also intended to be used to evaluate visual effects on Riverside. The number of users and viewer sensitivity level of KOP 6 would be similar to that for KOP 2, 3 and 4. The Hackberry Gulch TSF would be in the foreground-middleground and background views from KOP 6.

The dominant forms as seen from KOP 6 are the horizontal bands formed by the overlapping ridgelines and the Elder Gulch TSF. Other forms include the triangular shapes of the drainages below the ridgelines and the rounded clumps of vegetation, interrupted by the occasional vertical saguaro. The ridgelines create soft, undulating lines, except for the skyline which has a harder edge. The green vegetation creates the dominant color in the foreground, interspersed with the light red-tan color of the exposed earth. The colors become more muted and blue-grey as the landscape recedes. Textures are primarily coarse in the foreground, transitioning to the patchy texture in the middleground created by the clumps of shrubs against the exposed earth and then to a finer texture in the background.

Cultural modifications are highly visible from KOP 4. The horizontal form of the Elder Gulch TSF is compatible with the horizontal mountains, but the top edge creates a strong line against the curvilinear lines of the mountains. The colors seen on the embankment are compatible with the adjacent earth colors, but the geometric patterns formed by the different rock colors and the lack of vegetation contrast with the vegetation colors and the forms and textures of the surroundings. The light green color of the dust control treatment along the top of the existing Elder Gulch TSF accentuates its contrasting horizontal line. Unpaved roads and SR 177 also create color contrasts. Structures within the Riverside community are visible primarily as rectangular forms and lighter colors, with coniferous trees creating dark contrasts.

3.14.2 ENVIRONMENTAL CONSEQUENCES

The severity of a visual effect is dependent upon a number of factors including:

- Degree of contrast with the existing landscape;
- Visibility of project feature from sensitive viewing areas;
- The distance from sensitive viewing areas (i.e., transportation corridors, residential communities, and Arizona Trail);
- The level of disturbance to the visual resource;
- The duration of views from transportation or recreation corridors (length of view);
- Duration of the impact (short vs. long term);
- Potential for project features to alter the VRI Classification within BLM-managed lands; and,
- Potential for project features to conflict with VRM objectives within BLM-managed lands.

The distance from sensitive viewing areas is understood in terms of the TSF's location within the foreground, middleground or background. These terms are defined as follows:

- Foreground-middleground – typically the visible landscape between the viewer and a distance of three to five miles away, depending on specific conditions at each site. For the purposes of this analysis, the foreground-middleground zone is defined as visible areas between 0 to 5 miles from the viewer;
- Background – the portions of a landscape located beyond five miles from the viewer; and,
- Seldom Seen – the distant areas beyond 15 miles from the viewer or areas hidden from view.

Computer-generated visual simulations (WestLand Resources 2014) were prepared for six key observation points (KOPs) surrounding the TSF sites to represent the visual character of the TSF at the end of the centerline construction (approximately 20 years from project initiation) and at the end of the project operation, prior to closure (approximately 50 years from project initiation). KOPs locations are shown on **Figure 44, Key Observation Point (KOP) Locations.** Photographs of the existing visual conditions from each KOP and simulations of the expected appearance of the proposed TSF are set forth in **Appendix F, Visual Resource Inventory and Scenic Quality Analysis**.

3.14.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed. Visual contrasts would remain essentially in their current state, with operation of the Ray Mine and the Elder Gulch TSF being visible to those passing through the immediate area on SR 177 or the Florence-Kelvin highway, as well as those using the Arizona Trail, OHV trails or dispersed campsites in the vicinity of the Ray Mine. The area's visual character would continue to be affected by other features and structures, such as SR 177, the Florence-Kelvin highway, the SCIP 69 kV electric transmission line, and the houses and structures in the communities of Kelvin, Riverside and Kearny.

3.14.2.2 Effects Specific to the Ripsey Wash TSF Alternative

The Ripsey Wash TSF project would present visual contrasts with the natural landscape, visible from portions of the Florence-Kelvin Highway, SR 177, the Arizona Trail, and OHV routes in the vicinity of the TSF site. See **Figure 45, Visibility Study - Ripsey Wash Alternative.**

Travelers on the Florence-Kelvin highway would have intermittent views of the Ripsey Wash TSF for a total distance of about 5.4 miles, all of which would be foreground-middleground views. Users of the realigned Arizona Trail would have intermittent foreground-middleground views of the Ripsey Wash TSF for a distance of about 7.6 miles and background views for about 0.2 miles, primarily along the segment of the trail located north of the Gila River.

The Ripsey Wash TSF would be visible within the foreground-middleground view from SR 177 for a distance of about 1.7 miles and within the background view for about 1.0 miles. Some of the high-elevation OHV trails east of SR 177 in the Dripping Springs Mountains would have foreground-middleground or background views of the Ripsey Wash TSF. Some of the lower elevation OHV trails along the Florence-Kelvin Highway and south of the TSF site would have foreground-middleground views.

Certain TSF support facilities (pumping station, tailings pipeline, pipeline bridge, electric switchgear and drain-down pond) located primarily north of the Gila River would be visible from the Florence-Kelvin highway and a short segment (about 600 feet) of the Arizona Trail where it crosses the Gila River. These facilities would not generate extensive visual contrasts since they would be located near other similar cultural modifications, including the existing Florence-Kelvin highway, the Copper Basin Railway, the SCIP 69 kV electric transmission line and other utility lines, a Pinal County maintenance facility, and the proposed new Pinal County/ADOT Florence-Kelvin highway bridge over the Gila River.

The Ripsey Wash TSF would be visible in the background view from the White Canyon Wilderness Area, but views of the TSF site from the wilderness are from relatively inaccessible areas with rugged and steep terrain that are expected to have limited public visitation. The Pinal Mountains and portions of the Forest Service Pinal Mountain recreation facilities are located within the seldom-seen/unseen distance zone from the TSF site. Visual effects on these facilities would be minimal due to existing vegetative screening and the viewing distance of over 15 miles.

The Ripsey Wash TSF would generate contrasts with the form, line, texture, and colors found in the adjacent landscape, visible from sensitive viewing areas. See **Appendix E, Visual Simulations.** The horizontal form of the TSF embankment would be compatible with the horizontal mass of the surrounding mountains, but its geometric shape and the unbroken, straight lines of the top and side surfaces would contrast with the mountains’ curvilinear form.

The outer surface of the tailings embankment during the centerline construction phase would appear as a light, warm grey color with a uniform texture, contrasting with the surrounding green vegetation, light pink-tan earth colors, and rough, irregular textures created by the patches of vegetation against exposed earth.

After initiation of upstream tailings construction, concurrent reclamation would be initiated on the embankment slope created by centerline tailings construction. The embankment would be covered with rock quarried from an onsite source. This rock would be similar to the natural light pink-tan color of existing rock surfaces in the area, but its uniform texture would contrast with the irregular texture and combination of green vegetation and earth colors of the surrounding natural landscape.

During the upstream construction phase, dust-control treatment would be applied to the top lifts of the embankment. This would create a contrasting, light green color, accentuating the horizontal line of the TSF. Rock would be applied to the outer embankment after every third 10-foot lift; thus, the maximum height of the exposed tailings with dust control treatment would be about 30 feet.

Effects of TSF construction and operation on night sky resources would be minimal, as most construction would occur during daylight and operations would require little lighting. Construction activities would generate some fugitive dust, and high winds during operations could also lead to blowing dust that would be visible.

Upon permanent closure, TSF support facilities (i.e., drain-down pond, seepage ponds and power lines) would be removed, and those areas would be graded to blend with the surrounding undisturbed topography. Stormwater control features would remain in perpetuity.

The remaining outer surface of the tailings embankment would be covered with rock, thus eliminating the contrast created by the dust-control treatment. The impoundment area would also be covered with rock material, which would give the surface a light pink-tan color, instead of the grey tailings color. This would cause the TSF to better blend with the existing soil color, but the facility would continue to contrast with the adjacent landscape colors due to the lack of vegetation. The impoundment would also create contrasts in form, line, and texture with the surrounding natural landscape. The natural revegetation process would gradually soften this contrast, but it would take many years.

The Ripsey Wash TSF would require relocation of a 6.8-mile section of the Arizona Trail with a 6.4-proposed route located east of the existing trail within the Tortilla Mountains. The realigned trail would have views of the TSF for about 18% of its length. Views of the existing Ray Mine from the re-aligned trail would be similar in duration (64% of its length) to the portion of the existing trail to be replaced (67% of its length). The new trail would provide a similar visual quality as the existing trail, but has more variety in the adjacent topography and remains at a higher elevation than the existing trail and thus offers panoramic views. The visual resource inventory classifies the existing landscape of the trail route as Class B Scenic Quality due primarily to the interesting topographic features visible from the trail.

The new trail would result in minor visual effects on travel routes in the vicinity and thus would not alter the VQR rating of the area. The trail route currently traverses Class II and Class III VRI zones, but after trail construction would be entirely within a Class II VRI since it would fall entirely within the trail's foreground-middleground distance zone. The proposed route is located primarily on the eastern side of the Tortilla Mountains and thus would not be highly visible from the Florence-Kelvin highway. It may be slightly visible from intermittent locations along SR 177, within the foreground-middleground view, as a line of lighter color and relatively smooth texture against the hillside. Its form and line would be relatively compatible with the curvilinear character of the surrounding landscape.

The trail would involve an approximate disturbance width of three feet, but it would be slightly wider where switchbacks and retaining walls are used, and these may be visible in the immediate vicinity of the trail route. Onsite materials will be used to construct rock walls or rip/rap. Transplanting vegetation along areas of numerous switchbacks may be necessary, which would minimize visual effects. The proposed new trailhead site near the junction of Riverside Road with the Florence-Kelvin highway is currently disturbed, and thus development of the trailhead would likely improve visual conditions at this location.

No adverse effects are expected to visual resources as a result of the work in the areas proposed for waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation**

Plan). The general upgrade (seeding and removal of tamarisk) of the riparian habitat within the proposed mitigation sites would enhance the visual appearance of the sites to a more natural landscape. The proposed mitigation work would soften the cultivated appearance of Mitigation Sites A, B and D, as well as remove stands of burned tamarisk in Mitigation Site E that are now visible from State Highway 177.

The only Ripsey Wash TSF facility located within BLM-administered lands is an approximate .3 mile long segment of tailings/reclaim water pipelines, to be located adjacent or buried within the Florence-Kelvin highway west of the Gila River. The pipeline installation would be compatible with the interim Class III VRM, since it would not dominate the view and would not be highly noticeable in the context of the other existing cultural modifications in the immediate vicinity (Florence-Kelvin highway, the proposed Kelvin bridge over the Gila River, county maintenance buildings and electric transmission lines). The relocated Arizona Trail would meet the Class III VRM as well, since the trail would not dominate the view as seen from surrounding locations.

Using BLM criteria, the 196 acres of BLM-managed lands within the Ripsey Wash SQRU would remain as a Class III VRI, since the SQR would remain as a Class C and the area would continue to be within the foreground-middleground view from the Arizona Trail. The Class II portions of the Tortilla Mountains SQRU would remain a Class II VRI under the Ripsey Wash TSF. The relocated Arizona Trail and the tailings pipeline are the only project features located within this unit, which would not be highly visible, and thus are not expected to change the SQR. Much of the VRI III portions of this SQRU would change from II to III because they would fall within the foreground-middleground view from the new Arizona Trail. The VRI Classes in the other SQRU's are not expected to change substantially as a result of the Ripsey Wash TSF.

The Class III VRM objective would only apply to the BLM-managed lands to be used for the pipeline route. This objective would be met, since the TSF would not be visible from most of the route and most of the pipeline would be underground.

3.14.2.2.1 KOP 1: Florence-Kelvin Highway

Both the tailings embankment and impoundment of the Ripsey Wash TSF would be highly visible in the foreground-middleground at this KOP (approximately 0.8 miles away), located on the Florence-Kelvin highway. See **Appendix E, Visual Simulations**. As seen from this KOP, the TSF would generate contrasts in form, line, color, and texture. Views of the TSF from portions of the Florence-Kelvin highway south of KOP 1 would occupy a smaller portion of the overall view than at KOP 1 and become lighter and greyer in color with distance, reducing the level of contrast relative to contrasts seen from KOP 1.

3.14.2.2.2 KOP 2: Arizona Trail, Mile 4.3

KOP2 is situated within the Gila Canyon passage of the Arizona Trail, approximately 1.3 miles north of the Ripsey Wash TSF site. See **Appendix E, Visual Simulations**. The trail is oriented north to south in the vicinity of KOP 2, and thus the TSF would be backlit during much of the day, making color and texture contrasts less visible than if they were in direct sunlight. This orientation also results in southbound hikers having a view of the TSF for about one mile. Since KOP 2 is 543 feet lower than the ultimate height of the TSF, the tailings embankment would be visible to hikers, but the actual tailings impoundment area would not be visible as it would be from KOP 1. The tailings embankment would block views of most of the background mountains, generating contrasts in form, line, color, and texture. The relocated Florence-Kelvin highway and SCIP electric transmission line would also be visible from this

KOP. The visual effects of these features are discussed in Section 3.14.2.2.3, KOP 3: Arizona Trail, Jake's Overlook.

3.14.2.2.3 KOP 3: Arizona Trail, Jake's Overlook

KOP 3 is located north of the Gila River and would have foreground-middleground views of the relocated Florence-Kelvin highway and SCIP electric transmission line. See **Appendix E, Visual Simulations**. The middleground ridge would screen views of the TSF from KOP 3. Since KOP 3 faces south, the highway and transmission line would be backlit and thus in shadow during much of the day.

Road cuts, road fills, and retaining walls of the relocated Florence-Kelvin highway would be highly visible and would generate contrasts with the existing landscape. Although relatively compatible with the diagonal shapes of the adjacent ridges and drainages, the road cuts would create relatively straight lines due to the difference in color and texture. The lighter color of the cut slopes relative to the existing rock, coupled with the lack of vegetation, would create a color contrast and a homogeneous texture that would contrast with the uneven, patchy texture of the surrounding vegetated slopes.

The concrete retaining walls (reaching a maximum height of approximately 50 feet) would create greater contrasts than the cut slopes, with the top edge creating a relatively straight horizontal line and the bottom edges appearing as a relatively geometric shape compared to the more curvilinear forms and lines of the adjacent drainages. The relatively smooth texture of the concrete would create a strong visual contrast, accentuating the form and line contrasts. The use of colored concrete on the retaining walls would reduce the color contrast with existing natural earth color over uncolored concrete, but earth colored concrete could contrast with the green colors of the adjacent vegetation. See **Appendix E, Visual Simulations**.

SCIP electric transmission line structures (power poles) would be most visible where silhouetted against the sky, creating a stark color contrast. The actual visibility of the transmission line wires would depend on the sun angle and the background. The vertical form and straight lines of the structures would contrast with the horizontal mass of the ridge and the softer lines and diagonal form of the drainages. Most of the SCIP structures, however, would be viewed against the hillside and thus not be as visible as those seen against the sky due to their color, which is slightly darker than the natural reddish earth color.

3.14.2.2.4 KOP 4: Arizona Trail Access

The relocated Florence-Kelvin highway and SCIP electric transmission line would be highly visible from KOP 4, which is located north of the Gila River, about 0.7 miles from the highway/transmission line corridor. The corridor would be most visible during the morning hours due to its location southwest of the KOP. Visual contrasts created by the highway and electric transmission line at KOP 4 would be similar to those seen from KOP 3. See **Appendix F, Visual Resource Inventory and Scenic Quality Analysis**.

3.14.2.3 Effects Specific to the Hackberry Gulch TSF Alternative

As with the Ripsey Wash TSF project, the Hackberry Gulch TSF would generate visual contrasts with the adjacent landscape, visible from portions of the Florence-Kelvin Highway, SR 177, the Arizona Trail, and OHV routes in the project area. The contrasts in form, line, texture and color resulting from the embankment and tailings impoundment during the centerline and upstream tailings construction phases would be the same as for the Ripsey Wash TSF. Effects of TSF construction and operation on night sky resources and fugitive dust would also be similar to those under the Ripsey Wash TSF, as well as the visual effects occurring after permanent closure.

The visual effects of the Hackberry Gulch TSF would differ from the Ripsey Wash TSF primarily in terms of its visibility from sensitive viewing locations. See **Figure 46, Visibility Study - Hackberry Gulch Alternative**. Surface disturbance for the construction and operation of the Hackberry Gulch TSF would be highly visible within the foreground-middleground view from SR 177, as well as from the Arizona Trail and the community of Riverside, both of which have panoramic views of the Hackberry Gulch TSF site. The Hackberry Gulch TSF would be less noticeable from the town of Kearny and the Florence-Kelvin highway since most of the views from these areas are either relatively distant or screened by vegetation or topography.

Travelers on SR 177 would have foreground-middleground views of the Hackberry Gulch TSF for a total distance of 7.8 miles and background views for a distance of 0.6 miles. From the Florence-Kelvin highway, the Hackberry Gulch TSF would be visible for a total distance of 3.1 miles within the foreground/middleground and about two miles within the background. Hikers on the realigned Arizona Trail would have foreground/middleground views of the Hackberry Gulch TSF for about 4.6 miles and no background views.

Using BLM criteria, the VRI classification of the 2,917 acres of BLM-managed land within the Hackberry Gulch TSF area would not be altered by the project, thus remaining primarily (81 percent) Class III, with the remaining lands (19 percent) as Class IV, since the SQR would remain a Class C.

The Hackberry Gulch TSF site would not meet the interim Class III VRM assigned to the area because the change to the landscape would be considered major and the TSF would dominate the view, especially as seen from SR 177. Asarco is currently working with the BLM on a land exchange that would involve the BLM-administered lands, including the site proposed for the Hackberry Gulch TSF. The transfer of BLM-administered land to Asarco would mean that the federal land would become private ownership where VRM protocol would not apply.

No adverse effects are expected to visual resources as a result of the work in the areas proposed for waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**). The general upgrade (seeding and removal of tamarisk) of the riparian habitat within the proposed mitigation sites would enhance the visual appearance of the sites to a more natural landscape. The proposed mitigation work would soften the cultivated appearance of Mitigation Sites A, B and D, as well as remove stands of burned tamarisk in Mitigation Site E that are now visible from SR 177.

3.14.2.3.1 KOP 5: State Route 177

The Hackberry Gulch TSF would have a major visual impact to travelers on SR 177 and residents of Riverside because of its location and proximity, along with the contrast generated by its form, line, color, and texture. The Hackberry Gulch TSF embankment would be highly visible within the foreground/middleground view from KOP 5, which is located on SR 177 approximately one mile south of the TSF. See **Appendix F, Visual Resource Inventory and Scenic Quality Analysis**. The actual tailings impoundment area would not be visible from KOP 5 because its elevation is below the ultimate tailings embankment height.

From KOP 5, the Hackberry Gulch TSF would screen views of most of the existing Elder Gulch TS. The Hackberry Gulch TSF would be compatible with the straight lines and geometric shapes of the visible portion of the Elder Gulch TSF. The continuous, straight line created by the crest of the Hackberry Gulch TSF embankment, however, would contrast with the curvilinear character of the form and lines of the adjacent undisturbed landscape. Visual contrasts would diminish along SR 177 south of KOP 5 towards Kearny as the TSF becomes lighter and greyer with distance and occupies a smaller portion of the overall view.

3.14.2.3.2 KOP 6: Arizona Trail, Mile 2

The Hackberry Gulch TSF would be located about 1.9 miles east of KOP 6, which is located on the Arizona Trail. The TSF would be highly visible within the foreground/middleground view from this KOP. See **Appendix F, Visual Resource Inventory and Scenic Quality Analysis**. The TSF would be most visible in the afternoon given the east-facing orientation of KOP 6. The view from Riverside would be much closer than from KOP 6, slightly over one mile away; thus, the TSF embankment would occupy most of the view. KOP 6 is lower in elevation than the ultimate height of the TSF embankment, so the actual tailings impoundment area would not be visible from this KOP.

3.15 WILDLIFE

Identify impacts to wildlife and wildlife habitats. *Areas of concern include (1) the impacts to wildlife habitat, such as the physical loss of habitat and a reduction in diversity and habitat effectiveness; (2) the impacts to wildlife species found in the area, including those species listed in the Arizona Game and Fish Species of Greatest Conservation Need (SGCN) and Species of Economic and Recreational Importance (SERI); (3) the impacts on any threatened, endangered, and candidate wildlife species as identified by the U.S. Fish and Wildlife Service; and, (4) the impacts to any Bureau of Land Management sensitive wildlife species.*

3.15.1 AFFECTED ENVIRONMENT

Information used to describe and characterize wildlife resources for the Ripsey Wash and Hackberry Gulch TSF sites was obtained from:

- Published literature;
- AGFD’s State Wildlife Action Plan (SWAP), HabiMap graphics information system (GIS), and Heritage Data Management System (HDMS);
- BLM;
- Pinal County; and,
- WestLand field surveys and reports.

In addition, Cedar Creek Associates, Inc. completed reconnaissance level surveys of the Ripsey Wash and Hackberry Gulch TSF sites in early March of 2014.

The Ripsey Wash analysis area consists of approximately 9,500 acres and was defined to include all three Ripsey Wash Alternative TSF footprints and tailings embankments, surface water diversion features, seepage collection infrastructure, tailings delivery and reclaim water pipelines and project power line, the relocation of a segment of the Florence-Kelvin Highway, the realignment of a segment of the SCIP power line, and the realignment of the Arizona Trail. The analysis area consists of lands owned primarily by the ASLD, including lands that Asarco is seeking to acquire, and privately owned lands and lands administered by the BLM. Approximately 2,574 acres would be disturbed by the Ripsey Wash alternative within the 9,500-acre analysis area. **Figure 47, Wildlife Analysis Area - Ripsey Wash and Hackberry Gulch TSF**, displays the extent of the Ripsey Wash TAF Alternative analysis area.

The Hackberry Gulch analysis area consists of approximately 6,900 acres and was defined to include both Hackberry Gulch Alternative TSF and tailings embankments, surface water diversion features, tailings delivery and reclaim water pipelines, project power line, seepage collection infrastructure, lining of Belgravia Wash above its confluence with the Gila River, and a buffer area around all potential project activities including a reach of the Gila River downslope from Project activities. The analysis area consists of primarily of privately-owned lands, lands administered by the BLM, and lands owned by the ASLD. Approximately 2,290 acres would be disturbed by the preferred Hackberry Gulch alternative within the 6,900-acre analysis area. **Figure 47, Wildlife Analysis Area – Ripsey Wash and Hackberry Gulch TSF**, displays the extent of the Hackberry Gulch analysis area.

3.15.1.1 Habitat Overview

The topography, vegetation, and water sources within the Ripsey Wash and Hackberry Gulch analysis areas create a diversity of habitats and habitat features that support a variety of wildlife species. The Ripsey Wash and Hackberry Gulch analysis areas are characterized by rugged terrain, which varies from sandy wash bottoms to ridges and terraces with relatively steep side slopes and areas of rock outcrop. Elevations at the Ripsey Wash TSF site range from 1,800 to 3,000 feet above mean sea level and from 1,770 feet to 3,600 feet at the Hackberry Gulch TSF site. Both sites are mapped within the Arizona Upland subdivision of the Sonoran Desertscrub biotic community and possess the characteristic slopes, broken ground, and multi-dissected sloping plains typical of this subdivision (Brown and Lowe 1980).

Vegetation baseline surveys and analysis have confirmed the majority of both analysis areas are in Arizona Upland (WestLand 2014a, 2014b, and 2014c). There is a narrow riparian zone with patches of Sonoran Riparian Deciduous Woodland and Sonoran Riparian Scrubland along the Gila River and patches of Sonoran Riparian Scrubland on the lower reach of Mineral Creek. Small patches of Sonoran Interior Strands are also present in the xeroriparian vegetation along the major ephemeral drainages. Aquatic habitat near the two TSF sites is limited to lower Mineral Creek, the Gila River and seeps and springs that create relatively small perennial surface water sources within the Hackberry TSF site.

Seven upland plant associations were identified and mapped within Arizona Upland subdivision and three categories of riparian vegetation in the Ripsey Wash TSF (WestLand 2014a). Six upland plant associations and three categories of riparian vegetation were also identified and mapped for the Hackberry Gulch TSF (WestLand 2014b). The saguaro/paloverde-jojoba/mixed cacti shrubland plant association dominates both sites and the entire Arizona Trail realignment is in this plant association. Summary descriptions of the upland, xeroriparian, mesoriparian, and hydroriparian plant associations for the two TSF sites are provided in Section 3.5, Waters of the U.S. and Section 3.13, Vegetation.

3.15.1.1.1 Special Habitat Features

Seeps and springs provide water sources for wildlife and abandoned mine features create special habitat features important to some wildlife species groups (WestLand 2014d and 2014e). Surface water sources are discussed in Section 3.4, Surface Water, and associated wetlands are discussed in Section 3.5, Waters of the U.S. Locations of surface water features are depicted for Ripsey Wash and Hackberry Gulch, respectively, on **Figures 26, Surface Water Features – Ripsey Wash TSF**, and **Figure 28, Site Drainages – Hackberry Gulch TSF**.

There are no seeps or springs within the Ripsey Wash TSF, and the only wetlands near this TSF site are along the Gila River. There are two water wells and associated stock watering structures present within the Ripsey Wash TSF footprint (WestLand 2014d). Additionally there is a spring in a higher tributary, outside of the Ripsey Wash TSF footprint, that provides water to two stock watering structures within the TSF. All drainages within the Ripsey Wash TSF are ephemeral.

Within the Hackberry Gulch TSF, thirty eight surface water features have been identified. These include five wetland areas (including one or more seeps at each wetland), two springs, six small seeps with no associated wetland vegetation, and two wells (WestLand 2014e). Seeps and springs supported within the Hackberry Gulch TSF provide water sources important to almost all wildlife species in the TSF and nearby areas as well as supporting small pockets of riparian vegetation, including Fremont cottonwood (*Populus fremontii*), velvet ash (*Fraxinus velutina*), net-leaf hackberry (*Celtis reticulata*), Goodding's willow (*Salix gooddingii*), seepwillow (*Baccharis salicifolia*), and tamarisk (*Tamarix* sp.). Cattails (*Typha* sp.), arrowweed (*Pluchea sericea*), and spikerush (*Eleocharis* sp.) are also present at some of the more mesic seep and spring locations (WestLand 2014e). Pockets of riparian and wetland habitats within an area, otherwise dominated by dry upland habitats, serve to increase habitat diversity and support a wider diversity of resident and migratory wildlife species.

The Gila River and associated riparian vegetation create an important habitat feature near the Ripsey Wash and Hackberry Gulch TSF sites, although riparian habitat value is somewhat reduced by the dominating presence of a non-native species, salt cedar. The riparian zone along the river also provides enhanced conditions to increase the diversity of bird and mammal species in the TSF analysis areas. The Gila River is the only aquatic habitat within the both analysis areas that supports fish populations. The lower reach of Mineral Creek, near its confluence with Gila River also supports fish populations within the Ripsey Wash TSF analysis area. The riparian woodlands along the Gila River are of relatively limited occurrence in central Arizona. These woodlands, dominated by tamarisk, Fremont cottonwood, and Goodding's willow, are important to many types of wildlife life, but especially to songbirds and some raptor species. Gila River riparian woodlands are known to support many migratory and resident songbirds, including breeding populations of the federally listed endangered southwestern willow flycatcher (*Empidonax traillii extimus*) and threatened yellow-billed cuckoo (*Geococcyx americanus*).

Saguaro cactus density is generally low in the in the two TSF sites, although there are areas with fairly dense saguaro stands. Saguaros are important to many species of wildlife in that they provide forage in the form of pollen, nectar, and fruit in the late spring and early summer. Saguaros are also used by Gila woodpeckers (*Melanerpes uropygialis*) and gilded flickers (*Colaptes chrysoides*) to excavate cavity nest sites, which are subsequently used by a number of other cavity-nesting bird species, including elf owl.

3.15.1.1.2 AGFD Habitat Ratings

The AGFD uses the Species and Habitat Conservation Guide (SHCG) for non-tribal lands across Arizona to evaluate wildlife conservation potential. The SHCG model is intended to identify areas of wildlife conservation potential at a landscape/statewide scale to guide the AGFD's strategic wildlife goals and objectives. The five model indicators upon which SHCG mapping values are based (AGFD 2013) are:

- The importance of the landscape in maintaining biodiversity - represented by the Species of Greatest Conservation Need (SGCN);
- The economic importance of the landscape to the Department and the community – represented by the Species of Economic and Recreational Importance (SERI);
- The economic importance of the water bodies and aquatic systems to the Department and the community - represented by sport fish;
- Large areas of relatively intact habitats - represented by unfragmented areas; and,
- The importance of riparian habitat to wildlife – represented by riparian habitat.

These indicators are ranked and mapped as separate layers within the AGFD's HabiMap system (AGFD 2013a), and all five layers are combined to rank conservation potential. AGFD's HabiMap was queried to obtain rankings for the five indicators and SHCG for the Ripsey Wash and Hackberry Gulch TSF analysis areas. See **Table 3-64, AGFD Habitat and SHCG Rankings.**

Table 3-64, AGFD Habitat and SHCG Rankings

Habitat Indicators	Ripsey Wash	Hackberry Gulch
SGCN (Rating Scale: 1-10)	10 for bottom of Ripsey Wash and Gila River corridor; 6-8 for remainder of area	6-8 for entire area
SERI (Rating Scale: 1-10)	10 for entire area	5 for entire area
Sport fish (Rating Scale: 1-10)	1 for Gila River only; remainder of TSF - 0	1 for Gila River only; remainder of TSF - 0
Unfragmented Areas (Rating Scale: 1-10)	2 for entire area	5 for most of area; 1 for northwest edge nearest State Highway 177
Riparian Habitat (Rating Scale: 1-10)	10 for Gila River corridor only; remainder of TSF - 0	10 for Gila River corridor only; remainder of TSF - 0
SHCG (Overall Rating Scale: 1-10)	6 for most of Ripsey Wash area and Gila River corridor	5 for most of Hackberry Gulch area; 3 for northwest edge nearest State Highway 177; 6 for Gila River corridor

Notes:

(1) SHCG is Species and Habitat Conservation Guide.

(2) "0" represents no habitat present, while "1" represents the lowest ranking.

(3) SGCN is Species of Greatest Conservation Need.

(4) SERI is Species of Economic and Recreational Importance

3.15.1.2 Mammal Species of Economic and Recreational Importance (SERI)

Mammal game species potentially residing in or near the two TSF sites include: collared peccary or javelina (*Pecari tajacu*), mule deer (*Odocoileus hemionus*), and mountain lion (*Puma concolor*). On-site field surveys documented the presence of all species within the two TSF sites, except for mountain lion at the Hackberry Gulch TSF site (WestLand 2014f and 2014g). Mule deer, collared peccary, and mountain lion are highly mobile species and can occur anywhere within the two TSF sites, but population numbers are relatively low in these two areas.

3.15.1.2.1 Ripsey Wash TSF

The Ripsey Wash TSF is located within GMU 37B. This 755,307-acre unit extends from Oracle in the south to Superior in the north. State Highway 177 forms the eastern boundary of the unit and State Highway 179 forms the western boundary. The northern boundary is State Highway 60 in the vicinity of Superior. The Ripsey Wash TSF site comprises less than 0.3 percent of the total area of the GMU. Because of the large area and diverse habitats included within this GMU, not all of the game species within the GMU are likely to occur within or near the TSF site.

The AGFD SERI ranking for the Ripsey Wash TSF site, and for most of GMU 37B, is high (10). See **Table 3-64, AGFD Habitat and SHCG Rankings**. Based on AGFD information (2012), hunting success (2007 through 2011) within Unit 37B is below statewide averages for deer[27] (26.0 percent statewide to 19.0 percent in 37B for general firearm harvest) and collared peccary (23.2 percent statewide average to 21.2 percent in 37B for the spring general hunt). Based on information provided to hunters on the AGFD website[28], the area that includes the Ripsey Wash TSF site (Tortilla Mountains west of the town of Kearny) receives little hunting pressure, with most coming primarily from local hunters.

3.15.1.2.2 Hackberry Gulch TSF

The Hackberry Gulch TSF is within AGFD (GMU) 24A, a 518,566-acre unit that extends from State Highway 177 (southwest of the Hackberry Gulch TSF) to the Salt River Canyon north of Globe, a distance of about 55 miles. Highway 177 separates this GMU from 37B. The Hackberry Gulch TSF site comprises less than 0.4 percent of the total GMU area. Because of the large area and diverse habitats, not all of GMU-listed game species are likely to occur within or near the TSF site.

The AGFD SERI ranking for GMU 24B ranges from medium (5) to high (10), with the higher rated (8-10) areas in the GMU being correlated primarily to the Dripping Springs Mountains east of the Ray Mine and the Hackberry Gulch TSF site as well as most portions of the GMU north and northeast of the Globe and Miami area. The AGFD SERI ranking for the Hackberry Gulch TSF site is medium (5). See **Table 3-64, AGFD Habitat and SHCG Rankings**.

AGFD SERI rankings are based on demand for the game resource and economic value of the game resource for communities. These factors are determined by the AGFD evaluating a variety of parameters including hunting applications (first choice applicants ÷ permits issued), economic value (daily expenditures x hunter days/sq. mi.), and revenue ((tag + license cost) x permits issued/sq. mi.). The lower rating of the Hackberry TSF site compared to the Ripsey Wash TSF site is likely due to more limited hunter access opportunities into the Hackberry Gulch TSF site in comparison to the Ripsey Wash TSF site. Based on information provided by the AGFD (2012), hunting success (2007 through 2011) within GMU 24A is above statewide averages for deer (26 percent statewide to 36.4 percent in 24A for general firearm harvest) and collared peccary (23.2 percent statewide average to 26.2 percent in 24A for the spring general hunt).

3.15.1.3 Predators and Furbearers

Based on known ranges and habitat preferences, a variety of mammalian predators and furbearers are likely to inhabit the two TSF sites. Species potentially occurring within the two TSF sites include coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), bobcat (*Lynx rufus*), mountain lion (discussed in Section 3.14.2), hooded skunk (*Mephitis macroura*), western spotted skunk (*Spilogale gracilis*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), ringtail (*Bassariscus astutus*), white-nosed coati (*Nasua narica*), and American beaver (*Castor canadensis*). These species are relatively widespread and common throughout the Desert Southwest.

Surveys documented the presence of these species within one or both of the TSF sites, except for western spotted skunk and striped skunk (WestLand 2014f and 2014g). All of these species, except for American beaver are wide-ranging and could occur throughout the TSF sites. American beaver is only present in aquatic habitats associated with the Gila River. Because of the nocturnal and relative

[27] Averages based on the percentage of hunters reporting a successful harvest during the 2007–2012 general firearm seasons for deer and collared peccary.

[28] http://www.azgfd.gov/h_f/hunting_units_37b.shtml, accessed January 3, 2014.

secretive habits of most of these species, their presence, distribution, and relative abundance is difficult to determine in any given area.

3.15.1.4 Other Mammals

No specific surveys for other mammals have been completed within the Ripsey Wash and Hackberry Gulch TSF sites, although incidental observations of mammals and mammal sign were recorded while conducting other surveys for the two TSF sites (WestLand 2014f and 2014g). Based on known distributions and habitat preferences, species of other mammals likely to occur in or near the TSF sites are listed in WestLand (2014f, 2014g). Other mammal species observed in or near the TSF sites were rock squirrel (*Spermophilus variegatus*), Harris antelope squirrel (*Ammospermophilus harrisii*), white-throated woodrat (*Neotoma albigula*), desert cottontail, and black-tailed jackrabbit (*Lepus californicus*) (WestLand 2014f and 2014g). Most of these species were observed throughout the two TSF sites, except for white-throated woodrat. Observations of this species and its sign (feces and nests) were recorded primarily in association with abandoned mine and mineral exploration features. All observed species are relatively widespread and common throughout the Desert Southwest.

A number of bat species, including five BLM-listed Sensitive bat species could occur in the region of the two TSF sites. Some of these bat species require caves for colonial winter hibernation, maternity, or day use sites. Abandoned mine features such as shafts and adits with suitable temperature regimes can also provide important roosting, hibernation, or maternity habitat for cave-dwelling bats. Surveys of abandoned mine and mineral exploration features were completed within the two TSF sites to evaluate potential bat and other species use of these features (WestLand 2014h and 2014i).

Within and near the Ripsey Wash TSF site, thirty-eight abandoned mine features were located and surveyed, which included eleven shafts, fourteen adits, and thirteen test evacuations (WestLand 2014h). Most were relatively shallow with limited potential for bat use, but bat evidence was recorded in 11 of the old mine workings. A single Townsend's big-eared bat was observed in two features, and 10 features had bat quano and large insect wings on the adit floor, indicating use of the feature for night roosting by larger insectivorous bats such as California leaf-nosed (*Macrotus californicus*) and pallid bat (*Antrozous pallidus*). No evidence was found indicating more intensive hibernation or maternity use of these features.

Within or near the Hackberry Gulch TSF site, thirteen abandoned mine features were located and evaluated, which included nine adits, three shafts, and one test excavation (WestLand 2014i). All of these, but one shaft (Hackberry shaft), are located outside of the proposed footprint area of the Hackberry TSF site. Evidence of bat use, primarily insectivorous bat guano, was found in four adits. These adits could be used as summer daytime roosts by several bat species, but the habitat conditions and quantity of guano suggested use by the cave myotis (*Myotis velifer*) (WestLand 2014i).

3.15.1.5 Raptors

Several species of raptors are known to occur in the region of the two TSF sites. Most are present as year-round residents, but a few species: zone-tailed hawk (*Buteo albonotatus*), and elf owl (*Micrathene whitneyi*), are present only as summer residents. Turkey vulture (*Cathartes aura*) occurs as both a summer and year-round resident. Other possible year-round residents include prairie falcon (*Falco mexicanus*), American peregrine falcon (*Falco peregrinus anatum*), Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), Harris's hawk (*Parabuteo unicinctus*), red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), barn owl (*Tyto alba*), great horned owl (*Bubo virginianus*), and western screech owl (*Megascops kennicottii*).

Based on similarities in habitat and topographic features between the Ripsey Wash and Hackberry Gulch analysis areas, raptor presence and use is likely to relatively similar between the two sites. Raptors observed within the TSF sites were Cooper's hawk, turkey vulture, Harris hawk, zone-tailed hawk, red-tailed hawk, and great horned owl (WestLand 2014f and 2014g). Possible evidence of barn owl presence (whitewash and pellets) was also observed in abandoned mine features at both TSF sites (WestLand 2014h and 2014i). Barn owl and great horned owl may also use abandoned mine features for nesting.

American peregrine falcon and golden eagle are listed by the BLM as sensitive species, and the black hawk is listed by the AGFD as a WSC. The American peregrine falcon, prairie falcon and elf owl are listed by the USFWS as Birds of Conservation Concern (BCC).

Suitable habitat for Cooper's hawk, sharp-shinned hawk, zone-tailed hawk, and western screech owl within or near the TSF sites is provided only by riparian and mesquite woodlands along and adjacent to the Gila River. These species may nest in these habitats, but breeding was not documented within or near the TSF sites (WestLand 2014f and 2014g).

Harris's hawk resides as year-round resident in desertscrub habitats where saguaros, velvet mesquite, paloverde, and ironwood are common. This species also occurs along edges of riparian areas dominated by Freemont cottonwood, willow, and mesquite (Corman 2005a). Harris's hawk typically constructs its nests in saguaros, paloverde, mesquite, and, less often, isolated Fremont cottonwoods (Corman 2005a). Suitable hunting and breeding habitat exists for this species in both TSF sites and along the Gila River, but no nesting was documented (WestLand 2014f and 2014g).

Turkey vulture is a summer breeder in Arizona and occurs over most of the state. They arrive in Arizona from late January through March with breeding and egg laying from March through June. They nest in areas removed from human disturbance often in rock outcrop, caves, steep boulder strewn slopes, rocky ridges, abandoned mines, and Native American cliff structures (Corman 2005b). Evidence of possible turkey vulture nesting or roosting use of two abandoned mine features were found in the Ripsey Wash TSF site (WestLand 2014h).

Red-tailed hawks occur as year-round residents throughout most of Arizona and in most habitats in the state except for dense forest areas and the driest deserts (Wise-Gervais 2005). In Arizona, red-tailed hawks nest in trees, saguaros, cliffs, and artificial structures, including transmission line poles and towers (Wise-Gervais 2005). Nesting habitat in and near the two TSF sites is restricted primarily to saguaros and trees along the Gila River riparian corridor. Cliffs and areas of rock outcrop in the Dripping Spring Mountains east of the TSF sites may also provide suitable nesting habitat. Nesting by red-tailed hawk was not documented in or near the two TSF sites (WestLand 2014f and 2014g).

3.15.1.6 Waterbirds

Waterbirds include ducks, geese, wading birds, sandpipers, and other species dependent on aquatic habitats and associated shorelines and wetlands. Suitable habitat for waterbirds within the two analysis areas is restricted primarily to the Gila River and Mineral Creek. There are some spring-associated water sources in the more upland portions of the Hackberry Gulch analysis area (WestLand 2014e), but because of their small size and isolated nature are not likely to receive much waterbird use. Because of the limited extent of aquatic habitat found near the TSF sites, recorded observations of waterbirds was restricted to great blue heron (*Ardea herodias*) and American coot (*Fulica americana*) (WestLand 2014f and 2014g). It is likely the Gila River aquatic habitats would also be occasionally used by wintering or migrant puddle duck species such as mallard (*Anas platrhynchos*) and green-winged teal (*Anas crecca*) for loafing sites when water is present from fall through spring.

Several large, flat-platform stick nests were located in a large Fremont cottonwood at the edge of the Gila River near its confluence with Ripsey Wash during the Cedar Creek's early March 2014 reconnaissance of the Ripsey Wash TSF site. The clustering of nests and nest configuration was indicative of a great blue heron rookery. In lower elevation desert habitats in Arizona, great blue herons breeding activity begins by mid-January to mid-February with egg laying starting in late February and March (Latta 2005). Since no heron activity was noted in the vicinity of the rookery tree, it was assumed the rookery was unoccupied during the 2014 nesting season.

3.15.1.7 Upland Gamebirds

Upland gamebirds present in GMUs 24A and 37B are Gambel's quail, mourning dove, and white-winged dove. All three species were recorded by field surveys within the Ripsey Wash and Hackberry Gulch TSF sites (WestLand 2014f and 2014g), and populations of these species within two analysis areas are likely to similar. Dove populations may be somewhat higher within the Hackberry Gulch analysis area because of seeps and springs and associated surface water sources with some of these features. Gambel's quail and white-winged dove are classified as SERI species by AGFD. Gambel's quail prefer rugged, brushy habitats, while doves will often be found primarily around seeps, springs, stock tanks, and other locations with surface water. Populations will vary from year to year depending on rainfall and available forage and cover. No hunter use or harvest data is available for these species within GMUs 24A and 37B.

3.15.1.8 Other Migratory and Resident Birds

A number of songbird and other bird species associated with Sonoran Desertscrub communities may occur within the two TSF analysis areas, and field observations indicate songbird populations are relatively similar between the two areas . Some species winter in southern Arizona and areas farther south in Central and South America and move farther north to breed in spring and summer. Others, particularly species associated with riparian habitats along the Gila River and at seeps and springs, are spring/summer breeders in southern Arizona and migrate south to Central and South America to winter. Finally, a number of species remain as year-round residents and most of these occur in association with desertscrub habitats. Common year-round residents observed in desertscrub habitats at the Ripsey Wash and Hackberry Gulch analysis areas include: greater roadrunner (*Geococcyx californianus*), gila woodpecker (*Melanerpes uropygialis*), common raven (*Corvus corax*), canyon wren (*Catherpes mexicanus*), rock wren (*Salpinctus obsoletus*), cactus wren (*Campylorhynchus brunneicapillus*), curve-billed thrasher (*Toxostoma curvirostre*), phainopepla (*Phainopepla nitens*), black-throated sparrow (*Amphispiza bilineata*), northern cardinal (*Cardinalis cardinalis*), and pyrrhuloxia (*Cardinalis sinuatus*)

The Migratory Bird Treaty Act (MBTA) provides federal protection for migratory bird species listed at 50 CFR 10.13. The USFWS places the highest management priority on BCC (USFWS 2008). The BCC list was developed as a 1988 amendment to the Fish and Wildlife Conservation Act. This Act mandated that the USFWS "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973." The goal of the BCC list is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions. Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (January 10, 2001) stipulates, in part, that federal agency actions avoid or minimize, to the extent practicable, *adverse impacts on migratory bird resources*. In addition, the Executive Order also requires federal agencies to identify where unintentional take is likely to have *a measurable negative effect on migratory bird populations…….*, and the agency *shall develop and use principles, standards, and practices that will lessen the amount of unintentional take*, *developing any such conservation efforts in cooperation with the Service* (USFWS).

The habitats and ranges of the BCC for the Sonoran and Mojave Deserts U.S. Portion only (BCR-33) (USFWS 2008) were reviewed to create a list of BCC potentially occurring in the two TSF sites. Potential BCC breeding bird populations within this region are listed in **Table 3-65, Birds of Conservation Concern**. The remaining species on the BCC list for Sonoran and Mojave Deserts either have ranges outside of the TSF sites, prefer habitats not found in the TSF sites, or occur only as migrants near the TSF sites during spring and fall migration.

Table 3-65, Birds of Conservation Concern

Species Common Name/ Scientific Name	Potential to Occur	Range and Habitat
American peregrine/ *Falco peregrinus anatum*	Possible but not observed by baseline surveys (WestLand 2014f & 2014g)	TSF sites are within year-round range of this species. Prefers to nest on high cliff sites and hunt areas near riparian and aquatic habitat with abundant bird prey. Dripping Spring Mountain cliff sites East of Hackberry Gulch may represent potential nest sites. Gila River may provide foraging habitat.
Prairie falcon/ *Falco mexicanus*	Possible but not observed by baseline surveys	TSF sites are within year-round range of this species. Cliff sites and rock outcrop with ledges or cavities are used as nest sites. Hunts over open deserts and grasslands
Yellow-billed cuckoo/ *Coccyzus americanus*	Breeding presence documented in Gila River riparian habitat	Gila River is within summer breeding range of this species. Dense deciduous woodlands and mesquite stands near water.
Elf owl/ *Micrathene whitneyi*	Possible but not observed by baseline surveys	TSF sites are within summer breeding range of this species. Prefers riparian and desert habitats with saguaro cactus. Woodpecker cavities in trees and saguaros used for nesting
Costa's hummingbird/ *Calypte costae*	Possible but not observed by baseline surveys	TSF sites are within summer breeding range of this species. Prefers brushy desert and chaparral habitats.
Gila woodpecker/ *Melanerpes uropygialis*	Observed by baseline surveys in Ripsey Wash and Hackberry Gulch	TSF sites are within year-round range of this species. Sonoran desert habitats. Excavates cavities in saguaro cactus for nesting.
Gilded Flicker/ *Melanerpes uropygialis*	Possible but not observed by baseline surveys	TSF sites are within year-round range of this species. Sonoran desert habitats. Excavates cavities in saguaro cactus for nesting.
Bell's vireo/ *Vireo bellii*	Possible but not observed by baseline surveys	TSF sites near the northern edge of summer breeding range of this species. Riparian and mesquite brush lands near water.
Gray vireo/ *Vireo vicinior*	Possible but not observed by baseline surveys	TSF sites are within year-round range of this species. Desert scrub, mesquite, chaparral, and mixed juniper, piñon pine and oak scrub woodlands
Bendire's thrasher/ *Toxostoma bendirei*	Possible but not observed by baseline surveys	TSF sites are near edge of year-round and summer range of this species. Sonoran desert with scattered shrubs and cacti.
Lucy's warbler/ *Oreothlypis luciae*	Possible but not observed by baseline surveys	TSF sites are within year-round range of this species. Riparian mesquite woodlands.
Yellow warbler/ *Dendroica petechial*	Observed by baseline surveys in Gila River riparian habitat	TSF sites are within summer breeding range of this species. Riparian habitats near water.
Black-chinned sparrow/ *Spizella atrogularis*	Unlikely and not observed by baseline surveys	TSF sites are within summer breeding range of this species. Dense brushy habitats of sagebrush, chaparral, and manzanita.

Species Common Name/ Scientific Name	Potential to Occur	Range and Habitat
Lawrence's goldfinch/ *Spinus lawrencei*	Possible but not observed by baseline surveys	TSF sites are within winter non-breeding range of this species. Dry open woodlands, woodland and forest edges, and shrubby habitats such as chaparral, usually near water.

3.15.1.9 Reptiles and Amphibians

No surveys for reptiles and amphibians other than Sonoran desert tortoise have been completed within the Ripsey Wash and Hackberry Gulch TSF sites. Suitable habitat for amphibians within the Ripsey Wash analysis area is limited by lack of surface water except for the Gila River and Mineral Creek. The Hackberry Gulch analysis area contains segments of the Gila River and also a few areas of perennial surface water associated with seeps and springs that could support breeding populations of amphibians. Based on known distributions and habitat preferences, species of reptiles and amphibians likely to occur in or near the TSF sites are listed in WestLand (2014f, 2014g). Reptile observations were similar between the two analysis areas, and species observed were zebra-tailed lizard (*Callisaurus draconoides*), ornate tree lizard (*Urosaurus ornatus*), regal horned lizard (*Phrynosoma solare*), reticulate Gila monster (*Heloderma suspectum*), and western diamondback rattlesnake (*Crotalus atrox*) (WestLand 2014f, 2014g). No amphibian species were recorded within the two analysis areas (WestLand 2014f, 2014g).

3.15.1.10 Gila River Associated Aquatic Species

Suitable habitat for fish species in or near the TSF sites is restricted to the Gila River and Mineral Creek. The Gila River is very dynamic river system with documented highly variable flows over the last 100 years. See Section 3.4, Surface Water Hydrology.

The operation of the upstream Coolidge Dam has moderated flows in the downstream segments of the Gila River, but channel-scouring high flows have still occurred, as evidenced by the 1993 flood. See Section 3.4, Surface Water Hydrology.

The majority of water in the middle Gila River is allocated for agricultural use and for several weeks water is not released from Coolidge Dam. Drought and increased demands for irrigation water, especially since 2000, often results in a zero streamflow measurement at the Kelvin stream monitoring gage on the Gila River from June through November.

In contrast during high flow periods when water is released from the Coolidge Dam, high flows with high sediment loads scour the channel reducing riffle-run-pool heterogeneity and resulting in low aquatic habitat diversity with nearly homogeneous run habitat (King and Baker 1995). In addition, mining activities and smelters along the middle reach of the Gila River have resulted in some metal contamination of river sediments (Andrews and King 1997).

No specific fish surveys were completed in the Gila River for the Ripsey Wash and Hackberry Gulch TSF sites. However, non-native fish species are known to have been introduced into the Middle Gila River system, including channel catfish (*Ictalurus punctatus*), common carp (*Cyprinus carpio*), fathead minnow (*Pimephales promelas*), mosquitofish (*Gambusia affinis*), channel catfish (*Ictalurus punctatus*), green sunfish (*Lepomis cyanellus*), and bluegill (*Lepomis macrochirus*) (WestLand 2014f, 2014g). The presence of channel catfish and common carp was documented near the TSF sites (King and Baker 1995). Three native species, desert sucker (*Catostomus clarki*), Sonora sucker (*Catostomus insignis*), and longfin dace (*Agosia chrysogaster*), are listed as BLM Sensitive species and are likely to be present based on their documented presence in nearby reaches of the Gila River (AGFD HDMS 2014).

3.15.1.11 BLM Sensitive Wildlife Species and Arizona Wildlife Species of Concern (WSC)

A screening analysis was conducted to determine the potential for any BLM sensitive species within or near the two TSF sites (WestLand 2014j, 2014k). This screening analysis was based on:

- Field observations and habitat assessments for the two TSF sites;
- Review of the known range, distribution and habitat requirements of BLM sensitive species; and
- Review of records of occurrences in published literature.

Principal sources of information used in the analysis included:

BLM Sensitive Species List for Arizona (2013);

- Various biological survey data collected by WestLand in or near the TSF sites;
- The AGFD HDMS on-line environmental review tool (AGFD 2013b);
- AGFD species abstracts (available at http://www.azgfd.gov); and
- Available published literature.

The AGFD HDMS on-line environmental review tool (AGFD 2013b, Appendix A) was also queried to locate WSC occurrence records within three miles of the TSF sites (WestLand 2014j and 2014k). A total of 15 BLM Sensitive species and/or AGFD WSC could be present in or near the two TSF sites. These species are listed in **Table 3-66, BLM Sensitive Wildlife Species and Arizona Wildlife Species of Concern**. Summaries of their range and habitat preferences are taken from WestLand (2014j, 2014k).

Table 3-66, BLM Sensitive Wildlife Species and Arizona Wildlife Species of Concern

Species and Status	Range and Habitat Preferences	Potential to Occur In or Near TSF Sites
FISH		
Desert sucker (*Catostomus clarki*) STATUS: BLM – Sensitive	RANGE: Lower Colorado River downstream from the Grand Canyon, and tributaries including the Bill Williams, Salt, Gila, and San Francisco River drainages. HABITAT: Rapids and flowing pools of streams and rivers primarily over bottoms of gravel-rubble with sandy silt in the interstices. ELEVATION: 480 to 8,840 ft. REFERENCES: AGFD 2002a	Possible[29]. This species could be present in the Gila River near the TSF sites. It has been reported in the Gila River within 5 miles of the TSF sites (AGFD HDMS Database Distribution Mapping 1/21/14).

[29] **Possible** – The species has not been documented in the TSF sites, but the known, current geographic range of the species includes the TSF sites and habitat characteristics required by the species appear to be present in the TSF sites.

Species and Status	Range and Habitat Preferences	Potential to Occur In or Near TSF Sites
Longfin dace (*Agosia chrysogaster*) STATUS: BLM – Sensitive	RANGE: Native to the Gila and Bill Williams drainages in Arizona, and the Magdalena and Sonoyta drainages in Mexico. HABITAT: Wide ranging, from intermittent hot low-desert streams to clear and cool brooks at higher elevations. ELEVATION: Generally below 4,900 ft., but has been recorded up to 6,700 ft. REFERENCES: AGFD 2013b	Possible. Potential to occur in the Gila River near the TSF sites. A subspecies (*A. c. chrysogaster*) has been reported in the Gila River within 5 miles of the TSF sites (AGFD HDMS Database Distribution Mapping 1/21/14).
Sonora sucker *Catostomus insignis* STATUS: BLM - Sensitive	RANGE: Colorado River drainage in New Mexico and Arizona, also in northern Sonora, Mexico. Widespread in Gila and Bill Williams systems in Arizona. HABITAT: Variety of habitats from warm water rivers to trout streams. ELEVATION: 1,210 to 8,730 ft. REFERENCES: AGFD 2002b	Possible. Potential to occur in Gila River near TSF sites. This species has been reported in the Gila River within 5 miles of the TSF sites (AGFD HDMS Database Distribution Mapping 1/21/14).
AMPHIBIANS		
Lowland leopard frog (*Lithobates yavapaiensis*) STATUS: BLM - Sensitive AGFD – WSC	RANGE: Across central Arizona from Mohave County to Cochise County. HABITAT: Usually along streams or rivers with dense vegetation, but also in ponds, cienegas, springs, cattle tanks, wetlands, and ditches. Sonoran Desertscrub to Great Basin Conifer Woodland or Madrean Evergreen Woodland. ELEVATION: 480 to 6,200 ft. REFERENCES: AGFD 2006a; Brennan and Holycross 2006	Possible. TSF sites are within geographic range and potentially usable habitat may be present in isolated areas with surface water and ephemeral drainages and in the Gila River and its riparian zone. This species has been reported in the Gila River within 5 miles of the TSF sites (AGFD HDMS Database Distribution Mapping 1/21/14).
BIRDS		
American peregrine falcon (*Falco peregrinus anatum*) STATUS: BLM - Sensitive AGFD - WSC	RANGE: Breeds from central Alaska to central Mexico, wintering as far south as Chile. Found throughout Arizona where cliffs and prey are available. HABITAT: Steep, sheer cliffs overlooking woodlands, riparian areas, or other habitats supporting avian prey species in abundance. ELEVATION: 400 to 9,000 ft. REFERENCES: AGFD 2002c; Corman and Wise-Gervais 2005	Possible. Steep cliffs that could provide potential nest sites are available east and northeast of the TSF sites in the Dripping Spring Mountains, and suitable prey abundance may be available along the Gila River riparian zone near the TSF sites.
Common black-hawk (*Buteogallus anthracinus*)	RANGE: Breeds from northern South America to the southwestern U.S. including Arizona,	Possible. The breeding range in Arizona includes the upper Gila River drainages

Species and Status	Range and Habitat Preferences	Potential to Occur In or Near TSF Sites
STATUS: AGFD - WSC	southwest New Mexico, western Texas, and southern Utah. HABITAT: Inhabits remote riparian streams with mature, undisturbed habitat and permanent flowing water. ELEVATION: 1,750 to 7,080 ft. REFERENCES: AGFD 2013c; Corman and Wise-Gervais 2005	(eastern Arizona). This species has been reported along the Gila River within 5 miles of the TSF sites (AGFD HDMS Database Distribution Mapping 1/21/14)
Desert purple martin (*Progne subis hesperia*) Status: BLM - Sensitive	RANGE: Throughout North America from southern Canada to central Mexico. This subspecies limited to Sonoran desertscrub areas of south-central Arizona. HABITAT: Sonoran desertscrub, usually nesting in woodpecker cavities in saguaros. ELEVATION: 1,800 to 4,060 ft. REFERENCES: Corman and Wise-Gervais 2005	Possible. TSF sites are within geographic range and support suitable Sonoran desertscrub breeding habitat with saguaros.
Gilded flicker (*Colaptes chrysoides*) Status: BLM - Sensitive	RANGE: Western Arizona south to Sinaloa, Mexico. Limited to southwestern part of Arizona. HABITAT: Primarily Sonoran desertscrub, with saguaros. ELEVATION: 200 to 3,200 ft. REFERENCES: Corman and Wise-Gervais 2005	Possible. TSF sites are within geographic range and support suitable Sonoran desertscrub breeding habitat with saguaros.
Golden eagle (*Aquila chrysaetos*) Status: BLM - Sensitive	RANGE: Holarctic distribution. Throughout Arizona. HABITAT: Open country, in prairies, arctic and alpine tundra, open wooded country, and barren areas, especially in hilly or mountainous regions. They nest on rock ledges, cliffs or in large trees. ELEVATION: 1,300 to 9,000 ft. REFERENCES: AGFD 2002d; Corman and Wise-Gervais 2005	Possible. TSF sites are within geographic range and support potential foraging habitat. No suitable nesting habitat in TSF sites, but rock ledges on cliffs in the Dripping Spring Mountains, west of the Hackberry analsysis area represent the nearest potential nesting areas to the TSF sites.
Mississippi kite (*Ictinia mississipiensis*) STATUS: AGFD - WSC	RANGE: Breeding resident in North America, non-nesting seasons in South America. In the United States, they range from the Gulf States to Nebraska and Wisconsin, west to Colorado and Arizona. During the winter, they range as far south as Paraguay and Argentina. HABITAT: Breeding habitat in Arizona consists of riparian deciduous forests that border desertscrub upland habitats.	Possible: TSF sites are within geographic range and the Gila River supports potential foraging and nesting habitat. HDMS records indicate recorded observations along the San Pedro River and Gila River near Kearney.

Species and Status	Range and Habitat Preferences	Potential to Occur In or Near TSF Sites
	ELEVATION: 1,400 to 3,040 ft. REFERENCES: AGFD 2003a; Corman and Wise-Gervais 2005	
MAMMALS		
California leaf-nosed bat (*Macrotus californicus*) STATUS: BLM - Sensitive AGFD - WSC	RANGE: From southern Nevada and southern California south and east to Baja California, Sinaloa, Chihuahua, and Tamaulipas, Mexico. Below Mogollon Rim in Arizona. HABITAT: Sonoran desertscrub; primarily roosts in mines, caves, and rock shelters. ELEVATION: Below 4,000 ft. REFERENCES: AGFD 2001a; Adams 2003	Possible. TSF sites are within geographic range and support suitable foraging habitat. Abandoned mines for possible roost sites are available in the nearby Dripping Spring Mountains. This species has been reported from Dripping Spring Wash and the Tortilla Mountains within five miles of the TSF sites (AGFD HDMS Database Distribution Mapping 1/21/14)
Cave myotis (*Myotis velifer*) STATUS: BLM - Sensitive	RANGE: Southern California and Kansas south to Honduras. Below Mogollon Rim in Arizona. HABITAT: Desertscrub of creosote, brittlebush, paloverde and cacti. Colonial roosts in caves, tunnels, and mineshafts, and under bridges, and sometimes in buildings within a few miles of water. ELEVATION: Mostly between 300 and 5,000 ft., but some records as high as 8,800 ft. REFERENCES: AGFD 2002d; Adams 2003	Possible. TSF sites are within geographic range and support potential foraging habitat. Abandoned mines for possible roost sites are available in the nearby Dripping Spring Mountains. Field surveys found evidence of myotis (likely cave myotis) in the Grey Horse Mine just outside of the Hackberry analysis area (WestLand 2014i).
Greater western bonneted bat (*Eumops perotis californicus*) STATUS: BLM - Sensitive	RANGE: Western U. S. to southern Mexico; also South America. Widely distributed across western and southern Arizona. HABITAT: Lower and upper Sonoran desertscrub near cliffs, preferring rugged rocky canyons with abundant crevices. Primary roosting sites in deep crevices. ELEVATION: 240 – 8,475 ft. REFERENCES: AGFD 2002e; Adams 2003	Possible. TSF sites are within geographic range and support potential foraging habitat. Roosting sites may be available in cliffs in the Dripping Spring Mountains west of the Hackberry analysis area.
Pocketed free-tailed bat (*Nyctinomops femorosaccus*) STATUS: AGFD - WSC	RANGE: Southern California to the Big Bend area of Texas south through Baja California and central-western Mexico to central Mexico. In Arizona it is found in primarily in south half of state in Cochise, Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Yavapai, and Yuma counties HABITAT: In Arizona, low desert, desertscrub, riparian, mesquite, and pine-oak forests. Roosts in crevices high on cliff faces in rugged canyons ELEVATION: 190 to 7,520	Possible. TSF sites are within geographic range and support potential foraging habitat. Roosting sites may be available in cliffs in the nearby Dripping Spring Mountains. This species has been reported from the Gila River and sites west of the Ray Mine within 5 miles of the TSF sites (AGFD HDMS Database Distribution Mapping 1/21/14).

Species and Status	Range and Habitat Preferences	Potential to Occur In or Near TSF Sites
	REFERENCES: AGFD 2011a; Adams 2003	
Townsend' big-eared bat (*Corynorhinus townsendii*) STATUS: BLM - Sensitive	RANGE: Widespread across western U. S. south to central Mexico. Widely distributed across Arizona. HABITAT: Desert scrub up to woodlands and coniferous forests. Day roosts in caves and abandoned mines. ELEVATION: 550 and 7,520 feet, but most records above 3,000 ft. REFERENCE(S): AGFD 2003b; Adams 2003	Present. TSF sites are within geographic range and support suitable habitat but TSF sites are below most common elevation range. Abandoned mines for possible roost sites are available in the nearby Dripping Spring Mountains. This species has been reported from Dripping Spring Wash within 5 miles of the TSF sites (AGFD HDMS Database Distribution Mapping 1/21/14). Two Townsend's big-eared bats were found in abandoned mine features in the Ripsey Wash TSF site (WestLand 2014h).

3.15.1.12 Threatened, Endangered, Proposed and Candidate Wildlife Species

A screening analysis was conducted to determine the potential for any federal listed species within or near the two TSF sites (WestLand 2014l and 2014m). The potential for species to be present within or near the two TSF sites were based on the following:

- An evaluation of the known geographic and elevation range for the listed species;
- A review of the known habitat and natural history requirements of the listed species;
- A summary of field observations and habitat descriptions of the TSF sites;
- A review of occurrence records in published or gray literature; and,
- Data comparisons with the physical and biological conditions present in the TSF sites.

The principal sources of information for this analysis were:

- ESA-listed species for Pinal County (USFWS 2013);
- The AGFD HDMS on-line environmental review tool;
- USFWS final and proposed listing and critical habitat rules;
- AGFD species abstracts;
- Accessible published literature;
- Biological survey results available for the TSF sites and vicinity; and,
- The USFWS Critical Habitat Portal on-line mapping tool.

Two listed species were identified as having the potential to occur within or near the TSF sites, and their presence has been confirmed by field surveys (WestLand 2014l and 2014m). They are southwestern willow flycatcher (*Empidonax traillii extimus*)-endangered, and yellow-billed cuckoo (*Coccyzus americanus*)-threatened.

One other species, northern Mexican garter snake (*Thamnophis eques megalops*), listed as threatened, is not present in or near the TSF sites or nearby segments of the Gila River but may be present along portions of the San Pedro River, upstream of its confluence with the Gila River (Westland 2015a).

3.15.1.12.1 Southwestern Willow Flycatcher (Endangered).

Southwestern willow flycatcher (SWFL) is a neotropical migrant that winters in Mexico and Central America and breeds throughout the southwestern United States. In Arizona, this species breeds very locally along dynamic riparian systems, including the Colorado River, near the mouth of Little Colorado River and south of Yuma; headwaters of the Little Colorado River near Greer and Eagar; middle Gila, Salt, and Verde Rivers; the middle to lower San Pedro River; and the upper San Francisco River near Alpine (AGFD 2002g). SWFL prefers to nest in cottonwood/willow and/or tamarisk riparian communities near water. Nests are typically placed in trees where the plant growth is most dense, where trees and shrubs have vegetation near ground level, and where there is a low-density canopy (USFWS 2013c).

The USFWS (2013c) has designated critical habitat for SWFL along a segment of the Middle Gila River from Dripping Spring Wash to the Ashurst-Hayden Dam, including a segment of the Gila River between the Ripsey Wash and Hackberry Gulch TSF sites. See **Figure 48, Southwestern Willow Flycatcher Designated Critical Habitat Near the TSF Sites**.

This segment includes its confluences with Ripsey Wash, Zelleweger Wash. SWFL surveys completed by Graber and Koronkiewicz (2008, 2009, 2011) and Graber et al. (2012) from Dripping Springs Wash to the Ashurst-Hayden Dam have identified numerous SWFL nest sites along this segment of the Gila River, with the highest densities found between Kearny and Hayden and between Apache Springs and Dripping Spring Wash. One active nest location was found in 2009 and 2010 on the Gila River near its confluence with Ripsey Wash (Graber and Koronkiewicz 2009, 2012), and SWFL presence and likely nesting have been consistently documented near the Florence-Kelvin highway bridge from 2011 through 2014 (WestLand 2011, 2013a, 2013b, and 2014 and 2015b).

The Westland SWFL survey area was expanded in 2014 and 2015 to include portions of the Gila River down gradient from the Hackberry TSF site between Kearney and Riverside. SWFL presence and likely nesting was also documented along this reach of the Gila River (Westland 2014p, 2015b.)

3.15.1.12.2 Yellow-billed Cuckoo (Threatened)

Yellow-billed cuckoo is a neotropical migrant that winters in South America to central Argentina and Uruguay and breeds in North America west of the Rocky Mountains south to southern Baja California (Terres 1980). In Arizona, this species occurs in all counties but is generally found in the southern and central portions of the state (AGFD 2011b). Its breeding distribution is restricted primarily to mature cottonwood/willow riparian woodlands, but they may also occur in larger mesquite bosques in Arizona (AGFD 2011b).

Yellow-billed cuckoo was recently listed by the USFWS as threatened (USFWS 2014). The USFWS has proposed critical habitat for this species (USFWS 2014b), and Unit 28: AZ-20 lower San Pedro, Gila Rivers in Pinal, Pima, and Gila Counties, Arizona includes the reach of the Gila river near the Ripsey Wash and Hackberry Gulch TSF sites. See **Figure 49, Yellow-billed Cuckoo Proposed Critical Habitat Near the TSF Sites**. Unit 28 includes the of the Lower San Pedro River from above the Town of Mammoth in Pima County downstream to its confluence with the Gila River and the Gila River from the San Carlos Reservoir downstream of the Town of Riverside in Pinal County.

Surveys in 2012, 2013, 2014 and 2015 have documented the presence of yellow-billed cuckoo along the Gila River downstream of Kearney to Zelleweger Wash, with most detections in the vicinity of Riverside and the Florence-Kelvin highway bridge (WestLand 2012, 2013c, 2014q and 2015c). No yellow-billed cuckoos were detected within the two TSF sites outside of the Gila River riparian corridor. The 2012, 2013, and 2014 surveys recorded 14, 6, and 10 confirmed detections of yellow-billed cuckoo, respectively. Although breeding was not confirmed by the surveys, this segment of the Gila River provides suitable nesting habitat and likely supports one or more breeding pairs (WestLand 2013c).

3.15.1.12.3 Northern Mexican Gartersnake

The northern Mexican gartersnake is one of ten currently recognized subspecies of *Thamnophis eques* and the only subspecies that occurs in the U.S. (USFWS 2014c). A proposed designation of critical habitat and listing of the northern Mexico gartersnake was published on July 10, 2013 (USFWS 2013d), and a final rule to list the northern Mexican gartersnake as threatened under the ESA was published on July 8, 2014 (USFWS 2014c). Designated critical habitat for northern Mexican gartersnake is a proposed rule that is currently pending final publication.

Historically, northern Mexican gartersnake ranged throughout the lower Colorado River and Gila River basins in appropriate habitat in southern Arizona and extreme southwestern New Mexico and into the Sierra Madre Occidental and the Mexican Plateau of Mexico (USFWS 2014c). Currently the USFWS considers viable populations to only exist in five areas in Arizona: 1) the Bill Williams River, 2) upper Verde River, 3) Oak Creek (at the Page Springs and Bubbling Ponds State Fish Hatcheries), 4) Tonto Creek, and 5) the upper Santa Cruz River (USFWS 2014c). The USFWS (2014c) also indicates a possible extant, low-density population along the San Pedro River from the Mexico/U.S. border to its confluence with the Gila River.

In Arizona, northern Mexican gartersnake inhabit streams, cienegas, springs, and earthen stock ponds that support dense perimeter riparian vegetation (Brennan and Holycross 2006, Rosen and Schwalbe 1988). Northern Mexican gartersnakes are a highly aquatic species that are rarely found far from perennial to near-perennial waters and dense vegetation.

3.15.2 ENVIRONMENTAL CONSEQUENCES

3.15.2.1 Effects of the No Action Alternative

Under the no action alternative, neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed, and wildlife habitats and populations within the Ripsey Wash or Hackberry Gulch TSF site and adjacent areas of the Gila River would remain unchanged. Current land use trends in the region, including mining, livestock grazing and dispersed recreation activities, such as hunting, would have a continuing effect on wildlife populations and habitat.

3.15.2.2 Effects of the Ripsey Wash TSF Alternative

The Ripsey Wash TSF would cause the direct wildlife habitat loss from the area of disturbance. See **Table 2-1, Summary of Ripsey Wash TSF Alternative**.

General effects on wildlife would be the physical loss of habitat; habitat fragmentation and isolation displacement of wildlife; increased competition of wildlife; impacts to special wildlife habitats, and impacts to threatened, endangered and sensitive species. These effects can be classified as both short-term and long-term. Short-term impacts arise from displacement of wildlife due to construction activity, including human presence and noise. Long-term impacts would consist of permanent changes to habitats and the wildlife populations dependent on those habitats.

3.15.2.2.1 Habitat Loss and Fragmentation

Construction and operations would result in permanent loss of habitat. Direct impacts to wildlife habitats would occur from grading for infrastructure, harvesting of borrow material, and the progressive burial of vegetation and wildlife habitat features by placement of tailings material. Habitat loss through tailings deposition would occur incrementally within the tailings impoundment. Because of this incremental loss, portions of wildlife habitats subject to eventual burial by tailings may remain viable to some extent as the TSF footprint is progressively covered with tailings.

Permanent loss of vegetation communities and habitat features would also be associated with the construction of various TSF support facilities including starter dams, detention dams and diversion structures, seepage trenches, reclaim ponds, pumping stations, Florence-Kelvin Highway reroute, and the Arizona Trail realignment. Rock quarries would be established within the TSF footprint and would not contribute to additional habitat loss. The direct impacts resulting from the permanent burial of existing vegetation communities and wildlife habitats would be irreversible.

Habitat fragmentation and isolation are difficult to determine and probably vary species to species, but they could occur primarily as a result of the construction of the tailings facility. The size of the tailings facility would result in a movement barrier to many small and medium-sized land mammals, thereby fragmenting habitat and isolating some populations of these species. Other ancillary facilities such as roads, power lines, diversion structures, and pipeline corridors do not usually create physical barriers to wildlife movement. However, the effective use of adjacent undisturbed habitats to these facilities could be diminished. Habitat fragmentation and isolation can be problematic in areas of limited habitat, such as along the Gila River.

3.15.2.2.2 Displacement of Wildlife.

The most common wildlife responses to noise and human presence are avoidance and accommodation.

Displacement is unavoidable in the short-term and long-term under both action alternatives, and this displacement has the potential to be the most significant effect on wildlife. Avoidance of disturbed areas would result in wildlife displacement from an area larger than the actual disturbed sites. The extent of this displacement would be related to the duration, magnitude and the visual prominence of the activity, as well as the extent of construction and operational noise levels above existing background levels. Visual prominence of facilities is dependent upon the surrounding topography.

Displacement would result in local reductions in wildlife populations if adjacent, undisturbed habitats are at carrying capacity. In this situation, animals are either forced into less than optimal habitats or they compete with other animals already occupying unaffected habitats. Possible consequences of such displacement are lower survival, lower reproductive success, lower recruitment, and ultimately lower carrying capacities and reduced populations.

Reaction of animals to noise and human presence varies depending on the intensity of the noise source and whether it is continuous or intermittent. Transient loud noises would provoke alarm responses; however, many animals learn to ignore more constant, lower level noise sources that are not associated with negative experiences such as being chased or hunted.

The extent of wildlife displacement is impossible to predict for most species since the response severity varies from species to species and can even vary between different individuals of the same species. After initial avoidance, some wildlife species (usually certain birds and rodents) may acclimate to the activity and begin to reinvade areas previously avoided. The acclimation and reoccupation would be expected to occur following the initial site development and construction activities when the project moves into the operation phase of tailings placement, where less noise and human activity would take place. Acclimation to activity may increase predation on some species.

Early site development and construction noise have the potential of affecting wildlife species surrounding the actual disturbed areas, including within the vegetated floodplain of the Gila River. Construction of the tailings facility, including pipeline corridors, the Gila River pipeline bridge, diversion channels and detention dams, and roads, would reduce the use of surrounding habitat by wildlife.

These impacted sites reduce foraging due to direct loss of vegetation from ground disturbance. In addition, there is an area surrounding these sites that tends not to be utilized due to the increased human activity. This “zone” can extend up to a half mile from the developed area. Consequently, development impacts to wildlife can extend further offsite than the actual amount of disturbed area. Although some animals can habituate to the increased infrastructure, it is generally assumed that an increased human footprint on a previously lightly developed area is detrimental to most species.

In addition to the avoidance response, increased human presence intensifies the potential for increased traffic levels on new and existing roads, which could increase the potential for wildlife-vehicle collisions.

Following early site development and construction, noise levels and human presence would decrease. The tailings and reclaim water pumps would be powered by electric motors. As a result, some species might acclimate to the TSF operations and utilize habitats immediately adjacent to such sites. This has been observed at the existing Elder Gulch TSF.

After mine closure and reclamation activities are complete, adjacent unaffected habitat areas would likely return to areas more fully utilized by wildlife populations because of the removal of disturbance factors associated with active mining. Some wildlife populations might eventually recolonize the TSF site if some natural establishment of vegetation communities occurs over the long term. However, based on current reclamation plans, the site would never provide as productive wildlife habitat conditions as those in existence prior to disturbance.

3.15.2.2.3 Wildlife Mortality

During construction, most larger, mobile wildlife species would be displaced to adjacent habitats; however, direct habitat disturbance could result in some direct loses of smaller, less mobile species of wildlife, such as small mammals, reptiles and ground nesting birds.

Predictions of wildlife population losses based on habitat disturbances and displacement are hard to make since accurate information on wildlife population numbers is difficult to obtain for many species. Even if accurate population numbers were available, projections of losses many not be accurate since it is impossible to account for the effects of weather and natural cyclical population changes. If it is assumed that the existing adjacent habitats are at carrying capacity for most species, locally displaced populations may be permanently eliminated. Upon site closure, and natural revegetation, wildlife species would be expected to reutilize the once disturbed sites. However, natural desert revegetation would take many years after site closure and reclamation, and the site would never provide as productive wildlife habitat conditions as those in existence prior to disturbance.

3.15.2.2.4 Wildlife Exposure to Contaminated Surface Water

Results of geochemistry testing for the Ripsey Wash TSF tailings revealed a low potential for any acid generation from tailings materials and confirmed that alluvium material to be used for construction activities are not acid-generating. The meteoric water mobility testing on both tailings and alluvium material also revealed that the probability for dissolution and mobilization of leaching minerals from these materials is low (See Section 3.3, Geology and Geochemistry). Therefore, no wildlife mortalities associated with exposure to ponded water on the Ripsey TSF site are expected to occur. There have been no documented wildlife mortalities at the existing Elder Gulch TSF and ponded water at the upper end of that existing facility support a population of fish identified as mosquitofish by AGFD personnel.

3.15.2.2.5 Increased Competition for Wildlife

Currently, there is hunting activity within the areas of proposed TSF development and operation. Increased competition for wildlife resources could occur outside of the TSF site since hunting and other wildlife oriented recreation would be displaced out of this area. Hunting would also be expected to increase in the general area as recreation activities increase. However, given the hunting management polices of AFGD, no detrimental increased competition for wildlife resources is anticipated.

3.15.2.2.6 Special Habitat Features

Within the Ripsey Wash TSF site there are no seeps or springs and associated areas of surface water, wetlands, and riparian vegetation that would be lost to project development; however, there are three stock watering features that would be lost along with two of their well sources.

Some segments of the Gila River and adjacent riparian habitat may be close enough to the TSF facility to create indirect impacts of construction and operation on wildlife populations using the Gila River corridor, but such indirect impacts are expected to be minor.

No adverse effects are expected to wildlife as a result of the relocation of the Arizona Trail or the work in the areas proposed for waters of the U.S. mitigation (see **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**).

Most of the new Arizona Trail would be constructed or cleared using manual labor, although there may be the short-term need for small equipment such as a skid-steer or compact track loader and a compact excavator to assist in constructing switchbacks or moving large rocks for the relocated trail. There might be some temporary displacement of wildlife species during the construction of new trail due to noise and human presence, but these impacts would be short-term and localized.

As explained in **Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**, all or portions of Mitigation Sites A, B, C and D would require active management to enhance the riparian habitat values; this action would be primarily fencing and seeding. A mechanical posthole digger mounted on an off-road vehicle would be used for fence construction, and a farm tractor with a cultivator and a drill seed would be used for seeding, although hand seeding could also be used. For Mitigation Site E and on other sites where tamarisk would be removed, a bulldozer (Caterpillar D6 or equivalent) would be used to clear and grub burned trees and stumps. Given noise and human presence during the fencing and general upgrade (seeding and removal of tamarisk) within the proposed mitigation sites, there might be some temporary displacement of wildlife species, but these impacts would be short-term and localized. The proposed work should improve the wildlife habitat in the areas of mitigation sites.

3.15.2.2.7 Mammal and Bird Species of Economic and Recreational Importance (SERI)

SERI species adversely affected by TSF site development include collared peccary, mule deer, mountain lion, Gambel's quail, and white-winged dove. All are highly mobile species, and project construction and operations would result in the displacement of the more mobile species from the TSF and associated facilities footprint and a larger perimeter area due to equipment operation and human presence. Once initial construction activities have been completed, local populations will likely adapt to the presence of the TSF facilities over time and reoccupy adjacent, undisturbed habitat areas.

Predictions of SERI wildlife population losses based on habitat disturbance and displacement are difficult to make since accurate information on wildlife population numbers are often not available for many species. Even if accurate population numbers were available, projections of losses may not be accurate since it is impossible to account for the effects of weather and natural cyclical population changes. If it is assumed that the existing adjacent habitats are at carrying capacity for most species, locally displaced populations may be eliminated.

3.15.2.2.8 Predators, Furbearers, and Other Mammals

Construction and operation of a TSF site would result in direct losses of smaller, less mobile mammal species such as rodents and rabbits. Most predators and furbearers are highly mobile and wide-ranging and would be displaced from disturbance areas. However, similar to SERI species, if it is assumed that the existing adjacent habitats are at carrying capacity for most species, locally displaced populations may be eliminated.

American beaver is only present in aquatic habitats associated with the Gila River and would not be directly affected by habitat loss with TSF site development. Although, there would be a very minor (0.01-acre) loss of river habitat associated with pipeline and bridge construction. Surface and ground water impact analyses (see Sections 3.4, Surface Water Hydrology, and 3.6, Groundwater Hydrology) indicate TSF site development and operation would not have adverse water quality effects on the Gila River and only negligible water quantity effects.

TSF site development and operation would result in the burial of abandoned mine features within the TSF site footprint. Loss of these features would eliminate bat roosting use of these subterranean structures. Surveys completed by WestLand (2014h) indicated relatively minor use of abandoned mine features within the Ripsey Wash TSF site by Townsend's big-eared bat, California leaf-nosed, and pallid bat and individuals of these species may be lost with TSF site development. However, the WestLand surveys did not document any large colonial winter hibernation, maternity, or day use sites within the proposed TSF facility sites so TSF development would not have any substantial adverse effect on local populations of bats.

3.15.2.2.9 Raptors

Raptors potentially occurring or observed within the TSF site are highly mobile species and project construction and operations would result in the displacement of these species from the TSF and associated facilities footprint and possibly a larger perimeter area due to equipment operation and human presence. Once initial construction activities have been completed, local populations will likely adapt to the presence of the TSF facilities over time and reoccupy adjacent, undisturbed habitat areas. Displacement from a TSF site would likely primarily affect raptor foraging use over the site. Although abandoned mine features in the Ripsey Wash TSF footprint exhibited evidence of possible nesting use of by great horned owl, barn owl, and turkey vulture that could be adversely affected by project development, no raptor nesting use of either TSF site was documented by field surveys (WestLand 2014f). Nesting by species such as elf owl, screech owl, sharp-shinned hawk, Cooper's hawk, and American kestrel could be affected by development of the Ripsey Wash TSF site.

Construction of TSF starter dams and water control features would result in the immediate loss of raptor foraging habitats while the remainder of the TSF footprint would be lost as available hunting habitat incrementally with tailings deposition. Foraging habitat loss could result in a permanent reduction in local raptor populations over the long-term, but the extent of raptor population reductions is impossible to predict. The potential for incidental loss of nest sites, eggs, or young if abandoned mine features or saguaros are removed or impacted during the nesting season exists.

3.15.2.2.10 Waterbirds

Surface and ground water impact analyses (see Section 3.4, Surface Water Hydrology, and Section 3.6, Groundwater Hydrology) indicate TSF site development and operation would not have adverse water quality effects on the Gila River and only very negligible (if any) water quantity effects. Therefore, project development is not likely to have any direct adverse effects on waterbird use of the Gila River; however, indirect impacts could occur based on noise and general TSF activity, especially during early site development construction work. The Ripsey TSF site would be over 0.5 mile away from the inactive great blue heron rookery on the Gila River and would probably not affect future heron use of this rookery site.

3.15.2.2.11 Other Migratory and Resident Birds

Since songbirds and other bird species are highly mobile, construction and operation of a TSF site would result in displacement of bird species from disturbance areas. If it is assumed that the existing adjacent habitats are at carrying capacity for most bird species, locally displaced populations may be eliminated resulting in a permanent reduction in local bird populations since the TSF site would not be reclaimed to pre-existing habitats.

In areas where TSF construction or tailings inundation occurs during the nesting season, there would probably be an incidental loss of occupied nests, eggs, or young would occur for a variety of resident and migratory birds known to breed in habitats within the TSF footprint. This could include BCC species such as Costa's hummingbird, Gila woodpecker, and gray vireo. BCC species, such as Bell's vireo, Lucy's warbler, yellow warbler, and Lawrence's gold finch, that are associated with riparian and mesquite woodlands, would not likely be adversely affected since these habitats would not be directly impacted by TSF site development.

3.15.2.2.12 Reptiles and Amphibians

Construction and operation of a TSF site would result in direct losses of reptile populations over the entire TSF facility footprint and an overall reduction in local populations of reptiles. Adverse impacts to local amphibian populations are likely to be relatively minor since most amphibian species are associated with the Gila River and adjacent riparian habitats not directly affected by TSF site development. Indirect impacts to amphibian populations through indirect impacts to riparian habitats and surface water quality and quantity in the Gila River are not likely since surface and ground water impact analyses (see Section 3.4, Surface Water Hydrology, and Section 3.6, Groundwater Hydrology) indicate TSF site development and operation would not have adverse water quality effects on the Gila River and only very negligible (if any) water quantity effects.

3.15.2.2.13 Gila River Associated Aquatic Species

Surface and ground water impact analyses (see Section 3.4, Surface Water Hydrology, and Section 3.6, Groundwater Hydrology) indicate TSF site development and operation would not have adverse water quality effects on the Gila River and only very negligible (if any) water quantity effects on the Gila River. The proposed new tailings pipeline and highway bridge crossing would span the Gila River and much of the adjacent wetland and riparian habitats. Therefore, project development is not likely to have any adverse effects on fish and other aquatic species populations in the Gila River.

3.15.2.2.14 BLM Sensitive and State Wildlife Species of Concern (WSC)

Based on a review of known ranges and habitat preferences, seven BLM sensitive species and two WSC species could be affected by project development. Project development is not likely to adversely affect BLM sensitive and WSC species associated with the Gila River and associated riparian habitats, since surface and ground water impact analyses (see Section 3.4, Surface Water Hydrology, and Section 3.6, Groundwater Hydrology) indicate TSF site development and operation would not have adverse water quality effects on the Gila River and only very negligible (if any) water quantity effects. The tailings pipeline and bridge construction required for the Ripsey Wash alternative over the Gila River would span most of the river and associated wetland and riparian habitats and would not have any measurable impact on BLM sensitive and WSC species associated with the Gila River and associated riparian habitats.

BLM species potentially impacted by project development include desert purple martin, gilded flicker, golden eagle, California leaf-nosed bat, cave myotis, greater western bonneted bat, and Townsend's big-eared bat. WSC species are California leaf-nosed bat and pocketed free-tailed bat. Project development could affect potential nesting habitat for desert purple martin and gilded flicker, although these species were not documented in the TSF sites by field surveys. Project development would not impact golden eagle nesting habitat but could result in a minor reduction in foraging habitat for this wide-ranging species.

Field surveys documented likely roosting use of abandoned mine features by Californian leaf-nosed bat, cave myotis, and Townsend's big-eared bat (WestLand 2014h). Project development could result in the loss of a few individuals of these species if abandoned mine features are destroyed while occupied by these bats. However, project development is not likely to have substantial effect on local populations of these bats since field surveys did not document any large colonial winter hibernation, maternity, or day use sites within the proposed TSF facility sites. No potential roost sites for greater western bonneted bat or pocketed free-tailed bat would be affected by project development, but a reduction in potential foraging habitat could occur.

3.15.2.2.15 Threatened, Endangered, Proposed, and Candidate Species

Two listed species were identified by WestLand (2014l) as having the potential to occur within or near the Ripsey Wash TSF site, and their presence has been confirmed by field surveys. They are southwestern willow flycatcher (Endangered), and yellow-billed cuckoo (Threatened).

Another species, northern Mexican gartersnake (Threatened) is not present in or near the TSF sites or nearby segments of the Gila River but may be present along portions of the San Pedro River, upstream of its confluence with the Gila River (Westland 2015a). The following sections provide preliminary impact assessments for these four species. The USFWS will require formal Section 7 Consultation on the effects of development of the Ripsey Wash TSF on listed threatened and endangered species, and this section will need to be updated as Section 7 consultation progresses.

Southwestern Willow Flycatcher and Yellow-billed Cuckoo. The Arizona Department of Transportation (ADOT) and Pinal County have proposed a new highway bridge for the Florence-Kelvin Highway, immediately upstream from the existing Kelvin Bridge crossing of the Gila River. ADOT has indicated that Section 7 Consultation for the construction of the new highway bridge would be initiated in 2016 (pers. comm. Joshua Fife, ADOT, as cited in Westland 2015a). It is currently anticipated that highway bridge construction would begin prior to the Project's pipeline bridge construction. Therefore, a portion of the proposed pipeline bridge construction corridor in the Gila River would be previously disturbed from the planned construction of new highway bridge.

The Ripsey Wash TSF pipeline bridge construction would take place immediately upstream of the new highway bridge. Construction activities would occur on the north and south banks of the river within approximately 110-foot wide corridors on either side of the Gila River channel. These construction areas encompass approximately 1.0 acre. Access to the construction areas would be achieved from both the north and south sides of the river in order to avoid impacts to the river channel and Clean Water Act Section 404 jurisdictional areas. The design plans for the ADOT State Highway Project Florence-Kelvin Highway Bridge depict an area of approximately 0.8 acre as the construction work zone for the highway bridge. This area overlaps with approximately 0.3 acre within the Ripsey Wash TSF pipeline bridge construction area. Therefore, construction of the Ripsey Wash TSF pipeline bridge would require approximately 0.7 acre of additional vegetation disturbance within the Gila River riparian corridor.

The proposed pipeline bridge crossing of the Gila River would pass through designated critical habitat for SWFL and proposed critical habitat for yellow-billed cuckoo. As indicated, construction of the pipeline bridge would require vegetation clearing of approximately 0.7 acre. Permanent impacts would result from the placement of the approximately 14-ft wide pipeline bridge, resulting in approximately 0.2 acre of permanent impact along the Gila River. Construction impacts would lead to a temporary loss of 110 feet of vegetation within the SWFL Middle Gila-San Pedro Management Unit (50.1 miles of the Gila River and 78.4 mi of the San Pedro River). This impact represents approximately 0.02 percent of the river miles in this management unit. Riparian vegetation within the bridge construction area will recover over time except at bridge structure locations.

Relocation of the Florence-Kelvin Highway, relocation of the SCIP power line, and construction of the seepage collection system near the confluence of Ripsey Wash and the Gila River will also result in direct impacts to mapped SWFL critical habitat and potential yellow-billed cuckoo foraging habitat. However, yellow-billed cuckoo foraging habitat and an approximate 6.5 acres of mapped SWFL critical habitat potentially impacted by these project components is dominated by velvet mesquite, desert broom, and other xeroriparian plant species. There is no mesoriparian or hydroriparian vegetation in this area, and it does not provide the dense shrub and/or tree cover required for SWFL nest sites. In addition, the xeroriparian vegetation is likely to provide less insect prey for SWFL and yellow-billed cuckoo than the hydroriparian zone adjacent to the Gila River.

It is possible that SWFL and yellow-billed cuckoo could occasionally forage in this area, but this area is about 0.2 miles from perennial water in the Gila River, and it would not provide optimal foraging conditions. Another approximate 6.5 acres of mapped SWFL critical habitat and potential yellow-billed cuckoo foraging habitat, north of the Copper Basin Railway and east of the proposed drain-down pond, pump station, and electrical switch gear, would be impacted by project infrastructure. This area is also dominated by velvet mesquite and other xeroriparian plant species, and it does not provide the dense shrub and/or tree cover required for SWFL nest sites or preferred foraging areas for SWFL or yellow-billed cuckoo.

Site clearing and pipeline bridge construction activities would directly impact two SWFL breeding territories and possible yellow-billed cuckoo breeding habitat, and bridge construction activities and related noise could impact other SWFLs and yellow-billed cuckoos in the vicinity. It is important to note that and no evidence of yellow-billed cuckoo breeding has been observed by any of the surveys conducted within the Ripsey Wash TSF project area, including the pipeline bridge construction area

(Westland 2014r, 2015c). Approximately 0.7 acres would be temporarily impacted, but the riparian vegetation within the construction area is expected to recover over time. The footprint of the approximately 14-foot wide pipeline bridge spanning the river and the associated six piers within the river's riparian corridor (approximately 0.2 acre) would remain as a permanent direct impact. The bridge would be elevated and existing vegetation remaining upstream and downstream of the bridge would eventually reestablish in proximity to the bridge. The bridge is not expected to act as a barrier to long distance migrations or local dispersal movements.

Construction of the new Florence-Kelvin highway bridge and tailings pipeline over the Gila River for the Ripsey Wash alternative has the potential to disturb breeding or nesting activity by SWFL and yellow-billed cuckoo if construction occurs during the nesting season. Disruption of breeding or nesting activity would be violation of the MBTA and the Endangered Species Act (ESA). Therefore, it is recommended that vegetation clearing occur outside of the breeding and nesting season of these two species prior to construction.

In addition to direct habitat loss and possible disturbance to individual birds by construction activities, increased levels of traffic, noise, and dust generation have the potential to directly impact SWFL and yellow-billed cuckoo individuals. An evaluation of these impact vectors concluded that they may disturb individuals but would not likely result in any SWFL or yellow-billed cuckoo mortalities (Westland 2015a). Once construction is complete, noise and traffic levels should return to pre-existing background levels.

TSF site operation is not likely to have any indirect effects on the Gila River and associated SWFL and yellow-billed cuckoo riparian habitats since TSF site development and operation would not have adverse water quality effects on the Gila River and only very negligible (if any) water quantity effects.

Project mitigation activities would not have any direct adverse effect on yellow-billed cuckoo proposed critical habitat or SWFL critical habitat. Mitigation actions along the San Pedro and Gila Rivers will exclude livestock grazing, off-road vehicle access, and wood harvesting. These beneficial actions should allow further development of mesquite bosque and riparian vegetation, which would be expected to enhance conditions within SWFL critical habitat and proposed yellow-billed cuckoo proposed critical habitat.

Northern Mexican Gartersnake. There is no proposed critical habitat for northern Mexican gartersnake mapped along the Middle Gila River, and due to the presence and abundance of non-native aquatic species in the middle Gila River, northern Mexican gartersnake is not likely to occur along portions of the Gila River near the Ripsey Wash TSF site. As a result, project activities associated with construction of the Ripsey Wash TSF and associated infrastructure, including the proposed pipeline bridge crossing of the Gila River, would not have any direct or indirect adverse effects on populations of northern Mexican gartersnake.

Proposed northern Mexican gartersnake critical habitat mapped along the San Pedro River includes portions of proposed Clean Water Act, Section 404 mitigation sites. No activities are planned at the mitigation sites that would adversely impact proposed northern Mexican gartersnake critical habitat. Mitigation actions along the lower San Pedro River will exclude livestock grazing, off-road vehicle access, and wood harvesting. These actions would contribute to improving the aquatic and riparian conditions along the river within sections of northern Mexican gartersnake proposed critical habitat.

3.15.2.3 Effects of the Hackberry Gulch Wash TSF Alternative

The Hackberry Gulch TSF would cause direct habitat loss in the area of disturbance. See **Table 2-2, Summary of Hackberry Gulch TSF Alternative**. General effects on wildlife would be similar to those described for the Ripsey Wash TSF Alternative.

3.15.2.3.1 Habitat Loss and Fragmentation

These impacts would be the similar to those described for the Ripsey Wash TSF Alternative except there would be no impact associated with the relocation of the Florence Kelvin Highway or the Arizona Trail.

3.15.2.3.2 Displacement of Wildlife

These impacts would be the similar to those described for the Ripsey Wash TSF Alternative, except the footprint of the Hackberry TSF site would be slightly smaller

3.15.2.3.3 Wildlife Mortality

These impacts would be the similar to those described for the Ripsey Wash TSF Alternative.

3.15.2.3.4 Wildlife Exposure to Contaminated Surface Water

These impacts would be the similar to those described for the Ripsey Wash TSF Alternative.

3.15.2.3.5 Increased Competition for Wildlife

These impacts would be the similar to those described for the Ripsey Wash TSF Alternative.

3.15.2.3.6 Special Habitat Features

Within the Hackberry Gulch TSF site there are 11 seeps, two springs, one water well, and one stock tank that would be lost with this alternative. Five of the identified seeps support perennial surface water sources with associated riparian and wetland vegetation, which would also be lost with this alternative. The Gila River and adjacent riparian habitat is separated from the Hackberry Gulch TSF site by Highway 177, and given this and the distance between the Hackberry Gulch TSF site, construction and operation of the TSF site is unlikely to have any indirect effects on wildlife use of the Gila River corridor.

Effects to wildlife as a result work in the areas proposed for waters of the U.S. mitigation (**Appendix J, Clean Water Act Section 404 Conceptual Mitigation Plan**) would be essentially the same as described in Section 3.15.2.2.6, Special Habitat Features.

3.15.2.3.7 Mammal and Bird Species of Economic and Recreational Importance (SERI)

These impacts would be the similar to those described for the Ripsey Wash TSF Alternative except that the Hackberry Gulch has been given a lower SERI rating than the Ripsey Wash TSF site.

3.15.2.3.8 Predators, Furbearers, and Other Mammals

These impacts would be the similar to those described for the Ripsey Wash TSF Alternative, except there would be no bridge or pipeline crossing of the Gila River with the Hackberry Wash Alternative and no possible adverse effects to American beaver use of the Gila River.

TSF site development and operation would result in the burial of only one abandoned mine feature (Hackberry shaft) within the TSF site footprint. This shaft exhibited no evidence of bat use and possible evidence of occasional owl perching use. Therefore the Hackberry Gulch alternative is unlikely to have any adverse effects on regional bat populations or owl nesting use.

3.15.2.3.9 Raptors

These impacts would be the similar to those described for the Ripsey Wash TSF Alternative.

3.15.2.3.10 Waterbirds

These impacts would be the similar to those described for the Ripsey Wash TSF Alternative.

3.15.2.3.11 Other Migratory and Resident Birds

These impacts would be the similar to those described for the Ripsey Wash TSF Alternative.

3.15.2.3.12 Reptiles and Amphibians

These impacts would be the similar to those described for the Ripsey Wash TSF Alternative. However, loss of five seeps and supported areas of surface water and riparian and wetland habitats would result in the loss of any local amphibian populations possibly breeding in these habitats.

3.15.2.3.13 Gila River Associated Aquatic Species

These impacts would be the similar to those described for the Ripsey Wash TSF Alternative, except there would be no bridge or pipeline construction over the Gila River.

3.15.2.3.14 BLM Sensitive and State Wildlife Species of Concern (WSC)

These impacts would be the similar to those described for the Ripsey Wash TSF Alternative but for two exceptions. There would be no abandoned mine features affected by the Hackberry Gulch TSF alternative that support bat day roosting activity, and some of the more perennial springs and associated surface water areas in the Hackberry Gulch TSF footprint may provide suitable habitat for lowland leopard frog, a BLM sensitive and AGFD WSC species.

3.15.2.3.15 Threatened, Endangered, Proposed, and Candidate Species

Impacts to threatened, endangered, proposed, and candidate species for the Hackberry Gulch alternative would be relatively similar to the Ripsey Wash alternative except there would be no need for construction of the tailings pipeline bridge crossing of the Gila River. As a result, the Hackberry Gulch TSF alternative would not have the potential for directs adverse impacts to SWFL and yellow-billed cuckoo foraging, breeding, and nesting habitat. Both project areas support relatively low populations of desert tortoise that would be lost to project development. With the Hackberry Gulch alternative 2,290 acres of low quality desert tortoise habitat would be impacted and lost to any future use by desert tortoise.

3.16 ACCIDENTS AND SPILLS

Protect worker health and safety. *Areas of concern include: (1) health and safety risks from the construction and operation of a tailings storage facility; (2) the possibility of an accident that would necessitate an emergency response; and (3) the potential for an accidental spill of tailings or other substances that could impact the environment, especially to the Gila River.*

3.16.1 OVERVIEW

There are an infinite number of accident and spill scenarios that could be developed for a TSF project. Analysis of such scenarios can include varying levels of complexity and portray a variety of results.

The discussion in this section provides an assessment of risk from potential accidents and spills associated with a TSF. For a related perspective example, an accident assessment of a trip in an automobile or an airplane could be very frightening. We know that, but we continue to take those trips anyway. However, the knowledge of a certain type of accident may persuade us to take extra precautions en route.

There is a difference between a predicted effect and a potential effect or risk. Predicted effects are specifically identified as such and have been discussed in the preceding sections in terms of magnitude and duration. Effects or risks that are not predicted, but which have a potential to occur have been selected and presented in this section. These potential effects are recognized and described to ensure that reasonable steps are taken to minimize or prevent them. Potential effects or risks are not predicted to occur, but they are merely presented as examples of the effects or risks that could be associated with a TSF.

3.16.2 ENVIRONMENTAL CONSEQUENCES

3.16.2.1 Effects of the No Action Alternative

There would be no potential for accidents and spills under the no action alternative, as neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed.

3.16.2.2 Effects of the Ripsey Wash TSF Alternative

The following discussion does not predict numerical probabilities for an accident or spill event, but instead discusses the type and relative magnitude that could result. With respect to these considerations, the following accident and spill scenarios are presented:

- Tailings or reclaim water pipeline break or leak;
- Leak through the TSF seepage trenches and reclaim ponds;
- Tailings dam failure; and,
- Transportation spill.

3.16.2.2.1 Tailings Pipeline Break or Leak

A rupture of or a leak from the Ripsey Wash TSF tailings pipeline could cause varying effects. The magnitude of effects would depend on a number of conditions including the location of the spill, the volume of spill, clean-up response time and effectiveness, and weather conditions.

For example, if the tailings pipeline and its secondary containment ruptured on the bridge over the Gila River, causing tailings to spill into the Gila River, there could be impacts to aquatic life, riparian vegetation and wetland areas, and possibly waterfowl. However, the likelihood of this event is very remote as the tailings pipeline across the Gila River would be sleeved within secondary containment, which would allow any tailings pipeline leakage or breakage to gravity drain to a lined tailings drain-down pond located on the northeast side of the Gila River. In addition, any tailings pipeline rupture or leakage would trigger an immediate shut-down of tailings pumping until the problem is fixed.

3.16.2.2.2 Leak through the TSF Seepage Trenches and Reclaim Ponds

The likelihood of a leak through the Ripsey Wash TSF seepage trenches or reclaim ponds causing down-drainage environmental problems to the Gila River is very low. The seepage trench systems on the Ripsey Wash drainage and the unnamed east side drainage have been designed and would be constructed to intercept any seepage through alluvium material in the major washes down-drainage of the TSF sites, and the design and proposed construction techniques are based on protocol that would be approved by Arizona DEQ for the APP permit. The reclaim ponds downgradient of the seepage trenches would incorporate an engineered double synthetic liner system, which would include a leak detection system; the purpose of this system would be to detect any leakage through the liner system. In addition, Asarco plans to implement special precautions against leakage in the area of the Hackberry fault zone. If such leakage was detected beneath the Ripsey Wash TSF, the leakage water would be returned to the TSF.

Wells down-drainage of the Ripsey Wash TSF seepage trenches, reclaim ponds and Hackberry fault internal containment structure would be monitored for water quality standards set by Arizona DEQ for the APP permit. Should a contamination problem in excess of APP permit standards be detected, mitigation measures such as pump-back of groundwater to the TSF from the wells down-gradient of the facility, installation of additional seepage containment structures, maintenance on existing containment facilities, and/or other appropriate measures would be required by the Arizona DEQ to stop or mitigate the contamination.

3.16.2.2.3 Tailings Dam Failure

A tailings dam failure could be initiated by circumstances such as a catastrophic event (earthquake, flood, etc.), a design or construction flaw, or oversaturation of the tailings embankment. These could result in severe structural damage to the embankment causing a breach or break in the embankment.

Two modes of failure are considered in this section: (1) Earthquake induced embankment failure (flow slide failure) and (2) dam breach by overtopping. Given engineering design, construction protocol and operational safeguard, these scenarios have an extremely remote possibility of happening. The Arizona DEQ has design oversight for tailings facilities within the state, and this agency reviews and approvals the design of the facility. The Arizona State Mine Inspector and MSHA are responsible for safe operation of tailings facilities. See **Appendix C, Agency Responsibilities (Regulatory Framework)**.

3.16.2.2.3.1 Earthquake Inducted Failure

As explained in Section 3.3, Geology and Geochemistry, this region of Arizona has a low seismic risk. Strict safety procedures and precautions are mandated for construction and operation of a TSF, including the design of the facility to withstand a maximum credible earthquake (MCE) for this region of Arizona.

Unsaturated and compacted tailings embankments exhibit satisfactory behavior under intense earthquake loadings. Considering that dissipation of pore pressure across the embankment through drainage systems during centerline construction by chimney and blanket drains and the control of phreatic surface within the embankment, the TSF embankment would be capable of undergoing the design earthquake without a realistic possibility of a failure that would trigger an uncontrolled release of the tailings.

Although the plans are to design and construct a TSF embankment to withstand expected seismic events for the region, the TSF embankment could experience erosion, planar or cylindrical failures under more extreme events. An embankment failure could result in a flow slide failure of the tailings material within the embankment itself and/or in the impoundment behind the embankment.

A flow slide failure is essentially a mud slide, resulting from a partial or total embankment collapse, which could release part of the tailings deposit. The total release of tailings from the facility would be extremely unlikely, unless that the tailings were conservatively assumed to be in a total fluid state, which would not be the case. Under the proposed operating conditions, the tailings are expected to be drained and consolidated in the area of the embankment and impossible to liquefy. However, the extremely conservation assumption of total liquification would cause failure of the TSF embankment and tailings to flow (like a mud flow) down the ephemeral washes beneath the facilities. In this case, some tailings could flow into the Gila River.

3.16.2.2.3.2 Dam Breach by Overtopping

This would be an erosional failure caused by overtopping of the tailings embankment by flood events. Overtopping typically would result when the volume of run-on entering the tailings impoundment exceeds the capacity of the impoundment. This is an extremely unlikely scenario since one must assume either huge storm events or improper design or construction of detention and diversion of surface water around the TSF.

Tailings material that is situated five to ten feet below the level of tailings in the impoundment would be very unlikely to join a breach flow; however, the upper layer of tailings might be sufficiently saturated to flow, and the depth of any breaching would be assumed to stop somewhere in that range of depth. Lower tailings would be compressed. Since the TSF would be built in stages or lifts with tailings added during each stage or lift, the impoundment would never fill entirely with water.

Should the tailings embankment breach, a dam-break wave of saturated tailings would progress down-drainage of the TSF. The time from initial overtopping to breaching would undoubtedly be very short. The peak discharge would occur very rapidly, probably within minutes after the breaching starts. On both action alternatives, the peak flow of saturated tailings would probably reach the Gila River.

The magnitude of the impacts to vegetation, wetlands, wildlife, aquatic life and personal property is difficult to predict other than it is realized that environmental and property destruction would occur. Human life, personal property and domestic water sources in the washes and the down-drainage reaches of the Gila River would be in jeopardy. There would be loss of wildlife, aquatic life and wetlands with the downstream floodplain of the Gila River, and the erosional effects of the peak flow would be severe.

Within the flow slide area, vegetation, wetlands and aquatic habitats would be damaged or destroyed. Based on the geochemical testing of the tailings solids, there would be no toxic impacts, only the inundation of very fine-grained material within the slide zone. The impacts would remain until cleanup and restoration is completed.

3.16.2.2.4 Transportation Spill

An accident involving a diesel fuel tanker truck or a diesel fuel spill during the fueling process could cause varying effects. Any diesel fuel spill that reached Gila River could spread fuel downstream if containment measures, such as placement of oil booms, installation of temporary dikes, removal of the fuel source, etc. are not initiated quickly. There could be adverse impacts to aquatic life, riparian and wetland areas, and possibly waterfowl. Other effects that could possibly occur might be damage to private property and contamination of domestic water supplies in close proximity to the Gila River. The magnitude of effects would depend on a number of conditions including:

- Accident severity and volume of spill;
- Integrity of the transport containers;
- Clean-up response time and effectiveness;
- Weather conditions;
- Local soil and vegetation types;
- Proximity of accident to a drainage, in particular the Gila River; and,
- Volume of the receiving water body.

Isolated spills of diesel fuel could result in soil or vegetation contamination that could result in the affected soil or vegetation requiring removal and appropriate treatment. Spills would be handled in compliance with on-site SPCC plans, with affected soils disposed of according to those plans. It is expected that the area and volume of soils impacted by isolated spills would be limited, with a minor overall effect.

3.16.2.3 Effects of the Hackberry Gulch TSF Alternative

The potential for accidents and spills for the Hackberry Gulch TSF alternative would be essentially the same as addressed in Section 3.16.2.2, Effects of the Ripsey Wash TSF Alternative. There would be two primary differences for the Hackberry Gulch TSF Alternative versus the Ripsey Wash TSF Alternative. First, the tailings and water return pipelines for the Hackberry Gulch TSF Alternative would not cross the Gila River, so there would be no potential for a break in pipelines that cross the river (because there would be no pipeline bridge). Second, the Hackberry Gulch TSF Alternative has seven seepage trenches and seven reclaim ponds (and the piping and ditching associated with these facilities), as compared to two seepage trenches and two reclaim ponds for the Ripsey Wash TSF Alternative. Having more seepage trenches, reclaim ponds, pipelines and ditches does not necessarily mean that there would be accidents or spills, but the increased number of these facilities does add design, construction and operational complexity.

3.17 IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENT

3.17.1 OVERVIEW

Irreversible resource commitments are those that cannot be reversed (loss of future options), except perhaps in the extreme long-term. It relates primarily to non-renewable resources, such as minerals or cultural resources or those resources that are renewable only over long periods of time, such as mature desert vegetation. A tailings facility covers soils material, and this would result in an irreversible loss of that resource.

Irretrievable resource commitments are those lost for a period of time. An example here is the loss of area for livestock grazing until the site is closed and some form of vegetation returns to the area of disturbance.

3.17.2 ENVIRONMENTAL CONSEQUENCES

3.17.2.1 Effects of the No Action Alternative

There would be no potential for irreversible and irretrievable resource commitments under the no action alternative, as neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed.

3.17.2.2 Effects of the Ripsey Wash TSF Alternative

Use of land for the Ripsey Wash TSF would displace existing land uses. Existing grazing, wildlife habitat and recreation uses would be disrupted or eliminated during the estimated life of the tailings facility and for a long period thereafter. Closure and the return of vegetation through natural reclamation, land uses might eventually return to some resemblance of current uses, but this would take a long time for some resources such as mature wildlife habitat, which may never occur.

The irreversible commitment of resources associated with the Ripsey Wash TSF would include the consumption of non-renewable energy, such as diesel fuel and gasoline, during the construction, operation and closure of the TSF.

The soils overlying the surface of the Ripsey Wash TSF site would be buried by tailings deposition resulting in a permanent loss of productivity. Similarly, the soils overlying adjunct facility sites and reroute disturbances where the facilities would remain on the surface following site closure would also result in a permanent loss of soil productivity. These areas include detention dams and diversion structures, various facility ponds, and the reroute of the Florence-Kelvin Highway. Soil materials lost as a result of erosion during construction and prior to the application of rock cover would also be an irreversible commitment of the soil resource.

The topography would be permanently altered by the creation of the Ripsey Wash TSF. This would result in an irreversible loss of the current scenic quality. The contrasting form, line, color, and texture created by the TSF would represent an irreversible commitment of visual resources, since it would continue to be a highly dominant feature in the landscape.

The relocated Florence-Kelvin highway associated with Ripsey Wash TSF would create a permanent change in the character of the area, affecting portions of the Arizona Trail corridor.

The Hackberry Gulch TSF would create a permanent extension of the existing contrasting elements of the Ray Mine and Elder Gulch TSF, affecting primarily the SR 177 and the Arizona Trail corridors. Contrasts in color and texture under both TSF alternatives would be reduced as the natural revegetation process occurs over time, but this would occur very gradually over a long period of time and likely would not eliminate all contrasts entirely. As the vegetation gradually reduces color and texture contrasts, the contrasting form and line would be less noticeable.

There would be a permanent loss of several primitive roads used by OHV users and dispersed recreation areas used by local residents. Under Ripsey Wash TSF Alternative, the Arizona Trail and Florence-Kelvin Highway Trailhead would need to be permanently relocated outside the area of proposed TSF disturbance. Views of the TSF would result in irreversible visual effects on recreation facilities within the project viewshed, including the Arizona Trail.

Cultural sites within the footprint of the TSF site would be lost; however, research values would be recovered prior to the physical loss.

The loss of specific surface water features buried by the Ripsey Wash TSF would be irreversible and irretrievable.

Although the results Asarco's condemnation drilling at the Ripsey Wash TSF site revealed no mineralized copper resources beneath the locations of the proposed TSF, federal mineral estate would be buried beneath tailings. This action would effectively preclude future mineral resource development beneath the facilities.

The loss of groundwater recharge to the Gila River alluvium from watersheds of the ephemeral washes where the Ripsey Wash TSF site would be located would represent an irreversible impact.

Tailings placed in the Ripsey Wash TSF would bury wells and could cause a reduction in water yield from wells down-gradient of the facility; these impacts would be irreversible and irretrievable.

Soils would be buried in the areas to be used for the TSF. This would result in the irretrievable and irretrievable commitment of soils.

Vegetation would be either removed (in the areas of the tailings embankment, reclaim ponds, drain-down ponds, and detention dams) or buried in the areas to be used for the TSF. This would result in the irretrievable commitment of vegetation. The tailings would become revegetated to some degree, but the site would never have the species composition or density of vegetation as that site currently exists.

There would be long-term irretrievable loss of land use at the Ripsey Wash TSF site, as the return to pre-project land use of dispersed recreation and wildlife habitat would not happen to the same extent as currently exists because the TSF will be covered with rock and only sparse vegetation is expected to return, and even that condition would only occur many years after full site closure.

The Ripsey Wash TSF activity would displace wildlife with the area of direct disturbance (e.g., loss of habitat) and some wildlife within a larger area (e.g., reduced habitat effectiveness due to human presence and noise). These effects would likely cause a reduction in wildlife population. Upon closure and the incursion of natural revegetation, wildlife habitat would eventually be restored, but probably never the same quality and quantity that would be lost, and certainly not for a long period of time.

Recreation opportunities would be restricted with the area of the Ripsey Wash TSF site, and these recreation values would be displaced to other sites during TSF construction and operation. Upon closure, dispersed recreation opportunities would be less that currently exists.

Wildlife habitats and populations within the disturbance footprint of the Ripsey TSF site and permanent adjunct facilities (detention dams, diversion structures, reclaim ponds, pumping structures, the Florence-Kelvin highway reroute, and any quarries outside the TSF footprint) would be buried resulting in a long-term loss of these resources.

3.17.2.3 Effects of the Hackberry Gulch TSF Alternative

The potential for irreversible and irretrievable resource commitments for the Hackberry Gulch TSF alternative would be essentially the same as addressed in Section 3.17.2.2, Effects of the Ripsey Wash TSF Alternative. There would be two primary differences for the Hackberry Gulch TSF Alternative versus the Ripsey Wash TSF Alternative. First, the Arizona Trail would remain in its existing location under the Hackberry Gulch TSF Alternative. Second, the Florence-Kelvin highway would not be relocated under the Hackberry Gulch TSF Alternative.

3.18 UNAVOIDABLE ADVERSE IMPACTS

There are unavoidable impacts that would occur as a result of tailings disposal. Some of these effects would be short-term (during operations), while others would be long-term (extending well into the future beyond tailings closure) or permanent.

3.18.1 Effects of the No Action Alternative

There would be no unavoidable adverse impacts under the no action alternative, as neither the Ripsey Wash nor the Hackberry Gulch TSF would be constructed.

3.18.2 Effects of the Ripsey Wash TSF Alternative

The following are unavoidable adverse effects that could occur with construction, operation and closure of the Ripsey Wash TSF:

- The generation of fugitive dust during construction (short-term) and during and following operation (long-term);
- The loss of soil productivity through burial, profile mixing and compaction (long-term and permanent);
- Loss of vegetation within the area of TSF disturbance (long-term);
- Loss of waters of the U.S. (short and long term, and permanent beneath the tailings);
- The consumption of water resources (short-term);
- The loss of a portion of the Arizona Trail under the footprint of the Ripsey Wash TSF (long term and permanent);
- The loss of several primitive roads used by OHV users and dispersed recreation acreage and displacement of recreation to nearby areas (long-term);
- The burial of cultural resources (long-term);
- The permanent alteration of topography (long-term and permanent);
- The loss of stormwater runoff from the footprint of the TSF sites during construction and operation (short term and long term);
- Increased road traffic (short-term); and,
- The loss of wildlife habitats and associated wildlife populations through permanent burial of the TSF and associated facility sites (short-term and long-term). Unavoidable impacts are also associated with the clearing of selected facility sites such as the diversion structures, pipeline corridor, electric transmission line structure base areas, and the rerouted segment of the Florence Kelvin highway road where vegetation would be cleared but not restored.

3.18.3 Effects of the Hackberry Gulch TSF Alternative

The potential for unavoidable adverse effects for the Hackberry Gulch TSF alternative would be similar to those addressed in Section 3.18.2, Effects of the Ripsey Wash TSF Alternative. The following are unavoidable adverse effects that could occur with construction, operation and closure of the Hackberry Gulch TSF:

- The generation of fugitive dust during construction (short-term) and during and following operation (long-term);
- The burial of nine water wells and the potential reduction of yield from another seven down-gradient water wells from the construction and operation of the Hackberry Gulch TSF (long-term);
- The loss of soil productivity through burial, profile mixing and compaction (long-term and permanent);
- Loss of vegetation within the area of TSF disturbance (long-term);
- Loss of waters of the U.S. (short and long term, and permanent beneath the tailings);
- The consumption of water resources (short-term);

- The loss of several primitive roads used by OHV users and dispersed recreation acreage and displacement of recreation to nearby areas (long-term);
- The burial of cultural resources (long-term);
- The permanent alteration of topography (long-term and permanent);
- The loss of stormwater runoff from the footprint of the TSF during construction and operation (short term and long term);
- Increases in noise levels to residents of the community of Riverside during construction of Hackberry Gulch TSF (short-term);
- Increased road traffic (short-term); and,
- The loss of wildlife habitats and associated wildlife populations through permanent burial of the TSF and associated facility sites (short-term and long-term). Unavoidable impacts are also associated with the clearing of selected facility sites such as the diversion structures, reclaim ponds and pipeline corridors, where vegetation would be cleared but not restored.

4.0 CUMULATIVE IMPACTS

This EIS chapter discusses the potential cumulative impacts that would occur with the construction, operation and closure/reclamation of either the Ripsey Wash or Hackberry Gulch TSF alternatives.

The Council of Environmental Quality (CEQ), in the NEPA regulations, defines cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).

Cumulative impacts vary by resource, and the area that influences cumulative impacts can also vary for each resource area. For this cumulative impact assessment, the Corps considered the expected extent to which the environmental impacts (direct and indirect) for each environmental resource could be reasonably detected and then used this area to define a general cumulative effects study area (CESA) for each resource discipline. See **Table 4-1, Cumulative Effects Study Areas**.

Table 4-1, Cumulative Effects Study Areas

Resource Identification Number	Resource Discipline	Cumulative Effects Study Area
1	Air Quality	Actions within the same general air shed as TSF alternatives.
2	Climate Change	Actions that have national or global importance.
3	Soils	Actions within the same watersheds as TSF alternatives.
4	Geochemistry	Actions within the same watersheds as TSF alternatives.
5	Surface Water	Actions within the same watersheds as TSF alternatives.
6	Waters of the U.S.	Actions within the same watersheds as TSF alternatives.
7	Groundwater	Actions within the same watersheds as TSF alternatives.
8	Land Use	Actions within eastern Pinal County.
9	Noise	Actions within geographic area examined for TSF alternatives.
10	Recreation	Actions within geographic area examined for TSF alternatives.
11	Cultural Resources	Actions within geographic area examined for TSF alternatives.
12	Socioeconomics	Communities in eastern Pinal County, including communities of Kearny, Kelvin, Gold Canyon, Hayden, Riverside, Superior and Winkelman.
13	Environmental Justice	Same as socioeconomics above.
14	Transportation	Actions within Eastern Pinal County with particular focus on U.S. Highway 60, Arizona State Highway 177, and the Florence-Kelvin Highway.
15	Vegetation	Actions within the same watersheds as TSF alternatives.
16	Visual Resources	Actions within geographic area examined for TSF alternatives.
17	Wildlife	Actions within geographic area examined for TSF alternatives.
18	Accidents and Spills	Actions within same watersheds as TSF alternatives.

The locations of the regional activities considered as part of this cumulative impact assessment are shown on **Figure 50, Regional Activities/Actions Locations Map/Actions Locations Map**. The description of these activities, including the Ray Mine operations, is set forth in **Appendix D, Regional Activity**.

Many of the regional actions and activities, in combination with the Ripsey Wash or the Hackberry Gulch TSF alternatives, would not contribute to cumulative impacts of individual resource disciplines, as such actions and activities are deemed outside the CESAs for the particular resource. The Corps reviewed each of the identified regional actions and activities and screened them for their relevance to a cumulative impact assessment for the Ripsey Wash or the Hackberry Gulch TSF alternatives. See **Table 4-2, Relevant Activities and Resources Evaluated for Cumulative Impacts**.

Table 4-2, Relevant Activities and Resources Evaluated for Cumulative Impacts

Activity[1]	Relevant (yes or no)	General Basis of Selection for Evaluation	Resources Evaluated [2]
Exploration, Mining and Related Industrial Activity			
Ray Mine	Yes	Mining expected to continue into the future (50+ years).	1-18
Resolution Copper Project	Yes	This proposed mining project has estimated life of 60+ years.	1, 2, 5, 8, 12, 14
Hayden Concentrator	Yes	The Hayden concentrator will continue to operate into the future.	5
Hayden Smelter	Yes	The smelter is projected to operate into the future.	1
Transportation and Utilities			
U.S. Route 60	Yes	This highway will continue to be used into the future.	9, 14
State Highway 77	No	Outside the area studied for transportation.	None
State Highway 177	Yes	This highway will continue to be used into the future.	9, 14
Florence Kelvin Highway	Yes	This highway will continue to be used into the future.	9, 14
Florence Kelvin Bridge over the Gila River	Yes	This new bridge is scheduled for construction in the near future and will replace an existing bridge that will remain as part of Arizona Trail.	9, 14
Copper Basin Railroad	Yes	This railroad will continue to operate into the future.	8, 9, 14
SCIP 69 kV Electric Line	Yes	A portion of the powerline to be re-routed if the Ripsey wash TSF is constructed. No alignment change under Hackberry Gulch TSF.	8
APS 500 kV Electric Line	No	Outside the areas studied for visual resources, recreation and noise.	None
Recreation and Wilderness			
Dispersed Recreation	Yes	Dispersed recreation to continue into the future.	1,2, 5, 7
Arizona National Scenic Trail	Yes	Recreationalists to continue to use this trail into the future.	3, 8, 15, 16
Bryce Thompson Arboretum	No	This facility is outside of area studied for recreation.	None
Superstition Wilderness	No	Outside of area where air quality, visual and recreation effects expected.	None
White Canyon Wilderness	Yes	Recreationists will continue to use this nearby wilderness into the future.	15,16
Needle's Eye Wilderness	No	Outside of area where air quality, visual and recreation effects expected.	None
Aravaipa Canyon Wilderness	No	Outside of area where air quality, visual and recreation effects expected.	None
Communities			
Apache Junction	No	Outside economic area of influence for TSF alternatives.	None
Gold Canyon	Yes	Within economic area of influence for TSF alternatives.	8, 12
Hayden	Yes	Within economic area of influence for TSF alternatives.	8, 12

Activity(1)	Relevant (yes or no)	General Basis of Selection for Evaluation	Resources Evaluated (2)
Kearny	Yes	Within economic area of influence for TSF alternatives.	8, 12
Kelvin	Yes	Within economic area of influence for TSF alternatives.	8, 9, 12
Riverside	Yes	Within economic area of influence for TSF alternatives.	8, 9, 12
Superior	Yes	Within economic area of influence for TSF alternatives.	8, 12
Winkelman	Yes	Within economic area of influence for TSF alternatives.	8, 12
Agriculture			
Livestock Grazing	Yes	Within and adjacent to areas of TSF alternatives.	5, 7, 8
Farming	No	Outside of area of influence for TSF alternatives.	None
Dams and Reservoirs			
Coolidge Dam-San Carlos Reservoir	Yes	The Coolidge Dam is located on the Gila River upstream of TSF alternatives.	5
Ashurst–Hayden Diversion Dam	No	This facility is located on Gila River downstream of TSF alternatives and outside of area of influence from the TSF alternatives.	None
Miscellaneous			
Ray Land Exchange	Yes	Pending. Involves land exchange between BLM and Asarco.	8,10
BLM Special Management Areas	Yes	Special management policies and regulations will apply to these areas.	8

Notes:

(1) See Appendix D, Regional Activity.

(2) These numbers are from listing in Table 4-1, Cumulative Effects Study Areas, and represent the resource disciplines for which the cumulative impacts are discussed for the pertinent activity.

The potential cumulative impacts associated with the Ripsey Wash and Hackberry Gulch TSF alternatives are expected to be similar. Therefore, given the inherent uncertainties with assessing cumulative effects, this cumulative impact analysis jointly covers both alternatives.

4.1 AIR QUALITY CUMULATIVE IMPACTS

Because the proposed new TSF is slated to replace the existing Ray Mine Elder Gulch TSF, overall cumulative emissions as a result of the proposed new TSF sites would be minor during construction and low once the TSF is put in operations.

Fugitive dust and gaseous emissions associated with either TSF action alternative would add to the overall emissions in the region, particularly during the expected three years of initial site development and construction activities, but additional TSF construction generated emissions would be minor compared to the overall emissions from the region that already experiences mining (Ray Mine), industrial (Hayden smelter), urban (the Phoenix metropolitan area), transportation and agricultural activities.

As shown on **Figure 20, Air Quality Zones Map**, the two TSF action alternatives are located within the Hayden PM_{10} non-attainment area, but the new TSF is merely slated to replace the existing Ray Mine Elder Gulch TSF. The construction, operation and closure of either new TSF would cumulatively add

PM_{10} emissions, with the construction period generating the most annual PM_{10} emissions. However, the estimated annual PM_{10} emissions during construction are expected to add minor amounts of these emissions to the environment, at amounts below the EPA defined *de minimis* levels (40 CFR 93 §153) that would require a conformity determination by the Corps.

The Ripsey Wash TSF action alternative is located outside the Hayden SO_2 non-attainment area, where the primary SO_2 emission source is from the Hayden Smelter[30]. The Hackberry Gulch TSF alternative would be located within this Hayden SO_2 non-attainment area. The SO_2 emissions from the construction, operations and closure of either TSF action alternative would have a negligible effect on regional SO_2 levels.

As stated in Section 3.1.3, Air Quality Regulatory Framework, only a portion of one designated Class I area is located within 30 miles of the TSF sites, the closest being the Superstition Wilderness Area, located approximately 12 miles north of the proposed TSF sites. The other two Class I areas are approximately 40 miles from the TSF sites. Both TSF action alternatives would emit emissions that could contribute to regional haze, but the amounts of these emissions would be negligible when compared to emissions released by urban and industrial activities of the greater Phoenix metropolitan area.

Because the Ripsey Wash or Hackberry Gulch TSF sites would probably be constructed and in operations (replacing the existing Ray Mine Elder Gulch TSF) before the Resolution Copper Project is approved and its construction initiated, there would be negligible cumulative fugitive dust and gaseous emissions associated with a new Ray Mine TSF and the Resolution Copper Project. It is expected that a future NEPA analysis for the Resolution Copper Project would address the cumulative air quality impacts for that project and surrounding activities.

4.2 CLIMATE CHANGE CUMULATIVE IMPACTS

Cumulative impacts associated with climate change would be negligible, as the proposed TSF is slated to replace the Elder Gulch TSF.

4.3 SOILS CUMULATIVE IMPACTS

Cumulative impacts to soils would be negligible, but there is minor potential for soil erosion and increase sedimentation to the Gila River. Soil resources have and would continue to be impacted by the continued operation of the Ray Mine, high winds during thunderstorms, winter cold fronts, and dispersed recreation activities, such as four-wheeling. In a similar manner, soils would be subject to the erosive force of water resulting in sheet flow and channelization from major storms.

4.4 GEOLOGY, GEOTECHNICAL AND GEOCHEMISTRY CUMULATIVE IMPACTS

The geology in and around the Ray Mine has been and would continue to be altered by mining activities (Ray Mine), but there are no other anticipated major local or regional cumulative geologic or geotechnical effects expected for either of the action alternatives. There would be no cumulative

[30] Asarco announced plans in 2014 for a $110 million upgrade of the Hayden Smelter that will bring the facility into compliance with the new federal SO_2 emissions regulations. Asarco plans a converter retrofit, installation of improved primary and secondary hoods and an electrostatic precipitator for removal of emissions prior to SO_2 capture at the smelter's existing acid plant. The plan aims to reduce SO_2 emissions at the Hayden Smelter by 85%, with a planned total SO_2 capture rate of 99.7% of what is produced during the copper smelting process.

geotechnical effects as a result of TSF construction, operation and closure, unless there was a partial or catastrophic TSF failure, the possibility of which is extremely unlikely as discussed in Section 3.16, Accidents and Spills. Any geochemical cumulative effects (related to water quality) are discussed in Section 3.4, Surface Water Hydrology, and Section 3.6, Groundwater Hydrology.

4.5 SURFACE WATER HYDROLOGY CUMULATIVE IMPACTS

There would be no expected cumulative impacts within the local ephemeral drainages at either the Ripsey Wash or Hackberry Gulch TSF sites. Similarly, there would be no cumulative impacts to Mineral Creek as neither TSF alternative is located within this watershed.

The proposed underground mining at the Resolution Copper Project would be located within the Mineral Creek watershed upstream of the Ray Mine. Although there is the possibility of surface water impacts to Mineral Creek associated with the construction and operation of the Resolution Copper Project and other regional activities (including the Ray Mine), there are not expected to be cumulative impacts as a result of the construction and operation of either the Ripsey Wash or Hackberry Gulch TSF sites (as they are not located within the Mineral Creek drainage) and the operation of the Resolution Copper Project.

Potential cumulative impacts to the Gila River would be most affected by irrigation demands, which have the most prominent impact to flows in the Gila River. Near the proposed TSF sites (and the existing Ray Mine), the flows in the Gila River are and would continue to be influenced by upstream storage in and water releases from the San Carlos Reservoir behind the Coolidge Dam, which is controlled by SCIP. Ground disturbances and channel diversions associated with past, present and future land uses in the area, combined with impacts from either the Ripsey Wash or Hackberry Gulch TSF, may cause increased erosion and sediment, and may transport sediments to the Gila River.

Because the proposed new TSF is slated to replace the existing Ray Mine Elder Gulch TSF, and a new TSF would operate as a zero surface water discharge operation, there would be no cumulative water quality impacts to Gila River as a result of either of these TSF alternatives and the continued operation of the Hayden Concentrator and its TSF, which are located southeast of the proposed Ripsey Wash and Hackberry Gulch TSF sites.

Surface water could be cumulatively impacted by dispersed recreation activities, such as off-road vehicular travel, but such impacts should be negligible.

4.6 WATERS OF THE US CUMULATIVE IMPACTS

Over thirty (30) vegetated wetlands were identified along the banks of the Gila River downstream of the Ripsey Wash TSF alternative; combined, they total approximately one half (0.5) acre in size, (WestLand, 2013b). Similar wetlands would be expected downstream of the Hackberry Gulch TSF. Although the construction and operation of either TSF would result in a loss of approximately 0.2% of the surface and groundwater flow to the Gila River and its Quaternary deposits, this loss would have a negligible cumulative effect on downstream waters of the U.S. and wetlands.

Appendix B, Alternative Screening and Clean Water Act Section 404(b)(1) Alternative Analysis, provides a discussion of cumulative impacts to waters of the U.S. that would be expected from implementation of this project. The Ripsey Wash alternative is located in Box O Wash-Gila River watershed (HUC 1505010003). Based on previous Clean Water Act permitting records, the Corps has authorized the fill of 3.03 acres (linear feet measurement not available) in this watershed. Using the

U.S. Geological Survey's National Hydrography Database, the Corps determined that this alternative would impact 168,490 linear feet of drainages in this watershed, which is 1.7 percent of the total estimated linear feet of waters within this watershed.

Other land use activities in the region would continue to contribute to the cumulative impacts on wetlands and waters of the U.S. These activities include continued mining, grazing, dispersed and developed recreation use, residential and commercial developments along the Gila River and its tributaries, and release of water from the upstream Coolidge Dam on the Gila River.

4.7 GROUNDWATER HYDROLOGY CUMULATIVE IMPACTS

Potential cumulative impacts to groundwater would be negligible to minor for either the Ripsey Wash or the Hackberry Gulch TSF sites. Some impacts could result from changes in availability of groundwater recharge to down-gradient water right holders, but the operation of a new TSF in combination with the ongoing mining, ranching and dispersed recreation is not expected to have any adverse cumulative impact to the groundwater quality in the Quaternary deposits of the Gila River or the general bedrock groundwater in the area.

4.8 LAND USE CUMULATIVE IMPACTS

No significant cumulative land use effects are anticipated. Mining[31], livestock grazing, and dispersed recreation would remain the dominant land uses in the region.

Given that a new TSF is slated to replace an existing facility, no cumulative impacts are expected from any new commercial and residential development in the communities of Kearny, Hayden, Winkelman, Riverside or Kelvin related to the construction or operation of a new TSF. The communities of Superior and Gold Canyon could experience growth from the urban expansion of the greater Phoenix area and the operation of the Resolution Copper Project.

The BLM would continue to administer its special management areas in the region with no expected cumulative impacts as a result of the construction and operation of either the Ripsey Wash or Hackberry Gulch TSFs.

As discussed **Appendix D, Regional Activity**, the BLM-Asarco Ray Land Exchange would involve the transfer of certain federal administered lands to private land in the area of the Ray Mine, but this transfer would not affect the land uses of the area. See **Figure 32, Surface Ownership**. This proposed land exchange is mainly for land parcels within or adjacent to the Ray Mine, where there is limited livestock grazing and dispersed recreational activities.

4.9 NOISE

As explained in Section 3.7, Noise, the level of noise, especially during the expected three-year construction period for either TSF alternative, would attenuate to near background noise levels within a relative short distance from its source.

Given the lack of nearby residents or other surrounding activities, there would be negligible cumulative noise impacts for the Ripsey Wash TSF alternative. Non-project related traffic on the Florence-Kelvin

[31] This would include continued mining at the Ray Mine, as well as the possible future underground copper mining at the proposed Resolution Copper Project in an area east of the town of Superior, Arizona, north of the Ray Mine.

highway would create some elevated noise levels adjacent to the road, but non-project traffic on this road is limited. See Section 3.11, Transportation. Cumulative impact noise created by recreational users in the area of the Ripsey Wash TSF is expected to be limited and sporadic.

For the Hackberry Gulch TSF alternative, cumulative noise impacts would be created by railroad traffic on the Copper Basin Railroad that serves the Ray Mine, as well as Ray Mine-related and other traffic along State Highway 177 and the Florence-Kelvin highway. Residents of the communities of Kelvin and Riverside would be subject to these noise impacts, which already occur given the past and ongoing operations of the Copper Basin Railroad and traffic on State Highway 177.

4.10 RECREATION CUMULATIVE IMPACTS

Past disturbance and present actions have resulted in the incremental loss of public lands available for dispersed recreation. See Section 3.8, Recreation.

Cumulative recreation impacts would essentially be the same for either the Ripsey Wash or Hackberry Gulch TSF. The proposed Resolution Copper Project east of Superior and new commercial and residential development associated with urban growth in the greater Phoenix area, are expected to incrementally affect recreation resources in the future. The Arizona Trail and dispersed recreational opportunities in this region are also likely to be affected by expected increases in population in the greater Phoenix area, tourism, and recreation demand.

In Pinal County, north of the Ray Mine, the Arizona Trail could experience cumulative impacts from the potential development of the Resolution Copper Project, which is currently considering alternative tailings facility sites, some of which would require Arizona Trail relocation. Trail relocations have the potential to change the quality of the recreational experience depending on the location, design, and character of the new trail corridor.

Planned development of new recreation facilities and improved access to public lands, such as those proposed in the Pinal County Open Space and Trails Master Plan, would help mitigate these impacts. The plan proposes the preservation or development of 802,000 acres of open space, focusing on open space protection and connectivity, such as mountainous and riparian area preservation, open space buffers, wildlife corridors, open space connections, and regional connectivity. Improved recreation corridors and additional open space preservation would help mitigate the loss of primitive trails and open space resulting from the proposed TSF and other past and foreseeable actions. The Ray Land Exchange will transfer BLM land to private ownership (Asarco). Recreational opportunities could be restricted on these new private lands.

4.11 CULTURAL RESOURCES CUMULATIVE IMPACTS

Land disturbances and permanent facility siting from past, present, and future mining activities in the project area typically have disturbed, and would continue to disturb, cultural resources as operations expand or shift into new areas. The locations of these potential resources are not currently known, but the density of known archaeological sites in the area suggests that a substantial numbers of sites are present. For these reasons, the Ripsey Wash or Hackberry Gulch TSF alternatives would contribute incrementally to an adverse cumulative effect to cultural resources in the region.

Adverse effects to historic properties will be mitigated through avoidance and preservation in place, or through data recovery excavations that will conform to an approved Historic Properties Treatment Plan.

4.12 SOCIOECONOMIC CUMULATIVE IMPACTS

The construction and operation of the Ripsey Wash or Hackberry Gulch TSF would not have a measurable cumulative socioeconomic effect on the community and public services of Kearny and other Pinal County communities. The new TSF is simply designed to replace the existing Elder Gulch TSF.

The communities of Superior, Gold Canyon and Apache Junction in Pinal County could experience cumulative impacts from the potential development of the Resolution Copper Project, which is located east of the town of Superior. This project would create additional employment opportunities and would potentially add the need for additional housing and services in the aforementioned communities.

4.13 ENVIRONMENTAL JUSTICE

No cumulative impacts associated with environmental justice are expected, as the proposed TSF is slated to replace the Elder Gulch TSF.

4.14 TRANSPORTATION CUMULATIVE IMPACTS

Pinal County and ADOT plan to construct the new bridge over the Gila River for the Florence-Kelvin highway in 2015-2016, so bridge construction activity should be completed prior to TSF early development work. This bridge project is independent of the Asarco TSF project.

During the three year TSF construction period, the TSF construction traffic, combined with ongoing Ray Mine traffic, would result in cumulative impacts, but such additional traffic is not expected to affect the operational or safety conditions of SR 177 or the Florence-Kelvin highway.

The proposed Resolution Copper Project is expected to employ over 1,000 workers. The construction and operation of this project is likely to add cumulatively to the existing traffic on U.S 60.

4.15 VEGETATION CUMULATIVE IMPACTS

Current land use practices that contribute to cumulative impacts on vegetation communities include mining, grazing, dispersed recreation use, residential and commercial developments along transportation corridors that connect towns in the project vicinity, all resulting in vegetation destruction or degradation.

4.16 VISUAL RESOURCE CUMULATIVE IMPACTS

The TSF sites would cumulatively add to the existing visual effects created by area highways (SR 177 and the Florence-Kelvin highway), the Ray Mine, the Copper Basin Railroad, electric utility lines (such as SCIP's 69kV electric transmission line) and the structures and housing in nearby residential communities, such as Kelvin, Riverside and Kearney.

Cumulative effects resulting from continued and new mining, bridge construction (Florence-Kelvin highway bridge over the Gila River), development and expansion of residential areas (particularly along the U.S. 60 highway corridor, utility line installation, and other commercial and industrial projects could have the potential to cumulatively degrade the overall visual experience of Arizona Trail users and to affect the values for which the Arizona Trail was designated.

4.17 WILDLIFE CUMULATIVE IMPACTS

Historic and ongoing land uses in the area have resulted in the loss of native wildlife habitats. Land use practices that contribute to cumulative effects on vegetation communities and wildlife habitats include mining, residential development and use, grazing, traffic and increased developed recreation, such as use of the Arizona Trail, and dispersed recreation activities, such as hunting. Increased and ongoing human presence in the area would continue to cause cumulative effects to wildlife through vehicle mortalities, increased legal or illegal hunting, noise effects, and harassment. In the context of cumulative impacts, any proposed disturbance would incrementally add to wildlife habitat losses and overall habitat fragmentation with the project area and surrounding region.

4.18 ACCIDENTS AND SPILLS CUMULATIVE IMPACTS

The construction and operation of the Ripsey Wash or Hackberry Gulch TSF would add to the infrastructure from past, present and future mining and milling activities in the region. Although a new TSF is simply designed to replace the existing Elder Gulch TSF, and safeguards are planned, the construction and operation of a new TSF would increase the industrial facilities in the area, which would expand the potential for accidents and spills.

5.0 CONSULTATION AND COORDINATION

In March 2013, Asarco submitted a permit application (that was subsequently revised) to the U.S. Army Corps of Engineers (Corps) for the proposed Ripsey Wash TSF. This permit application was designed to comply with regulations promulgated under Section 404 of the Clean Water Act. This Section 404 permit is required because the Corps determined the Ripsey Wash drainage and other ephemeral washes within the proposed project footprint are "waters of the United States" and subject to Corps jurisdiction under Section 404 of the Clean Water Act. Asarco, as the applicant, is proposing to place fill material within Waters of the United States, which triggers the requirement for a Section 404 permit.

With the Section 404 permit application submittal, the Corps determined that an EIS would be prepared to comply with NEPA and that the Corps) would serve as the lead agency for the EIS preparation work.

The Corps contacted various federal, state, and local agencies regarding the proposed TSF. The agencies are as follows:

- Environmental Protection Agency;
- United States Department of the Interior, Bureau of Land Management;
- United States Department of the Interior, Bureau of Indian Affairs, San Carlos Irrigation Project;
- United States Department of Agriculture, Forest Service;
- United States Department of Interior, Fish and Wildlife Service;
- Arizona Department of Environmental Quality;
- Arizona Department of Game and Fish;
- Arizona State Lands Department;
- Arizona Department of State Parks;
- Arizona State Historic Preservation Office;
- Arizona Department of Transportation; and
- Pinal County.

The participation of agencies in the EIS is based upon their interest, their legal requirements involved with potential future permitting responsibilities, and their expertise. The EPA, BLM and SCIP agreed to serve as formal cooperating agencies with the Corps on the EIS Preparation.

In addition, because the 404 permitting process is a federal undertaking, the Corps, under the National Historic Preservation Act, initiated consultation with Native American Tribes that might have an interest in this project. The Corps has directly contacted 14 tribal government entities to seek their input on archaeological resources, including traditional cultural properties that might be impacted by the project.

On August 26, 2013, a Notice of Intent (NOI) for the Corps to prepare an EIS was published in the *Federal Register*; this notice officially began the scoping period for the project. Written comments on the proposed action were solicited and received. Public scoping "open house" meetings were held in Kearny, Arizona on September 24, 2013 and in Apache Junction, Arizona on September 25, 2013.

The Corps also hosted several meetings with cooperating and interested agencies. On September 10, 2013, the Corps and Asarco met with representatives of the Environmental Protection Agency (EPA) at their offices in San Francisco, California. Then, on September 26, 2013, the Corps hosted a meeting at its Phoenix office for cooperating and interested agencies; at this meeting, there were representatives from Asarco, Bureau of Land Management (BLM), San Carlos Irrigation Project (SCIP), Arizona Department of Environmental Quality (DEQ), and the Arizona Department of Game and Fish. The purpose of these agency meetings was to describe the proposed project, outline the planned NEPA work, and solicit input about any issues or concerns that the agencies might have about the project.

The Corps allowed for a 60-day comment period, which was originally scheduled to close on October 28, 2013. However, with the October 2013 shut-down of portions of the federal government, the Corps extended the scoping comment period for another 21 days, until November 18, 2013, to allow for comment from federal agencies affected by the shut-down.

Twenty-two comment letters were received during the scoping period. Although a court recorder was available at both public scoping "open house" meetings, none of the meeting attendees provided verbal comments to the court recorder.

6.0 LIST OF PREPARERS

The U.S Army Corps of Engineers (Corps) is the lead agency for the Ray Mine TSF EIS and is responsible for the contents of this EIS document. The Environmental Protection Agency (EPA), the Bureau of Land Management (BLM), and the San Carlos Irrigation Project (SCIP) served as cooperating agencies on this EIS document. Czar Inc. was retained as the third party contractor and utilized numerous subcontractors for the preparation of the EIS.

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8.0 ACRONYMS, GLOSSARY AND SCIENTIFIC TERMINOLOGY

8.1 ACRONYMS

AAC	Arizona Administrative Code
AAWQS	Arizona Aquifer Water Quality Standards
ABA	Acid Base Accounting
ACEC	Area of Critical Environmental Concern
ADOT	Arizona Department of Transportation
ADT	Average Daily Traffic
ADWR	Arizona Department of Water Resources
AGP	Acid Generating Potential
AMD	Acid Mine Drainage
ARD	Acid Rock Drainage
ANP	Acid Neutralization Potential
ANST	Arizona National Scenic Trail (Arizona Trail)
AGFD	Arizona Game and Fish Department
AORCC	Arizona Outdoor Recreation Coordinating Commission
APE	Area of Potential Effects
APLIC	Avian Power Line Interaction Committee
APP	Aquifer Protection Plan
ASLD	Arizona State Land Department
ASTM	American Society for Testing Materials
ATA	Arizona Trail Association
AWC	Available Water Capacity
BA	Biological Assessment
BADCT	Best available demonstrated control technology
BCC	Birds of Conservation Concern
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CAP	Central Arizona Project

CEQ	Council of Environmental Quality
Corps	United States Army Corps of Engineers
CWA	Clean Water Act
DEQ	Department of Environmental Quality
DWR	Department of Water Resources
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FCAA	Federal Clean Air Act
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FLMPA	Federal Lands Management Policy Act
GIS	Graphics Information System
GMU	Game Management Unit
GPS	Global Positioning System
HCT	Humidity Cell Test(s)
HDMS	Heritage Data Management System
HDPE	High Density Polyethylene
KOP	Key Observation Point
MBTA	Migratory Bird Treaty Act
MOA	Memorandum of Agreement
MSHA	Mine Safety and Health Administration
MWMP	Meteoric Water Mobility Procedure
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NNP	Net Neutralizing Potential
NOI	Notice of Intent
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places

NSPS	New Source Performance Standards
OHV	Off-Highway Vehicle
OHWM	Ordinary High Water Mark
PSD	Prevention of Significant Deterioration
RMP	Resource Management Plan
ROD	Record of Decision
ROS	Recreational Opportunity Spectrum
ROW	Right-of-Way
RUS	Rural Utility Services
SCIP	San Carlos Irrigation Project
SDWA	Safe Drinking Water Act
SERI	Species of Economic and Recreational Importance
SGCN	Species of Greatest Conservational Need
SHCG	Species and Habitat Conservation Guide
SHPO	State Historic Preservation Office(r)
SPCC	Spill Prevention Control Countermeasures
STS	Southwest Trail Solutions
SWCA	Steven W. Carothers & Associates
SWFL	Southwestern Willow Flycatcher
SWMP	Stormwater Management Plan
TCP	Traditional Cultural Property
TDS	Total Dissolved Solids
THPO	Tribal Historic Preservation Office(r)
TSF	Tailings Storage Facility
TVV	Total Vegetation Volume
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

VRI	Visual Resource Inventory
VRM	Visual Resource Management
WSC	Wildlife Species of Concern
XRD	X-Ray Diffraction

8.2 GLOSSARY

A

Arboretum: A plot of land on which many different trees or shrubs are grown for display.

Acceleration (Accelerate): An increase of speed or velocity.

Acid Base Accounting (ABA): An evaluation of the acid generating potential (AGP) by comparing various levels and forms of acid-forming and acid-neutralizing materials found in ore or waste rock.

Acid Plant: Infrastructure/facilities to capture and treat Sulfur Dioxide gas (SO_2) emissions for re-use at tailings leaching operations.

Acid Drainage: Low pH drainage (range 2.0 to 4.5) resulting from the oxidation of sulfides. Acid drainage can mobilize and transport heavy metals which are often the characteristic of metals deposit.

Adit: An underground mining term; a horizontal or near horizontal access opening to an ore deposit with a single opening to the surface (a tunnel has two openings).

Aesthetic (Aesthetics): Concerned with the art or nature of beauty and the appreciation of beauty.

Alkaline: Having the quality of a basic substance; with a pH greater than 7.0 holds the ability to neutralize acid.

Allotment: A plot of land that has been divided and distributed by share or portion.

Alluvial: Said of a placer deposit or sediment, formed by the action of running water, as in a stream channel or an alluvial fan.

Alluvium: Unconsolidated sedimentary material including clay, silt, sand, gravel and mud deposited by flowing water.

Alternative(s): In an EIS, alternatives are options to compare against the proposed action. An EIS must include a no-action alternative.

Alunite: A hydrated aluminum potassium sulfate mineral, yellow to white-grey in color; formed by the action of sulfuric acid bearing solutions on these rocks during the oxidation and leaching of metal sulfide deposits.

Ambient Air: In this EIS, a set of primary and secondary air quality standards set by the EPA; standards require minimum pollutants of Carbon Monoxide (CO), Lead (Pb), Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), Ozone and particulate matter.

Anode: An electrode with a positive electric charge.

Anode Copper: Specially shaped copper slabs used as anodes in electric refinement.

Anoxic: Containing no or an abnormally low amount of oxygen.

Antimony (Sb): A native, metallic element, silver and white in appearance; occurs in granular or shapeless masses.

Aplite Porphyry: A light-colored igneous rock characterized by fine grained, granular texture consisting of quartz, potassium feldspar and acid plagioclase.

Appurtenant: Pertaining or belonging to.

Aquatic: Growing, living in, frequenting or taking place in water.

Aquifer: A zone, stratum or group of strata acting as a hydraulic unit that stores or transmits water in sufficient quantities for beneficial use.

Arizona Trail (Arizona National Scenic Trail): A recreational and scenic trail that is approximately 800 miles long that crosses Arizona stretching from Utah to Mexico.

Arsenic (As): Native metallic element with a steel-grey appearance; commonly occurs in granular or kidney-shaped masses.

Artesian: Refers to ground water under hydrostatic pressure, water in a well rises above the level of the water table due to hydrostatic pressures (artesian) usually flowing at the surface.

Asymmetrical: Not identical on both sides of a central line; lacking symmetry.

Audible: Able to be heard.

Avian: Of or pertaining to birds.

Axis: A line that dissects a two or three-dimensional object or figure.

B

Base Flow: A sustained or fair-weather flow of a stream

Baseline: In an EIS, a surveyed line established with care which serves as a reference point to which all associated surveys are coordinated and compared.

Basin: A depressed area with no surface outlet, term widely applied; lake basin, groundwater basin, river basin or drainage basin.

"Beach": Unconsolidated material that covers a gently sloping zone due to the accumulation of loose, water-borne material.

Bed: A small, formal unit given to the deposited space of sedimentary rocks.

Bedding: Within a bed, the arrangement of sediments and rocks in layers of varying thicknesses and composition.

Bedrock: The rock, usually solid, that underlies soil or other unconsolidated material.

Bench (Benches): In open-pit mines and quarries, A ledge which forms a single level of operation where ore and/or waste rock is excavated.

Beryllium (Be): A chemical element, blue-grey in color; an alloying element to copper and other metals.

Biotic: Pertaining to life.

Blast-hole Drills: A piece of mining equipment purposed with drilling the holes in which explosives will be loaded.

Blast-hole Drill

Bosque: The name for areas of gallery forest found along the riparian flood plains of stream and river banks in the southwestern United States.

Box Culverts: Structures that allow water to flow under a road, railroad, trail, or similar obstruction.

Breccia: A coarse-grained rock composed of broken angular segments held together by a mineral cement or fine grained matrix.

Bulldozer: A highly versatile piece of mining equipment; a tractor with a curved blade on the front and a ripper arm(s), primarily used for the manipulation of material.

Bulldozer

C

Cadmium (Cd): A native element, a soft bluish-white transition metal

Calcium (Ca): A chemical element, a soft grey alkaline metal.

Carbonate: A mineral compound characterized by the ionic compound CO_3^{-2} also used to refer to sediments formed of carbonates of calcium.

Cathode: the electrode from which a conventional current leaves a polarized electrical device. The polarity depends on the system.

Cathode Copper: Electrolytically refined copper that has been deposited on the cathode of an electrolytic bath of acidified copper sulfate solution.

Centerline Construction: A common construction method used for tailings facilities; tailings are cycloned and spigotted d off the crest of the starter dams. The centerline of the embankment is maintained as fill and progressive raises would occur on both the beaches (up-drainage side) and the downstream face of the embankment.

Centrifugal Force: The apparent force that draws the body away from the center of rotation while spinning.

Cessation: The temporary or complete stopping.

Chalcocite: A copper sulfide mineral (Cu_2S)

Chalcopyrite: A copper iron sulfide mineral ($CuFeS_2$)

Coke Oven: A chamber of brick or other heat-resistant material in which coal is destructively distilled.

Colluvium: A term applied to any loose heterogeneous and incoherent mass of soil, material and/or rock deposited by rainwash, sheetwash or slow continuous creep, usually collecting at the base of hillsides.

Compensatory: To counterbalance or offset for a loss, lack or injury.

Compliance: The act of cooperation or obedience.

Composite Samples: Sample made up of separate parts or elements.

Compound: A pure substance composed of two or more elements whose composition is constant.

Concentrates [copper]: the valuable fraction of ore that is left after waste material is removed in processing. This material is what is sent to the smelter.

Concentrator: Another name for a mill. (*See Mill*)

Conceptual: Pertaining to an idea or formulation of an idea.

Concurrence (Concurrent): Acting in according with general agreement.

Condemnation Drilling: Also known as Sterilization drilling, a test of a mine site area to ensure there are no valuable minerals, so that infrastructure may be built on that land.

Confluence: A flowing together of two rivers or streams.

Conglomerate: A coarse grained sedimentary rock comprised on fragments larger than 2mm (pebbles, cobbles, boulders) set in a matrix of silt or sand cement.

Conical: Having the form of or resembling a cone.

Coniferous Trees (Conifers): Flora hosting needlelike or scale-like leaves and naked seeds borne in cones. Conifers include pines, furs and spruces.

Consultation: An inclusive meeting for deliberation, discussion and/or decision.

Contemporaneous: Living or occurring during the same period of time; contemporary.

Contingent: In this EIS, dependent on for construction/existence.

Contouring (Re-contouring): Utilizing bulldozers and graders to reshape ground material into a final landform.

Converter Furnace: One of the various types of furnaces used for smelting copper. In this process, air is combined with the matte to burn away excess iron and sulfide gases.

Conveyor: Mechanical infrastructure, generally electrically driven, which extends from a receiving point to a discharge point and conveys, transports, or transfers material between those points.

Copper (Cu): A red to salmon-pink native element. Copper is ductile, malleable, and a good conductor of heat and energy.

Raw Copper (Cu)

Copper is the only metal that occurs abundantly in large masses. It has many uses including electrical wiring, piping and the base metal in brass, bronze and other metals.

Copper Basin Railroad: An Arizona short-line railroad that operates from Magma to Winkelman (54 miles).

Crest: In mining, the highest point on a working bench.

Curvilinear: Consisting of or defined by curved lines.

Cyanide: A naturally occurring organic compound composed of carbon and nitrogen (CN_3). The solid chemical compound is dissolved in water to form a solution suitable for the extraction of precious metals from ore by using a leaching process.

Cyanidation: A type of milling were prepared ore is exposed to cyanide under a set of specific conditions to extract precious metals.

Cyclone(d): A water process that separates finer material from coarse material.

D

Decant (Decanted): to flow so as not to disturb the sediment. The goal being to separate water from sediment and fines.

Decibel (dBA): A unit for expressing the relative intensity (loudness) of sound weighted along audible frequencies.

Deciduous: Flora that loses their leaves seasonally.

Degradation: The wearing down of the land by the erosive action of water or wind.

Delineate (Delineation): To trace the outline of; either on a map and/or on the physical landscape.

Demography (Demographics): A statistical study of the characteristics of human populations with reference to size, density, growth, distribution, migration and effect on social and economic conditions.

Density: the number of inhabitants or the like per unit area.

Density [physics]: Mass per unit volume

Deposit [ore]: An accumulation of natural resources, such as precious minerals, metals, coal, oil, gas, etc. that may be pursued for its intrinsic value; copper deposit.

Deposit (Deposited): Something precipitated, delivered and left, or thrown down, as by a natural process:

Detention Dams/Ponds: Structures constructed by excavation and/or building an embankment whose purpose is to temporarily detain water and allow for fines settlement and/or to reduce the flow.

Detraction: The act of disparaging or belittling the reputation or worth.

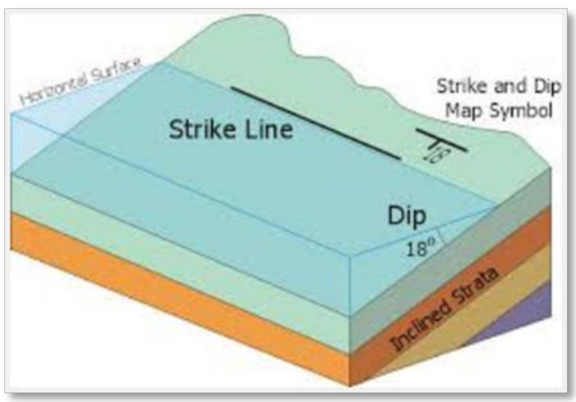
Development Rock: or waste rock, the uneconomic rock material that must be broken, removed and disposed of to gain access to and excavate ore.

Diabase: A rock which comprises a majority of the tailings material. The major rock-forming minerals in this unit are hornblende, plagioclase and biotite; minor minerals are magnetite and quartz. Other minerals that occur in small quantities (less than 5 percent) are chlorite, ilmenite, apatite, hematite, montmorillonite, sphene and epidote.

Diabase rock specimen

Dike(s): A tabular igneous intrusion that cuts across the bedding or foliation of the host rock.

Dip: The angle at which a bed, stratum, or vein is inclined from the horizontal plane; measured perpendicular to the strike and in the vertical plane.



Strike/Dip diagram

Discharge: The volume of water flowing past a point per unit time; commonly expressed as cubic feet per second (cfs).

Dissolution: A process of chemical weathering by which mineral and rock material passes into solution.

Diversion Channels: Pathways which remove water from its natural course and location; in this EIS, mostly by means of a ditch.

Diversion Structures*: see diversion channels*

Diversity: An expression of community structure; high if there are many types of abundant species; low if there are minimal types of abundant species.

Dredge(d): Very fine mineral matter held in suspension in water; usually in relation to material left in suspension while increasing width and/or depth of a canal.

"Dry Stack" Tailings: A system that promotes dewatering of tailings material so that the dry “cake” material can be repeatedly transported, piled and spread on an unsaturated tailings deposit.

E

Easements: An intangible right distinct from the ownership of the soil, consisting of a liberty, privilege, or use of another's land without profit or compensation; a right-of-way.

Ecological/Ecology: the study of relationships between organisms and their environment.

Eco-tourism: A form of tourism involving visiting relatively undisturbed natural areas, intended as a low-impact and often small scale alternative to standard mass tourism.

Edaphic: Said of ecologic formations or effects resulting from or influenced by local conditions of the soil or substrate; soil conditions that affect plants.

Effects: In an EIS, environmental changes resulting from the proposed action.

Direct Effects: caused by the action at the exact location and time

Indirect Effects: caused by the action at a later time and distance

Egress: A mean of going out or exiting.

Electric Switchgear Facility: TSF infrastructure that would help safely supply power to pumping operations.

Elevation: A vertical survey method to a point on the Earth’s surface to indicate height; usually from the datum of mean sea level.

Embankment [eng]: A linear structure, usually constructed of earth or gravel, as an extension above the natural ground surface so as to hold back water from overflowing or to retain water.

Emissions: In this EIS, emissions pertain to air, dust and gas; the action and amount of certain parameters of particulate matter that enters our atmosphere.

Energy Dissipaters: Structures, usually built of concrete, to disrupt and steady the flow of water and the like.

Ephemeral Wash (or channel or drainage): A channel that is at all times above the water table and flows only in response to precipitation (see A.A.C. R18-11-101(18)).

Erosion: The wearing away of the land surface by running water, wind, ice or other geologic agents including gravitational creep.

Escarpment: A long more or less continuous cliff or steep slope, generally facing in the same direction.

Evaporation: The process by which a substance changes from a solid or liquid state into a vapor/gaseous state.

Excavation (Excavated): The process of removing soil and/or rock and materials from one location and transporting them to another.

Excavator: A piece of heavy construction or mining equipment consisting of a boom, stick, bucket and cab on a rotating platform known as the house.

Excavator

Exploration: The search for deposits of useful minerals and fossil fuels.

F

Fault: A displacement of rock along a sheer surface or linear plane.

Federal Register: The daily journal of the United States government; posting of rules, regulations, publications and significant documents. www.federalregister.gov

Fill Material: Soil or loose rock used to raise the surface of low-lying land, such as an embankment to fill a hollow.

Fiscal: Of or pertaining to money or financial matters.

Floodplain: Any low-level flat land the borders a stream that may be covered by its waters during a flood stage.

Flux: A substance used to refine metals by combining with impurities to form a molten mixture that can be removed.

Folding: Curving or bending of the rock strata, bedding planes, foliation or cleavage.

Foliation (Foliated): A planar arrangement of textural or structural features in any type of rock.

Forage: the act of searching for food.

Fossil: Any remains or trace or imprint of a plant or animal that has been preserved by the Earth's crust.

Fractures: Any break in the rock due to mechanical failure by stress; includes cracks, joints and faults.

Frequency: the number of occurrences of an event per unit time.

Frequency [sound]: Measured in hertz (Hz), the number of sound wave cycles per second.

Front End Loaders: A piece of heavy construction or mining equipment consisting of a large bucket connected to a hydraulic boom system mounted on a body; usually fitted with rubber tires.

Front End Loader

Froth Floatation: Part of the milling process used to separate cooper minerals from other non-economic rock material in the ore.

Fugitive Dust: Dust particles suspended randomly in the air, usually from road travel, excavation, and rock loading operations.

Furbearers: any animal that has a coat of fur.

G

Geochemistry: The study of the distribution and amounts of chemical elements in minerals, ores, rocks, soils, water and the atmosphere and the study of the circulation of these elements in nature.

Geology: The study of the planet Earth: the materials by which is made, the processes that act on these materials, the products formed and the history of the planet and its life forms since origin.

Geotechnical [eng]: Concerned with the engineering design aspects of slope stability, settlement, Earth pressures, bearing capacity, seepage control and erosion.

Graben: The depressed block bounded by the fault structure or system, on the long sides.

Gradational: Pertaining to leveling of the land or bringing the land surface or area to a uniform or close to uniform slope of grade through erosion and deposition.

Grade [ore]: based on the degree of copper purity of the mineral.

Graders (Motor Graders): A piece of heavy construction or mining equipment; self-propelled or towed machine provided with a row of removing or digging teeth and (behind) a blade to spread and level the material.

Grader

Grading: The act of manipulating and leveling ground surface.

Granite (Granitic): A hard, igneous rock with mainly quartz constituents and a granular texture.

Groundwater: Water beneath the land surface in the zone of saturation below the water table.

Gulch (Gulches): A narrow, deep ravine with steep sides or a short cleft in a hillside.

H

Habitat: The natural environment of a plant or animal including all biotic, climatic and soil conditions or other environmental influences affecting living conditions; the place where an organism lives.

Heavy Metals: A group of elements including copper, cobalt, chromium, iron, zinc, etc.

Haul Road: A road used by large (typically off-road vehicles) trucks to relocate material for deposition or construction purposes.

Heterogeneity: A concept relating to the uniformity in a substance; one that is heterogeneous is distinctly non-uniform in a quality.

Hibernacula: A protective case or covering, especially for winter, as of an animal or a plant bud. Winter quarters for a hibernating animal.

Holarctic: Belonging or pertaining to a geographical division comprising the Nearctic and Palearctic regions.

Homogenous: A concept relating to the uniformity in a substance; one that is homogeneous is distinctly uniform in a quality.

H-poles: Wooden structures used to lift, hold-up and secure power lines.

Hue: A gradation or variety of a color; tint.

Hydraulic Conductivity: The measure of the ability of rock or soil to permit the flow of groundwater under a pressure gradient; permeability.

Hydrogeology: The science that deals with subsurface waters and with the related geologic aspects of surface waters.

Hydrologic Systems: A complex of related parts: both the physical and conceptual study forming an orderly body of hydrologic units and their man-related aspects such as the use, treatment, reuse and disposal of water and the costs and benefits thereof. The interaction of hydrological factors impacting sociology, economics and ecology.

Hydrology: The science that deals with global water (both liquid and solid form), its properties, circulation, distribution on the Earth's surface and in the atmosphere.

I

Income: Money that an individual or business receives in exchange for providing a good or service or through investing capital.

Infiltration: The movement of water or other fluid into the soil (or other medium) through pores or other openings.

Infrastructure: The underlying foundation or basic framework; substructure of a community (i.e. schools, police, fire department, roads, water, sewer systems, etc.)

Ingress: A means of coming in or entering.

Interfingering: The disappearance of sedimentary bodies in laterally adjacent masses owning to splitting into many thin "tongues" or "fingers".

Intermittent: Stopping or ceasing for a time or alternately ceasing and starting again.

Interstice(s): Occupying the spaces between sediment particles.

Intrusion (Intrusive): In this EIS, the injection or emplacement of scenic forms.

Ionized (Deionized): To separate into ions; electrically charged atoms or group of atoms formed by the loss or gain of one or more electrons.

J

Jurisdiction: the right, power or authority to administer justice to an extent of law; the land over which authority is exercised.

Juxtaposition: an act or instance of placing close together or side by side, especially for comparison or contrast.

K

K-factor [erodibility]: A means or factor used to express the erosion potential of soils through use of the "Revised Universal Soil Loss Equation." (RUSLE)

Kilovolts (kV): A unit of measurement for electrical potential energy; 1kV = 1000 Volts.

Kinetic Test: A category of tests used to predict the occurrence of acid drainage from mine waste or workings (e.g. Humidity Cell Test – HCT). Kinetic tests involve cycles of leaching and monitoring under controlled conditions ideally yielding information of acid generation.

L

Landform: Any physical, recognizable form or feature and the Earth's surface having characterizing shape that was formed naturally.

Landscape: The sum of total characteristics that distinguish a certain area on the Earth from another area. These distinctions are due to both natural causes and human occupancy.

Laramide Age: A time of deformation, typically recorded in the Eastern Rocky Mountains of the United States, whose several phases lasted from late Cretaceous until the end of Paleocene period.

Laws: Principles and regulations established in a community by some authority and applicable to its people, whether in the form of legislation or of custom and policies recognized and enforced by judicial decision.

Leachate: The solution obtained by leaching.

Leaching: The process of applying a chemical agent to bond preferentially with and dissolve materials, such as precious metals, into solution.

Lead Agency: In the NEPA process, the lead agency is the agency or agencies with the main responsibility to comply with NEPA (and SEPA if applicable) procedural requirements such as preparation of the EIS.

In this EIS, the lead agency is the U.S Corps of Engineers.

Limestone: A sedimentary rock consisting mostly of calcium carbonate.

Lineated: Marked with lines.

Liners: synthetic material (80 mil HDPE or equivalent) used to create a barrier between TSF and the ground surface. These liners have leak detection systems incorporated into their design and operation.

Loam: A rich, permeable soil composed of a mixture of clay (7-27%), silt (28-50%) and sand (23-52%) particles; composition is important for classification.

Logistics: The planning, implementation, and coordination of the details of a business or other operation.

Logarithmic: a nonlinear scale used when there is a large range of quantities. Common uses include acoustics, optics and chemistry. It is based on orders of magnitude, rather than a standard linear scale.

M

Magnesium (Mg): a chemical element with symbol Mg and atomic number 12. Its common oxidation number is +2. It is an alkaline earth metal and the eighth-most-abundant element in the Earth's crust.

Magnesium (Mg)

Matrix [geology]: The fine grain material enclosing or filling the interstices between larger grains or particles or sediment.

Matte: Part of the smelting process, matte is the bottom valuable layer containing copper and some traces of iron; a metallic sulfide mixture made by melting the roasted product in smelting sulfide ores.

Mesozoic: An era of geologic time; from 225 to 65 million years ago.

Siemens (Micro Siemens)[µs]: Unit of electric conductance and electric admittance.

Milling: The general process of separating the valuable constituent (copper) from the undesirable or non-economic constituent of the ore material.

Mine: An opening or excavation in the ground for the purpose of extracting minerals.

Mine Life: The time in which, through labor, capital and tangible resources the ore reserves will be extracted.

Mineralization: The process by which a mineral or minerals are introduced to rock, resulting in a valuable or potentially valuable deposit; a zone of ore.

Mineral Reserves: Identified resources of mineral-bearing rock from which a mineral can be extracted profitably with existing technologies under present market conditions.

Mineral Resource: Reserves plus all other mineral deposits that may become available – either known deposits that are not economical or technologically recoverable, or deposits that have been inferred yet not fully discovered. *(See Mineral Reserves).*

Mineralogy: The study of minerals.

Mining: The science, technique, and business of mineral discovery and exploitation; the act of extracting ore out of the ground.

Mitigation (Mitigate): Includes:

(a) Avoiding an impact altogether by not taking action or certain parts of an action;

(b) Minimizing impacts by limiting the degree of magnitude of the action and its implementation;

(c) Rectifying the impact by repairing, rehabilitating or restoring the environmental effects;

(d) Reducing or elimination of the impact over time by preservation and maintenance of operations during the life of the action;

(e) Compensating for the impact by replacing or proving substitute resources or environments.

(40 CFR Part 1508.20)

Modification(s) [scenic]: A quality objective: man's activity may dominate the characteristic landscape, yet must utilize natural form, line, color and texture.

Moisture Content: The amount of moisture in the medium. Moisture is defined as water diffused in the atmosphere or the sample.

Motor Graders: *see grader.*

N

Negligible: So small, trifling, or unimportant that it may generally be disregarded.

NEPA Process: Measures necessary to comply with all requirements of Section 2 and Title I of the National Environmental Policy Act.

Neutralization: A chemical reaction in which an acid and a base react quantitatively with each other. In a reaction in water neutralization results in there being no excess of hydrogen or hydroxide ions present in solution. The pH of the neutralized solution depends on the acid strength of the reactants. Neutralization is used in many applications.

No Action Alternative: As part of the NEPA process, the alternative in which project conditions remain the same. It is mandatory to consider a No-Action Alternative.

Nocturnal: Active at night.

Noise: Unwanted sound, unpleasant sound that interferes with hearing or lacks agreeable quality.

Noxious Weed: A weed that has been designated by country, state, provincial, or national agricultural authority as one that is injurious to agricultural and/or horticultural crops, natural habitats and/or ecosystems, and/or humans or livestock.

O

Off-highway Trucks: Also known as a Haul Truck, a truck of such size, weight, or dimensions that it cannot be used on public highways.

Off-Highway (Haul) Truck

Open-pit Mining: A type of surface mining that involves excavation of the ore and overburden by above ground techniques. The result of such an operation is known as an "open pit."

Ore (Ore Material): A deposit of rock from which valuable material or minerals can be economically mined for profit.

Outcrop: That part of a geologic formation or structure that breaches the Earth's surface.

Outfall Location: The location of the mouth of the stream or the outlet of the lake; or

The vent or end of a drain pipe, tube, ditch, canal that carries tailings slurry.

Overburden: Barren rock material, either made loose or unconsolidated, overlying a mineral deposit which must be removed prior to mining; aka Development rock or waste rock.

Oxide: A mineral compound characterized by link between oxygen and one or more metallic elements.

Oxygen Flash Furnace: Part of the smelting process, the structure where oxygen is added to the copper concentrate in extreme heat producing matte, slag and sulfur dioxide (SO_2)

Ozone (O_3): Form of oxygen compound found largely in the stratosphere; a product of reaction between ultraviolet light and oxygen.

P

Packer Tests: A test in which water is forced under pressure into rock through the walls of a borehole. The test provides a means of determining the apparent permeability of the rock, and yields information regarding its soundness.

Paleontology: The science of the forms of life existing in former geologic periods, as represented by their fossils.

Panorama: An unobstructed and wide view of an extensive area in all directions; an extended pictorial representation of a landscape or other scene.

Parameter: A variable as a part of a set of comparable variables or limits, boundaries or guidelines.

Particulates: Small particles suspended in the air; generally considered pollutants.

Pediment: A broad gently sloping rock-floored erosion surface or plain of low relief. Typically located in an arid or semiarid region at the base of an abrupt or receding mountain or plateau and underlain by bedrock (bare or with a thin veneer of alluvium).

Perch (Perching): a pole or rod, usually horizontal, serving as a roost for birds.

Percolating: To cause liquid to pass through a porous body

Perennial: Lasting or continuing throughout the entire year, as a stream.

[Of plants] Having a life cycle lasting more than two years.

Permanent Disposal Facilities (dumps): Areas for the tipping and dumping of overburden.

Permeable (Permeability): The property or capacity for porous rock, sediment or soil for transmitting fluid; a measure of relative ease of fluid flow under uneven pressure.

Pertinent: Relating directly and significantly to the matter at hand; relevant:

Petrocalcic Horizon (Cemented Horizon): A diagnostic subsurface soil horizon that is characterized by an induration with calcium carbonate.

Phreatic Surface: The surface between the zone of saturation and the zone of aeration (unsaturated ground).

Physiographic Province: A region having a particular pattern of relief features and landforms that differs significantly from that of adjacent regions.

Piezometer: A device for measuring moderate groundwater pressures.

Pinal Schist: A common Arizona rock which comprises a majority of the tailings material; the major rock-forming minerals in this unit are quartz, orthoclase, plagioclase, sericite and biotite.

Pinal Schist Rock Specimen

Pitch [sound]: An auditory sensation in which a listener assigns musical tones to relative positions on a musical scale based primarily on the frequency of vibration.

Point Source: Under the Clean Water Act, under Section 502(14), the term “point source” means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural stormwater discharges and return flows from irrigated agriculture.

Policy (Policies): A guiding principle upon which is based a specific decision or set of decisions.

Porphyry: An igneous rock of any composition that contains phenocrysts in a fine grained groundmass.

Practicable: Capable of being done; feasible under practical conditions.

Precambrian Age: The span of time older than 570 million years.

Precipitation: Rain or snow.

Preclude: To prevent the presence or occurrence of; make impossible.

Professional Engineer (PE): A qualification from the National Society of Professional Engineers (NSPE). To become PE licensed and certified, engineers must complete a four-year college degree, work under a Professional Engineer for at least four years, pass two intensive competency exams and earn a license from their state's licensure board.

Profit (Profitability): Revenue less costs; a company's ability to make money.

Project: The whole of an action, which has the potential in resulting in a physical change in the environment. An organized effort to achieve an objective identified by location, timing, activities, output, effects, and responsible execution all within a given time period.

Promulgated: To make known by open declaration.

Proposed Action: A description of the proposed project. In NEPA, this is the description of the project as proposed by the project applicant or proponent. A plan that contains sufficient details about the intended actions to be taken, (40 CFR 1508.23).

Public Scoping: Giving the public the opportunity for oral or written comments concerning the intentions, activities, or influence of a project on an individual, community and/or environment

Pump-back Wells (Monitoring Wells): A critical part of the tailings facility, these wells have the ability to monitor ground water conditions and if necessary, to return water to the reclaim ponds.

Pumping Booster Station: Infrastructure which forces tailing slurry to the tailings storage facility through pipeline by mechanical action.

Q

Quadrangle Maps: In geology or geography, the word "quadrangle" refers to USGS 7.5-minute quadrangle maps, which are usually named after a local physiographic feature.

Quarry: An open or surface mineral working, usually for the extraction of building stone, as slate, limestone, etc. It is distinguished from a mine because a quarry usually is open at the top and front, and, in ordinary use of the term, by the character of the material extracted.

Quaternary: A sediment system consisting of a mixture of four components or end members; Quaternary is also a geologic time period, the second period of the Cenozoic. It began 3 million years ago and extends to the present.

R

Radioactivity: The emission of energetic particles and/or radiation during radioactive decay.

Radionuclides: A radioactive nuclide; an atomic species characterized by the specific constitution of its nucleus.

Radium [Ra-226 228+]: A chemical element with an atomic of number 88. It is the sixth element in group 2 of the periodic table, also known as the alkaline earth metals.

The most stable isotope of Radium is Radium-226, which has a half-life of 1600 years and decays into radon gas.

Raptor-deterring: A design that minimizes the available space on top of a utility pole and restricts the clearance for the birds to fly, build nests and perch.

Ray Concentrator: Part of the milling process, A concentrator is used to grind and process copper ore through froth floatation.

The Ray Concentrator produces a copper concentrate that is loaded into railroad cars and shipped to the Hayden Smelter.

Recharge(d): Absorption and addition of water to the zone of saturation.

Reclaim Ponds: Down-gradient of the seepage trenches, to intercept and store any water seepage that might migrate under the tailings facility through the alluvium material located above the bedrock and pump either back to the Ray Concentrator or to the tailings facility.

Reclamation: Returning disturbed land to an approved post-mining land use, such as required in conformity with a government regulatory program such as the Arizona Mined Land Reclamation Act and Rules.

Reconnaissance Surveys: A preliminary survey, quick and low-cost, prior to mapping in detail and with greater precision.

Recreation Opportunity Spectrum (ROS) Classification: The ROS continuum describes the existing conditions that define a land area's capability and suitability for providing a particular range of recreation experience opportunities.

Refinery: A facility in which relatively crude smelter products such as blister copper are refined and emerge as acceptably pure products.

Regulations: A law, rule, or other order prescribed by authority, especially to regulate conduct. Usually a regulation supports a law.

Residuum: The structureless groundmass of microscopic constituents; particles less than 1-2 microns in size.

Revenue(s): The return or yield from any kind of property, patent, service, etc.; income.

Richter Scale: A numerical logarithmic measure of earthquake intensity.

Right-of-Way: A strip of land or corridor over which a powerline, pipeline, access road or maintenance road can pass.

Rill Erosion: The development of numerous minute closely spaces channels resulting from uneven removal of surface soil or material by running water that is concentrates in streamlets of sufficient discharge to cause cutting power.

Riparian: A type of ecological community that occurs next to streams and rivers directly influence by water. It is characterized by certain types of vegetation, soils, hydrology, and fauna and requires free or unbound water conditions more moist that normally found within that area.

Riparian Zone: Terrestrial areas where the vegetation and microclimate are influenced by perennial and intermittent water, associated with high water tables.

Runoff: Precipitation that is not retained on the site where it falls, not absorbed by the soil; the natural drainage away from an area.

S

Saline: A natural deposit of halite or any soluble slat.

Scenic Quality: The essential attributes of landscape that when viewed by people, elicit a realized beauty and benefit to a person and the community.

Schematic: A diagram, plan, or drawing.

Scoping Process: As part of the National Environmental Policy Act (NEPA) and State Environmental Policy Act (SEPA) process, early and open activities used to determine the scope and significance of the issues, and range of actions, alternative and impacts, to be considered as part of the Environmental Impact Statement. (40 CFR 1501.7 & WAC 197-11-360)

Sediment: Earth material transported, suspended and deposited by air, water or ice; also the some material once it has been deposited.

Sedimentary Rocks: A rock resulting from the consolidation of loose sediment that has accumulated in layers.

Sedimentation: The act or process of accumulating sediment in layers; including the deposition, transportation and actual diagenetic changes to form ultimate consolidation.

Seepage Trench: Down-gradient of the starter dams, a ditch to intercept any water leakage that might migrate under the tailings facility through the alluvium material located above the bedrock.

Seismic: Of or pertaining to earthquakes or Earth vibration, including those that are artificially produced.

Sensitive Species: A plant or animal species that is susceptible or vulnerable to activity impacts or habitat alterations.

Sensitivity Level(s): A particular degree of measure of viewer interest in and concern for the scenic quality of the landscape.

Separated Fines Fraction (Slimes): The fines that overflow out of the top of the cyclone separation process.

Shaft (Mine Shaft): A vertical or near-vertical tunnel from the top down used to pull ore out of the mine or transport men in and out of the mine.

Shear (Sheared)[geology]: A deformation resulting from stresses that cause parts of a body to slide opposite to each other in their parallel contact plane.

Shovel(s): Any bucket-equipped machine used for digging and loading earthy or fragmented rock materials; shovels can be electrically (rope) or hydraulically powered.

Rope Shovel

Significant: Requires consideration of both context and intensity.

Context means that the significance of an action must be analyzed in several contexts such as society, interests and locality.

Intensity refers to the severity of the impacts; the severity of the impact should be weighted and gauged alongside the likelihood of occurrence.

Silica: The naturally occurring, chemically resistant dioxide of silicon (SiO_2).

Silt(s): A rock fragment with a particle size smaller than very fine sand and larger than coarse clay (4 to 62 microns)

Sinuosity (Sinuous): The ratio of the length of the channel to the down valley distance; a ratio of larger than 1.5 is called “meandering”.

Slag: The lighter, top layer bi-product of the oxygen flash furnace; comprised of mostly iron and silica.

Slimes: *See Separated Fines Fraction*

Sloughing: Fragmented soil and rock material has crumbled and fallen away from the bank.

Slurry: A highly fluid mixture of water and finely divided material; either naturally occurring such as a muddy lake-bottom deposit; or man-made like the tailings slurry sent through pipe for treatment.

Smelter: A furnace in which the raw materials of ores are melted to produce metal.

Socioeconomic: Pertaining to or signifying the combination or interaction of social and economic factors.

Sodic: Salt affected.

Sodium: A chemical element with symbol Na and atomic number 11. It is a soft, silver-white, highly reactive metal and is a member of the alkali metals; commonly related to salts.

Soil: The natural medium for the growth of plants; a term used in the soil classification for the collection of natural earthy materials on the Earth's surface.

Soil Productivity: The capacity of the soil, in-situ, to produce a specified plant or sequence of plants under a certain ecosystem. Productivity is generally dependent on availability of soil moisture and nutrients as well as length of growing seasons.

Soil Profile: A vertical section of the soil through all of its horizons and extending into the parent material at a depth of 60 inches.

Solicit: To seek to influence or entice action.

Solvent Extraction-Electrowinning (SX-EW): A metallurgical technique, so far applied only to copper ores, in which metal is dissolved from the rock by organic solvents and recovered from solution by electrolysis.

Spectrometer: An optical instrument where scales are provided for reading angles. A wavelength spectrometer is one designed or equipped in a manner to measure the wavelengths at which absorption bands occur in an absorption spectrum.

Spigot(s): a faucet or cock for controlling the flow of liquid from the pipeline.

Standard: A model, example or goal set by an authority, custom or general consent as a rule for the measurement of quantity, weight, extent, value or quality.

Sterilize: In this EIS, a sterilized area is one void of ore after being drilled and tested for mineralization.

Stipulation(s): A condition, demand, or promise in an agreement or contract.

Stockpile: Material piled for future use.

Stormwater: The runoff reaching stream channels immediately after rainfall or snowmelt.

Strike/(Dip): The direction or trend taken by a structural surface; e.g. a bedding plane as it intersects the horizon. (*See Dip diagram)*

Substance(s): Matter of the same physical and chemical make-up.

Suitability: The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the environmental and economic consequences and alternate uses foregone.

A unit of land may be suitable for a variety of individual or combined management practices (FSM 1905).

Sulfide: A mineral compound characterized by the bonding with the native element of Sulfur (S).

Supernatant Pool: In a tailings impoundment, the water than gathers above the settled tailings material.

Surficial: Pertaining to or occurring on the surface.

Susceptible (Susceptibility): capable of having an impression left or being changed.

Synthetic liner (HDPE): A protective layer comprised of man-made materials installed along the bottom, sides and/or top of a disposal area to reduce the fluid migration into or out of that disposal area.

T

Tackifier: Chemical compounds used in formulating adhesives to increase the tack, the stickiness of the surface of the adhesive.

Tailings: The non-economic, ground rock material that remains after the valuable minerals have been removed from the ore by milling.

Tailings Drain Down Ponds: In case of need, a pond capable of draining and storing water from tailings facility.

Tailings Storage Facility: The tailings dam and all associated infrastructure needed to safely, efficiently and successfully manage and separate tailings slurry from water.

Tectonism: A branch of geology dealing with the broad architecture of the outer part of the Earth, a study of structural and deformation relationships of large features.

Tertiary: The span of time between 65 and 3 to 2 million years ago.

Texture: The visual manifestation of the interplay of light and shadow created by variations in the surface of an object.

Theoretical: Of or pertaining to a group of tested general propositions, commonly regarded as correct, that can be used as principles of explanation and prediction.

Thickening (Thickened): The process of concentrating a relatively dilute slime pulp into a thick pulp i.e. one containing a lower percentage of water by rejecting liquid that is substantially solid-free.

Topography: A configuration of surface including its relief, elevation, and the portion of natural and human created features.

Topsoil: A presumably fertile soil; the dark colored upper portion of a soil varying in depth and contour.

Tranmissivity: The rate at which water is transmitted through rock under a unit hydraulic gradient.

Tributary (Tributaries): A stream, feeding, joining, or flowing into a larger stream or into a lake.

Tuff: A compacted deposit of volcanic ash and dust that may contain up to 50% sediments, sand or clay.

U

Ubiquitous: Existing or being everywhere, especially at the same time.

Underflow: Movement of water through subsurface material.

Underground Mining: A mining method consisting of an adit or shaft access where ore is mined using various methods and hauled out by mine car or conveyor belt. Usually the underground mining option is selected due to economic factors or environmental constraints.

Undulating: A landform having a wavy outline or form.

Upland: A general term for high land or an extensive region of high land; the higher ground of a region.

Upstream Method: The tailings construction method Asarco plan to use after the Tailings Storage Facility reaches a height of 2,200m. This would be an activity similar to the centerline method, but the cyclone used for centerline construction would no longer be used. Coarse material would be deposited and remain close to the pipeline spigot, and that material would be used in construction of the next lift.

V

Variegated: Varied in appearance or color.

Vegetation: All the plants or plant life of a place, taken as a whole.

Velocity: The rate of change of the position of an object, equivalent to a specification of its speed and direction of motion, e.g. 60 km/h to the North.

Veneer(s): A weathered or otherwise altered coating on a rock surface.

Viable: practical and capable of being done.

Visual Resources: The composite of basic terrain, geological features, water features, vegetation patterns and land use effects that influence the visual appeal for the viewer.

W

Waste Rock: The non-ore rock that is removed to access the ore zone. It contains no copper or copper below the economic cut off level.

"Waters of the United States": The term as applies to the jurisdictional limits of the authority of the U.S. Army Corps of Engineers under the Clean Water Act. See 33 CFR §328.1 and33 CFR §328.3(a). The Clean Water Act was enacted in 1972 to restore and maintain the chemical, physical and biological integrity of U.S. Waters and is used to oversee federal water quality programs for areas that have a “water of the U.S.” The term navigable “waters of the U.S.” was derived from the Rivers and Harbors Act of 1899 to identify waters that were involved in interstate commerce and were designated as federally protected waters. Since then, a number of court cases have further defined navigable “waters of the U.S.” to include waters that are not traditionally navigable. This could include lakes, rivers, streams, mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes and natural ponds.

Watershed: The entire land area that contributes water to a particular drainage system or stream.

Water Quality: The interaction between certain parameters that affects the usability of the water for on-site or downstream purposes.

Such factors include temperature, turbidity, suspended sediment, conductivity, and pH.

Water Table: The level of the saturated zone where the pressure head is equal to atmospheric pressure.

Weathering: The process whereby larger particles of soils and rock are reduced to finer particles by wind, water, temperature changes, and plant and bacteria action.

Weld (Welded): A fabrication process that joins materials, usually metals or thermoplastics, by melting the work pieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint.

Wetland(s): A land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem.

Windrow (Windrowed): A ridge of soil pushed up by a grader or bulldozer; usually for the purposes of safety or delineation.

8.3 SUBSTANCES AND SCIENTIFIC TERMINOLOGY

Term	Phrase
amsl	above mean sea level
CO	Carbon Monoxide
Cu	Copper
dB	Logarithmic Decibel
dBA	Decibel
kV	Kilovolts
NO_2	Nitrogen Dioxide
NOx	Nitrous Oxide
O_3	Ozone
Pb	Lead
pH	Power of Hydrogen - chemistry scale of the acidity/base as compared to water
PM_{10}	Inhalable Particulate Matter
$PM_{2.5}$	Fine Particulate Matter
ppm	Parts Per Million
Q_{al}	Alluvial Deposits
Q_{og}	Older Gravels
SO_2	Sulfur Dioxide

9.0 INDEX

R

S

T

U

W