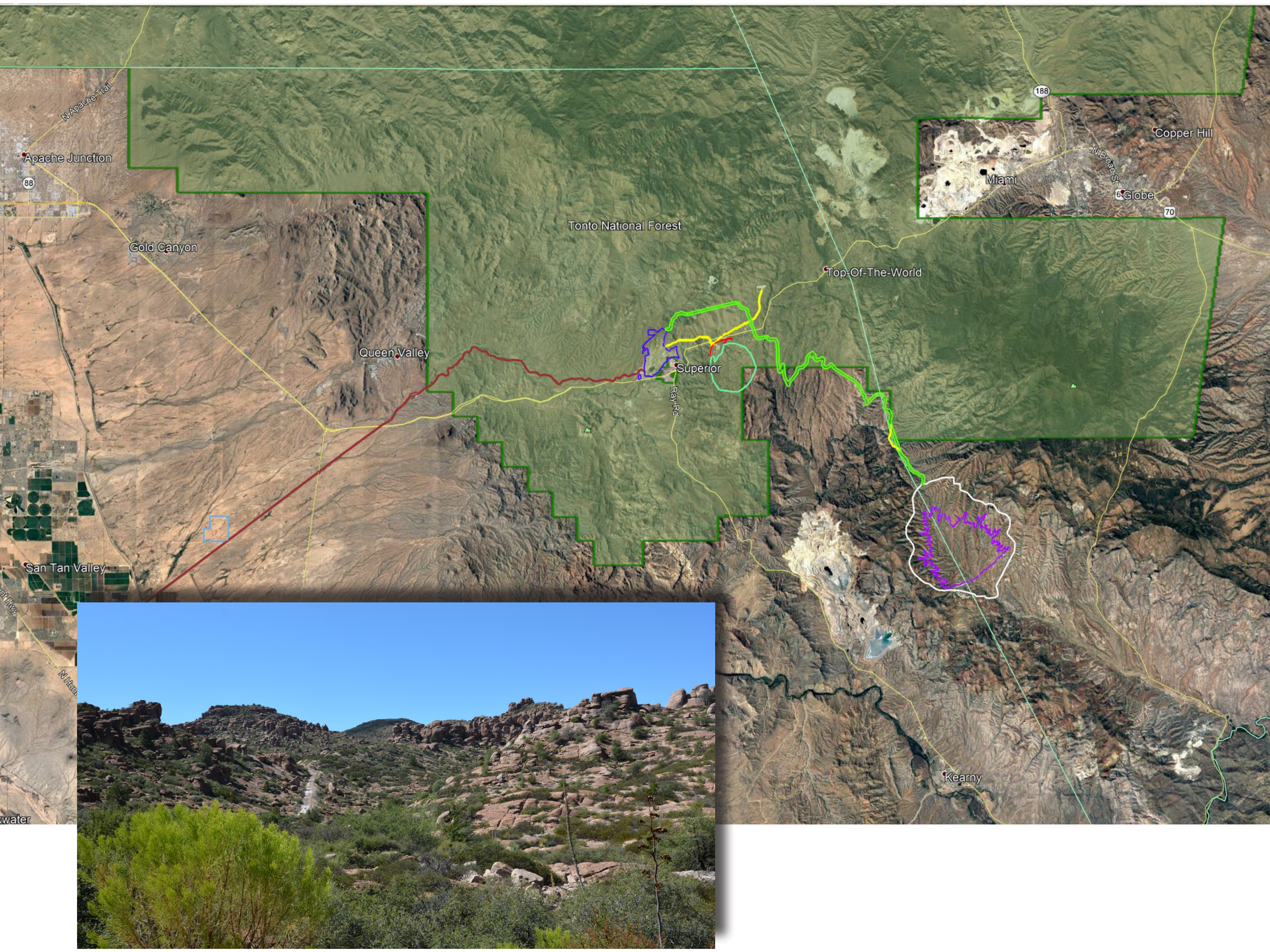
Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Tonto National Forest **MB-R3-12-10** **June 2025**

FINAL Environmental Impact Statement

Resolution Copper Project and Land Exchange

Coconino, Gila, Maricopa, Pinal, Santa Cruz, and Yavapai Counties, Arizona



Volume 1

Front Cover photo captions:

Top: Map of the Preferred Alternative Project location and the Tonto National Forest

Bottom Left: Oak Flat Federal Parcel

Executive Summary

ES-1. Introduction

This executive summary provides an overview of the final environmental impact statement (FEIS) for the proposed Resolution Copper Project and Land Exchange (herein called the project). The FEIS describes the process undertaken by the U.S. Forest Service (Forest Service), a land management agency under the U.S. Department of Agriculture (USDA), to evaluate the predicted effects of and issues related to the submittal of a mining General Plan of Operations (GPO) by Resolution Copper Mining LLC (Resolution Copper), along with a connected, legislatively mandated land exchange of Federal and private parcels in southeastern Arizona (figure ES-1).

This Executive Summary does not provide all the details contained in the FEIS. Please refer to the FEIS, its appendices, or referenced reports for more information. The FEIS and supporting documents are available on the project website at https://www.ResolutionMineEIS.us/.

ES-1.1 Background

Resolution Copper proposes to develop an underground copper mine on unpatented mining claims on National Forest System (NFS) land near the town of Superior in Pinal County, Arizona, approximately 60 miles east of Phoenix. Resolution Copper is a limited liability company that is owned by Rio Tinto (55 percent) and BHP Copper, Inc. (45 percent). Rio Tinto is the managing member.

Resolution Copper has ties to the century-old Magma Mine, located in Superior, Arizona. The Magma Mine began production in 1910. In addition to constructing substantial surface facilities in Superior, the Magma Mine created approximately 42 miles of underground workings.

In 1995, the Magma Copper Company discovered a copper deposit about 1.2 miles south of the Magma Mine through exploration of those underground workings. The ore deposit lies between 4,500 and 7,000 feet below the surface.

In 1996, BHP Copper, Inc., acquired the Magma Copper Company, along with the Resolution Copper Mine deposit. Later that year, BHP closed operations at the Magma Mine, but exploration of the copper deposit continued.

In 2001, Kennecott Exploration, a subsidiary of Rio Tinto, signed an earn-in agreement with BHP and initiated a drilling program to further explore the deposit. Based on drilling data, officials believe the Resolution Copper Mine deposit to be one of the largest undeveloped copper deposits in the world, with an estimated copper resource of 1,970 billion metric tonnes at an average grade of 1.54 percent copper.

The portion of the Resolution Copper Mine deposit explored to date is located primarily on the Tonto National Forest and open to mineral entry under the General Mining Law of 1872. The copper deposit likely extends underneath an adjacent 760-acre section of NFS land known as the “Oak Flat Withdrawal Area.” The 760-acre Oak Flat Withdrawal Area was withdrawn from mineral entry in 1955 by Public Land Order 1229, which prevented Resolution Copper from conducting mineral exploration or other mining-related activities. Resolution Copper pursued a land exchange for more than 10 years to acquire lands northeast of the copper deposit.

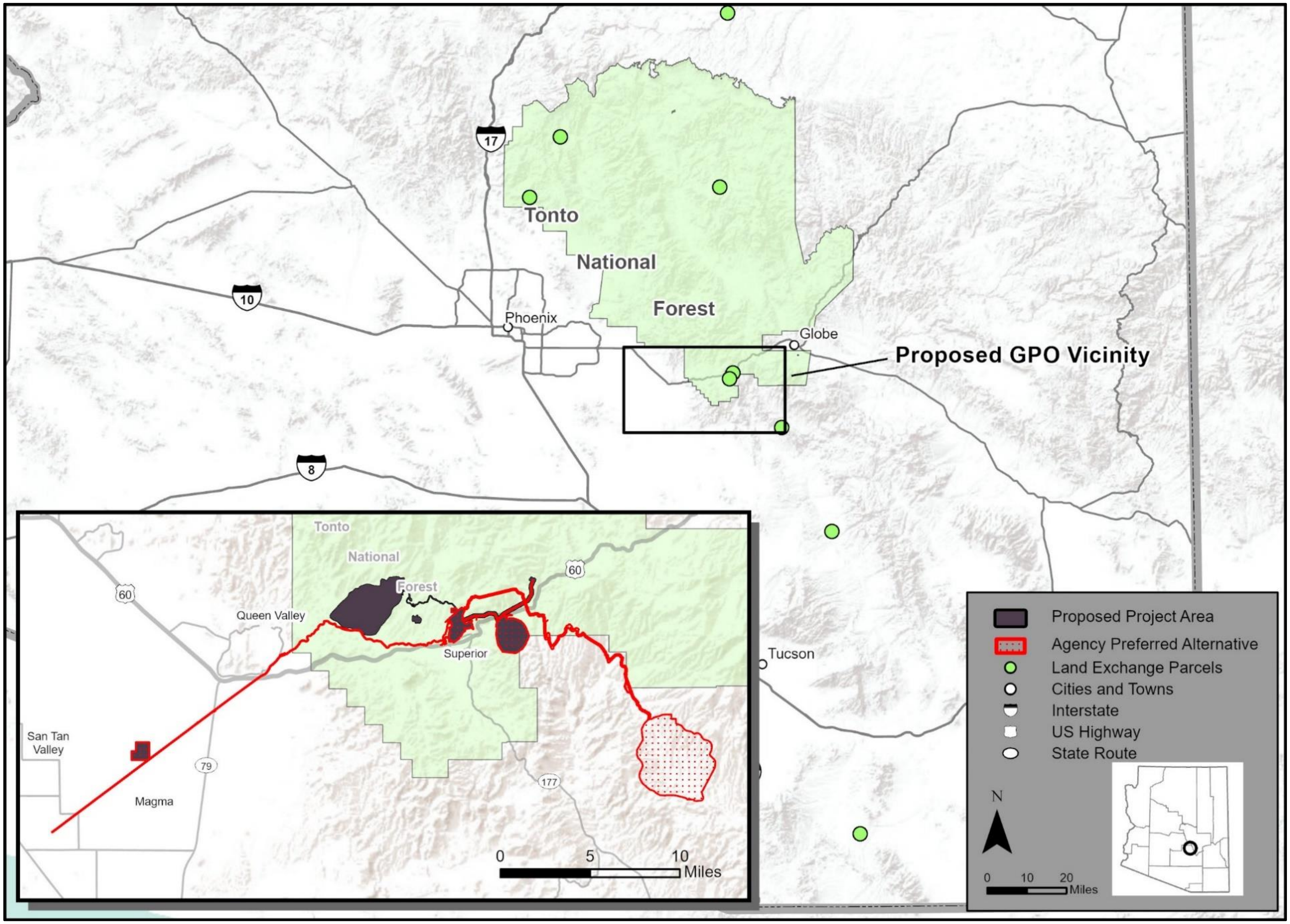


Figure ES-1. Resolution Copper Project vicinity map

In December 2014, Congress authorized a land exchange pending completion of the environmental impact statement (EIS), as outlined in Section 3003 of the Carl Levin and Howard P. 'Buck' McKeon National Defense Authorization Act for Fiscal Year 2015 (which is referred to as Public Law (PL) 113-291). The exchange parcel to be conveyed to Resolution Copper includes not only the Oak Flat Withdrawal Area but also the NFS lands above the location of the copper deposit. This collective 2,422-acre tract of land is known as the "Oak Flat Federal Parcel."

The draft EIS (DEIS) was published for public review and comment in August 2019.

The FEIS was completed and originally published on January 15, 2021. On March 1, 2021, the USDA directed the Forest Service to withdraw the Notice of Availability and rescind the FEIS and draft record of decision. The USDA took this step to provide an opportunity for the agency to conduct a thorough review; to ensure regulatory compliance of environmental, cultural, and archaeological analyses; and to provide time for the Forest Service to fully understand concerns raised by Tribes and the public and the project's impact to these important resources.

The FEIS is being republished at this time. The FEIS contains corrections, modifications, and additional analysis in direct response to public comments submitted on the DEIS. Appendix R of the FEIS contains written responses to all public comments received. In addition, revisions have been made since the original publication in January 2021 in response to events and changes since that time.

ES-1.2 Project Overview

Resolution Copper is proposing to develop an underground copper mine at a site in Pinal County, about 60 miles east of Phoenix near Superior, Arizona. Project components include the mine site, associated infrastructure, a transportation corridor, and a tailings storage facility.

The project would progress through three distinct phases: construction (mine years 1 to 9), operations, also referred to as the production phase (mine years 6 to 46), and reclamation (mine years 46 to 51–56). At the end of operations, facilities would be closed and reclaimed in compliance with permit conditions.

Operational projections anticipate removal of 1.4 billion tons of ore and production of 40 billion pounds of copper using a mining technique known as panel caving. Using this process, a network of shafts and tunnels is constructed below the ore body. Access to the infrastructure associated with the panel caving would be from vertical shafts in an area known as the East Plant Site, which would be developed adjacent to the Oak Flat Federal Parcel. This area would include mine shafts and a variety of surface facilities to support mining operations. This area currently contains two operating mine shafts, a mine administration building, and other mining infrastructure. Portions of the East Plant Site would be located on NFS lands and would be subject to Forest Service regulatory jurisdiction. Ore processing would take place at the old Magma Mine site in Superior.

A tailings storage facility would be constructed to house the waste material that remains after processing. The facility disturbance footprint would occupy between 2,300 and 5,900 acres, depending on the location and embankment design. Pipelines would be constructed to transport the tailings waste from the ore processing facility to the tailings storage facility.

The estimated total quantity of external water needed for the life of the mine (construction through closure and reclamation) is substantial and varies by alternative (180,000 to 590,000 acre-feet). Resolution Copper proposes to use water either directly from the Central Arizona Project (CAP) canal and/or groundwater pumped from the East Salt River valley. Over the past decade, Resolution Copper has obtained banked water credits for recharging aquifers in central Arizona; the groundwater pumped would be through recovery of those banked water credits, or groundwater use authorized by the State of Arizona under a mineral extraction withdrawal permit.

While all mining would be conducted underground, removing the ore would cause the ground surface to collapse, creating a subsidence area at the Oak Flat Federal Parcel. The crater would start to appear in year 6 of active mining. The crater ultimately would be between 800 and 1,115 feet deep and roughly 1.8 miles across. The Forest Service assessed alternative mining techniques in an effort to prevent subsidence, but alternative methods were considered unreasonable.

The workforce during construction/ramp-up is expected to peak at 1,600 personnel in Pinal County and another 1,600 in other areas. During operations, the project would employ an average of approximately 2,100 people annually in Pinal County and another 1,700 in other areas. During the reclamation phase, employment is projected to be 600 in Pinal County and 600 in other areas.

ES-1.3 Areas of Controversy

The Resolution Copper Project and Land Exchange is controversial for several reasons.

Foremost among them are the expected significant environmental impacts and loss of the Oak Flat area, historically used by Native Americans, who hold the land as sacred and use the area for spiritual and traditional uses. Additionally, in March 2016, the Oak Flat area was listed in the National Register of Historic Places (NRHP) as a traditional cultural place (TCP).

Measures to resolve adverse effects on known historic properties, including but not limited to data recovery, have been developed through consultation with the State Historic Preservation Office, Tribes, and others. However, there is the potential for some portion of existing yet currently unidentified prehistoric and historic artifacts and resources to be disturbed or destroyed, especially within the Oak Flat subsidence area and the footprint of the tailings storage area. These losses could include human burials within these areas.

Water use is a major concern among the public, other government agencies, and interested parties. Recycling and reuse would happen extensively throughout the mine operations, but as previously mentioned, additional external water is needed for processing.

There are concerns regarding how public safety may be affected by the project. This includes the physical safety of persons in areas of subsidence and adjacent communities, as well as increased traffic and effects on air and water quality.

There is public apprehension over the creation, and type, of a tailings embankment for the tailings storage facility. The catastrophic collapse of the Brumadinho tailings dam in Brazil in January 2019, resulting in 259 confirmed fatalities with 11 people still missing (Nogueira and Plumb 2020), has heightened concerns.

In January 2019, Representative Raul Grijalva, a Democrat who serves as the U.S. Representative for Arizona’s 3rd congressional district (which includes the western third of Tucson), and Senator Bernie Sanders, an Independent from Vermont, introduced legislation that would overturn the land exchange described in Section 3003 of PL 113-291. Congressman Grijalva cited the need to protect Oak Flat and restore some balance to the country’s natural resource policies. In November 2020, Congressman Grijalva released an opinion article admonishing Rio Tinto for its role in destroying a centuries-old Aboriginal heritage site in Australia and subsequently tying the global mining company’s trustworthiness to the Resolution Copper Project.

In January 2021, three lawsuits were filed seeking to halt the land exchange. The consolidated cases were stayed in May 2021 due to the rescinding of the January 2021 FEIS by the Forest Service. The District Court ruling in one of those cases (Apache Stronghold v. U.S.) denied an injunction. That District Court ruling was appealed to the Ninth Circuit, and the District Court ruling was upheld. The Apache Stronghold case is based on arguments involving religious freedom and treaty obligations. In November 2022, the Ninth Circuit vacated that ruling and ordered the appeal to be heard en banc. The en banc hearing occurred in March 2023, and a ruling was issued in May 2024 in which the en banc court affirmed the District Court ruling denying an injunction.

ES-1.4 Lead and Cooperating Agency Roles

In compliance with the National Environmental Policy Act (NEPA), the Forest Service is the lead agency preparing this FEIS. The Forest Supervisor, Tonto National Forest, is the primary deciding official for the proposed GPO submitted by Resolution Copper.

The Forest Service's role as lead agency includes the following:

- Analyzing and disclosing environmental effects of the proposed mine and the land exchange on private, State, and NFS lands or other Federal lands
- Conducting government-to-government consultations with potentially affected Tribes
- Developing mitigations to protect surface resources of the Tonto National Forest and recommending mitigations for lands not under Forest Service jurisdiction

Authorization of more than 25 permits and plans from various jurisdictions are required for this mine project. Representatives from Federal, State of Arizona, and county governments are serving as cooperating agencies with the Forest Service in developing this EIS. Cooperating agencies have jurisdiction over some part of the project by law or have special expertise in the environmental effects that are addressed in the EIS. Monthly calls and meetings between the lead and cooperating agencies have occurred since November 2017. The nine cooperating agencies are as follows:

- U.S. Army Corps of Engineers (USACE)
- U.S. Department of the Interior Bureau of Land Management (BLM)
- U.S. Environmental Protection Agency
- Arizona State Land Department
- Arizona Department of Environmental Quality
- Arizona Department of Water Resources
- Arizona Game and Fish Department
- Arizona State Mine Inspector
- Pinal County Air Quality Control District

Pursuant to Section 404 of the Clean Water Act, Resolution Copper has asked for authorization to discharge fill material into waters of the U.S. for the construction of a tailings storage facility at certain proposed locations. Because Congress directed that a single EIS is to support all Federal decisions related to the proposed mine, the USACE is relying on this EIS to support a decision for issuance of a Section 404 permit.

The 404 permitting process includes Resolution Copper's submittal of a document called a "404(b)1 alternatives analysis" to USACE. The purpose of the 404(b)1 alternatives analysis is to identify the least environmentally damaging practicable alternative. Part of USACE's permitting responsibility is to identify the least environmentally damaging practicable alternative, as well as to require adequate mitigation to compensate for impacts to waters of the U.S.

While most of the impacts considered under the USACE process are identical to those considered in this EIS, some impacts considered under the USACE process are specific only to that permitting process, which may have a different scope of analysis than the EIS. Because of these differences, the 404(b)1 alternatives analysis is a document strongly related to the EIS, but also separate. Accordingly, the 404(b)1 alternatives analysis is attached to the FEIS as appendix C.

ES-1.5 Purpose and Need

The purpose of and need for this project is twofold:

1. To consider approval of a proposed GPO governing surface disturbance on NFS lands—outside the exchange parcels—from mining operations that are reasonably incident to extraction, transportation, and processing of copper and molybdenum.
2. To consider the effects of the exchange of lands between Resolution Copper and the United States as directed by Section 3003 of PL 113-291.

The role of the Forest Service under its primary authorities in the Organic Administration Act, Locatable Minerals Regulations (36 Code of Federal Regulations (CFR) 228 Subpart A), and the Multiple-Use Mining Act is to ensure that mining activities minimize adverse environmental effects on NFS surface resources and comply with all applicable environmental laws. The Forest Service may impose reasonable conditions to protect surface resources.

Through the Mining and Mineral Policy Act, Congress has stated that it is the continuing policy of the Federal Government, on behalf of national interests, to foster and encourage private enterprise in

- development of economically sound and stable domestic mining, minerals, and metal and mineral reclamation industries; and
- orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help ensure satisfaction of industrial, security, and environmental needs.

Secretary of Agriculture regulations that govern the use of surface resources in conjunction with mining operations on NFS lands are set forth under 36 CFR 228 Subpart A. These regulations require that the Forest Service respond to parties who submit proposed plans to conduct mining operations on or otherwise use NFS lands in conjunction with mining for part or all of their planned actions.

Compliance with other laws and regulations, such as State of Arizona water and air regulations, the Endangered Species Act, the Clean Water Act, and the National Historic Preservation Act, also frames the proposed mining activities.

The EIS also serves to support other Federal decisions, including those of the USACE and the BLM. These agencies only have decisions to be supported under certain alternatives.

ES-1.6 Proposed Action

The proposed action consists of (1) approval of a proposed GPO for operations on NFS lands associated with a proposed large-scale mine, which would be on private land after the land exchange, (2) a land exchange between Resolution Copper and the United States directed by PL 113-291, (3) amendments to the "Tonto National Forest Land Management Plan" (forest plan) if needed, and (4) mitigations to offset impacts from the proposed project. The next two sections summarize the proposed GPO and land exchange actions.

ES-1.6.1 General Plan of Operations

A detailed description of the GPO can be found in section 2.2.2.2. The complete GPO is available on the project website, www.ResolutionMineEIS.us.

The type of copper deposit that would be mined at the East Plant Site is a porphyry deposit, a lower grade deposit that requires higher mine production rates to be economically viable. The copper deposit that Resolution Copper proposes to mine averages 1.54 percent copper (i.e., every ton of ore would on average contain 31 pounds of copper).

Mined ore would be crushed underground and then transported underground approximately 2.5 miles west to an area known as the West Plant Site, where ore would be processed to produce copper and molybdenum concentrates. Portions of the West Plant Site would be located on NFS lands and would be subject to Forest Service regulatory jurisdiction.

Once processed, the copper concentrate would be pumped as a slurry through a 22-mile pipeline to a filter plant and loadout facility located near Florence Junction, Arizona, where copper concentrate would be filtered and then sent to off-site smelters via rail cars or trucks. The molybdenum concentrate would be filtered, dried, and sent to market via truck directly from the West Plant Site.

The copper concentrate slurry pipeline corridor would be located along an existing, previously disturbed right-of-way known as the Magma Arizona Railroad Company (MARRCO) corridor. The MARRCO corridor would also host other mine infrastructure, including water pipelines, power lines, pump stations, and groundwater wells. A portion of the MARRCO corridor is located on NFS lands and would be subject to Forest Service regulatory jurisdiction.

Tailings produced at the West Plant Site would be pumped as a slurry through several pipelines for 5.3 miles to a tailings storage facility. The tailings storage area would gradually expand over time, eventually reaching about 3,300 acres in size. A fence constructed around the tailings to prevent public access would enclose about 4,900 acres. The proposed tailings storage facility would be located on NFS lands and would be subject to Forest Service regulatory jurisdiction.

All power to the mine would be supplied by the Salt River Project. Portions of the proposed electrical infrastructure would be located on NFS land and would be subject to Forest Service regulatory jurisdiction. A Forest Service special use permit would be required to approve construction and operation of new power lines on NFS lands by the Salt River Project.

Access to the mine facilities at the East Plant Site would be provided by existing roads. The Magma Mine Road would eventually be relocated as a result of expected subsidence.

Water for the process would come from a variety of sources. Filtrate from the filter plant, recycled water from the tailings storage facility, and recovered water from the concentrator complex would be recycled back into the mining process. Additional water would be obtained from dewatering of the mine workings, pumping from a well field along the MARRCO corridor, or potentially direct delivery of CAP water.

Reclamation would be conducted to achieve post-closure land use objectives. This would include closing and sealing the mine shafts, removing surface facilities and infrastructure, and establishing self-sustaining vegetative communities using local species. The proposed tailings storage facility would be reclaimed in place, providing for permanent storage of mine tailings.

An initial review of the consistency of the proposed GPO with the forest plan indicates that approval of the proposed GPO would result in conditions that are inconsistent with the forest plan for some alternatives. If needed, an amendment to the forest plan would address the necessary changes to relevant standards and guidelines for managing visual quality and recreation opportunities, as determined by the project's record of decision.

ES-1.6.2 Land Exchange

Section 3003 of PL 113-291 directs the conveyance of specified Federal lands to Resolution Copper if Resolution Copper offers to convey the specified non-Federal land to the United States. Section (i)(2) of Section 3003 of PL 113-291 allows for modifications to the acreages from those disclosed in the Act due to minor errors, conflict, and mutual agreement. The acreages shown here are the current acres agreed to by all parties and supported by cadastral surveys. For further information on acreage changes between PL 113-291 and publication of this FEIS, see appendix B. Summaries of the appraisals for each parcel were publicly released by the Forest Service on April 22, 2025. The following summarizes the land parcels that would be exchanged.

- The United States would transfer the 2,422-acre **Oak Flat Federal Parcel** to Resolution Copper
- Resolution Copper would offer to transfer the following parcels to the U.S. Department of Agriculture:
    - 140 acres near Superior in Pinal County, Arizona, known as the **Apache Leap South End Parcel**, to be administered by the Tonto National Forest
    - 148 acres in Yavapai County, Arizona, known as the **Tangle Creek Parcel**, to be administered by the Tonto National Forest
    - 147 acres in Gila County, Arizona, known as the **Turkey Creek Parcel**, to be administered by the Tonto National Forest
    - 149 acres near Cave Creek in Maricopa County, Arizona, known as the **Cave Creek Parcel**, to be administered by the Tonto National Forest
    - 640 acres north of Payson in Coconino County, Arizona, known as the **East Clear Creek Parcel**, to be administered by the Coconino National Forest
- Resolution Copper would offer to transfer the following parcels to the U.S. Department of the Interior:
    - 3,120 acres near Mammoth in Pinal County, Arizona, known as the **Lower San Pedro River Parcel**, to be administered by the BLM as part of the San Pedro Riparian National Conservation Area
    - 956 acres south of Elgin in Santa Cruz County, Arizona, known as the **Appleton Ranch Parcel**, to be administered by the BLM as part of the Las Cienegas National Conservation Area
    - 160 acres near Kearny in Gila and Pinal Counties, Arizona, known as the **Dripping Springs Parcel**, to be administered by the BLM
- An additional PL 113-291 requirement calls for the United States to convey upon payment the following land to Superior, Arizona, if the Town of Superior requests it:
    - 30 acres associated with the Fairview Cemetery
    - 250 acres associated with parcels contiguous to the Superior Airport
    - 265 acres of Federal reversionary interest associated with the Superior Airport

In October 2021, the Town of Superior requested the land transfer.

ES-1.7 Nature of Lead Agency Decision

With regard to the proposed GPO, the Forest Supervisor, Tonto National Forest, would make the following decisions using the analysis in the EIS and supporting documentation:

- Decide whether to approve the proposed GPO submitted by Resolution Copper or require changes or additions to the proposed GPO to meet the requirements for environmental protection and reclamation set forth in 36 CFR 228 Subpart A before approving a final GPO. The Forest Service decision may be to authorize use of the surface of NFS lands in connection with mining operations under the GPO such that the authorized use is composed of elements from one or more of the alternatives considered.
- Decide which alternative to select for approval in the final GPO, which must minimize adverse impacts on NFS surface resources to the extent feasible and must comply with all Federal and State laws and regulations
- Decide whether to approve amendments to the forest plan, which would be required to approve the final GPO
- Decide whether to approve a special use permit for the Salt River Project to authorize construction and operation of power lines on NFS lands
- Decide whether to approve a special use permit for Resolution Copper to authorize construction and operation of pipelines on NFS lands. This decision is applicable to Alternatives 5 and 6. For both of these alternatives, the tailings storage facility is located off NFS lands, with only the pipeline/power line corridor crossing NFS lands. Hence, the NFS authorization would no longer occur under 36 CFR 228 Subpart A (mineral regulations), but rather under 36 CFR 251.50 (special uses).

With regard to the land exchange, Section 3003 of PL 113-291 directs the Secretary of Agriculture to convey to Resolution Copper all right, title, and interest of the United States in and to identified Federal land if Resolution Copper offers to convey to the United States all right, title, and interest of Resolution Copper in and to identified non-Federal lands. Note that the acreages shown in this section are those offered by Resolution Copper to the Federal Government, after completion of cadastral surveys, map revisions, and at the time of publication of this FEIS. Ultimately, the Federal Government may not accept all portions of these lands. The exact parcels and acreage have been assessed through the land appraisal process; summaries of the appraisals for each parcel were publicly released by the Forest Service on April 22, 2025. The Forest Supervisor, Tonto National Forest, has limited discretion to (1) address concerns of affected Tribes; (2) ensure that title to the non-Federal lands offered in the exchange is acceptable; (3) accept additional non-Federal land or a cash payment from Resolution Copper to the United States in the event that the final appraised value of the Federal land exceeds the value of the non-Federal land; or (4) address other matters related to the land exchange that are consistent with Section 3003 of PL 113-291.

ES-1.8 Public Participation

The Forest Service sought public input during several phases of the environmental review process prior to publication of the FEIS.

The public scoping period began on March 18, 2016, with the Forest Service publication of a notice of intent to prepare an EIS in the Federal Register. Scoping is the first step in the NEPA process and seeks input from within the agency, from the public, and from other government agencies in order to define the scope of issues to be addressed in depth in the EIS.

The Forest Service planned for a 60-day public scoping period from March 18, 2016, to May 17, 2016.

Numerous individuals and several organizations requested an extension of the public scoping period, as well as additional public scoping meetings. The Forest Supervisor, Tonto National Forest, accommodated these requests by extending the public scoping period through July 18, 2016, resulting in a total overall scoping period of 120 days.

Between March and June 2016, the Forest Service held five EIS public scoping meetings.

A scoping report summarizing 133,512 public comments was completed and made available online on the project website on March 9, 2017 (U.S. Forest Service 2017i).

The Forest Service conducted two public workshops to collect information on public opinion regarding where to site a mine tailings storage facility.

Internal scoping efforts included several meetings and field trips with the NEPA interdisciplinary (ID) team. ID team members include Forest Service resource specialists and planners representing anticipated topics of analysis in the NEPA process, managers, and Tonto National Forest line officers.

Cooperating agency scoping was conducted through a kick-off meeting and through comments submitted by cooperating agencies and Tribes during the public scoping comment period.

Between May 2017 and October 2020, the Forest Service participated in numerous informal meetings (one or more per month) with key stakeholders, Tribes, and cooperating agencies regarding technical feasibility of the project and alternatives, differing environmental impacts and tradeoffs among the alternatives, and mitigations for reducing expected impacts of the proposed GPO and land exchange.

Additional details about scoping conducted during Tribal consultation can be found in section 1.6.5, chapter 5, and appendix S of the FEIS.

The Tonto National Forest released the DEIS on August 9, 2019. A notice of availability was published alongside the DEIS in the Federal Register. This began a 90-day public comment period that ended on November 7, 2019.

The Forest Service conducted six public meetings to present information, answer questions, and receive public comments. Over 29,000 comment submittals were received and responded to as recorded in appendix R. Tribes requested an extended comment period and meeting, which were granted by the Forest Service. Tribes were given a 45-day extension to submit comments; the extension concluded on December 23, 2019.

ES-1.9 Issues Selected for Analysis

Issues help set the scope of the actions, alternatives, and effects to consider in the Forest Service's analysis (Forest Service Handbook 1909.15.12.4).

Comments submitted during the 2016 scoping period were used to formulate issues concerning the proposed action. An issue is a point of dispute or disagreement with the proposed action based on some anticipated environmental effect. The DEIS disclosed known information and impacts on these issues.

Below are the social, physical, and biological resources or other concerns that the Forest Service selected for analysis, based on scoping comments.

Issues carried forward for analysis

Social and Cultural Issues	Physical and Biological Issues
• Cultural Resources	• Air Quality
• Environmental Justice	• Geology, Minerals, and Subsidence
• Public Health and Safety	• Livestock and Grazing
• Recreation	• Noise and Vibration
• Socioeconomics	• Scenic Resources
• Transportation and Access	• Soils and Vegetation
• Tribal Values and Concerns	• Water Resources
	• Wildlife and Special Status Species

Section 1.7, Issues, in chapter 1 of the FEIS provides a snapshot of these issues. Detailed information about these issues appears in chapter 3 of the FEIS.

ES-2. Alternatives

NEPA requires consideration of a reasonable range of alternatives that can accomplish the purpose of and need for the proposed action. The Forest Service studied a range of alternatives to the Resolution Copper GPO, each of which

- responds to key issues raised during public scoping; project purpose and need; and applicable Federal and State laws and regulations;
- considers input from resource specialists, mining experts (project team), cooperating agency representatives, Tribes, and stakeholders; and
- is technically feasible to implement—but with differing environmental impacts and tradeoffs.

The alternatives include five action alternatives (out of 30+ considered) at four separate locations, including one location not on Federal land.

In addition, the Forest Service did the following:

- Assessed alternative mining techniques in an effort to prevent subsidence. No alternative methods were considered reasonable.
- Assessed tailings disposal in brownfield sites (old mine pits). No reasonable brownfield locations were found.
- Identified three separate methods of depositing tailings, including using filtered (dry-stack) tailings.

Environmental impacts and tradeoffs among the five action alternatives vary due to the differences in the tailings embankment design, the tailings deposition method, or the geographic location and affected surroundings of the proposed tailings storage facility (figure ES-2). Ore extraction and processing activities as proposed in the GPO remain similar between all action alternatives.

Additional alternatives were considered but dismissed from detailed analysis for various reasons.
See appendix F of the FEIS for discussion of the other alternatives considered and the rationale for their dismissal.

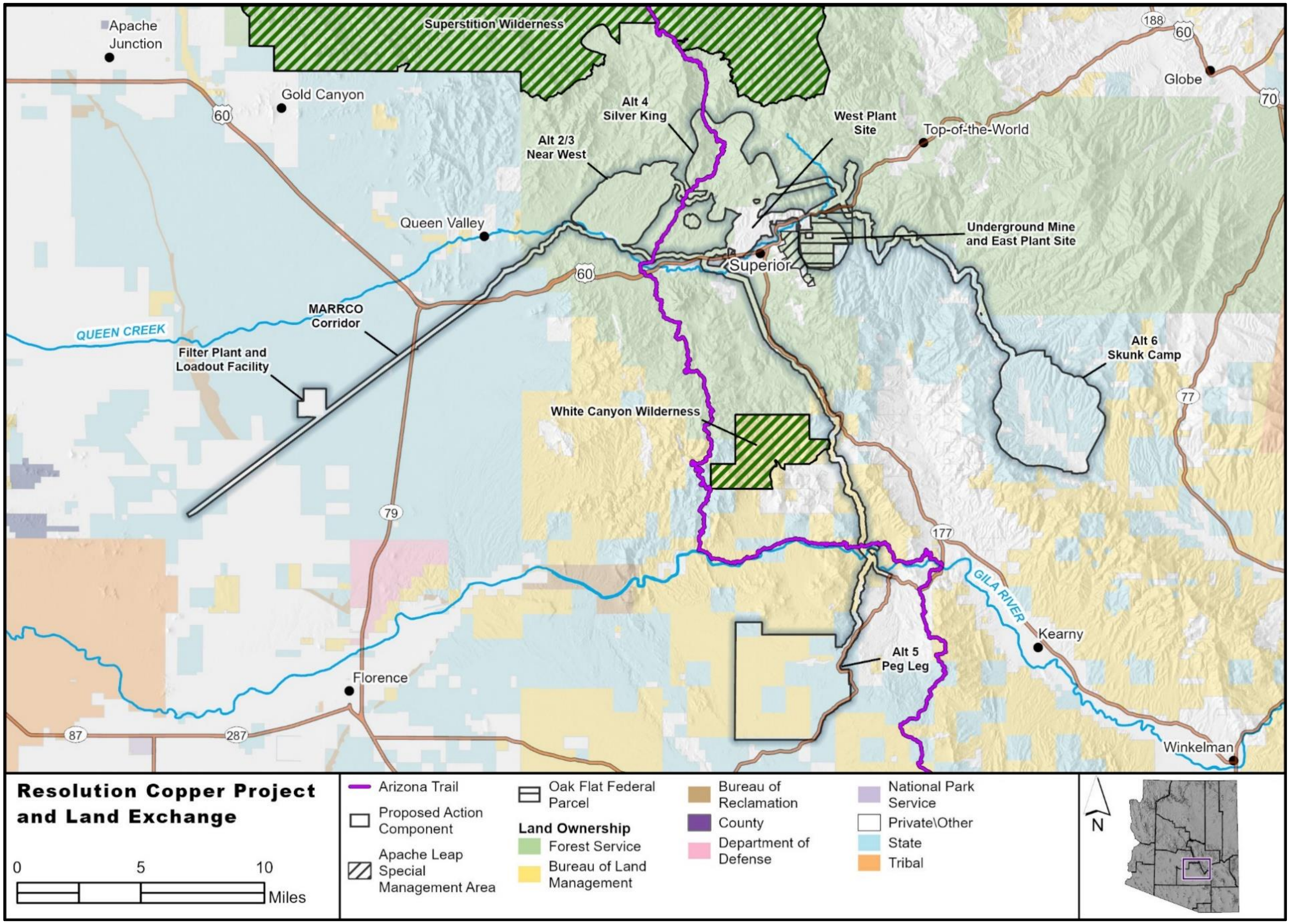


Figure ES-2. Overview of project alternative locations

ES-2.1 No Action Alternative

The no action alternative provides a basis for comparison in the EIS. Under this alternative, the Forest Service would not approve the GPO, none of the activities in the final GPO would be implemented on NFS lands, and the mineral deposit would not be developed. Additionally, the land exchange would not take place.

The no action alternative serves as a point of comparison for the proposed action and action alternatives.

ES-2.2 Alternative 2 – Near West Proposed Action

This alternative is a variation of the proposed action described in the May 9, 2016, version of the Resolution Copper GPO. In early 2018, Resolution Copper changed its original plan for an "upstream" embankment design to a "modified-centerline" configuration for a tailings storage facility.

Alternative 2 would include a split-stream tailings processing method with two tailings types:

- Non-potentially acid generating (NPAG) tailings
- Potentially acid generating (PAG) tailings

PAG tailings have a greater potential to oxidize and generate acidic seepage to groundwater or surface waters. To minimize this potential, PAG tailings would be deposited centrally in the tailings storage facility and surrounded by NPAG tailings. A 5- to 10-foot-deep water cap would keep PAG tailings saturated to reduce exposure to oxygen during tailings storage facility development.

Additionally, the larger NPAG deposit would act as a buffer between the PAG tailings and areas outside the tailings storage facility. Water spigots would keep the NPAG tailings "beach" area wet, ensuring effective dust management during operations.

The modified centerline embankment construction would consist of earthfill and cyclone sand from the NPAG tailings stream. This sand results from tailings processed through one or more dedicated centrifuges to separate larger tailings particles from the finer particles.

A suite of engineered seepage controls, including engineered low-permeability liners, compacted fine tailings, and/or a "grouting" process to seal ground fractures, would limit and contain seepage. Uncontained seepage would be collected in downstream ponds and pumped back to the tailings storage facility. Figure ES-3 provides an overview of Alternative 2.

Alternative 2 Facility Details

Ownership	Tonto National Forest
Tailings facility footprint	3,309 acres
Area excluded from public access during operations	4,903 acres
Embankment height	520 feet
Embankment length	10 miles
Tailings type	Slurry

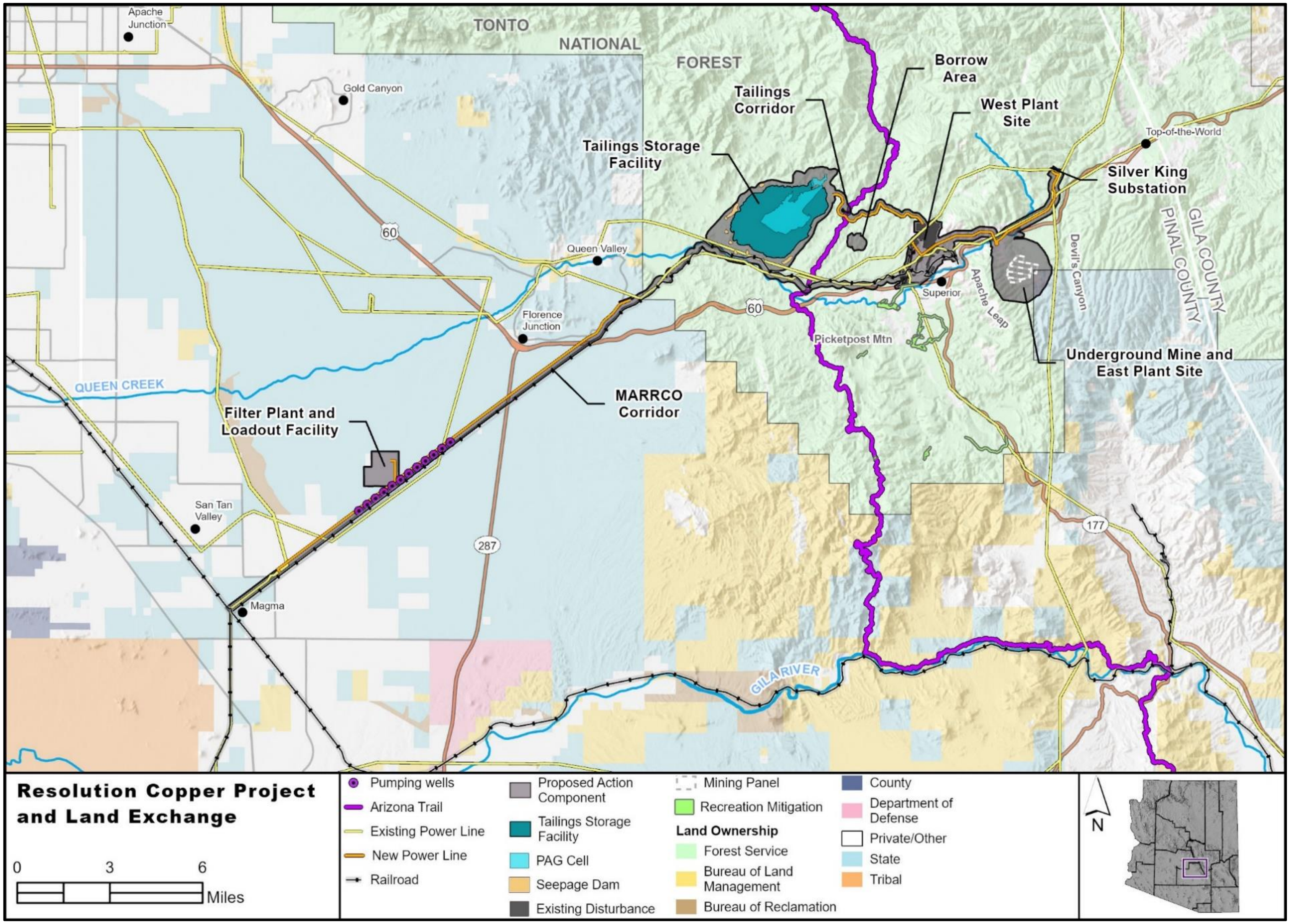


Figure ES-3. Alternative 2 – Near West Proposed Action

ES-2.3 Alternative 3 – Near West – Ultrathickened

ES-2.3.1 Similarities with Alternative 2

This alternative represents a variation of the proposed action described in the May 2016 GPO. It includes a change in embankment design for a tailings storage facility to a "modified-centerline" configuration consisting of earthfill and cycloned sand.

Alternative 3 has a split-stream tailings processing method with two tailings types:

- NPAG tailings
- PAG tailings

A suite of engineered seepage controls, including engineered low-permeability liners, compacted fine tailings, and/or a "grouting" process to seal ground fractures, would limit and contain seepage, along with downstream seepage collection ponds.

The location on the Tonto National Forest would be identical. Figure ES-4 provides an overview of Alternative 3.

ES-2.3.2 Differences from Alternative 2

This alternative would use physical barriers to segregate PAG tailings in a separate cell from NPAG tailings. Cycloned sand would be used to build low-permeability "splitter berms" between the two tailings storage areas.

This alternative has a proposal to reduce initial amounts of water retained in NPAG tailings and encourage rapid evaporation, as well as reduce seepage potential, through

- additional on-site thickening of NPAG tailings, which would increase the thickness by 5 percent, reducing the overall amount of water in the facility; and
- possible use of "thin-lift" (also known as thin layer) deposition, to enhance evaporation and further reduce the amount of water in the facility.

Alternative 3 would require less time to close the recycled water pond, compared with Alternative 2. By using ultrathickening methods that reduce water entering the tailings, officials estimate closure in 5 years, compared with 25 years estimated for Alternative 2.

Alternative 3 Facility Details

Ownership	Tonto National Forest
Tailings facility footprint	3,309 acres
Area excluded from public access during operations	4,903 acres
Embankment height	510 feet
Embankment length	10 miles
Tailings type	Thickened slurry

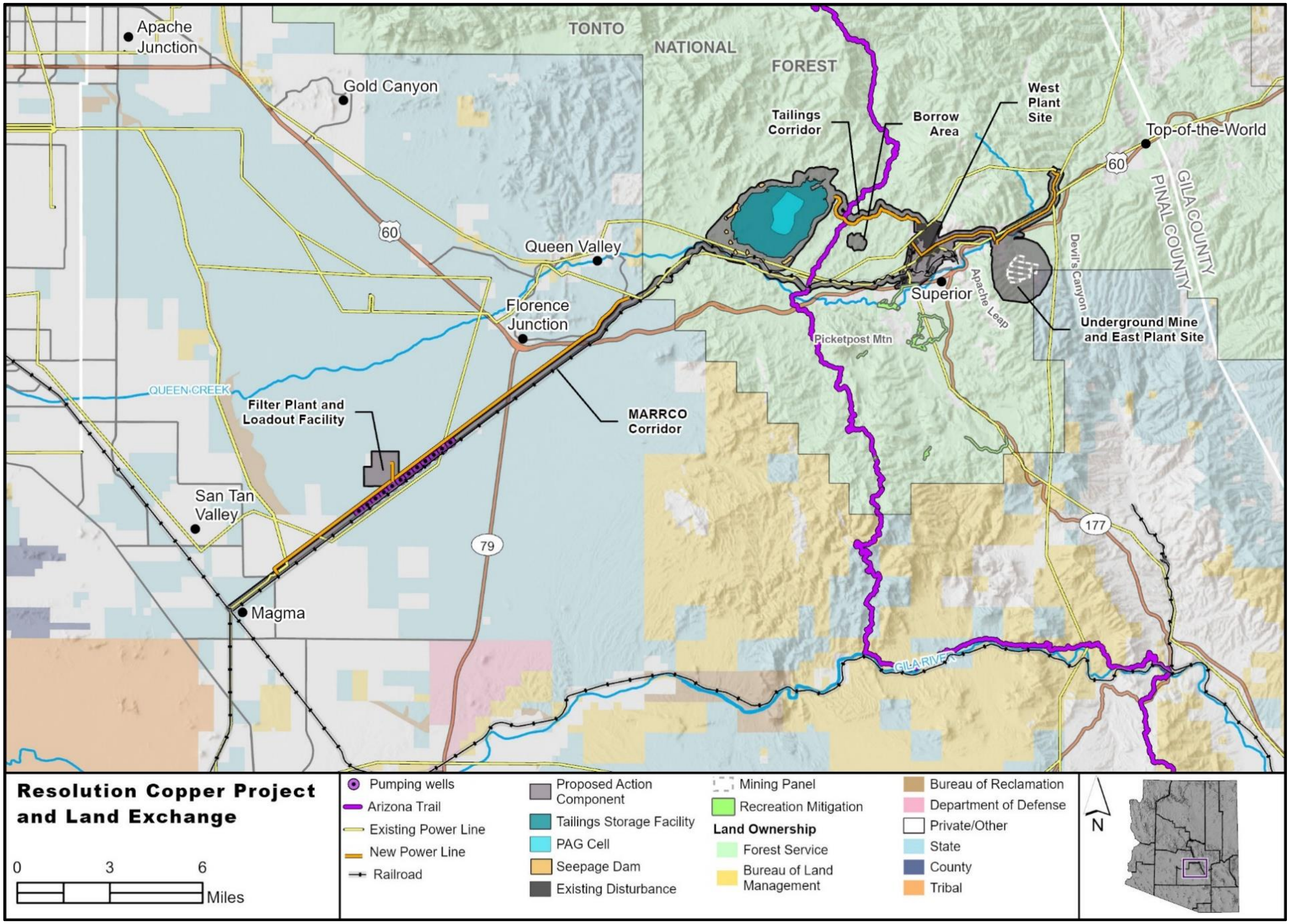


Figure ES-4. Alternative 3 – Near West – Ultrathickened

ES-2.4 Alternative 4 – Silver King

This is the lone alternative proposing to use filtered tailings—instead of slurry tailings—at the tailings storage facility.

As with other alternatives, Alternative 4 would include a split-stream tailings processing method with two tailings types:

- NPAG tailings
- PAG tailings

From the West Plant Site, pipelines would transport the two tailings slurry streams to filter plants at the Silver King location north of the West Plant Site and the town of Superior. Pressure filters would extract about 85 percent of the water from the tailings, resulting in a more solid product and a decrease in water pumped for operations. The water would be recycled in the process water at the West Plant Site.

Conveyors and mobile equipment would mechanically deposit NPAG and PAG tailings in two separate, adjacent tailings storage facilities. Figure ES-5 provides an overview of Alternative 4.

To limit exposure of tailings to water, all runoff would be directed to perimeter ditches, sumps, and/or underdrains. Water coming into contact with exposed tailings would be collected in large ponds located in natural valleys downstream of the tailings storage facility. Large diversions also would be needed to keep upstream stormwater from reaching the tailings storage facility.

Unlike for the proposed action and other alternatives, the filter plant and loadout facilities would be constructed at the West Plant Site, and copper ore would be transported by rail car to the railhead by Magma Junction along the MARRCO corridor.

ES-2.4.1 Arizona National Scenic Trail

The tailings storage facility and associated auxiliary facilities would impact approximately 5.5 miles of the Arizona National Scenic Trail, resulting in the rerouting of that portion of the trail.

Alternative 4 Facility Details

Ownership	Tonto National Forest
Tailings facility footprint	2,266 acres
Area excluded from public access during operations	5,660 acres
Embankment height	Filtered tailings do not use an embankment to contain tailings. However, for comparison with the other alternatives, the overall height of the facility would be approximately 1,000 feet.
Embankment length	Not applicable
Tailings type	Filtered

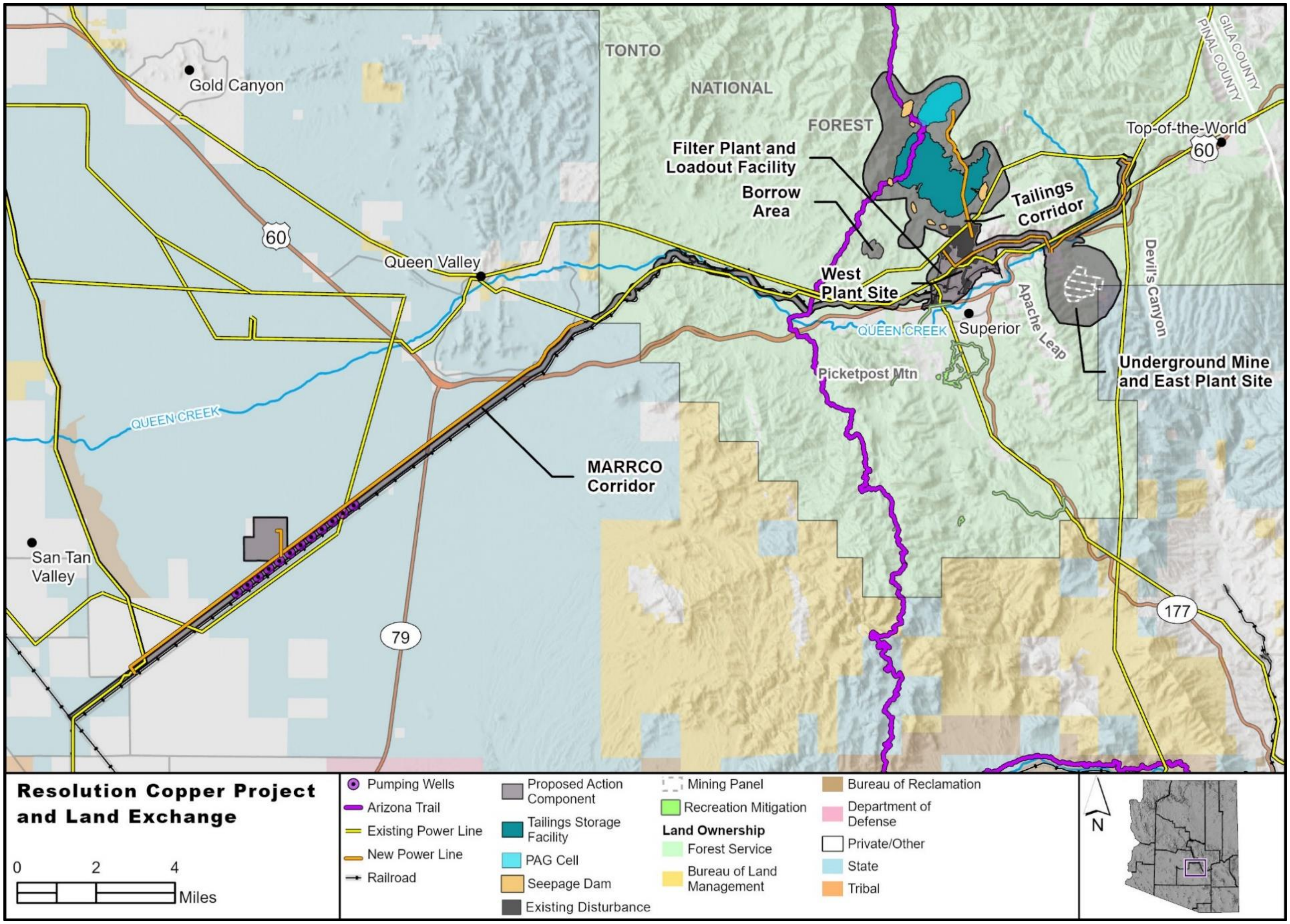


Figure ES-5. Alternative 4 – Silver King

ES-2.5 Alternative 5 – Peg Leg

This alternative allows for an evaluation of a tailings site that is more isolated from existing communities while remaining adjacent to areas of active mining on the landscape.

Alternative 5 also provides for a comparison of the impacts of slurry tailings if placed on a flatter, alluvial landscape instead of an upland wash or canyon.

As with other alternatives, Alternative 5 would include a split-stream tailings processing method with two tailings types:

- NPAG tailings
- PAG tailings

The tailings slurry streams would be transported via 23 miles of pipeline to the Peg Leg tailings storage facility. Two separate storage facilities for NPAG and PAG tailings would exist throughout the life of the mine.

The PAG facility would consist of four separate cells. This would reduce the pond size required for operations and allow for progressive reclamation. Only one cell would be operational at a time. A downstream embankment consisting of earthfill and cycloned sand is proposed for the PAG cells.

NPAG tailings would be located primarily on an alluvial soil foundation to the west and slightly downslope of the PAG site. A centerline embankment, also consisting of earthfill and cycloned sand, is proposed for NPAG tailings. Figure ES-6 provides an overview of Alternative 5.

Officials project higher seepage because of the alluvial foundation. A suite of engineered seepage controls, including low-permeability layers at the PAG facility and low-permeability barriers (liners or fine-grained tailings) for the NPAG tailings, would limit and control seepage. A downstream well field would capture seepage and return it to the tailings storage facility.

Alternative 5 Facility Details

Ownership	BLM; Arizona State Land Department
Tailings facility footprint	5,889 acres
Area excluded from public access during operations	10,781 acres
Embankment height	310 feet
Embankment length	7 miles
Tailings type	Slurry

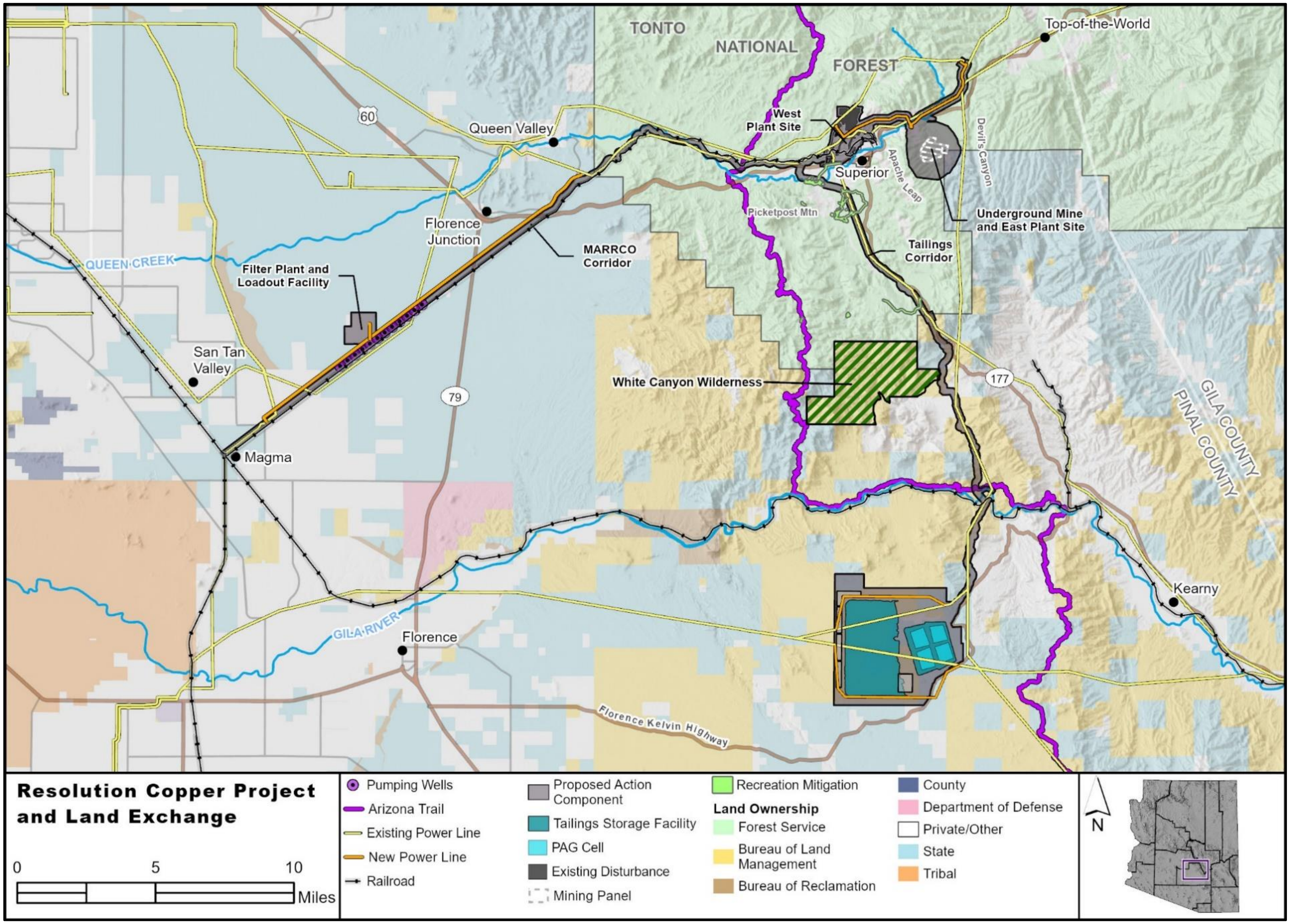


Figure ES-6. Alternative 5 – Peg Leg

ES-2.6 Alternative 6 – Skunk Camp

Preferred Alternative

The Forest Service has identified Alternative 6 (Skunk Camp) as the Lead Agency's preferred alternative.

This alternative was developed with consideration for its geospatial features:

- Its location is largely isolated from human residences and other infrastructure.
- It is adjacent to an existing mine (Ray Mine).
- Its location enables use of cross-valley embankments, requiring less fill to retain tailings, compared with a ring-like impoundment. This, in turn, simplifies construction and operations.

As with other alternatives, Alternative 6 would include a split-stream tailings processing method with two tailings types:

- NPAG tailings
- PAG tailings

The tailings slurry streams would be transported via 20 miles of pipeline to the Skunk Camp tailings storage facility. NPAG tailings would be cycloned to produce embankment fill with cycloned overflow—the finer particles—thickened at the tailings storage facility before discharge into the impoundment. PAG tailings would be deposited in two separate cells, behind a separate cycloned sand downstream-type embankment, to the north (upstream) end of the facility. Only one cell would be operational at a time, providing for early reclamation of the first cell. The much larger volume of NPAG tailings would be behind its own embankment of compacted cycloned sand and deposited immediately south of (downstream) and adjacent to the PAG tailings.

A suite of engineered seepage controls, including engineered low-permeability liners, compacted fine tailings, and/or a "grouting" process to seal ground fractures, would provide a low-permeability layer to limit and control seepage. A seepage collection pond also would be placed downstream. Figure ES-7 provides an overview of Alternative 6.

Alternative 6 Facility Details

Ownership	Private land; Arizona State Land Department
Tailings facility footprint	4,002 acres
Area excluded from public access during operations	9,218 acres
Embankment height	490 feet
Embankment length	3 miles
Tailings type	Slurry

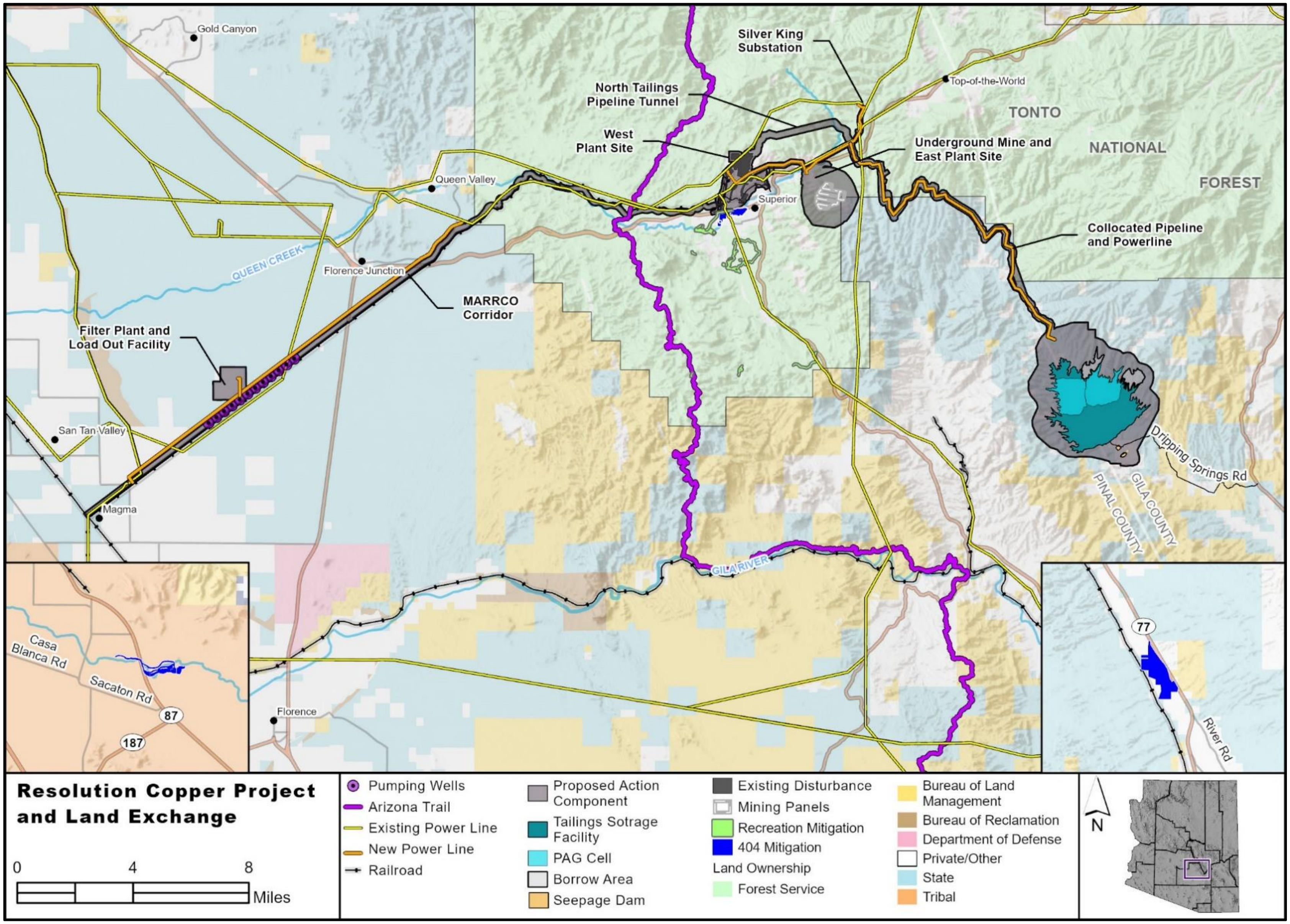


Figure ES-7. Alternative 6 – Skunk Camp (preferred alternative)

ES-3. Summary of Impacts

ES-3.1 Introduction

Information in chapter 3 of the FEIS describes the natural and human environment that may be affected by the proposed action and its alternatives and discloses the direct, indirect, and cumulative impacts that could occur as a result of implementation of the proposed action or alternatives. The effects of the legislated land exchange are also disclosed in the FEIS. Once the land exchange is completed, Forest Service management regulations would no longer apply on 2,422 acres of the Oak Flat Federal Parcel transferred to Resolution Copper, and 5,460 acres scattered across southeast Arizona would transfer from private ownership into Federal ownership and regulation.

ES-3.2 Geology, Minerals, and Subsidence

This section describes known geological characteristics at each of the major facilities of the proposed mine—including alternative tailings storage locations—and how the development of the project may impact existing cave and karst features, paleontological resources, area seismicity, and unpatented mining claims. It also outlines subsidence impacts that would result from Resolution Copper's plans to extract the ore from below the deposit using a mining technique known as "block caving" or "panel caving."
The analysis concludes the following:

- The subsidence zone at the Oak Flat Federal Parcel would break through to the surface at mine year 6, would be between 800 and 1,115 feet deep, and would be about 1.8 miles in diameter.
- No damage is expected to Apache Leap, Devil's Canyon, or U.S. Route 60 as a result of the subsidence. The mine is also unlikely to induce seismic activity that would cause damage.
- Some unpatented mining claims not belonging to Resolution Copper are located within the project footprint, and access to these claims may be inhibited.

ES-3.3 Soils and Vegetation

This section explains how the proposed mine would disturb large areas of ground and potentially destroy native vegetation, including species given special status by the Forest Service, and encourage noxious or invasive weeds. The analysis concludes the following:

- Between 9,900 and 17,000 acres of soil and vegetation would be disturbed by the project.
- Revegetation success in these desert ecosystems is demonstrated. However, impacts to soil health and productivity may last centuries to millennia, and the ecosystem may not meet desired future conditions. The habitat may be suitable for generalist wildlife and plant species, but rare plants and wildlife with specific habitat requirements are unlikely to return.
- Arizona hedgehog cactus (endangered) may be impacted during operations at the East Plant Site, by ground subsidence, and by the pipeline/power line corridor for Alternative 6. The pipeline corridor associated with Alternative 5 would impact critical habitat for acuña cactus (endangered).
- Reclamation of disturbed areas would decrease but not eliminate the likelihood of noxious weeds' becoming established or spreading.

ES-3.4 Noise and Vibration

This section provides a detailed analysis of estimated impacts from noise and vibration under the proposed GPO and each of the alternatives. The analysis concludes the following:

- Noise impacts were modeled for 15 sensitive receptors representing residential, recreation, and conservation land uses. Under most conditions, predicted noise and vibration during construction and operations, for blasting and non-blasting activities, at sensitive receptors are below thresholds of concern. Rural character would not change due to noise.
- One exception is that noise along Dripping Springs Road (Alternative 6) is above thresholds of concern. However, no residual impacts would occur once mitigation is implemented. After mitigation, no unavoidable adverse impacts are anticipated from noise or vibration from any alternative.

ES-3.5 Transportation and Access

This section discusses how the proposed Resolution Copper Mine would increase traffic on local roads and highways and likely alter local and regional traffic patterns and levels of service. This section also examines NFS road closures, along with accelerated deterioration of local roadways as a result of increased use. The analysis concludes the following:

- Approximately 8.0 miles of NFS roads are expected to be decommissioned or lost from the East Plant Site, West Plant Site, or subsidence area.
- An additional 21.7 miles of NFS roads would be lost as a result of the Alternative 2 and 3 tailings storage facility. Another 17.7 miles of NFS roads would be lost as a result of the Alternative 4 tailings storage facility. Approximately 29 miles of BLM inventoried roads would be lost as a result of the Alternative 5 tailings storage facility. The Alternative 6 tailings storage facility would impact 5.7 miles of private roads.
- NFS roads lost to the subsidence area provide access to areas that include Apache Leap and Devil's Canyon. Access to these areas still would be available but would require using routes that are not as direct or convenient. Alternative 4 would also change access to the highlands north of Superior, as well as to private inholdings in the Tonto National Forest.

ES-3.6 Air Quality

This section analyzes potential impacts from an increase in dust, wind-borne particulates, and transportation-related emissions as a result of construction, mining, and reclamation activities at the mine and along transportation and utility corridors. The analysis concludes the following:

- Neither daily nor annual maximum impacts for fugitive dust (particulate matter 2.5 ($PM_{2.5}$) and particulate matter 10 (PM_{10})) would exceed established air quality thresholds.
- None of the predicted results are anticipated to exceed the National Ambient Air Quality Standards at the project fence line (where public access is excluded).
- Impacts on air quality related values (deposition and visibility) at Class 1 and other sensitive areas would be within acceptable levels.

ES-3.7 Water Resources

This section analyzes how the Resolution Copper Project could affect water availability and quality in three key areas: groundwater quantity and groundwater-dependent ecosystems (GDEs), groundwater and surface water quality, and surface water quantity. The analysis concludes the following:

- Impacts to between 18 and 20 GDEs are anticipated. Six of these are springs that are anticipated to be impacted by groundwater drawdown under the no action alternative as a result of ongoing dewatering by Resolution Copper. When block caving occurs, groundwater impacts would expand to overlying aquifers, and two more springs would be impacted. Direct disturbance within the project footprint would impact another six to nine springs or ponds. Depending on the alternative, GDEs associated with Queen Creek, Devil's Canyon, and the Gila River would be impacted as a result of reductions in surface runoff. The loss of water would be mitigated for some GDEs, but impacts to the natural setting would remain.
- Groundwater supplies in Superior and Top-of-the-World could be impacted by groundwater drawdown but would be replaced through mitigation.
- Over the mine life, 87,000 acre-feet of water would be pumped from the mine, and between 180,000 and 590,000 acre-feet of makeup water would be pumped from the Desert Wellfield in the East Salt River valley. Alternative 4, which uses filtered (dry-stack) tailings, requires the least amount of makeup water. The wellfield pumping would incrementally contribute to the lowering of groundwater levels and cumulatively reduce overall groundwater availability in the area.
- After closure, the reflooded block-cave zone could have poor water quality. However, a lake in the subsidence zone is not anticipated, and no other exposure pathways exist for this water.
- Stormwater runoff could have poor water quality, but under normal conditions no stormwater contacting tailings or facilities would be released during operations or post-closure until reclamation is successful. For some combination of extreme storms (300-year return period or greater) and operational upset conditions, stormwater could be released over the spillway of the seepage pond.
- All of the tailings facilities would lose seepage with poor water quality to the environment, and all are dependent on a suite of engineered seepage controls to reduce this lost seepage. Modeling indicates that seepage from Alternatives 2 and 4 would result in water quality problems in Queen Creek; Alternative 3 would not, but requires highly efficient seepage control to achieve this (99.5 percent capture). Seepage from Alternatives 5 and 6 would not result in any anticipated water quality problems. These two alternatives also have substantial opportunity for additional seepage controls if needed.
- There would be a reduction in average annual runoff as a result of the capturing of precipitation by the subsidence zone and tailings facilities, varying by alternative: 3.5 percent at the mouth of Devil's Canyon, between 6.5 and 8.9 percent in Queen Creek at Whitlow Ranch Dam, and between 0.2 and 0.5 percent in the Gila River. Alternative 4 also would result in an almost 20 percent loss of flow in Queen Creek at Boyce Thompson Arboretum.
- Under the Clean Water Act, Alternatives 2, 3, and 4 would impact zero acres of jurisdictional waters, based on a decision by the USACE that no such waters exist above Whitlow Ranch Dam. Alternative 5 directly would impact about 180 acres, and Alternative 6 would directly impact about 130 acres of potentially jurisdictional waters.

ES-3.8 Wildlife and Special Status Wildlife Species

This section describes how impacts to wildlife can occur from habitat loss and fragmentation, as well as from artificial lighting, noise, vibration, traffic, loss of water sources, or changes in air or water quality. The analysis concludes the following:

- Habitat would be impacted in the analysis area for about 50 special status wildlife species. General impacts include a high probability of mortality or injury with vehicles or from grading; increased stress due to noise, vibration, and artificial light; and changes in cover. Changes in behavior include changes in foraging efficiency and success, changes in reproductive success, changes in growth rates of young, changes in predator–prey relationships, increased movement, and increased roadkill.
- There would be loss and fragmentation of movement and dispersal habitats from the subsidence area and tailings storage facility. Ground-clearing and consequent fragmentation of habitat blocks for other mine-related facilities would also inhibit wildlife movement and increase edge effects.
- For Tonto National Forest and BLM sensitive wildlife species, the proposed project may adversely impact individuals but is not likely to result in a loss of viability in the analysis area, nor is it likely to cause a trend toward Federal listing of these species as threatened or endangered.
- The general removal of vegetation, increased activity, and potential changes in streamflow and associated riparian vegetation along Devil's Canyon could impact the yellow-billed cuckoo (threatened); during consultation under Section 7 of the Endangered Species Act, U.S. Fish and Wildlife Service concurred that the project may affect, but is not likely to adversely affect, the yellow-billed cuckoo and designated critical habitat.
- The pipeline crossings of the Gila River under Alternative 5, including removal of vegetation and increased activity, could impact southwestern willow flycatcher (endangered).
- Critical habitat for Gila chub (endangered) occurs in Mineral Creek above Devil's Canyon. No individuals have been identified here during surveys, and this area is not anticipated to be impacted by groundwater drawdown. During consultation under Section 7 of the Endangered Species Act, U.S. Fish and Wildlife Service concurred that the project may affect, but is not likely to adversely affect, the Gila chub and designated critical habitat.

ES-3.9 Recreation

This section quantifies, when possible, anticipated changes to some of the area's natural features and recreational opportunities as a result of infrastructure development related to the project. The analysis concludes the following:

- Public access (Tonto National Forest, Arizona State Land Department, and BLM lands) would be eliminated on 8,400 to 15,200 acres. Alternatives 2, 3, and 4 would result in 7,200 to 7,900 acres of access lost on Tonto National Forest land. Alternative 5 would primarily impact access to 2,600 acres of Tonto National Forest land and 7,000 acres of BLM land, as well as 4,600 acres of Arizona State land, and Alternative 6 would primarily impact access to 11,600 acres, of which 8,200 acres is Arizona State land.
- There would be changes to the recreation opportunity spectrum acres within the Globe Ranger District, with losses of 18 to 166 acres of semi-primitive non-motorized areas.

- Visitors to the Superstition Wilderness, Picketpost Mountain, and Apache Leap would have foreground and background views of the tailings facilities from trails and overlooks, and the recreation setting from certain site-specific views could change. Three miles of the Arizona National Scenic Trail would be impacted by Alternative 4 and require rerouting, whereas pipeline corridor crossings for Alternatives 2 and 5 would impact the trail.
- The exchange of the Oak Flat Federal Parcel would remove world-recognized rock climbing areas from public access, as well as Oak Flat campground. Both of these would be partially mitigated by replacement areas.
- The number of Arizona hunting permits that are issued in individual Game Management Units would not change as a result of implementation of any of the action alternatives.

ES-3.10 Public Health and Safety

This section addresses three areas of interest: tailings embankment safety, fire risks, and the potential for releases or public exposure to hazardous materials. The analysis concludes the following:

- The risk of embankment failure for all alternatives would be minimized by required adherence to Federal and Arizona design standards and by applicant-committed environmental protection measures.
- The consequences of a catastrophic failure and the downstream flow of tailings would include possible loss of life and limb, destruction of property, displacement of large downstream populations, disruption of the Arizona economy, contamination of soils and water, and risk to water supplies and key water infrastructure like the CAP canal. The highest population is located downstream of Alternative 2.
- All alternative designs are built to the same safety standards, but they have inherent differences in their resilience when unexpected events or upsets happen. Alternatives 2 and 3 are the least resilient because they use modified-centerline embankments, have long (10-mile) freestanding embankments, and do not use separately contained PAG storage cells. Alternative 6 is the most resilient of the slurry tailings alternatives because it uses a centerline embankment that is only 3 miles long and anchored on each side and has separate PAG storage cells that use downstream embankments.
- Alternative 4, using filtered (dry-stack) tailings, is more resilient than slurry tailings alternatives and would have the fewest consequences if a failure occurred, collapsing as a slump or landslide, and impacting the local vicinity only.
- With respect to other public safety risks, the risk of inadvertent ignition and resulting wildland fire is considered quite low. However, Alternative 4 includes areas classified with shrub fuels that burn with high intensity in the event of ignition. As the Mine Safety and Health Administration and other regulations and standards govern the transport and storage of explosives and hazardous chemicals, risks of spills or releases are therefore considered possible, but unlikely, with appropriate response plans in place.

ES-3.11 Scenic Resources

This section addresses the existing conditions of scenic resources (including dark skies) in the area of the proposed action and alternatives. It also addresses the potential changes to those conditions from construction and operation of the proposed project. The analysis concludes the following:

- All tailings facilities would be visible from long distances, and the change in contrast caused by land disturbance and vegetation removal, dust, and equipment would strongly impact viewers, including recreationists on scenic highways.

- Alternatives 2 and 3 would impact Arizona National Scenic Trail users and off-highway vehicle users, as would Alternative 4. Alternative 4 would be the tallest facility when viewed (1,000 feet high). It would dominate the scene and be viewable from sensitive locations (like Picketpost Mountain). Alternative 5 would also be highly visible and would impact Arizona National Scenic Trail and off-highway vehicle users. Alternative 6 would be visible from within the valley of Dripping Spring Wash but otherwise would not be as visible on the landscape as the other alternatives.

ES-3.12 Cultural Resources

This section analyzes potential impacts on all known cultural resources within the project area.
The analysis concludes the following:

- The NRHP-listed *Chí'chil Biłdagoteel* Historic District TCP would be directly and permanently damaged by the subsidence area at the Oak Flat Federal Parcel.
- A Programmatic Agreement (PA) was pursued and drafted during the Section 106 consultation process. The Rescinded FEIS included that PA (appendix O). All signatories, other than the Advisory Council on Historic Preservation (ACHP), had signed the PA as of January 15, 2021. On February 11, 2021, ACHP notified the Forest Service that "ACHP believes that further consultation in this case would be unproductive and therefore, we are hereby terminating consultation pursuant to 36 CFR § 800.7(a)(4)." In accordance with 36 CFR 800.7(c)(4), the Secretary of Agriculture delivered a written response to the ACHP on April 17, 2025, and that response concluded the Section 106 process for this undertaking. Since ACHP did not sign the PA, the PA was never executed. Therefore, mitigation measures identified in the PA and any others identified subsequently will now be implemented through the final record of decision and special use permit for use of NFS lands, through enforcement by other State and federal agencies, and through third parties in separate agreements. Changes in enforcement of the measures described in the draft PA are further described in appendix J.
- All alternative area surveys anticipated are complete at this time. Any remaining acreage slated for ground disturbance or land sale would be inventoried and cultural sites identified and addressed in accordance with several agreements that are detailed in appendix J. From surveyed areas, the number of NRHP-eligible sites are as follows:
  - Alternatives 2 and 3: 120 NRHP-eligible sites and 18 sites of undetermined eligibility would be directly affected, and 59 sites would be indirectly affected;
  - Alternative 4: 145 NRHP-eligible sites and 2 sites of undetermined eligibility would be directly affected, and 55 sites would be indirectly affected;
  - Alternative 5: 154 NRHP-eligible sites and 3 sites of undetermined eligibility would be directly affected, and 77 sites would be indirectly affected; and
  - Alternative 6: 377 NRHP-eligible sites and 3 sites of undetermined eligibility would be directly affected, and 55 sites would be indirectly affected.

ES-3.13 Socioeconomics

This section examines the social and economic impacts on the quality of life for neighboring communities near the proposed mine. The analysis concludes the following:

- On average, the mine is projected to directly employ 1,434 workers, pay about $149 million per year in total employee compensation, and purchase about $490 million per year in goods and services. Including direct and multiplier effects, the proposed mine is projected to increase the average annual economic value added in Arizona by about $1.2 billion.

- The proposed mine is projected to generate an average of between $80 and $120 million per year in State and local tax revenues and would also produce substantial revenues for the Federal Government, estimated at more than $200 million per year. There would be a loss of hunting revenue as a result of the tailings storage facilities. With Alternatives 2, 3, and 4, the loss would be highest in the Superior area.
- Construction and operations of the proposed mine could affect costs for both the Town of Superior and Pinal County to maintain street and road networks and could strain public services. A number of agreements between Resolution Copper and the Town of Superior would offset impacts to quality of life, education, and emergency services.
- Property values are expected to decline in close proximity to the tailings storage facilities.

ES-3.14 Tribal Values and Concerns

This section discusses the potential for the proposed mine to directly, adversely, and permanently affect numerous cultural artifacts, sacred seeps and springs, traditional ceremonial areas, resource gathering localities, burial locations, and other places and experiences of high spiritual and other value to Tribal members.

Under all action alternatives, the Oak Flat Federal Parcel will be adversely impacted by the proposed mining operation. Extraction of the ore via block caving will eventually lead to the subsidence of the parcel; access to Oak Flat and the subsidence zone will be curtailed once it is no longer safe for visitors. Several springs located on the Oak Flat Federal Parcel will be lost due to the development of the subsidence area. The subsidence has a high potential to directly and permanently adversely affect numerous cultural resources sites, including the following: archaeological resources; areas with sacred values such as springs, seeps, and prayer locations; resource gathering sites; ancestor burial sites; traditional ceremonial and dance locations; and other places of spiritual and cultural significance to members of federally recognized Tribes.

ES-3.15 Environmental Justice

This section has been removed in compliance with Executive Orders 14148 and 14173.

ES-3.16 Livestock and Grazing

This section discloses the impacts to currently authorized livestock grazing on lands managed by the Forest Service, BLM, or Arizona State Land Department that are located within the project area. The analysis concludes the following:

- There would be a reduction in available allotment acreage (BLM, Forest Service, and Arizona State land) ranging from around 8,600 to 15,700 acres and a proportional reduction in livestock capacity from around 700 to 2,800 animal-unit months. The water sources and grazing infrastructure associated with these allotment areas would also be lost.

ES-3.17 Impact Avoidance, Minimization, and Mitigation

The FEIS serves in part to inform the public and review agencies of design features, best management practices, and mitigation measures that are included with the project to reduce or avoid impacts. The Forest Service views these elements as part of the project and considers Resolution Copper's proposed mitigation measures, described in appendix J of the FEIS, as inherent to the proposed alternative, as well as other action alternatives' applicable components.

To the extent possible, these measures, including any potential impacts associated with these measures, were considered when assessing the impacts of the project on the resources. Where there is insufficient detail to determine whether an impact can be avoided or minimized, the measure cannot be incorporated into the impact analysis but serves to inform the public of Resolution Copper's plans.

Additional mitigation measures identified or recommended to date during the NEPA process have been compiled and will be considered by the Forest Service and cooperating agencies as part of their permit decisions to further minimize project impacts. This list will be further updated upon completion of the Forest Service administrative review process (objection process), as needed, to provide a comprehensive list of all measures identified during the NEPA process.

All measures will be assessed with the goal of disclosing the likelihood that the measures would be adopted by the applicant or implemented as a condition in a State, Federal, or local permit by the responsible agencies as part of their permit decisions following completion of the NEPA process. Specific mitigation conditions would be determined following completion of the environmental review and would be included in the record of decision for any permit that may be issued.

Compensatory mitigation for unavoidable impacts to aquatic resources may be required to ensure that activities requiring a permit comply with 404(b)(1) guidelines. Compensatory mitigation is the restoration (reestablishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources to offset unavoidable adverse impacts.

Resolution Copper has developed a draft conceptual compensatory mitigation plan outlining its proposed approach for compensatory mitigation. The draft conceptual compensatory mitigation plan would be amended in the future to include proposed mitigation plans. In addition, Resolution Copper proposes to use monitoring measures through construction, operation, and closure of the project to assess predicted project impacts and the effectiveness of mitigation measures.

The draft conceptual compensatory mitigation plan submitted to the USACE by Resolution Copper is included in the EIS as appendix D.

ES-4. FEIS Appendices

The final section of the FEIS provides detailed information on 21 subjects. These appendices are as follows:

- Appendix A: Section 3003 of PL 113-291
- Appendix B: Existing Conditions of Offered Lands
- Appendix C: Clean Water Act 404(B)(1) Alternatives Analysis – Resolution Copper
- Appendix D: Clean Water Act Section 404 Conceptual Mitigation Plan – Resolution Copper Project
- Appendix E: Alternatives Impact Summary
- Appendix F: Alternatives Considered but Dismissed from Detailed Analysis
- Appendix G: Further Details of East Plant Site, West Plant Site, MARRCO Corridor, and Filter Plant and Loadout Facility Infrastructure

- Appendix H: Further Details of Mine Water Balance and Use
- Appendix I: Summary of Effects of the Land Exchange
- Appendix J: Mitigation and Monitoring Strategy
- Appendix K: Summary of Content of Resource Analysis Process Memoranda
- Appendix L: Detailed Hydrographs Describing Impacts on Groundwater-Dependent Ecosystems
- Appendix M: Water Quality Modeling Results for Constituents of Concern
- Appendix N: Summary of Existing Groundwater and Surface Water Quality
- Appendix O: *This appendix has been removed from the FEIS*
- Appendix P: Final Biological Opinion Completing Consultation under Section 7 of the Endangered Species Act
- Appendix Q: Special Use Permit Applications
- Appendix R: Response to Comments Received on the DEIS
- Appendix S: Consultation History
- Appendix T: Proposed Forest Plan Amendment and NFMA Compliance Determination for Preferred Alternative
- Appendix U: Supplemental Information for Section 3.14, Tribal Values and Concerns

This page intentionally left blank.

Table of Contents

Volume 1

Volume 2

Volume 3

Volume 4

Volume 5

Volume 6

Figures

Tables

Chapter 1. Purpose of and Need for Action

1.1 Introduction

The U.S. Forest Service (Forest Service) is a land management agency under the U.S. Department of Agriculture (USDA). The Forest Service's mission is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. The Tonto National Forest, a unit of the Forest Service located in south-central Arizona, prepared this environmental impact statement (EIS) to disclose the potential environmental effects of the Resolution Copper Project and Land Exchange (project). The project includes (1) the Southeast Arizona Land Exchange (land exchange), a congressionally mandated exchange of land between Resolution Copper Mining LLC[1] (Resolution Copper) and the United States; (2) approval of the General Plan of Operations (GPO)[2] for any operations on National Forest System (NFS) land associated with a proposed large-scale underground mine (Resolution Copper Project); and (3) project-specific amendments to the "Tonto National Forest Land Management Plan" (forest plan) (U.S. Forest Service 2023d).

Overview

On March 18, 2016, the Tonto National Forest issued a Notice of Intent to prepare an EIS for the Resolution Copper Project and Land Exchange.

Three separate but related components are analyzed in the EIS:

- Approval of a proposed mine plan governing surface disturbance on NFS lands outside the exchange parcels from mining operations that are reasonably incident to extraction, transportation, and processing of copper and molybdenum that was submitted to the Tonto National Forest in November 2013
- An exchange of the Oak Flat Federal Parcel (2,422 acres of NFS land) for eight parcels located throughout Arizona (5,460 acres of Resolution Copper land)
- Approval of an amendment to the "Tonto National Forest Land Management Plan," if needed.

Resolution Copper is a limited liability company that is owned by Rio Tinto (55 percent) and BHP (45 percent). Rio Tinto is the managing member. In November 2013, Resolution Copper submitted a proposed GPO to the Forest Service for development and operation of a large-scale mine near Superior, Arizona (figure 1.1-1).[3] The proposed GPO sought authorization for surface disturbance on NFS lands for mining operations and processing of copper and molybdenum. The proposed mine, along with mining infrastructure, would be located on the Globe and Mesa Ranger Districts. The Forest Service determined the proposed GPO to be complete in December 2014 (U.S. Forest Service 2014c). As proposed in the GPO, the mining portion of the project would occur on a mixture of private, State, and NFS lands.

1 Resolution Copper Mining LLC is a U.S. corporation registered in Delaware.

2 The GPO, as amended, is available online at http://www.resolutionmineeis.us/eis-documents, and at the Tonto National Forest Supervisor's Office, 2324 East McDowell Road, Phoenix, Arizona 85006.

3 The maps contained in this EIS are based on a variety of sources of electronic and geographic data. Every effort has been made to ensure the correctness of these data coverages; however, the U.S. Department of Agriculture Forest Service makes no warranty, expressed or implied, about the accuracy, reliability, completeness, or utility of geospatial data not developed specifically for the Resolution Copper Project and Land Exchange EIS.

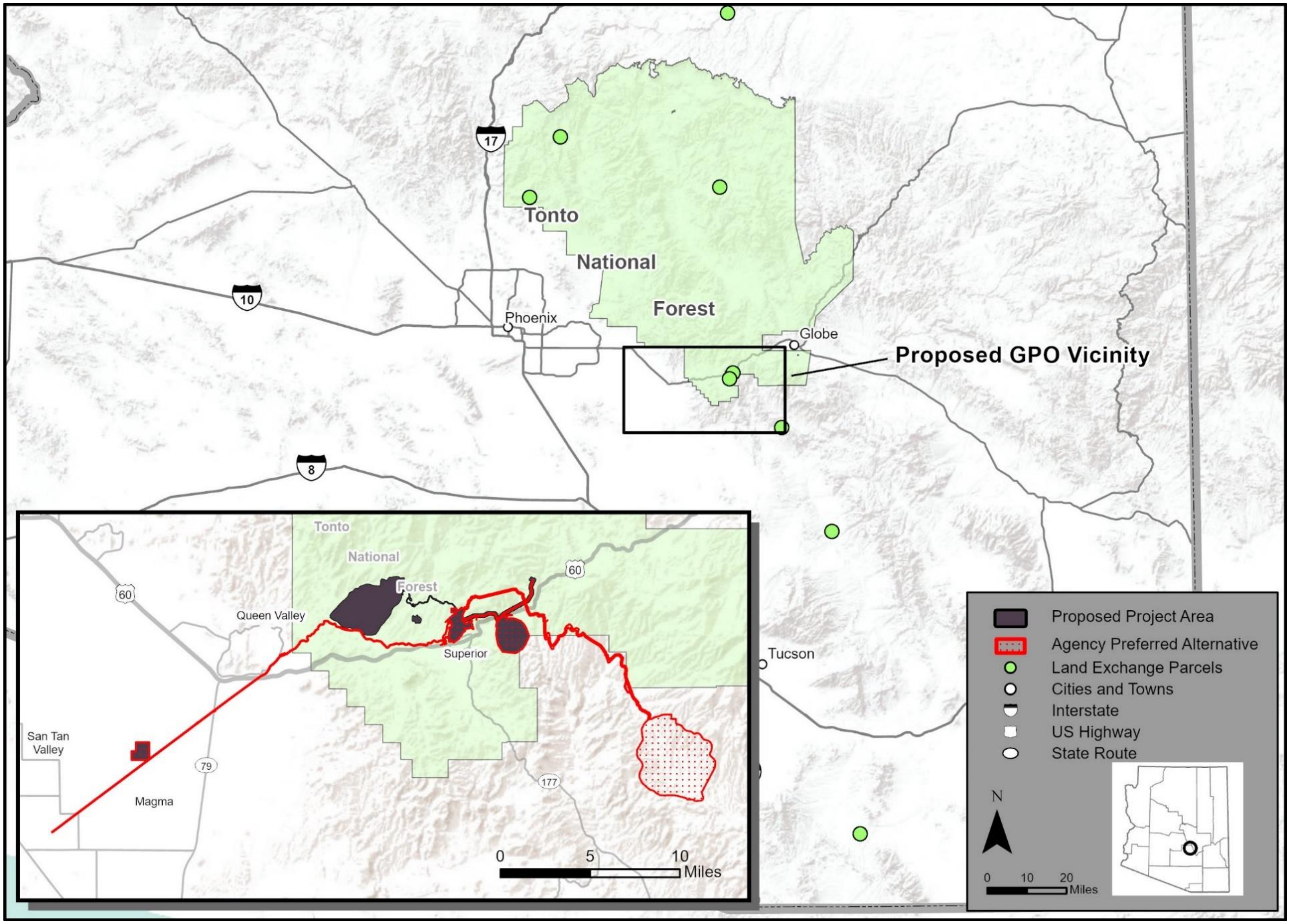


Figure 1.1-1. Resolution Copper Project vicinity map

However, in December 2014, Congress passed the Carl Levin and Howard P. 'Buck' McKeon National Defense Authorization Act (NDAA) for Fiscal Year 2015 (which is referred to as Public Law (PL) 113-291 in this final EIS (FEIS)). Section 3003 of PL 113-291 (appendix A) authorizes and directs the Secretary of Agriculture to administer an exchange of NFS lands, which would convey NFS land in the area of the proposed mine to Resolution Copper in exchange for private land on eight parcels located elsewhere in Arizona (see section 1.4.2).

The offered private lands would be transferred from Resolution Copper to the United States, to be administered by the Forest Service and the U.S. Department of the Interior Bureau of Land Management (BLM). Upon completion of the land exchange, it is expected that one of the largest copper mines in the United States would be established on the exchange parcel, with an estimated surface disturbance of roughly 9,900 acres[4] (approximately 11 square miles). It would also be one of the deepest mines in the United States, with mine workings extending 7,000 feet beneath the surface.

Section 3003 of PL 113-291 explicitly requires the Secretary of Agriculture to prepare an EIS prior to conveying the Federal land. This EIS shall be used as the basis for all decisions under Federal law related to the proposed mine, the GPO, and any related major Federal actions, including the granting of permits, rights-of-way, or the approvals for construction of associated power, water, transportation, processing, tailings, waste disposal, or other ancillary facilities.

Section 3003 of PL 113-291 requires this EIS to assess the effects of mining and related activities on such cultural and archaeological resources that may be located on the NFS lands conveyed to Resolution Copper, and identify measures that may be taken, to the extent practicable, to minimize potential adverse impacts on those resources, if any. The Secretary of Agriculture is further directed to engage in government-to-government consultation with affected Indian Tribes regarding issues of concern to the affected Tribes related to the land exchange and, following such consultation, consult with Resolution Copper and seek to find mutually acceptable measures to address affected Tribes' concerns and "minimize the adverse effects on the affected Indian Tribes resulting from mining and related activities on the Federal land conveyed to Resolution Copper" (see 16 United States Code (U.S.C.) 539p(c)(3)).

1.1.1 Document Structure

The Tonto National Forest prepared this EIS in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives.

This document has six volumes: volume 1, which contains an executive summary, chapters 1 and 2, and the first portion of chapter 3; volume 2, which contains the continuation of chapter 3; volume 3, which contains the remainder of chapter 3, chapters 4–9, and two appendices; and volumes 4–6, which contain the remainder of the appendices. The general contents of each volume follow.

[4] This acreage includes a number of different facilities. See section 2.2.4 for full details.

1.1.1.1 Volume 1

- *Executive Summary*: Provides a brief overview of the contents of chapters 1 through 3 of the EIS.
- *Chapter 1. Purpose of and Need for Action*: Focuses on the underlying need to which the lead agency (Forest Service) is responding in proposing the action and alternatives, the framework in which decisions would be made, and the significant issues associated with the proposed action.
- *Chapter 2. Alternatives, Including the Proposed Action*: Describes the proposed action and four additional action alternatives considered in detail. These alternatives were developed based on significant issues raised by the public, Forest Service resource specialists, and other agencies. The no action alternative is included in the range of alternatives considered in detail. The chapter concludes with a summary that compares the environmental consequences of each alternative, based on the effects disclosed in chapter 3.
- *Chapter 3. Affected Environment and Environmental Consequences*: Describes the affected environment and the environmental consequences associated with the proposed action and the alternatives. The resources described under the affected environment headings represent baseline environmental conditions, incorporating past and present actions. Environmental consequences are the potential direct and indirect effects of each alternative on the affected environment. Reasonably foreseeable future actions (RFFAs) are considered in combination with the effects of each alternative to define the potential for cumulative effects. Any required mitigation measures are assessed, along with their effectiveness to reduce or offset impacts. Irreversible and irretrievable commitments of resources, the relationship between short-term uses and long-term productivity of the environment, and adverse environmental impacts that cannot be avoided are disclosed for each resource as well as in a section at the end of chapter 3. Chapter 3 provides the analyses for the comparison summary presented in chapter 2.

1.1.1.2 Volume 2

- *Chapter 3. Affected Environment and Environmental Consequences*: Continuation of chapter 3 sections.

1.1.1.3 Volume 3

- *Chapter 3. Affected Environment and Environmental Consequences*: Continuation of chapter 3 sections.
- *Chapter 4. Cumulative Effects*: Identifies the combined impacts on the affected environment of the Resolution Copper Project and other reasonably foreseeable future actions.
- *Chapter 5. Consulted Parties*: Identifies the Native American Tribes, organizations, and Federal, State, and local government agencies and other parties consulted during the development of the EIS.
- *Chapter 6. List of Preparers*: This chapter lists the individuals who, under the supervision of the Forest Service, contributed to the preparation of the document and includes their organization, education, years of experience, and project role.
- *Chapter 7. Literature Cited*: Provides a list of literature cited in this document.
- *Chapter 8. Glossary; Acronyms and Abbreviations*: Provides definitions of terms used in this document.
- *Chapter 9. Index*: Indicates where keywords can be found within the document.

- *Appendices.* Each part of the appendix provides detailed information in support of the analyses and conclusions reported in the EIS. Volume 3 contains the following appendices:
    - Appendix A: Section 3003 of PL 113-291
    - Appendix B: Existing Conditions of Offered Lands

1.1.1.4 Volume 4

- *Appendices.* Each part of the appendix provides detailed information in support of the analyses and conclusions reported in the EIS. Volume 4 contains the following appendices:
    - Appendix C: Clean Water Act 404(B)(1) Alternatives Analysis – Resolution Copper
    - Appendix D: Clean Water Act Section 404 Conceptual Mitigation Plan – Resolution Copper Project
    - Appendix E: Alternatives Impact Summary
    - Appendix F: Alternatives Considered but Dismissed from Detailed Analysis
    - Appendix G: Further Details of East Plant Site, West Plant Site, MARRCO Corridor, and Filter Plant and Loadout Facility Infrastructure
    - Appendix H: Further Details of Mine Water Balance and Use
    - Appendix I: Summary of Effects of the Land Exchange
    - Appendix J: Mitigation and Monitoring Strategy
    - Appendix K: Summary of Content of Resource Analysis Process Memoranda

1.1.1.5 Volume 5

- *Appendices.* Each part of the appendix provides detailed information in support of the analyses and conclusions reported in the EIS. Volume 5 contains the following appendices:
    - Appendix L: Detailed Hydrographs Describing Impacts on Groundwater-Dependent Ecosystems
    - Appendix M: Water Quality Modeling Results for Constituents of Concern
    - Appendix N: Summary of Existing Groundwater and Surface Water Quality
    - Appendix O: *This appendix has been removed from the FEIS*
    - Appendix P: Final Biological Opinion Completing Consultation under Section 7 of the Endangered Species Act
    - Appendix Q: Special Use Permit Applications

1.1.1.6 Volume 6

- *Appendices.* Each part of the appendix provides detailed information in support of the analyses and conclusions reported in the EIS. Volume 6 contains the following appendices:
    - Appendix R: Response to Comments Received on the DEIS
    - Appendix S: Consultation History
    - Appendix T: Proposed Forest Plan Amendment and NFMA Compliance Determination for Preferred Alternative
    - Appendix U: Supplemental Information for Section 3.14, Tribal Values and Concerns

Additional project documentation, including more detailed analyses of project area resources, may be found in the project planning record, located at the Tonto National Forest Supervisor's Office, 2324 East McDowell Road, Phoenix, Arizona 85006.

1.1.2 Changes from the Draft EIS

This document reflects a number of changes made to the draft EIS (DEIS) that was released to the public in August 2019. Many of these changes were made directly in response to comments from the public, elected officials, and agencies. In most chapters and sections, particularly the chapter 3 resource sections, readers will find a general description of these changes.

For the entire EIS, key structural changes include the following:

- The full cumulative effects analysis now occupies a separate chapter, chapter 4, with a summary of cumulative effects included in each resource section in chapter 3.
- Chapter 5, Consulted Parties (formerly chapter 4 in the DEIS), now contains a full summary of Tribal consultation undertaken by the Tonto National Forest with affected Tribes.
- Appendix C now contains the final Clean Water Act (CWA) 404(b)1 Alternatives Analysis, as approved by the U.S. Army Corps of Engineers (USACE).
- Appendix D now contains the final CWA conceptual mitigation plan approved by the USACE.
- Appendix J was revised to reflect a number of new mitigation measures developed in response to impacts disclosed in the DEIS. Pertinent mitigation measures are summarized in each resource section of chapter 3 and analyzed for their effectiveness at reducing, minimizing, or offsetting impacts.
- Appendix P contains the final Biological Opinion issued by the U.S. Department of the Interior Fish and Wildlife Service (FWS) that reflects the outcome of consultation under Section 7 of the Endangered Species Act (ESA).
- Appendix Q contains the special use permit application submitted by Resolution Copper, which would be applicable to the preferred alternative (see section 1.5 for more discussion).
- Appendix R contains the response to public comments on the DEIS, including full copies of the letters received from agencies and public officials.

We expanded a number of discussions in chapter 1 in response to public comments. Given the complexity of the regulatory jurisdictions, which vary not only by alternative but also with or without the land exchange, for clarity we added more description of which agencies would have jurisdiction for different mine components, and the authorities on which that jurisdiction is based. One specific purpose of this expanded description is to provide a clear understanding of how the preferred alternative—which after the land exchange would consist of mining and tailings storage on private land—would be permitted by the Tonto National Forest.

We also added additional discussion of how financial assurance and bonding would be approached for the project.

1.1.3 Changes from the January 2021 Rescinded FEIS

The FEIS was completed and originally published on January 15, 2021. On March 1, 2021, the USDA directed the Forest Service to withdraw the Notice of Availability and rescind the FEIS and draft record of decision (ROD). The USDA took this step to provide an opportunity for the agency to conduct a thorough review, to ensure regulatory compliance of environmental, cultural, and archaeological analyses, and to provide time for the Forest Service to fully understand concerns raised by Tribes and the public and the project's impact to these important resources.

The FEIS is being republished at this time, and additional revisions have been made since the original publication in January 2021 in response to events and changes since then.[5] Key events or changes include the following:

- Termination of consultation by the Advisory Council on Historic Preservation (ACHP)
- Reinitiation of Tribal consultation
- Updates to cumulative effects
- Changed conditions in the project area
- Litigation outcomes
- Status of Council on Environmental Quality (CEQ) regulations
- Updated consistency review for amendment of the 2023 forest plan

1.1.3.1 Termination of Consultation by ACHP

Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to take into account the effects of their undertakings on historic properties. Section 106 consultation involves multiple parties including the State Historic Preservation Office (SHPO), affected Tribes, and in some cases the direct participation of the ACHP. The ACHP began participating in the Resolution Copper Project Section 106 consultation process in December 2017.

The ultimate outcome of consultation is often a Memorandum of Agreement or Programmatic Agreement (depending on the complexity of the project). The agreement outlines the roles and responsibilities of parties, the procedure for identification and evaluation of historic properties, assessment for effects, and each party's responsibilities for resolving adverse effects from the project. The execution of the agreement evidences the agency official's compliance with Section 106. The agency official then must ensure that the undertaking is carried out in accordance with the agreement.

A Programmatic Agreement (PA) was pursued and drafted during the Section 106 consultation process. The Rescinded FEIS included that PA (see appendix O, which had the PA, of the January 2021 Rescinded FEIS). All signatories, other than the ACHP, had signed the PA as of January 15, 2021. On February 11, 2021, the ACHP notified the Forest Service that the "ACHP believes that further consultation in this case would be unproductive and therefore, we are hereby terminating consultation pursuant to 36 CFR § 800.7(a)(4)." In accordance with 36 Code of Federal Regulations (CFR) 800.7(c)(4), the Secretary of Agriculture will deliver a written response to the ACHP, and that response will conclude the Section 106 process for this undertaking.

Since the ACHP did not sign the PA, it was never executed. Therefore, mitigation measures identified in the PA and any others identified subsequently will now be implemented through the final ROD and special use permit for use of NFS lands, and through enforcement by other State and Federal agencies as well as third parties in separate agreements. Appendix O formerly contained the PA but has now been removed from the FEIS. Changes in enforcement of the measures described in the draft PA are further described in appendix J.

[5] The changes or lack of changes since the January 2021 Rescinded FEIS are consistently identified in a section called "Changes from the January 2021 Rescinded FEIS," which can be found in chapter 2, each resource section of chapter 3, and chapter 4. The changes themselves are not otherwise marked in the document.

1.1.3.2 Reinitiation of Tribal Consultation

As noted above, one reason for the March 2021 withdrawal of the Notice of Availability and rescinding of the January 2021 FEIS was to allow the Forest Service to re-engage with consulting Tribes to fully understand their concerns. On September 20, 2021, the Forest Service notified Tribes that the Forest Service would reinitiate Tribal consultation. This was followed by a Tribal listening session on October 19, 2021, and subsequent consultation and staff meetings thereafter. The reinitiated Tribal consultation has informed the republished FEIS.

1.1.3.3 Updates to Cumulative Effects

The passage of time since publication of the January 2021 Rescinded FEIS has resulted in changes to a number of cumulative effects. Chapter 4 has been updated accordingly.

1.1.3.4 Changed Conditions in the Project Area

The passage of time since publication of the January 2021 Rescinded FEIS has resulted in some changes to the affected environment. This includes the Telegraph Fire, which burned large portions of the project area in June 2021, and worsening drought conditions in the Colorado River basin (discussed in Chapter 4, Cumulative Effects).

1.1.3.5 Litigation Outcomes

In January 2021, multiple lawsuits were filed against the Forest Service with respect to the publication of the FEIS and the subsequent Congressionally mandated trigger of the land exchange. In February 2021, the district court issued a decision on one of these cases—Apache Stronghold v. United States (CV-21-00050-PHX-SPL)—denying a temporary restraining order and preliminary injunction. The Apache Stronghold case was appealed to the Ninth Circuit. Meanwhile, the consolidated cases were stayed in district court in May 2021. A three-judge panel of the Ninth Circuit upheld the district court ruling on the Apache Stronghold case in June 2022. In November 2022, the three-judge ruling was vacated, and the case was ordered to be heard en banc by the Ninth Circuit. The en banc hearing occurred in March 2023, and a ruling was issued in May 2024 in which the en banc court affirmed the district court ruling denying an injunction. Based on the legal framework established to date in the Apache Stronghold case, no changes have been made to the NEPA analysis or approach.

In other litigation, since January 2021 several court decisions (Ctr. for Biological Diversity v. USFWS, No. 19-17585, 9th Cir., 2022; Great Basin Resource Watch v. U.S. Department of the Interior and Eureka Moly, LLC, No. 3:19-cv-00661-LRH-CSD, 2023 (Eureka Moly); and Bartell Ranch LLC v. Ester M. McCullough, No. 3:21-cv-00080-MMD-CLB, 2023 (Thacker Pass)) have been rendered with respect to the “Rosemont ruling,” which has ramifications on the Resolution Copper Project. In 2007, the Rosemont Copper Project was proposed to be developed on the Coronado National Forest. The open-pit copper mine included placement of waste material on nearby NFS lands on which unpatented mining claims were held by the mine proponent. Litigation was filed after the final ROD was issued in June 2017. In 2019, the district court granted summary judgment to plaintiffs vacating the FEIS and ROD on the grounds that the Forest Service’s decision was inconsistent with the General Mining Act of 1872 (herein called the Mining Law) and other Federal mining statutes, specifically with the right to place waste materials on the claims without determining the validity that those claims held a valuable mineral deposit. The decision from the district court was appealed to the Ninth Circuit Court of Appeals in February 2021. On May 12, 2022, the Circuit Court upheld the Arizona District Court’s decision. In February 2023, an additional ruling on the Thacker Pass case used the Rosemont precedent, as did an additional ruling on the Eureka Moly case in March 2023. The intersection of these legal cases with the Resolution Copper Project alternatives is described in the republished FEIS in Section 3.2, Geology, in the subsection titled “Ramifications of the Rosemont Copper Ruling.”

1.1.3.6 Status of CEQ Regulations

In January 2025, Executive Order 14154 was issued, directing the CEQ to propose rescinding CEQ's NEPA regulations found at 40 CFR 1500 et. seq. In February 2025, CEQ published an interim final rule removing CEQ regulations from the Code of Federal Regulations. The Forest Service NEPA implementing regulations are found at 36 CFR Part 220 and remain in effect.

1.1.3.7 Updated Consistency Review for Amendment of New Forest Plan

The Resolution Copper Project DEIS and January 2021 Rescinded FEIS indicated that Alternatives 2, 3, and 4 would require amendment of the 1985 "Tonto National Forest Land and Resource Management Plan" (U.S. Forest Service 1985b). The forest plan consistency review was revised after the 2023 "Tonto National Forest Land Management Plan" (forest plan) was implemented in December 2023 (SWCA Environmental Consultants 2025). The revised consistency review indicated that a multi-component project-specific amendment of the 2023 forest plan would be needed with each of the action alternatives presented in the FEIS, Alternatives 2 through 6. Details of the amendment and exception of plan components are included in chapter 2, each resource section of chapter 3, and appendix T (for the preferred alternative) and are summarized in table 1.4.3-1.

1.2 Background

The area around Superior, Arizona, has a long mining history, starting with sporadic production of silver and gold from claims in the 1870s. The Silver King Mine, a few miles north of Superior, was the richest silver mine in Arizona, producing over 6 million dollars' worth of silver between 1877 and 1886. In 1902, George Lobb, Sr., a former level boss at the Silver King Mine, sold his group of claims to the Lake Superior and Arizona Mining Company and laid out the townsite, which was named Superior. Later, William Boyce Thompson acquired the former Silver Queen mining property and organized the Magma Copper Company in 1910. The merger of Lobb's Golden Eagle claims with Thompson's Silver Queen claims allowed development of the Magma Copper Company mine. The original concentrator was built in 1914, and in 1915, the Magma Arizona Railroad went into operation to transport high-grade ore and concentrates to connect with the Phoenix & Eastern Railroad near Webster (later Magma Junction) and on to a smelter in Hayden. By 1920, the mine had increased in size and production to support construction of a smelter in Superior. The smelter began operating in 1924, including a roaster plant and a 300-foot stack. The highway through Queen Creek Gorge, providing direct travel between Superior and Globe, was completed by the Arizona Highways Department at about the same time.

The Magma Mine boomed in the late 1920s, producing more than 40 million pounds of copper in 1929. The Magma Mine survived the Great Depression on reduced workers' hours but returned to full production during World War II. Dewatering of the mine workings was required to allow access and production from the deeper underground shafts. Superior became one corner of Arizona's "Copper Triangle"—which stretched between the towns of Superior and Globe/Miami to the north and Hayden/Winkelman to the southeast—and which is the general location of more than 30 historical and active copper mines (figure 1.2-1). Mines and smelters in the area included ASARCO's Ray Mine, the Hayden Smelter, the Christmas Mine north of Winkelman, and a number of large open-pit mines in the Globe/Miami area (see figure 1.2-1).

The Magma Mine operated consistently until copper prices fell in the 1980s but reopened in the late 1980s before closing for good in 1996. In addition to substantial surface facilities in Superior, the Magma Mine left approximately 220,000 feet (42 miles) of underground workings.

Exploration from those underground workings led to the discovery of the Resolution deposit—deeper than the historic Magma Mine and a few miles south. The Resolution deposit is not exposed at the surface but lies between 4,500 and 7,000 feet below the surface. Existing workings from the Magma Mine have been repurposed to allow exploration of and access to the copper deposit.

According to the available geological data, the ore body is one of the largest undeveloped copper deposits in the world with an estimated copper resource of 1.787 billion metric tonnes at an average grade of 1.54 percent copper. Additional strategic and critical materials such as rhenium, tellurium, indium, arsenic, and bismuth could also be recovered economically (Strauss 2022).

The portion of the copper deposit explored to date is located primarily on NFS lands. The ore body likely extends underneath a 760-acre area of NFS land identified in PL 113-291 as the “Oak Flat Withdrawal Area.” The Oak Flat Withdrawal Area was withdrawn from mineral entry in 1955 by Public Land Order 1229; consequently, the GPO does not propose to extract minerals from or conduct mining operations on these lands.

However, for more than 10 years, Resolution Copper pursued a land exchange to acquire adjacent lands northeast of the copper deposit. In December 2014, Congress authorized a land exchange pending completion of the EIS; the exchange parcel to be conveyed to Resolution Copper includes not only the Oak Flat Withdrawal Area but also the NFS lands above which the copper deposit is located. This collective 2,422-acre area of land is known as the “Oak Flat Federal Parcel.”

The land ownership of the project area includes surface land administered by the Forest Service or BLM with Resolution Copper–controlled unpatented mining and/or mill site claims; Resolution Copper–owned private land; lands where Resolution Copper controls the patented mining claims; as well as lands with unpatented lode claims not controlled by Resolution Copper. Additional information on claims can be found in section 3.2.3.2.

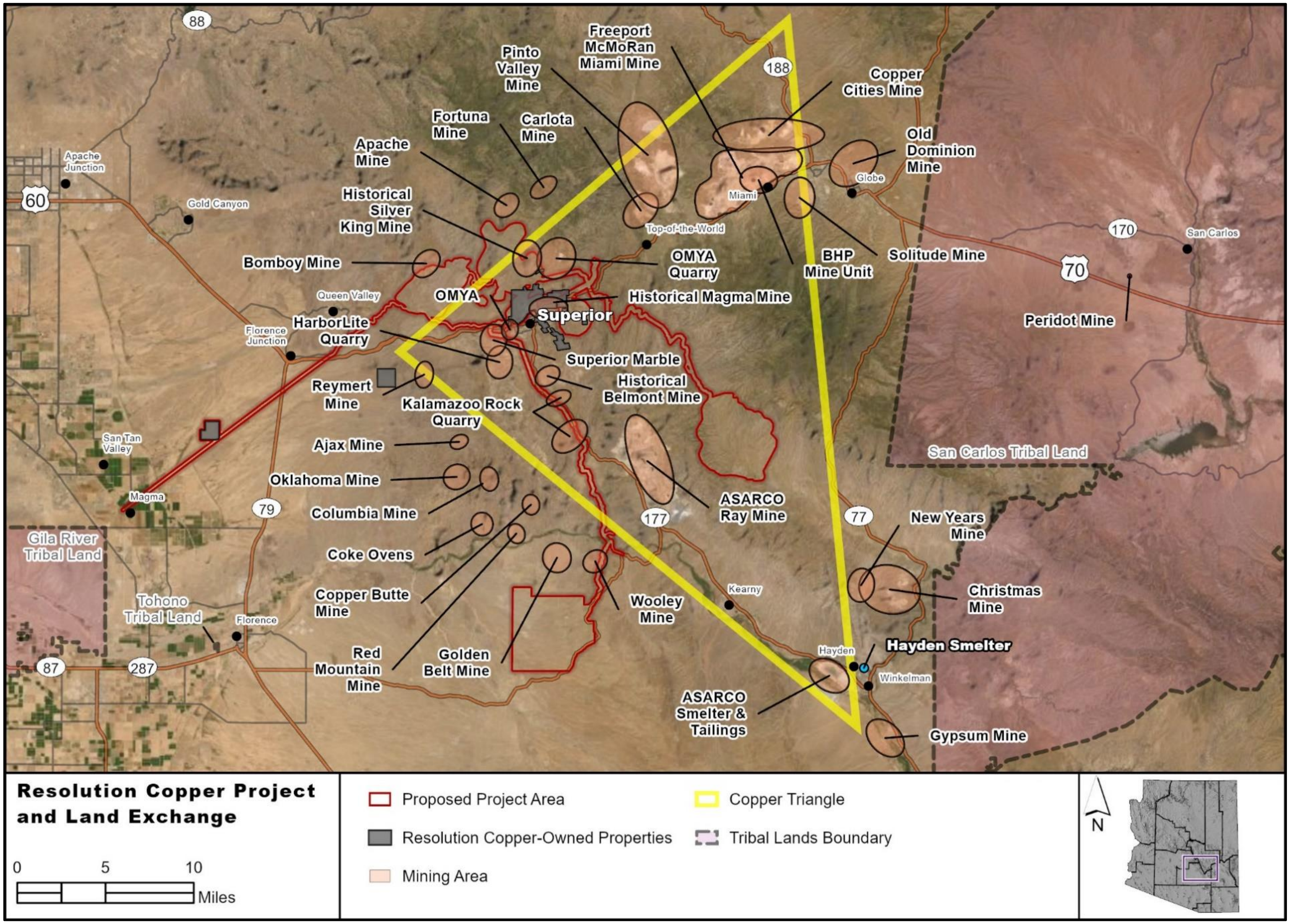


Figure 1.2-1. The Copper Triangle map

The land surface overlying the copper deposit is located in an area that has a long history of use by Native Americans, including the Apache, O'odham, Puebloan, and Yavapai people currently represented by the following federally recognized Tribes: Fort McDowell Yavapai Nation, Gila River Indian Community, Hopi Tribe, Mescalero Apache Tribe, Pueblo of Zuni, Salt River Pima-Maricopa Indian Community, San Carlos Apache Tribe, Tonto Apache Tribe, White Mountain Apache Tribe, Yavapai-Apache Nation, and Yavapai-Prescott Indian Tribe. The Forest Service maintains formal and informal consultations with these Tribes and other interested and affected parties to better understand the historical, cultural, and religious importance of the area.

1.3 Purpose of and Need for Action

The purpose of and need for this project is twofold:

1. To consider approval of a proposed mine plan governing surface disturbance on NFS lands outside of the exchange parcels from mining operations that are reasonably incident to extraction, transportation, and processing of copper and molybdenum.
2. To disclose the effects of the exchange of lands between Resolution Copper and the United States as directed by Section 3003 of PL 113-291.

The role of the Forest Service under its primary authorities in the Organic Administration Act, Locatable Minerals Regulations (36 CFR 228 Subpart A), and the Multiple-Use Mining Act is to ensure that mining activities minimize adverse environmental effects on NFS surface resources and comply with all applicable environmental laws. The Forest Service may also impose reasonable conditions to protect surface resources. Through the Mining and Mineral Policy Act, Congress has stated that it is the continuing policy of the Federal Government, in the national interest, to foster and encourage private enterprise in

- the development of economically sound and stable domestic mining, minerals, and metal and mineral reclamation industries; and
- the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help ensure satisfaction of industrial, security, and environmental needs.

The Southeast Arizona Land Exchange and Conservation Act was included in a large public lands package containing 68 bills which was amended to the NDAA during the 113th Congress. The NDAA was signed into law by President Obama on December 19, 2014. Under the Southeast Arizona Land Exchange and Conservation Act, Resolution Copper would receive Federal land at the site of the future underground copper mine in exchange for privately owned conservation and recreation lands throughout Arizona after the completion of a FEIS. While the mine itself would be located on private land after the exchange is completed, ancillary mining operations would need to occur on NFS land, and possibly other Federal and non-Federal land, outside the exchange parcel.

1.4 Proposed Action

The proposed action consists of (1) approval of a mining plan of operations on NFS land associated with a proposed large-scale mine, which would be on private land after the land exchange, (2) the land exchange between Resolution Copper and the United States as directed under PL 113-291, (3) a project-specific amendment of the forest plan, if needed, and (4) mitigations to offset impacts from the proposed project.

It should be noted that the proposed action is one of several alternatives considered in the EIS.
The proposed action should not be confused with the preferred alternative. The preferred alternative is identified in the executive summary and chapter 2 and is the agency's preference for implementation

based on the alternatives evaluated and the current analysis. See the executive summary and chapter 2 for details about the differences between the proposed action and the alternatives, including the preferred alternative.

1.4.1 General Plan of Operations

The following is a brief summary of the mining proposal components. A detailed description of the GPO can be found in section 2.2.2.2. The complete GPO is available on the project website, www.ResolutionMineEIS.us.

Resolution Copper proposes to conduct underground mining of a copper-molybdenum deposit located 4,500 to 7,000 feet below the ground surface within the exchange parcel. Resolution Copper estimates that the mine would take approximately 10 years to construct, would have an operational life of approximately 41 years, and would be followed by 5 to 10 years of reclamation activities.

The mining operation would include the following facilities and activities analyzed in the EIS, which would be conducted on a mixture of NFS, private, and State lands:

- The mining itself would take place under the Oak Flat Federal Parcel, which is to be transferred to Resolution Copper pursuant to Section 3003 of PL 113-291. Mining would use an underground mining technique known as panel caving. Resolution Copper would use this process to construct a network of shafts and tunnels below the ore body. They would access the tunnels from vertical shafts in an area known as the East Plant Site. The panel caving technique fractures ore with explosives; gravity moves the ore downward, and then Resolution Copper removes it from below the ore deposit. As the ore moves downward and is removed, the land surface above the ore body also moves downward or "subsides." Analysts expect a "subsidence" zone to develop near the East Plant Site; there is potential for downward movement to a depth between 800 and 1,115 feet. Resolution Copper projects the subsidence area to be up to 1.8 miles wide at the surface. Note that after the land exchange takes place and the Oak Flat Federal Parcel is privately held, no mining takes place beneath NFS land, only beneath private land.
- An area known as the East Plant Site would be developed adjacent to the Oak Flat Federal Parcel. The East Plant Site is the location of the Magma Mine #9 Shaft and #10 Shaft and associated surface mining support facilities. This area would include mine shafts and a variety of surface facilities to support mining operations. This area currently contains two operating mine shafts, a mine administration building, and other mining infrastructure. Existing roads would provide access to the mine. Magma Mine Road would eventually be relocated as a result of the expected subsidence.[6]
- Resolution Copper would crush the mined ore underground and then transport it underground approximately 2.5 miles west to an area known as the West Plant Site. There, operations would process the ore to produce copper and molybdenum concentrates. The West Plant Site is the location of the old Magma Mine processing and smelter facilities in Superior. Portions of the West Plant Site would be located on NFS lands and would be subject to Forest Service regulatory jurisdiction. A flotation process would process the ore; no heap leach processing is proposed.
- The molybdenum concentrate would then be dried, bagged, and transported to market from the West Plant Site.
- Resolution Copper would then pump the copper concentrate as a slurry through a 22-mile-long pipeline to a filter plant and loadout facility located near Magma Junction near San Tan Valley,

[6] A full description of subsidence can be found in section 2.2.2.2.

Arizona. They would then filter the copper concentrate and send it to off-site smelters via rail cars or trucks.

- The copper concentrate slurry pipeline corridor would be located along an existing, previously disturbed right-of-way known as the Magma Arizona Railroad Company (MARRCO) corridor. The MARRCO corridor would also host other mine infrastructure, including water pipelines, power lines, pump stations, and a number of wells for groundwater pumping and recovery of banked Central Arizona Project (CAP) water. A portion of the MARRCO corridor is located on NFS, Arizona State Land Department (ASLD), and private lands and would be subject to corresponding regulatory jurisdiction.
- Several pipelines would transport the tailings as slurry produced at the West Plant Site for 4.7 miles to a tailings storage facility. The tailings storage facility would gradually expand over time and eventually reach about 4,900 acres in size. The proposed tailings storage facility is on NFS lands and would be subject to Forest Service regulatory jurisdiction.
- The Salt River Project (SRP) would supply all power to the mine. Portions of the proposed electrical infrastructure would be on NFS land and would be subject to Forest Service regulatory jurisdiction. The Forest Service can approve SRP's construction and operation of new power lines on NFS lands by either a special use permit or as part of the GPO. As analyzed in the EIS, access to the power lines would use existing roads.[7]
- Reclamation would be conducted to achieve post-closure land use objectives, including closing and sealing the mine shafts, removing surface facilities and infrastructure, and establishing self-sustaining vegetative communities using local species. The proposed tailings storage facility would be reclaimed in place, providing for permanent storage of mine tailings. A bond conditioned on compliance is required prior to approval of a mining plan of operations. In determining the amount of the bond, consideration would be given to the estimated cost of stabilizing, rehabilitating, and reclaiming the area of operations.
- Water for the process would come from a variety of sources. Resolution Copper would recycle (1) filtrate from the filter plant, (2) reclaimed water from the tailings storage facility, and (3) recovered water from the concentrator complex, back into the mining process. They would obtain additional water from dewatering of the mine workings, possible direct delivery of CAP water, and pumping of water from a well field along the MARRCO corridor.[8] The State of Arizona would authorize the water pumped from the well field either as recovered water from long-term storage credits or as groundwater under a mineral extraction withdrawal permit or other appropriate groundwater right.

All of the above components are considered connected actions to the Resolution Copper Mine proposal and are fully analyzed in the FEIS. Two additional components were considered conceptually in the DEIS, and now are incorporated explicitly into the mine footprint in the FEIS:

- Compensatory mitigation lands that have been developed as part of the CWA Section 404 permitting process, under the jurisdiction of the USACE. The FEIS considers all activities that are associated with these mitigations.

---

7 Note that the analysis conducted by the Forest Service is only one step in the process of permitting the power line. For all power lines 115 kilovolts or greater, SRP would still need to undertake the process of obtaining a Certificate of Environmental Compatibility from the Arizona Corporation Commission, regardless of the Forest Service decision.

8 While portions of the MARRCO corridor cross NFS land, these wells are located off of NFS land in the East Salt River valley. This is described further in chapter 2.

- Mitigations for lost recreation opportunities associated with the loss of Oak Flat from Federal jurisdiction, including a number of new motorized and non-motorized travel routes on NFS land. The FEIS considers all impacts from any areas associated with the construction and use of these new routes.

Several specific actions raised in public comments are not considered connected actions to the project. These include the following:

- Exploration, characterization, and monitoring activities undertaken by Resolution Copper previously authorized by the Tonto National Forest. These include an approval for prefeasibility activities largely on Oak Flat (approved in May 2010 after preparation of an environmental assessment), and baseline hydrogeologic and geotechnical characterization activities largely at the Near West tailings storage facility location (approved in August 2016 after preparation of an environmental assessment). While not connected actions, these two actions were brought forward for consideration in the cumulative effects analysis.
- Power use by the mine is disclosed in the EIS but specific impacts from off-site generation of that power cannot be analyzed without knowing the exact location and type of power generation; identifying such aspects is speculative at this time. The exception is estimation of greenhouse gas production. The specific location of generation is not necessary to estimate greenhouse gas production.
- Post-sale delivery, smelting, and use of copper or molybdenum concentrates similarly cannot be analyzed without knowing the transport route or end location. The use of trucks to transport molybdenum concentrate from the West Plant Site is incorporated into the EIS analysis for those highways and routes in the immediate vicinity of the mine; movement beyond these routes is speculative at this time. The delivery of concentrate from the filter plant and loadout facility to the railhead near Magma Junction is incorporated into the EIS analysis; movement beyond this point is speculative at this time. Similar to power use, the exception is estimation of greenhouse gas production. The specific transport routes are not necessary to estimate greenhouse gas production.

1.4.2 Land Exchange

Following Section 3003 of PL 113-291, the Federal Government would convey 2,422 acres of specified NFS lands at Oak Flat to Resolution Copper if Resolution Copper offers to convey 5,460 acres[9] of private lands to the United States. Table 1.4.2-1 provides a brief summary of the land exchange parcels. A detailed description of the land exchange parcels can be found in section 2.2.2.1 and appendix B. The complete text of Section 3003 of PL 113-291 is provided in appendix A.

Note that the acreages shown in this section are those offered by Resolution Copper to the Federal Government, after completion of surveys and at the time of this publication. Ultimately, the Federal Government may not accept all portions of these lands. The exact parcels and acreage have been assessed through the land appraisal process; summaries of the appraisals for each parcel were publicly released by the Forest Service on April 22, 2025.

9 Resolution Copper increased the offered parcel of 5,344 acres by an additional 116 acres of privately held land. See table 1.4.2-1.

Table 1.4.2-1. Summary of land exchange parcels

Parcel Land Ownership	Description of Parcels to Be Exchanged
Parcels transferred from the United States to Resolution Copper	• 2,422 acres near Superior in Pinal County, Arizona, known as the **Oak Flat Federal Parcel**, to become private lands
Parcels transferred from Resolution Copper to the Secretary of Agriculture, for land to be administered by the Forest Service	• 140 acres* near Superior in Pinal County, Arizona, known as the **Apache Leap South End Parcel**, to be administered by the Tonto National Forest • 148 acres in Yavapai County, Arizona, known as the **Tangle Creek Parcel**, to be administered by the Tonto National Forest • 147 acres in Gila County, Arizona, known as the **Turkey Creek Parcel**, to be administered by the Tonto National Forest • 149 acres near Cave Creek in Maricopa County, Arizona, known as the **Cave Creek Parcel**, to be administered by the Tonto National Forest • 640 acres north of Payson in Coconino County, Arizona, known as the **East Clear Creek Parcel**, to be administered by the Coconino National Forest
Parcels transferred from Resolution Copper to the Secretary of the Interior, for land to be administered by the BLM	• 3,120 acres† near Mammoth in Pinal County, Arizona, known as the **Lower San Pedro River Parcel**, to be administered by the BLM as part of the San Pedro Riparian National Conservation Area • 956 acres† south of Elgin in Santa Cruz County, Arizona, known as the **Appleton Ranch Parcel**, to be administered by the BLM as part of the Las Cienegas National Conservation Area • 160 acres near Kearny in Gila and Pinal Counties, Arizona, known as the **Dripping Springs Parcel**, to be administered by the BLM

* Resolution Copper increased the offered parcel by an additional 32 acres. In addition, minor map revisions were made of privately held land adjacent to the 110 acres presented in PL 113-291 as part of the Apache Leap Special Management Area. The additional land was provided to allow for a more contiguous parcel to mitigate for Tribal and cultural values as part of mitigation RV-CR-04 (see appendix J) and for ease of surveying.

† Final cadastral surveys were completed on the Lower San Pedro River Parcel and the Appleton Ranch Parcel, resulting in additional private acres' being transferred to Federal ownership.

1.4.2.1 Appraisal

The exchange of Federal lands is subject to a formal appraisal for all tracts of land included in an exchange. Additionally, PL 113-291 requires that exchanged private lands be of equal value to the Federal lands. PL 113-291 requires the joint selection of an appraiser who is determined by both parties (the Federal Government and Resolution Copper) to be qualified to complete appraisals supporting the exchange. The appraisals are completed under the direction of the Forest Service.

If an appraisal indicates that the value of the Federal lands exceeds the value of the private lands, Resolution Copper must either provide more private land or provide cash to the Federal Government to make up the difference. If a cash payment is used to equalize the values, that money would be placed in a special account to be used for acquisition of additional NFS land in Arizona or New Mexico.
An additional provision of PL 113-291 requires Resolution Copper to make annual payments to the Federal Government during mine production in the event that the appraisal undervalues the copper resource on the lands Resolution Copper is acquiring.

1.4.2.2 Town of Superior Exchange Lands

An additional condition of PL 113-291 calls for the United States to transfer several parcels to the Town of Superior, Arizona, if the Town of Superior requests it. The Forest Service–administered lands to be conveyed to the Town of Superior include a 30-acre parcel known as Fairview Cemetery and 250 acres contained in four parcels known as the Superior Airport Contiguous Parcels. In addition, the Town of Superior lands include a Federal reversionary interest to a 265-acre Superior Airport Parcel. The Superior Airport Parcel originally was owned by the Federal Government, then deeded to Pinal County, and subsequently conveyed to the Town of Superior with the condition that it could only be used as an airstrip. Any other use would cause the property to revert to Federal land (the reversionary interest).
As part of the land exchange, the Federal reversionary interest would be removed, after which time the

parcel could be used for non-airport purposes. On October 15, 2021, the Town of Superior requested to purchase the Superior Airport Contiguous Parcels and the Federal reversionary interest to the 265-acre Superior Airport Parcel. On March 25, 2022, the Town updated its request to purchase to include the 30-acre parcel known as Fairview Cemetery. The direction in PL 113-291 that requires that a single EIS be prepared is specific to "all decisions under Federal law related to the proposed mine and the Resolution mine plan of operations." The Town of Superior land exchange is not directly related to the proposed mine, would be subject to separate analysis under NEPA, and is not considered to be a connected action to the Resolution Copper Project. In June 2024, the BLM published Public Land Order No. 7943, withdrawing the Town of Superior exchange lands from location and entry under U.S. mining laws (Bureau of Land Management 2024; U.S. Forest Service 2024b).

1.4.3 Forest Plan Amendment

The Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976 (NFMA), requires national forests to be managed under the land and resource management plan (land management plan or forest plan). The NFMA requires proposed projects, such as the Resolution Copper Project, to be consistent with a land management plan of the national forest on which the project occurs. A forest plan applies to only those lands within the NFS (U.S. Forest Service 2023d:15).

When a proposed project is not consistent with applicable components contained within the forest plan, the Forest Service has the following options: (1) modify the proposed project to make it consistent with the applicable plan; (2) reject the proposal; (3) amend the plan so that the project would be consistent with the plan as amended; or (4) amend the plan contemporaneously with the approval of the project so the project would be consistent with the plan as amended (U.S. Forest Service 2023d:22). The fourth option may be limited to only the project.

A consistency review between the Resolution Copper Project action alternatives (Alternatives 2 through 6) and the 2023 "Tonto National Forest Land Management Plan" (forest plan) indicates that approval and eventual implementation of any of the action alternatives would result in changed conditions that are inconsistent with existing forest plan direction. Approval of an alternative action would therefore require a project-specific forest plan amendment that would except a number of forest plan components, i.e., desired conditions and guidelines. The necessary forest plan amendment would be narrow in scope and scale, i.e., limited to the project area and actions; and limited to the substantive rule provisions at 36 CFR 219.13(b)(5) that are directly related to the amendment.

A review of all components of the 2023 forest plan was conducted to identify the need for amendment due to the effects of the project. Specific findings on the effects of the forest plan amendment are summarized under the environmental consequences section for each resource in chapter 3. Information specific to more than 600 forest plan components reviewed are detailed in SWCA Environmental Consultants (2025).

Summarily, the outcomes of the 2023 forest plan consistency review indicate that a multi-component project-specific amendment would be necessary if any of the action alternatives become the selected alternative in the project decision. While the forest plan components included in an amendment differ by alternative, they generally include forest plan components intended to protect soil productivity, scenic resources, national scenic trails, recreation resources, wildlife habitat, and cultural resources.

Each of the Resolution Copper Project action alternatives would include a multicomponent project-specific amendment to the forest plan so that the project would be consistent with the forest plan. The forest plan would be amended contemporaneously with approval of the project. The proposed project-specific amendment would differ by alternative, as described in chapters 2 and 3 and summarized in table 1.4.3-1.

The proposed amendment would be limited to apply only to this project. Only the selected alternative for the Resolution Copper Project would be excepted from the specific current plan desired conditions and guidelines included in the amendment, which would allow the project to be consistent with the amended forest plan. All other desired conditions, objectives, standards and guidelines would remain unexcepted and applicable to all other projects and activities across the Tonto National Forest. The selected alternative for the Resolution Copper Project would be excepted from complying with the desired conditions and guidelines contained in the amendment on the area of the Tonto National Forest where impacts would occur. Refer to appendix T of this FEIS for more detailed information on the proposed project-specific amendment for the preferred alternative.

Table 1.4.3-1. Multiple-component project-specific amendment to the 2023 "Tonto National Forest Land Management Plan" for the Resolution Copper Project

Forest Plan Component*	Alternatives Not Consistent†			
	2/3	4	5	6
Recreation Guideline 10 (REC-G-10) (forest plan, p. 31)	X	X	X	X
Wildlife Related Recreation Guideline 03 (REC-WR-G-03) (forest plan, p. 44)	X	X	X	X
Cultural and Historic Resources Desired Condition 01 (CUH-DC-01) (forest plan, p. 55)	X	X	X	X
Cultural and Historic Resources Desired Condition 02 (CUH-DC-02) (forest plan, p. 55)	X	X	X	X
Cultural and Historic Resources Desired Condition 07 (CUH-DC-07) (forest plan, p. 55)	X	X	X	X
Scenery Desired Condition 03 (SC-DC-03) (forest plan, p. 67)	X	X	X	X
Scenery Guideline 01 (SC-G-01) (forest plan, p. 67)	X	X	X	X
Scenery Guideline 03 (SC-G-03) (forest plan, p. 67)	X	X	X	X
Riparian Areas, Seeps, Spring, Wetlands, and Riparian Management Zones Desired Condition 01 (RMZ-DC-01) (forest plan, p. 135)	X	X		
Riparian Areas, Seeps, Spring, Wetlands, and Riparian Management Zones Desired Condition 02 (RMZ-DC-02) (forest plan, p. 135)	X	X		
Riparian Areas, Seeps, Spring, Wetlands, and Riparian Management Zones Desired Condition 03 (RMZ-DC-03) (forest plan, p. 135)	X	X		
Riparian Areas, Seeps, Spring, Wetlands, and Riparian Management Zones Desired Condition 06 (RMZ-DC-06) (forest plan, p. 135)	X	X		
Riparian Areas, Seeps, Spring, Wetlands, and Riparian Management Zones Desired Condition 07 (RMZ-DC-07) (forest plan, p. 135)	X	X		
Riparian Areas, Seeps, Spring, Wetlands, and Riparian Management Zones Desired Condition 08 (RMZ-DC-08) (forest plan, p. 135)	X	X		
Riparian Areas, Seeps, Spring, Wetlands, and Riparian Management Zones Desired Condition 09 (RMZ-DC-09) (forest plan, p. 135)	X	X		
Riparian Areas, Seeps, Spring, Wetlands, and Riparian Management Zones Guideline 05 (RMZ-G-05) (forest plan, p. 136)	X	X		
Wildlife, Fish, and Plants Guideline 06 (WFP-G-06) (forest plan, p. 142)	X	X	X	X
Wildlife, Fish, and Plants Guideline 07 (WFP-G-07) (forest plan, p. 142)	X	X	X	X
Soils Guideline 02 (SL-G-02) (forest plan, p. 147)	X	X	X	X
National Trails Management Area Desired Condition 03 (NTMA-DC-03) (forest plan, p. 182)	X	X	X	X
National Trails Management Area Desired Condition 06 (NTMA-DC-06) (forest plan, p. 182)	X	X	X	X
National Trails Management Area Desired Condition 07 (NTMA-DC-07) (forest plan, p. 182)	X	X	X	X

Forest Plan Component*	Alternatives Not Consistent†			
	2/3	4	5	6
National Trails Management Area Guideline 01 (NTMA-G-01) (forest plan, p. 182)	X	X	X	X
National Trails Management Area Guideline 02 (NTMA-G-02) (forest plan, p. 183)		X		
National Trails Management Area Guideline 08 (NTMA-G-08) (forest plan, p. 183)	X	X	X	X

* The wording is abridged from the full wording in the forest plan.

† Alternatives that are not consistent with a forest plan component are marked with an X and shaded. Alternatives without shading and an X are consistent with the forest plan component.

1.5 Decision Framework

Given the purpose and need, the deciding official(s) reviews the proposed action, the other alternatives, and the environmental consequences in order to make the following decisions.

1.5.1 Forest Service

As the lead agency tasked with completion of a single EIS, the Forest Service has management responsibility for the following:

- The NFS lands that would be affected by the proposed GPO or special use authorization
- Executing the land exchange that was mandated by Congress
- Approve necessary amendments to the forest plan (see section 1.4.3).

1.5.1.1 General Plan of Operations or Special Use Authorization

The Forest Supervisor, Tonto National Forest, is the deciding official and has discretion to determine whether changes in the proposed GPO would be required prior to approval, or would decide to authorize a special use for the project.

For the action alternatives in the Resolution Copper Project FEIS, determination of appropriate regulations under which actions can be permitted on Federal lands depends on a number of specific details of the alternative in question. These include consideration of whether the mine itself (mineral extraction facilities) is located wholly or partially on Federal land or non-Federal land. The land exchange directed in Section 3003 of PL 113-291 is a factor as well. Section 1.5.5. summarizes the agencies or authorities that would regulate the various aspects of the mine, under different alternatives and scenarios.

If the land exchange is completed as specified in Section 3003 of PL 113-291, the entire Resolution mine (mineral extraction facilities) would be located on private land. Forest Service mining regulations at 36 CFR 228 Subpart A apply to operations conducted under the Mining Law (36 CFR 228.2). Mining operations that take place entirely on non-Federal lands are private mining operations, not operations under the Mining Law. Therefore, any associated uses of NFS land such as roads, pipelines, and utilities are managed as special uses and regulated under 36 CFR 251.50.

If the land exchange does not occur, most of the mineral extraction facilities (East Plant Site) would be located on private land; however, much of the ore body being mined would be under NFS lands, and an access road to the East Plant Site and the subsidence area (surrounded by a fence to prevent people from entering) also would be on NFS land. Where mineral extraction occurs on NFS land (or on both non-Federal and NFS lands in one integrated operation), these mining operations on NFS land are conducted under the Mining Law. Regulations at 36 CFR 228 Subpart A apply.

Another factor that could influence the appropriate regulations under which actions would be permitted on Federal lands is whether Resolution Copper holds mill site claims. The Mining Law allows for location of mill sites, which can be used for tailings and waste disposal on NFS land under certain circumstances. Mill sites do not necessarily have to be associated with mineral extraction on NFS lands or any Federal land. Operations on qualifying mill sites on NFS land are operations under the Mining Law and are covered by regulations at 36 CFR 228 Subpart A.

It is unknown whether the land exchange will occur as described in Section 3003 of PL 113-291 until the appraisal is complete, reviewed, and accepted, and Resolution Copper has accepted or rejected the exchange. It is unknown whether Resolution Copper plans to convert any of its mineral claims to mill site claims for the purpose of placing tailings on NFS or other Federal lands. These factors must be known before the Forest Service and other Federal land management agencies can determine what regulations are appropriate to use for permitting actions on their lands. These factors also must be known before we issue a final ROD. The final ROD will describe the regulations used to permit actions on Federal lands that are contained in the selected alternative.

Forest Service Process under Mining Law

Regulations that govern the use of surface resources in conjunction with mining operations on NFS lands are set forth under 36 CFR 228 Subpart A. These regulations require that the Forest Service respond to parties who submit proposed plans to conduct mining operations on or otherwise use NFS lands in conjunction with mining. Compliance with other laws and regulations, such as State of Arizona water and air regulations, the ESA, CWA, and NHPA, also frames the proposed mining activities.

After considering the state of land exchange at the time the final ROD is issued, and the alternative tailings location selected by the Forest Supervisor, if either the mine or tailings were located on NFS lands, then the Forest Supervisor would proceed according to Mining Law.

The Forest Supervisor would use analysis in this EIS along with supporting documentation to make the following decisions regarding the proposed GPO:

1. Approve the proposed GPO submitted by Resolution Copper or require changes or additions to the proposed GPO to meet the requirements for environmental protection and reclamation set forth at 36 CFR 228 Subpart A before approving a final GPO. The Forest Service decision may be to authorize use of the surface of NFS lands in connection with mining operations under the GPO composed of elements from one or more of the alternatives considered. The alternative(s) that is/are selected for approval in the final ROD must minimize adverse impacts on NFS surface resources to the extent feasible.
2. Whether to approve project-specific amendments to the forest plan, which may be required to approve the final GPO.
3. Whether to approve a special use permit for SRP to authorize construction and operation of power lines on NFS lands.

The Forest Supervisor would then release a draft ROD that would address these three decisions. The draft ROD would be subject to 36 CFR 218, “Project-Level Pre-decisional Administrative Review Process.”

Once objections to the draft ROD are resolved, the Forest Supervisor would issue a final ROD. Resolution Copper may have an opportunity to appeal the decisions as set forth at 36 CFR 214, “Post-decisional Administrative Review Process for Occupancy and Use of National Forest System Lands and Resources.”

The remaining step would be approval of a final GPO, which may require Resolution Copper to modify the proposed GPO to align it with (1) the description of the selected alternative in the final ROD, and (2) changed conditions mandated by Section 3003 of PL 113-291. Additionally, the Forest Supervisor, Tonto National Forest, would require Resolution Copper to submit a reclamation bond or other financial assurance to ensure that NFS lands and resources involved with the mining operation are reclaimed in accordance with the approved GPO and Forest Service requirements for environmental protection (36 CFR 228.8 and 228.13). After the Forest Service has determined that the GPO conforms to the ROD and that the reclamation bond is acceptable, it would approve the GPO. Implementation of mining operations that affect NFS lands and resources may not commence until a plan of operations is approved and the reclamation bond or other financial assurance is in place.

Forest Service Process under Special Use Regulations

As described in chapter 2, the Forest Supervisor has identified Alternative 6 – Skunk Camp as the preferred alternative. This alternative is unique in that the tailings storage facility would be located on private lands (after eventual acquisition of Arizona State Trust land). If the land exchange occurs, then the mine, all processing facilities, and the tailings storage facility would be located off of NFS lands. The remaining portions of the project on NFS land would be roads, pipelines, and utilities. Any associated uses of NFS land such as roads, pipelines, and utilities are considered special uses and regulated under 36 CFR 251.50.

Rather than submittal of a GPO, authorization for a special use or occupancy of NFS lands requires submittal of a special use application (SF-299). This application process is designed to ensure that authorizations to use and occupy NFS lands are in the public interest (36 CFR 251, Subpart B). Once submitted, this application is subject to initial screening, in accordance with Forest Service Handbook (FSH) 2709.11.12.21 (U.S. Forest Service 2020b), to determine consistency with law, regulation, and policy, consistency with the forest plan, and consistency with other policies for use of NFS land. After completion of the initial screening, a secondary screening is undertaken, as detailed in FSH 2709.11.12.32 (U.S. Forest Service 2020b), to determine appropriateness of the special use and financial and technical capability. After processing and ensuring that appropriate processes are met, such as NEPA compliance, the Forest Supervisor would proceed to either approve or deny the application. The special use authorization would include terms and conditions (36 CFR 251.56), including minimizing damage to the environment, protecting the public interest, and requiring compliance with water and air quality standards.

Under the likelihood that the land exchange would occur and Alternative 6 would be selected, Resolution Copper submitted an SF-299 special use permit application for the tailings pipeline uses on September 7, 2020. Tonto National Forest staff carried out initial and secondary screenings and accepted the application on September 28, 2020 (U.S. Forest Service 2020d). Similarly, SRP submitted an SF-299 special use permit application for the transmission line uses on November 11, 2020. Tonto National Forest staff carried out initial and secondary screenings and accepted the application on November 18, 2020 (U.S. Forest Service 2020c). These applications are included as appendix Q of the FEIS.

1.5.1.2 Land Exchange

There are two types of land exchanges the Forest Service may undertake: administrative and legislative. The Forest Service is authorized to conduct land exchanges under the General Exchange Act of 1922, the Federal Land Exchange Facilitation Act of 1988, and the Federal Land Policy and Management Act (FLPMA) of 1976. These laws govern how these land exchanges—known as administrative exchanges—will occur. An administrative exchange is a discretionary decision on the part of the Forest Supervisor and would occur only after appropriate NEPA analysis and issuance of a final ROD.

Congress also can direct the Forest Service to exchange lands, which is known as a legislative land exchange. Section 3003 of PL 113-291 directs the Forest Service to undertake a legislative land exchange. With regard to the legislative land exchange, the Tonto National Forest Supervisor has no decision authority due to the constraints imposed by PL 113-291. The Forest Supervisor does have a responsibility to (1) address concerns of affected Indian Tribes and see mutually acceptable resolution of concerns with Resolution Copper; (2) ensure that title to the non-Federal lands offered in the exchange is acceptable in accordance with Section 3003(c)(2)(A) of PL 113-291; and (3) accept additional non-Federal land or a cash payment from Resolution Copper to the United States in the event that the final appraised value of the Federal land exceeds the value of the non-Federal land in accordance with Section 3003(c)(5)(B)(i) of PL 113-291.

Environmental effects resulting from the land exchange on private, State, and NFS lands are analyzed in the EIS. Although the Forest Service no longer would have regulatory jurisdiction for those lands, Resolution Copper would still be required to comply with applicable Federal and State environmental laws, which address air quality, hazardous waste management, mine safety, mine reclamation, and other aspects of the proposed mine.

In passing Section 3003 of PL 113-291, Congress specified the timing of the land exchange, tying it to the publication of the FEIS: “Not later than 60 days after the date of publication of the final environmental impact statement, the Secretary shall convey all right, title, and interest of the United States in and to the Federal land to Resolution Copper” (Section 3003(c)(10)). The ROD for this project does not include any decision related to the land exchange—it only includes decisions related to authorizing mine components located on NFS land. The land exchange itself is not subject to the objection process, objection resolution process, or the ROD.

1.5.1.3 Forest Plan Amendment

Plan amendments are guided by Federal regulations at 36 CFR 219 (NFMA implementing regulations, 2012 Planning Rule, or Planning Rule). An analysis of compliance of the proposed project-specific forest plan amendment for the preferred alternative was conducted, which concluded that the amendment would comply with the Planning Rule. See appendix T of this FEIS for details.

1.5.2 Bureau of Land Management

The land exchange directed by PL 113-291 would transfer ownership of approximately 4,236 acres of Resolution Copper private lands to the BLM. As with the Forest Service, the BLM has no decision authority with respect to the land exchange.

The BLM would incorporate and administer the land acquired for the Lower San Pedro River Parcels into the San Pedro National Conservation Area no later than 2 years after the date on which the land is acquired. The San Pedro Riparian National Conservation Area Resource Management Plan (Bureau of Land Management 2019c) would be updated to reflect the acquired land.

The BLM would incorporate and administer the land acquired for the Appleton Ranch Parcel into the Las Cienegas National Conservation Area in accordance with the FLPMA, laws (including regulations) applicable to the Las Cienegas National Conservation Area, and applicable land use plans.

For purposes of this analysis, the Forest Service has identified an alternative that includes siting mine facilities on BLM-administered land, rather than on NFS lands as proposed by Resolution Copper (see section 2.2.7 for a description of Alternative 5 – Peg Leg). If the Forest Service were to select Alternative 5 – Peg Leg, the Forest Service’s selection of that alternative would not authorize surface use of any BLM-managed public lands. In order to use the public lands identified in Alternative 5 – Peg Leg, Resolution Copper would be required to obtain surface use authorization under the applicable BLM regulations. BLM would require the submittal of a separate mining plan of operations to determine whether unnecessary or undue degradation would occur (43 CFR 3809.11(a)). BLM would then issue a separate ROD from the Forest Service to approve mine-related actions on BLM-administered lands and would need to conduct any administrative review processes required under BLM regulations; this would include review of conformance with any current management plans. The BLM ROD would not necessarily be issued at the same time as the Forest Service ROD. Additional Tribal and public involvement might also be required to satisfy BLM regulations if Alternative 5 – Peg Leg were selected. To date, Resolution Copper does not have any pending requests for surface use authorization before BLM.

1.5.3 U.S. Army Corps of Engineers

Selection of some, but not all, of the alternatives would require the USACE to issue a permit under Section 404 of the CWA, which regulates discharge of dredged and fill within waters of the U.S. The USACE previously evaluated drainages and wetlands in portions of the Upper Queen Creek watershed[10] associated with this project and found these aquatic features were not subject to the USACE's jurisdiction under current rules in effect at that time. Under those rules, for drainages to be under the jurisdiction of the USACE, they must have a "significant nexus" to a traditionally navigable water. In 2012, the USACE determined that the drainages within the Upper Queen Creek watershed do not have a significant nexus to the closest traditionally navigable water, which is the Gila River between Powers Butte and Gillespie Dam. Ultimately, this determination means that a tailings storage facility sited within these areas in the Upper Queen Creek watershed (Alternatives 2, 3, or 4; see section 2.2) would not need a Section 404 permit, whereas other alternatives would require one (Alternatives 5 or 6). The following issuances contain the determinations of which drainages are under the jurisdiction of the USACE, which were then renewed in 2025 (U.S. Army Corps of Engineers 2025):

- USACE 2012a and 2015. These documents are Approved Jurisdictional Determinations that indicate an absence of jurisdiction within the Upper Queen Creek watershed above Whitlow Ranch Dam (U.S. Army Corps of Engineers 2012a, 2015).
- USACE 2020a. This document is an Approved Jurisdictional Determination that indicates absence of jurisdiction for portions of the Alternative 6 pipeline corridor that are within the Upper Queen Creek watershed above Whitlow Ranch Dam (U.S. Army Corps of Engineers 2020a).
- USACE 2020b. This document is a Preliminary Jurisdictional Determination for portions of the Alternative 6 pipeline corridor and tailings storage facility that are within the Dripping Spring Wash-Gila River watershed[11] (U.S. Army Corps of Engineers 2020b). Under a Preliminary Jurisdictional Determination, geographic jurisdiction is presumed based solely on the presence of ordinary high water mark indicators.

Because Congress directed that the EIS serves to support all Federal decisions related to the proposed mine, if Alternative 5 or 6 were ultimately selected, the USACE would rely on this EIS to support issuance of a Section 404 permit. In accordance with the CWA, Section 404(b)(1) guidelines (40 CFR 230), the USACE may only permit the least environmentally damaging practicable alternative in light of cost, logistics, and technology. An alternatives analysis has been prepared for the range of alternatives originally considered for this project using the criteria in the Section 404(b)(1) guidelines and has been included with this FEIS as appendix C; this document identifies Alternative 6 – Skunk Camp as the least environmentally damaging practicable alternative.

---

[10] For the purposes of the EIS, a "watershed" is understood to be the area defined by the 10-digit Hydrologic Unit Code (HUC) established by the U.S. Geological Survey (USGS). The 10-digit HUC for the Upper Queen Creek watershed is 1505010004.

[11] The 10-digit HUC for the Dripping Spring Wash-Gila River watershed is 1505010001.

A permittee is also required to compensate for the loss of waters of the U.S. in accordance with 33 CFR 332. Appendix D of this EIS contains Resolution Copper's conceptual mitigation plan. This plan has been approved by the USACE and determined to contain adequate mitigation to compensate for the loss of waters of the U.S.

Based on the analysis in this EIS and supporting documentation, the USACE's public interest review, and the determination of the least environmentally damaging practicable alternative in the Section 404(b)(1) alternatives analysis, the USACE would determine whether to do one of the following:

1. Issue Resolution Copper a CWA Section 404 individual permit for the discharge of dredged and/or fill material into waters of the U.S.; or
2. Issue Resolution Copper a CWA Section 404 individual permit with modifications or special conditions; or
3. Deny the CWA Section 404 individual permit.

The USACE issued a public notice during the DEIS comment period and has considered all comments received in response to the public notice, the DEIS, and public hearings (if applicable) as part of the public interest review. Following issuance of the FEIS, the USACE would prepare a ROD, separate from the Forest Service, regarding the Section 404 permit. The USACE's administrative appeals process allows the applicant to appeal a denied permit or a proffered permit that the applicant has declined. Details on this process are contained in 33 CFR 331, "Administrative Appeals Process."

1.5.3.1 Clarification of Least Environmentally Damaging Practicable Alternative

With respect to the least environmentally damaging practicable alternative, there are differences between the Forest Service and USACE regulatory frameworks.

Under 40 CFR 230.10(a), "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." In practice, this determination is contained in the 404(b)1 Alternatives Analysis, as described above. As noted above, the complete and approved 404(b)1 Alternatives Analysis is included as appendix C of the FEIS and identifies Alternative 6 – Skunk Camp as the least environmentally damaging practicable alternative.

Forest Service NEPA regulations contain a similar definition of the "environmentally preferable alternative" (36 CFR 220.3), but there is no requirement that the environmentally preferable alternative be selected.

1.5.4 Bureau of Reclamation Withdrawal Lands

The U.S. Department of the Interior commented on the DEIS and identified an area within the Tonto National Forest that previously was withdrawn from mineral entry for use by the SRP for water storage and diversion and/or power generation, transmission, and distribution. This area is shown in figure 1.5-1; the MARRCO corridor and the tailings storage facility footprints for Alternatives 2 and 3 lie partially within this withdrawal area.

In December 2019, the Tonto National Forest held a subsequent meeting with the Bureau of Reclamation to discuss the ramifications of the withdrawal. The lands are managed through a Tri-party Agreement between the Tonto National Forest, SRP, and Bureau of Reclamation dating to 1979. The withdrawal remains in force as long as the purpose for withdrawal still exists. As such, these lands are generally unavailable for mineral entry, including the staking of mill site claims that would be required for a tailings storage facility. The mine-related activities to take place within the MARRCO corridor are allowable as part of the existing right-of-way already in place.

With respect to the NEPA process, the presence of the withdrawn lands does not invalidate consideration of Alternatives 2 and 3. CEQ guidance is that "an alternative that is outside the legal jurisdiction of the lead agency must still be analyzed in the EIS if it is reasonable. A potential conflict with local or federal law does not necessarily render an alternative unreasonable, although such conflicts must be considered" (NEPA 40 Most Asked Questions #2b) (U.S. Fish and Wildlife Service 2020b).

There is a similar Bureau of Reclamation withdrawal area along the Gila River, through which the pipeline and power line corridor for Alternative 5 would be required to cross. It has not been determined whether the presence of a pipeline or power line would be incompatible with the purpose of the withdrawal in the same manner as a tailings storage facility; however, as with Alternatives 2 and 3, the presence of the withdrawal area does not invalidate the alternative from consideration under NEPA.

1.5.5 Regulatory Jurisdiction by Mine Component and Alternative

As discussed above, jurisdiction over the mine project will differ based on whether the land exchange occurs or not, and which alternative is selected. Not only would the Forest Service authorizing regulations differ, but other Federal agencies (USACE and BLM) would only have regulatory roles under certain alternatives. Table 1.5.5-1 describes the agencies with jurisdiction over each project component, focusing on Federal agencies and State agencies with key permitting roles.

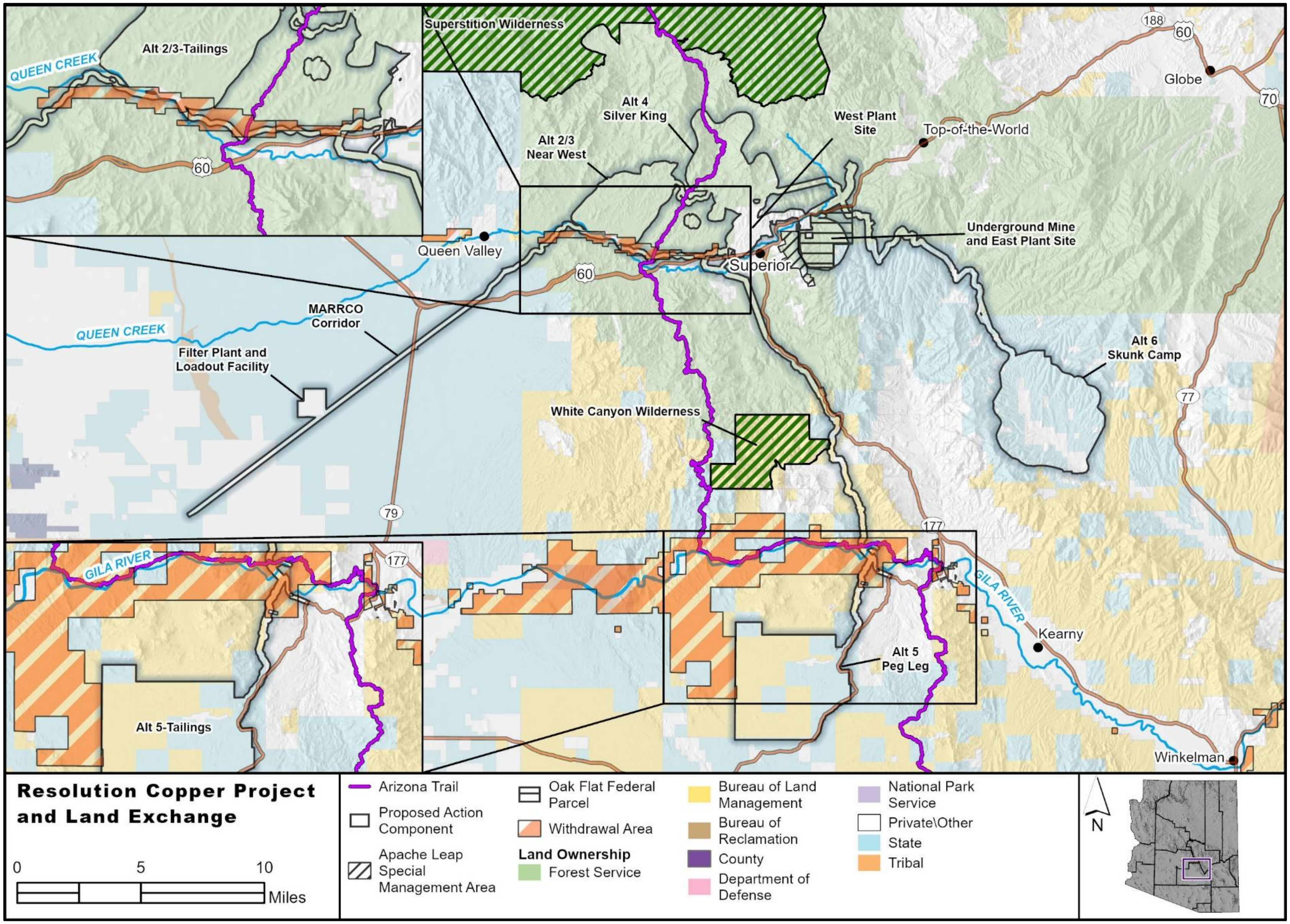


Figure 1.5-1. Bureau of Reclamation withdrawn lands

Table 1.5.5-1. Agency jurisdiction over different project components

	Project Component					
	East Plant Site/ Subsidence Area/ Block Cave Zone: With Land Exchange	**East Plant Site/ Subsidence Area/ Block Cave Zone: Without Land Exchange**	**West Plant Site: Facilities**	**West Plant Site: Access Roads**	**Tailings Storage Facility— Alternatives 2 and 3**	**Tailings Storage Facility— Alternative 4**
Agency						
Forest Service	None*	Use allowed under 36 CFR 228 Subpart A; authorization through final mine plan of operations, with financial assurance. Subsidence restricted from occurring within Oak Flat Withdrawal Area.	None	Use allowed under either 36 CFR 228 Subpart A or 36 CFR 251	Use allowed under 36 CFR 228 Subpart A, subject to appropriate mine claims; authorization through final mine plan of operations, with financial assurance.	Use allowed under 36 CFR 228 Subpart A, subject to appropriate mine claims; authorization through final mine plan of operations, with financial assurance.
BLM	None	None	None	None	None	None
USACE	None†	None†	None†	None†	None†	None†
Bureau of Reclamation	None	None	None	None	Tailings facility lies within Bureau of Reclamation withdrawal area along Queen Creek	None
Arizona Department of Environmental Quality	Aquifer Protection Permit required; with financial assurance Arizona Pollutant Discharge Elimination System (AZPDES) permit	Aquifer Protection Permit required; with financial assurance AZPDES permit	Aquifer Protection Permit required; with financial assurance AZPDES permit	AZPDES permit	Aquifer Protection Permit required; with financial assurance AZPDES permit	Aquifer Protection Permit required; with financial assurance AZPDES permit
Arizona Department of Water Resources	Permitting required for dewatering	Permitting required for dewatering	None	None	None	None
Arizona State Land Department	None	None	None	None	None	None
Pinal County	Air permit required	Air permit required	Air permit required	None	Air permit required	Air permit required
Arizona State Mine Inspector	Reclamation plan required; with financial assurance	Reclamation plan required; with financial assurance	None	None	Reclamation plan required; with financial assurance	Reclamation plan required; with financial assurance

* The potential for subsidence to impact NFS surface resources within the Apache Leap Special Management Area allows for Forest Service involvement in subsidence monitoring.

† According to the jurisdictional determinations approved by the USACE, no jurisdictional waters of the U.S. are present in the Superior Basin above Whitlow Ranch Dam.

	Project Component			
	Tailings Storage Facility—Alternative 5: Facility	**Tailings Storage Facility—Alternative 5: Pipeline and Power Line Corridor**	**Tailings Storage Facility—Alternative 6: Facility**	**Tailings Storage Facility—Alternative 6: Pipeline and Power Line Corridor**
Agency				
Forest Service	None	Use allowed under either 36 CFR 228 Subpart A (with no land exchange) as part of final mine plan, or 36 CFR 251 (with land exchange) as a special use permit	None	Use allowed under either 36 CFR 228 Subpart A (with no land exchange) as part of final mine plan, or 36 CFR 251 (with land exchange) as a special use permit
BLM	Use allowed under 43 CFR 3809, subject to appropriate mine claims; authorization through final mine plan of operations, with financial assurance. Requires separate submittal of mine plan to BLM.	Use allowed under 43 CFR 3809, subject to appropriate claims; authorization through final mine plan of operations, with financial assurance. Requires separate submittal of mine plan to BLM.	None	None
USACE	Individual 404 permit	Individual 404 permit	Individual 404 permit	Individual 404 permit
Bureau of Reclamation	None	Pipeline/power line crosses Bureau of Reclamation withdrawal area along Gila River	None	None
Arizona Department of Environmental Quality	401 water quality certification Aquifer Protection Permit required; with financial assurance Arizona Pollutant Discharge Elimination System (AZPDES) permit	401 water quality certification AZPDES permit	401 water quality certification Aquifer Protection Permit required; with financial assurance Air permit required AZPDES permit	401 water quality certification AZPDES permit
Arizona Department of Water Resources	None	None	None	None
Arizona State Land Department	Would require auction/purchase of State Trust land	Would require right-of-way through State Trust land	Would require auction/purchase of State Trust land	Would require right-of-way through State Trust land
Pinal County	Air permit required	None	None	None
Arizona State Mine Inspector	Reclamation plan required; with financial assurance	None	Reclamation plan required; with financial assurance	None

	Project Component					
	MARRCO Corridor	**Filter Plant and Loadout Facility**	**Power Lines to West Plant Site and East Plant Site**	**Recreation Mitigation Areas**	**Compensatory Mitigation Lands**	**Offered Lands**
Agency						
Forest Service	Use fits within parameters of existing right-of-way	None	Use allowed under 36 CFR 228 Subpart A (with no land exchange) as part of final mine plan, or 36 CFR 251 (with land exchange) as a special use permit	Motorized/ non-motorized routes managed by Forest Service	None	No decision; acceptance of parcels only
BLM	None	None	None	None	None	No decision; acceptance of parcels only
USACE	None	None	None	None	Individual 404 permit, special condition	None
Bureau of Reclamation	None	None	None	None	None	None
Arizona Department of Environmental Quality	Arizona Pollutant Discharge Elimination System (AZPDES) permit	Aquifer Protection Permit required; with financial assurance AZPDES permit	AZPDES permit	None	401 water quality certification	None
Arizona Department of Water Resources	Permitting of groundwater withdrawals from Desert Wellfield	None	None	None	None	None
Arizona State Land Department	None	None	None	None	None	None
Pinal County	None	Air permit required	None	None	None	None
Arizona State Mine Inspector	None	None	None	None	None	None

1.5.6 Required Permits, Licenses, and Authorizations

Other permits, licenses, and authorizations would be required for the mine to be operational. Additional special use permits and rights-of-way may also be needed for power lines built by SRP, access roads, or other features. The EIS would not determine whether a permit through another agency would be approved but would disclose impacts for resources analyzed. Table 1.5.6-1 provides the permits and licenses commonly required for this type of project; it is not meant to be a comprehensive list of all possible permit(s), license(s), or authorization(s) needed. A list of existing Resolution Copper permits and licenses currently held for ongoing operations is shown in table 1.4.2 of the GPO.

Table 1.5.6-1. Permits, licenses, and authorizations required for the Resolution Copper Project

Permitting Agency	Type of Permit	Permit Use
Arizona Corporation Commission, Line Siting Committee	Certificate of Environmental Compatibility	Ensures compliance with Arizona Revised Statutes (ARS) 40-360 and regulates the placement of electrical transmission lines.
Arizona Department of Agriculture	Agriculture Land Clearing Permit	Authorizes disturbance and clearing of State-protected native plants, as required under the Arizona Native Plant Law.
Arizona Department of Environmental Quality	Aquifer Protection Permit (APP)	An APP is required for any activity that discharges a pollutant to an aquifer, or to the land surface so that there is a reasonable probability that the pollutant would reach an aquifer. General APPs are available for some impoundments and facilities, as long as they have characteristics specified by Arizona regulations (like lining). Resolution Copper currently holds a number of general APPs for wash bays (type 3.02 permits), wastewater treatment discharges (type 3.03 permits), and rock stockpiles (type 2.02 permits). Resolution Copper also currently holds an Individual Industrial Reclaimed Water APP, which allows conveyance of treated water to the New Magma Irrigation and Drainage District (NMIDD) for agricultural application (alfalfa, barley, Bermudagrass, cotton, sorghum, turf, and wheat). A similar permit would be required during operations for any treated water discharged to NMIDD. Resolution Copper also holds an area-wide APP that authorizes the closure of existing APP-regulated facilities at the West Plant Site under a compliance schedule, and an individual APP for a non-municipal solid waste landfill, which is approved to accept construction and demolition debris, non-hazardous mine refuse, vegetative waste, non-tire rubber products, solid waste petroleum-contaminated soil, metal-contaminated soil, empty containers, and nonfriable and friable asbestos-containing material. For operations, Resolution Copper would require an Individual APP that would encompass all mining and processing activities with the potential to discharge, most notably the tailings storage facility. The specific project components requiring permitting through the Individual APP are not yet determined.

Permitting Agency	Type of Permit	Permit Use
Arizona Department of Environmental Quality	Arizona Pollutant Discharge Elimination System (AZPDES) Permit	The State of Arizona has received jurisdiction (also known as "primacy") to administer Section 402 of the CWA, which is accomplished through the AZPDES program. Section 402/AZPDES regulates any discharges of pollutants to waters of the U.S., including potential pollutants in stormwater runoff. Any direct discharge of a pollutant into a water typically requires an individual AZPDES permit. At the time of publication of the January 2021 Rescinded FEIS, Resolution Copper held an AZPDES permit to discharge treated mine site stormwater runoff (Outfall 001) and treated seepage pumping and mine dewatering effluent (Outfall 002) to Queen Creek. Resolution Copper had sought and received renewal of that permit; however, in November 2022, a decision was issued in an ongoing appeal and the court found that the Arizona Department of Environmental Quality (ADEQ) could not renew the permit because Resolution Copper's dewatering discharge from Shaft 10 represented a new source. Further, the court noted that ADEQ would need to finalize standards on Queen Creek before a permit could be issued. Permitting of any discharges at these locations under the AZPDES program remain unresolved at this time. However, note that these discharges are not anticipated as part of the proposed project, as all water is anticipated to be required for use in processing. The ADEQ has also issued a multi-sector general permit, which covers stormwater discharges from common industrial activities. Typically, a permittee would apply for coverage under the Multi-Sector General Permit (MSGP) program, and develop a stormwater pollution prevention plan (SWPPP) detailing how stormwater would be handled to reduce the potential for pollutants, including sediment. Resolution Copper currently is authorized under the MSGP for stormwater discharges from both the West Plant Site and East Plant Site. During operations, stormwater discharges from mine facilities most likely would take place under the MSGP program. Temporary stormwater discharges may also be covered under the construction general permit, which has similar requirements as the MSGP program. Certain temporary discharges (such as pump testing of a well) may also be covered under the de minimis permit program. The specific AZPDES permits required for construction and operation would be determined by ADEQ.
Arizona Department of Environmental Quality	Clean Water Act Section 401 Water Quality Certification	The State must issue, waive, or deny certification of an application for a USACE permit for discharge of dredged or fill material to waters of the U.S. To certify, the State must find that the activities proposed under the 404 permit would not result in a violation of State surface water quality standards. The 401 certification may specify conditions, including reporting requirements. ADEQ issued the 401 water quality certification for the Resolution Copper Project on December 22, 2020.
Arizona Department of Environmental Quality	Drinking Water Division Monitoring Assistance Program	Public water system for serving potable groundwater to Resolution Copper employees.
Arizona Department of Environmental Quality	Drinking Water Registration and Regulations	Systems (including nontransient, noncommunity systems) must register with ADEQ and meet substantive requirements. Requires inspection, sampling/analysis, contingency/emergency planning, reporting, and notification.
Arizona Department of Environmental Quality	Hazardous Waste Management Program	Governs the management of hazardous waste (including transport and disposal). Requirements differ somewhat, depending on the volume and nature of hazardous waste generated; however, in general, it requires inspection, training, and contingency/emergency planning.
Arizona Department of Environmental Quality	Solid Waste Plan Approval	Required to meet the requirements of 40 CFR 257, along with other requirements set forth in State statutes (e.g., compliance with location restrictions, recording of a restrictive covenant).
Arizona Department of Environmental Quality	Special Waste Facility Generator	Resolution Copper is authorized to handle wastes designated as "special wastes" by the State.

Permitting Agency	Type of Permit	Permit Use
Arizona Department of Environmental Quality	Air Quality Control Program	Governs the issuance of permits for air emissions under the Clean Air Act. The Skunk Camp alternative lies within Gila County. Gila County relies on ADEQ to issue air permits within the county. At this time, it is anticipated that air permits would be obtained from Pinal County Air Quality Control District (PCAQCD) for operations solely within Pinal County (East Plant Site, West Plant Site, filter plant and loadout facility), and from ADEQ for the tailings storage facility if the Skunk Camp alternative is selected.
Arizona Department of Transportation	Right-of-Way Encroachment Permit	Authorizes work within the State right-of-way, such as highways, driveways, grading, fence removal or replacement, surveying, and geotechnical investigation. Resolution Copper would be required to obtain Forest Service Road Use Permits, which grant Resolution Copper the authorization to perform road maintenance/reconstruction on NFS roads. These permits are part of the decision to be authorized in the ROD resulting from this EIS process.
Arizona Department of Water Resources	Groundwater Permits	Groundwater pumping and use is regulated heavily within Active Management Areas (AMAs), which are areas of intensive water use, originally identified in the Arizona Groundwater Management Act of 1980. The locations of pumping for dewatering (Shafts 9 and 10) and the future makeup water supply (Desert Wellfield) lie within the East Salt River valley subbasin of the Phoenix AMA. Within the AMA, pumping groundwater requires a valid groundwater right, or a valid withdrawal permit. Resolution Copper currently holds several groundwater rights: Type 2 Non-Irrigation Grandfathered Rights/Type II Mineral Extraction Rights, and a dewatering withdrawal permit. Similar rights or permits would be required for any dewatering that occurs during operations. Resolution Copper would be required to permit any wells associated with the Desert Wellfield, which would lie within the MARRCO corridor. Notices of Intent to Drill would be required for any well installation, to ensure proper construction and documentation. Any further permits or rights required would depend on whether water pumped was legally considered recharged or banked water, or regular groundwater. This would be determined by the Arizona Department of Water Resources.
Arizona State Land Department	Right-of-Way Permit	Allows water and electrical supply lines to be placed within a right-of-way. Permit would be issued after the Arizona Corporation Commission approves the electrical supply alignment.
Arizona State Land Department	Special Land Use Permit	Resolution Copper holds several permits for geotechnical and hydrological data gathering, installation of surface water monitoring equipment, and groundwater monitor well installation and access. These permits may or may not be required during operations.
Arizona State Mine Inspector	Arizona Mined Land Reclamation Plan Approval	Applies to reclamation activities at the site. Requires certification, plan updates, annual reporting, and financial assurance. Resolution Copper currently holds a plan authorizing the reclamation of surface disturbances at the East and West Plant Sites.
Bureau of Land Management	Mining Plan of Operations and Record of Decision	In the event that Alternative 5 – Peg Leg is selected, Resolution Copper's GPO would be denied with respect to the facilities proposed on NFS lands that are identified to be placed on BLM-managed public lands, State lands, or private lands. To use BLM-managed public lands, Resolution Copper would need to obtain surface use authorization from BLM in accordance with BLM's surface management regulations 43 CFR subpart 3809. BLM would then issue a separate ROD from the Forest Service to approve mine-related actions on BLM-administered lands, and would need to conduct any post-decision administrative review processes required under BLM regulations.
Bureau of Land Management	Right-of-Way Application	In the event Alternative 5 – Peg Leg is selected, Resolution Copper's GPO would be denied with respect to rights-of-way proposed on NFS lands that are identified to be placed on BLM-managed public lands, State lands, or private lands. To use BLM-managed public lands for right-of-way purposes, Resolution Copper would need to obtain surface use authorization from BLM for any right-of-way that crosses BLM-managed public lands.
Federal Communications Commission	Radio License	Required for current use of communication network; would be required during operations.

Permitting Agency	Type of Permit	Permit Use
Pinal County Air Quality Control District	Air Quality Control Permit	Resolution Copper currently holds an air quality control permit that pertains to the historical mining (reclamation) and development and exploratory mining exploration facilities operated by Resolution Copper. A similar air quality permit would be required for the full operations. The PCAQCD may also issue dust permits for construction, earthwork, and land development. The Skunk Camp alternative also lies within Gila County. Gila County relies on ADEQ to issue air permits within the county. At this time, it is anticipated that air permits would be obtained from PCAQCD for operations solely within Pinal County (East Plant Site, West Plant Site, filter plant and loadout facility), and from ADEQ for the tailings storage facility if the Skunk Camp alternative is selected.
Pinal County Air Quality Control District	Meteorological and Ambient Air Monitoring Plan	Resolution Copper collects meteorological and air quality monitoring data under a plan approved by PCAQCD. Data collection would continue during operations, but possibly under a separate plan.
U.S. Army Corps of Engineers	Project-specific (Individual) Section 404 Clean Water Act Permit	This permit is required for the discharge of dredged or fill material into waters of the U.S. This permit may only be applicable to certain alternatives (see section 1.5.3). Individual Section 404 permits typically incorporate mitigation that would be implemented to compensate for lost aquatic resources. A conceptual mitigation plan was approved by the USACE and is included as appendix D of the FEIS.
U.S. Department of Transportation	Hazardous Materials Certificate of Registration	Resolution Copper is certified and would be required to keep certification current during operations as required by the U.S. Department of Transportation hazardous materials program procedures in 49 CFR 107, Subpart G.
U.S. Department of Transportation	Hazardous Materials Transportation Permit	Governs the transport of hazardous materials as defined by the U.S. Department of Transportation. Requires specific employee training and security and contingency planning.
U.S. Environmental Protection Agency	Hazardous Waste Identification Number	Authorizes facilities to generate and transport off-site hazardous waste in quantities in excess of 100 kilograms per month (or those that generate acute hazardous waste in quantities exceeding 1 kilogram per month). Requires specific employee training, inspections, and contingency planning.
U.S. Fish and Wildlife Service	Biological Opinion	The Biological Opinion is issued by the FWS at the completion of consultation under Section 7 of the ESA. The Biological Opinion ensures that the Tonto National Forest's approval of the revised mining plan of operations would not jeopardize the continued existence of a threatened or endangered species or adversely modify designated critical habitat. Biological Opinions may authorize "take" of a protected species, and would detail the conservation measures committed to by Resolution Copper, as well as other reasonable and prudent measures (and associated terms and conditions) that must be taken by Resolution Copper. Failure to comply with requirements specified in the Biological Opinion could require reconsultation and could also result in civil and criminal penalties. The Biological Opinion is included in appendix P of the FEIS.
U.S. Forest Service	Baseline Hydrologic and Geotechnical Data Gathering Activities Plan of Operations	To collect hydrologic, geochemical, and geotechnical data in order to provide baseline information on these aspects of the environment over an area being considered at the Near West site. These activities are complete.
U.S. Forest Service	Final Mining Plan of Operations (after publication of the FEIS and approval of the ROD)	For projects being approved under mining laws, a final mining plan of operations must be approved by the Forest Supervisor. Approval of the final mining plan provides the authorization to conduct activities on NFS lands. The final mining plan must reflect requirements specified in the ROD, including mitigation, monitoring, reporting, requirements of all applicable permits and authorizations, and is accompanied by posting of a bond or other financial assurance. If the land exchange takes place and Alternative 6 – Skunk Camp is identified in the ROD as the selected alternative, authorization likely would take place under special use regulations, not mining regulations.

Permitting Agency	Type of Permit	Permit Use
U.S. Forest Service	Special use permit	The existing special use permit authorizes Resolution Copper to construct and maintain a water pipeline corridor from the water treatment plant to an irrigation canal operated by the NMIDD. Future activity within the MARRCO corridor potentially could be covered under the final mining plan of operations, rather than a special use permit. If the land exchange takes place and Alternative 6 – Skunk Camp is identified in the ROD as the selected alternative, authorization likely would take place under special use regulations, not mining regulations. This would require the issuance of a special use permit to Resolution Copper for the tailings pipeline corridor across NFS lands, and to SRP for the tailings power line corridor across NFS lands. The power line permit would be issued after the Arizona Corporation Commission approves the electrical supply alignment.

1.5.7 Financial Assurance

1.5.7.1 Forest Service

Financial Assurance under Mining Regulations

Actions on NFS lands under Alternatives 2, 3, or 4 would be authorized by Forest Service mining regulations. The Forest Service mission of promoting healthy and resilient forests and grasslands is a key component for ensuring that the lands and resources the Forest Service manages are available for future generations. Mineral development on NFS lands is a temporary use of those lands, although some uses like tailings storage facilities are permanent and remain part of the landscape in perpetuity. Reclamation of mining sites is an integral part of all mine plans considered by the Forest Service, as is the requirement that adequate fiscal resources be available to ensure that reclamation can be conducted.

The primary authority for the Forest Service to require financial assurance is contained in the locatable mineral regulations (36 CFR 228 Subpart A). These include the requirement for a plan of operations to include provisions for reclamation: "The plan of operation shall include . . . measures to be taken to meet the requirements for environmental protection. . . ." (36 CFR 228.4). The regulations include specific requirements for financial assurance: "Any operator required to file a plan of operations shall, when required by the authorized officer, furnish a bond conditioned upon compliance with 228.8(g), prior to approval of such plan of operations" (36 CFR 228.13). The amount of financial assurance is also addressed by regulation: "In determining the amount of the bond, consideration would be given to the estimated cost of stabilizing, rehabilitating, and reclaiming the area of operations" (36 CFR 228.13b).

Reclamation and financial assurance requirements are summarized in Forest Service guidance (U.S. Forest Service 2004), which notes that while in the past long-term maintenance, monitoring, and interim management have not been included in bonding or financial assurance estimates, it is now accepted practice to include these items. The Forest Service guidance notes that: "A basic premise of the estimate is that the operator is not available to complete the reclamation and the Forest Service would need to do the reclamation work" (U.S. Forest Service 2004).

However, funding of long-term maintenance and monitoring has always posed a logistical problem, because of the long time frames that would be required. In 2015, the Forest Service issued guidance for establishment of long-term trusts for future large mines, with the intent of eliminating the growing mine-related liabilities on NFS lands (U.S. Forest Service 2015a). The guidance allows the Forest Service to accept trust accounts from operators of large mines by establishing a trust with the Forest Service as a benefactor to address long-term liabilities such as water treatment, dam maintenance, and care and maintenance of infrastructure, which may be required for many years (or centuries) beyond a planned or unplanned mine closure. Use of a long-term trust is one method that will be considered to provide fiscal resources to ensure maintenance and monitoring that extend beyond the closure of the mine.

More detail on financial assurances specific to individual resources can be found in Section 3.3, Soils, Vegetation, and Reclamation; and Section 3.7.2, Groundwater and Surface Water Quality.

Financial Assurance under Special Use Regulations

Actions on NFS lands under Alternatives 5 or 6 would be authorized by Forest Service special use regulations (36 CFR 251). Project pipelines and utilities approved under special use regulations (36 CFR 251) follow a different regulatory framework for financial assurances than those projects approved under mineral regulations as described above. Special use authorizations would incorporate terms and conditions (36 CFR 251.56), including minimizing damage to the environment, protecting the public interest, and requiring compliance with water and air quality standards. Pursuant to 36 CFR 252.56(e), the Forest Service may require the holder to furnish a bond or other security to secure all or any of the obligations imposed by the terms of the authorization or by any applicable law, regulation, or order.

Where the Federal Government's interest requires protection from damage to NFS lands, or particular circumstances of performance are involved, the authorization holder shall be required to furnish a bond (Forest Service Manual (FSM) 2713.3). A performance and/or payment bond may be required to secure obligations imposed on a special use authorization holder by the authorization terms or any applicable law, regulation, or order. A bond must not be used to enforce general conditions of the permit; rather it applies only to those requirements which are readily identifiable, and which are specified in the clause requiring the bond (FSM 2713.13). Blanket bonds may be used for special use authorization. Some bonds may be required only for the period needed to satisfy particular situations. For instance, a bond covering the construction of special use authorization facilities should remain in force only during construction. Bond security would be necessary to return the site to an acceptable condition if the construction plans fail.

Administration of bonds is detailed in FSM 6500, Chapter 6560 – Bonding Administration. Reclamation bonds for mining activities are described in FSM 6561.4 and bonds for special use authorizations are described in FSM 6561.7. Both mining and special use authorization bonds may be secured with cash as a last resort, but preferably credit/debit cards or electronic check processing, corporate surety, deposited securities, an irrevocable letter of credit, or assignment of savings account. The penal sum of the bond must at least equal the estimated reclamation cost or financial loss (FSM 6561.7).

Separate annual rental fees may also be required for rights-of-way authorized under special use regulations (36 CFR 251.57). The annual fee "shall be based on the fair market value of the rights and privileges authorized, as determined by appraisal or other sound business management principles" (36 CFR 251.57(a)(1)).

Logistically, bonding amounts and rental fees are calculated and finalized at the time the final special use permit is issued, not during the environmental analysis.

1.5.7.2 U.S. Army Corps of Engineers

Pursuant to 33 CFR 332.3(n), the USACE requires sufficient financial assurances to ensure a high level of confidence that any compensatory mitigation project permitted under a 404 permit would be successfully completed in accordance with applicable performance standards. In some circumstances, the USACE may determine that financial assurances are not necessary for a compensatory mitigation project.
In consultation with the proponent, the USACE determines the amount of the required financial assurances. This is based on the size and complexity of the compensatory mitigation project, the degree of completion of the project at the time of project approval, the likelihood of success, the past performance of the project sponsor, and any other factors the USACE deems appropriate. Financial assurances may be in the form of performance bonds, escrow accounts, casualty insurance, letters of credit, legislative appropriations for government-sponsored projects, or other appropriate instruments, subject to approval

by USACE. If financial assurances are required, the 404 permit would include a special condition requiring the financial assurances to be in place prior to commencing the permitted activity. The financial assurance for 404-permitted mitigation is phased out once the USACE determines mitigation is successful in accordance with the plan's performance standards. The USACE will identify any financial assurance required in any issued 404 permit.

1.5.7.3 State Agencies

Pursuant to Arizona Revised Statutes (ARS) Title 27, Chapter 5, mine operators must submit a reclamation plan for surface disturbance and financial assurance instruments once that reclamation plan is approved, to the Arizona State Mine Inspector. The financial assurance is meant to be sufficient to perform the approved reclamation measures as specified in the reclamation plan for areas of surface disturbance, and to provide continued care and monitoring of revegetated areas. The Arizona State Mine Inspector may periodically adjust the amount of financial assurance, and the mine operator may apply for changes in the amount of financial assurance, based on changed conditions. There are also provisions in the law to prevent duplication of financial assurance with other state or Federal agencies. The scope of financial assurance for the Arizona State Mine Inspector is relatively limited, focusing on surface disturbance and revegetation, but not specifically addressing aspects like long-term seepage or water quality.

Pursuant to ARS Title 49, Chapter 2, Article 3, mine operators applying to the Arizona Department of Environmental Quality (ADEQ) for an Aquifer Protection Permit (APP) are required to demonstrate financial responsibility to cover the estimated costs to close the facility and, if necessary, to conduct post-closure monitoring and maintenance. The amount and type of financial assurance are determined through the permitting process and must be in place prior to discharges to groundwater, such as by tailings seepage. Unlike the Arizona State Mine Inspector financial assurance, under the APP the financial assurance is intended to cover long-term issues, such as monitoring impacts to water quality from tailings seepage.

1.5.7.4 Existing Financial Assurance

Resolution Copper currently maintains financial assurances under a number of regulatory frameworks. These include the following:

- The Forest Service holds a bond related to the prefeasibility plan of operations, which allowed for exploration, characterization, and monitoring on Oak Flat. The amount of the assurance is approximately $2 million. Note that upon execution of the land exchange, all or part of this financial assurance may be released or transitioned, given that the land itself will no longer be under Forest Service jurisdiction.
- The Forest Service holds a bond related to the baseline hydrologic and geotechnical data-gathering activities at the Near West tailings location. The amount of the assurance is approximately $1.45 million.
- The Arizona State Mine Inspector holds a bond related to reclamation plans for existing mining facilities. The amount of the assurance is approximately $6 million.
- The ADEQ holds a bond for the existing APP for the facility. The amount of the assurance is approximately $18 million.
- The ASLD holds a bond for activities on State lands. The amount of the assurance is $15,000.

1.5.7.5 Timing of Financial Assurance

For all jurisdictions described above, the financial assurance calculations take place later in the process as part of the permitting. Financial assurance itself is not required to be in place until final approval of activities. For the Forest Service, the bond amount would be calculated after the publication of the final ROD as part of the issuance of either a final mine plan of operations or a special use permit. For the USACE, the bond amount would be calculated as part of the individual Section 404 permit. Financial assurance would need to be in place prior to any impacts occurring to waters of the U.S. For state agencies, the calculations of bond amounts are made as part of the permitting process and financial assurances would need to be in place prior to undertaking any ground disturbance or discharges to groundwater.

Bond estimates are not included in the EIS, as they are not calculated until after a decision has been made.

1.5.7.6 Calculations of Bond Amounts

The bond amount represents the Forest Service's estimated cost to complete site reclamation in the event the operator cannot or would not perform the required reclamation or meet the stipulations of a special use permit. These calculations require a detailed understanding of the mine design and facilities, and specific estimates of labor and materials that would be required to complete reclamation activities.

Bonds generally are calculated to include direct and indirect costs. Direct costs are assigned to reclamation tasks that are specific in scope and to which a cost can be assigned based on requirements outlined in the ROD or in the approved mine plan of operations. Examples of direct costs include removing surface facilities and roads, post-closure grading, revegetating disturbed areas, and removing pipelines. Indirect costs are costs that cannot be attributed to any one specific activity. Rather, indirect costs represent expenses necessary to the overall successful implementation and execution of the reclamation. Examples of indirect costs include contractor mobilization and demobilization, bid and scope contingency, engineering redesign, and project administration.

In general the reclamation bond may be in the form of a surety bond, an irrevocable letter of credit, a certificate of deposit, or cash. The bond for larger mining operations is usually in the form of a surety or irrevocable letter of credit because of the significant financial obligation that reclamation typically represents.

1.5.7.7 Bond Release

There is no specific time frame for bond release once reclamation activities have been completed. Bond release is performance-based and is granted or denied based on the evaluation of the agency. The Forest Service may not release a bond until the reclamation requirements of 36 CFR 228.8(g) are met (for mine plans of operation), or until all stipulations of a special use permit are met, including reclamation requirements. The bond with the Arizona State Mine Inspector remains in place until reclamation is completed, at which time the mine operator can apply for release. For the APP, the bond remains in place for the duration of the permit.

1.6 Public Involvement

The Forest Service sought public input during several phases of the EIS process. A summary of public involvement is outlined in this section.

1.6.1 Scoping

The purpose of the scoping process is to obtain input from agencies and members of the public on the extent of the proposed project, the range of alternatives, and the content of the issue analysis in the EIS. The Forest Service's public participation and public scoping efforts are described in detail in the "Resolution Copper Project and Land Exchange Environmental Impact Statement Scoping Report" (U.S. Forest Service 2017i).

The public scoping period commenced on March 18, 2016, with the Forest Service publication of the Notice of Intent (NOI) to prepare an EIS in the Federal Register. The Forest Service planned for a 60-day public scoping period from March 18, 2016, to May 17, 2016. Numerous individuals and several organizations requested an extension of the public scoping period, as well as additional public scoping meetings. The Forest Supervisor, Tonto National Forest, accommodated these requests by extending the public scoping period through July 18, 2016, resulting in a total overall scoping period of 120 days. The "Notice of Extension of Public Scoping Period for the Resolution Copper Project and Land Exchange EIS" was published in the Federal Register on May 25, 2016.

Tonto National Forest staff held five scoping meetings in the project area that provided the public with an opportunity to ask questions, learn about the proposed project, and provide comments on issues and concerns that should be addressed in the EIS and alternatives that should be evaluated (table 1.6.1-1).

Table 1.6.1-1. Scoping meeting locations, dates, and attendance numbers

Meeting Location	Date	Number of People Who Signed In
Queen Valley, Arizona – Recreation Hall	March 31, 2016	106
Superior, Arizona – Superior High School	April 4, 2016	78
Globe, Arizona – Globe Elks Lodge	April 5, 2016	63
Gilbert, Arizona – Southeast Regional Library	April 6, 2016	88
San Tan, Arizona – Central Arizona College	June 9, 2016	50

Internal scoping efforts included several meetings and field trips with the NEPA interdisciplinary (ID) team. ID team members include Forest Service resource specialists and planners representing anticipated topics of analysis in the NEPA process and Tonto National Forest line officers and program managers.

Cooperating agency scoping was conducted through a kick-off meeting and through comments submitted by cooperating agencies and Tribes during the public scoping comment period. Additional detail on scoping conducted during Tribal consultation can be found in section 1.7.1.

Scoping comment submittals on the Resolution Copper Project and Land Exchange EIS were analyzed and categorized using a standard Forest Service process called "content analysis." The goals of the content analysis process are to (1) ensure that every comment is considered, (2) identify the concerns raised by all respondents, (3) represent the breadth and depth of the public's viewpoints and concerns, and (4) present those concerns in a way that facilitates the Forest Service's consideration of comments. All comments were treated evenly and were not weighted by number, organizational affiliation, "status" of the commenter, or other factors. Consideration was on the content of a comment, rather than on who wrote it or the number of submitters who agreed with it.

In total, 133,653 submittals were collected during public scoping, 141 of which were identified as duplicate submittals. Of the non-duplicate submittals received, 131,592 submittals or 98.56 percent were identified as form letters, 683 submittals or 0.51 percent as form letters with additional comments, and 1,237 or 0.94 percent as unique submittals. Approximately 99.89 percent of submittals were from individuals, with the remaining submittals from non-governmental organizations (NGOs), and governments (table 1.6.1-2).

Table 1.6.1-2. Distribution of submittals by sender type

Sender Type	Submittal Count
Individual	133,368
NGO	66
Government	78
Total	**133,512**

The contents of the comments received during scoping are summarized in the project record.[12] The scoping comments were used to develop the issues (see Section 1.8, Issues), alternatives (see Chapter 2 – Alternatives, Including the Proposed Action), and mitigation strategies that form the EIS analysis.

1.6.2 Project Update and Alternatives Development Workshop

As part of the EIS process, the Forest Service is required to investigate alternatives to various aspects of the proposed action described in section 2.2.4. During the alternatives development process,[13] the Forest Service hosted two in-person public workshops and one online workshop to (1) update the public on the status of the EIS process, (2) describe the alternatives development process, and (3) solicit input on the criteria being used to evaluate alternative tailings storage facility locations. The in-person workshops were held in Superior, Arizona, on March 21, 2017, and in Gilbert, Arizona, on March 22, 2017. The online workshop was available on the project website from March 23, 2017, through April 5, 2017. Workshop attendees were asked to provide input regarding the relative importance of a variety of environmental and social criteria regarding the location of the tailings storage facility. The public responses showed Environmental Impacts and Tailings Storage Location as their primary concern, with protection of streams and springs having the highest concern. The Forest Service used the information gathered to inform the evaluation and comparison of alternative tailings storage facility locations during the alternatives development process.

1.6.3 Public Comment on the DEIS

The DEIS public comment period disclosed analyses and anticipated impacts from the proposed project and alternatives considered. We notified interested stakeholders, cooperating agencies, elected officials, and adjacent landowners of the DEIS release, dates and times of public meetings, and how to provide substantive comments. The August 9, 2019, publication of the Notice of Availability for the DEIS in the Federal Register initiated the comment period. In addition to the Federal Register notice, we used other outreach and means of notification, including 15,200+ postal mail and 23,000+ emails to the project mailing list, social media posts, news releases, website announcements, 16 newspaper notices (in English and Spanish), and posters physically displayed at 37 various local bulletin boards and areas in the project vicinity. We held six public meetings in local communities in the vicinity of the project during the 90-day public comment period that ended on November 7, 2019. Each public meeting included an open house, a

[12] See "Resolution Copper Project and Land Exchange Environmental Impact Statement Scoping Report" (U.S. Forest Service 2017i); "Resolution Copper Project and Land Exchange Environmental Impact Statement Public Concern Statements" (U.S. Forest Service 2017h); "Resolution Copper Project and Land Exchange Environmental Impact Statement Final Summary of Issues Identified Through Scoping Process" (SWCA Environmental Consultants 2017b).

[13] See "Resolution Copper Project and Land Exchange Environmental Impact Statement Alternatives Evaluation Report" SWCA Environmental Consultants (2017a).

formal presentation, and an opportunity to provide verbal comments that were translated by court reporters. The locations of these meetings were chosen as they mirrored locations used during the scoping period. Meetings were held mid-week during the evening hours in Superior, San Tan Valley, Kearny, Globe, Queen Valley, and Tempe, Arizona. We added the Tempe meeting based on public requests for a meeting closer to central Phoenix. We conducted a seventh meeting with the San Carlos Apache Tribe during a special Tribal Council meeting on November 22, 2019. This occurred within an extended 135-day comment period for Tribes that ended on December 22, 2019.

The DEIS and notifications on website announcements were made 508 compliant.[14] Interested parties could obtain the DEIS in multiple ways: by electronically downloading the document from the project website; by picking up a free flash drive that contained the DEIS and was available at public meetings and Tonto National Forest offices; or by requesting a printed copy of the DEIS by contacting Tonto National Forest offices.

A mailing list was maintained throughout the project and includes interested parties, adjacent landowners, and those who have commented upon the project. At the San Tan Valley public meeting, local residents expressed concern they were not aware of the project. This led us to expand our outreach and notification efforts to include landowners beyond those immediately adjacent to the project. Previous efforts included adjacent landowners up to 1 mile from the project; after the San Tan Valley public meeting, we added landowners in the San Tan Valley up to 10 miles from the proposed project.

Tonto National Forest received, analyzed, and responded to over 29,000 submittals on the DEIS, as shown in table 1.6.3-1. Comments were reviewed and categorized based on topic. We compiled over 5,200 responses to the comments; these responses are shown in appendix R. The FEIS was revised based on comments received. Those revisions and updates are summarized in section 1.1.2, and in each resource section of chapter 3. Comments could be submitted in a variety of formats prior to the due date, including verbally at public meetings, hand delivery, U.S. mail, email, or electronically by webform.

Table 1.6.3-1. Distribution of submittals by sender type

Sender Type*	Submittal Count
Individual	29,324
Non-governmental organization	80
Government	60
Total	**29,464**

* Comments from individual Tribal members are included under the “individual” category, whereas comments from Tribal governments are included under the “government” category.

1.6.4 Cooperating Agencies

Forest Service NEPA regulations require identification of lead, joint lead, or cooperating agencies (36 CFR 220.5(b)(3)). A cooperating agency is any Federal agency (other than the lead agency) and any State or local agency or Indian Tribe with jurisdictional authority or special expertise with respect to any environmental impact involved in a proposal. Nine cooperating agencies with jurisdictional authority and/or applicable special expertise cooperated in the development of this EIS (table 1.6.4-1).

[14] Section 508 refers to Section 508 of the Rehabilitation Act of 1973. This and other Federal laws require documents to be accessible to and usable by individuals with disabilities.

Table 1.6.4-1. Cooperating agencies participating in the EIS process

Agency	Resource Area of Expertise
Arizona Department of Environmental Quality	Special expertise and jurisdiction under the authority of ARS Title 49, having jurisdiction to manage environmental resources within the state of Arizona, including protection of air and water resources; aquifer protection; drinking water protection; solid and hazardous waste generation and control; and environmental economics and policy.
Arizona Department of Water Resources	Special expertise in water resources and ensuring technical accuracy and conformance with laws, regulations, and policies within the Arizona Department of Water Resources' special expertise.
Arizona Game and Fish Department	Jurisdiction over wildlife in the state of Arizona. Special expertise with wildlife including endangered, threatened, and special status species, recommendations for mitigation, and assistance with data evaluation and review relative to the department's State Trust responsibilities and jurisdiction.
Arizona State Land Department	Jurisdictional responsibilities and special expertise in matters related to management of, and potential impacts on, State Trust land.
Arizona State Mine Inspector	Jurisdictional responsibilities and special expertise in matters related to protecting the lives, health, and safety of miners and the health and safety of the general public. The Arizona State Mine Inspector is also responsible for oversight of mine closure and reclamation on State and private lands.
Bureau of Land Management	Jurisdiction over lands managed by BLM or parcels that would transfer to BLM ownership. BLM would review the land exchange proposal under 43 CFR 2200. BLM may review and decide on a request for surface use authorization from Resolution Copper, if one is ultimately submitted under the applicable BLM regulations.
Pinal County Air Quality Control Division	Special expertise and jurisdiction to regulate air-polluting activities identified in the Pinal County Air Pollution Control District Code of Regulations and further identified in ARS Title 49, Article 3.
U.S. Army Corps of Engineers	Special expertise pertains to protection of waters of the U.S., and preservation of USACE-constructed public works. *Would assist with NEPA review only at this time; if waters of the U.S. would be affected, as with Alternatives 5 and 6, then the agency would have regulatory jurisdiction under CWA regulations*.
U.S. Environmental Protection Agency	Jurisdiction over a number of Federal environmental laws, including the Clean Air Act, the CWA, and the Safe Drinking Water Act. The U.S. Environmental Protection Agency (EPA) reviews and comments on EISs pursuant to its authority under NEPA, 42 U.S.C. 4371 et seq., and Clean Air Act Section 309, 42 U.S.C. 7609, . EPA's participation in this EIS does not imply endorsement of the project or preferred alternative and does not abridge the independent review of the EIS, which EPA conducts pursuant to NEPA and Section 309 of the Clean Air Act, 42 U.S.C. 7609.
Arizona State Parks (Arizona State Historic Preservation Office)	Declined status as a cooperating agency; however, they have a consulting role under Section 106 of the NHPA.

The cooperating agencies assisted with EIS preparation in a number of ways, including providing research and baseline data information, reviewing scientific reports, identifying issues, assisting with the formulation of alternatives, and reviewing preliminary DEIS content and other EIS materials.

1.6.5 Forest Plan Amendment

As noted above, opportunities for public participation for this project have been extensive. The need to amend the 1985 forest plan for some alternatives was noted in scoping notifications as well as in notifications for opportunities for comment on the DEIS (Boyne 2022; U.S. Forest Service 2016b, 2019a). At the time of the release of the January 2021 Rescinded FEIS and draft ROD, forest plan compliance was based on the 1985 forest plan, and the preferred/selected alternative was consistent with all components in that plan (U.S. Forest Service 2021b:4). The forest plan was revised, with a new plan implemented in December 2023. A subsequent review of the Resolution Copper Project action alternatives compared with the 2023 forest plan indicated the need for a project-specific forest plan amendment under each of the action alternatives (SWCA Environmental Consultants 2025).

The Resolution Copper Project and Land Exchange will follow the administrative review process described in 36 CFR part 218, subpart A. Title 36 CFR 219.51(c) and 36 CFR 219.59(b) state that when a plan amendment is approved in a decision document approving a project or activity, and the amendment applies only to the project or activity, the administrative review process of 36 CFR part 215 or part 218, subpart A applies. This is the case for the proposed plan amendment for the Resolution Copper Project and Land Exchange, which will be approved in the decision document (ROD) for the project, and applies only to the project activity.

1.7 Consultation

1.7.1 Tribal Consultation

Federal agencies consult on a government-to-government basis with federally recognized Native American Tribes having interests in and/or ties to the lands potentially affected by a proposed action and alternatives. The Forest Service is conducting ongoing consultation with 15 Tribes, in accordance with PL 113-291 and FSH Section 1509.13, Chapter 10, “Consultation with Indian Tribes and Alaska Native Corporations” (U.S. Forest Service 2016b). Content discussed in government-to-government consultations is confidentially protected under Subtitle B, “Cultural and Heritage Cooperation Authority,” Sections 8101–8107(5) of PL 110-234, which authorizes the Secretary of Agriculture to protect the confidentiality of certain information, including information that is culturally sensitive to Indian Tribes.

Government-to-government consultation for this land exchange process and EIS process was initiated with a formal letter from Forest Supervisor Neil Bosworth to Tribes in August 2015 and April 2016. The Forest Service held meetings and continues to seek Tribal input via written correspondence, telephone calls, and in-person meetings. Details of the government-to-government consultation process are summarized in Chapter 5, Consulted Parties, and appendix S.

1.7.2 Endangered Species Consultation

The Forest Service requested formal consultation with the FWS under Section 7 of the ESA with submittal of a Biological Assessment on June 26, 2020 (SWCA Environmental Consultants 2020a). The FWS accepted the Biological Assessment on July 9, 2020 (U.S. Fish and Wildlife Service 2020c), and initiated the consultation process. Consultation included the endangered Arizona hedgehog cactus (*Echinocereus triglochidiatus* var. *arizonicus*), the endangered Gila chub (*Gila intermedia*) and designated critical habitat, the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) and designated critical habitat, the threatened northern Mexican gartersnake (*Thamnophis eques megalops*), and the threatened yellow-billed cuckoo (*Coccyzus americanus*) and proposed critical habitat. The FWS completed consultation with the issuance of a Biological Opinion. The Biological Opinion is included in appendix P of the FEIS.

1.7.3 Section 106 Consultation

Section 106 of the NHPA requires Federal agencies to consider the effects of an undertaking on historic properties, which are defined by 36 CFR 800.16(l)(1) as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). An undertaking is a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license, or approval (36 CFR 800.16(y)).

Title 36 CFR 800 sets forth the procedures to be followed during the Section 106 process: initiation of the Section 106 process, identification of historic properties, assessment of adverse effects, and resolution of adverse effects. The Forest Service consulted as required to identify the analysis area, historic properties, and to assess adverse effects on those properties. For resolution of adverse effects, considering the complexity of the project, the Forest Service developed a PA in consultation with the Arizona SHPO, ACHP, Tribes, and other consulting parties.

The Rescinded FEIS included that PA (see appendix O). All signatories, other than the ACHP, had signed the PA as of January 15, 2021. On February 11, 2021, the ACHP notified the Forest Service that the "ACHP believes that further consultation in this case would be unproductive and therefore, we are hereby terminating consultation pursuant to 36 CFR § 800.7(a)(4)." In accordance with 36 CFR 800.7(c)(4), the Secretary of Agriculture delivered a written response to the ACHP on April 17, 2025, and that response concluded the Section 106 process for this undertaking.

Since the ACHP did not sign the PA, it was never executed. Therefore, mitigation measures identified in the PA and any others identified subsequently will now be implemented through the final ROD and special use permit for use of NFS lands, and through enforcement by other State and Federal agencies as well as third parties in separate agreements. Changes in enforcement of the measures described in the draft PA are further described in appendix J.

The Section 106 process is described in more detail in FEIS Section 3.12, Cultural Resources, as well as in Chapter 5, Consulted Parties.

1.8 Issues

Issues serve to highlight effects or unintended consequences that may occur from the proposed action and alternatives, giving opportunities during the analysis to reduce adverse effects and compare trade-offs. Issues help set the scope of the actions, alternatives, and effects to consider in our analysis (FSH 1909.15.12.4) (U.S. Forest Service 2012a).

Comments submitted during the scoping period were used to formulate issues concerning the proposed action. Issues are statements of cause and effect, linking environmental effects to actions (FSH 1909.15.12.41) (U.S. Forest Service 2012a). The EIS ID team separated the issues into two groups: significant and non-significant. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues as identified by CEQ regulations include issues that are outside the scope of the proposed action; already decided by law, regulation, forest plan, or other higher level decision; irrelevant to the decision to be made; or conjectural and not supported by scientific or factual evidence.

NEPA analysis should identify and eliminate from detailed study the issues that are not significant or that have been covered by prior environmental review. A list of non-significant issues and reasons regarding their categorization as non-significant may be found in the project record.[15]

While completing the EIS analysis, some factors and issues formulated during scoping were modified to accurately analyze the resource impacts. Appendix E, Table E-1, Alternatives Impact Summary, documents the issues and issue factors used or modified during the EIS analysis.

The following issue summaries represent brief synopses of the 14 major project issues that were developed from input provided by agencies, Tribes, stakeholders, and the public during scoping for this EIS. Many of the identified primary issues were then subdivided into detailed sub-issues in an effort to more fully and accurately capture the concerns expressed. The complete listing of primary issues and sub-issues is included in Appendix E, Table E-1, Alternatives Impact Summary, as well as in "Resolution Copper Project and Land Exchange Environmental Impact Statement: Final Summary of Issues Identified

[15] See "Resolution Copper Project and Land Exchange Environmental Impact Statement FINAL Summary of Issues Identified Through Scoping Process" (U.S. Forest Service 2017i).

Through Scoping Process," available at https://www.resolutionmineeis.us/documents/usfs-tonto-issues-report-201711.

1.8.1 Issue 1 – Tribal Values and Concerns

Tribes are concerned about current and future adverse effects on area resources from the Resolution Copper Project, as well as other ongoing mining, transportation, energy transmission, pipeline, and other developments in and around the Superior region. These affected resources may include physical resources such as access routes, air, groundwater and surface water, plant and animal life, and landscapes, as well as less tangible attributes such as sense of place; sense of historical, spiritual, religious, and Tribal identity; opportunities for solitude; and opportunities to continue traditional cultural practices and ceremonies.

1.8.2 Issue 2 – Socioeconomics

Construction and operation of the Resolution Copper Project would result in substantial economic and "quality of life" changes—both beneficial and adverse—in the greater Superior area. A large influx of workers to the area would lead to greater demands for housing and capacity pressures on local schools, hospitals, and other medical service providers, as well as on municipal infrastructure such as roads, water and sewer systems, and electrical and communications systems. Conversely, this same influx of workers would contribute to greater retail spending on goods and consumer services in the area and to increased tax revenues to local, county, and state governments. Residential and commercial property values may increase for some but decline for those whose properties are considered negatively affected by proximity to mine facilities (such as the tailings storage area). Some qualities of rural life may be diminished through increased traffic and a possible decrease in local recreational opportunities.

1.8.3 Issue 3 – Environmental Justice

This issue was analyzed in the DEIS. Section 3.15 has been removed in compliance with Executive Orders 14148 and 14173.

1.8.4 Issue 4 – Cultural Resources

Construction and operation of the mine would profoundly and permanently alter the NRHP-listed *Chí'chil Biłdagoteel* (Oak Flat) Historic District Traditional Cultural Place (TCP) through anticipated large-scale geological subsidence. Linear facilities, including new pipelines, power lines, and roads, as well as other facilities such as electrical substations, would also be constructed in support of mine operations.
In addition, development of the proposed tailings storage facility at any of the four proposed or alternative locations would permanently bury or otherwise destroy many prehistoric and historic cultural artifacts, potentially including human burials. Disturbance of known or unknown cultural resources is an impact that is important to many Tribes, regardless of whether data recovery is undertaken. Under the terms of the land exchange, the Oak Flat Federal Parcel would leave Forest Service jurisdiction. Historic properties' leaving Federal management is considered an adverse effect.

1.8.5 Issue 5 – Public Health and Safety

Construction and ongoing operation of the mine may have a variety of adverse effects on public health and safety. These concerns have focused principally on possible risks of breach or other failure of the tailings facility embankment; emissions and negative effects on air quality; possible seepage from or other contamination related to the tailings facility fouling local groundwater supplies; the potential for hazardous material/chemical spills; conflicts between mine-related haul truck and employee vehicles and residential traffic (including pedestrians); possible safety issues resulting from the anticipated subsidence in the Oak Flat area; and potentially increased risk of wildfire from mine operations.

1.8.6 Issue 6 – Water Resources

Potential effects on groundwater and surface water resources from construction, operation, closure, and reclamation of the Resolution Copper Mine is a multi-faceted and complex issue. In many ways, groundwater and surface waters are interconnected, and depletions and geochemical or other alterations of one are likely to affect the other, as well as to affect water-dependent resources such as vegetation and wildlife.

This issue is further complicated by the highly complex geological setting in which the Resolution Copper Mine would be constructed, which would be permanently altered by large-scale ore removal and geological subsidence. The resulting 7,000-foot-deep area of fractured rock and approximately 1.8-mile-wide subsidence area at the surface of Oak Flat, together with ongoing mine dewatering, would be likely over time to result in measurable reductions in flows in Devil's Canyon and Queen Creek and the long-term loss of some seeps and springs in the Superior area.

In addition, a tailings storage facility at either the proposed (Near West) location or at any of the three alternative sites (Silver King, Peg Leg, and Skunk Camp) would, through necessary stormwater management and seepage control practices, reduce the amount of surface water available in that particular watershed. The tailings storage facility also presents risks to the watershed through the potential for contaminants from metals or chemicals in tailings seepage to escape controls and enter groundwater and/or downstream surface waters, thereby potentially threatening riparian areas and other wildlife habitats, human uses, and waters provided to livestock.

1.8.7 Issue 7 – Biological Resources

Mine development has the potential to adversely affect local flora and fauna, including through direct injury or mortality; habitat alteration and loss; habitat fragmentation; reduction in water available to the ecosystem; disturbance by vehicular traffic, increased noise, and increased light; potential exposure to toxic chemicals or other hazardous substances; introduction and/or propagation of noxious or invasive plant species; and curtailed reproduction, pollination, seed dispersal, and other biological processes.

1.8.8 Issue 8 – Air Quality

Construction, ongoing ore recovery and processing, and other related activities at the mine and along transportation and utility corridors would increase dust, airborne chemicals, and transportation-related (mobile) emissions in the area, which has the potential to result in exceedances of one or more established air quality standards.

1.8.9 Issue 9 – Long-term Land Suitability

The mining proposed in the GPO is expected to cause large-scale surface subsidence in the Oak Flat area, eventually resulting in a subsidence area up to 1.8 miles in diameter at the surface and between 800 and 1,115 feet deep. In addition, mine-related ground disturbance from clearing vegetation, grading, and stockpiling soils or equipment or other materials has the potential to compact soils, accelerate erosion, and reduce soil productivity. Damage, disturbance, contamination, or removal of soil may result in a long-term loss of soil productivity, physical structure, and ecological function across the proposed mine site as well as on lands downgradient of mine facilities.

1.8.10 Issue 10 – Recreation

Mine development in the Oak Flat area, including within the anticipated subsidence area and, ultimately, at Oak Flat campground, would eliminate numerous recreational opportunities in this part of the Tonto National Forest. Much of the area would be fenced off and no longer accessible to hikers, rock climbing enthusiasts, cyclists, equestrians, campers, hunters, and other recreational users of these former public lands.

Mine-related linear facilities such as pipelines, power lines, and development within the MARRCO corridor may also sever connectivity of existing roads and trails and further limit recreational access. In addition, construction of a large tailings storage facility and associated pipeline and power line corridors could directly impact the Arizona National Scenic Trail or alter the user experience. Wherever constructed, the area of such a facility would be closed to all recreational uses, resulting in displacement of existing recreation in that area to other locations. Similarly, the exchange of the Oak Flat Federal Parcel would reduce the Federal land base available for recreation and alter recreation access.

1.8.11 Issue 11 – Scenic Resources

Construction and operation of the Resolution Copper Mine would, as a result of anticipated geological subsidence at the East Plant Site, permanently alter the topography and scenic character of the Oak Flat area. Development of a proposed tailings storage facility at any of the four alternative locations now being considered would ultimately result in a new and permanent landform approximately 2,300 to 5,900 acres in area (depending on the alternative) and several hundred feet higher than the current landscape, thus forever altering the existing viewsheds. New utility lines and construction of other mine facilities and infrastructure at the West Plant Site, East Plant Site, and filter plant and loadout facility would alter existing viewsheds, although some of these facilities may be removed and the associated areas reclaimed following mine closure. Changes to viewsheds could alter the user experience along scenic highways and the Arizona National Scenic Trail.

1.8.12 Issue 12 – Transportation and Access

Transportation of personnel, equipment, supplies, and materials related to mine development, operation, and reclamation would increase traffic in and around the town of Superior. Increased mine-related traffic on local roads and highways has the potential to impact local and regional traffic patterns, levels of service, and planned transportation projects and users of NFS roads. Increased mine-associated rail traffic along the MARRCO corridor also has the potential to impact traffic patterns in the local area.

Mine development is likely to result in permanently altered, added, or decommissioned NFS roads or to temporarily restrict access to NFS roads and lands, which could impact recreational users, visitors, and permittees.

1.8.13 Issue 13 – Noise and Vibration

Development, operation, and reclamation of the mine would result in an increase in noise and vibration in the immediate vicinity of mine facilities. Activities that could increase noise and vibration include blasting, underground conveyance of ore, processing operations, operations at the filter plant and loadout facility, and, in the Oak Flat area, episodic land subsidence events. Increases in traffic associated with worker commuting, material delivery, and mine product shipment could also contribute to an overall increase in noise and vibration on area roads and highways.

1.8.14 Issue 14 – Land Ownership and Boundary Management

Changes in land ownership could have impacts as a result of the loss of public lands from the land exchange and mine proposal, including impacts on recreational access and to ranching in the area resulting from changes in easements, rights-of-way, fencing, and/or livestock access, or through special land or resource conservation agreements. Effects on current boundary management of Federal, State, and private lands in the area may include removal or other loss of survey markers, corner monuments, fences, and similar features, particularly in the area of the proposed or alternative tailings storage facility locations.

1.9 Other Proponent-Related Activities on National Forest System Lands

The Tonto National Forest has reviewed and approved multiple other analyses and NEPA documents completed in support of the project. A list of additional projects that have been analyzed can be found in table 1.4-1 of the GPO.

1.9.1 Plan of Operations for Baseline Hydrological and Geotechnical Data-Gathering Activities

Several plans of operation for the copper deposit have been processed during the exploration and development phases to authorize surface-disturbing activities. Currently, Resolution Copper is conducting development drilling in accordance with the approved "Pre-feasibility Plan of Operations," which was authorized in 2010 (U.S. Forest Service 2010b).

In 2013, Resolution Copper submitted the proposed "Plan of Operations for Baseline Hydrological and Geotechnical Data Gathering Activities" (Resolution Copper 2016d). The purpose of this proposal was to collect hydrological, geochemical, and geotechnical data at the location of a potential tailings storage site. The hydrologic, geochemical, and geotechnical data are being used to support detailed design of the facility and the environmental analysis contained in this EIS.

Baseline activities affected approximately 75 acres located on public lands managed by the Tonto National Forest approximately 4.5 miles west of Superior, Arizona. Activities included construction of temporary access roads and drilling/trenching sites; improvement of existing access roads; and installation of groundwater monitoring wells, geotechnical bore holes, and trenches.

1.9.2 Apache Leap Special Management Area

In Section 3003(g) of PL 113-291, Congress designated a portion of the Tonto National Forest as the Apache Leap Special Management Area (SMA) for the purposes of preserving the natural character surrounding the Apache Leap escarpment, allowing traditional and religious uses by Indian Tribes, and protecting and conserving the cultural and archaeological resources of the area.

The Forest Service, in consultation with Indian Tribes, the Town of Superior, Resolution Copper, and other interested members of the public, developed a management plan that provides long-range direction for protecting natural and cultural resources, and managing human uses of the Apache Leap SMA. In December 2017, the Tonto National Forest finalized the environmental review process, management plan, and associated forest plan amendment.

As related to the Resolution Copper Project and Land Exchange, PL 113-291 Section 3003(g)(4)(B) specifically authorized the following activities within the Apache Leap SMA:

- installation of seismic monitoring equipment on the surface and subsurface to protect the resources located within the special management area;
- installation of fences, signs, or other measures necessary to protect the health and safety of the public; and
- operation of an underground tunnel and associated workings, as described in the GPO, subject to any terms and conditions the Secretary of Agriculture may reasonably require.

This page intentionally left blank.

Chapter 2. Alternatives, Including the Proposed Action

2.1 Introduction

Overview

The Forest Service developed reasonable and feasible alternatives to the proposed action to resolve, minimize, or reduce impacts on people and resources by identified issues while meeting the purpose of and need for the proposed action.

Alternatives are a mix of strategies that meet the purpose of and need for the proposed action and resolve or address key issues identified during scoping.

Alternatives for this EIS include the proposed action and no action alternative, along with a range of reasonable action alternatives.

Forest Service NEPA regulations (36 CFR 220.5(e)) require the examination of reasonable alternatives to the proposed action.

Chapter 2 summarizes the alternatives development process, summarizes alternatives eliminated from further consideration, and describes the alternatives carried forward for detailed analysis in the EIS. This chapter presents the range of alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for comparison and choice between options by the decision maker and the public. The differences between alternatives include changes in the location, design, or engineering of the alternative (e.g., acreage required for the footprint of each tailings storage facility); these are discussed in section 2.2. Other differences between alternatives are based on the environmental effects (e.g., the amount of dust caused by different tailings processing methods), social effects (e.g., the miles of roads used for recreation that are lost), and economic effects (e.g., the reduction in property values near the tailings storage facility) of implementing each alternative. Section 2.5 and appendix E include a summary of these effects; chapter 3 provides a more detailed analysis of these effects.

The alternatives development process included comments provided during the scoping period for alternatives that should be considered in the EIS. Alternatives consist of a mix of strategies that meet the purpose of and need for the proposed action and resolve or address key issues identified during scoping. The additional alternatives that were determined to be outside the scope of the project, duplicative of the alternatives already being considered in detail, or technically or economically infeasible or that were determined to include components that would cause unnecessary environmental harm, are further described in Appendix F, Alternatives Considered but Dismissed from Detailed Analysis.

Alternatives considered but dismissed from detailed analysis in this EIS include the following:

- Alternative mining techniques,
- Brownfield tailings disposal, and
- Other alternative tailings disposal locations.

The Forest Service developed the following six alternatives for analysis in the EIS, which include the no action and proposed action alternatives, in response to issues raised by the public, the Tonto National Forest, or cooperating agencies (see section 1.7).

For reference in reviewing this chapter and the EIS in general, a comprehensive glossary of technical mining terminology is included in chapter 8.

2.1.1 Changes from DEIS

The primary change in chapter 2 is the action alternatives themselves. For the DEIS, Alternatives 5 and 6 each had two alternative pipeline routes to carry tailings slurry from the West Plant Site to the respective tailings storage facility. We dropped the Alternative 5 – West pipeline option and the Alternative 6 – South pipeline option from further consideration, and now include a single pipeline option for each alternative. The location of the Alternative 6 – North pipeline option was revised to lessen impacts to resources. We describe all of these changes in detail in chapter 2. We also added additional discussion of power and water use to provide updated information and to respond to concerns raised by the public.

2.1.1.1 NPAG/PAG Terminology

We received public comments suggesting that our terminology in the DEIS to describe the tailings was misleading. As described in this chapter, there are two separate tailings streams that leave the West Plant Site processing facility. Early analyses and the GPO titled these “scavenger” and “cleaner” tailings, which refers to specific processes at the flotation plant. However, we deliberately chose to change these names for the DEIS, particularly because “cleaner” has connotations of better water quality when, in fact, “cleaner” tailings contain concentrated pyrite minerals and are actually more problematic for water quality. To avoid these misunderstandings, we used the terms non-potentially acid generating (NPAG) tailings and potentially acid generating (PAG) tailings in the DEIS.

Public comments were concerned that NPAG tailings still have the potential for acid generation and therefore use of this term is misleading. The discussion of the actual acid-generation potential of the tailings, based on laboratory testing, is found in Section 3.7.2, Groundwater and Surface Water Quality. As disclosed there, samples of the tailings we call NPAG in reality are classified roughly as 15 percent acid generating, 41 percent non-acid generating, and 44 percent PAG. By contrast, samples of the tailings we call PAG are classified 100 percent as acid generating.

We accept the validity of this concern, but in order to avoid confusion we have chosen to maintain consistent terminology between the DEIS and FEIS. A substantial number of documents in the project record also use NPAG/PAG terminology. We also added further discussion of this topic to section 3.7.2.

2.1.1.2 Alternative Mining Techniques

We received detailed comments on our assessment of alternative mining techniques other than block caving; the most commonly noted was cut-and-fill mining. As noted above, this assessment is described in detail in appendix F. Ultimately, we confirmed our decision to dismiss alternative mining techniques from detailed analysis. Almost all industry mining guidance indicates alternative mining techniques are not appropriate for a deposit like the Resolution Copper deposit, and the trade-offs are unreasonable. However, we added further description here due to the interest in this topic.

Comments note the benefits that would ensue from using cut-and-fill mining or other underground mining techniques, including the lack of a subsidence area overhead on Oak Flat, and the ability to backfill tailings underground. We agree with commenters that these are valid benefits if such a technique were reasonable to mine the Resolution Copper deposit.

However, our analysis found that it is an unreasonable technique. Based on review of industry guidance for selection of mining methods, block caving is the standard mining method used in the industry for ore bodies with the grade, size, depth, and geological characteristics of the Resolution Copper deposit.
The ore and host rock characteristics that are favorable to other underground techniques differ from the Resolution Copper deposit. While physically almost any technique could be undertaken, it is unlikely that any of these other underground techniques would be chosen as a reasonable technique for a similar deposit.

Aside from appropriateness when compared to industry standards, use of any of these alternative underground mining techniques would result in higher per-ton mining costs, and as a result the cutoff grade for the deposit would need to be higher to be economically feasible. An increase in the cutoff grade from 1 percent to 2 percent removes an estimated 80 percent of the tonnage of the Resolution Copper deposit from consideration for development. The tonnage is likely to be even lower at a 2 percent cutoff grade, as many of these areas of high-grade ore are not contiguous or continuous. We found that accepting this level of reduction to accommodate an alternative mining technique is not economically feasible and would be unreasonable.

Based on public comments, the primary misunderstanding is that the decision not to analyze alternative mining techniques is based on profit, and that we are prioritizing profitability over environmental protection. This is not the case. Analysis of profitability of the mine was not conducted, and does not factor into the NEPA analysis or the determination of alternatives. Rather, our decision is based on what is reasonable under regulations and policy. We found that forgoing 80 percent of the ore deposit to accommodate an alternative mining technique is an unreasonable outcome. More discussion is included in appendix F.

2.1.2 Changes from the January 2021 Rescinded FEIS

Since January 2021, minor changes have been made to chapter 2 to reflect updates to electrical usage and reclamation and closure plans and to clarify aspects of the water balance and water supply. In addition, the Resolution Copper Project DEIS and January 2021 Rescinded FEIS indicated that Alternatives 2, 3, and 4 would require amendment of the 1985 “Tonto National Forest Land and Resource Management Plan.” The forest plan consistency review was revisited after the revised forest plan was implemented in December 2023 (SWCA Environmental Consultants 2025). The revised consistency review indicated that a project-specific amendment of the 2023 forest plan would be needed with each of the action alternatives presented in the FEIS, Alternatives 2 through 6. Details of the project-specific amendment and exception of plan components are included in chapter 2, in each resource section of chapter 3, and in appendix T (for the preferred alternative) and are summarized in table 1.4.3-1.

2.2 Alternatives Considered in Detail

The FEIS presents five action alternatives and the no action alternative. Alternative 2 is the proposed action and consists of the GPO that was submitted to the Forest Service by the proponent. The remaining action alternatives were developed to meet the purpose and need, and sharply define the issues.
The specific reasons for the development of each action alternative are described in the introduction to each alternative in this chapter.

- Alternative 1 – No Action Alternative. The land exchange would not occur, and the GPO would not be approved. Existing activities occurring on private land would continue as permitted (see section 2.2.3).
- Alternative 2 – Near West Proposed Action. This alternative is a variation of the proposed action described in the May 9, 2016, version of the GPO. Alternative 2 would include a split-stream tailings processing method with two tailings types deposited at a facility at the “Near West” location with a modified-centerline embankment (see section 2.2.4).

- Alternative 3 – Near West – Ultrathickened.[16] Alternative 3 proposes to reduce the amount of water retained in the NPAG[17] tailings as well as reduce seepage potential through on-site ultrathickening of NPAG tailings at a facility at the "Near West" location with a modified-centerline embankment (see section 2.2.5).
- Alternative 4 – Silver King. This is the only alternative that proposes to use filtered tailings instead of slurry tailings at a facility located north of Superior and the West Plant Site. After filtering, conveyors and mobile equipment would mechanically deposit PAG[18] and NPAG tailings in two separate, adjacent storage facilities (see section 2.2.6).
- Alternative 5 – Peg Leg. This alternative allows for a comparison of the impacts of slurry tailings if placed in a flatter alluvial setting instead of in an upland wash or canyon. The tailings would be placed behind a centerline embankment at a location approximately 20 miles south of Superior. A tailings pipeline corridor would be required (see section 2.2.7).
- **Alternative 6 – Skunk Camp (Lead Agency Preferred).[19]** This alternative uses a centerline, cross-valley embankment at a location approximately 20 miles southeast of Superior. This location requires less fill material to retain tailings, compared with a ring-like impoundment, simplifying construction and operations. A power line and tailings pipeline corridor would be required (see section 2.2.8).

The tailings storage facility and type of tailings processing and placement formed the most substantial differences between alternatives, as shown in table 2.2-1.

Table 2.2-1. Tailings storage facility comparison

Alternative	Tailings Storage Facility (area within fence line) and Tailings Corridor (acres)	Embankment Length and Type	Separate PAG Cell?	Approximate Length of Slurry Pipeline (miles)	Tailings Type	Total Groundwater Pumped from Desert Wellfield (acre-feet)
Alternative 2 – Near West Proposed Action	4,981	10-mile-long modified-centerline embankment	Not separated	5.3	Thickened slurry (NPAG and PAG)	600,000
Alternative 3 – Near West – Ultrathickened	4,981	10-mile-long modified-centerline embankment	Separate cell using an internal splitter berm	5.3	Ultrathickened NPAG slurry; thickened PAG slurry	500,000
Alternative 4 – Silver King	5,684	Not applicable – compacted structural zone	Separated, 1 cell	0.2	Filtered	180,000

16 The term "ultrathickened" can have different meanings in the mining industry. Thickened tailings generally have 50 to 70 percent solids; in this case, "ultrathickened" refers to tailings at the high end of this range. Alternative 3 tailings are thickened to 70 percent solids. See figure 2.2.2-10.

17 *Scavenger* is another term found in reference documents and is synonymous with NPAG. As noted in section 2.1.1.1, use of the term NPAG does not mean there is a complete lack of acid generation capacity in these samples.

18 *Pyrite* and *cleaner* are other terms found in reference documents and are synonymous with PAG.

19 Most details about the development of alternatives can be found in the Alternatives Evaluation Report from November 2017 (SWCA Environmental Consultants 2017a). However, the Alternative 6 – Skunk Camp tailings storage facility location was added for consideration in March 2018, following a suggestion by the BLM. The evolution of the Skunk Camp location is described in the project record in "Process Memorandum to File - Evolution of Range of Alternatives Considered in Detail in DEIS, after Publication of the Alternatives Evaluation Report (Nov 2017)" (Garrett 2018c).

Alternative	Tailings Storage Facility (area within fence line) and Tailings Corridor (acres)	Embankment Length and Type	Separate PAG Cell?	Approximate Length of Slurry Pipeline (miles)	Tailings Type	Total Groundwater Pumped from Desert Wellfield (acre-feet)
Alternative 5 – Peg Leg	12,094	7-mile-long centerline embankment	Separated, 4 cells	22.7	Thickened slurry (NPAG and PAG)	550,000
Alternative 6 – Skunk Camp	10,379	3-mile-long centerline embankment	Separated, 2 cells	19.2	Thickened slurry (NPAG and PAG)	550,000

2.2.1 Forest Service Preferred Alternative

Alternative 6 – Skunk Camp remains the Lead Agency's preferred alternative.

2.2.2 Elements Common to All Action Alternatives

Elements that are common to the proposed action and action alternatives are described in this section. Later sections in chapter 2 describe specific features or changes that are particular to each individual alternative. The elements that are common to all alternatives include the land exchange process and many elements of the GPO except for the tailings storage facility.

2.2.2.1 Land Exchange

Section 3003 of PL 113-291 authorizes and directs the Secretary of Agriculture to administer a land exchange between Resolution Copper and the Forest Service. PL 113-291 also directs the Forest Service to carry out the land exchange in accordance with the requirements of NEPA with a single EIS. The land exchange is not a discretional decision, but required by PL 113-291; therefore, no decision will be issued for the land exchange process. As detailed in PL 113-291, the land exchange would convey 2,422 acres of NFS land (selected lands) to Resolution Copper. The land being transferred to Resolution Copper is located east of the town of Superior in an area known as Oak Flat.

In exchange for the transfer of the Oak Flat Federal Parcel out of Federal ownership, Resolution Copper would convey private land parcels to the Federal Government consisting of approximately 5,460 acres of private land (offered lands) on eight parcels located elsewhere in Arizona. Section 3003 of PL 113-291 limits the future uses of these lands, including for the purposes of mining: "(f) WITHDRAWAL.— Subject to valid existing rights, Apache Leap and any land acquired by the United States under this section are withdrawn from all forms of—(1) entry, appropriation, or disposal under the public land laws; (2) location, entry, and patent under the mining laws; and (3) disposition under the mineral leasing, mineral materials, and geothermal leasing laws."

The selected and offered land exchange parcels are listed in the legislation authorizing the land exchange (figure 2.2.2-1 and Appendix B, Existing Conditions of Offered Lands). See table 1.4.2-1 in chapter 1 for a summary of the land exchange components. Detailed figures for each of the land exchange parcels are provided in appendix B.

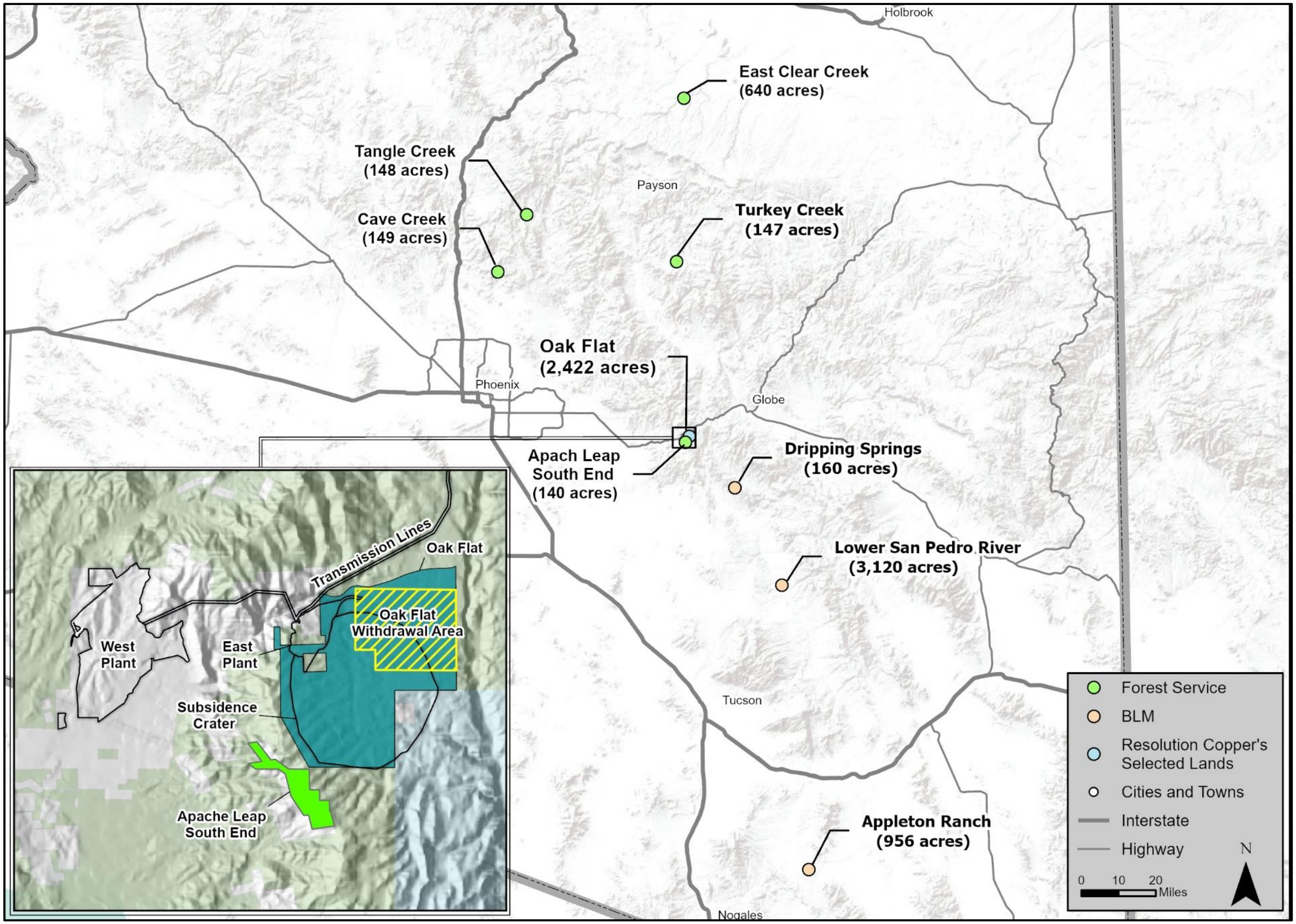


Figure 2.2.2-1. Land exchange parcels overview

Selected Lands

The selected lands include 2,422 acres of NFS lands, known as the Oak Flat Federal Parcel, located east of Superior in Pinal County, Arizona. The lands transferred from the NFS to Resolution Copper would become private lands (both surface and subsurface mineral estate).

The 760-acre Oak Flat Withdrawal Area (the boundaries of which are shown in figure 2.2.2-1) includes a 50-acre campground with 16 campsites, known as the Oak Flat campground. The Oak Flat campground would be conveyed to Resolution Copper during the land exchange. As a condition of conveyance of the Federal land, Resolution Copper must agree to provide access to the surface of Oak Flat campground to members of the public until such a time that mine operations preclude access for safety reasons.

The Oak Flat Federal Parcel is adjacent to and surrounding Resolution Copper private land on which the existing East Plant Site mining facilities are located. The underground mining operations would take place beneath the Oak Flat Federal Parcel, and additional infrastructure would be located on the Oak Flat Federal Parcel after approval of the final GPO and execution of the land exchange.

Offered Lands

The offered lands include approximately 5,460 acres of Resolution Copper private land on eight parcel groups located throughout Arizona. The parcels of offered lands would be transferred to the United States, for administration by either the Forest Service or BLM.[20]

FOREST SERVICE

Land exchange parcel locations are shown in figure 2.2.2-1. Five of the eight parcels Resolution Copper would transfer to the Federal Government would administratively fall under the Forest Service.

Apache Leap South End Parcel: The Apache Leap South End Parcel consists of 140 acres located near the eastern edge of the town of Superior in Pinal County, Arizona. The Apache Leap South End Parcel would become part of the Apache Leap SMA, administered by the Tonto National Forest, Globe Ranger District. Upon completion of the land exchange, Resolution Copper would surrender all mining claims and interests to this parcel.

The parcel includes lands located above and below Apache Leap, an escarpment of sheer cliff faces, hoodoos, and buttresses that forms the scenic backdrop to the town of Superior. Vegetation on the parcel includes shrubs, cacti, and trees such as mesquite, paloverde, and ironwood below the escarpment and woody evergreens and shrubs such as oaks above the escarpment. Current land uses on the parcel include informal recreation and livestock grazing. Additionally, there are multiple historic mining features and remnants of old mining-related roads located throughout the parcel. The acreage of this parcel was updated to reflect additional areas offered by Resolution Copper and a cadastral survey completed by the BLM in 2018.

Tangle Creek Parcel: Located in Yavapai County, Arizona, approximately 35 miles north of the towns of Cave Creek and Carefree, the Tangle Creek Parcel is a 148-acre private inholding within the Tonto National Forest. The parcel would be administered by the Tonto National Forest, Cave Creek Ranger District.

The Tangle Creek Parcel is located in Bloody Basin, a rugged, scenic basin in central Arizona with abundant hiking, camping, and hunting opportunities. The parcel was homesteaded in the 1890s by the

---

[20] The acreages shown in this section are those offered by Resolution Copper to the Federal Government, after completion of surveys. Ultimately, the Federal Government may not accept all portions of these lands. The exact parcels and acreage would be assessed in the appraisal process.

Babbitt family. The historically cultivated farm fields are in the process of reverting to open woodlands and thickets of hackberry, mesquite, and catclaw acacia. Features of the Tangle Creek Parcel include Tangle Creek (an intermittent stream) and associated riparian habitat, as well as mature netleaf hackberry, mesquite, ash, and sycamore trees, which provide habitat for migratory birds and nesting songbirds. The parcel also contains a power line transmission corridor.

Turkey Creek Parcel: The Turkey Creek Parcel is a 147-acre parcel located approximately 8 miles southeast of the community of Pleasant Valley in Gila County, Arizona. The Turkey Creek Parcel is a private inholding within the Tonto National Forest and would be administered by the Tonto National Forest, Pleasant Valley Ranger District.

The parcel includes a historic 1880s-era homestead, including the cabin site foundation, hand-dug well, and fruit trees. Turkey Creek (an intermittent stream) and associated riparian habitat also provide varied wildlife habitat for elk, mule deer, and native fish and proposed critical habitat and two protected activity centers for Mexican spotted owl.[21]

Cave Creek Parcel: The Cave Creek Parcel is a 149-acre parcel located approximately 7 miles north of Cave Creek in Maricopa County, Arizona. The Cave Creek Parcel is a private inholding surrounded by Tonto National Forest lands. Upon completion of the land exchange, the parcel would be administered by the Tonto National Forest, Cave Creek Ranger District.

The Cave Creek Parcel includes Cave Creek (an intermittent stream) and its riparian habitat corridor, with stands of cottonwood and mesquite trees. Perennial waters provide wildlife habitat for migratory songbirds, raptors, amphibians, javelina, mule deer, and coyotes. The parcel also encompasses numerous archaeological sites, including petroglyphs, structure ruins, and grinding sites.

East Clear Creek Parcel: The East Clear Creek Parcel is a 640-acre private inholding within the Coconino National Forest, located north of Payson in Coconino County, Arizona. The parcel would be administered by the Coconino National Forest, Mogollon Rim Ranger District. The East Clear Creek Parcel is located in a transitional zone between the upper plateau and riparian ecosystems on the Mogollon Rim. The parcel includes portions of East Clear Creek Canyon and several secondary side canyons, which provide riparian wildlife habitat and raptor nesting and roosting sites.[22] East Clear Creek is a perennial stream.

BUREAU OF LAND MANAGEMENT

The BLM would administer the remaining three parcels of land to be transferred from Resolution Copper to the Federal Government.

Lower San Pedro River Parcel: The Lower San Pedro River Parcel is approximately 3,120-acre parcel located near Mammoth in Pinal County, Arizona. In November 1988, Congress designated 40 miles and approximately 56,000 acres of the upper San Pedro corridor as the San Pedro Riparian National Conservation Area. The parcel, which includes approximately 7 miles of the Lower San Pedro River (an intermittent stream at this location), would be administered by the BLM Gila District, Tucson Field Office, as part of the San Pedro Riparian National Conservation Area. The parcel is non-contiguous to, and roughly 60 miles northwest of, the existing BLM-administered San Pedro Riparian National Conservation Area. The riparian corridor in the parcel includes more than 800 acres of mesquite woodland that features a spring-fed wetland. The parcel’s riparian areas and woodlands provide habitat

[21] The Bear Fire (July 2018) had minimal burn effects on the Turkey Creek Parcel.

[22] The Tinder Fire (April 2018) did burn a large portion of the East Clear Creek Parcel, with vegetation burned from grass through crown level.

for a wide variety of wildlife, including many migratory bird species and lowland leopard frogs. The acreage of this parcel was updated based on a cadastral survey completed by the BLM in 2020.

Appleton Ranch Parcel: The Appleton Ranch Parcel includes approximately 956 acres of non-contiguous private lands south of Elgin in Santa Cruz County, Arizona. The parcels are within the Appleton-Whittell Research Ranch and Las Cienegas National Conservation Area acquisition area. The parcels are to be administered by the BLM Gila District, Tucson Field Office, as part of the Las Cienegas National Conservation Area. The Las Cienegas National Conservation Area, established in 2000, is a 45,000-acre conservation area containing cottonwood-willow riparian forests and marshlands associated with Cienega Creek, rolling grasslands, and woodlands. The Appleton-Whittell Research Ranch was established in 1969 by the Appleton family in partnership with the National Audubon Society, Forest Service, and BLM as a sanctuary for native plants and animals and a research facility for the study of grassland ecosystems. The ranch, currently managed by the National Audubon Society, contains more than 90 species of native grass and 480 native plant species and is used by more than 200 species of birds for wintering, breeding, or migratory habitat. The acreage of this parcel was updated based on a cadastral survey completed by the BLM in 2020.

Dripping Springs Parcel: The Dripping Springs Parcel is a 160-acre parcel located northeast of Kearny in Gila and Pinal Counties, Arizona. The parcel, situated in the Dripping Spring Mountains near Tam O'Shanter Peak, is almost completely surrounded by BLM-administered lands, with some adjacent ASLD-administered State Trust land. The parcel would be administered by the BLM Gila District, Tucson Field Office. Vegetation on the parcel includes shrubs, cacti, and desert trees such as paloverde, ironwood, and mesquite, as well as areas of semidesert grassland with desert grasses and shrubs. The parcel's abundant rock formations are known for offering recreational rock-climbing opportunities.

Land Exchange Appraisal

PL 113-291 Section 3003(c)(5) requires that the private lands to be exchanged also be of equal monetary value to the Federal lands; however, PL 113-291 specifically waives the FLPMA-mandated 25 percent cap, allowing a larger percentage of cash payment on the differences in exchange values, if any exist, for the Resolution Copper Project. This allows the Secretary of Agriculture to accept a payment in excess of the FLPMA-mandated 25 percent cap in order to achieve a parity in overall exchange values.

APPRAISAL PROCESS

The appraisal used the Uniform Standards of Professional Appraisal Practice, the Uniform Appraisal Standards for Federal Land Acquisitions, and Federal regulations under 36 CFR 254.9 (Forest Service appraisal procedures). The Uniform Standards of Professional Appraisal Practice are the industry standard for real estate appraisals. The Uniform Appraisal Standards for Federal Land Acquisitions are an additional set of appraisal standards for Federal land acquisitions and exchanges. The appraisal process began with the Notice of Exchange Proposal Land-For-Land Exchange published on December 12, 2017.

PL 113-291 requires the joint selection of a qualified appraiser by both parties (the Federal Government and Resolution Copper). The appraiser was selected and began work in 2019. The completed appraisal reports were reviewed by a Forest Service review appraiser. The review appraiser ensured that the appraisal follows the appraisal instructions, Uniform Standards of Professional Appraisal Practice and Uniform Appraisal Standards for Federal Land Acquisitions standards, Federal regulations, and the special requirements found in PL 113-291. The review appraiser ensured that the values concluded by the appraiser are sound and well supported.

PL 113-291 specifies "a detailed income capitalization approach analysis of the market value of the Federal land which may be utilized, as appropriate, to determine the value of the Federal land." The income capitalization approach is one of three commonly used approaches used for real property appraisals.

PL 113-291 specifies that the appraisal reports (or a summary thereof) supporting the land exchange will be made available for public review prior to consummation of the land exchange. Summaries of the appraisals for each parcel were publicly released by the Forest Service on April 22, 2025.

2.2.2.2 General Plan of Operations Components

The proposed action consists of three main components: (1) the Southeast Arizona Land Exchange, a congressionally mandated exchange of land between Resolution Copper and the United States; (2) approval of the GPO for any operations on NFS land associated with the Resolution Copper Project; and (3) project-specific amendments to the forest plan. Because the land exchange would be the same under the proposed action and all action alternatives, it is described in Section 2.2.2, Elements Common to all Action Alternatives.

This section summarizes the components of the proposed action as described in detail in the GPO. For a full description of the proposed mining operation, including the construction, operation, closure, and reclamation phases of the proposed mine, please refer to the GPO, as amended, which is available online at http://www.resolutionmineeis.us/documents/resolution-copper-gpo or at the Tonto National Forest Supervisor's Office, 2324 East McDowell Road, Phoenix, Arizona 85006.

The description of the GPO is organized as follows:

1. The mine's main facilities (existing and new).
2. The mining processes and activities that would occur during operations of the mine.
3. The closure and reclamation processes that would occur, including financial assurance for reclamation activities.

The proposed action is composed of new mining facilities, existing mining facilities, and existing facilities that are proposed for expansion. The main facilities can be summarized as the East Plant Site, West Plant Site, tailings storage facility, and filter plant and loadout facility (figure 2.2.2-2). In addition, detailed information is provided for several linear corridors, including the ore conveyor/infrastructure corridor and the MARRCO corridor. Surface subsidence is also expected above the underground mine, and this subsidence area is described in relation to the underground mining process (see "Predicted Subsidence Area" later in this section). Table 2.2.2-1 summarizes the direct surface disturbance areas for each of the main mining facilities.

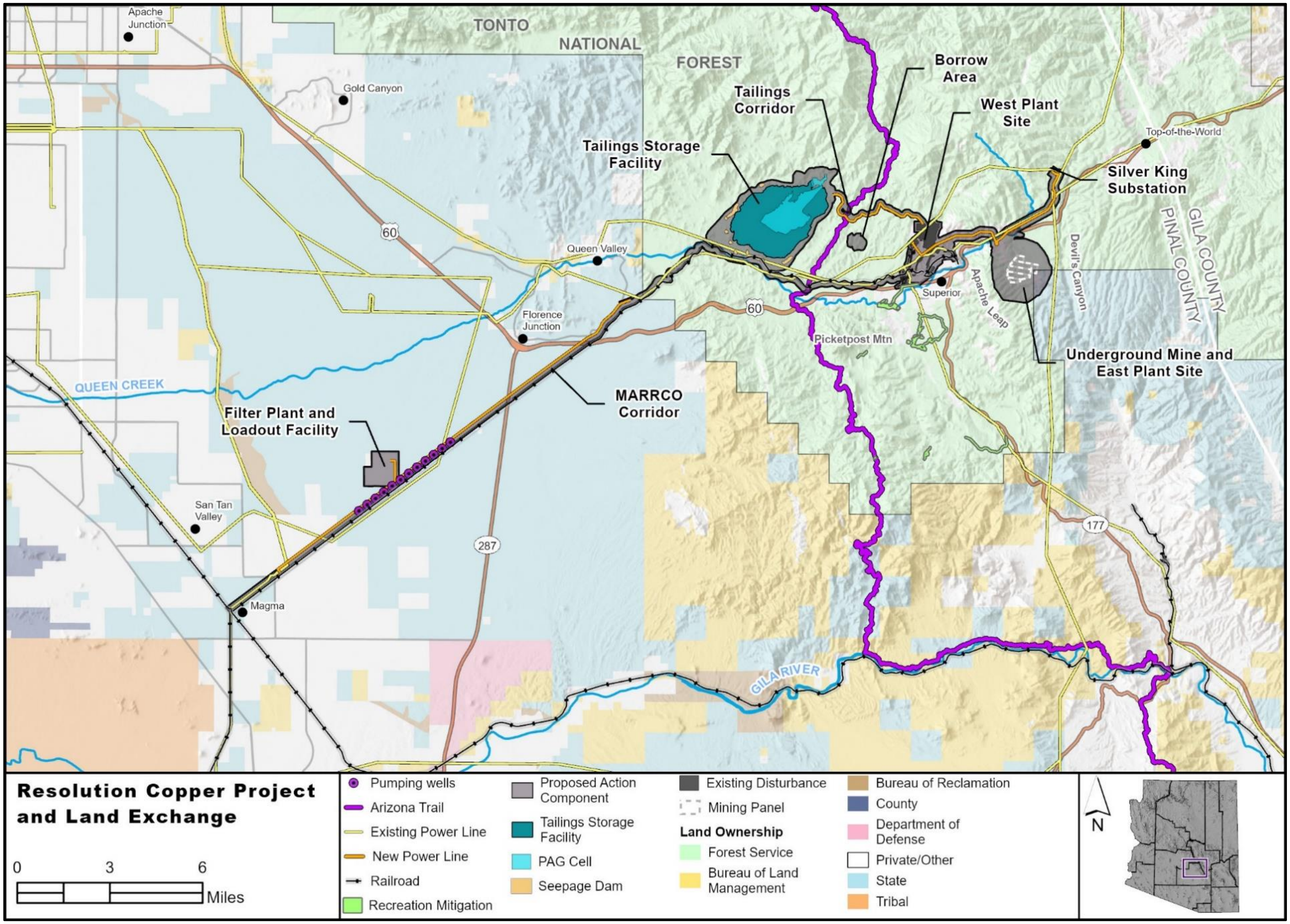


Figure 2.2.2-2. Alternative 2 – Near West Proposed Action overview

Table 2.2.2-1. Summary of project surface disturbance by proposed action

Facility	Total Disturbance (acres rounded to whole numbers)
East Plant Site (includes Magma Mine Road). Note that all NFS acreage shown in the East Plant Site would become private following the land exchange.	189 (85 NFS and 104 private)
Subsidence area (excluding the East Plant Site). Note that all NFS acreage shown in the subsidence area would become private following the land exchange.	1,672 (1,458 NFS, 147 ASLD, 67 private)
West Plant Site	940 (all private)
Tailings storage facility (area within fence line) and tailings pipeline corridor	4,981 (4,940 NFS, 41 private)
MARRCO corridor	685 (235 NFS, 165 ASLD, 285 private)
Filter plant and loadout facility	553 (all private)
Power lines	670 (378 NFS, 292 private)
Borrow area	90 (all NFS)
Total	**9,780 (7,186 NFS, 312 ASLD, 2,282 private)**

Note: Excludes Silver King Road realignment option (see section 2.2.9.2) and mitigation disturbance (see section 2.3)

Mine Phases: Construction, Operation, and Closure and Reclamation Time Frames

The estimated overall life of the mine is 51 to 56 years and would consist of three phases: (1) construction, (2) operations, and (3) closure and reclamation. The time frames for these phases and the general activities that would occur under each phase are summarized in figure 2.2.2-3. The term "mine year" is defined as 1 year after the final ROD has been signed and the final GPO has been approved by the Forest Service.[23] These phases were initially defined in table 1.8-1 in the GPO[24] and showed a 45-year operations phase. Subsequent design work and analysis to support the DEIS refined the length of active mining to be 40 years.

[23] Should construction implementation be substantially delayed after the GPO has been approved by the Forest Service (for example, by litigation), the Forest Service would review and update the trigger for tracking mine years. Terminology for mine phases is described further in Rigg (2018).

[24] Multiple versions of the GPO exist. See the process memorandum titled "History of Revisions to General Plan of Operations" (Garrett 2016) for full details. The version of the GPO cited here is dated May 9, 2016 (Resolution Copper 2016c).

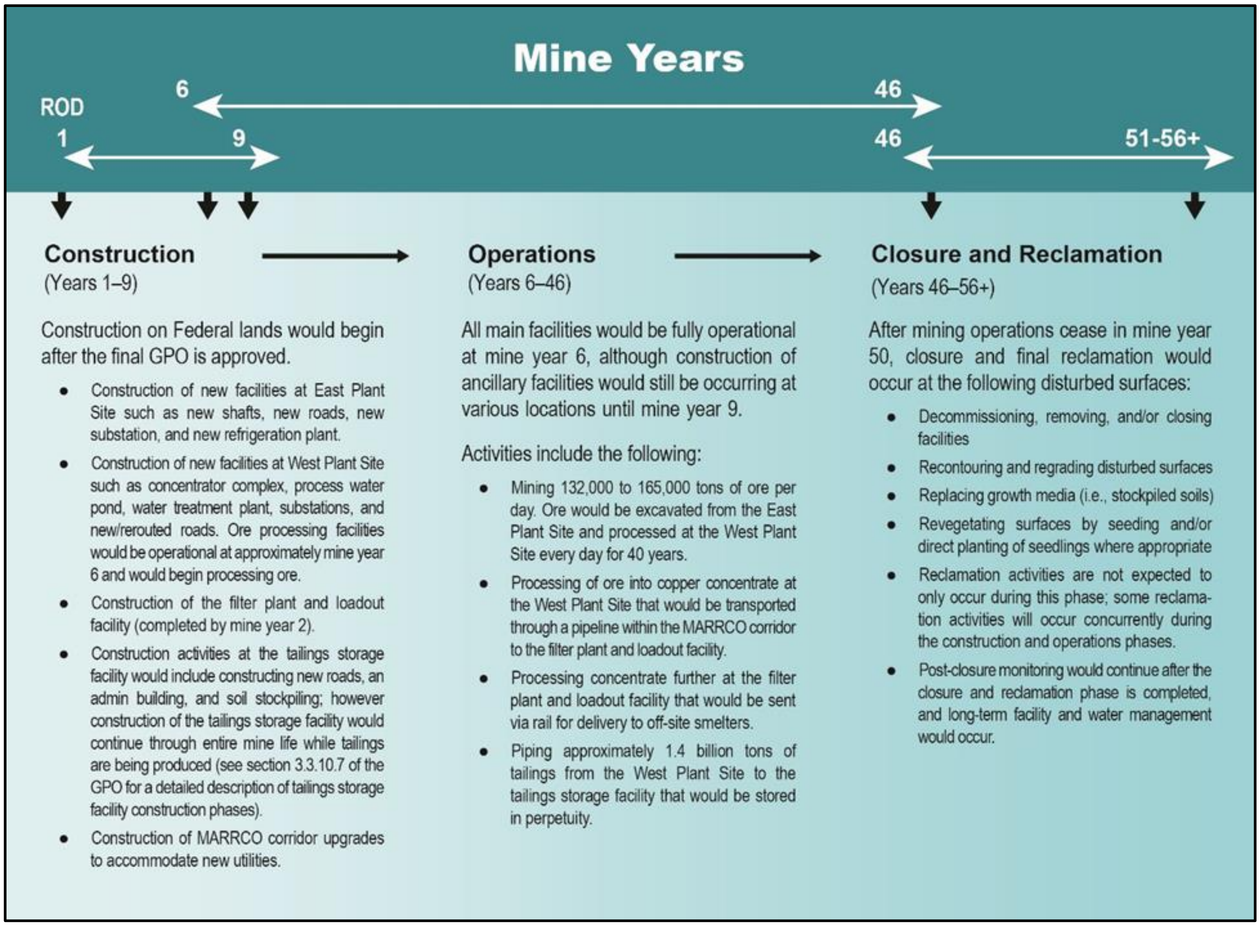


Figure 2.2.2-3. Mine phases, time frames, and mine activities by phase

Mining Process Overview

The Resolution Copper Mine, including all facilities described in this document, would operate 24 hours per day, 365 days per year. Figure 2.2.2-4 shows an overview of the entire mining process that would occur at full operation.

Mining the copper deposit would occur between approximately 4,500 and 7,000 feet below ground. At full operation, underground mining would produce 132,000 to 165,000 tons of ore per day. Ore would be crushed underground before being transported to two production shafts that would hoist the ore to an offloading station approximately halfway to the surface. From the offloading station, a conveyor system would transport the ore underground to the concentrator complex at the West Plant Site, approximately 2.25 miles west of the East Plant Site.

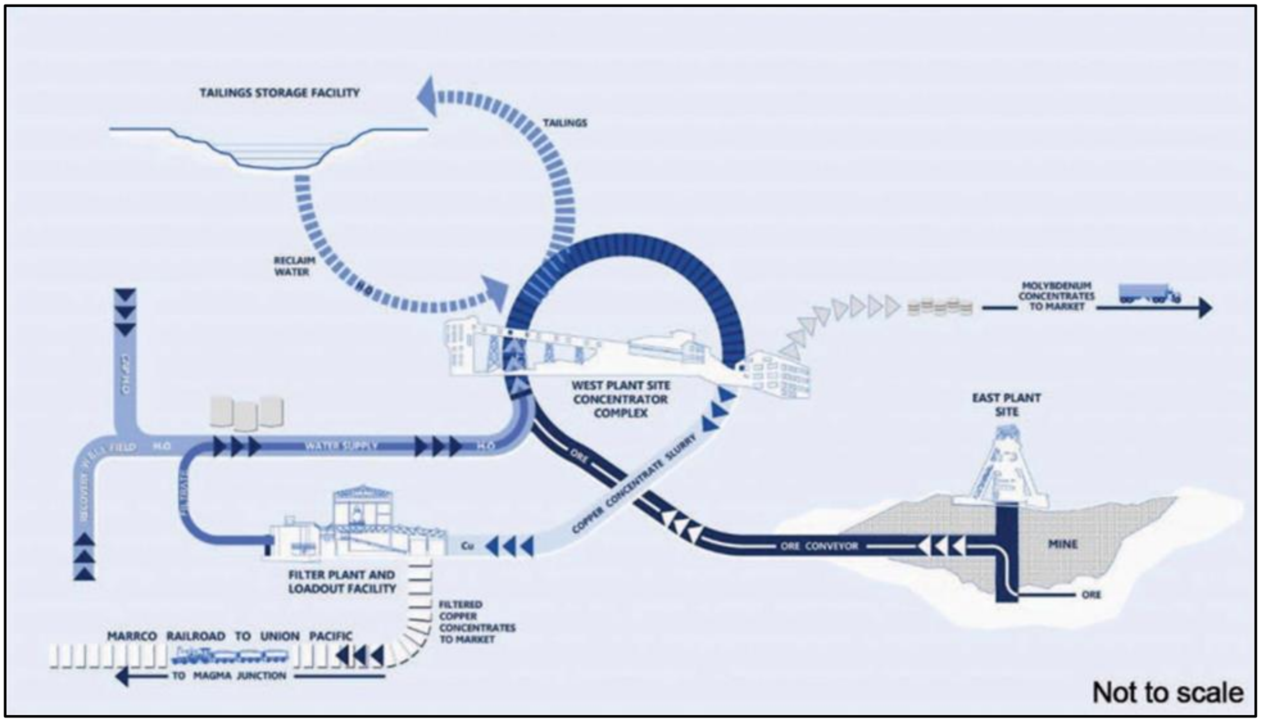


Figure 2.2.2-4. Overview of the mining process at full operation

Once arriving at the concentrator complex, the ore would either be processed right away or stockpiled for future processing at a covered stockpile. The ore would then be conveyed into a concentrator building for additional crushing and grinding to a sand-size fraction and then further processed by flotation, whereby copper and molybdenum minerals are separated from non-economic minerals in a water bath with the addition of air and reagents. This process produces two products: molybdenum concentrate and copper concentrate. The molybdenum concentrate would be sent to the molybdenum plant for additional processing, packaging, and delivery to market via truck. Approximately 24,145 tons of molybdenum concentrate would be produced per year and sent to market during the operations phase. The copper concentrate slurry would be partially dewatered and pumped about 21 miles to the filter plant and loadout facility through two 8-inch high-density polyethylene (HDPE)-lined steel pipelines that would be located within the MARRCO corridor.

At the filter plant and loadout facility, copper concentrate would be filtered to remove more water and prepared for transport by railcar to Magma Junction for unloading at the Union Pacific Railroad. During the operations phase, between 6,000 and 7,000 wet tons per day of copper concentrate would be produced and sent out for smelting at an off-site smelter. The final smelter destination is unknown at this time. Water recovered during the filter process would be returned to the process water pond at the West Plant Site through the mine's main water supply pipeline in the MARRCO corridor.

The non-economic sand-like material that remains after the ore has been crushed and the copper and other valuable minerals has been extracted is called tailings. Tailings would be sent to a tailings storage facility approximately 4.7 miles west of the West Plant Site through two pipelines (48-inch pipe for NPAG, 24-inch pipe for PAG; reclaimed water would return to West Plant Site in an 18-inch pipe).

Approximately 1.37 billion tons of tailings would be created during the mining process and would be permanently stored at the tailings storage facility. Tailings leaving the processing plant would be split into two separate streams. About 16 percent of the tailings are classified as potentially acid generating, or PAG tailings. These tailings contain much of the sulfides from the ore. The remaining 84 percent of the tailings are classified as non-potentially acid generating, or NPAG, tailings.

The PAG tailings and NPAG tailings would arrive at the tailings storage facility separately. The PAG tailings would be deposited in such a way that they are kept submerged beneath water (known as “subaqueous deposition”). This limits oxygen from interacting with the concentration of sulfides in the PAG tailings, minimizing and preventing water quality problems (acid rock drainage). The NPAG are less reactive and would be deposited in a way that would eventually encapsulate the PAG tailings.

UNDERGROUND MINING

Resolution Copper proposes to mine the copper deposit under the Oak Flat Federal Parcel using a method known as panel caving. Panel caving would be the mining method used under all action alternatives. Other mining methods were considered but not analyzed in detail; for additional information, see appendix F. The following sections describe the panel caving method and the various other activities that would occur at the underground mine.

Panel Caving Overview

The type of copper deposit that would be mined at the East Plant Site is a porphyry deposit located between approximately 4,500 and 7,000 feet below the Oak Flat Federal Parcel. The copper deposit that Resolution Copper proposes to mine averages 1.54 percent copper (i.e., every ton of ore would on average contain 31 pounds of copper). The proposed action would use panel cave technology, a type of block caving that is a large-scale mining method.

In general, the panel caving mining system divides the ore into large sections or panels and depends on gravity and internal geological stresses to extract ore from underneath the ore body. After accessing the area below the copper deposit through the construction of vertical shafts, a network of tunnels (vertical shafts and horizontal drifts) is excavated under the copper deposit. The tunnels would be created by standard underground techniques, including drilling, blasting, and removing the blasted rock. The network of tunnels would have four levels, each with different functions, as described in table 2.2.2-2.

Table 2.2.2-2. Description of underground tunnel levels

Level	Function	Components
Undercut blasting	Blast ore body directly overlying the undercut blasting level	Drifts, shafts, and mechanical support
Extraction	Collect blasted ore	Drifts, shafts, mechanical support, drawbells, load-haul-dump vehicles, and ore passes and chutes
Exhaust	Circulate cool air from refrigeration system throughout underground mine operations	Drifts, shafts, ductwork, and variable-speed fans
Rail haulage and crushing	Transport ore from drawbells to underground crushing facility and then convey to production shafts	Drifts, shafts, crushing facility, mechanical support, haul trucks, and/or rail cars and rail system

Once the tunnels are built below the copper deposit, the ore above is blasted to fracture it. The ore then collapses downward through funnel points known as drawbells.

From the drawbells, the collapsed ore in the extraction level would be transported through the tunnel system to a crushing facility underneath the haulage level, where the ore would be crushed by one of three gyratory crushers. Once crushed, the ore would be conveyed to a production shaft where it would be hoisted approximately halfway to the surface (approximately 3,500 feet below surface) and sent from a loadout facility to the West Plant Site via the inclined underground to surface conveyor system.

After the ore has been blasted and collapsed into the drawbells, an expansion void (or cave) within the ore body would form. Additional fracturing and ore collapsing would occur at the expansion void as a result of internal geological stresses caused by the cave, at times aided by additional blasting. The continued process of collapsing and excavating the ore would be repeated until the copper deposit is exhausted or the grade of the collapsed ore is no longer economically viable. Over the 40-year operations phase, this process would be applied at six panels adjacent to one another under the Oak Flat Federal Parcel (figure 2.2.2-5). The mining sequence would begin away from Apache Leap in Panel 2; subsequently mined panels would be Panels 3, 1, 4, 5, and 6, as shown in figure 2.2.2-5.

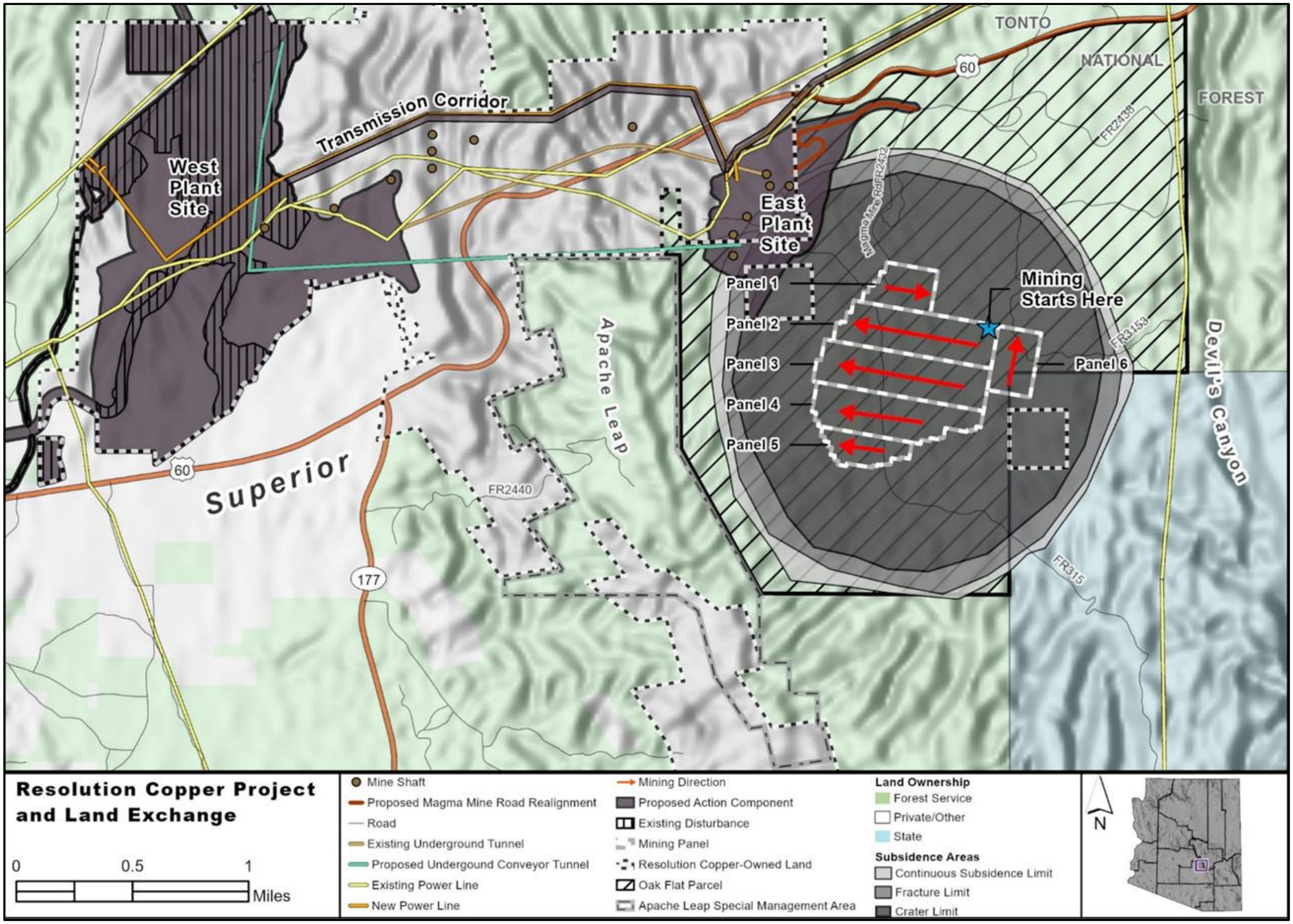


Figure 2.2.2-5. Predicted mining subsidence areas and the East Plant Site area

In total, about 600 pieces of mobile equipment would be used at the underground mining operations. This equipment is identified in table 2.2.2-3.

Table 2.2.2-3. Underground mobile equipment

Use	Equipment
Drilling and blasting	Drilling jumbos
	Production drills
	Explosives loader unit
	Load-haul-dump machines
	Load-haul-dump generator trucks
Production and haulage	Underground haul trucks
	Railroad locomotives
	Rail bottom dump cars
	Medium reach rigs
Secondary breaking fleet	Robust rigs
	Mobile rock breakers
	Rock and cable bolters
	Shotcrete sprayer and trucks
	Scissor lifts
Miscellaneous maintenance and service vehicles	Support trucks: fuel/lube, crane, water, shotcrete
	Flat
	Deck and service
	Graders
	Personnel vans and other vehicles

Refrigeration and Ventilation Systems

Heat in the underground mining operations would be generated by numerous human-made and natural thermal sources. The geological formation is naturally hot at the depth of mining, and in addition to this heat, other sources of underground heat and exhaust would be generated by vehicles and mobile equipment (both electric and diesel driven), workshops, warehouses, pump stations, the refrigeration plant, conveyors, the crusher station, and electrical substations. A refrigeration and ventilation system would be constructed at the surface at the East Plant Site to maintain appropriate temperatures in the underground mining operations and protect the health and safety of workers from excessive heat, equipment exhaust, gases, radon, respirable dust, and fibers. At full production, Shafts 11, 12, and 13 would be used as downcast fresh-air intake shafts, while Shafts 9, 10, and 14 would be used as upcast ventilation exhaust shafts, along with the conveyor/infrastructure tunnel exhaust raise. Mine shaft locations are shown in figure 2.2.2-7.

Underground Mine Auxiliary Facilities

Construction of auxiliary facilities within the underground mine workings would support the operations, including the following:

- Electrical substations, along with transmission and distribution systems, to provide power to the underground facilities and equipment.

- An underground workshop, warehouses, a batch plant, and fuel/tire storage to support mine operations.
- Various pump stations, pipelines, and infrastructure necessary for dewatering water from underground mine workings and the transfer of process and cooling water in the mining circuit.

Predicted Subsidence Area

As the panel caving process is repeated, the volume of ore extracted from the underground mine is expected to cause the surface of the Oak Flat Federal Parcel to collapse or subside. The size and depth of the land surface depression is primarily affected by the depth and footprint of the mine.

The analysis of the environmental effects of mining is contained in chapter 3, including a detailed discussion of subsidence. However, the collapse of rock downward is also a fundamental aspect of how the panel caving technique works; therefore, subsidence is described briefly here as part of the proposed action.

Resolution Copper has conducted simulations and modeling to predict the potential area that would subside. The overall subsidence would consist of three areas: (1) the crater limit, (2) the fracture limit, and (3) the continuous subsidence limit. Table 2.2.2-4 identifies the characteristics of each of the three subsidence areas, as well as the acreages of each area that are predicted to occur under the proposed action.

Under the proposed action, mining would not occur within some sections of the 1 percent copper deposit shell nearest Apache Leap to minimize risk of subsidence at Apache Leap.

Table 2.2.2-4. Characteristics and acreages of subsidence subareas

Subsidence Subarea	Characteristics	Predicted Acreage of Each Area
Crater limit	Large, visible crater with cave angles of 70 to 78 degrees and with a depth between approximately 800 and 1,115 feet at the end of mine life	1,329
Fracture limit	Visible deformation in a conical form between the surface and cave zone; characterized by rotational failures, tension and dislocation cracks, benching, fractured surfaces, and toppling	250
Subsidence limit	Extremely small rock deformations that can only be detected by high-resolution monitoring equipment (would not be visible in the soil or on the ground)	172
Total Area of Subsidence		**1,751**

Note: The acreages shown here for the subsidence area differ from the acreage in table 2.2.2-1. The acreage shown for the subsidence area in table 2.2.2-1 does not include areas within the East Plant Site, to avoid double-counting.

Figure 2.2.2-5 shows a map of the predicted mining subsidence areas, and figure 2.2.2-6 shows a cross section and aerial views of the predicted subsidence areas.

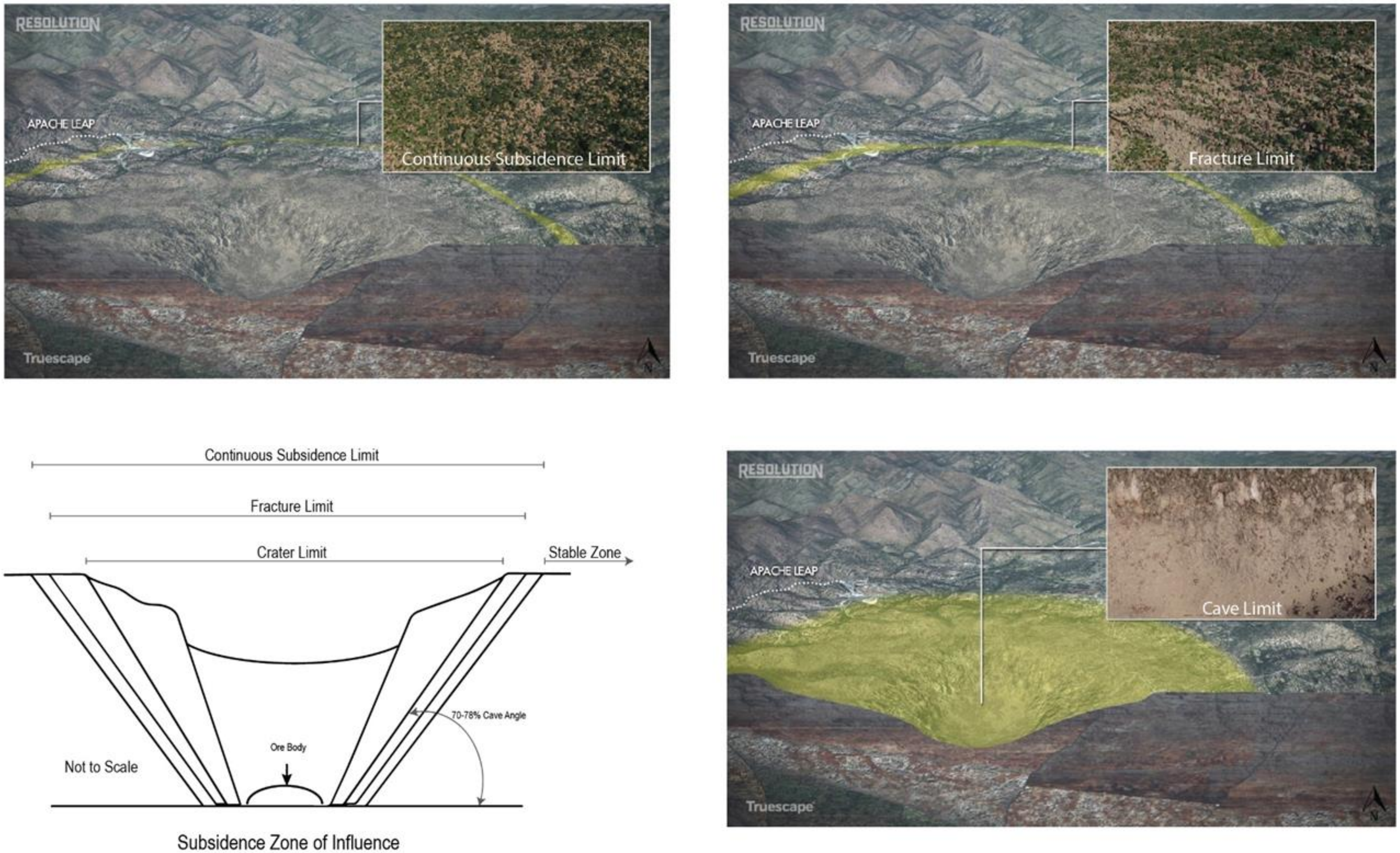


Figure 2.2.2-6. Cross section and aerial photograph simulations of the predicted subsidence areas

East Plant Site

The East Plant Site includes the surface support facilities for underground mining activities, including the access shafts (see figure 2.2.2-7). The East Plant Site would expand from its current size of 39 acres to 189 acres. At present, 4 acres of the existing East Plant Site and 81 acres of the proposed East Plant Site are NFS lands; following the land exchange, all of the East Plant Site would be private. The 4 acres of the existing East Plant Site has been previously disturbed. These acreages do not include several other aspects of the East Plant Site, including the underground infrastructure for the panel caving, the mined panels themselves, or the surface subsidence area.

Details of existing East Plant Site facilities, new East Plant Site facilities, and materials used at the East Plant Site are summarized in appendix G.

Ore Conveyor/Infrastructure Corridor

Partially crushed ore from the East Plant Site underground mine operations would be transported to the West Plant Site concentrator complex via an inclined underground to surface conveyor system (see figure 2.2.2-7). The underground conveyance system would be composed of an underground tunnel with two conveyors that are inclined at approximately 10 degrees for more than 2.5 miles. The alignment of the conveyance system would be under a combination of unpatented mining claims and private lands owned by Resolution Copper. Surface disturbance from the inclined underground to surface conveyor system would be limited generally to the shafts above the conveyor feed at the East Plant Site, an exhaust raise (and ventilation fans) along the conveyor tunnel alignment for ventilation, the tunnel portal at the West Plant Site, and the overland portion of the conveyor at the West Plant Site, all of which would be located on private land owned by Resolution Copper.

West Plant Site

In general, the West Plant Site would be the location where crushed ore material arriving from the East Plant Site (figure 2.2.2-8) would be processed into copper and molybdenum concentrates. The West Plant Site consists of three main facilities: (1) the stockpile, which includes the development rock and intermediate rock stockpiles (figure 2.2.2-9); (2) the concentrator complex, which includes the process water pond, ore stockpile facility, tailings thickeners, copper molybdenum and copper concentrator thickeners (thickeners), and the molybdenum plant; and (3) the auxiliary facilities, which include the administration building, contractor and warehouse laydown yards, and construction and employee parking (see figure 2.2.2-8).

The total footprint of the West Plant Site would be on private lands owned by Resolution Copper; 12 acres of the site are currently disturbed. The GPO had described a process pond on NFS land north of the West Plant Site, but it was determined that moving the process pond onto Resolution Copper private property directly to the west of the current West Plant Site would reduce impacts on NFS resources (see section 2.2.9.1 and figure 2.2.9-1).

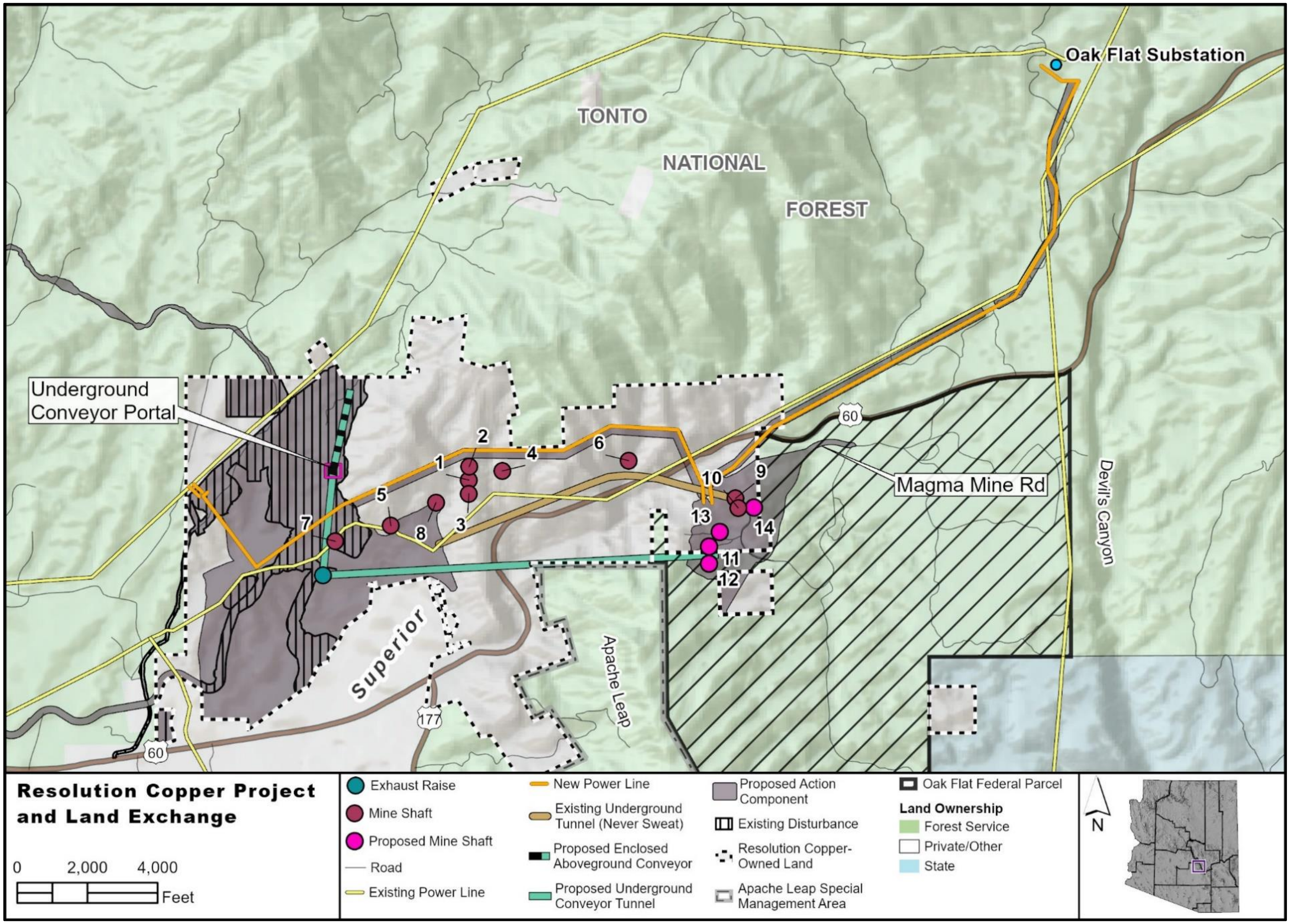


Figure 2.2.2-7. East Plant Site detailed facilities layout

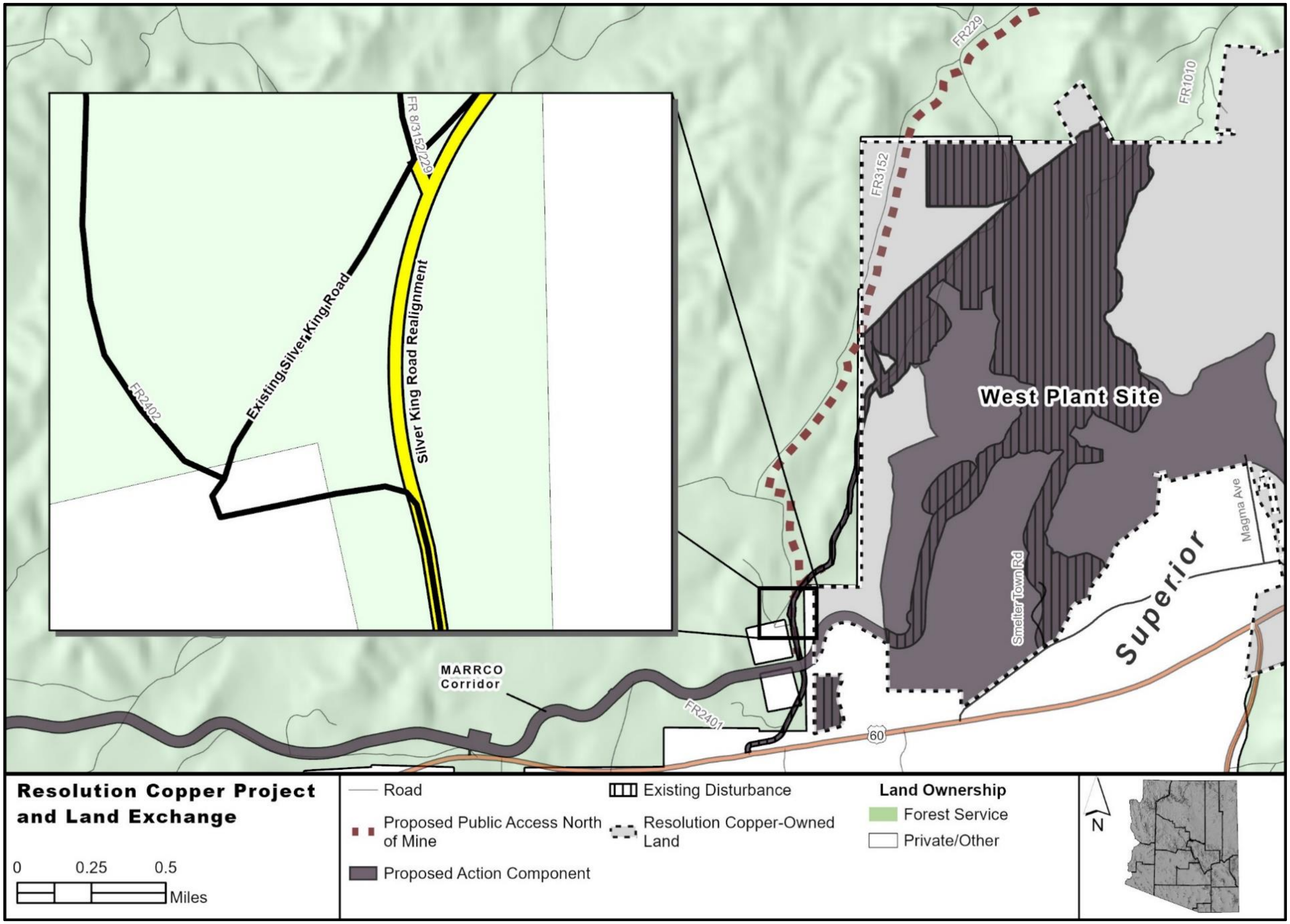


Figure 2.2.2-8. Redesign and/or improvement of vehicle access to and from the West Plant Site

Access to the West Plant Site would be via Silver King Mine Road (NFS Road 229), which is on both private and NFS lands. Portions of NFS Road 229 across private land would be reconstructed to Mine Safety and Health Administration (MSHA) specifications and maintained by Resolution Copper. This road would be used as an alternate road to transport mine personnel, equipment, supplies, and molybdenum and other mine products, to and/or from the West Plant Site. The alignment would generally follow the existing Silver King Mine Road with changes at drainage crossings and tight corners (see figure 2.2.2-8). Public access on NFS Road 229 would be controlled at a security gate where the road crosses private land. Alternative public access to areas north of the West Plant Site can occur on NFS Road 8 and NFS Road 3152 that would reconnect to NFS Road 229 north of the private land. Employees primarily would enter the mine site from Main Street/Lone Tree (Smeltertown) Road. Use of the Main Street/Magma Avenue entrance would be minimized to limit traffic through Superior.

Details of existing West Plant Site facilities, proposed new West Plant Site facilities, and materials used at the West Plant Site are summarized in appendix G and shown in figure 2.2.2-9.

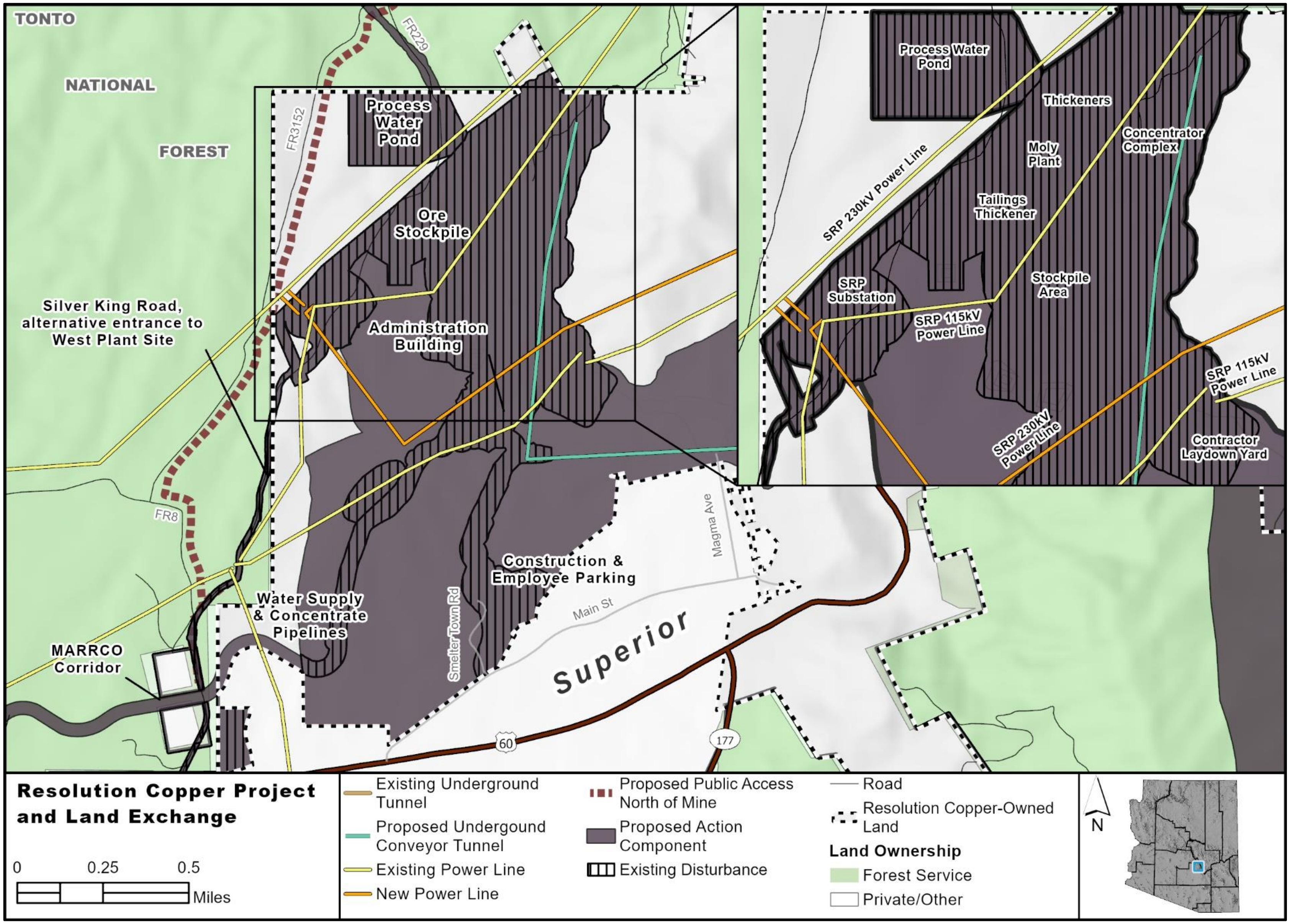


Figure 2.2.2-9. West Plant Site facilities overview

Tailings Storage Facility and Tailings Pipeline Corridor

Approximately 1.37 billion tons of tailings produced by the mining operation would need to be stored in perpetuity. The tailings corridors have been designed to follow existing roads or disturbance where possible. The proposed action and all alternatives would transport tailings within a corridor that would include multiple pipelines, an access road, and power and communication lines.

All action alternatives handle tailings in separate split streams based on the ore processing at the West Plant Site. PAG and NPAG tailings are transported in separate pipelines as they are split during the ore processing. The pipelines are designed for optimum performance during each mine phase to match flow characteristics of materials and velocity and vary between 10-inch, 22-inch, or 34-inch diameter (table 2.2.2-5). Recycled water would be transported back to the West Plant Site from the tailings storage facility via a 16-inch pipeline. The solids content of the tailings streams varies between alternatives; see figure 2.2.2-10 for ranges of tailings types at deposition.

Table 2.2.2-5. Summary of carbon steel pipe specifications and use during mine life

Year of Operation	Carbon Steel Pipe Specification			
	10-inch Diameter 0.375-inch Wall	22-inch Diameter 0.375-inch Wall 0.5-inch HDPE Liner	34-inch Diameter 1.25-inch Wall	16-inch Diameter 0.375-inch Wall
1–5 (ramp-up)	PAG	NPAG	–	Reclaim water
6 (ramp-up)	PAG	–	NPAG	Reclaim water
7–41 (steady state)	–	PAG	NPAG	Reclaim water

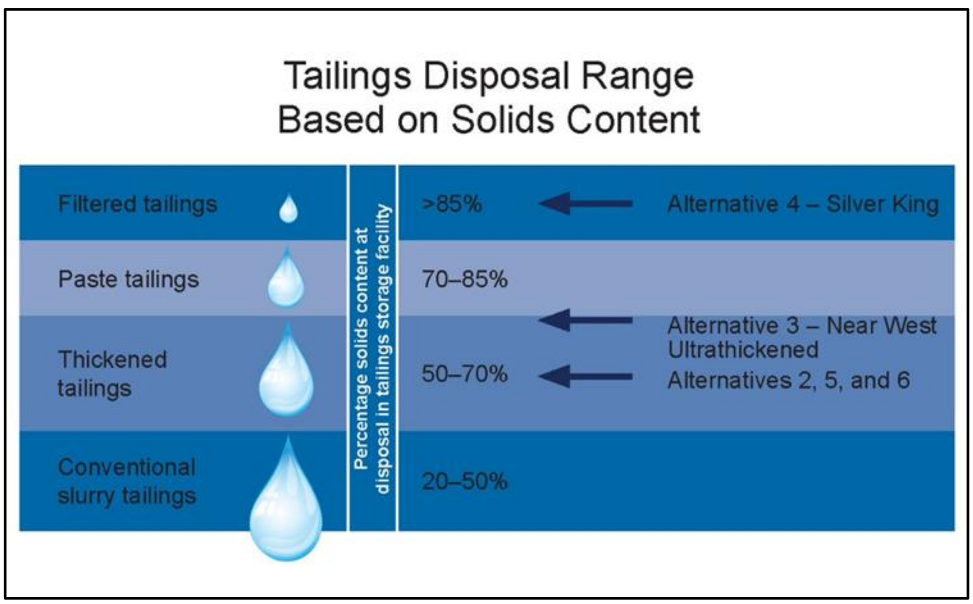


Figure 2.2.2-10. Range of tailings types based on solids content

The tailings conveyance corridors used to transport the tailings to the facility and reclaimed water back to the West Plant Site are designed with similar pipeline dimensions. Pipeline installation, spill containment necessary based on pipeline installation method, and access and bypass roads necessary would vary by topography and alternative routing option selected. The pipeline design could include buried, overland secured, horizontal directional drilling (HDD) or micro-tunneling, surface run, cable-stayed bridge, or through-truss bridge layouts. The installation designs would vary based on topography throughout each corridor segment and general design configurations are shown in figure 2.2.2-11.

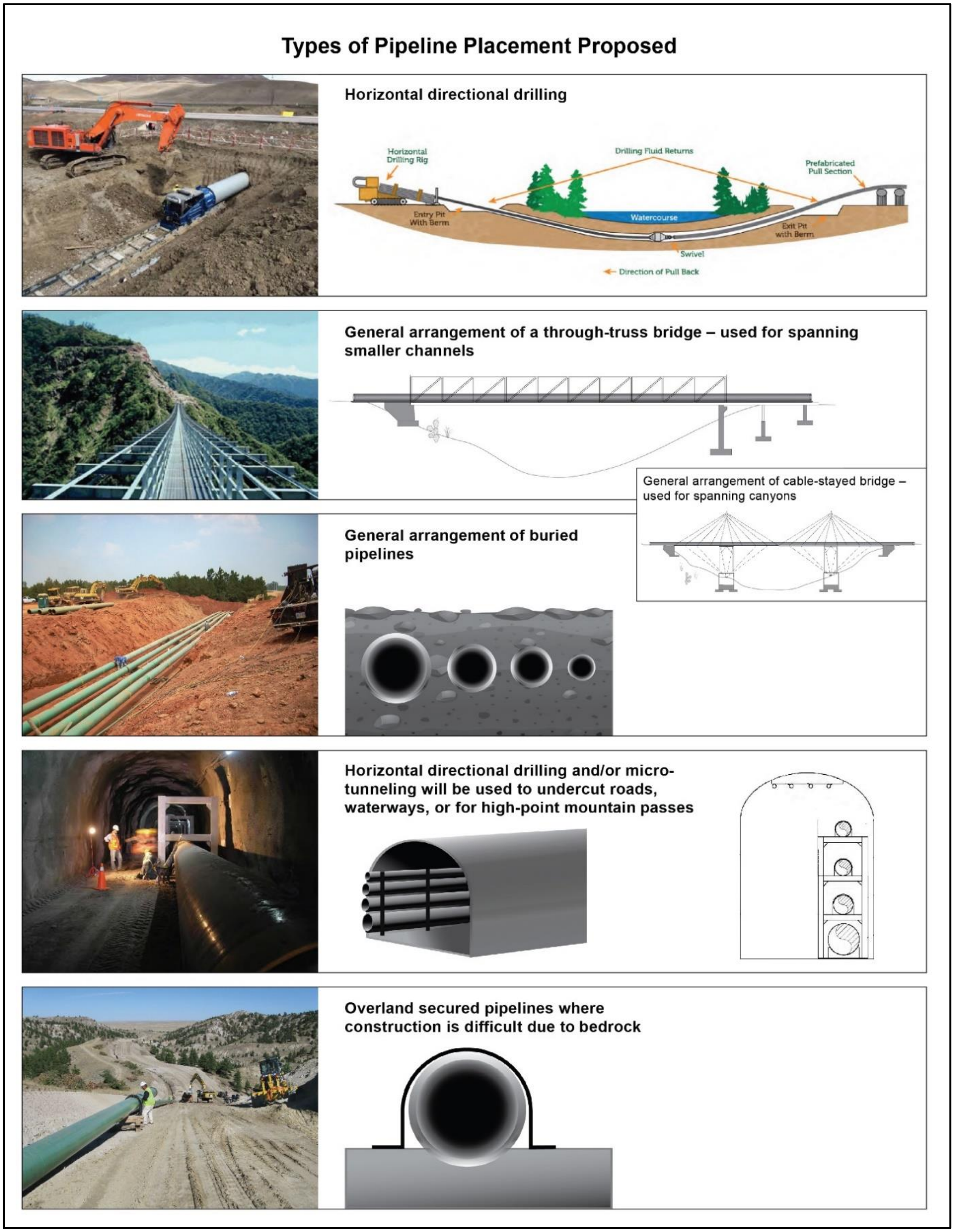


Figure 2.2.2-11. Graphical display of pipeline arrangements used in tailings conveyance corridor design

The tailings conveyance corridor averages 110 to 230 feet wide, with the majority of the pipeline buried. In very steep sections of terrain, the corridor could be as wide as 1,000 feet. The pipeline would be equipped with a leak detection system and a modern control system permitting operation of the entire pipeline from a central control room. An access road that followed the pipelines would be used for construction, and maintenance during operations. Where necessary based on topography, other techniques could be used for pipeline construction, such as secured at the surface on overland secured placement, or through HDD or micro-tunneling at water crossings or through high mountain peaks. The pipeline can also span canyons, roadways, or trails such as the Arizona National Scenic Trail with cable-stayed or through-truss bridges. Booster pumps are required if unable to gravity-feed to the tailings storage facility; if necessary for design, the booster pumps would be located at the West Plant Site.

MARRCO Corridor

The 30-mile-long MARRCO corridor is a railroad and utility corridor running roughly east-west from Superior to Magma Junction. Hewitt Canyon Road (NFS Road 357) provides access to the MARRCO corridor, which crosses private lands as well as lands administered by the Tonto National Forest and ASLD (figures 2.2.2-12 and 2.2.2-13). Resolution Copper currently owns the MARRCO corridor right-of-way. The corridor generally is 200 feet wide and private parcels along the MARRCO corridor have been developed, particularly east of Queen Station and near Magma Junction. The corridor currently contains multiple utility lines and water pipelines and infrastructure. The existing infrastructure within the corridor includes the following: a buried fiber-optic line, an overhead transmission line and telephone line, buried natural gas pipelines, Arizona Water Supply pipelines and infrastructure providing water supply to the town of Superior, and an 18-inch dewatering line transporting water being dewatered from the East Plant Site to the New Magma Irrigation and Drainage District (NMIDD). New corridor facilities would include additional water pipelines, water pumps and recovery wells, and copper concentrate pipelines to transport ore concentrate to the filter plant and loadout facility.[25]

Details of existing and new MARRCO corridor facilities are summarized in Appendix G, Further Details of East Plant Site, West Plant Site, MARRCO Corridor, and Filter Plant and Loadout Facility Infrastructure.

Filter Plant and Loadout Facility

A pipeline within the MARRCO corridor would transport copper concentrate slurry from the concentrator complex at the West Plant Site to the filter plant and loadout facility. The filter plant's primary function would be to filter the copper concentrate to a state that is ready for transportation. The loadout facility's primary function would be to remove water from the copper concentrate to prepare the concentrate for delivery to an off-site smelter and recycle water to be reused in the concentrator. The filter plant and loadout facility would be located on 553 acres of private lands controlled by Resolution Copper near San Tan Valley, Arizona (figure 2.2.2-14).

Further details of East Plant Site, West Plant Site, MARRCO corridor, and filter plant and loadout facility infrastructure are summarized in appendix G.

[25] The wells located within the MARRCO corridor have been referred to by various terms during the NEPA process and in this EIS, including "pumping wells," "recovery wells," and "the Desert Wellfield," depending on the particular analysis being described. Regardless of terminology, these refer to the same water delivery infrastructure that is described in the GPO.

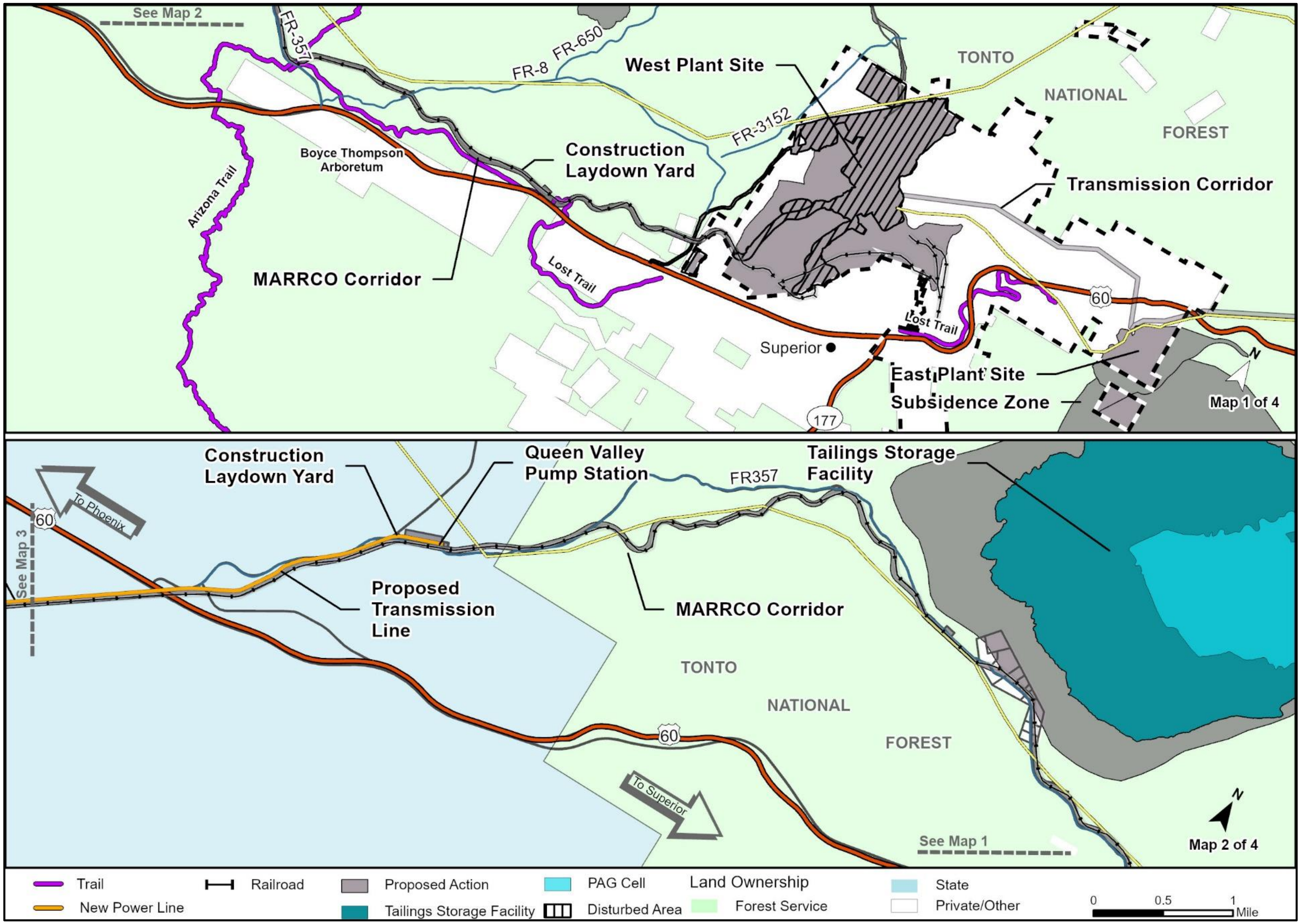


Figure 2.2.2-12. MARRCO corridor facility layout (1 of 2)

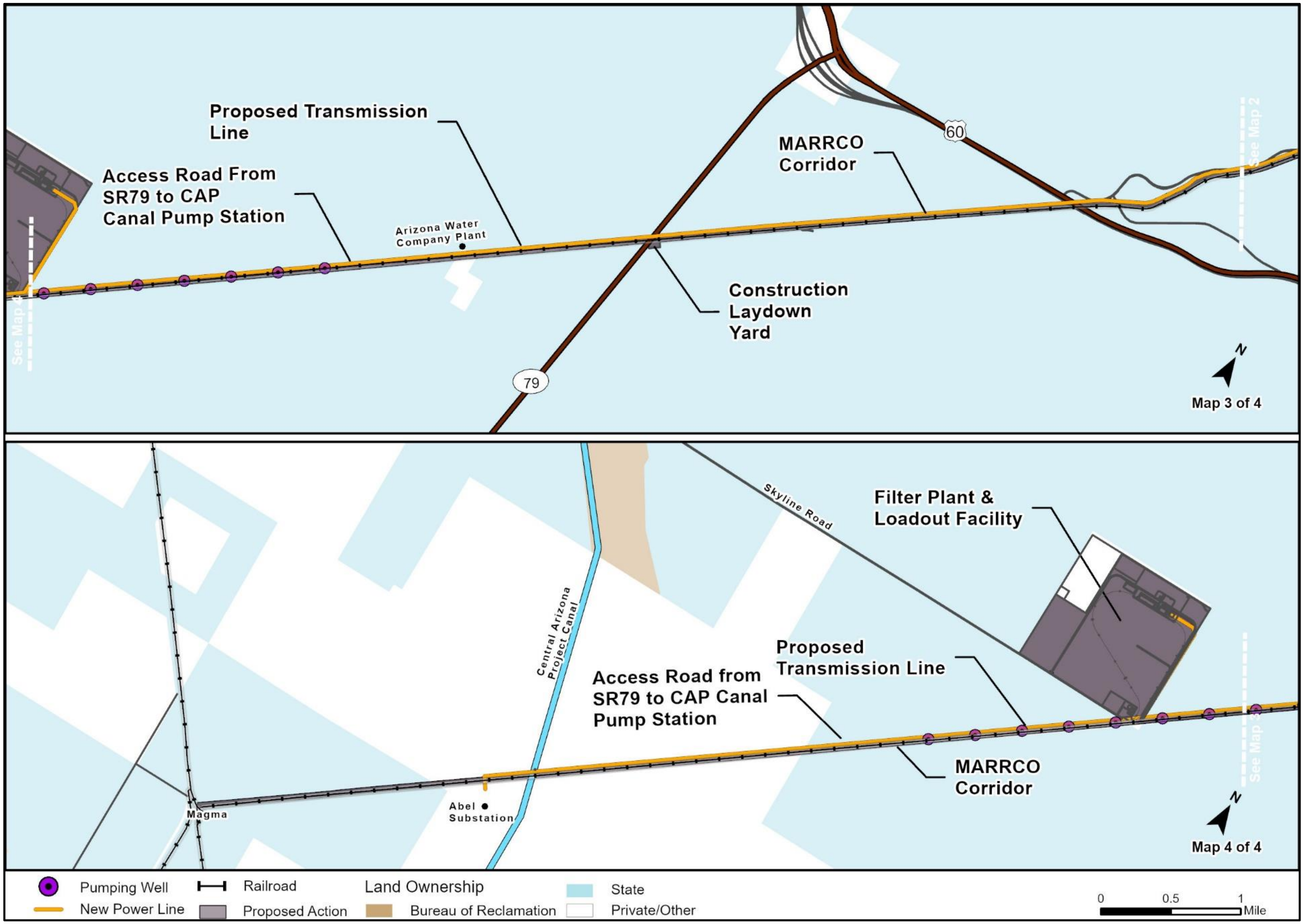


Figure 2.2.2-13. MARRCO corridor facility layout (2 of 2)

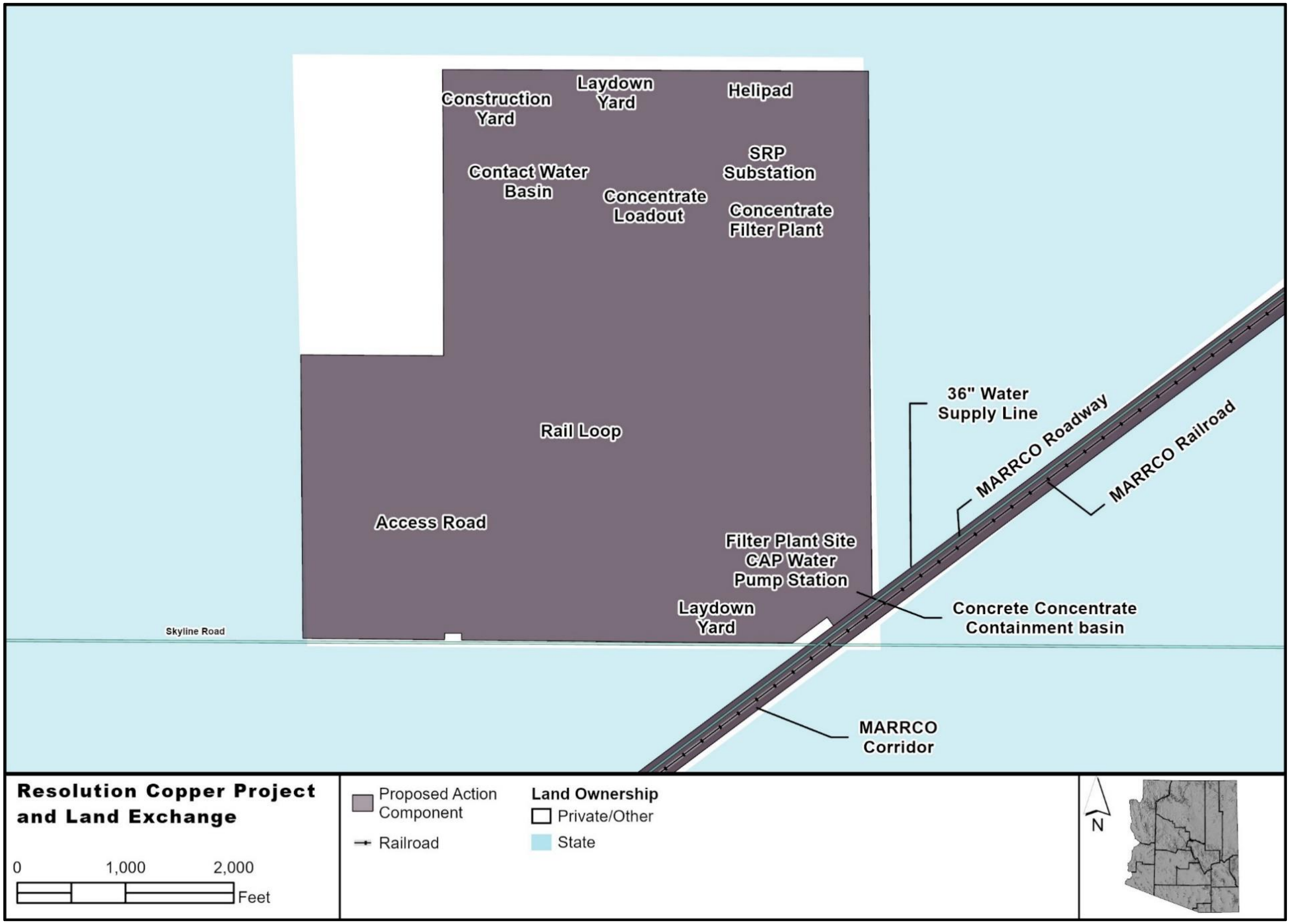


Figure 2.2.2-14. Filter plant and loadout facility detailed layout

Operations Processes and Activities

TRANSPORTATION

Each mine facility would have distinct access routes and traffic volumes during the construction, operations, and reclamation and closure phases. For detailed calculations of predicted traffic volumes that would be generated by the mine, including employee traffic, see the "Transportation and Access" resource section in chapter 3. Table 2.2.2-6 summarizes the access roads that would be used for each of the four main facilities and the materials and equipment deliveries that would occur during the construction and operation phases.

Table 2.2.2-6. Existing and proposed mine access roads and traffic

Facility	Access Routes	Construction Phase Materials and Equipment Traffic	Operation Phase Materials and Equipment Traffic	Closure and Post-closure Materials and Equipment Traffic
East Plant Site	Magma Mine Road from U.S. Route 60 (U.S. 60)	Materials deliveries would consist of fuel, underground concrete, underground production consumables, construction steel, other construction materials, and construction concrete. Major process equipment would be delivered over a 4-year period during the construction phase and would consist of crushers, conveyors, rail dump station, locomotives and railcars, ventilation equipment, hoisting equipment, dewatering equipment, and batch plants.	Materials deliveries would consist of fuel, underground concrete, and underground production consumables.	Salvageable equipment, unused chemical reagents, instrumentation, or other salvageable materials would be removed from site. Structures and other facilities would be demolished and/or dismantled and removed from site. Any contamination would be disposed of as appropriate. Replacement of growth media for revegetation would be delivered if not enough found within the footprint or stockpile.
West Plant Site	Main entrance: Rerouted Silver King Mine Road (NFS Road 229) from U.S. 60 and Main Street/Lone Tree (Smeltertown) Road	Materials deliveries would consist of concrete, rebar, structural steel, handrails/stairs, prefabricated buildings, chutes/launders, tanks, pipe, electrical equipment, overhead transmission line, semi-autogenous grinding mills, ball mills, and flotation cells. These shipments would occur during a 3-year period within the construction phase.	Materials deliveries would consist of semi-autogenous mill balls, ball mill balls, regrind mill balls, lime, sodium hydrosulfide, and miscellaneous reagents. Molybdenum concentrate shipments would leave the site daily from the concentrator complex.	Same as East Plant Site
Tailings storage facility	From U.S. 60 at three locations: service road adjacent to tailings pipeline corridor, Hewitt Canyon Road (NFS Road 357), and NFS Road 8	Materials and equipment deliveries would consist of pipe, valves, concrete, asphalt, and structural steel. These shipments would occur during a 3-year period within the construction phase.	Material deliveries would primarily consist of equipment and replacement equipment to operate spigots, recycle barges and pumps, and seepage collection systems.	Same as East Plant Site
Filter plant and loadout facility	East Skyline Road; rail via MARRCO corridor	Materials and equipment deliveries would consist of pipe, valves, concrete, asphalt, and structural steel. These shipments would occur during a 3-year period within the construction phase.	Filtered copper concentrate would be loaded and shipped 7 miles along the MARRCO corridor by rail car to Magma Junction where the rail line meets the Union Pacific Railroad. Final smelter destination is unknown at this time.	Same as East Plant Site

ELECTRICITY SUPPLY AND TRANSMISSION LINES

Electricity is currently supplied to the East Plant Site by an existing 115-kilovolt (kV) SRP transmission line and to the West Plant Site by an existing 500-kV SRP transmission line to existing facility substations. Construction and operation of the proposed mine would require electrical transmission lines between these main facilities to accommodate greater power needs, as well as new transmission lines to power the new tailings storage facility, new filter plant, and loadout facility. Substations also would need to be upgraded and/or new 230-kV substations would need to be constructed to accommodate electricity from the upgraded lines and distribute the electricity throughout the site (see East Plant Site, West Plant Site, tailings storage facilities, and filter plant and loadout facilities descriptions earlier in this chapter for upgraded/new substation descriptions).

We estimated power use by the mine in the DEIS (Garrett 2019c). Power use ramps up over time and varies slightly by tailings alternative, but during full operations is estimated to be approximately 250 to 280 megawatts (MW). The primary electricity consumers at the mine site would be as follows:

1. The hoist motors at the East Plant Site that raise the ore out of the mine (roughly 20 to 25 percent of total power use), and underground ore flow (roughly 10 to 15 percent of total power use).
2. The ventilation and cooling systems at the East Plant Site for the underground mine (roughly 10 to 15 percent of total power use).
3. The operation of the grinding and flotation machinery at the concentrator complex at the West Plant Site (roughly 40 to 50 percent of total power use).
4. For Alternatives 5 and 6, pumping of tailings to the tailings storage facility (roughly 5 to 10 percent of total power use). Note that Alternatives 2 and 3 use gravity flow to deliver the tailings to the tailings storage facility, and do not require substantial power for tailings pumping.
5. For Alternative 4, filtering of tailings prior to placement (roughly 5 to 10 percent of total power use).

Since publication of the January 2021 Rescinded FEIS, Resolution Copper has provided updated estimates of electricity usage year-by-year (for the preferred alternative), as part of estimating greenhouse gas mitigation needs. These estimates show that during production, electricity usage ranges roughly from 200 to 400 MW, with a median demand of 352 MW (Tipple 2022), higher than previously estimated.[26]

SRP would provide all electricity used at the mine facilities through the upgraded and new transmission lines. Figure 2.2.2-15 shows the proposed upgraded and new SRP transmission lines that would supply the main facilities with electricity. The Tonto National Forest would use analysis in this EIS to approve any rights-of-way and special use permits needed to construct the upgraded and new power lines.

Public comments received on the DEIS suggested that we underestimated power use for the mine. Many commenters focus on the amount and temperature of geothermal water that would be encountered during mining. Comments suggest that Resolution Copper has not incorporated these factors into their estimates and, therefore, the power requirements to pump the water and cool the mine are underestimated. Upon review, we found that neither the groundwater amounts nor the temperatures were unexpected or unanticipated in the design and analysis. There is no basis to extrapolate higher power use based on these factors (Garrett 2020c). The most recent estimates of electrical use are higher that previously noted in the

[26] These two estimates (Garrett 2019c; Tipple 2022) take different approaches for this estimate. Garrett (2019c) is based on instantaneous power requirements of equipment, which when added up reaches 250 to 280 MW. Tipple (2022) is based on a total annual consumption of megawatt-hours per year, which then must be converted to an average megawatt instantaneous demand.

January 2021 Rescinded FEIS (Tipple 2022) and these updated estimates have been used to calculate greenhouse gas emissions.

Partially in response to these public comments, SRP conducted an independent load study for the project and concluded the following: "The total maximum combined load proposed by RC is 273 to 315 MW, which represents 3.7 to 4.3% of SRP's 2019 peak demand. SRP is well suited to provide the needed power just as it has done with other large power users across the state. SRP does not see any limitations to serving this load to the Project at the aforementioned sites, presuming the recommended system upgrades are implemented. With these system upgrades, there will be no impact on the neighboring customers as the Project site increases loads as per the estimated load levels" (1898 and Company 2020). The more recent electrical demand estimates of 352 MW would represent 4.8 percent of SRP's 2019 peak demand.

Public comments also suggested the use of alternative power sources. As a corporate entity, Rio Tinto has plans to invest $1 billion over the next 5 years to support delivery of its emissions targets and company objectives for net-zero emissions from operations by 2050. In line with this objective, in November 2019, Resolution Copper entered into a Solar Participation Agreement with SRP to obtain solar power from a 100-MW solar photovoltaic generating facility expected to go online in January 2022. In furthering its commitment to increase its reliance on renewable energy, Resolution Copper subscribed to 4.6 percent of the generating facility's solar power. Resolution Copper anticipates similar agreements in the future to meet net-zero carbon commitments by 2050; however, as the Forest Service cannot enforce this, it is not relied upon for any part of the analysis. This is discussed further in appendix J.

Easements for the transmission lines would vary between 50 and 100 feet, depending on the size of the line and the requirements for construction, maintenance, and electrical clearances. Transmission lines would be either lattice steel towers or tubular steel poles. The foundations for the transmission line structures would be auger-drilled reinforced concrete piers. A lattice tower typically has four legs, each attached to a concrete foundation set into the ground. Steel pole structure footings are typically composed of a steel-reinforced concrete foundation referred to as an "anchor-bolt foundation," onto which the steel pole is bolted.

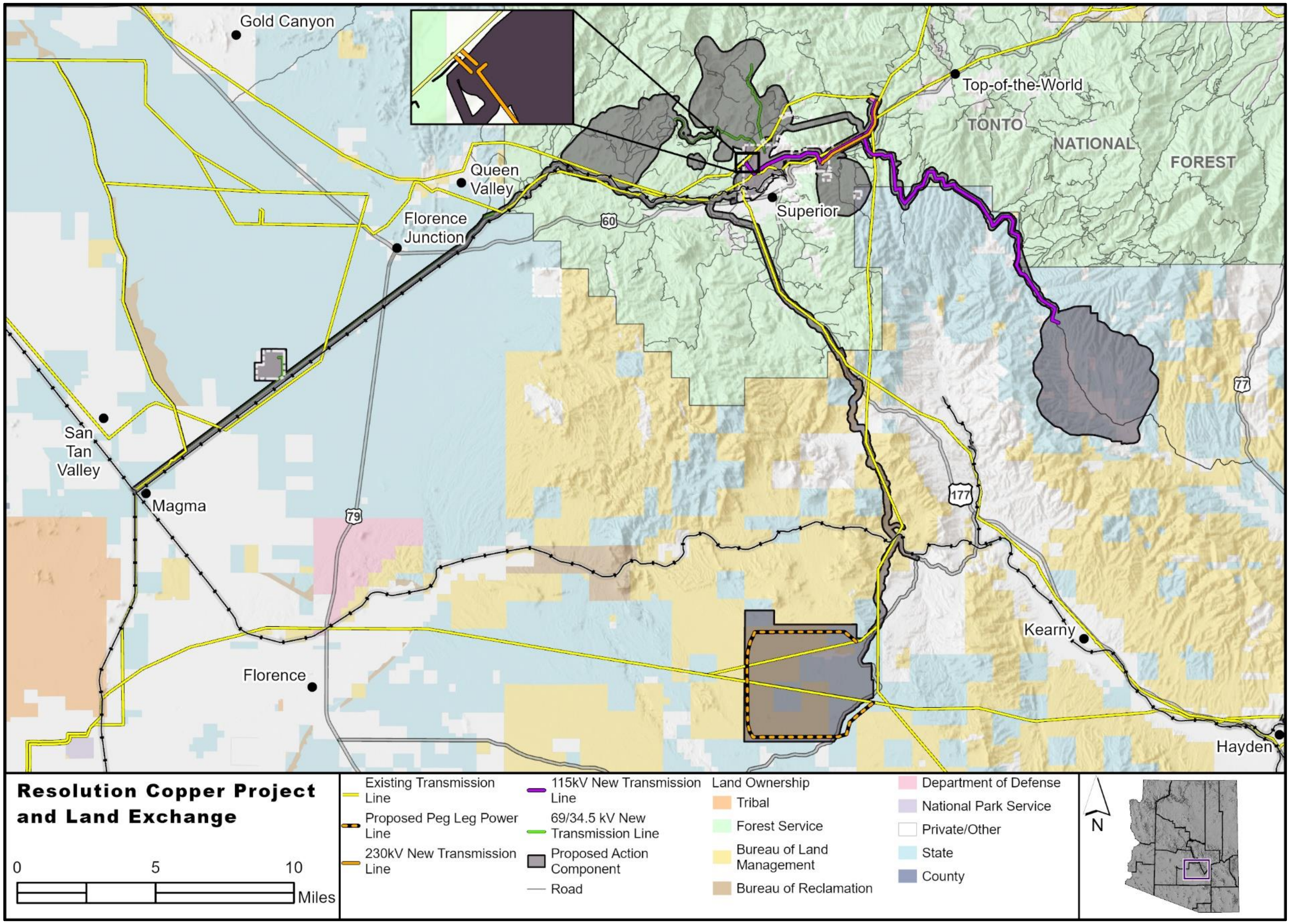


Figure 2.2.2-15. Proposed new and upgraded transmission lines

Table 2.2.2-7 identifies the main transmission lines that would provide power to each mining facility.

Table 2.2.2-7. Proposed new and upgraded transmission line summary

Facility	Transmission Line Route	New Alignment or Upgrade	Approximate Distance
East Plant Site	230-kV line from Silver King substation to Oak Flat substation	New, parallel to existing 115-kV line	3.6 miles
West Plant Site	230-kV line from West Plant Site substation to Oak Flat substation	New	3.5 miles
West Plant Site	Double-circuit 230-kV connection from West Plant Site substation to the existing 115-kV and 230-kV lines at the West Plant Site	New	0.5 mile
West Plant Site	115-kV line from West Plant Site substation to East Plant Site	No change	N/A
Tailings storage facility	Varies by alternative location; 35-kV line from West Plant Site substation to tailings substation at Near West location (Alternatives 2 and 3 only) or 115-kV line from Silver King substation to tailings storage facility at Skunk Camp location (preferred Alternative 6)	New	From 5.6 miles (Alternatives 2/3) to 23 miles (Alternative 5)
Filter plant and loadout facility	Two 69-kV power lines and one 12-kV power line from Abel substation (near CAP canal crossing of MARRCO corridor)	New (adjacent to MARRCO corridor)	4.7 miles

Wherever possible, existing roads would be used to construct the transmission facilities. In some areas, access roads would be cleared on an as-required basis to ensure adequate access for construction and maintenance activities. Staging areas immediately surrounding line structures would be necessary, depending on specific site access. Permanent access roads would be constructed along the transmission line alignments that are located in drivable terrain.

WATER USE

Recycling and reuse happen extensively throughout the mine operations, but there are generally three major external sources of water: dewatering from the East Plant Site, potential direct use of CAP water, and recovery of long-term storage credits and/or groundwater from wells located along the MARRCO corridor.

The estimated total quantity of external water needed for the life of the mine (construction through closure and reclamation) varies between alternatives. Resolution Copper proposes to use water either directly from the CAP canal or through wells along the MARRCO corridor in the East Salt River valley. The water pumped from those wells is either considered recovered long-term storage credits, or water authorized by the State of Arizona to be pumped under a mineral extraction withdrawal permit, a Type II non-irrigation grandfathered right, or other appropriate groundwater right. Regardless of the authority for obtaining the water, the water is pumped from the same wells. As of January 2020, Resolution Copper has acquired approximately 313,000 acre-feet of renewable long-term storage credits within the Phoenix and Pinal Active Management Areas (AMAs). These include credits for CAP water banked at the NMIDD, Hohokam Irrigation Drainage District, and Roosevelt Water Conservation District groundwater savings facilities, credits for CAP water directly recharged at the Tonopah Desert Recharge Project, and purchase of renewable long-term storage credits from the Gila River Water Storage LLC. On September 20, 2021, Resolution Copper entered into a subcontract with the United States and the Central Arizona Water Conservation District for an annual allocation of 2,238 acre-feet of Non-Indian Agriculture CAP water. In 2022, this allocation was delivered to NMIDD.

Figure 2.2.2-16 shows the general water supply and water use for each of the main facilities during operations of Alternative 2 – Near West Proposed Action. The water balance for the various mine facilities is complicated and varies by alternative. Further detail is included in Appendix H, Further

Details of Mine Water Balance and Use. As noted in appendix H, it should be understood that the water balance values shown figure 2.2.2-16, appendix H, and elsewhere in the EIS represent the best available understanding of the project water balance, as derived from complex operational and engineering plans. While the values shown suggest a high level of precision, note that there is inherent uncertainty in predicting water use. Actual water use may vary higher or lower, based on real-world operational, climatic, and hydrogeological conditions.

In order to construct mine infrastructure, Resolution Copper currently removes groundwater from sumps in Shafts 9 and 10, effectively dewatering the deep groundwater system (the bottom of Shaft 10 is about 7,000 feet below ground level). This dewatering started in 2009 and would continue throughout the mine life. When the mining begins, the block-cave zone would propagate toward the surface and effectively allow the effects of this dewatering to extend to more shallow aquifers as well.

There are several aspects of the water supply that could reduce the impacts of pumping from the Desert Wellfield—the use of CAP water, and the recovery of long-term storage credits. In order not to underestimate pumping impacts, the impact analysis in the FEIS assumes that all makeup water physically would be pumped from the Desert Wellfield (see Section 3.7.1, Groundwater Quantity and Groundwater-Dependent Ecosystems). Neither long-term storage credits nor potential CAP supplies are used in the analysis to offset impacts from project pumping.

Public comments received on the DEIS suggested that we underestimated water use for the mine. Based on published water use estimates for other copper mines, commenters suggest that water use for the Resolution Copper Project could be as high as 50,000 acre-feet per year, compared to the disclosed values (about 17,000 acre-feet per year). We confirmed that the water use anticipated for Resolution Copper is indeed less than other mines in Arizona; however, commenters failed to account for the differences between these mines (Garrett 2020c). Specifically, the Resolution Copper Project uses thickened tailings ranging from 50 to 65 percent solids, compared to 20 to 50 percent solids in a conventional tailings slurry. The Resolution Copper Project uses less water than other mines since the mine proponent has incorporated enhanced technology (thickening) in order to reduce water use.

Note that in response to public comments on competing water uses, drought, future meteorological trends, and potential water scarcity, we included an expansive discussion of these issues as part of the cumulative effects analysis in chapter 4.

SANITARY AND SOLID WASTE MANAGEMENT

New wastewater treatment plants would be constructed at both the East Plant Site and West Plant Site. Effluent from the East Plant Site wastewater treatment plant would be combined with the mine dewatering system, which would be delivered to the concentrator supply water pipeline for use in the concentrator.

Wastewater from the filter plant and loadout facility would be routed to an on-site septic tank and leach field. Septic solids would be removed and disposed of off-site as needed and in accordance with State laws.

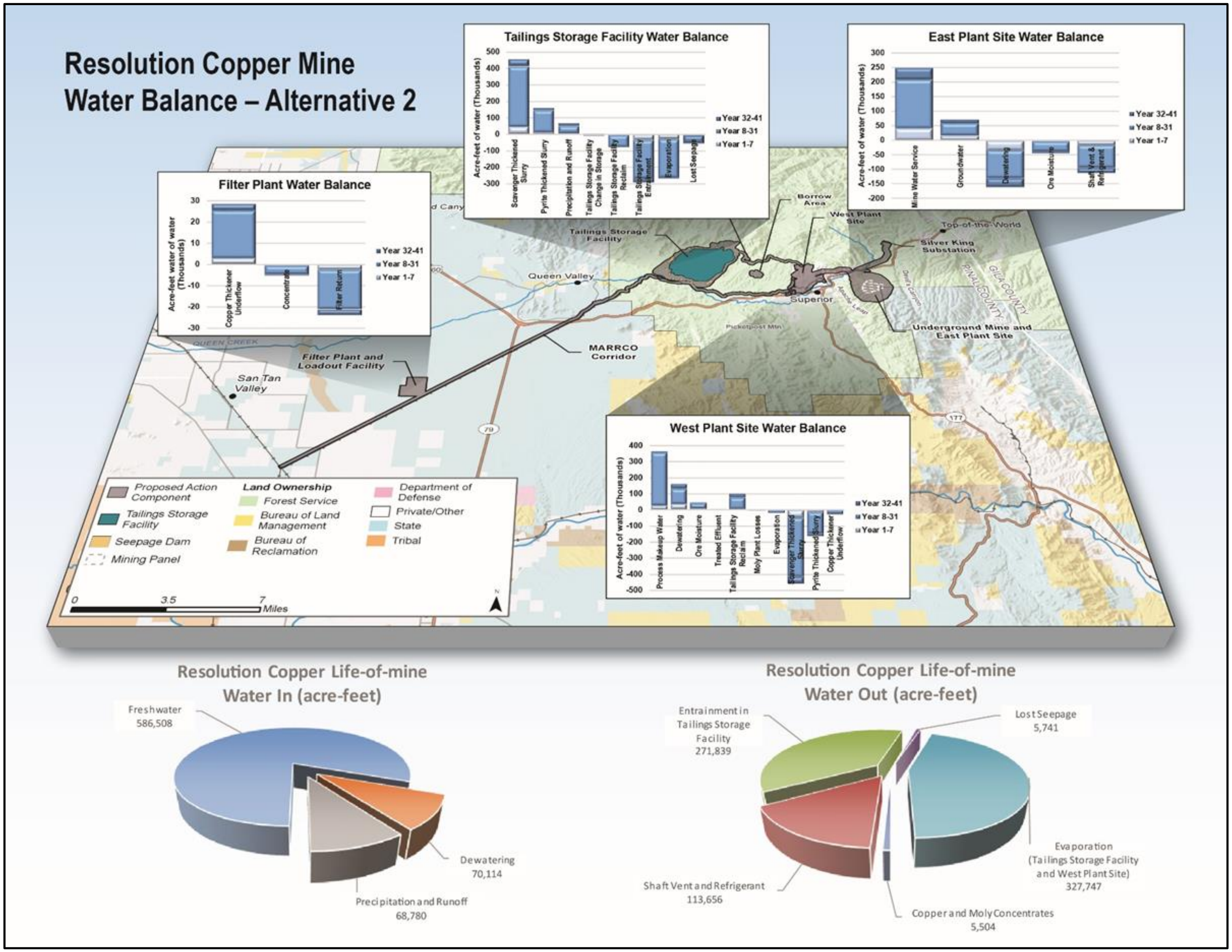


Figure 2.2.2-16. Alternative 2 – Near West Proposed Action water supply and water use diagram

Non-hazardous solid waste and special wastes (e.g., petroleum-contaminated soils) generated by any activities at the mine facilities would be disposed of in a manner consistent with applicable local, State, and Federal regulations. Resolution Copper drafted an environmental materials management plan that identifies the disposal method for each anticipated waste (Resolution Copper 2016b). Recycling programs currently used at the East Plant Site and West Plant Site would continue in an effort to reduce waste.

Waste is currently being disposed of and would continue to be disposed of in the following ways:

- Asbestos- and petroleum-contaminated soils waste streams would be managed in accordance with waste-handling protocols and disposed of at an approved waste facility.
- All trash and garbage would be hauled to State-approved landfills. Trash and garbage would be collected on-site in containers before being removed for disposal at permitted landfills. No open burning of garbage and refuse would occur at the project site.
- Wood and inert wastes such as concrete would be buried on-site as part of final closure and reclamation in selected areas in accordance with applicable county, State, and Federal regulations.

Closure and Reclamation

The closure and reclamation phase would occur after the 40-year operations phase and would have a duration of approximately 5 to 10 years.[27] A specific time frame for the closure and reclamation phase would not be known until after a final GPO or other appropriate authorization is submitted to the Tonto National Forest and approved. The GPO describes the preliminary closure and reclamation plans that would occur at each of the main facilities and the linear features that connect them, as summarized in this section and within the GPO. The primary goals of reclamation are to

- stabilize areas of surface disturbance;
- prepare those areas for a post-mining land use that is compatible with surrounding uses; and
- ensure long-term protection of the surrounding land, water, and air resources.

General Reclamation Procedures and Schedule

Although closure and reclamation would be a distinct phase after the operations phase during which the majority of the reclamation efforts would occur, the proposed action would employ three schedules of reclamation throughout the life of the mine: interim, concurrent, and final reclamation.

INTERIM RECLAMATION

Interim reclamation would be completed on disturbed areas that are not needed, at the time, for active operations. The three main periods of interim reclamation are as follows: after construction, following startup, and during operations. The principal focus of interim reclamation would be to reduce erosion and sedimentation. Interim reclamation would include activities like the reclamation of road or pad cuts and fills and tailings surfaces (e.g., temporary covers, vegetation, or polymers to control wind and water erosion, thus limiting dust). Interim reclamation would allow temporary stabilization of certain sites, such as the tailings storage facilities during operations, for temporary dust control.

Other areas that would be subject to interim reclamation would include construction laydown areas, growth media stockpiles, development rock stockpiles designated for processing through the concentrator,

[27] Note that the time required for reclamation is heavily dependent on the methods used to construct and manage the tailings storage facility, and therefore reclamation timing varies substantially between alternatives.

and development rock stockpiles salvaged for beneficial use. Areas would also include access roads used for construction but no longer needed during operations. Additionally, the slope of the tailings storage facility might receive temporary reclamation for dust control measures in advance of concurrent reclamation.

Interim shutdown would include the suspension of mining, production, or other operations, or placing the facility into standby status. Interim shutdown is not anticipated based on the mining method used with all alternatives analyzed in the FEIS. It is unlikely Resolution Copper would have to suspend operations for purely economic reasons during the 10-year ramp-up period or the following 20 years of full production, since the project incurs most capital costs prior to mining and during construction and ramp-up of operations. If interim shutdown were to occur, personnel and processes to ensure compliance with permits and regulations, along with protecting infrastructure, would continue.

In the event of a shutdown, the following activities would still occur:

- Measures to stabilize excavations and workings with inspections and maintenance;
- Measures to maintain the general project area in a safe condition in compliance with MSHA safety regulations;
- Measures to manage regulated materials (hazardous materials) in accordance with applicable requirements;
- Measures to maintain access and utilities would continue to function; and
- Plans for managing water systems and maintaining facilities as required by the stormwater pollution prevention plan (SWPPP), APP, and Arizona Pollutant Discharge Elimination System (AZPDES). Dewatering and treatment of water from the mine infrastructure would continue, and the water would be discharged.

CONCURRENT RECLAMATION

Reclamation completed during operations is termed concurrent reclamation (or sometimes progressive reclamation). Concurrent reclamation differs from interim reclamation in that this reclamation is designed to provide permanent achievement of reclamation goals and performance standards. Resolution Copper would implement concurrent reclamation of the outer slopes of the tailings storage facility, where practicable, as the operation progresses.

The ability to conduct concurrent reclamation varies by alternative, depending on construction of the tailings storage embankment. These differences between alternatives are explored more in Section 3.3, Soils, Vegetation, and Reclamation.

FINAL RECLAMATION

Final reclamation efforts would occur for a duration of 5 to 10 years after the operations phase.
The general steps to be used in reclaiming disturbed areas at the mine are

- decommissioning facilities,
- removing and/or closing structures and facilities,
- recontouring and regrading,
- replacing growth media (i.e., store-and-release cover design for tailings), and
- seeding and/or direct seedling plantings where appropriate.

The final reclamation efforts that would occur at each of the main facilities are described in the following text.

EAST PLANT SITE CLOSURE AND RECLAMATION

Reclamation at the East Plant Site would consist of salvaging and demolishing all buildings, except for the headframes and hoists, which would be used for post-closure groundwater monitoring. All salvageable and non-salvageable materials would be disposed of off-site. All disturbed surfaces except those needed for long-term monitoring, including paved and graveled areas, would be regraded and reseeded with appropriate local seed mixes. Contact water basins would be closed in accordance with APP requirements. Shaft collars and subcollars would be permanently sealed by an engineered seal.

Reclamation activities would not occur within the subsidence area. There would be a berm and/or fence constructed around the perimeter of the continuous subsidence area. To the extent practicable, surface water diversions would be constructed to divert stormwater away from the subsidence area and into natural drainages.

During operations, the potential for adverse water quality in the panel caving area involves many factors, due to the potential exposure of mine rock to both oxygen and water; water quality concerns during operations are explored in section 3.7.2. After completion of mining, the underground panel caving area would not be expected to be a continuing source of adverse groundwater quality. There would be a thick overlying layer of rock above the panel caving area, and this rock is generally inert or acid neutralizing (over 80 percent of the samples analyzed of Apache Leap Tuff are non-acid generating; see section 3.7.2). Water percolating through the overlying rock would help neutralize acidity in remaining non-economic rock in the panel caving area. Rising groundwater levels would eventually flood the panel caving area completely, isolating it from oxygen and controlling further chemical weathering.

WEST PLANT SITE CLOSURE AND RECLAMATION

The West Plant Site facilities would be decommissioned, and the land surfaces would be contoured and graded as necessary to blend into the surrounding topography and terrain and reseeded with appropriate local species seed mixes. The post-closure grading plans for the West Plant Site include the following:

- All fill slopes would be laid back to a maximum of 2.5:1.
- The West Diversion Channel, the East Stormwater Channel, and an on-site channel would remain in place to route flow through a new diversion channel to the Apex Tunnel to existing drainages (e.g., Silver King Wash).
- The process water pond located at the western portion of the West Plant Site would be closed in accordance with APP conditions.
- Contact water basins would be closed in accordance with APP requirements.
- The emergency overflow ditch from Contact Water Basin W1 would remain in place.
- Non-contact water basins would be graded to drain.

Roads that are necessary to support the reclamation and closure efforts would remain to provide access to monitoring stations and remediation areas. All other roads would be reclaimed. All buildings would be salvaged or demolished, and all materials would be disposed of off-site. All portals, ventilation shafts, and tunnel entrances would be decommissioned, capped, and reclaimed at the surface.

TAILINGS STORAGE FACILITY CLOSURE AND RECLAMATION

Closure details differ for each tailings alternative primarily with respect to the length of time needed for closure and with respect to the method for long-term management of seepage. The overall closure process is similar for all tailings facilities. The recycled water ponds on the slurry tailings facilities would gradually be reduced in size as closure occurs, and the PAG tailings would be covered with a layer of NPAG tailings with timing dependent on the surface being dry enough to allow equipment access for reclamation. The seepage and runoff collection ponds generally would remain in place and would not be decommissioned until seepage water quality meets standards for release. Until that time, the ponds primarily would be used to evaporate seepage. Any excess draindown not evaporated from the seepage ponds would require active management. Active management could include pumping to another location, increasing evaporation using spray evaporators, or releasing water to the environment after appropriate treatment. The final method of post-closure management for seepage collection water would be determined as the project progresses through the current NEPA process and engineering design. The final post-closure management plan would be based on overall expected volumes, anticipated seepage rates, and duration, in combination with the water chemistry assessment.

Additional final reclamation activities at the tailings would include contouring the tailings, installing riprap and erosion controls, covering the tailings with a combined armor protection (rock) and growth medium as an exterior shell, and revegetating the embankments and top of the covered tailings with a Forest Service–approved seed mix. The minimum depth of the exterior shell on the embankments would be 1.5 feet and would be thicker in areas where erosion protection would be required. Materials used for the exterior shell would be sourced from borrow pits and salvaged soil. The area within the tailings storage facility footprint would be used as a source, as well as other borrow areas that vary depending on alternative. Any borrow area not underneath the tailings storage facility that is used for the shell would ultimately be recontoured and revegetated using a Forest Service–approved seed mix.

A perimeter fence or berm would be constructed around the tailings storage facility to prevent access. Some surface water diversion structures would be revegetated to control water and wind erosion, while others would be reconfigured to carry water along topography through and off the site. The diversion structures that would stay in perpetuity would be reconstructed with riprap to minimize erosion.
All buildings, including foundations, at the tailings storage facility would be salvaged or demolished, and all salvage materials and demolition debris would be disposed of properly off-site. Roads that would not be required for closure and reclamation activities would be decommissioned, recontoured, and revegetated. All piping and electrical infrastructure connecting the tailings storage facility to the West Plant Site would be removed, leaving only the road and berms.

FILTER PLANT AND LOADOUT FACILITY AND MARRCO CORRIDOR CLOSURE AND RECLAMATION

All buildings, including building foundations, at the filter plant and loadout facility would be salvaged or demolished, and the salvaged material and demolition debris would be disposed of properly off-site. Tanks and ponds would be closed and reclaimed in accordance with APP and AZPDES permit requirements. All disturbed areas would be regraded with the exception of the diversion channel on the north side of the facility that routes surface water flows around the site to existing drainages.

The closure and reclamation of the MARRCO line is undetermined because the intended post-closure use of the railroad and utility lines is not known. Resolution Copper does not foresee a use of the railroad or utility lines for project reclamation or post-closure use, but another entity might buy the facilities and continue use. The concentrate lines, however, would be removed from the MARRCO corridor, and direct surface disturbance areas would be recontoured and revegetated to the extent possible with adjacent utilities. Bridge structures would be assessed and either removed or upgraded.

WATER SUPPLY FACILITIES AND PIPELINES CLOSURE AND RECLAMATION

Facilities associated with fresh water supply and distribution, such as pipelines, pump stations, and water tanks, may have a post-mining use and may be transferred to a third-party utility or community to provide water transport to the Superior Basin. No closure or reclamation activities would occur at these facilities if they were to be transferred to a third party.

Facilities that would not have a post-mining use include the tailings slurry lines, concentrate pipelines, and associated pump station with electrical power. These facilities would all be decommissioned and removed. Buried and aboveground pipelines would be removed and scrapped or salvaged. All disturbed areas would be recontoured and reseeded.

POWER TRANSMISSION FACILITIES CLOSURE AND RECLAMATION

Power transmission facilities, which include electrical substations, transmission lines, and power centers, may be removed as part of the reclamation program, unless a post-mining use is identified. SRP would continue to own the power lines and may have a post-mining use for ongoing power transmission in the area.

RECLAMATION FINANCIAL ASSURANCE

Resolution Copper would be required to establish and maintain sufficient financial assurance in accordance with requirements from the Forest Service, ASLD, BLM, USACE, the APP program, and the Arizona Mined Land Reclamation Act. The purpose of financial assurance is to ensure that responsible agencies would be able to continue any remaining reclamation activities if Resolution Copper becomes unable to meet reclamation and closure and post-closure obligations under the terms and conditions of the applicable permits and approvals. Under the Arizona Mined Land Reclamation Act, the Arizona State Mine Inspector would receive financial assurance for reclamation and closure activities required on private lands, the Forest Service would receive financial assurance for reclamation and closure activities on lands managed by the Forest Service previously described in section 1.5.5, and BLM would receive financial assurance for reclamation and closure activities on BLM-managed lands. USACE would receive financial assurance for compensatory mitigation activities. The APP program would receive financial assurance for reclamation and closure activities for facilities that have the potential to discharge water into the groundwater (tailings storage facility, process ponds, and stormwater ponds), regardless of the facility's location on private or NFS lands.

2.2.3 Alternative 1 – No Action Alternative

Under the no action alternative, current management plans would continue to guide management of the project area. The Forest Service would not approve the GPO, none of the activities in the final GPO would be implemented on NFS lands, and the mineral deposit would not be developed. However, note that certain activities are currently taking place on Resolution Copper private property, such as reclamation of the historic Magma Mine; exploration; monitoring of historic mining facilities such as tailings under existing State programs and permits; maintenance of existing shaft infrastructure, including dewatering; and water treatment and piping of treated water along the MARRCO corridor to farmers for beneficial use. These types of activities would be expected to continue, regardless of approval of the GPO. These activities are therefore assumed to occur in the no action alternative (Garrett 2018d).
The no action alternative provides a basis for comparison in the EIS.

The no action alternative includes the following:

- The final GPO would not be approved, thus, none of the activities in the final GPO would be implemented, and the mineral deposit would not be developed;

- The land exchange would not take place;
- Certain ongoing activities on Resolution Copper private land, such as reclamation of the historic Magma Mine, exploration, monitoring of historic mining facilities such as tailings under existing State programs and permits, maintenance of existing shaft infrastructure, including dewatering, and water treatment and piping of treated water along the MARRCO corridor to farmers for beneficial use, would continue regardless of GPO approval;
- Ongoing trends not related to the proposed project would continue, such as population growth, ongoing impacts on air quality from fugitive dust and vehicle emissions, human-caused fires, ranching, and a corresponding increase in use of public lands; and
- A project-specific forest plan amendment would not be needed for compliance with the forest plan.

2.2.3.1 Need for Inclusion of Land Exchange in Document

PL 113-291 directs the Forest Service to prepare a single EIS prior to the final execution of the land exchange to serve as the basis for all Federal decisions related to the proposed mine. The proposed action and action alternatives analyzed in detail in chapter 3 therefore assume that the land exchange would occur as directed by Congress; for this reason, it is included as a component common to all action alternatives (see section 2.2.2.1).

However, even though directed by Congress, the land exchange remains a discretionary decision on the part of Resolution Copper, which may or may not choose to undertake the exchange after receipt of the appraised value. It is possible that mining under the proposed action or action alternatives could also take place without the land exchange occurring. If the land exchange did not occur, the 760-acre Oak Flat Withdrawal Area would remain closed to mineral entry. While under the proposed action no mining panels are located below the Oak Flat Withdrawal Area, the proposed action might require modification to limit subsidence into that area. Regardless, mining without a land exchange would be a possibility. The single EIS must therefore allow for a comparison of potential impacts of mining that occurs on land remaining in Federal ownership with potential impacts that would occur following the land exchange. Whether the land exchange occurs or not, the mine would be developed in accordance with the Federal, State, and local laws governing mining operations. However, these laws could differ, depending on whether or not a land exchange occurred.

The no action alternative provides one baseline against which the proposed action and action alternatives may be compared. The no action alternative assumes no land exchange and no Forest Service approval of a GPO. This baseline allows a direct comparison of the effects of most of the mining impacts that would occur from the proposed action and action alternatives. However, the no action alternative is not sufficient to fully analyze the effects of the exchange of the selected lands.

Two other combinations of no action were considered during analysis:

- A fully executed land exchange, but no approval of the GPO; and
- The land exchange would not occur, Oak Flat would stay in Federal management, and the GPO would be approved with the mining taking place on public land.

The first combination was not carried forward as the Forest Service is unable to refuse approval of the GPO within their regulations and guidance. The second combination was considered because the land exchange is a discretionary action on the part of Resolution Copper. Therefore, an analysis was completed that compared the regulatory framework of mining activity on lands remaining in Federal ownership with the regulatory framework on lands being transferred to private ownership (appendix I). This provides the comparison of no land exchange, but approval of the mining plan of operations. See section 2.4 for more details. The effects of the land exchange are also assessed individually in each resource section of chapter 3.

2.2.4 Alternative 2 – Near West Proposed Action – Mine Plan Components

Alternative 2 – Near West Proposed Action would include approximately 9,780 acres of disturbance, of which 7,186 acres is NFS land, 312 acres is ASLD managed, and 2,282 acres is private land. Additional project activities would occur on 92 acres for recreational mitigations (see section 2.3) and optionally 13 acres for the Silver King Road realignment (see section 2.2.9.2).

Based on comments heard in scoping, in February 2018, Resolution Copper formally notified the Tonto National Forest that the company was revising its proposed action in the May 2016 version of the GPO and replacing the plan for an upstream-type tailings embankment at the GPO location with a modified-centerline design, which would provide greater overall stability and a more robust design. This change was in response to public scoping comments and supported by internal engineering discussions at Resolution Copper. The revised centerline tailings embankment configuration is described in greater detail in section 2.2.4.2.

This followed Resolution Copper's July 2017 decision to relocate the process pond. The process pond was moved from NFS lands to private property at the West Plant Site to minimize adverse impacts on NFS surface resources. The process pond is further described in Appendix G, Further Details of East Plant Site, West Plant Site, MARRCO Corridor, and Filter Plant and Loadout Facility Infrastructure.

2.2.4.1 Water Use

This alternative is estimated to need about 590,000 acre-feet of groundwater pumped from the Desert Wellfield through the life of the mine (see appendix H).

2.2.4.2 Tailings Storage Facility and Tailings Pipeline Corridor

Approximately 1.37 billion tons of tailings produced by the mining operation would require storage in perpetuity. The proposed tailings storage facility location, as identified in the GPO, is on lands managed by the Tonto National Forest. The facility would be approximately 3 miles west of the West Plant Site (figure 2.2.4-1).

The GPO proposes a thickened tailings process. Thickening tailings involves the mechanical process of removing some water from the tailings slurry. Thickened tailings can have a solid content ranging from 50 to 70 percent, depending on the degree of thickening. Thickened tailings can be piped to a tailings storage facility and, because they are still a liquid, require storage in an impoundment contained by an embankment. The GPO indicates that the tailings slurry would be thickened to a solids content of approximately 50 to 65 percent for deposition in the impoundment. Over time, the tailings within the impoundment would settle and consolidate to a greater solids content.

NPAG and PAG tailings would be transported in the form of a thickened slurry from the concentrator complex at the West Plant Site to the tailings storage facility via two separate pipelines. To reduce potential water quality issues, PAG tailings would be placed using subaqueous deposition in such a way that they are kept saturated. This limits oxygen from interacting with the sulfides in the PAG tailings, minimizing and preventing water quality problems (e.g., acid rock drainage). The NPAG would be deposited in a way that would eventually encapsulate the PAG tailings, allowing NPAG tailings to act as a buffer between PAG tailings and areas outside the tailings storage facility.

The modified proposed action tailings facility, Alternative 2 – Near West Proposed Action, would be constructed using a modified-centerline embankment design rather than an upstream embankment, as Resolution Copper originally proposed in its GPO submitted to the Tonto National Forest on May 9, 2016. The GPO as amended responds to issues of public health and safety, as a modified-centerline type embankment is considered more resilient than an upstream embankment, with less risk of failure.
The modified-centerline embankment would be constructed from compacted and free-draining cyclone tailings sand and earthen fill. NPAG tailings are processed through hydrocyclones[28] to produce a coarse particle tailings stream (cyclone sand used for construction) and a finer particle tailings stream. The larger tailings particles would drain water freely and would be mechanically compacted during embankment construction to further increase the stability of the embankment. The finer materials would be deposited into the interior of the tailings facility, where they would provide a low-permeability zone between the PAG tailings and the higher permeability perimeter embankment. As the tailings storage facility grows over time, the embankment would progressively be elevated to contain the tailings. A general schematic of the modified-centerline design is shown in figure 2.2.4-2. Resolution Copper currently is proposing an overall 4H:1V slope design for the embankment.

As noted in chapter 1, after publication of the DEIS, the Forest Service was informed that portions of the Alternative 2 tailings storage facility footprint lie within areas withdrawn from mining entry under the jurisdiction of the Bureau of Reclamation. The presence of a tailings storage facility likely would conflict with the purposes of the land withdrawal and this alternative ultimately would need to be modified to be built. CEQ guidance allows for consideration of alternatives outside the jurisdiction of the lead agency; while a complicating factor, the presence of the withdrawn lands does not invalidate consideration of Alternative 2 as part of the NEPA process.

Portions of the embankment may be modified to a 3H:1V design to

- reduce the overall amount of cycloned sands required, and
- facilitate an earlier start to concurrent reclamation activities on the embankment (at approximately mine life year 22 vs. year 28 for the 4H:1V design).[29]

[28] Hydrocyclone is a device to classify, separate, or sort particles in a liquid suspension based on particle size and particle density.

[29] The specific preferred design may be determined during the NEPA process or may be optimized if and when Alternative 6 becomes the selected alternative in the ROD.

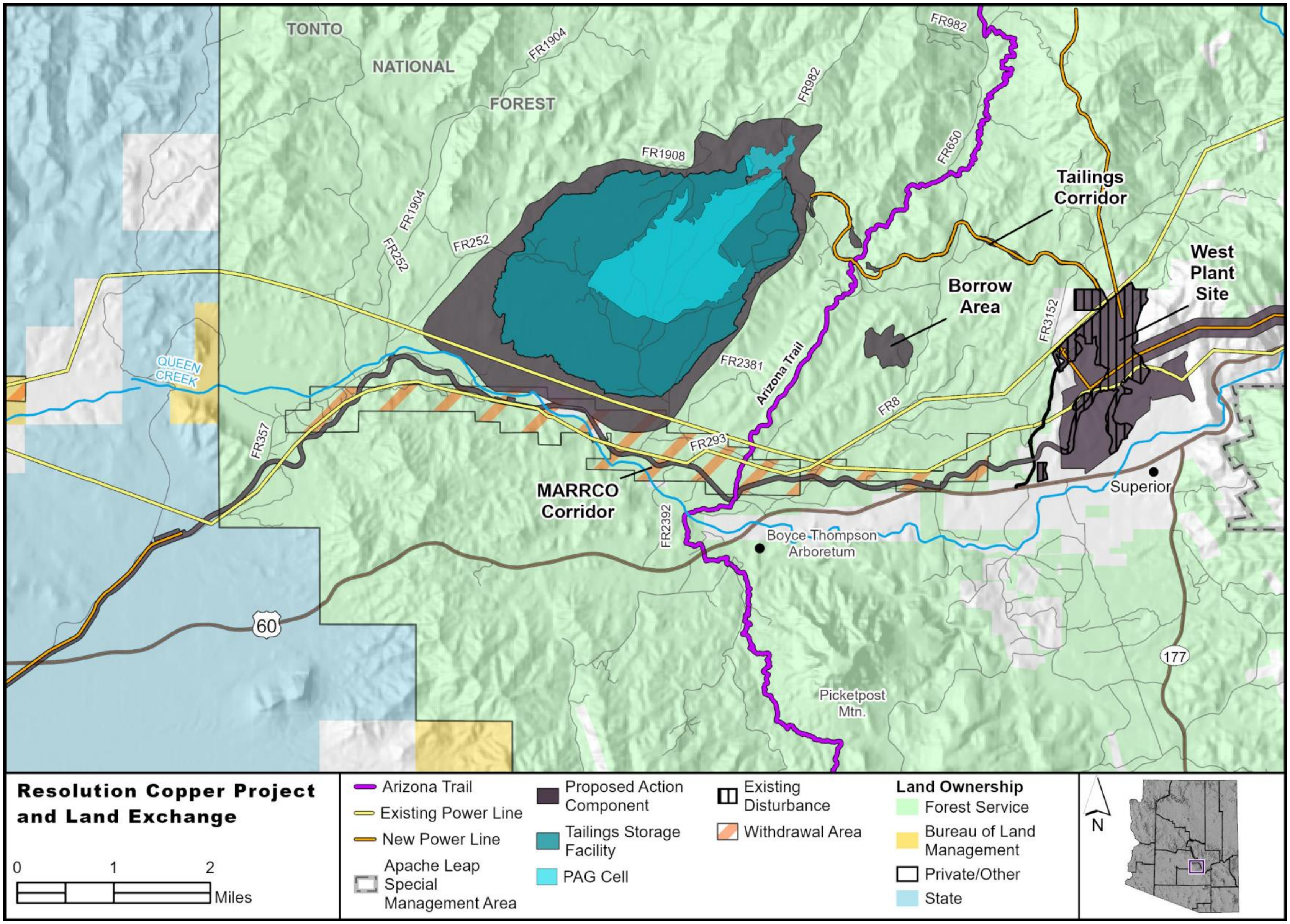


Figure 2.2.4-1. Overview of Alternative 2 – Near West Proposed Action tailings storage facility

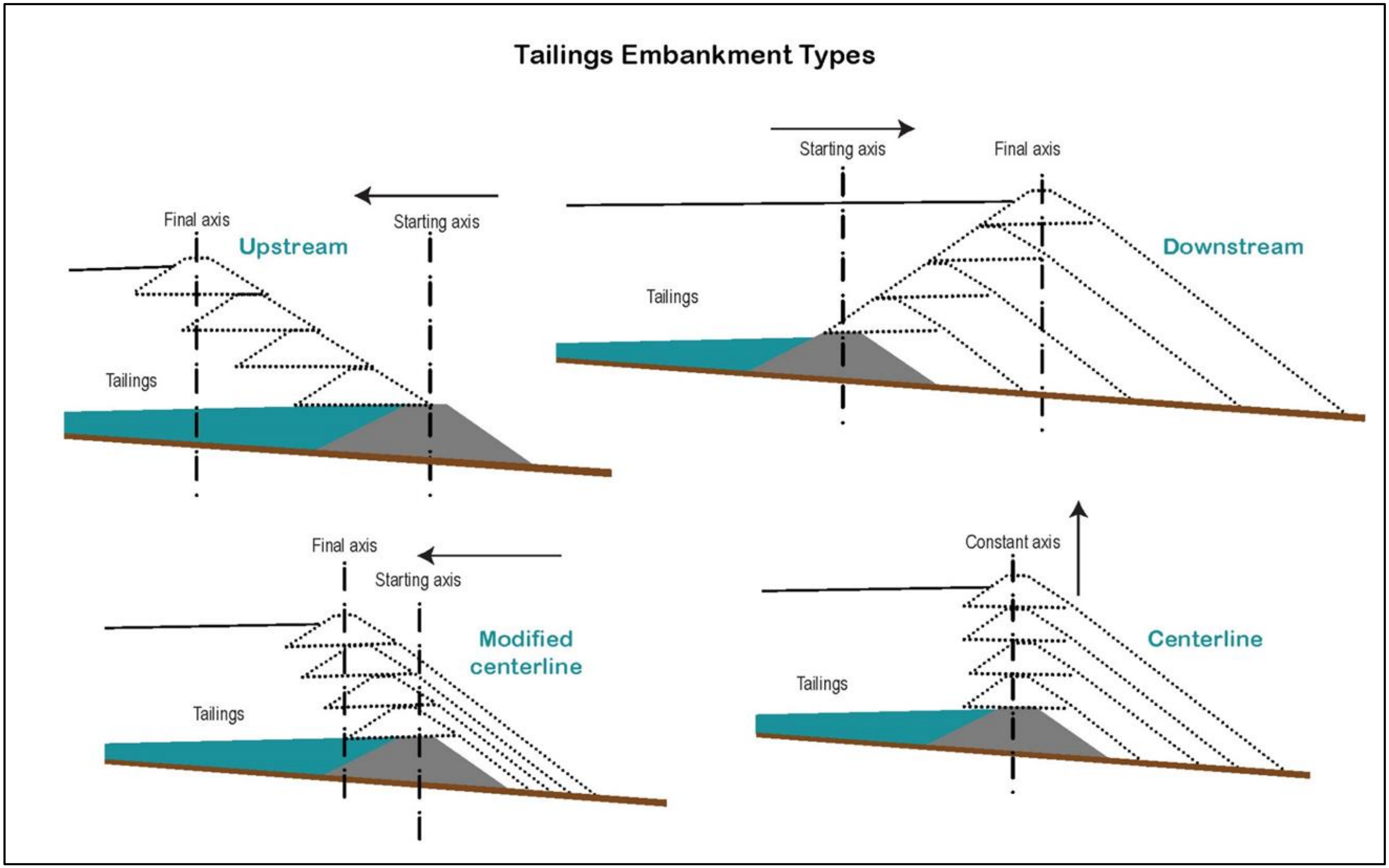


Figure 2.2.4-2. Diagram illustrating various embankment designs

Auxiliary facilities within the tailings storage facility would include a perimeter fence, private roads, borrow areas, soil stockpile areas, seepage control facilities, diversion channels and seepage containment ponds, groundwater monitoring wells, an office, and an equipment maintenance facility (figure 2.2.4-3).

The tailings facility would include a recycling system and a seepage containment system and stormwater diversions to control tailings seepage and surface runoff. All slurry tailings facilities have a pond on the surface known as the “recycled water pond.” The water collected in the recycled water pond would be recycled and pumped to the mill for reuse in ore processing via an aboveground pipe within the tailings conveyance corridor.

While water is recycled through the recycled water pond, some water also remains within the tailings void space and most of this water would eventually either drain downward or remain entrained within the tailings. The seepage and stormwater containment system would consist of engineered low-permeability layers, cutoff walls, grout curtains, diversion channels, and internal drains directing seepage and runoff to 11 planned downstream collection ponds. The NPAG embankment would contain an underdrain system comprising sand and gravel blanket and finger drains (primarily along main drainages, with some extended beneath the tailings beach) to maintain a low water level in the tailings embankment and to intercept and direct seepage from the impoundment to the downstream seepage collection system ponds.

During facility development, a PAG tailings starter cell would be constructed to maintain pyrite tailings saturation throughout the process and to limit seepage. This would include construction of a separate, earthfill starter dam to contain the initial PAG deposits; this starter dam would be constructed for the first 9 years of PAG tailings and would be lined with an engineered low-permeability layer. A combination of additional seepage collection design features would be implemented to limit seepage; these may include additional selective placement of engineered low-permeability layers, additional seepage collection dams, lined seepage collection ponds, pumpback systems, and refined stormwater control systems.[30]

A 34.5-kV tailings substation would be constructed near the offices and maintenance facilities and would receive electricity via a 34.5-kV transmission line from the West Plant Site substation.

The GPO identified four borrow areas, all located on NFS lands, that have been targeted for different borrow requirements (i.e., earthfill material for the starter dams and embankments, gravel for blanket underdrains, riprap for erosion control, and soil cover for reclamation). Three of these borrow areas were within the tailings storage facility fence line, and one is located outside the tailings storage facility footprint along NFS Road 8 (see figure 2.2.4-1).

If needed, material processing plants would be mobile and move to locations within the tailings footprint where borrow material is needed. Borrow material would be used for concurrent reclamation of the tailings storage facility.

[30] The technical documents prepared by Resolution Copper describe a phased approach to seepage control. Level 1 seepage control consists of foundation treatments and barrier layers built into the facility and the 11 initial seepage collection ponds downstream. Level 1 seepage controls would be installed as part of the initial construction. Level 2, Level 3, and Level 4 seepage controls were considered in the design to further control seepage. Some of these controls would have to be built into the facility from the start (such as any low-permeability liners), while others would be implemented if real-world observations during operations indicate that seepage controls are not operating as anticipated. The seepage analysis in section 3.7.2 contains further descriptions of these controls and how they were incorporated into the analysis (Klohn Crippen Berger Ltd. 2019d).

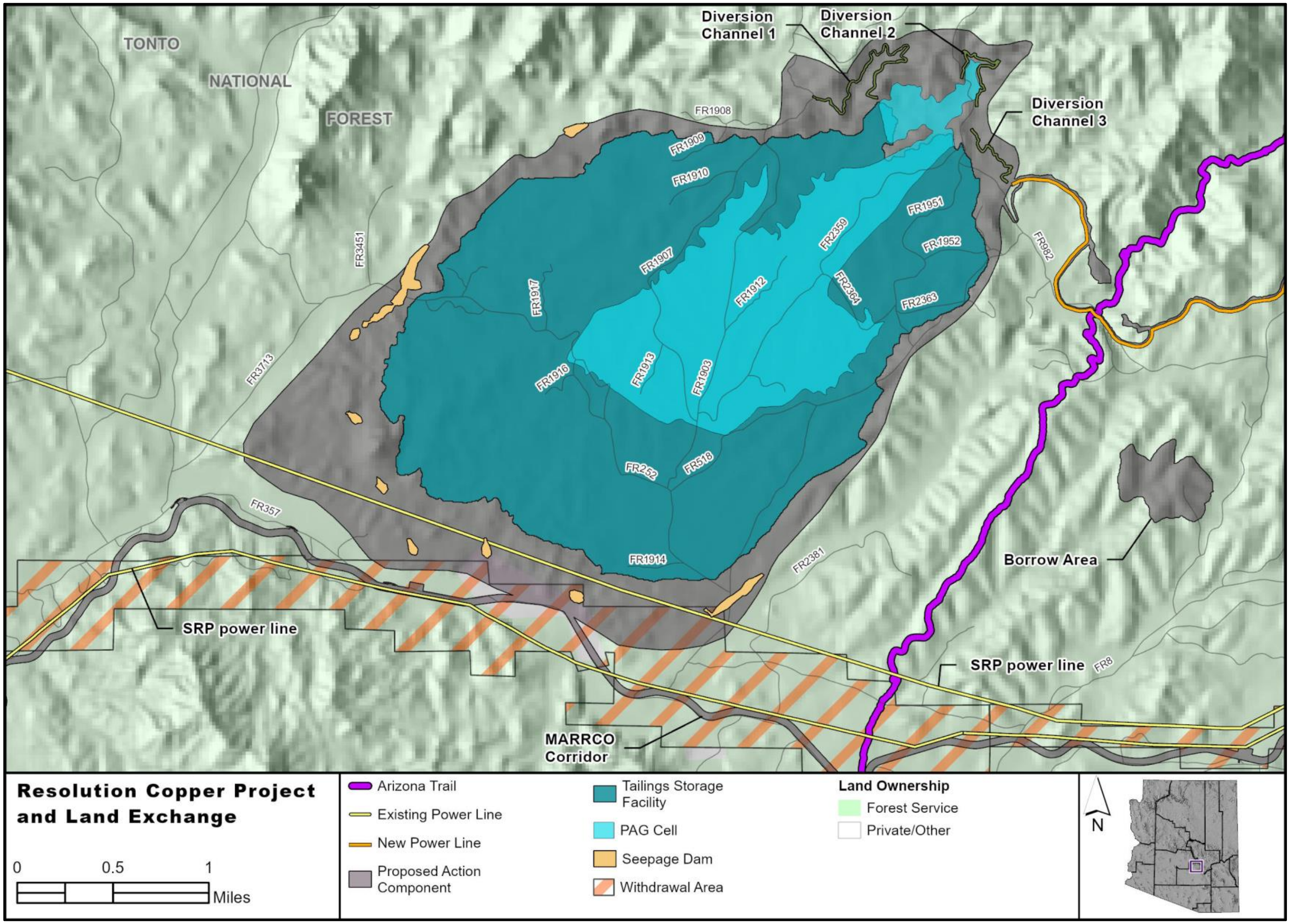


Figure 2.2.4-3. Alternative 2 – Near West Proposed Action tailings storage facility detailed layout

The tailings storage facility would be accessible at three locations:

- via a service road adjacent to the tailings pipeline corridor,
- from Hewitt Canyon Road (NFS Road 357), and
- from NFS Road 8.

During tailings storage facility construction, Hewitt Canyon Road and NFS Road 8 would be used by mine construction vehicles/equipment and provide emergency access. Several existing NFS roads within the proposed tailings storage facility would be removed from public access (see the "Transportation and Access" resource section in chapter 3). Several of these NFS roads would be reconstructed to provide access for mine equipment. A separate service road would be constructed around the periphery of the tailings storage facility for access to power distribution, seepage collection ponds, and pumps.

Throughout construction of the tailings facilities, sand and gravels at the tailings site facility would be salvaged and stored at a soil salvage yard for use during construction of the tailings facility and reclamation of the tailings facilities. Upon closure in mine year 46, the total footprint of the tailings storage facility would be approximately 4,903 acres. The tailings structure would be a four-sided perimeter embankment dam with an ultimate crest elevation of 2,751 feet above mean sea level (amsl). Maximum embankment height would be on the southern embankment at approximately 520 feet, with a 4:1 exterior slope angle.

Table 2.2.4-1 summarizes the components of the proposed action tailings storage facility.

Table 2.2.4-1. Summary of Alternative 2 – Near West Proposed Action tailings storage facility

Tailings Storage Facility	Description
Location	3 miles west of the West Plant Site, north of Hewitt Canyon Road (NFS Road 357)
Total footprint of disturbance for entire alternative	9,780 acres • NFS (7,186 acres) • BLM (0 acres) • ASLD (312 acres) • Private (2,282 acres) Plus an additional 92 acres for recreation mitigation and optional 13 acres for Silver King Road realignment
Approximate size at fence line of tailings storage facility	4,903 acres
Land ownership of tailings storage facility	NFS
Distance from West Plant Site	3 miles
Tailings type and disposal	Thickened slurry tailings placed subaqueously for PAG tailings from barge, NPAG placed hydraulically from perimeter At disposal, PAG tailings would be 50% solids content; thickened cyclone overflow (NPAG) would be 50% solids content; and NPAG sent directly from the mill would be 65% solids content. See figure 2.2.2-10 for more information on tailings solids content range.
Tailings embankment	Cycloned tailings and earthen starter dam, raised with compacted cyclone sand in a modified-centerline construction approach with a 4H:1V slope

Tailings Storage Facility	Description
Lining and other seepage controls	Engineered, low-permeability layers would be installed prior to start-up. These would be located within the PAG cell starter dam facility and in areas where the foundation may have high permeability. Seepage from the tailings would be recovered in 11 seepage collection ponds downstream of the embankment. The seepage and stormwater collected at the collection ponds would be managed during operations for use in the process water system. Finger and blanket drains would underlie the embankment and part of the NPAG tailings.
Approximate embankment height	521 feet
Tailings pipelines / conveyance	Thickened slurry pumped in two streams (PAG and NPAG) to the tailings storage facility and recycled water pipeline to return water to processing loop at West Plant Site 5.33 miles of corridor from West Plant Site to tailings storage facility
Auxiliary facilities	Two clusters of 26 cyclones, two high-density thickeners Upstream surface water north, west, and east of the tailings storage facility would be diverted to the extent possible around the facility through constructed diversion channels. This non-contact water would be diverted downstream to Queen Creek.
Other design considerations	The Arizona National Scenic Trail would need to be crossed by the slurry pipeline corridor and associated access road, but not rerouted. 8 miles of NFS roads are expected to be decommissioned or lost. Encroachment on Bureau of Reclamation withdrawal lands along Queen Creek would be required.
Consumptive water use over life of mine	590,000 acre-feet
Closure and reclamation	Concurrent reclamation of tailings facility beginning approximately at mine year 22 or at mine year 28, depending on final slope design, would occur on the modified-centerline tailings embankment. Closure of the tailings recycled water pond is estimated to take up to 25 years after the end of operations. Until that time, excess seepage in seepage ponds would be pumped back to the recycled water pond, and reclamation would take place on the embankment and tailings beaches. After the recycled water pond is closed, seepage ponds would be enlarged to allow adequate evaporation of seepage, and the remaining reclamation of the tailings would occur.

2.2.4.3 Closure and Reclamation

The closure and reclamation phase would occur after the 40-year operations phase and would have a duration of approximately 5 to 10 years.[31] A specific time frame for the closure and reclamation phase would not be known until after a final GPO or other appropriate authorization is submitted to the Tonto National Forest and approved. The GPO describes the preliminary closure and reclamation plans that would occur at each of the main facilities and the linear features that connect them, as summarized in this chapter. The primary goals of reclamation are to

- stabilize areas of surface disturbance;
- prepare those areas for a post-mining land use that is compatible with surrounding uses; and
- ensure long-term protection of the surrounding land, water, and air resources.

General Reclamation Procedures and Schedule

Although closure and reclamation would be a distinct phase after the operations phase during which the majority of the reclamation efforts would occur, the proposed action would employ three schedules of

[31] Note that the time required to achieve final reclamation is dependent on how long it takes for the tailings to drain and become accessible, as well as how long seepage from the tailings facility is required to be actively managed. Therefore, reclamation timing varies between alternatives.

reclamation throughout the life of the mine: interim, concurrent, and final reclamation. Interim and concurrent would be the same as described in Section 2.2.2.2, General Plan of Operations Components.

FINAL RECLAMATION

Final reclamation efforts would occur for a duration of 5 to 10 years after the operations phase as described in Section 2.2.2.2, General Plan of Operations Components.

The final reclamation efforts that would occur at each of the main facilities are described next.

TAILINGS STORAGE FACILITY CLOSURE AND RECLAMATION

In the final years of operations, tailings would be deposited to promote surface water runoff to the north, where runoff would be directed downstream, diverting around the seepage collection ponds, and surfaces throughout the facility would be reshaped as necessary to eliminate any potential for standing water.

A layer of NPAG tailings would be deposited over the PAG tailings as the recycled water pond disappears, in order to continue to isolate the PAG tailings from oxygen. During this time, the embankment and dry tailings beach areas would be reclaimed, with the PAG tailings with the NPAG cover being reclaimed last and covered by a 1- to 2-foot layer of low-permeability, erosion-resistant soil (e.g., Gila Conglomerate or equivalent soil, sand, and gravel mix) and revegetated. The timing of reclamation is dependent on the surface being dry enough to allow equipment access for reclamation.

Estimated seepage rates suggest passive closure of the tailings facility may be difficult, and active management may be required up to 100 years after the end of operations. Up to 25 years after closure, excess seepage would be pumped back to the recycled water pond. After 25 years, the recycled water pond is closed, and the seepage ponds would be enlarged to allow for more evaporation. Any excess seepage beyond the evaporation capacity of the seepage collection ponds would need to be actively treated. The sludge containing concentrated metals and salts from evaporation would require cleanup and handling as a solid or hazardous waste.

2.2.4.4 Forest Plan Amendment for Alternative 2

Alternative 2 would include a multicomponent amendment of the forest plan. This project-specific amendment would except 24 forest plan desired conditions and guidelines associated with soil productivity, scenic resources, national scenic trails, recreation resources, wildlife habitat, and cultural resources (see table 1.4.3-1). Approval of this amendment would except the project actions in Alternative 2 from compliance with these 24 forest plan desired conditions and guidelines in the project area. See chapter 3 for a discussion of the effects of the amendment on each resource.

2.2.5 Alternative 3 – Near West – Ultrathickened

Alternative 3 – Near West – Ultrathickened would include approximately 9,780 acres of disturbance, of which 7,186 acres is NFS land, 312 acres is ASLD managed, and 2,282 acres is private land. Additional project activities would occur on 92 acres for recreational mitigations (see section 2.3) and optionally 13 acres for the Silver King Road realignment (see section 2.2.9.2).

Alternative 3 is a modification of the tailings facility but remaining in the same location as Alternative 2. Alternative 3 was developed to respond to issues of public health and safety and groundwater quality. It addresses these issues by changing the techniques used in the tailings storage facility to reduce potential for seepage and exposure of PAG tailings. This action alternative would not change any plan components described under the proposed action, except for those associated with the tailings storage facility and tailings disposal. East Plant Site infrastructure, panel cave mining, West Plant Site ore processing, slurry copper concentrate delivery to the filter plant, and other utility corridors would remain identical to the proposed action (figure 2.2.5-1).

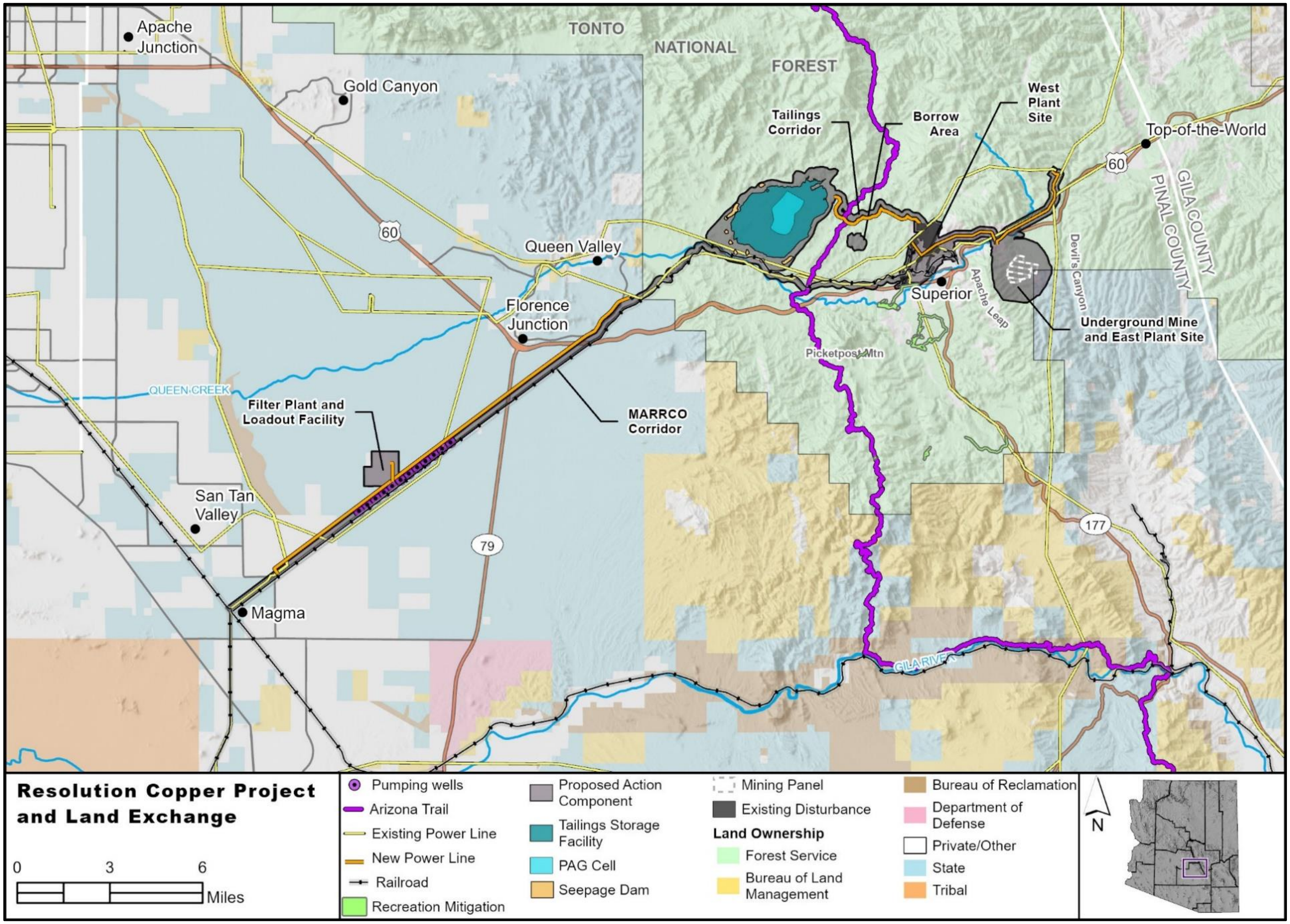


Figure 2.2.5-1. Alternative 3 – Near West – Ultrathickened overview

Alternative modifications to the proposed GPO tailings facility (figure 2.2.5-2) include the following:

- construction of two separate cells within the tailings facility: one for the NPAG and one for PAG tailings (PAG tailings would be kept saturated to prevent oxidation), separated by an internal splitter berm, in order to better control water quality concerns associated with PAG tailings (see figure 2.2.2-12);
- inclusion of engineered low-permeability layers in the PAG tailings cell to limit seepage and maintain PAG tailings saturation, to better control water quality concerns associated with PAG tailings; and
- incorporating further thickening into the NPAG tailings processing prior to deposition in the impoundment (further increasing the solids to water content of the tailings, from 50 to 65 percent in Alternative 2, up to 62 to 70 percent in Alternative 3), in order to reduce the amount of seepage from the NPAG tailings.

The rationale for choosing this alternative for assessment in the EIS is that, compared with the proposed action, it would allow for a direct comparison of the impacts from further thickening and segregating the saturated PAG tailings in an engineered low-permeability layered cell. By contrast, Alternative 2 only uses a separate engineered low-permeability layered PAG tailings cell during the first 9 years of operation and is not optimally located over less-fractured bedrock.

Similar to Alternative 2, portions of the Alternative 3 tailings storage facility footprint lie within areas withdrawn from mining entry under the jurisdiction of the Bureau of Reclamation. The presence of a tailings storage facility likely would conflict with the purposes of the land withdrawal and this alternative ultimately would need to be modified to be built. CEQ guidance allows for consideration of alternatives outside the jurisdiction of the lead agency; while a complicating factor, the presence of the withdrawn lands does not invalidate consideration of Alternative 3 as part of the NEPA process.

2.2.5.1 Alternative 3 Mine Plan Components

Water Use

This alternative uses the least water of the four conventional tailings alternatives (Alternatives 2, 3, 5, and 6) and is estimated to need about 490,000 acre-feet of groundwater pumped from the Desert Wellfield through the life of the mine (see appendix H). This is about 17 percent less water than the alternative without additional thickening of the NPAG tailings (Alternative 2), primarily as a result of greater recovery of water from the tailings and less evaporation losses from deposited tailings.

Tailings Facility – Tailings Type

The modified proposed action includes a slurry tailings disposal method, with the tailings split into a wet slurry of approximately 84 percent NPAG and 16 percent PAG tailings by total volume. The PAG tailings would be thickened at the West Plant Site to approximately 50 percent solids content and the NPAG tailings to approximately 65 percent solids. The cyclone overflow of the NPAG tailings would be thickened at the tailings storage facility site prior to depositing into the impoundment. Under this alternative both the NPAG tailings and cyclone overflow which is deposited in the impoundment would be high-density thickened at the tailings storage facility site to a higher solids content in comparison to Alternative 2 (NPAG thickened to 70 percent; cyclone overflow of the NPAG tailings thickened to 62 percent).

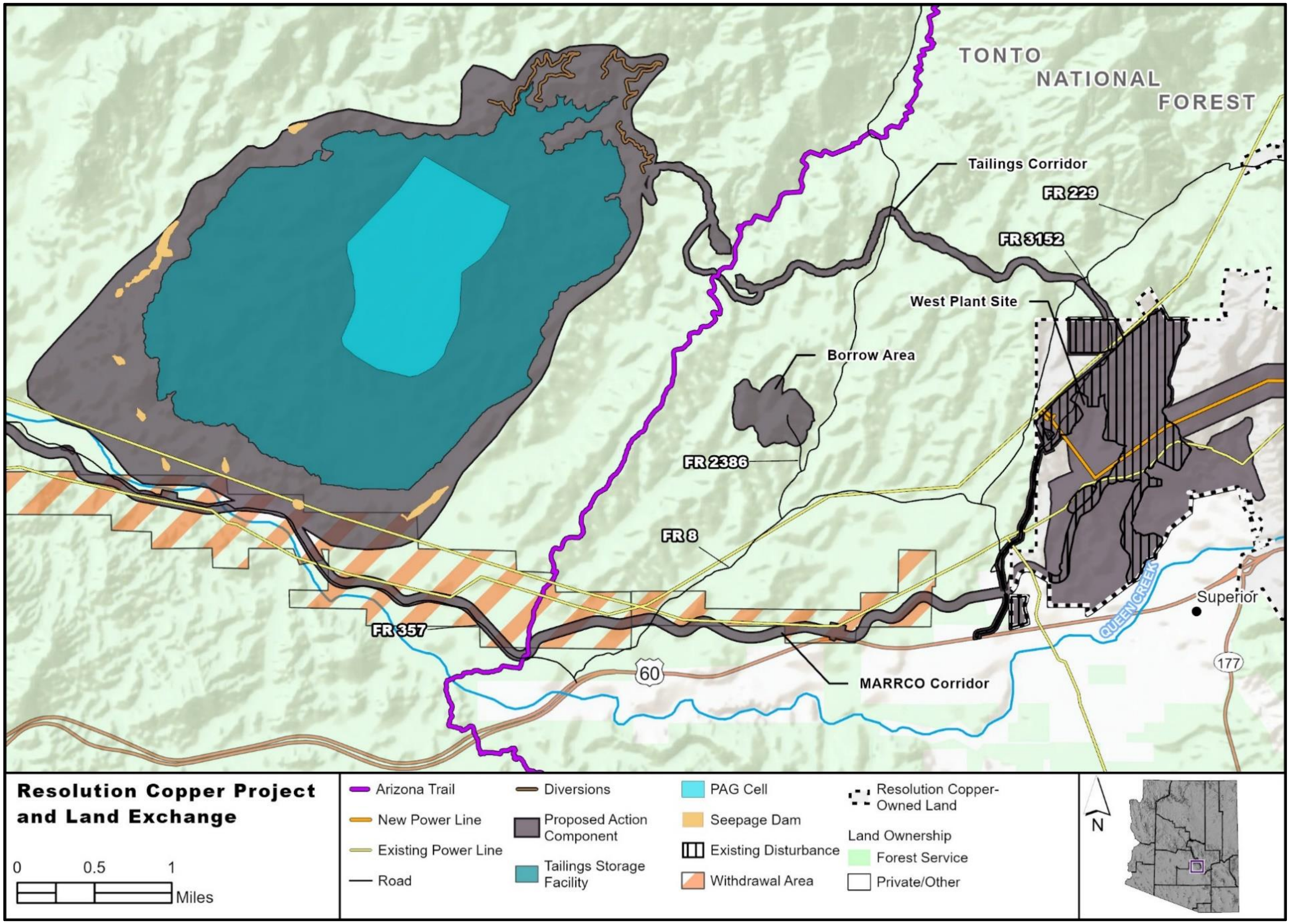


Figure 2.2.5-2. Alternative 3 – Near West – Ultrathickened tailings storage facility

Tailings Facility – Tailings Conveyance

Tailings conveyance via pipeline to the modified proposed action tailings facility would be the same as described in Alternative 2 – Near West Proposed Action.

Tailings Facility – Embankment Type

Alternative 3 would use the same approach, including an earthen starter dam, raised with compacted cyclone sand in a modified-centerline construction; however, the downstream slope would be 3H:1. Borrow material would come from the same locations as described in Alternative 2. The PAG tailings cell would be located within the larger NPAG deposit, separated by a splitter berm construction of compacted cycloned sand.

Tailings Facility – Liner

Where NPAG tailings are deposited on potentially high-permeability bedrock, the foundation would be covered with an engineered, low-permeability layers prior to tailings deposition. The PAG tailings cell would be hydraulically contained by engineered, low-permeability layers and deposited over less-fractured bedrock.

Alternative 3 would make use of the same phased approach for control and collection of seepage as Alternative 2, including downstream seepage collection ponds, and additional grouting, collection ponds, or pumping wells if needed.

Tailings Facility – Disposal Method

The PAG tailings would be sent directly to a floating deposition barge for subaqueous deposition located within the PAG cell. The difference to apply high-density thickening of the NPAG tailings would occur prior to placement within the tailings storage facility to further reduce entrained water through evaporation and thereby reduce seepage. There is a potential for even more water to be removed from the tailings through “thin-lift” deposition techniques (depositing tailings in very thin layers), which would be used if found to be feasible with ultrathickened tailings.

The PAG tailings would be maintained in a saturated condition under a water cover at least 10 feet deep throughout operations. A primary difference between Alternatives 2 and 3 is the location of the recycled water pond. Under Alternative 2 the recycled water pond overlies both a portion of the NPAG and all of the PAG tailings, while under Alternative 3 the recycled water pond would only overlie the PAG tailings cell. Low spots that accumulate water, released from the tailings or stormwater on the NPAG tailings surface, would be pumped and the water would be directed to the PAG tailings cell.

Tailings Facility – Auxiliary Facilities

Access roads and other auxiliary facilities associated with Alternative 3 are similar to those described in section 2.2.4. Stormwater diversion channels would be needed to route upstream storm flows around the facility. Precipitation falling within the facility would be incorporated into the tailings reclaim water. Additional cyclone thickeners would be required to thicken the NPAG tailings to a greater percentage than Alternative 2.

Tailings Facility – Closure and Reclamation

During operations, the cycloned sand embankment slopes would be progressively reclaimed as facility development allowed (i.e., lower slopes would be reclaimed as subsequent lifts added). Channels and other features would be constructed at strategic locations on the closed embankment slopes to convey stormwater away from the facility and seepage ponds, and the slopes would be progressively covered with a low-permeability, erosion-resistant soil layer (e.g., Gila Conglomerate) and revegetated.

In the final years of operations, tailings would be deposited to promote surface water runoff to the north, where runoff would then be directed downstream, diverting around the seepage collection ponds, and surfaces throughout the facility would be reshaped as necessary to eliminate any potential for standing water.

Following closure, the recycled water pond within the PAG cell would gradually be reduced in size and the seepage ponds downstream would be enlarged in order to maximize evaporation. The PAG cell would then be covered with a layer of NPAG tailings topped by a 1- to 2-foot layer of low-permeability, erosion-resistant soil (e.g., Gila Conglomerate or equivalent soil, sand, and gravel mix) and revegetated. The remaining NPAG areas would similarly be covered by a 1- to 2-foot layer of low-permeability, erosion-resistant soil (e.g., Gila Conglomerate or equivalent soil, sand, and gravel mix) and revegetated. The reclamation timing is dependent on the surface being dry enough to allow equipment access.

Active closure would be required for up to 9 years after the end of operations. Any water collected in the seepage collection ponds beyond the evaporation capacity of the seepage collection ponds would need to be actively treated. The sludge containing concentrated metals and salts from evaporation would require cleanup and handling as a solid or hazardous waste.

Other closure and reclamation measures, such as the removal of buildings, pipelines, electrical equipment and electrical lines, and the recontouring and revegetation of parking areas and other areas of ground disturbance, would be substantially identical to those described for Alternative 2.

Table 2.2.5-1 summarizes the components of the Alternative 3 tailings storage facility.

Table 2.2.5-1. Summary of Alternative 3 – Near West – Ultrathickened tailings storage facility

Tailings Storage Facility	Description
Location	3 miles west of the West Plant Site, north of Hewitt Canyon Road (NFS Road 357); same as Alternative 2 – Near West Proposed Action
Total footprint of disturbance for entire alternative	9,780 acres • NFS (7,186 acres) • BLM (0 acres) • ASLD (312 acres) • Private (2,282 acres) Plus an additional 92 acres for recreation mitigation and optional 13 acres for Silver King Road realignment
Approximate size at fence line of tailings storage facility	4,903 acres
Land ownership of tailings storage facility	NFS
Distance from West Plant Site	3 miles
Tailings type and disposal	Thickened slurry tailings placed subaqueously for PAG tailings from barge, NPAG placed hydraulically from perimeter At disposal—PAG tailings would be 50% solids content; thickened cyclone overflow (NPAG) would be 62% solids content; and additionally thickened NPAG stream sent directly from the mill would be 70% solids content
Tailings embankment	Cycloned tailings and earthen starter dam, raised with compacted cyclone sand in a modified-centerline construction approach with a 3H:1V slope

Tailings Storage Facility	Description
Lining and other seepage controls	Engineered, low-permeability layers would be installed prior to start-up. These would include the entire PAG cell and in other areas where the foundation may have high permeability. Seepage from the tailings would be recovered in 11 seepage collection ponds downstream of the embankment. The seepage and stormwater collected at the collection ponds would be managed during operations for use in the process water system. Finger and blanket drains would underlie the embankment and part of the NPAG tailings.
Approximate embankment height	510 feet
Tailings pipelines / conveyance	Thickened slurry pumped in two streams (PAG and NPAG) to the tailings storage facility and recycled water pipeline to return water to processing loop at West Plant Site 5.33 miles of corridor from West Plant Site to tailings storage facility
Auxiliary facilities	Two clusters of 26 cyclones, two high-density thickeners Upstream surface water north, west, and east of the tailings storage facility would be diverted to the extent possible around the facility through constructed diversion channels. This non-contact water would be diverted downstream to Queen Creek.
Other design considerations	8 miles of NFS roads are expected to be decommissioned or lost. Arizona National Scenic Trail would need to be crossed by the slurry pipeline corridor and associated access road, but not rerouted. Encroachment on Bureau of Reclamation withdrawal lands along Queen Creek would be required.
Consumptive water use over life of mine	490,000 acre-feet
Closure and reclamation	Reclamation of the tailings embankment face would occur progressively until about mine year 30 and continue through the end of the mining operations (approximately mine year 46). Dewatering of the tailings recycled water pond is estimated to take up to 5 years after the end of operations. Until that time, excess water collected in seepage ponds would be pumped back to recycled water pond, and reclamation would take place on the embankment and tailings beaches. After the recycled water pond is closed, seepage ponds would be enlarged to allow adequate evaporation of pond inflows, and the remaining reclamation of the tailings would occur.

2.2.5.2 Forest Plan Amendment for Alternative 3

Alternative 3 would include a multicomponent project-specific amendment of the forest plan that is identical to the amendment under Alternative 2.

2.2.6 Alternative 4 – Silver King

Alternative 4 – Silver King would include approximately 9,967 acres of disturbance of which 7,857 acres is NFS land, 312 acres is ASLD managed, and 1,798 acres is private land. Additional project activities would occur on 92 acres for recreational mitigations (see section 2.3) and optionally 13 acres for the Silver King Road realignment (see section 2.2.9.2).

The Silver King alternative was developed to respond to issues of water use, air quality, public health and safety, and groundwater quality through the use of filtered tailings instead of thickened slurry tailings (as proposed in the GPO) at an alternative location on Tonto National Forest land in an area known as Silver King. This alternative includes changes to the GPO for the tailings location, tailings processing and storage method, the location of the filter plant and loadout facility, and other emergency storage ponds which would increase the West Plant Site footprint and require different access road realignment along Silver King Mine Road, compared with the GPO and Alternatives 2, 3, 5, and 6. The borrow areas for mine construction would include areas within the tailings storage facility fence line and one area located along NFS Road 8, similar to Alternatives 2 and 3. Other plan components of the GPO remain the same as described in Alternative 2 – Near West Proposed Action.

This tailings facility would occupy the lower end of Silver King Canyon, in the Silver King Wash, the lower portion of Whitford Canyon, and Peachville Tank, immediately adjacent to the West Plant Site north of Superior, Arizona (figure 2.2.6-1). The tailings footprint was designed to avoid existing mining operations at the Silver King Mine and a historic cemetery; however, 5.5 miles of the Arizona National Scenic Trail would need to be rerouted and the McGinnel claim, 0.5 mile north of Silver King Mine, would be within the footprint of the tailings pile. Although the conceptual design of this facility is quite high (1,040 feet), the facility would consist of several benches to follow and mimic existing topography.

The use of filtered tailings reduces some concerns with water quality and public safety because removing water from the slurry prior to placement decreases the mobility of the tailings, providing greater stability of these tailings and a substantial reduction in seepage. Filtered tailings would allow progressive reclamation and compaction, but this alternative has large, dry, exposed surfaces that need to be managed to avoid air quality concerns. At this time, filtered tailings have not been used on a facility with a production rate as high as that proposed by Resolution Copper.

Tailings slurry would be delivered in separate tailings pipelines to two filter plants at the Silver King facility (one for PAG and one for NPAG) and filtering would then occur to remove water from the tailings, increasing percent solids generally to about 86 to 89 percent (vs. approximately 50 to 65 percent in the GPO tailings plan). Once filtered, the tailings would be conveyed into place as solids rather than pumped as a semi-liquid in a tailings pipeline, and, once in place, would be compacted in place using earthmoving equipment. The NPAG and PAG filtered tailings would be stacked in separate but nearly adjacent facilities.

Surface water management would include large upstream diversion dams with high-capacity outlets as well as large downstream collection ponds, as there would be no water recycling ponds, compared with slurry facilities to handle contact water. Emergency slurry ponds would be required for temporary storage of slurry in event of a tailings filter plant shutdown.

The rationale for choosing this alternative for detailed analysis is that, compared with the proposed action, it allows for a comparison of the impacts of thickened slurry tailings vs. filtered tailings, and it allows a comparison regarding whether the specific location selected for tailings in the GPO is preferable to other locations in the same general vicinity of Superior.

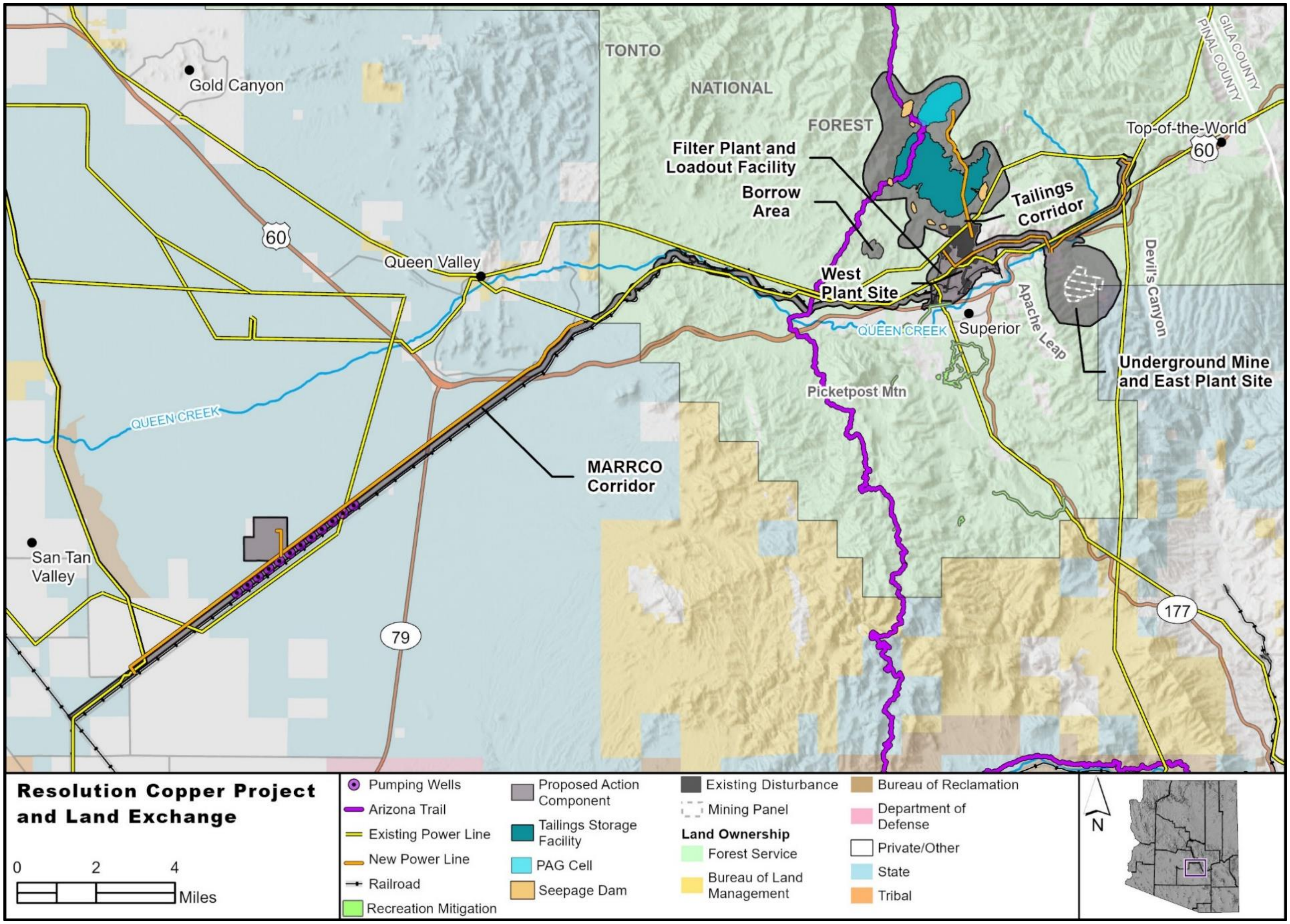


Figure 2.2.6-1. Alternative 4 – Silver King overview

2.2.6.1 Alternative 4 Mine Plan Components

Relocation of Filter Plant and Loadout Facility

This alternative would relocate the filter plant and loadout facility from the proposed location near Magma Junction to the West Plant Site, near the concentrator on the existing rail line north of U.S. Route 60 (U.S. 60) (figure 2.2.6-2). This modification to the proposed action responds to issues of air quality, noise, and public health and safety associated with locating mining support facilities in the heavily populated East Salt River valley.

The filter plant and loadout facility would continue to pressure-filter the copper concentrate in a way that is similar to the proposed process described in the GPO. Pipelines for copper concentrate and filtrate water would be located within the West Plant Site and not within the MARRCO corridor, thereby eliminating 21 miles of concentrate pipelines. This responds to issues of water quality and public health and safety that may be associated with concentrate pipeline ruptures or spills.

Two 50-railcar trains would instead use the MARRCO corridor twice a day to transport copper concentrate to market (concentrate loads would be transferred at Magma Junction to container cars of the Union Pacific Railroad for transport to an off-site smelter). The MARRCO corridor track would require upgrades along the entire length, bridge replacement at Queen Creek Bridge, and significant upgrades for crossings at Queen Creek, U.S. 60, State Route (SR) 79, the Arizona National Scenic Trail, Hewitt Canyon Road, and other NFS roads. Except for the removal of concentrate pipelines, the dimensions and uses of water pipelines, groundwater wells, pump stations, and 69- and 12-kV power lines within the MARRCO corridor would remain unchanged from how these facilities are described in the GPO.

Water Use

This alternative uses the least amount of water of all the tailings alternatives and is estimated to need about 180,000 acre-feet of makeup water pumped from the Desert Wellfield through the life of the mine (see appendix H). This is about 65 percent less water than Alternative 2, due to recovery of water during filtering and subsequently less evaporative loss from the tailings beaches and recycled water pond.

Tailings Facility – Tailings Type

NPAG and PAG tailings streams would each undergo dewatering to a "filtered" tailings type. Filtering tailings would remove more water from the tailings slurry and result in filtered tailings with approximately 86 to 89 percent solids. At this moisture content, the tailings are referred to as a "dry cake" and must be transported by conveyor or truck to a filtered tailings storage facility. This modification responds to issues of public health and safety, water quality, and water use by removing water from the tailings. The filtered tailings can be placed and compacted into piles and have less water entrained in the tailings facility (figure 2.2.6-3).[32]

[32] Public comments on the DEIS suggest the application of filtered tailings at other tailings locations. We chose not to apply this suggestion to the alternatives in the FEIS; the rationale for this choice is included in appendix F. Ultimately, a primary goal of the NEPA analysis is to compare alternatives and alternative components, in order to assess whether or how impacts could be reduced. Filtered tailings could have been applied at any alternative in order to allow a comparison of the impacts of using different tailings technologies; we chose to apply them to the Silver King location because of the close proximity and the potential need to mechanically move filtered tailings from the West Plant Site to the tailings storage facility, rather than move the tailings as a slurry. Similarly, for Alternative 4 we chose to move the filter plant/loadout facility to the West Plant Site in order to allow a comparison of the incremental impacts of moving copper concentrate by rail instead of pipeline, and the incremental impacts of consolidating processing activities out of the San Tan Valley.

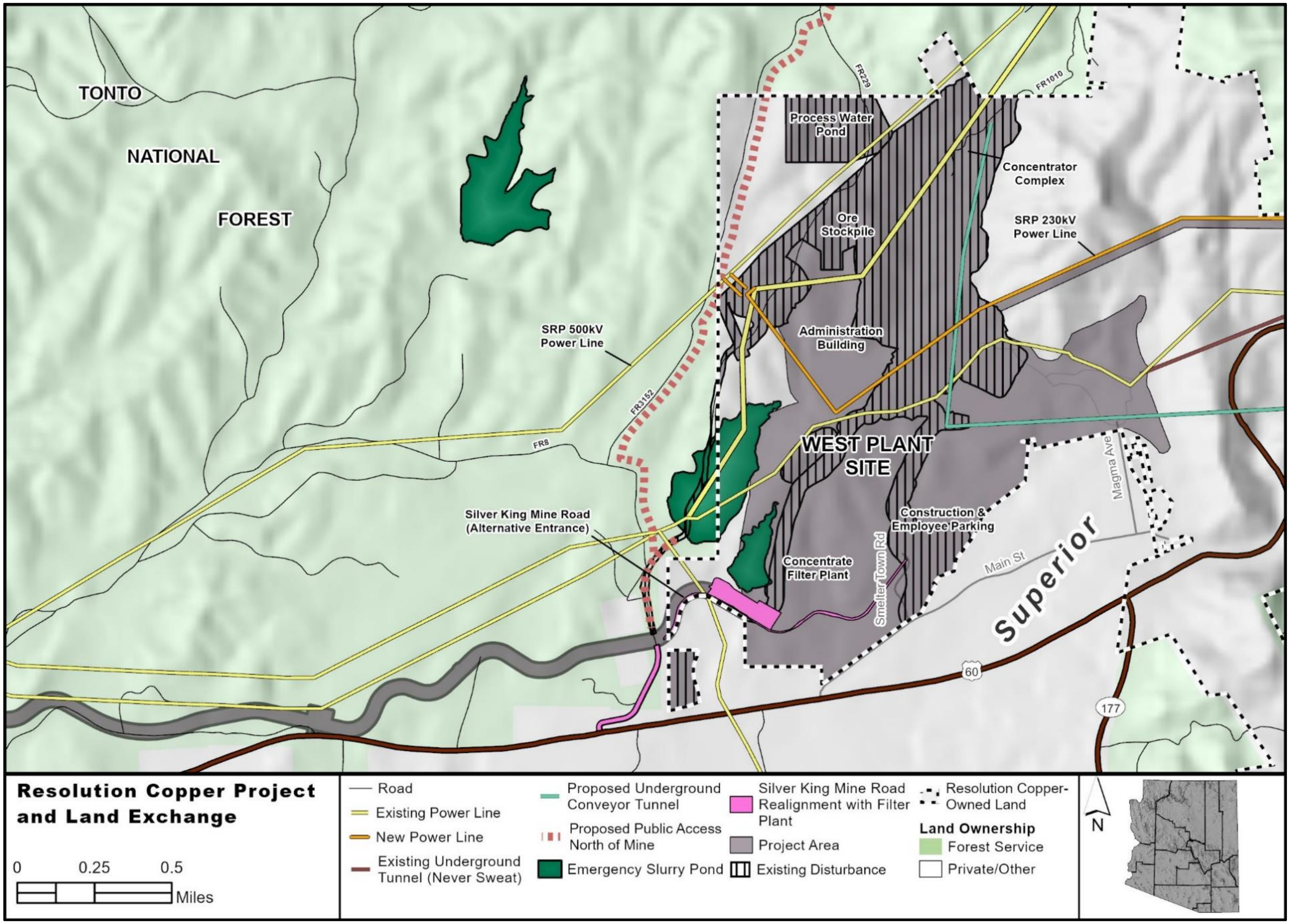


Figure 2.2.6-2. Relocation of filter plant and loadout facility

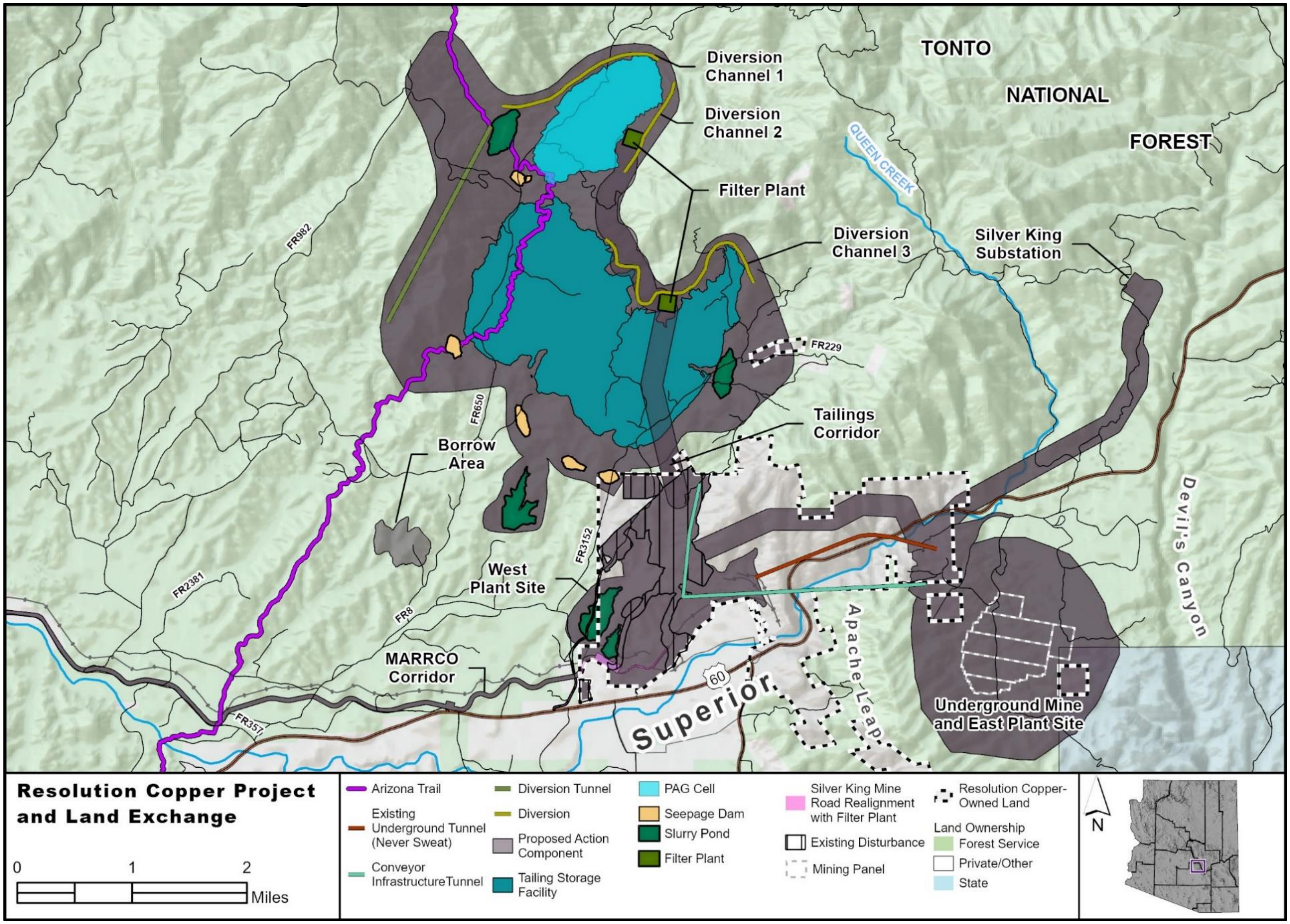


Figure 2.2.6-3. Alternative 4 – Silver King tailings storage facility

Tailings Facility – Tailings Conveyance

Tailings slurry would be delivered by pipeline from the West Plant Site to the two separate Silver King filter plants, one located on higher ground above and adjacent to the NPAG facility approximately 1.5 miles north of the West Plant Site, and the other on higher ground above and adjacent to the PAG facility approximately 1.4 miles north-northwest of the NPAG site. Situating the filter plants on higher ground would allow for greater efficiency through downhill conveyance of the two types of filtered tailings to their respective storage facilities. Upon arriving at each filter plant, the NPAG and PAG tailings slurries would be pressure filtered to remove water, then subsequently handled as solids and delivered by conveyor and mechanically placed within each of the two tailings facilities.

Unlike a typical slurry tailings facility, where slurry can be emptied directly into the facility in the event of a processing halt, for filtered tailings, one or more emergency slurry storage ponds would be constructed close to the West Plant Site as emergency disposal location(s) for filtered tailings in the event that a filter plant temporarily stops processing. The emergency storage facilities would be constructed behind earthfill embankment(s) and would be lined.

Tailings Facility – Embankment Type

Filtered tailings are treated as solids (not liquids) and therefore do not require storage behind an embankment. No embankment would be required for construction of the Silver King alternative tailings storage facility; however, a compacted zone of tailings around the perimeter of the facility would provide structural support.

Tailings Facility – Liner

The Silver King alternative tailings storage facility would not be lined. As discussed further in section 3.7.2, the use of a full liner was considered during alternatives development and eventually dismissed from detailed consideration due to logistical concerns.

Tailings Facility – Disposal Method

Tailings would be placed using “trains,” which are mechanical conveyors that place tailings in rows. Additional mobile mechanized equipment would be used to spread and compact the tailings. As stated previously, there would be two separate filtered tailings facilities: the NPAG tailings would be stacked closer to the West Plant Site and the PAG tailings farther north and upstream of the NPAG facility. Maintaining two separate facilities provides flexibility in how PAG tailings are managed and reclaimed.

Tailings Facility – Auxiliary Facilities

Unlike a slurry tailings facility, in which precipitation falling on the tailings is directed to the recycled water pond, stormwater must be managed on filtered facilities to prevent ponding on the surface of the tailings. Stormwater diversion channels, diversion tunnels, and retention structures would be needed to divert stormwater runoff from the tailings piles or move runoff quickly off the facilities. During operations, the tailings surfaces would be sloped to eliminate ponding and direct runoff to perimeter ditches, sumps, and/or underdrains. The top surfaces of the tailings piles would be sloped toward the hillside and surface runoff would be collected in lined ditches and conveyed to lined contact water collection ponds. As described under “Tailings Conveyance” earlier in this section, emergency slurry storage ponds would be needed near the West Plant Site as an emergency disposal location, in the event that the filter plant temporarily shuts down.

Tailings Facility – Closure and Reclamation

The filtered tailings facilities would be constructed in horizontal lifts. Thus, the external slopes of the stack can be reclaimed starting early in the mine life, unlike slurry facilities, which are unlikely to start embankment slope reclamation until after year 20. Because it is important to keep water away from the filtered facility, surface water diversion dams, tunnels, channels, and pipelines would be constructed where needed to direct the large upstream catchment runoff water away from the slopes and to limit erosion, and contact water would be directed to collection ponds for evaporation. After closure, upstream stormwater diversion features such as cutoff walls and channels would remain in place permanently to continue to direct surface water flows around and downstream of the tailings impoundments.

Active closure would be required for 5 years after the end of operations. During this time, reclamation of the exposed tailings would be in progress, and the need to retain stormwater in the collection ponds requires more capacity than the collection ponds can passively evaporate; active treatment may be required. Once stormwater can again be released downstream, after the tailings surface has been reclaimed with a stable closure cover, the collection ponds would be able to passively evaporate collected water. The sludge of concentrated metals and salts from evaporation would likely eventually require cleanup and handling as solid or hazardous waste.

The NPAG and PAG tailings piles would be treated as two separate facilities with separate covering, soil, and revegetation, but both stacks would use a store-and-release cover design to limit infiltration.
At closure, the PAG tailings pile would be covered by an engineered low-permeability layer of compacted NPAG material that would be covered by a 1- to 2-foot layer of low-permeability, erosion-resistant soil (e.g., Gila Conglomerate or equivalent soil, sand, and gravel mix) and revegetated. Other closure and reclamation measures, such as the removal of buildings, pipelines, electrical equipment and electrical lines, and the recontouring and revegetation of parking areas and other areas of ground disturbance, would be substantially identical to those described for Alternative 2.

Table 2.2.6-1 summarizes the components of the Silver King tailings storage facility.

Table 2.2.6-1. Summary of Alternative 4 – Silver King tailings storage facility

Tailings Storage Facility	Description
Location	Silver King Canyon (immediately north of and adjacent to the West Plant Site)
Total footprint of disturbance for entire alternative	9,967 acres • NFS (7,857 acres) • BLM (0 acres) • ASLD (312 acres) • Private (1,798 acres) Plus an additional 92 acres for recreation mitigation and optional 13 acres for Silver King Road realignment
Approximate size at fence line of tailings storage facility	5,660 acres
Land ownership of tailings storage facility	NFS
Distance from West Plant Site	1 mile
Tailings type and disposal	Filtered (dry stack) placed mechanically in two separate, but adjacent facilities At disposal—PAG tailings would be 86% solids content; NPAG tailings would be 89% solids content
Tailings embankment	Perimeter of filtered pile would be compacted into a structural zone to provide physical support. The downstream slope would not exceed 3H:1V.

Tailings Storage Facility	Description
Lining and other seepage controls	No lining of tailings, emergency temporary slurry ponds would be lined and retained by earthfill embankments. Seepage from the tailings would be recovered in five seepage collection ponds downstream of the facilities. Finger and blanket drains would underlie the tailings facilities.
Approximate embankment height	The approximate maximum height of the filtered NPAG tailings facility is 1,040 feet and PAG tailings facility is 750 feet
Tailings pipelines / conveyance	Thickened slurry would be pumped in two streams (PAG and NPAG) to the tailings storage facility and a recycled water pipeline would return water to processing loop at West Plant Site. There would be two filter plants (one for NPAG and one for PAG) at the Silver King tailings storage facility. After tailings are pressure filtered, they would then be placed within the facility by conveyor. 0.20 mile of corridor from West Plant Site to tailings storage facility.
Auxiliary facilities	Pressure filters, conveyors, mechanical spreaders, and mobile earthmoving equipment would be used for filtering and depositing the tailings. The filter plant and loadout facility would be relocated from the proposed location near Magma Junction to the West Plant Site. The facility would continue to pressure-filter the concentrate similar to the proposed process described in the GPO. Pipelines for copper concentrate and filtrate water would be located within the West Plant Site and not within the MARRCO corridor. Two 50-railcar trains would use the MARRCO corridor twice a day to transport copper concentrate to market. Permanent diversion channels upslope of the tailings pile would divert non-contact water around the tailings pile and discharge to either the West or East Diversion reservoirs. Multiple temporary slurry storage ponds would be required near the West Plant Site as emergency disposal locations in the event of planned or unplanned shutdowns. The ponds would be lined and retained by earthfill embankments.
Other design considerations	NFS Road 229 would need to be rerouted for private parcel access 17.7 miles of NFS roads are expected to be decommissioned or lost Approximately 5.5 miles of the Arizona National Scenic Trail would need to be rerouted The 230-kV and 115-kV transmission lines would need to be crossed or rerouted between the East Plant Site and the West Plant Site
Consumptive water use over life of mine	180,000 acre-feet
Closure and reclamation	Reclamation and contouring of the filtered tailings would occur concurrently during mining operations. Reclamation would begin on outer slopes as early as practicable. Seepage and contact water collection ponds would remain in place until reclamation of tailings surfaces is complete, about 5 years after closure. Seepage ponds would remain in place to evaporate seepage or runoff unless water quality were sufficient to allow discharge.

2.2.6.2 Forest Plan Amendment for Alternative 4

Alternative 4 would include a multicomponent project-specific amendment of the forest plan. This amendment would except 25 forest plan desired conditions and guidelines associated with soil productivity, scenic resources, national scenic trails, recreation resources, wildlife habitat, and cultural resources, (see table 1.4.3-1). This amendment would except the project actions of Alternative 4 from compliance with these 25 forest plan desired conditions and guidelines in the project area. See chapter 3 for a discussion of the effects of the amendment on each resource.

2.2.7 Alternative 5 – Peg Leg

For the DEIS, Alternative 5 – Peg Leg was presented with two different tailings corridor options (west and east). After receipt of public comments, we chose to eliminate the west tailings pipeline corridor from consideration. The west pipeline corridor intersected over 100 acres of critical habitat for Acuña cactus. It also had greater surface disturbance and was anticipated to have greater visual impacts. The west pipeline corridor also conflicted with recreational opportunities, particularly in the Reymert area.

Alternative 5 – Peg Leg would include approximately 16,812 acres of disturbance, of which 2,649 acres is NFS land, 7,050 acres is BLM managed, 4,602 acres is ASLD managed, and 2,511 acres is private land. Additional project activities would occur on 92 acres for recreational mitigations (see section 2.3) and optionally 13 acres for the Silver King Road realignment (see section 2.2.9.2).

The Peg Leg alternative was developed to respond to the issues of public health and safety and groundwater quality. This alternative includes changes to the GPO for storing tailings, including the tailings facility location, tailings conveyance route to storage facility, and tailings storage embankment type. Public health and safety is addressed by locating the tailings facility in an area farther from residential populations and using a more resilient and robust embankment type than the upstream embankment proposed in the original GPO. Water quality is addressed by containing and controlling any seepage from the facility, and the greater distance to downstream perennial waters. Other plan components of the GPO remain the same as described in Alternative 2 – Near West Proposed Action.

The Peg Leg alternative tailings facility location is on a mixture of ASLD-administered and BLM-administered and private land south of the Gila River (figure 2.2.7-1). Selection of this alternative by the Forest Supervisor would not automatically approve this alternative, as BLM would require submittal of a mining plan of operations and applications for other land use processes to approve the proposal. Since the other areas are not Federal land, obtaining access to use ASLD-administered trust land and private land is the responsibility of the applicant. The thickened slurry would be pumped from the West Plant Site in a split stream (approximately 84 percent NPAG and 16 percent PAG) via pipeline roughly 23 miles, and placed behind a centerline embankment retaining the larger NPAG tailings facility; the separate PAG cell would be situated behind a downstream embankment located adjacent to the NPAG impoundment. The PAG tailings would be kept saturated to prevent oxidation (the same as for the GPO).

This alternative tailings location was selected because it is far from dense residential areas and other infrastructure. The advantage of this site is a greater distance from Superior, Queen Creek, and other communities, along with a gently sloping 4 percent topography on alluvial soils underlain by shallow bedrock on the eastern portion. This alternative would consolidate mining activities on the landscape—this alternative is geographically close to the ASARCO Ray Mine complex and the planned Ripsey Wash tailings facility.

2.2.7.1 Alternative 5 Mine Plan Components

Water Use

This alternative uses about 540,000 acre-feet of groundwater pumped from the Desert Wellfield through the life of the mine (see appendix H). This is about 8 percent less water than under Alternative 2. This location has greater seepage losses to the aquifer. However, this increased water use is offset by the capture of more precipitation and runoff at this location and greater recovery of reclaimed water.

Tailings Facility – Tailings Type

Tailings types would be the same as described in Alternative 2 – Near West Proposed Action. The thickened tailings would consist of approximately 84 percent NPAG and 16 percent PAG.

The smaller PAG facility would be located on what is primarily granitic and granodiorite bedrock at the eastern portion of the Peg Leg facility footprint and would be constructed in a "four-square" pattern of separate cells as a way to reduce the pond size required for operations (i.e., the water cap needed to prevent airborne oxygen from interacting with the PAG tailings). The NPAG tailings would be located on what is primarily an alluvial material base immediately to the west and slightly downslope from the PAG location. Figure 2.2.7-2 shows the tailings storage facility for this alternative.

Tailings Facility – Tailings Conveyance

The tailings would be pumped as a thickened slurry in two separate pipelines from the West Plant Site to the Peg Leg tailings storage facility approximately 25 miles to the south. The pipeline alignment would initially lie within the SR 177 easement and then shift more directly southward across BLM-administered and private lands before crossing the Gila River west of the Kelvin Bridge area prior to connecting to the Peg Leg facility (see figure 2.2.7-2).

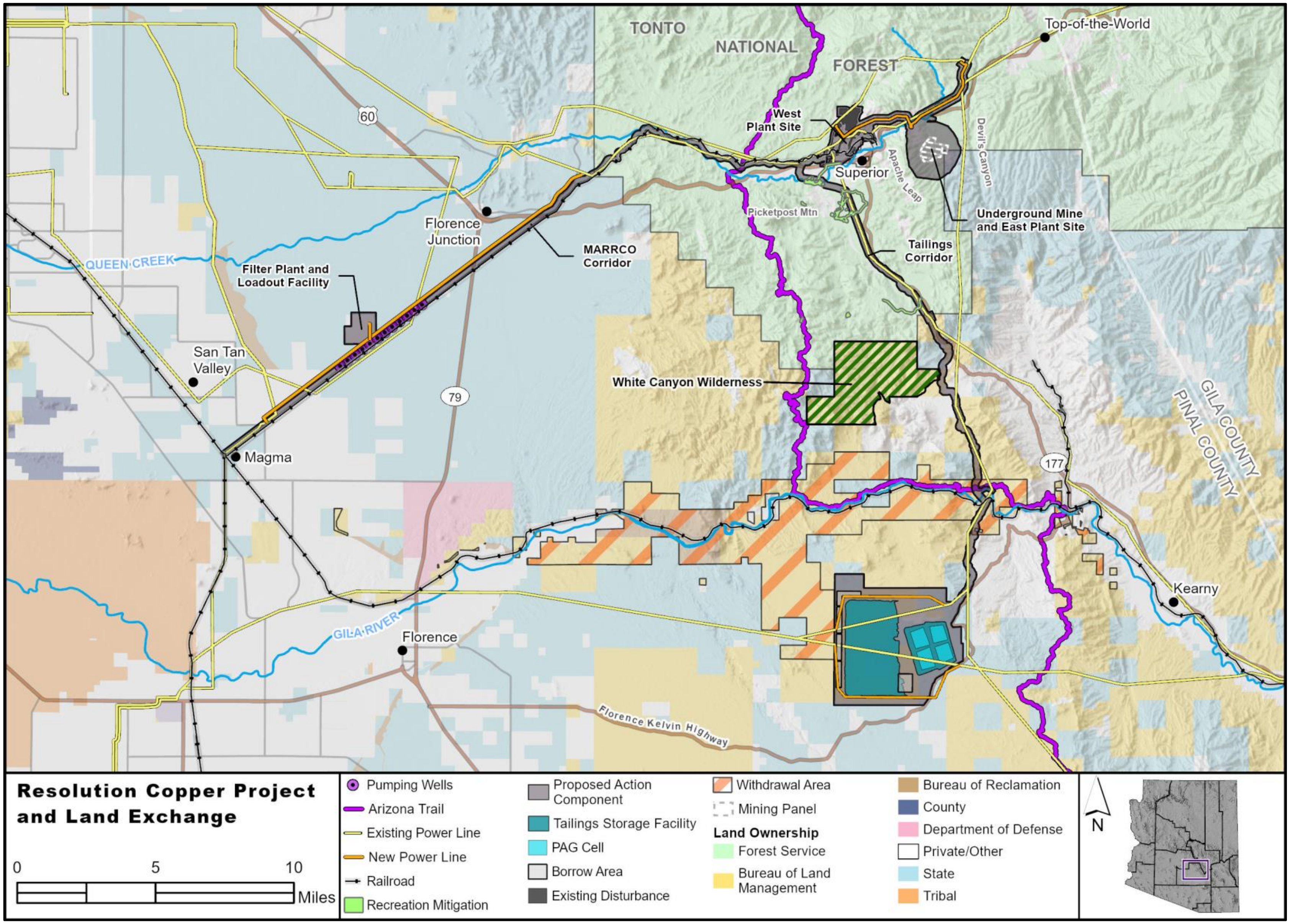


Figure 2.2.7-1. Alternative 5 – Peg Leg overview

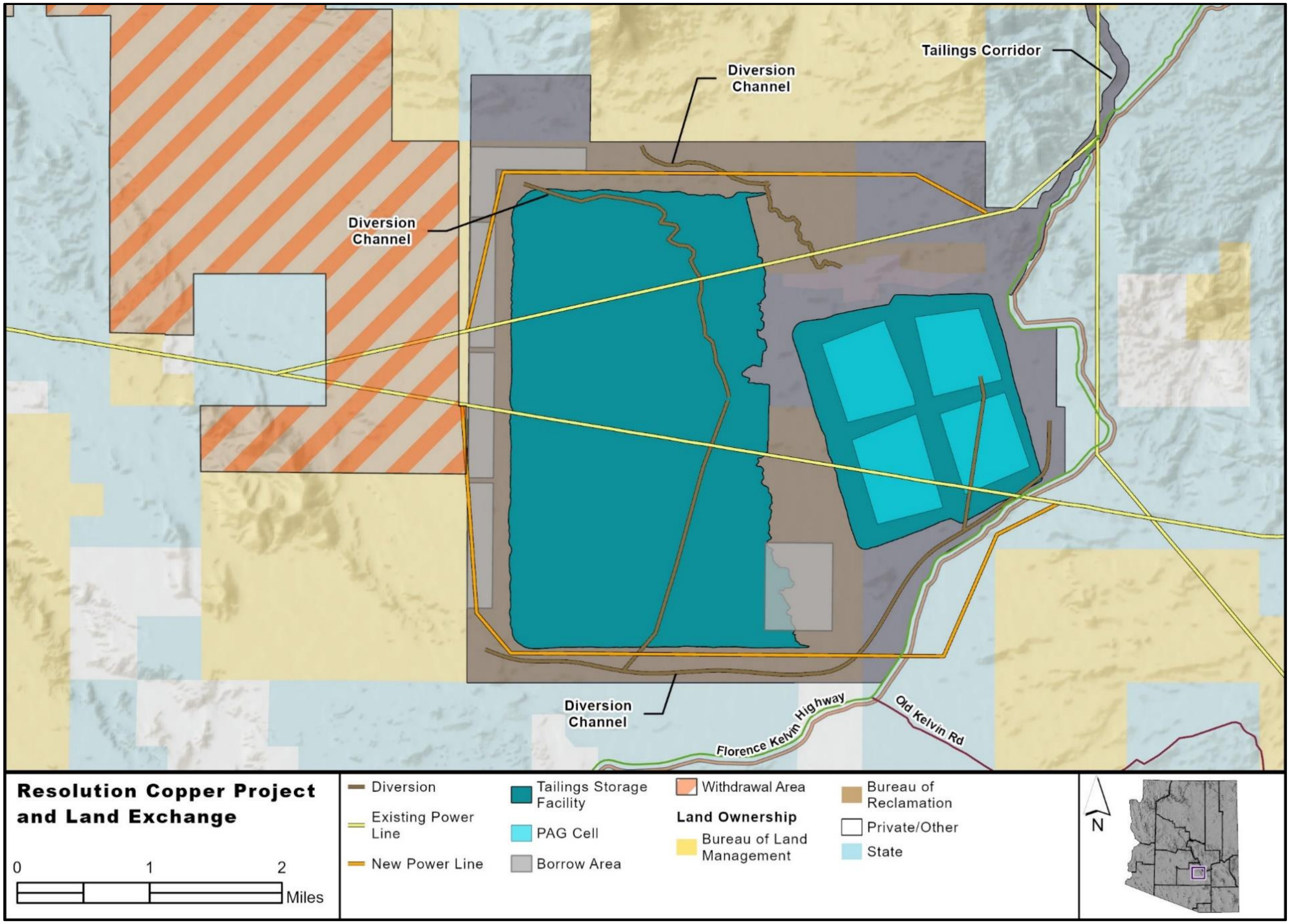


Figure 2.2.7-2. Alternative 5 – Peg Leg tailings storage facility

Tailings Facility – Embankment Type

As stated, the Peg Leg tailings facility would comprise two physically separate types of storage facilities: PAG and NPAG. The two facilities would remain segregated throughout the entire life of the mine.

A “downstream” embankment design, which is material-intensive and requires a larger footprint to be designed as a water retaining embankment, is proposed for the PAG cell as it contains a water cover to limit oxidation. This embankment would be constructed using a mixture of earthfill excavated from within the tailings facility footprint and compacted cyclone sand. At the end of mine life, the PAG embankment would be approximately 200 feet in height. The entire PAG facility would include engineered low-permeability layers, or possibly a full synthetic liner.

The NPAG tailings would be retained behind a “centerline” design embankment[33] just to the west and slightly downstream of the PAG facility. The NPAG embankment would be constructed first using earthfill excavated from within the facility footprint, followed by compacted cyclone sand (underflow). The NPAG facility would be partially lined with an engineered low-permeability lining and other low-permeability layers under the recycled water pond area of the impoundment. At completion, the NPAG main embankment would be approximately 310 feet in height. Borrow areas are located entirely within the tailings storage facility fence line area with no external borrow areas considered in this analysis (see figure 2.2.7-2).

Tailings Facility – Liner

A full engineered low-permeability lining or other low-permeability layer would be installed at the PAG facility and partial engineered low-permeability lining positioned along the starter dam and under the recycled water pond within the NPAG impoundment (the full areal extent of the liner needed in the NPAG facility would be assessed and adjusted during operations). Other seepage containment techniques, such as use of low-permeability tailing fines (cyclone overflow), as well as grouting or sealing of fractures in base rock using asphalt or bentonite or other materials, may be used to augment the engineered low-permeability lining within both the PAG and NPAG cells.

Alternative 5 was developed in part from the concept of a fully lined tailings facility. In practice, a full engineered low-permeability liner over such a large area would be both impractical and ineffective. However, because this alternative is located on alluvium, the potential water losses are expected to be substantial and a wide variety of seepage containment techniques would need to be employed to limit seepage to the extent possible and recover water for recycling back into the mine process (see section 3.7.2.4).

Embankment seepage would be captured in drains at the toe of the dams at each facility and collected in lined surface water and seepage collection ponds. This collected water would then be pumped back to the recycled water ponds at each facility. A groundwater pumpback system would be operated downgradient of the tailings facility to recover seepage.

The uncontained seepage from the facility is expected to produce a groundwater mound. A well field would be installed downstream of the facility to further control seepage and groundwater would be pumped back to the recycled water pond.

[33] Care should be taken to not confuse “modified centerline” with “centerline” designs. The modified centerline embankment type still has some resemblance to an upstream embankment, in that the crest of the embankment does move upstream over time and the embankment lifts are still constructed partially over tailings. The true centerline design builds the crest straight upward and retains a solid core that is not underlain by tailings.

Tailings Facility – Disposal Method

Tailings would be deposited by pipeline to their respective cells around each embankment. In this alternative, the PAG tailings would be deposited subaqueously. NPAG slurry would initially be deposited using traditional methods but would later transition to “thin-lift” (i.e., thin layer) deposition techniques to further increase evaporation and reduce seepage.

Tailings Facility – Auxiliary Facilities

Stormwater diversion channels and retention structures would be needed to manage stormwater runoff from the NPAG and PAG cells and to manage upstream (upslope) storm flows. Cutoff walls and diversion berms and channels would be constructed on the northern, eastern, and southern boundaries of the tailings facility to divert stormwater flows around the tailings impoundments.

Additional facilities that would support operations at the Peg Leg site would include electrical power lines and a substation; a cyclone separation plant; water pumping facilities for the PAG cells; collection ponds; a vehicle maintenance and fuel shop; an administration/maintenance building; an equipment storage building; and vehicle parking areas.

Existing power lines would need to be rerouted around the tailings facility, including a 115-kV SRP power line and a 12.5-kV San Carlos Irrigation Project power line as shown in figure 2.2.7-2.

Tailings Facility – Closure and Reclamation

A difference in the management of this alternative with tailings stored in perpetuity on BLM-managed lands, would require the GPO to remain active along with any reclamation bonds for many decades. After final tailings deposition and formal closure of the Peg Leg tailings storage facility, the surfaces of both the NPAG and PAG facilities would be shaped as necessary to prevent standing water. Surface water diversion features, including channels, would be constructed to limit erosion and direct precipitation that falls within the facilities to lined collection ponds to evaporate. Upstream diversion features would continue to direct stormwater flows around and downstream of the two impoundments; these structures would permanently remain in place after all other closure and disassembly/removal work had concluded.

The NPAG facility would be covered with 1 to 2 feet of low-permeability, erosion-resistant soil (e.g., Gila Conglomerate, or a sand, soil, and gravel mix) and revegetated. The PAG facility is separated into four separate cells to reduce the footprint of saturated tailings, thus reducing seepage and to promote early closure and reclamation. Each PAG cell would operate for approximately 10 years and would then be closed. The PAG facility would first be covered with a minimum of 10 feet of NPAG material, then topped with a similar 1- to 2-foot thickness of erosion-resistant soil and revegetated.

The seepage collection ponds would remain in place and passively evaporate seepage, and seepage extraction wells downstream would remain in place to control seepage as long as necessary. These seepage features are estimated to be in place between 100 to 150 years after closure. Once the collection ponds can be closed, the closure plan calls for encapsulating the accumulated sludge in geomembrane and backfilling with soil.

Other closure and reclamation measures, such as the removal of buildings, pipelines, electrical equipment and electrical lines, and the recontouring and revegetation of parking areas and other areas of ground disturbance, would be substantially identical to those described for Alternative 2.

Table 2.2.7-1 summarizes the components of the Peg Leg tailings storage facility.

Table 2.2.7-1. Summary of Alternative 5 – Peg Leg tailings storage facility

Tailings Storage Facility	Description
Location	South of the Gila River
Total footprint of disturbance for entire alternative	16,812 acres • NFS (2,649 acres) • BLM (7,050 acres) • ASLD (4,602 acres) • Private (2,649 acres) Plus an additional 92 acres for recreation mitigation and optional 13 acres for Silver King Road realignment
Approximate size at fence line of tailings storage facility	10,781 acres
Land ownership of tailings storage facility	ASLD, BLM, private
Distance from West Plant Site	15
Tailings type and disposal	Thickened slurry tailings placed subaqueously for PAG tailings from barge in one of four cells, NPAG placed hydraulically from perimeter in a thin-lift deposition once feasible At disposal—PAG tailings would be 50% solids content; thickened cyclone overflow (NPAG) would be 60% solids content; and thickened NPAG stream sent directly from the mill would be 60% solids content
Tailings embankment	Cyclone sand centerline-type embankment at NPAG facility with a 3H:1V slope; earthfill and cyclone sand downstream-type embankment at PAG facility
Lining and other seepage controls	Foundation treatments and/or low-permeability liners and layers under the entire PAG cell, under the NPAG starter cell, and where needed under the rest of the NPAG facility, depending on foundation conditions. Seepage from the tailings would be recovered in six seepage collection ponds downstream of the embankments. The seepage and stormwater collected at the collection ponds would be managed during operations for use in the process water system. Finger and blanket drains would underlie the embankment and part of the NPAG tailings. Seepage collection pumpback wells would be placed downstream of tailings storage facility.
Approximate embankment height	310 feet NPAG; 200 feet PAG
Pipelines / conveyance	Thickened slurry pumped in two streams (PAG and NPAG) to the tailings storage facility and recycled water pipeline to return water to processing loop at West Plant Site; 23 miles of corridor from West Plant Site to tailings storage facility
Auxiliary facilities	Booster pumps may be located at West Plant Site to improve pumping across topography Diversions will divert water around the facility and back into downstream channels
Other design considerations	Two transmission line corridors would need to be crossed and both transmission line corridors rerouted around the Peg Leg site The Arizona National Scenic Trail would need to be crossed by the tailings pipeline corridor No NFS roads are expected to be decommissioned or lost due to the tailings storage facility at Peg Leg, although BLM estimates 29 miles of inventoried routes would be directly affected Crossing of Gila River would be required Crossing of Bureau of Reclamation withdrawal lands along Gila River would be required
Consumptive water use over life of mine	540,000 acre-feet
Closure and reclamation	Reclamation of the tailings embankment face would not occur until construction of the tailings embankment face is complete, which would be at the end of the mining operations (approximately mine year 46) Seepage ponds would remain in use roughly 30 years after closure; groundwater pumpback system would remain in use roughly 20 years after closure

2.2.7.2 Forest Plan Amendment for Alternative 5

Alternative 5 would include a multicomponent project-specific amendment of the forest plan. This amendment would except 16 forest plan desired conditions and guidelines associated with soil productivity, scenic resources, national scenic trails, recreation resources, wildlife habitat, and cultural resources (see table 1.4.3-1). This amendment would except the project actions of Alternative 5 from compliance with these 16 forest plan desired conditions and guidelines in the project area. See chapter 3 for a discussion of the effects of the amendment on each resource.

2.2.8 Alternative 6 – Skunk Camp

For the DEIS, Alternative 6 – Skunk Camp was presented with two different tailings corridor options (north and south). After receipt of public comments, we chose to eliminate the south tailings pipeline corridor from consideration. The south pipeline corridor had impacts along Arnett Creek that otherwise would remain undisturbed and had greater surface disturbance.

The north pipeline corridor was further revised based in part on public comments. Key changes include the colocation of the power line and pipeline within the same corridors, moving the corridor away from paralleling perennial reaches of lower Mineral Creek, relocating the tunnel entrance to avoid private land and mineral claims not owned by Resolution Copper, relocating the corridor around Government Springs Ranch historic buildings but onto private land owned by Resolution Copper, and avoiding critical habitat. In addition, several aspects were changed to reduce impacts to sensitive drainages, including a span over Devil's Canyon, and directional drilling to avoid trenching through Mineral Creek. Overall, this reroute measurably reduced surface disturbance and potential impacts to threatened and endangered species, compared with the route described in the DEIS. Details of the corridor are shown in figures 2.2.8-3 through 2.2.8-6.

Alternative 6 – Skunk Camp, with the revised pipeline/power line corridor, would include approximately 14,938 acres of disturbance, of which 2,458 acres is NFS land, 8,210 acres is ASLD managed, and 4,270 acres is private land. Additional project activities would occur on 92 acres for recreational mitigations and 725 acres of 404 permitting compensatory mitigation (see section 2.3) and optionally 13 acres for the Silver King Road realignment (see section 2.2.9.2).

The Skunk Camp alternative was developed to respond to the issues of public health and safety, groundwater quality, impacts on scenic resources and recreational opportunities and to limit the impacts on NFS surface resources. This alternative includes changes to the GPO for storing tailings, including the tailings facility location, tailings conveyance, and tailings storage embankment type. Public health and safety is addressed by locating the tailings facility in an area farther from specifically established towns and population centers. Groundwater quality is addressed by containing and controlling seepage from the facility. Additionally, the proposed Skunk Camp location is much less likely to adversely impact recreational users of public lands than the GPO location, and would be largely out of public view. Like Alternative 5, this alternative also rose in part from the desire to consolidate mining disturbance on the landscape; the Skunk Camp location is just east of the ASARCO Ray Mine. Other plan components of the GPO remain the same as described in Alternative 2 – Near West Proposed Action.

The Skunk Camp alternative tailings facility location is on a mixture of ASLD-administered and private land that would occupy the upper portion of Dripping Spring Valley, the northeastern slopes and foothills of the Dripping Spring Mountains, and the southwestern foothills of the Pinal Mountains, including a 4-mile reach of Dripping Spring Wash, a 3.5-mile reach of Stone Cabin Wash, and a 4.8-mile reach of Skunk Camp Wash. The proposed site lies approximately 2 miles due east of the existing ASARCO Ray Mine and approximately 13 miles north of the point where Dripping Spring Wash drains into the Gila River (figure 2.2.8-1). Selection of this alternative by the Forest Supervisor would not automatically approve this alternative, since the other areas are not Federal land, obtaining access to use ASLD-administered trust land and private land is the responsibility of the applicant.

Alternative 6 – Skunk Camp remains the Lead Agency's preferred alternative.

2.2.8.1 Alternative 6 Mine Plan Components

Water Use

This alternative would need about 540,000 acre-feet of groundwater pumped from the Desert Wellfield through the life of the mine (see appendix H), or about 8 percent less water than under Alternative 2.

Tailings Facility – Tailings Type

Tailings types would be the same as described in Alternative 2 – Near West Proposed Action. The PAG tailings would be thickened at the West Plant Site. The thickened tailings would consist of approximately 84 percent NPAG and 16 percent PAG. Figure 2.2.8-2 shows the tailings storage facility for this alternative.

Tailings Facility – Tailings Conveyance

The two separate tailings streams (PAG and NPAG) would be piped as a thickened slurry from the West Plant Site to the Skunk Camp tailings storage facility, located approximately 14 miles (straight line) southeast of the West Plant Site. See figure 2.2.8-1 for the pipeline option under consideration. Figures 2.2.8-3, 2.2.8-4, 2.2.8-5, and 2.2.8-6 provide a detailed look at the tailings conveyance area.

Tailings Facility – Embankment Type

As stated, the Skunk Camp tailings facility would comprise two physically separate starter facilities: PAG and NPAG (see figure 2.2.8-2 and figure 2.2.8-6).

Once delivered as a slurry to the Skunk Camp site, NPAG tailings would be cycloned to separate the coarser particles for use as embankment fill for part of the year, with the cyclone overflow (i.e., finer particles) being thickened at the tailings storage facility site before discharge into the impoundment. PAG tailings would be deposited into two separate cells, operated sequentially behind a separate cycloned sand embankment, to the north (upstream) end of the facility until they are encapsulated by the NPAG tailings.

The PAG and NPAG cells would be impounded by separate cross-valley starter embankments initially constructed of borrow material from within the ultimate tailings facility footprint. The impoundments would then periodically be raised in elevation during operations with compacted cycloned sand fill. The NPAG cell would use the centerline embankment construction approach, while the PAG cells would be constructed as downstream dams. The NPAG embankment would contain an underdrain system comprising sand and gravel blanket and finger drains (primarily along main drainages, with some extended beneath the NPAG beach) to maintain a low saturated surface in the tailings embankment and to intercept and direct seepage from the impoundment to the downstream seepage collection system ponds.

At full buildout, the embankment containing the NPAG tailings would be approximately 490 feet in height. As stated, the PAG cell embankment would be behind (upstream) and ultimately contained within the larger NPAG deposit. Borrow areas are located entirely within the tailings storage facility fence line area with no external borrow areas considered in this analysis (see figure 2.2.8.1).

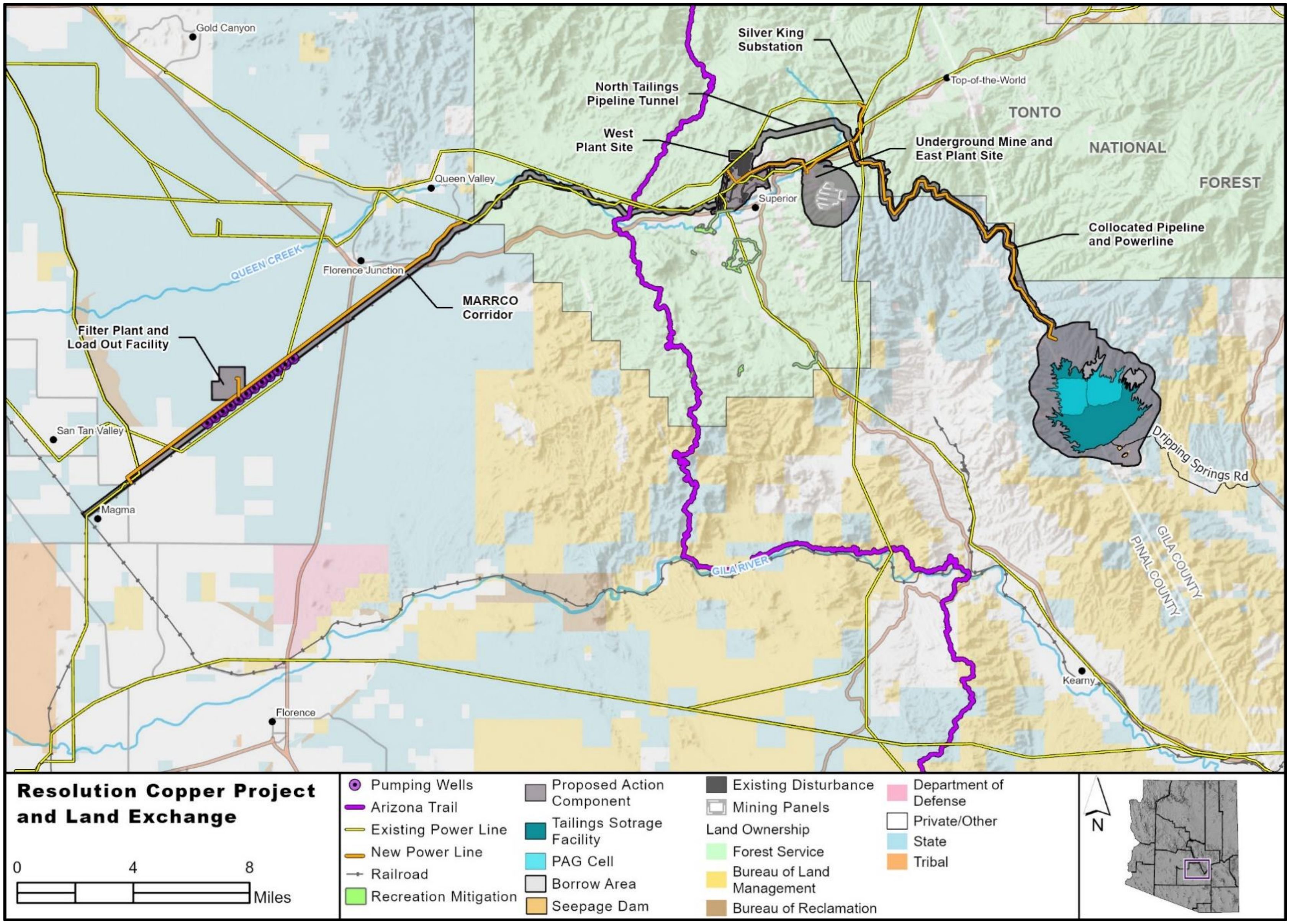


Figure 2.2.8-1. Alternative 6 – Skunk Camp overview

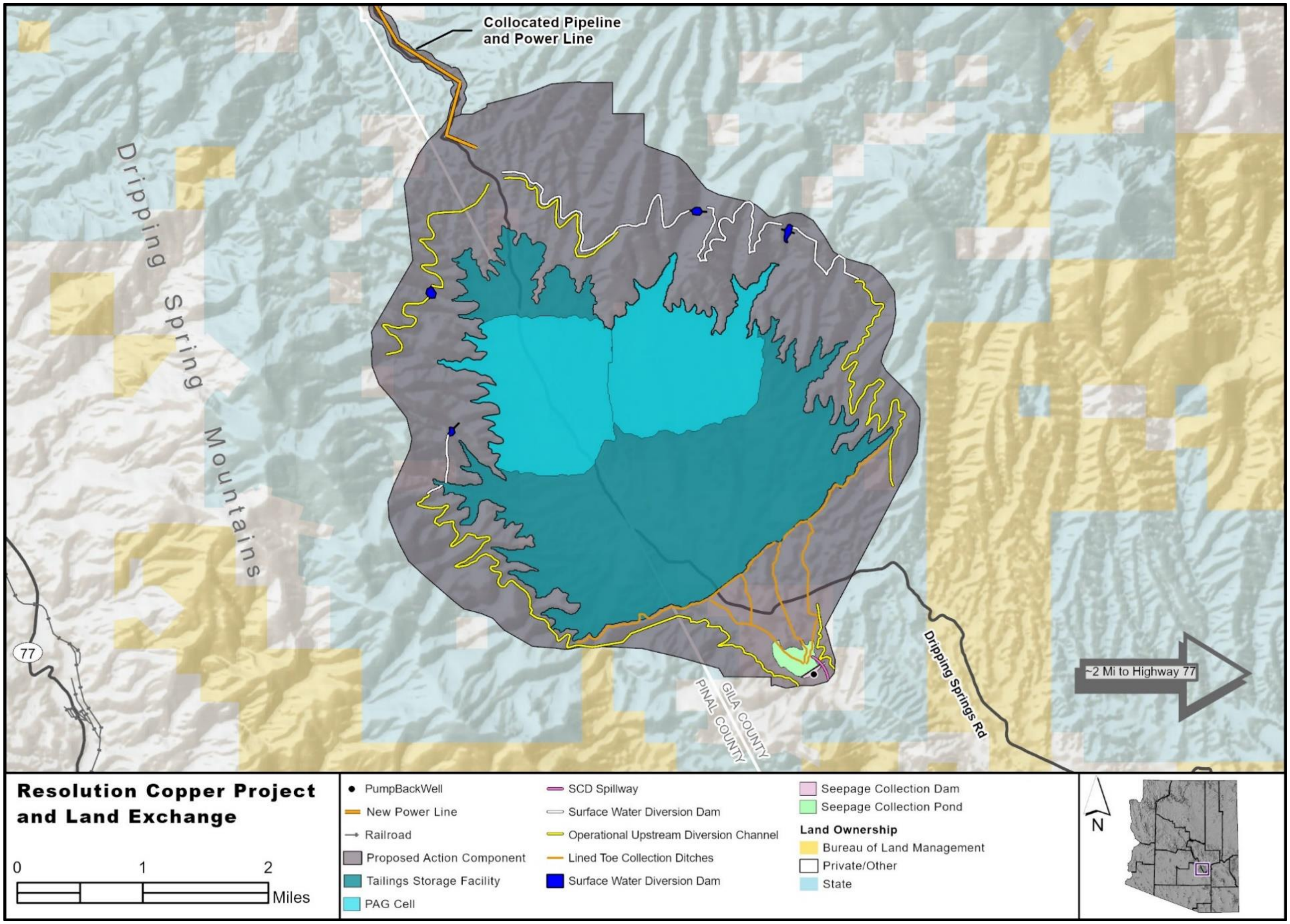


Figure 2.2.8-2. Alternative 6 – Skunk Camp tailings storage facility

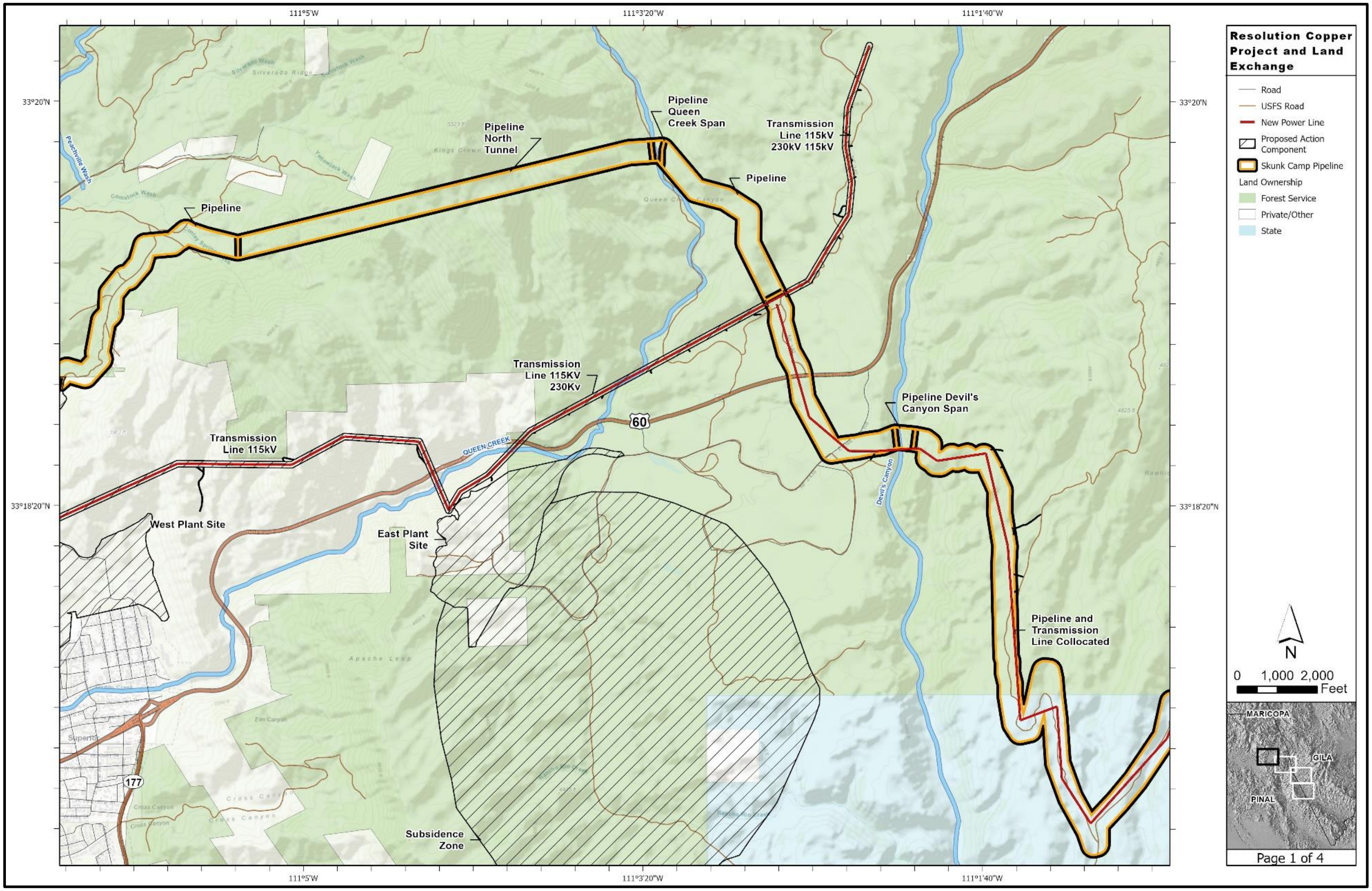


Figure 2.2.8-3. Alternative 6 – Skunk Camp detail of tailings pipeline and power line corridor (1 of 4)

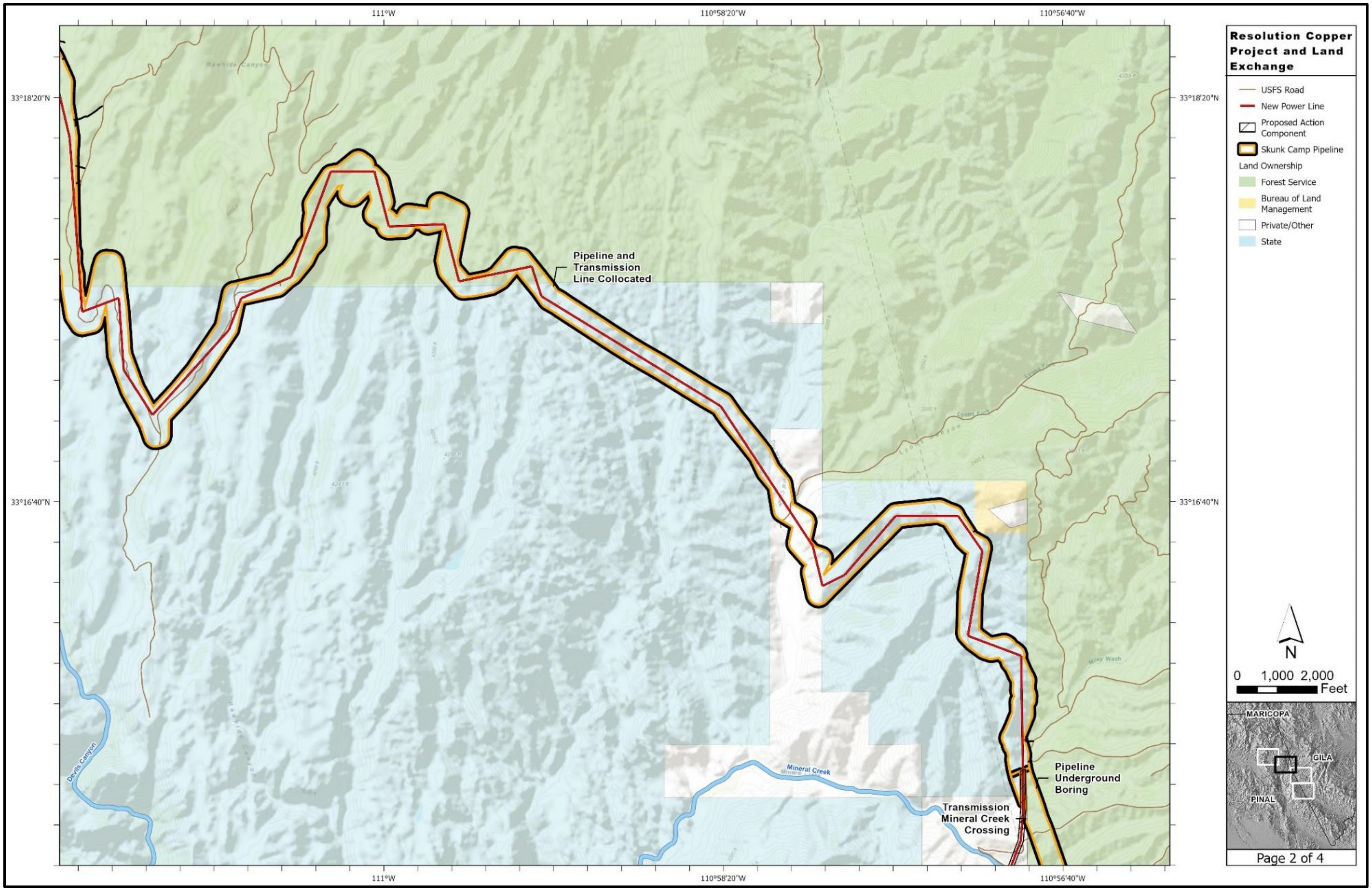


Figure 2.2.8-4. Alternative 6 – Skunk Camp detail of tailings pipeline and power line corridor (2 of 4)

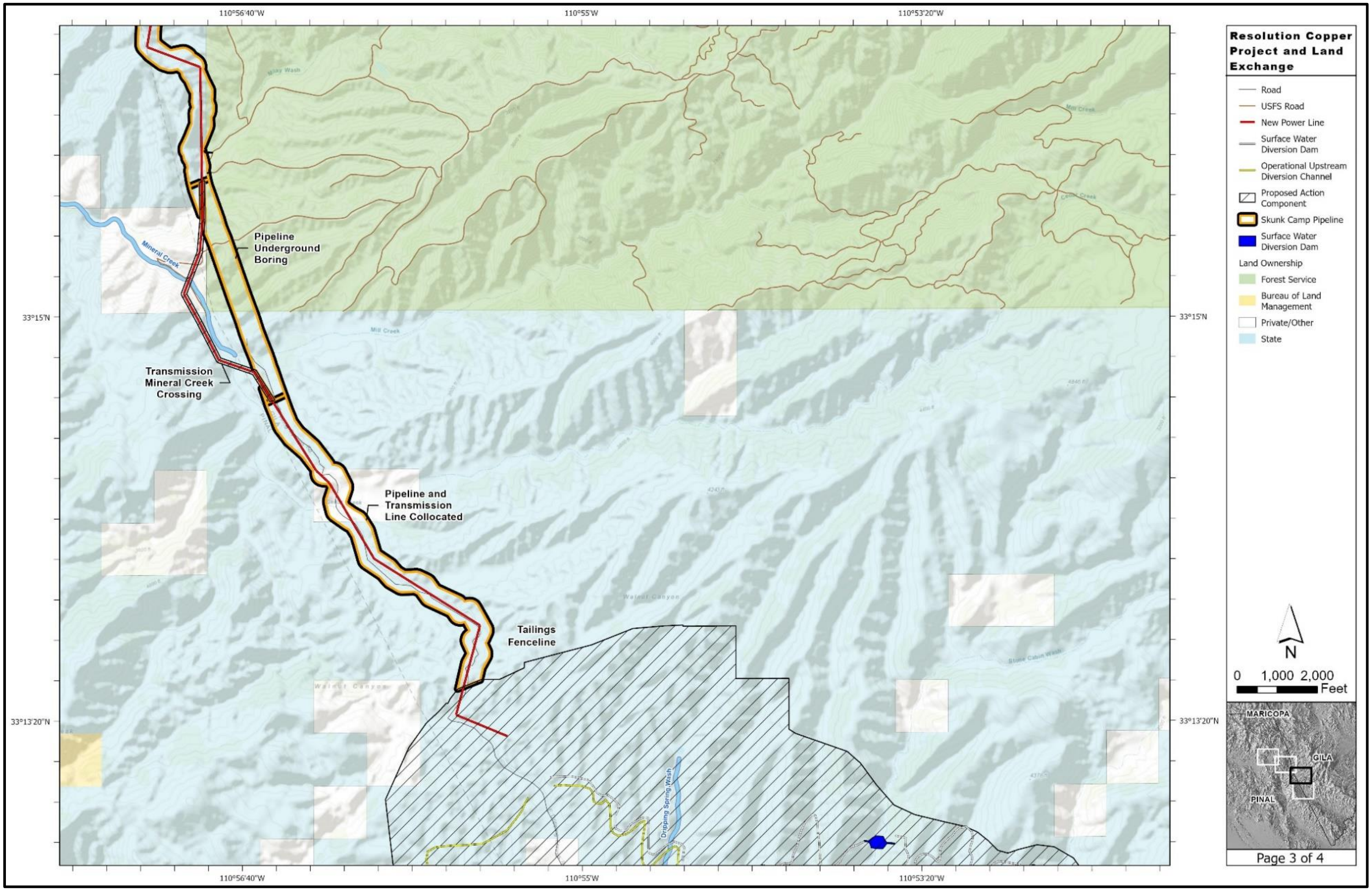


Figure 2.2.8-5. Alternative 6 – Skunk Camp detail of tailings pipeline and power line corridor (3 of 4)

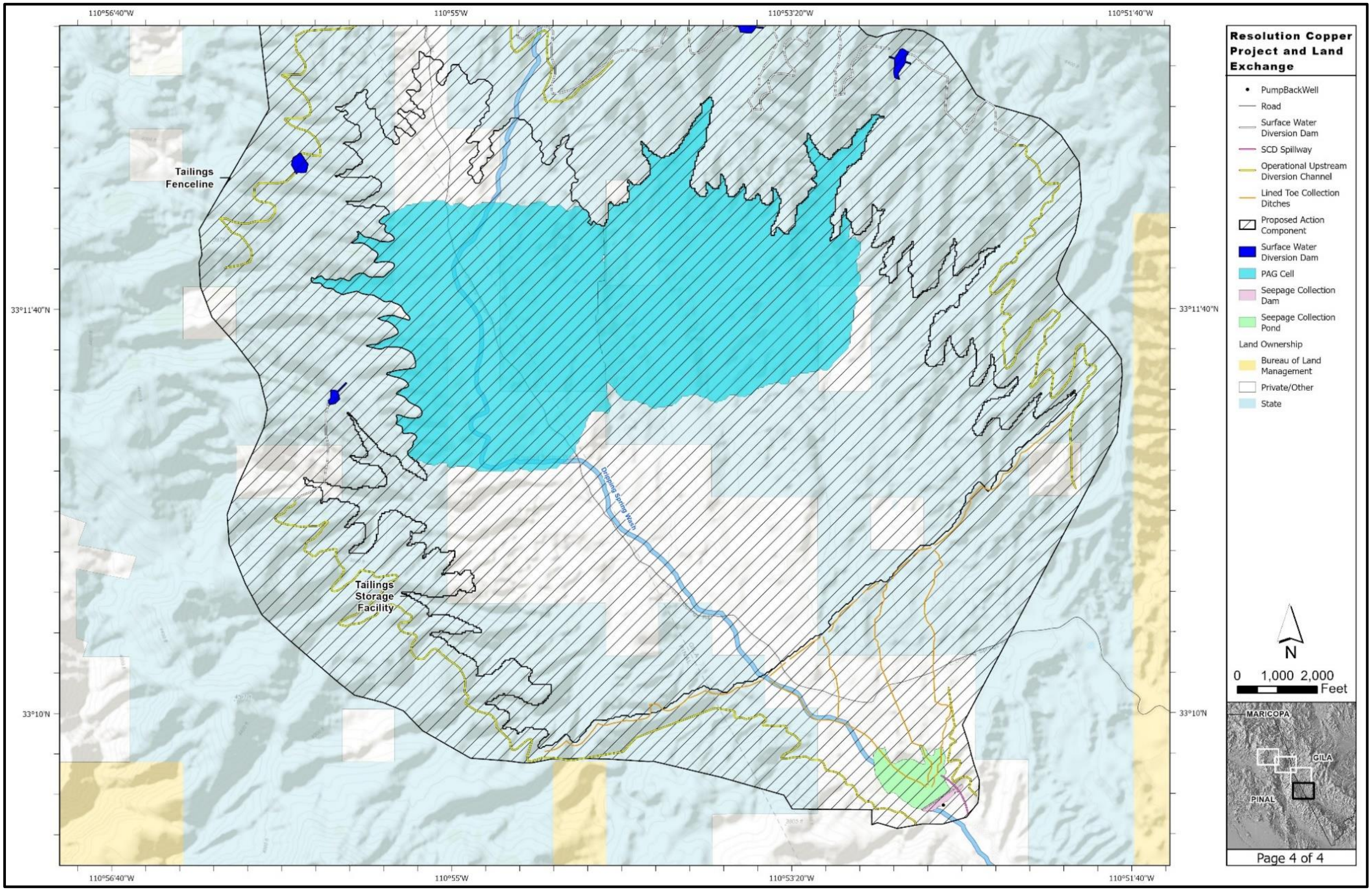


Figure 2.2.8-6. Alternative 6 – Skunk Camp detail of tailings pipeline and power line corridor (4 of 4)

Tailings Facility – Liner

To limit seepage under or around the Skunk Camp tailings storage facility, the PAG cell would incorporate an engineered low-permeability layer on the foundation and on the upstream face of the containment embankment. Engineered low-permeability layer containment could comprise one or more of the following: engineered low-permeability liner, compacted fine tailings, asphalt, slurry bentonite, cemented paste tailings, etc. To collect seepage downstream of the tailings storage facility, a foundation cutoff wall at the seepage collection pond would be constructed.

A single downvalley seepage collection pond would be the primary means for seepage and embankment construction and surface water collection during operations, with the collected water then pumped to a recycled water pond located within the operating PAG cell for use as process water at the cyclone house and/or at the West Plant Site, or for dust management at the tailings storage facility.

Tailings Facility – Disposal Method

Tailings would be deposited by pipeline to their respective cells around each embankment. In this alternative, the PAG tailings would be deposited subaqueously. NPAG slurry would initially be deposited using traditional methods.

Tailings Facility – Auxiliary Facilities

Five diversion dams, five diversion channels, and two non-contact water surface water pipelines would be constructed along the east and west sides of the tailings storage facility to intercept and route the upstream catchments around the facility. Collection ditches would be constructed along the embankment toe and at underdrain discharges to convey contact water to the seepage collection pond. Additional facilities at the Skunk Camp site would include the cyclone processing system (building to house the hydrocyclone(s), slurry dilution tanks, storage tanks, and associated equipment); an electrical substation and electrical distribution lines; a vehicle maintenance and fuel shop; equipment storage warehouse; administration and locker room facilities; and parking areas.

This is the only alternative that would require new transmission lines rather than tying into local lines nearby the facility. A new power line would be constructed from the existing Silver King substation north of U.S. 60 and almost entirely follow the same corridor as the tailings pipeline to the Skunk Camp location. Preliminary assessment of line voltage options show that either a 69-kV or 115-kV voltage level would be adequate to supply power to Skunk Camp; the design is for a 115-kV line. Further assessment by the electrical utility operating Silver King substation would be needed to determine the adequate voltage and construction engineering, including access roads to the transmission lines that would service the Skunk Camp tailings storage facility.

Tailings Facility – Closure and Reclamation

A site-specific reclamation and closure plan was prepared for Alternative 6 (KCB Consultants Ltd. 2020c). This reclamation plan was required by the Forest Service to be prepared prior to completion of the FEIS (see mitigation measure FS-226 in the DEIS). This site-specific reclamation and closure plan was further revised after the January 2021 FEIS was rescinded. The revised version of the Alternative 6 reclamation and closure plan was submitted to the Forest Service in October 2022 (KCB Consultants Ltd. 2021). The revised version of the Alternative 6 reclamation and closure plan includes an analysis of the ability of spray evaporators to manage the volumes of seepage produced, and consideration for use of constructed wetlands in lieu of evaporation.

Also note that after the January 2021 FEIS was rescinded, an additional reclamation and closure plan specific to the Alternative 6 pipeline/power line corridor was submitted to the Forest Service (Tetra Tech Inc. 2022). This reclamation and closure plan is different from the reclamation and closure plan for the tailings storage facility and was prepared specifically to address requirements for reclaiming the pipeline/power line corridor under a special use authorization.

At the end of operations, the remaining area of PAG tailings would be covered with a minimum 10-foot layer of NPAG tailings. The surfaces of both the NPAG and PAG facilities would be shaped to prevent standing water and divert runoff into channels leading to the downstream collection pond, and both NPAG and PAG areas would be covered by a 1- to 3-foot layer of Gila Conglomerate to form a store-and-release cover and revegetated. The timing of reclamation is dependent on the surface being dry enough to allow equipment access for reclamation.

Estimated seepage rates suggest active closure would be required up to 80 years after the end of operations. Up to 10 years after closure, the recycled water pond is still present and therefore all engineered seepage controls could remain operational. After 10 years, the recycled water pond is no longer present and seepage collection ponds would be expanded to maximize evaporation with active water management until the ponds could passively evaporate all incoming seepage (estimated at 80 years). Drainage from the tailings storage facility may continue to occur up to 250 years after the end of operations. The sludge containing concentrated metals and salts from evaporation would likely require cleanup and handling as a solid or hazardous waste.

Other closure and reclamation measures, such as the removal of buildings, pipelines, electrical equipment and electrical lines, and the recontouring and revegetation of parking areas and other areas of ground disturbance, would be substantially identical to those described for Alternative 2. Upstream (upslope) surface water diversion walls, channels, and other stormwater control elements would remain permanently in place to continue to direct surface flows around and downstream of the tailings impoundments. Final reclamation plans would include the designs and long-term requirements for maintenance of these permanent facilities.

Table 2.2.8-1 summarizes the components of the Skunk Camp tailings storage facility.

Table 2.2.8-1. Summary of Alternative 6 – Skunk Camp tailings storage facility

Tailings Storage Facility	Description
Location	In Dripping Spring Wash approximately 13 miles north of confluence with the Gila River
Total footprint of disturbance for entire alternative	14,938 acres • NFS (2,458 acres) • BLM (0 acres) • ASLD (8,210 acres) • Private (4,270 acres) Plus an additional 92 acres for recreation mitigation, an additional 725 acres of compensatory mitigation under the Clean Water Act Section 404 permit, and an optional 13 acres for the Silver King Road realignment
Approximate size at fence line of tailings storage facility	9,218 acres
Land ownership of tailings storage facility	ASLD, private
Distance from West Plant Site	15 miles
Tailings type and disposal	Thickened slurry tailings placed subaqueously for PAG tailings from barge in one of two cells, NPAG placed hydraulically from perimeter At disposal—PAG tailings would be 50% solids content; thickened cyclone overflow (NPAG) would be 60% solids content; and thickened NPAG stream sent directly from the mill would be 60% solids content

Tailings Storage Facility	Description
Tailings embankment	Earthen starter dams raised with compacted cyclone sand. The NPAG facility would be a centerline construction approach with a 3H:1V slope and the PAG cells would be a downstream construction approach with a 2.5H:1V slope.
Lining and other seepage controls	Engineered, low-permeability layers would be installed on PAG cell foundation and the upstream slope of the embankment
Approximate embankment height	490 feet
Pipelines / conveyance	Thickened slurry pumped in two streams (PAG and NPAG) to the tailings storage facility and recycled water pipeline to return water to processing loop at West Plant Site. 19 miles of corridor from West Plant Site to tailings storage facility via steel and/or HDPE pipelines. The pipelines will be buried to the extent practicable with trenchless methods (horizontal directional drilling, micro-tunneling, or other boring methods) to cross under roads, waterways, or for high-point mountain passes. The proposed crossings for Queen Creek and Devil's Canyon would be spanned using pipeline bridges; trenchless crossings would be used to pass underneath U.S. 60 and at the Mineral and Mill Creek crossing which includes riparian and sensitive species habitat. An underground tunnel about 8,800 feet long, located west of Superior and north of U.S. 60, will allow the pipelines and access road to pass underneath the Kings Crown Peak area and avoid sensitive habitat (see figure 2.2.2-11 for graphic). The 15 × 15–foot tunnel will include a pipe rack sufficient to carry four pipes, ventilation, and allow maintenance access. At the portal on the east flank of the range the pipelines would be buried and continue toward Oak Flat.
Auxiliary facilities	Surface water diversions would be large due to the steep surrounding terrain and need to surround the tailings facility on northern, eastern, and western sides with extensive stormwater diversion structures
Other design considerations	No NFS roads are expected to be decommissioned or lost due to the tailings storage facility at Skunk Camp, although BLM has identified loss of access to mining activities and grazing facilities
Consumptive water use over life of mine	540,000 acre-feet
Closure and reclamation	Reclamation of the NPAG tailings embankment face would begin as soon as the slope reaches its final extent starting at approximately mine year 10–15. The top of the tailings storage facility would not be reclaimed until after mining is complete. Closure of the tailings recycled water pond is estimated to take up to 5 years after closure. Until that time, excess seepage in seepage ponds would be pumped back to the recycled water pond, and reclamation would take place on the embankment and tailings beaches. After the recycled water pond is closed, seepage ponds would be used to evaporate seepage, and the remaining reclamation of the tailings surface would occur.

2.2.8.2 Forest Plan Amendment for Alternative 6

Alternative 6 would include a multicomponent project-specific amendment of the forest plan. This amendment would except the same 16 forest plan desired conditions and guidelines as the amendment under Alternative 5. See chapter 3 for a discussion of the effects of the amendment on each resource.

A detailed description of the Alternative 6 amendment is provided in appendix T.

2.2.9 Alternative GPO Components Common to All Action Alternatives

Minor modifications to two facilities proposed in the GPO have been considered in order to address specific resource impacts. These "alternative components," described in the following subsections, may be applied to the proposed action or any of the action alternatives.

2.2.9.1 Relocation of Process Water Pond within West Plant Site

This alternative component would move the process water pond, as proposed in the GPO, off approximately 11.4 acres of NFS land immediately north of and adjacent to the West Plant Site and relocate the pond and associated facilities (e.g., fencing, stormwater control systems) fully within Resolution Copper private property boundaries on the western portion of the West Plant Site (figure 2.2.9-1).

As noted earlier, this potential change to the GPO was brought to the attention of Tonto National Forest staff by representatives of Resolution Copper, who suggested this particular modification as a relatively low-cost change the company could make to reduce overall project impacts on NFS surface resources. It is anticipated that this alternative component to the GPO would be implemented under any project alternative and regardless of the site ultimately selected for location of the tailings storage facility and associated linear project features such as slurry pipelines and power lines.

2.2.9.2 Redesign and/or Improvement of Vehicle Access to and from the West Plant Site

Resolution Copper is also proposing an alternative routing of Silver King Mine Road (NFS Road 229), which would be used to transport mine personnel, equipment, supplies, and molybdenum and other mine products, to and/or from the West Plant Site (see figure 2.2.2-8). This rerouting is anticipated to reduce typical use of NFS Road 229 by mine personnel from 2.3 miles, as described in the GPO, to just 0.4 mile. It is anticipated that this alternative component to the GPO would be implemented under any project alternative and regardless of the site ultimately selected for location of the tailings storage facility and associated linear project features such as slurry pipelines and power lines.

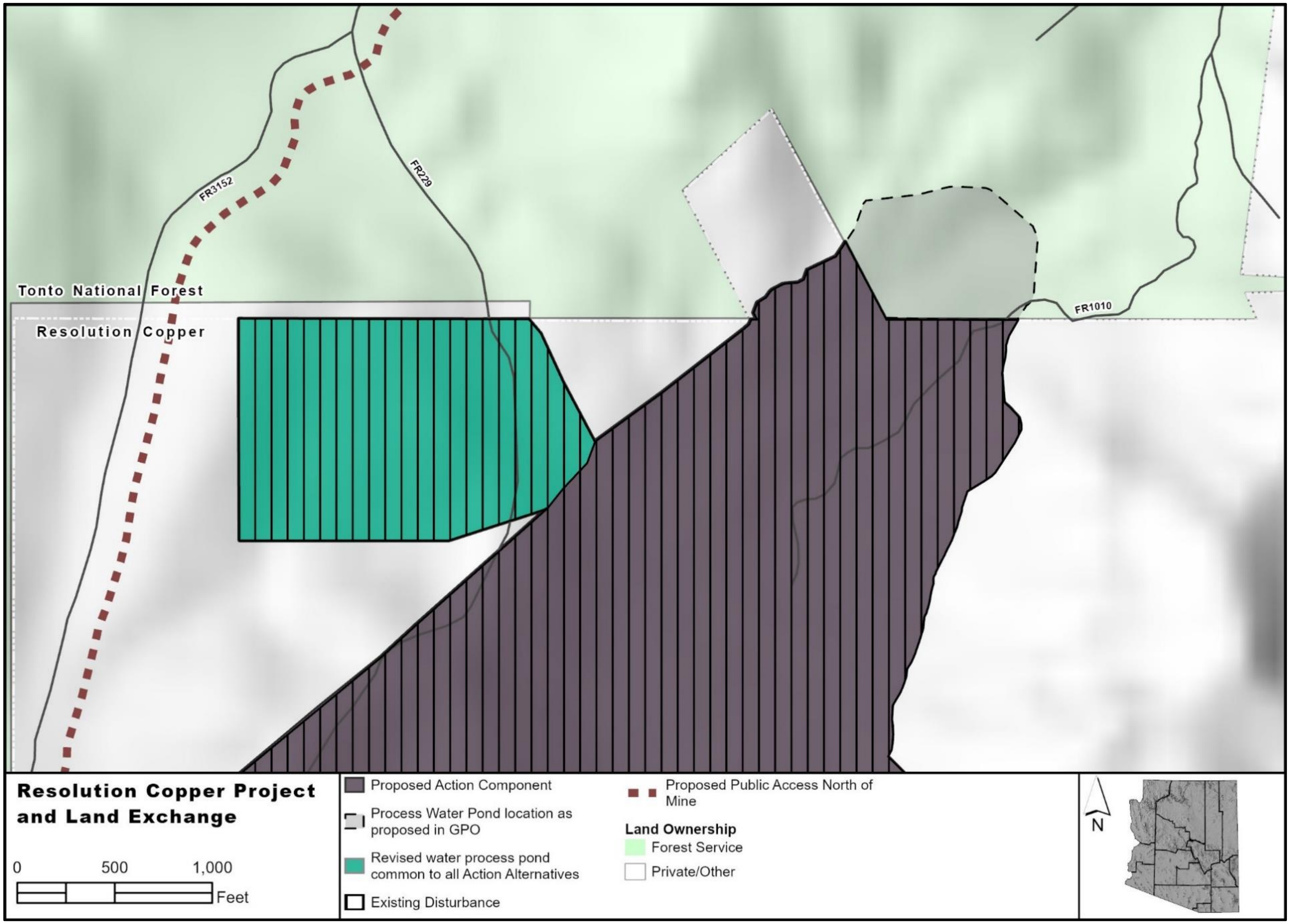


Figure 2.2.9-1. Relocation of process water pond within West Plant Site

2.3 Mitigation Common to All Action Alternatives

Mitigation measures include the following:

- Avoiding the impact altogether by not taking a certain action or parts of an action;
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation;
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating an impact over time, through preservation and maintenance operations during the life of the action; and
- Compensating for an impact by replacing or providing substitute resources or environments.
- Mitigation measures and monitoring developed for this project become part of the actions that are proposed in the proposed action or respective alternative. As part of the actions being proposed, the impacts and effectiveness of mitigation measures and monitoring actions are analyzed in tandem with other project actions in chapter 3..

The Forest Service has developed mitigation measures and monitoring actions to be included as project design features in the proposed action and action alternatives. The effectiveness of the mitigation measures and monitoring actions has been evaluated as part of the projected impacts analyses for the proposed action and action alternatives. Refer to the impacts analyses in chapter 3 for further detail.

2.3.1 Mitigation and Monitoring

The framework for the project mitigation and monitoring plan is contained in appendix J of this FEIS. Note that the full suite of mitigation measures and monitoring actions would not be known until many or most of the required permits have been issued, which often contain required measures intended to avoid or reduce environmental effects. Mitigation required by the Forest Service ultimately would be included in the ROD, and in the final authorization for the project, which would be either a final GPO or a special use permit.

2.3.1.1 Authority

The framework mitigation and monitoring plan is designed to clearly disclose which mitigation and monitoring items are within the authority of the Forest Service, or other regulatory and permitting agencies, such as the USACE, ADEQ, and Arizona Department of Water Resources (ADWR).

Forest Service

The role of the Forest Service under its primary authorities in the Organic Administration Act, Locatable Regulations (36 CFR 228 Subpart A), and Multiple-Use Mining Act is to ensure that mining activities minimize adverse environmental effects on NFS surface resources. The role of the Forest Service under special use authorizations (36 CFR 251 Subpart B) would include terms and conditions to minimize damage to the environment, protect the public interest, and require compliance with water and air quality standards.

Forest Service mitigation measures and monitoring are items that would help to minimize impacts on Forest Service surface resources; or are required to mitigate effects on affected species as described in the FWS Biological Opinion for the project. The Forest Service is responsible for determining whether the implementation of mitigation and the results of monitoring comply with the decision that would be documented in the ROD and in the final authorization for the project (a final GPO or a special use permit).

The Forest Service has no authority, obligation, or expertise to determine or enforce compliance with other agencies' laws or regulations. The Forest Service seeks to coordinate with other agencies to authorize a legally compliant project; however, it is the operator's responsibility to ensure that its actions comply with applicable laws.

Other Regulatory and Permitting Agencies

Mitigation and monitoring items under this heading are within the authority of other regulatory permitting agencies, including the ADEQ, ADWR, ASLD, BLM, Pinal County Air Quality Control District (PCAQCD), and USACE. Mitigation and monitoring measures under this authority include permit requirements and stipulations from legally binding permits and authorizations, such as the air quality permit, APP, and groundwater withdrawal permit. These other regulatory and permitting agencies would share with the Forest Service monitoring results and any instances of applicant non-compliance. The Forest Service would use the information provided by the regulatory and permitting agencies to determine compliance with the decision that would be documented in the ROD and the final project authorization (a final GPO or special use permit).

Resolution Copper

Resolution Copper has agreed to implement additional mitigation and monitoring measures in the mitigation and monitoring plan that are outside the scope of the authorities listed here. As these were considered as required in the resource analyses, the final ROD would require these mitigations be enforced. These include contractual, financial, and other agreements over which the Forest Service and other regulatory agencies have no jurisdiction. The Forest Service and regulatory agencies have no authority, obligation, or expertise to determine or enforce compliance of these measures. Since the Forest Service and regulatory permitting agencies cannot require implementation of the mitigation and monitoring measures in this authority, their implementation is not guaranteed until required by a signed final ROD with the mitigations included. The effectiveness of these mitigation measures is included in chapter 3 impact analyses.

2.3.1.2 Post-DEIS Mitigation Development Process

Public comments received on the DEIS suggested many potential mitigation measures. Some of these suggestions were specific and detailed, while others were conceptual. The Forest Service evaluated all of these suggestions for inclusion in the FEIS (Garrett 2020g).

The Forest Service identified roughly 280 public comments related to mitigation. These were consolidated into several mitigation lists that were provided to Resolution Copper for consideration and collaboratively discussed with the Forest Service (Garrett 2020f, 2020m; Morey 2020b). More than 140 individual mitigation suggestions were brought forward for consideration as a result of public comments on the DEIS.

Resolution Copper subsequently submitted a suite of mitigation measures they committed to undertake. These measures are included in appendix J. Examples include the following:

- Updated wildlife management plan containing changes made in collaboration with Arizona Game and Fish Department (AGFD) (Resolution Copper 2020i).
- Recreation-related mitigations, including the establishment and management of the new Castleberry campground and commitment to develop access to the Inconceivables climbing area (Graham 2020).
- Water-related mitigations including water quality management and monitoring along Dripping Spring Wash for the Alternative 6 tailings storage facility (Montgomery and Associates Inc.

2020f), an updated mitigation and monitoring plan related to groundwater-dependent ecosystems around the mine site (Montgomery and Associates Inc. 2020b), and replacement of water to Queen Creek to offset losses in runoff due to the subsidence area (Peacey 2020b).

- An updated subsidence monitoring plan, revised in collaboration with the Forest Service (Davies 2020a).
- An item-by-item review of the suggested mitigation lists resulted in adding over 40 new or revised mitigation measures in appendix J. This included agreement to fund a mitigation plan to offset impacts to motorized and non-motorized recreation from the loss of NFS roads on Oak Flat. This measure originated with a plan developed by a multi-faceted recreation user group (RUG) in Superior, and was included in concept in the DEIS (mitigation measure RC-214). After publication of the DEIS, the Forest Service internally evaluated the recreation plan and developed a revised suite of motorized routes, non-motorized routes, and trailheads consistent with Forest Service management priorities (Rausch and Rasmussen 2020). Resolution Copper has agreed to fund this revised plan. The surface disturbance associated with these mitigations is included in the acreage calculations in the FEIS, as detailed in the next section.

Other mitigation measures were developed after the DEIS as part of other specific regulatory processes. These are described in appendix J and include the following:

- Development of mitigations related to impacts to Tribes and cultural resources as part of the PA. The PA was never executed, but all of these measures remain in place, although under different authorities. This is described in appendix J.
- Development and approval by the USACE of compensatory mitigation related to permitting under Section 404 of the CWA (included with the FEIS as appendix D). Surface disturbance associated with these mitigations is included in the acreage calculations in the FEIS, as detailed in the next section.
- Conservation measures developed during consultation with the FWS in compliance with Section 7 of the Endangered Species Act (ESA). These are codified in the approved Biological Opinion (included with the FEIS as appendix P).

2.3.1.3 Additional Mitigation-Related Disturbance included in EIS Calculations

Recreation Mitigations

In 2020, land managers and resource specialists from the Tonto National Forest evaluated several proposed measures intended to mitigate recreation impacts on the Tonto National Forest resulting from actions associated with the proposed project. The mitigation measures evaluated include the "Superior, Arizona Recreation Project Conceptual Plan" (WestLand Resources Inc. 2019), along with other relevant project mitigation suggestions gleaned from the public between March 2016 and November 2019. This review resulted in a set of measures found to be legitimate, practicable, and effective, and were recommended for inclusion in the FEIS (Rausch and Rasmussen 2020).

The recommendations included 9.3 miles of motorized trail and 11.5 miles of non-motorized trail that would be located on and managed by Tonto National Forest. These routes encompass about 42 acres of additional disturbance that were incorporated into the project acreage calculations.

The potential disturbance associated with additional mitigation recommendation—the Castleberry campground located alongside Queen Creek—has also been incorporated into the project acreage calculations. This encompasses approximately 50 acres, of which 2 acres are NFS lands and 48 acres are privately owned by Resolution Copper.

These 92 acres are included as part of project action under each action alternative, as they will offset recreation impacts from the loss of Oak Flat. The recreation mitigation areas are shown in figure 2.3-1.

Compensatory Mitigation Lands

The three compensatory mitigation parcels approved under the Section 404 permitting process were incorporated into the project acreage calculations (figure 2.3-2). Full details are included in appendix D.

- MAR-5 Wetland/Olberg Road. The conceptual mitigation strategy consists of exotic tree species (principally tamarisk) removal and control, combined with native plant species reseeding, to allow for the establishment and maintenance of a riparian habitat dominated by native tree species. The MAR-5 Wetland site was established in 2015. Proposed continuing mitigation activities for the MAR-5 site include continued scheduled CAP water discharges, limited tamarisk removal and control, and seeding of native plant species. The Olberg Road site would represent new mitigation activities, and is located adjacent to the existing MAR-5 Wetland site. Mitigation activities at the Olberg Road site consist of tamarisk removal and control within the entire 23-acre site, followed by seeding of native plant species. The entire area encompasses 146 acres of lands; only the 23-acre Olberg Road mitigation parcel is part of the compensatory mitigation package.
- Queen Creek. This site is located downstream of the town of Superior, along Queen Creek. Resolution Copper would establish a conservation easement covering approximately 79 acres along 1.8 miles of Queen Creek to restrict future development of the site and provide protected riparian and wildlife habitat. Within a 33-acre area being considered as part of the compensatory mitigation package, conceptual mitigation elements include the removal of tamarisk to allow riparian vegetation to return to its historic composition and structure and promote more natural stream functions.
- H&E Farm. The H&E Farm is a 500-acre property owned by The Nature Conservancy. Mitigation activities proposed include earthwork to reconnect historic tributaries. The earthwork is proposed to reestablish the San Pedro River's access to its floodplain and terrace and enhance the wetland features present in the area. The soils across the site on the terraces are compacted and causing earth fissures and sinkholes on the parcel, which will continue if no intervention occurs. Grading in some areas would reestablish the natural alluvial fan and floodplain terrace structure. Planting and seeding native species is planned to restore a more native vegetation community along the bank of the river. It is intended to mirror previous mitigation strategies implemented by The Nature Conservancy as well as ongoing mitigation at the AGFD Lower San Pedro Wildlife Area that is contiguous to the western and northern boundaries of the H&E Farm parcel. The terrace area to be reestablished encompasses 300 acres, and the wetland area to be reestablished encompasses 15 acres. The remainder of the property would be conserved in the current condition.

These 725 acres described above are included as part of project action solely under Alternative 6 – Skunk Camp. This is because the compensatory mitigation is required for issuance of the Section 404 permit, and the 404 permit application as submitted to the USACE is specific to this location only.

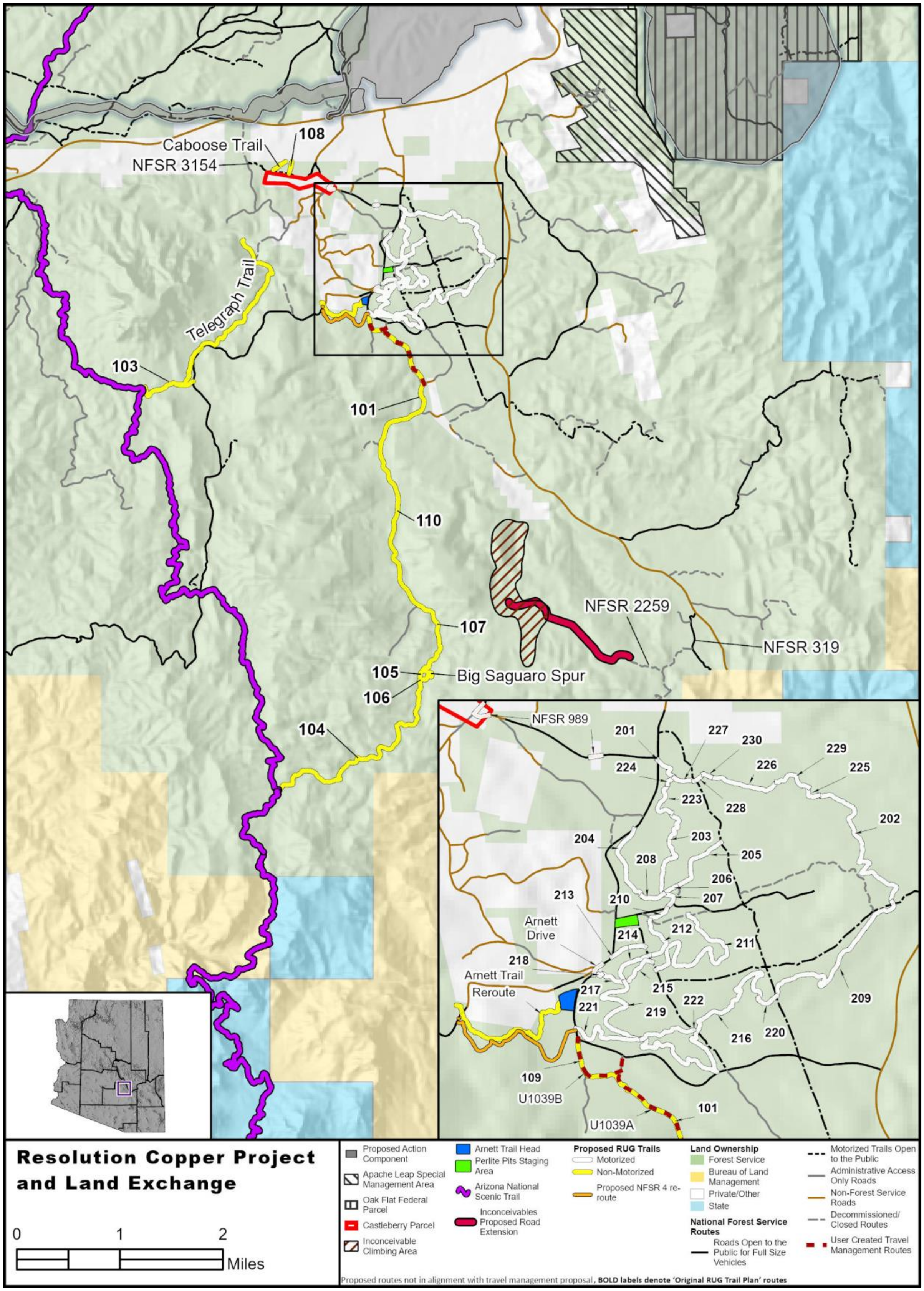


Figure 2.3-1. Location of recreation-related mitigation areas

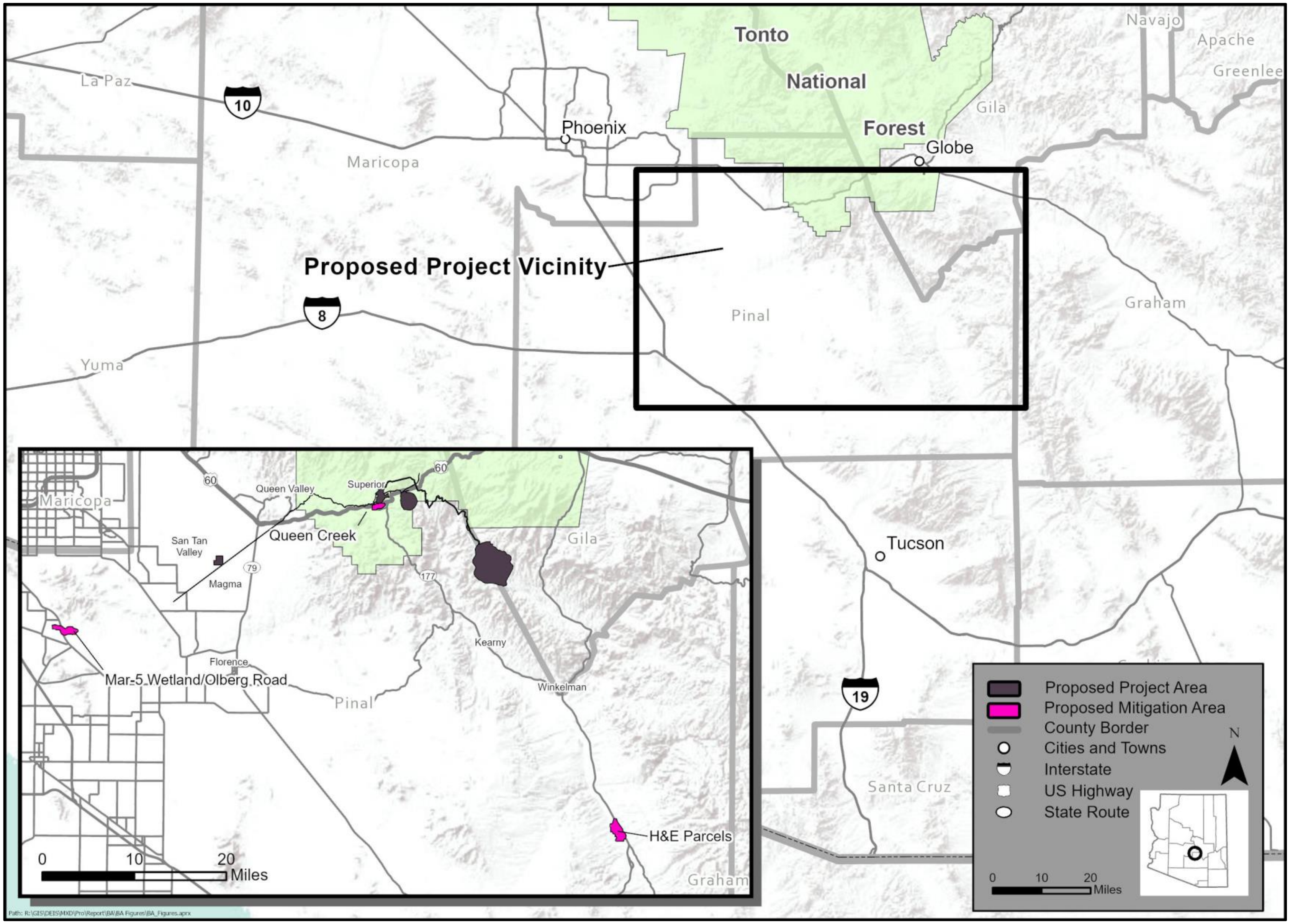


Figure 2.3-2. Location of compensatory mitigation lands required by Section 404 permitting

2.3.1.4 Applicant-Committed Environmental Protection Measures

Applicant-committed environmental protection measures are features incorporated into the design of the project by Resolution Copper to reduce potential impacts on resources. These measures would be non-discretionary as they are included in the project design, and their effects are accounted for in the analysis of environmental consequences disclosed in each resource section of chapter 3. Three specific applicant-committed environmental protection measures also are discussed as mitigation measures. Their inclusion in the mitigation section reflects specific changes that were made directly in response to public comments, or as a result of the impacts disclosed during the EIS analysis. These include the road use plan, wildlife management plan, and subsidence management plan.

2.3.1.5 Monitoring and Evaluation

Monitoring is fundamental for ensuring the implementation and effectiveness of mitigation commitments, meeting legal and permitting requirements, and identifying trends and possible means for improvement (Council on Environmental Quality 2011) Forest Service NEPA regulations indicate that any adaptive management approaches or alternatives "must also describe the monitoring that would take place to inform the responsible official whether the action is having its intended effect" (36 CFR 220.5(e)). Detailed monitoring plans would be incorporated by reference into the agency's decision document to ensure that they are legally binding. The following monitoring plans would identify the monitoring area, the monitoring systems, and future actions if thresholds are triggered:

- Subsidence management plan. This plan originally was included as an appendix to the GPO. Partially in response to public comments on the DEIS, the Forest Service collaborated with Resolution Copper to produce a revised subsidence monitoring plan (Davies 2020a). After review of the revised plan, we also developed additional stipulations that would be required as part of the subsidence monitoring. The revised plan and added stipulations are detailed in appendix J and discussed in section 3.2.
- Groundwater mitigation and monitoring plan. This plan was brought forward by Resolution Copper as a mitigation measure that was included in the DEIS, and addresses potential impacts to groundwater-dependent ecosystems near the mine site. As part of the reconvened Water Resources Workgroup, the Forest Service collaboratively reviewed the comments on the groundwater mitigation and monitoring plan, and Resolution Copper subsequently submitted a revised plan (Montgomery and Associates Inc. 2020b). The revised plan is detailed in appendix J and discussed in section 3.7.1. Also in response to public comments, Resolution Copper submitted a monitoring plan specific to water resources near the Alternative 6 tailings storage facility, in Dripping Spring Wash (Montgomery and Associates Inc. 2020f).
- Road use plan. This plan originally was included as an appendix to the GPO. Partially in response to public comments on the DEIS and further review by the Forest Service, Resolution Copper submitted a revised road use plan (Resolution Copper 2020b).
- Environmental emergency and response and contingency plan (appendix to GPO)
- Fire prevention and response plan (appendix to GPO)
- Preliminary spill prevention, control, and countermeasures plan (SPCC) (appendix to GPO)
- Explosives management plan (appendix to GPO)
- Acid rock drainage management plan (appendix to GPO)
- Hydrocarbon management plan (appendix to GPO)
- Environmental materials management plan (appendix to GPO)

- Preliminary SWPPP (appendix to GPO)
- Wildlife management plan. This plan originally was included as an appendix to the GPO. After collaborative discussions with AGFD, Resolution Copper submitted a revised wildlife management plan (Resolution Copper 2020i).
- Noxious weed and invasive species plan (Resolution Copper 2019)
- Historic properties treatment plan (HPTP) for Oak Flat land exchange parcel (Deaver and O'Mack 2019)
- Research design for GPO historic properties treatment (in process)
- Tailings pipeline management plans (AMEC Foster Wheeler Americas Limited 2019) and Skunk Camp pipeline protection and integrity plan (Golder Associates Inc. 2020)
- Concentrate pipeline management plan (M3 Engineering and Technology Corporation 2019)

Monitoring and evaluation activities would be prescribed, conducted, and/or reviewed by Resolution Copper, the Forest Service, and other agencies with regulatory or permitting authority. Resolution Copper would fund monitoring as set forth in the ROD, and an approved final GPO or special use permit. Other monitoring activities may be associated with the regulatory authority of other Federal and State agencies and would be funded by permit fees or the agencies themselves as part of their normal activities.

Evaluation and Reporting

Resolution Copper would submit an annual report to the Forest Service that contains a description of all activities conducted on NFS lands during the previous year and a summary of the amount of acreage disturbed, status of reclamation, spills or releases of chemicals or fuel, and results of all monitoring plans in a format approved by the Forest Service, including a complete data summary and any data trends, status of mining plan (tons of ore and waste mined and any changes to methods or equipment), and plans for the coming year. In addition to annual reporting, individual monitoring measures would also specify reporting requirements, which could include short-term emergency notification (for example, reporting spills within 72 hours) and interim reports (such as quarterly reports). The Forest Service would review reporting to ensure that mitigation commitments were implemented on NFS lands and the effectiveness of the mitigation. Significant changes from the proposed action to incorporate requirements contained in the ROD would be required to be incorporated into the approved final GPO or special use permit and reflected in financial assurance. Past, ongoing, or projected impacts on the environment may also require revision of the approved final GPO or special use permit, ROD, and/or financial assurance held for the project.

2.3.1.6 Financial Assurances

As part of the approval of a final GPO, the Forest Service would require Resolution Copper to post financial assurance, or reclamation bond, that would provide adequate funding to allow the Forest Service to complete reclamation and post-closure operation, maintenance activities, and necessary monitoring on NFS land for as long as required to return the site to a stable and acceptable condition. The amount of financial assurance would be determined by the Forest Service and would "address all Forest Service costs that would be incurred in taking over operations because of operator default" (U.S. Forest Service 2004). The financial assurance would be required in a readily available bond instrument payable to the Forest Service and would be subject to 36 CFR 228.13. In order to ensure that the bond can be adjusted as needed to reflect actual costs and inflation, there would be provisions allowing for periodic adjustment on bonds in the final GPO or special use permit prior to approval.

Further discussion of financial assurance is included in section 1.5.5, and in certain sections of chapter 3, including section 3.3 (Soils, Vegetation, and Reclamation), 3.7.2 (Groundwater and Surface Water Quality), and 3.10.1 (Tailings and Pipeline Safety).

2.4 Effects of the Land Exchange

As described in section 2.2.3.1, a completed land exchange is considered for all resource analyses in chapter 3.

Physically, the panel caving proposed to take place under Oak Flat is independent of the land exchange. The deposit would be mined with fundamentally the same techniques and require fundamentally the same infrastructure, and result in the same surface subsidence, regardless of whether the surface is under Forest Service jurisdiction or is private. The two primary differences are (1) the regulatory framework under which mining would occur "with" or "without" Federal oversight, and (2) without the land exchange, minerals underneath the withdrawal boundary could not be extracted.

With respect to regulatory framework, if a land exchange does not occur, Resolution Copper would mine and reclaim the mined land under Federal, State, and local permits and an approved GPO under 36 CFR 228 Subpart A. With respect to regulatory framework, if the land exchange does occur and the Oak Flat area becomes private lands, Resolution Copper would be required to conduct its activities in accordance with all applicable Federal, State, and local permits but may not be subject to the requirement of obtaining an approved GPO under 36 CFR 228 Subpart A.

With respect to mining under the 760 Oak Flat Withdrawal Area, if the land exchange did not occur, the 760-acre Oak Flat Withdrawal Area would remain closed to mineral entry. While under the proposed action no mining panels are located below the Oak Flat Withdrawal Area, the proposed action might require modification to limit subsidence into that area. Regardless, mining without a land exchange would still be a possibility.

Public comments on the DEIS noted various surface uses of Oak Flat. Foremost among these are uses by Tribal members. Other uses include recreation, grazing, and reported use by educational institutions. The land exchange would not necessarily prohibit these uses, but they would take place only with the permission of the private landowner, Resolution Copper. Most of these surface uses would be in conflict with mining operations and likely would cease or be greatly curtailed.

Mine operations are governed by several Federal, State, and local regulatory frameworks. Each of the regulatory frameworks is founded in statute and implemented through regulations and policies of the responsible agency. Agency regulations or rules provide guidance to the agency so it can implement the laws and provide guidance to mine operators so they can follow the laws. Each agency requires certain types of information (filing requirements) before it can process and issue permits under its regulations. Many of the filing requirements for permits from the various agencies are duplicative, even though each agency has its own regulatory authority and responsibilities. Performance standards specify the norm governing how operations would occur and describe the level of compliance expected by the agency.

Performance standards required by the Forest Service for mining on Federal land are contained in 36 CFR 228.8: "All operations shall be conducted so as, where feasible, to minimize adverse environmental impacts on National Forest surface resources." These include specific requirements for air quality, water quality, solid waste, scenery values, fishery and wildlife habitat, roads, and reclamation.

State agencies have similar performance standards. For example, the goal of the State's APP program is to ensure no degradation of the state's groundwater. ADEQ ensures this goal by implementing the performance standards outlined by the best available demonstrated control technology (Arizona

Department of Environmental Quality 2004). Also, the goal of the state mined land reclamation rules is to ensure safe and environmentally sound reclamation of mined lands. The Office of the Arizona State Mine Inspector ensures this goal by requiring operators to meet operational and post-mine performance standards specified in the regulations at ARS R11-2-601 *et seq*.

To ensure consistency, Federal, State, and local agencies in Arizona typically require that operators follow all other Federal, State, and local permit requirements and standards. The Forest Service specifies this explicitly for air quality (36 CFR 228.8(a)), water quality (36 CFR 228.8(b)), and solid waste (36 CFR 228.8(c)). Regulation also allows for certification or approval issued by State agencies or other Federal agencies to be accepted by the Forest Service as compliance with similar or parallel Forest Service regulations (36 CFR 228.8(h)).

While there is substantial overlap in many resources, there are also some resources that may lack any form of regulatory protection except under Federal jurisdiction. For instance, Forest Service regulations address scenic values (36 CFR 228.8(d)) and fisheries and wildlife habitat (36 CFR 228.8(e)), both of which are afforded little specific protection solely under other applicable Federal or State laws, the notable exception being species that are federally listed under the ESA.

A discussion of the differences in the regulatory framework if the land exchange occurs (mining occurs on private land) vs. if the land exchange does not occur (mining occurs under Forest Service jurisdiction) is included in appendix I.

Public comments on the DEIS expressed concern from a perceived lack of analysis of what would happen to resources associated with the offered land parcels after the exchange, including recreation, wildlife, habitat, and water rights. Each resource section in chapter 3 includes a subsection titled "Effects of the Land Exchange." Fundamental to the assessment of resource impacts in chapter 3 is the acknowledgment that specific management of the offered lands was not dictated by Congress in Section 3003 of PL 113-291, and the offered lands would be subject to management under whatever land and resource management plans are in place for BLM, Coconino National Forest, or Tonto National Forest. Knowledge of how the affected environment might change due to the land exchange is disclosed to the extent it can be. Each agency would determine future management of the offered parcels as appropriate under their management plans and regulatory requirements.

2.5 Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. The information on the following pages is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively between alternatives. See also Appendix E, Alternatives Impact Summary.

GEOLOGY, MINERALS, AND SUBSIDENCE — FEIS SECTION 3.2

Key factors to analyze the issue of geology, minerals, and subsidence	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Assessment of the extent, amount, and timing of land subsidence, with estimates of uncertainty • Assessment of potential public health risk from geological hazards, including seismic activity • Assessment of the potential to impact caves or karst resources, and paleontological resources • Assessment of impact on unpatented mining claims	Modeling indicates the subsidence area would first become evident at the surface at Oak Flat in mine year 6 or 7. At full mine development in year 40 or 41, the subsidence area is expected to be approximately 800–1,115 feet deep and approximately 1.8 miles in diameter. No damage is anticipated at Apache Leap, Devil's Canyon, or U.S. 60. Resolution Copper has stated they would cease mining additional subsurface panels if through ongoing monitoring it appears any of these areas would be impacted (see "Subsidence Impacts" in section 3.2.4.2). Potential risks to public safety from mine-induced seismic or other geological activity are low. Induced mine seismicity is possible, but unlikely to be of sufficient magnitude to cause structural damage (see "Geological Hazards" in section 3.2.4.2). With the exception of a small outcropping of Martin limestone that would be destroyed in the tailings facility footprint, no surface areas or geological units with known potential for caves, karsts, or paleontological resources are located within the predicted areas of disturbance (see "Paleontological Resources" and "Caves and Karst Resources" in section 3.2.4.2). Access may be inhibited to non–Resolution Copper unpatented lode or placer mining claims located under the tailings storage facility and pipeline (see "Unpatented Mining Claims" in section 3.2.4.2).	No. Subsidence is anticipated to only occur in the East Plant Site/Oak Flat area; these effects would be common to all action alternatives. Similarly, no geological or seismic activity of any kind is expected at any of the other proposed project facilities. All other alternatives also have non–Resolution Copper unpatented mining claims within either the tailings storage facility footprint or the tailings pipeline corridor.

SOILS, VEGETATION, AND RECLAMATION — FEIS SECTION 3.3

Key factors to analyze the issue of soils and vegetation	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Acres of disturbance leading to lost soil productivity • Assessment of the potential for revegetation of tailings and other mine facilities, based on revegetation efforts conducted in central and southern Arizona • Evaluation of alteration of soil productivity and soil development • Assessment of impacts on special status vegetation species • Assessment of the potential to create conditions conducive for invasive species	All action alternatives, including Alternative 2, would result in impacts on endangered Arizona hedgehog cactus at the East Plant Site/subsidence area and possibly also at other project locations (see “Special Status Plant Species” in section 3.3.3.2 and “Construction/Operational Impacts” in section 3.3.4.2). Alternative 2 would remove or modify approximately 9,898 acres of vegetation and soils. Based on case studies in Arizona and New Mexico, a minimum of 8% of vegetation cover (including both native and non-native species) can consistently be established by year 10 within project disturbance areas (see “Expected Effectiveness of Reclamation Plans” in section 3.3.4.2). The revegetation response is expected to be influenced by the nature of the surface disturbance. Irrigation or active soil management could enhance revegetation success, thereby reducing erosional losses and net negative impacts on soil productivity. However, even with optimal soil management, impacts on soil health and productivity may last centuries to millennia; the ecosystem may not meet desired future conditions. Habitat may be suitable for generalist wildlife and plant species, but rare plants and wildlife with specific habitat requirements are unlikely to return (see “Potential to Achieve Desired Future Conditions” in section 3.3.4.2). The proposed project, under any action alternative, would increase the potential for noxious weed cover and possibly alter natural fire regimes. Reclamation of disturbed areas would decrease but not eliminate the likelihood of noxious weeds becoming established or spreading (see “Noxious Weeds” in section 3.3.4.2).	Yes. These discussions are applicable to all proposed and alternative tailings locations, but disturbance acreages would vary by alternative. Alternative 3: Same as Alternative 2 Alternative 4 would remove or modify approximately 10,072 acres of vegetation and soils. Alternative 5 would remove or modify approximately 16,917 acres of vegetation and soils. The pipeline would disturb around 12 acres of Acuña cactus critical habitat. Alternative 6 would remove or modify approximately 15,043 acres of vegetation and soils; the pipeline/power line corridor for Alternative 6 would impact Arizona hedgehog cactus habitat and individuals.

NOISE AND VIBRATION — FEIS SECTION 3.4

Key factors to analyze the issue of noise and vibration	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Assessment of the ability of alternatives to meet rural landscape expectations • Assessment of noise levels (A-weighted decibels (dBA)) and geographic area impacted from mine operations, blasting, and traffic, and qualitative assessment of effects of noise at nearby residences and sensitive receptors • Assessment of effects of vibrations from blasting and mine operations at nearby residences and sensitive receptors	Noise impacts were modeled for 15 sensitive receptors representing residential, recreation, and conservation land uses. Under most conditions, predicted noise and vibrations during construction and operations, for both blasting and non-blasting activities, at sensitive receptors are below thresholds of concern; rural character would not change due to noise (see section 3.4.4.3).	Yes. For Alternatives 3, 4, and 5, noise impacts are the same, with noise and vibration levels at sensitive receptors below thresholds of concern under most conditions. For Alternative 6, noise levels along Dripping Springs Road exceed thresholds of concern. However, there would be no residual impacts after mitigation is implemented (i.e., paving the road, imposing 15 miles per hour speed limit, daytime deliveries only), therefore rural character would not be altered due to increased noise.

TRANSPORTATION AND ACCESS — FEIS SECTION 3.5

Key factors to analyze the issue of transportation and access	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Assessment of change in type and pattern of traffic by road and vehicle type • Assessment of the change in level of service (LOS) on potential highway routes and local roads • Assessment of roads decommissioned by the mine and roads lost to motorized access	Sixty-four trips expected during the peak hour in peak construction and 46 trips expected during the peak hour during normal operations. Project-related traffic would contribute to decreased LOS at many intersections; unacceptable LOS (E/F) caused by project-related traffic occurs Main Street/U.S. 60 (construction and operations), SR 177/U.S. 60 (construction), and Magma Mine Road/U.S. 60 (operations). Eight miles of NFS roads would be lost due to the West Plant Site, East Plant Site, and filter plant and loadout facility. For the tailings facility, 21.7 miles of NFS roads would be lost and decommissioned.	Yes. Alternatives 3, 5, and 6 would have similar impacts as Alternative 2, but Alternative 4 would increase to 88 trips expected during the peak hour in peak construction and 58 trips expected during the peak hour during normal operations, due to placing the filter plant and loadout facility at the West Plant Site. LOS impacts from project-related traffic are similar to Alternative 2 for all other alternatives. At Alternative 4, about 18 miles of NFS roads would be lost to the tailings storage facility. Alternative 5 would not have loss of NFS roads but would result in the loss or decommissioning of 29 miles of BLM inventoried routes. Alternative 6 would be located on private lands and impact 5.7 miles of Dripping Springs Road.

AIR QUALITY — FEIS SECTION 3.6

Key factors to analyze the issue of air quality	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Fugitive dust emissions • Stationary and mobile-source criteria air pollutant emissions and anticipated project conformance or non-conformance with National Ambient Air Quality Standards (NAAQS) • Conformance with the state implementation plan (SIP) in designated nonattainment and maintenance areas • Class I areas and air quality-related value impacts	Analysis finds that neither daily nor annual maximum impacts for fugitive dust ($PM_{2.5}$ and PM_{10}) would exceed established air quality thresholds; no predicted results for criteria pollutants are anticipated to exceed the NAAQS at the ambient air boundary/fence line (see “Air Quality Impact Assessment” in section 3.6.4.2). The Forest Service demonstrated conformity through reliance on modeling results including estimates of whether changes in silt content assumptions would change emissions (see “Conformity” in section 3.6.3.2). Impacts are projected to be less than the PSD increments at all Class I areas but exceed 50% of the PM_{10} and $PM_{2.5}$ PSD increments at the Superstition Wilderness. Impacts on air quality-related values (deposition and visibility) would be within established thresholds for de minimis levels of acceptability (see “Impacts at Sensitive Areas” in section 3.6.4.2).	No. Emissions are largely similar between all alternatives, and no alternative is predicted to exceed NAAQS for criteria pollutants at the ambient air boundary/fence line.

WATER RESOURCES: GROUNDWATER QUANTITY AND GROUNDWATER-DEPENDENT ECOSYSTEMS (GDES) — FEIS SECTION 3.7.1

Key factors to analyze the issue of groundwater quantity and groundwater-dependent ecosystems	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Geographic extent in which water resources may be impacted and number of GDEs degraded or lost • Impact on public groundwater supplies • Comparison of mine water needs • Potential for subsidence to occur as a result of groundwater withdrawal	Under no action, six GDEs (all springs) are anticipated to be impacted by groundwater drawdown from ongoing dewatering (see “Alternative 1 – No Action” in section 3.7.1.5). When block caving occurs, groundwater impacts expand to overlying aquifers and two more GDEs (springs) are anticipated to be impacted. Alternative 2 also directly disturbs nine GDEs (springs and ponds), and reductions in stormwater runoff impact three more GDEs (Devil’s Canyon and two reaches of Queen Creek). There are surface water rights associated with many of these GDEs. A total of 20 GDEs would be impacted by Alternative 2. Loss of water would be mitigated but impacts on natural setting would remain (see Alternative 2, “Groundwater-Dependent Ecosystems Impacted,” in section 3.7.1.5). Groundwater supplies in Superior and Top-of-the-World could be impacted by groundwater drawdown but would be replaced through mitigation (see “Anticipated Impacts on Water Supply Wells” in section 3.7.1.5). Over the mine life, Alternative 2 would dewater about 87,000 acre-feet from the mine and would require about 590,000 acre-feet of makeup water pumped from the Desert Wellfield. The wellfield pumping would incrementally contribute to ground subsidence in the East Salt River valley, and cumulatively reduce overall groundwater availability in the area (see ”Changes in Basin Water Balance – Mine Dewatering” and Alternative 2, “Changes in Desert Wellfield Pumping,” in section 3.7.1.5).	Yes. There are differences between alternatives in the number of GDEs impacted and the amount of makeup water required. Alternative 3 would impact the same GDEs as Alternative 2 but would pump about 490,000 acre-feet from the Desert Wellfield over the mine life (see Alternative 3 in section 3.7.1.5). Alternative 4 would impact 18 GDEs (8 springs from groundwater drawdown, 7 springs or ponds from direct disturbance, and 3 stream reaches from reductions in stormwater runoff (Devil’s Canyon and 2 areas of Queen Creek)). Alternative 4 uses filtered tailings and would pump about 180,000 acre-feet from the Desert Wellfield over the mine life, much less than the other alternatives (see Alternative 4 in section 3.7.1.5). Alternative 5 would impact 18 GDEs (8 springs from groundwater drawdown, 6 springs or ponds from direct disturbance, and 4 stream segments from reductions in stormwater runoff (Devil’s Canyon, 2 areas of Queen Creek, and the Gila River)). Alternative 5 would pump about 540,000 acre-feet from the Desert Wellfield over the mine life (see Alternative 5 in section 3.7.1.5). Alternative 6 would impact the same GDEs and would pump about the same amount of water as Alternative 5 (see Alternative 6 in section 3.7.1.5).

WATER RESOURCES: GROUNDWATER AND SURFACE WATER QUALITY — FEIS SECTION 3.7.2

Key factors to analyze the issue of groundwater and surface water quality	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Anticipated groundwater and surface water quality changes, compared for context to Arizona water quality standards, in the block-cave zone and from tailings seepage • Anticipated surface water quality impacts from stormwater runoff • Assessment of seepage control techniques • Potential for a lake to develop in the subsidence crater • Reductions in assimilative capacity • Potential impacts on impaired waters • Assessment of the potential for processing chemicals, asbestos, or radioactive materials in tailings seepage	After closure, the reflooded block-cave zone may have poor water quality (above Arizona water standards). No lake is anticipated to develop in the subsidence crater, and no other exposure pathways exist for this water (see “Potential for Subsidence Lake Development” in section 3.7.2.4). Stormwater runoff could have poor water quality, but under normal operations no stormwater contacting tailings or facilities is released during operations or post-closure until reclamation is successful and water meets appropriate standards (see “Potential Surface Water Quality Impacts from Stormwater Runoff” in section 3.7.2.4). For some combination of extreme storms (300-year return period or greater) and operational upset conditions, stormwater could be released over the spillway of the seepage pond. Engineered seepage controls designed for Alternative 2 are modeled to capture 99% of seepage. No concentrations are above aquifer water quality standards; however, selenium concentrations in Queen Creek at Whitlow Ranch Dam are anticipated to be above surface water standards. There are substantial difficulties in adding additional seepage controls at this location; the risk for potential water quality problems is high (see Alternative 2, “Potential Water Quality Impacts from Tailings Storage Facility,” in section 3.7.2.4). Assimilative capacity for selenium in Queen Creek is used up by impact of tailings seepage. Queen Creek is impaired for copper, and copper load from tailings seepage inhibits watershed load reduction efforts (see “Potential Impacts on Impaired Waters” and “Predicted Reductions in Assimilative Capacity” in section 3.7.2.4). Analysis found little risk of processing chemicals, asbestos, or radioactive materials to persist in tailings or tailings seepage (see “Other Water Quality Concerns” in section 3.7.2.4).	Yes. All alternatives differ in engineered seepage controls, risk of water quality problems from tailings seepage, and impacts on downstream waters for assimilative capacity and impairment. Engineered seepage controls designed for Alternative 3 are modeled to capture 99.5% of seepage. This results in no concentrations above aquifer or surface water standards. Adding seepage controls at this location would be difficult, and risk for potential water quality problems high (see Alternative 3, “Potential Water Quality Impacts from Tailings Storage Facility,” in section 3.7.2.4). Engineered seepage controls designed for Alternative 4 are assumed (not modeled) to capture 90% of seepage. This results in no concentrations are above aquifer water quality standards; however, selenium concentrations in Queen Creek at Whitlow Ranch Dam are anticipated to be above surface water standards. Some potential exists to add seepage controls at this location, so risk of potential water quality problems is less than Alternatives 2 and 3 (see Alternative 4, “Potential Water Quality Impacts from Tailings Storage Facility,” in section 3.7.2.4). Engineered seepage controls designed for Alternative 5 are modeled to capture 84% of seepage. This results in no concentrations above aquifer or surface water standards. Alternative 5 also has substantial flexibility for adding other layers of seepage controls during operations as needed (see Alternative 5, “Potential Water Quality Impacts from Tailings Storage Facility,” in section 3.7.2.4). Engineered seepage controls designed for Alternative 6 are modeled to capture 90% of seepage. This results in no concentrations above aquifer or surface water standards. This result was confirmed using a refined numeric water quality model, based on site-specific investigations conducted at the Skunk Camp location. Alternative 6 also has substantial flexibility for adding other layers of seepage controls during operations as needed (see Alternative 6, “Potential Water Quality Impacts from Tailings Storage Facility,” in section 3.7.2.4).

WATER RESOURCES: SURFACE WATER QUANTITY — FEIS SECTION 3.7.3

Key factors to analyze the issue of surface water quantity	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Assessment of the change in volume, frequency, and magnitude of runoff from the project area, as it affects Devil’s Canyon, Queen Creek, and the Gila River • Acres of 100-year floodplains impacted • Acres of wetland impacted, based on National Wetlands Inventory • Acres of potentially jurisdictional waters of the U.S. (CWA 404 permit) • Potential changes in downstream geomorphology and sediment yield	There would be a reduction in average annual runoff due to the subsidence crater capturing precipitation, amounting to 3.5% at the mouth of Devil’s Canyon, and 3.5% in Queen Creek at Whitlow Ranch Dam. The Alternative 2 tailings storage facility also captures precipitation, resulting in a combined loss in Queen Creek at Whitlow Ranch Dam of 6.5% (see Alternative 2, “Impacts on Surface Runoff and Streamflow,” in section 3.7.3.4). Alternative 2 impacts 8.5 acres of floodplain (though Federal Emergency Management Agency (FEMA) coverage is incomplete), 162.7 acres of wetlands in the National Wetlands Inventory (93% of these are xeroriparian/ephemeral washes), and zero acres of impacts of jurisdictional waters (the USACE gave an approved delineation to Resolution Copper in 2015 that indicates waters upstream of Whitlow Ranch Dam are not considered jurisdictional; see Alternative 2 in section 3.7.3.4). Geomorphology and sediment impacts in downstream waters are unlikely to change for any alternative, due to nature of ephemeral washes and stormwater controls (see “Impacts on Sediment Yields and Geomorphology of Streams” in section 3.7.3.4).	Yes. Alternative 3 is identical to Alternative 2, but surface flow reductions, floodplains, wetlands, and waters of the U.S. differ for Alternatives 4 through 6. Alternative 4 results in an 8.9% combined loss of average annual runoff in Queen Creek at Whitlow Ranch Dam and 19.9% loss in Queen Creek at Boyce Thompson Arboretum. Alternative 4 impacts the same floodplains as Alternative 2, 175.4 acres of wetlands in the National Wetlands Inventory (94% of these are xeroriparian/ephemeral washes), and zero acres of impacts on jurisdictional waters (see Alternative 4 in section 3.7.3.4). Alternative 5 results in a 0.2% loss of average annual runoff in the Gila River at Donnelly Wash. Alternative 5 impacts 179 acres of floodplains, 291 acres of wetlands in the National Wetlands Inventory (92% are xeroriparian/ephemeral washes), and 182.5 acres of potentially jurisdictional waters of the U.S. (Alternatives 5 and 6 are not in the Queen Creek drainage, unlike Alternative 2; see Alternative 5 in section 3.7.3.4). Alternative 6 results in a 0.5% loss of average annual runoff in the Gila River at Dripping Spring Wash and 0.3% in the Gila River at Donnelly Wash. Alternative 6 impacts 786 acres of mapped floodplain, 251 acres of wetlands in the National Wetlands Inventory (93% are xeroriparian/ephemeral washes), and 129 acres of potentially jurisdictional waters (see Alternative 6 in section 3.7.3.4). A refined geomorphology model for Alternative 6 suggests detention of sediment by the stormwater controls, during operations, has the potential to result in scour downstream of the facility.

WILDLIFE AND SPECIAL STATUS WILDLIFE SPECIES — FEIS SECTION 3.8

Key factors to analyze the issue of wildlife	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Assessment of effects on riparian habitat and species due to changes in flow • Assessment of acres of suitable habitat disturbed for each special status species and by type of terrestrial and aquatic habitat lost, altered, or indirectly impacted • Potential of mortality of animal species resulting from the increased volume of traffic related to mine operations • Effects on wildlife behavior from noise, vibrations, and light • Change in movement corridors and connectivity between wildlife habitats • Impacts on aquatic habitats and surface water that support wildlife and plants	Alternative 2 would impact 20 groundwater-dependent ecosystems (GDEs). For the springs or stream segments impacted by groundwater drawdown or surface water flow reductions, mitigation would replace the water source and prevent widespread loss of riparian habitat. The remaining GDEs are lost to surface disturbance and would not be mitigated. Loss of xeroriparian habitat occurs for all alternatives. Habitat would be impacted to some extent for about 50 special status wildlife species (see table 3.8.4-2 for details). Specific impacts could occur with western yellow-billed cuckoo (endangered) and southwestern willow flycatcher (endangered) from vegetation removal or project activities. Gila chub (endangered) has critical habitat along Mineral Creek but is not known to be present and habitat in Mineral Creek is not anticipated to be impacted (see “Impacts on Special Status Wildlife Species” in section 3.8.4.2). There is a high probability of mortality and/or injury of wildlife individuals from collisions with mine construction and employee vehicles as well as the potential mortality of burrowing animals in areas where grading would occur. Some individuals would be likely to move away from the sources of disturbance to adjacent or nearby habitats. Project-related noise, vibration, and light may also lead to increased stress on individuals and alteration of feeding, breeding, and other behaviors (see “General Construction Impacts” and “General Operations Impacts” in section 3.8.4.2). There would be loss and fragmentation of movement and dispersal habitats from the subsidence area and tailings storage facility. Ground-clearing and consequent fragmentation of habitat blocks for other mine-related facilities would also inhibit wildlife movement (see “Wildlife Connectivity” in section 3.8.4.2). There are 15 identified wildlife waters within 5 miles of the project footprint. Under Alternative 2, three would be lost beneath the tailings storage facility.	Yes. Alternative 3 is similar to Alternative 2. Alternative 4 would have more reduction in surface flow and greater impacts on Queen Creek. Alternatives 5 and 6 would have less impact on Queen Creek due to surface flow reductions. A total of 18 GDEs and 2 wildlife waters would be impacted under Alternatives 4, 5, and 6. Specific acres of habitat affected varies between alternatives (see table 3.8.4-2 for details). Alternative 6 would impact the greatest amount of acreage for Habitat Block 1 areas.

RECREATION — FEIS SECTION 3.9

Key factors to analyze the issue of recreation	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Changes in Recreation Opportunity Spectrum designations • Assessment of acres of the Tonto National Forest that would be unavailable for recreational use, for various phases of mine life and reclamation • Assessment of potential for noise to reach recreation areas (i.e., audio “footprint”) • Assessment of impacts on solitude in designated wilderness and other backcountry areas • Assessment of hunter-days lost (quantity based on number of permits available and number of days in season) • Assessment of miles of Arizona National Scenic Trail, NFS trails, or other known trails requiring relocation, and qualitative assessment of user trail experience • Assessment of increased pressure on other areas, including roads and trails/trailheads, from displacement and relocation of recreational use as a result of mine facilities	Under Alternative 2, based on the Recreation Opportunity Spectrum (ROS) designation of user experiences, direct removal of 18 acres of the semi-primitive non-motorized setting, 4,409 acres of the semi-primitive motorized setting, and 1,221 acres within the roaded natural setting (see table 3.9.4-1). All public access (Tonto National Forest, ASLD, BLM lands) would be eliminated on 8,423 acres. Rock-climbing opportunities at Euro Dog Valley, Oak Flat, and other portions of the mine area would be lost under all action alternatives but would be partially mitigated by new climbing area(s) set aside by Resolution Copper (see “Rock Climbing” in section 3.9.4.2). Under most conditions, with sensitive receptors representing recreation users, predicted noise during construction and operation are below thresholds of concern (see Alternative 2, “Recreation Opportunity Spectrum,” in section 3.9.4.3). Visitors to the Superstition Wilderness, Picketpost Mountain, and Apache Leap would have foreground and background views of the tailings facilities from trails and overlooks, and the recreation setting from certain site-specific views could change. Under Alternative 2, 0.07 mile of the tailings pipeline corridor would intersect the Arizona National Scenic Trail (see Alternative 2, “Recreation Sites,” in section 3.9.4.3). The number of Arizona hunting permits that are issued in individual Game Management Units would not change as a result of the any of the action alternatives being implemented, though some individuals’ preferred hunting grounds may be lost (see “Hunting” in section 3.9.4.2). Under all action alternatives, it is likely that increased use would occur on other nearby lands that provide similar experiences, depending upon the recreational user type. A minor to moderate increase in user activity would be expected to occur in recreational use areas elsewhere, with uses largely similar to those displaced.	Yes. Alternative 3 is identical to Alternative 2. Alternative 4 would remove 36 acres of the semi-primitive non-motorized setting, 5,063 acres of the semi-primitive motorized setting, and 597 acres within the roaded natural setting. All public access (Tonto National Forest, ASLD, BLM lands) would be eliminated on 9,015 acres. Alternative 4 would require 3.05 miles of the Arizona National Scenic Trail to be closed and relocated to an area that would be safe for public use. Under Alternative 4, 26 NFS roads would be impacted for motorized recreation. Alternative 5 would remove 18 acres of the semi-primitive non-motorized setting, 7 acres of the semi-primitive motorized setting and 1,025 acres of the roaded natural setting. All public access (Tonto National Forest, ASLD, BLM lands) would be eliminated on 15,215 acres. Under Alternative 5, 23 miles of BLM routes would be impacted for motorized recreation, and additional BLM and NFS roads would be crossed by the pipeline. Alternative 5 would intersect the Passage 16 segment of the Arizona National Scenic Trail by 0.18 mile of the proposed tailings storage facility pipeline. Visitors to the White Canyon Wilderness would have background views of the Alternative 5 pipeline from some trails and overlooks. Alternative 6 would remove 166 acres of the semi-primitive non-motorized setting, 249 acres of the semi-primitive motorized setting, and 373 acres of the roaded natural setting. All public access (Tonto National Forest, ASLD, BLM lands) would be eliminated on 11,566 acres. Under Alternative 6, no BLM or NFS roads are within the footprint, although roads are crossed by the pipeline. The Alternative 6 pipeline would be visible from trails and overlooks in the Superstition Wilderness and Picketpost Mountain area.

PUBLIC HEALTH AND SAFETY: TAILINGS AND PIPELINE SAFETY — FEIS SECTION 3.10.1

Key factors to analyze the issue of tailings and pipeline safety	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Qualitative assessment of the risk of failure of tailings embankment or concentrate/tailings pipelines and potential impacts downstream in the event of a failure	Risk of failure of all alternatives is minimized by required adherence to National Dam Safety Program and APP standards, and applicant-committed environmental protection measures (see "Federal Requirements for Tailings Facility Design" in section 3.10.1.3). Failure of a slurry tailings facility has historically been demonstrated to have the potential to runout tailings dozens or even hundreds of miles downstream. Consequences of a catastrophic failure at the Alternative 2 tailings storage facility would include possible loss of life and limb, destruction of property, and displacement of large populations with a downstream population of over 600,000, including Queen Valley, within a few miles downstream. A catastrophic failure would disrupt the Arizona economy, would result in contamination of soils and water, and would jeopardize water supplies for over 700,000 people and key water infrastructure like the CAP canal (see 3.10.1.4, Alternative 2). Consequences of a concentrate or tailings pipeline failure would include soil and water contamination and destruction of vegetation in any water bodies crossed. The Alternative 2 embankment is less resilient than Alternatives 5 and 6 due to: • modified-centerline construction instead of centerline construction • a long embankment (10 miles) • a freestanding structure • the potential to release PAG materials during a failure	Yes. While all built to the same standards, the alternatives differ in downstream environment and resilience of the design. Alternative 3 is similar to Alternative 2, but the design is more resilient because of the use of ultrathickened tailings (see Alternative 3 in section 3.10.1.4). Alternative 4 is fundamentally different from the other action alternatives. As a filtered tailings facility, if Alternative 4 were to fail, it would likely fail as an earth slump or landslide, impacting only several miles of xeroriparian wash and not jeopardizing life and limb, property, or water supplies (see Alternative 4 in section 3.10.1.4). Alternative 5 has smaller downstream populations (32,000), with no major population center for 20 miles. The Gila River Indian Community and substantial agricultural water supplies are downstream. Alternative 5 facility is more resilient than Alternatives 2 and 3 due to: centerline construction, a slightly shorter embankment (7 miles), and storage of PAG in separate cells that use downstream embankments (see Alternative 5 in section 3.10.1.4). Alternative 6 has the smallest downstream population (3,200) but with a population center just downstream. The Alternative 6 facility is more resilient than Alternatives 2, 3, or 5 due to: centerline construction, the shortest embankment (3 miles), cross-valley construction, and storage of PAG in separate cells that use downstream embankments (see Alternative 6 in section 3.10.1.4).

PUBLIC HEALTH AND SAFETY: FUELS AND FIRE MANAGEMENT — FEIS SECTION 3.10.2

Key factors to analyze the issue of fuels and fire management	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Potential for increased fire risk due to mine operations (i.e., inadvertent ignition) • Potential for increased fuelwood loads in the Oak Flat area as a result of subsidence and dewatering • Adequacy of Forest Service and municipal fire teams and equipment to respond to wildfires	Wildfire is always a risk, particularly in areas where human activities and greater densities of standing and fallen vegetation intersect (areas, for example, such as Oak Flat). It is assumed that MSHA regulations, Resolution Copper's own internal policies, as well as Forest Service and Pinal County–announced fire risk alerts and restrictions during periods of drier conditions and higher winds, would serve to prevent most cases of inadvertent, human-caused ignition (see section 3.10.2.4). While some increase in dead and dying vegetation within the subsidence area may be expected, other plants may be expected to persist and still others to reestablish within the area, particularly once active subsidence ceases. The risk of human-caused ignitions in the subsidence area is effectively negligible because the area would be fenced off and no entry would be permitted. Die-off of riparian vegetation is not anticipated as a consequence of dewatering in the Oak Flat area generally, because agreed-upon mitigation measures would ensure replacement water in these areas. Wildfire response in and adjacent to the project areas would be provided by local fire department personnel such as those from the Town of Superior. The Tonto National Forest, BLM, and Pinal County also provide support for initial wildfire attack (called Initial Attack) for areas within and adjacent to wildland-urban interface (WUI) areas, while the Arizona Department of Forestry and Fire Management is responsible for suppression of wildfire on State Trust land and private property located outside incorporated communities. Historically, these assets and accompanying wildfire control strategies have been considered adequate; it should be noted, however, that fire response resources tend to become limited during the height of the annual fire season due to commitments elsewhere in the state (see "Wildfire Response" in section 3.10.2.3).	Yes. While under any of the alternatives, the risk of inadvertent ignition and resulting wildfire is considered quite low, Alternative 4 includes areas classified with shrub fuels (SH7) that burn with high intensity in the event of an ignition. Intense fire behavior was observed within the footprint of Alternative 4 during the Peachville Fire, which burned a portion of the proposed tailings area in 2005. In addition, the southern portion of the footprint for Alternative 4 is located within the WUI for the town of Superior, meaning this location could potentially expose life and property to wildfire impacts should an ignition occur. On the other hand, because of the close proximity to Superior, fire response to the area should be rapid with emergency services provided by both the Tonto National Forest and the Town of Superior (see section 3.10.2.4).

PUBLIC HEALTH AND SAFETY: HAZARDOUS MATERIALS — FEIS SECTION 3.10.3

Key factors to analyze the issue of hazardous materials	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Amount, type, location of storage, use, and disposal of hazardous materials and potential for release to the environment • Transportation of hazardous materials to the project area and potential for release to the environment • Fate and transport of different types of hazardous materials if they enter the environment	The Resolution Copper GPO and appendix G of the EIS provide information on the company's expected use of various chemicals and other hazardous materials in its mining and processing operations. MSHA and other regulations and standards govern the transport and storage of explosives and hazardous chemicals; risks of spills or releases are therefore considered possible, but unlikely. Potential releases of hazardous materials during transportation could occur, but the fate and transport of those hazardous materials depend entirely on where the release occurs and the quantity of the release. The company would be required by various local, State, and Federal regulations to maintain spill prevention, control, and emergency response plans.	No. See section 3.10.3.4.

SCENIC RESOURCES — FEIS SECTION 3.11

Key factors to analyze the issue of scenic resources	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Acres of Tonto National Forest that would no longer meet current forest plan Scenic Integrity Objective (SIO) designations (note that with the implementation of the 2023 forest plan, this analysis factor was changed from the previous Visual Quality Objective criteria) • Anticipated changes in landscape character from key analysis viewpoints, for various phases of mine life and reclamation • Miles of project area visibility along major thoroughfares in the area (i.e., U.S. 60, SR 79, and SR 177) • Potential for increase in sky brightness resulting from the mine facility and mine-related vehicle lighting	Analysis finds that within the project footprint the following acreage totals have designations that would not allow for the proposed project activities: 4,952 acres of High SIO, 264 acres of Moderate SIO, and 949 acres of Low SIO (see table 3.11.4-14). The analysis of anticipated changes in landscape character from key analysis viewpoints for Alternative 2 is too extensive to summarize here and is presented in tables 3.11.4-1, 3.11.4-4, 3.11.4-5, and 3.11.4-6. Analysis shows that Alternative 2 facilities would be visible along 21.2 miles of U.S. 60 and 2.5 miles of SR 177 (see table 3.11.4-5). Lighting at the East Plant Site, West Plant Site, and tailings facility would be visible and noticeable at night from the town of Superior, U.S. 60, Boyce Thompson Arboretum, the Arizona National Scenic Trail, and the surrounding national forest landscape (see Alternative 2, "Dark Skies," in section 3.11.4.3).	Yes. Under Alternative 4, analysis finds that within the project footprint the following acreage totals have designations that would not allow for the proposed project activities: 4,863 acres of High SIO, 1,386 acres of Moderate SIO, and 641 acres of Low SIO (see table 3.11.4-14). Analysis of anticipated changes in landscape character for Alternative 4 is presented in tables 3.11.4-9 and 3.11.4-10. Alternative 4 facilities would be visible along 18.3 miles of U.S. 60 and 3.6 miles of SR 177 (see table 3.11.4-9). Under Alternative 5, analysis finds that within the project footprint the following acreage totals have designations that would not allow for the proposed project activities: 850 acres of High SIO and 282 acres of Moderate SIO (see table 3.11.4-14). Alternative 5 would also exceed the characteristics of Class III VRM on 7,086 acres (see table 3.11.4-14). Analysis of anticipated changes in landscape character for Alternative 5 is presented in tables 3.11.4-11 and 3.11.4-12. Alternative 5 facilities would be visible along 1.5 miles of U.S. 60 and 1.4 miles of SR 177 (see table 3.11.4-11). Under Alternative 6, analysis finds that within the project footprint the following acreage totals have designations that would not allow for the proposed project activities: 516 acres of High SIO and 345 acres of Moderate SIO (see table 3.11.4-14). Analysis of anticipated changes in landscape character for Alternative 6 is presented in table 3.11.4-13. Alternative 6 facilities would not be visible from U.S. 60 or SR 177. Dark sky impacts are similar between alternatives.

CULTURAL RESOURCES — FEIS SECTION 3.12

Key factors to analyze the issue of cultural resources	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Assessment of the impacts on places of traditional and cultural significance to Native Americans, including natural resources • Assessment of number of NRHP-eligible historic properties, sacred sites, and other landscape-scale properties to be buried, destroyed, or damaged • Assessment of impacts on historic properties, including number of NRHP-eligible historic properties expected to be visually impacted	The NRHP-listed *Chí'chil Biłdagoteel* Historic District TCP would be directly and permanently damaged. Under Alternatives 2 and 3, 120 NRHP-eligible sites and 18 sites of undetermined eligibility would be directly affected; another 59 sites would be indirectly affected (see "Direct Impacts" and "Indirect Impacts" in section 3.12.4.3). Additional historic properties and archaeological sites are located within 6 miles of the proposed project and could be impacted by their proximity to mining disturbance (see "Atmospheric Impacts" in section 3.12.4.3).	Under any action alternative, impacts of mine development at the associated project facilities would have equivalent adverse effects on cultural resources. All anticipated surveys are complete at this time. For Alternative 4, 145 NRHP-eligible sites and 2 sites of undetermined eligibility would be directly affected; another 55 sites would be indirectly affected (see section 3.12.4.5). For Alternative 5, 154 NRHP-eligible sites and 3 sites of undetermined eligibility would be directly affected; another 77 sites would be indirectly affected (see section 3.12.4.6). For Alternative 6, 377 NRHP-eligible sites and 3 sites of undetermined eligibility would be directly affected; another 55 additional sites would be indirectly affected (see section 3.12.4.7).

SOCIOECONOMICS — FEIS SECTION 3.13

Key factors to analyze the issue of socioeconomics	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Assessment of potential changes in employment, labor earnings, and area economic output as a result of the Resolution Copper Mine, including direct and indirect economic effects • Assessment of changes to tax revenues; potential increased need for road maintenance and local emergency services; potential changes in tourism and recreation; potential effects on property values	On average, the mine is projected to directly employ 1,434 workers, pay about $149 million per year in total employee compensation, and purchase about $490 million per year in goods and services. Including direct and multiplier effects, the proposed mine is projected to increase average annual economic value added in Arizona by about $1 billion (see “Impact on employment, earnings, and value added” under “Socioeconomic Impacts” in section 3.13.4.2). The proposed mine is projected to generate an average of between $80 and $120 million per year in state and local tax revenues and would also produce substantial revenues for the Federal Government, estimated at over $200 million per year (see “State and local government revenue summary” under “Socioeconomic Impacts” in section 3.13.4.2). Construction and operations of the proposed mine could affect both the Town of Superior’s costs to maintain its network of streets and roads as well as those of Pinal County, and put a strain on public services. A number of agreements between Resolution Copper and the Town of Superior would offset impacts on quality of life, education, and emergency services (see “Mine-related demands and costs for public services” under “Socioeconomic Impacts” in section 3.13.4.2). Property values are expected to decline in close proximity to the tailings storage facilities and are estimated to average 4.1% under Alternative 2 (see “Potential property value effects from tailings” under “Socioeconomic Impacts” in section 3.13.4.2). Loss of hunting revenue due to the tailings storage facility is expected to be greatest under Alternative 2 (see “Potential effects on the nature-based tourism economy” under “Socioeconomic Impacts” in section 3.13.4.2).	Yes. Socioeconomic effects under any of the action alternatives are anticipated to be fundamentally the same as Alternative 2, except for property values and hunting revenue. Property values are expected to decline 10.6% under Alternative 4; approximately 6.3% under Alternative 5; and about 4.0% under Alternative 6 (see table 3.13.4-4). Loss of hunting revenue is similarly high under Alternative 4, and lowest under Alternative 5. Being private and State lands, hunting effects have yet to be determined for Alternative 6.

TRIBAL VALUES AND CONCERNS — FEIS SECTION 3.14

Key factors to analyze the issue of Tribal values and concerns	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Assessment of how cumulative resource disturbance impacts Tribal values and spiritual practices • Assessment of number of sacred springs or other discrete sacred sites that would be impacted, and potential effects on Native Americans from the desecration of land, springs, burials, and sacred sites • Estimated acres of traditional resource collection areas that would be impacted	Development of the Resolution Copper Mine would directly and permanently damage the NRHP-listed *Chí'chil Biłdagoteel* Historic District TCP. Other large-scale mine development along with smaller transportation, utility, and private land development projects in the greater Superior region may also affect places and resources of value to Native Americans, including historical and ceremonial sites and culturally valued landforms and features. Dewatering or direct disturbance would impact between 18 and 20 GDEs, mostly sacred springs. While mitigation would replace water, impacts would remain to the natural setting of these places. Burials are likely to be impacted; the numbers and locations of burials would not be known until such sites are detected as a result of mine-related activities. Under this or any action alternative, one or more Emory oak groves at Oak Flat, used by Tribal members for acorn collecting, would likely be lost. Other unspecified mineral- and/or plant-collecting locations would also likely be affected; historically, medicinal and other plants are frequently gathered near springs and seeps, so drawdown of water at these locations may also adversely affect plant availability.	Under any action alternative, impacts of mine development at the East Plant Site (Oak Flat), West Plant Site, MARRCO corridor, and at other ancillary facilities would have equivalent adverse effects on Tribal values and concerns. Impacts on Tribal values and concerns would be similar in context and intensity under Alternatives 4, 5, and 6; however, because the tailings storage facility under each of these alternatives would be in a different location, the specific impacts on potentially meaningful sites, resources, routes, and viewsheds would vary. See sections 3.11.4 (Scenic Resources), 3.12.4 (Cultural Resources), and 3.14.4 (Tribal Values and Concerns) for detailed impact analyses specific to each alternative.

ENVIRONMENTAL JUSTICE — FEIS SECTION 3.15

This section has been removed in compliance with Executive Orders 14148 and 14173.

LIVESTOCK AND GRAZING — FEIS SECTION 3.16

Key factors to analyze the issue of livestock and grazing	What are the results of impact analysis for the proposed action (Alternative 2)?	Are the analyzed impacts of these issues substantially different under Alternatives 3, 4, 5, or 6?
• Potential for changes to acreages of grazing allotments; potential for loss of grazing-related facilities (waters, stock tanks, roads, fences, etc.); and potential for changes to available animal unit months (AUMs) within individual grazing allotments (see section 3.16.4.2)	Under Alternative 2, affected grazing allotments would experience a reduction of 8,573 acres and 664 AUMs over 6 allotments and 21 grazing-related facilities (water sources) would also be lost (see Alternative 2 in section 3.16.4.3).	Yes. Although acreage changes to grazing allotments would be identical under Alternatives 2 and 3, Alternatives 4, 5, and 6 would be different. Alternative 4: There would be a reduction in 9,178 acres and 703 AUMs over 6 allotments, and 20 grazing-related facilities (water sources) would be lost (see Alternative 4 in section 3.16.4.5). Alternative 5: There would be a reduction in 15,705 acres and 1,507 AUMs over 10 allotments, and 10 grazing-related facilities (water sources) would be lost along with infrastructure at the Teacup headquarters (see Alternative 5 in section 3.16.4.6). Alternative 6: There would be a reduction of 13,781 acres and 2,797 AUMs over 9 allotments, and 14 grazing-related facilities (water sources) would be lost along with infrastructure at the Slash S headquarters (see Alternative 6 in section 3.16.4.7).

This page intentionally left blank.

Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

Each of the following sections in chapter 3 focuses on a specific resource, describes the environment that may be affected by the proposed action and its alternatives, and describes the direct, indirect, and cumulative impacts that could occur for that resource.

Overview

Chapter 3 describes the natural and human environment that may be affected by the proposed action and its alternatives, and discloses the direct, indirect, and cumulative impacts that could occur because of the proposed action or alternatives.

Direct and indirect impacts are those caused by the project itself. Cumulative impacts take into account not just the direct and indirect impacts of the proposed action (or alternatives), but also the combined effects of other past, present, and reasonably foreseeable future actions. These actions may have individually minor effects but become significant when combined. In most cases past and present actions, including ongoing trends, are part of the description of the affected environment.

"Geology, Minerals, and Subsidence" (section 3.2) describes known geological characteristics at each of the major facilities of the proposed mine—including alternative tailings storage locations—and how the development of the project may impact existing cave and karst features, paleontological resources, area seismicity and other geological hazards, and mining claims. It also outlines subsidence impacts that would result from Resolution Copper's plans to extract the ore from below the deposit using a mining technique known as "block caving" or "panel caving" and describes how subsidence would affect Apache Leap.

"Soils, Vegetation, and Reclamation" (section 3.3) explains how the proposed mine would disturb large areas of ground and potentially destroy native vegetation, including species given special status by the Forest Service, and encourage noxious or invasive weeds. This section also discusses reclamation plans and expected reclamation success.

"Noise and Vibration" (section 3.4) provides a detailed analysis of estimated impacts from noise and vibration under the proposed mining plan and each of the alternatives, including blasting impacts.

"Transportation and Access" (section 3.5) discusses how the proposed Resolution Copper Mine would increase traffic on local roads and highways and likely alter local and regional traffic patterns and levels of service. NFS road closures, along with accelerated deterioration of local roadways as a result of increased use, are examined.

"Air Quality" (section 3.6) analyzes potential impacts from an increase in dust, wind-borne particulates, and transportation-related emissions as a result of construction, mining, and reclamation activities at the mine. It also assesses how those emissions affect distant sensitive areas like the Superstition Wilderness.

"Water Resources" analyzes how the Resolution Copper Project could affect water availability and quality in three key areas: groundwater quantity and groundwater-dependent ecosystems (section 3.7.1); groundwater and surface water quality (section 3.7.2); and surface water quantity (3.7.3). This includes analysis of the impacts of dewatering at the mine site, analysis of pumping from the Desert Wellfield for the mine water supply, and anticipated effects from tailings seepage.

"Wildlife and Special Status Wildlife Species" (section 3.8) describes how impacts on wildlife can occur from habitat loss and fragmentation as well as from artificial lighting, noise, vibration, traffic, loss of water sources, or changes in air or water quality.

"Recreation" (section 3.9) describes the anticipated changes to some of the area's natural features and recreational opportunities as a result of infrastructure development related to the project.

"Public Health and Safety" addresses three areas of interest: tailings and pipeline safety (section 3.10.1), fire risks (section 3.10.2), and the potential for releases or public exposure to hazardous materials (section 3.10.3).

"Scenic Resources" (section 3.11) addresses the existing conditions of scenic resources (including dark skies) in the area of the proposed action and alternatives, along with the potential changes to those conditions from construction and operation of the proposed project.

"Cultural Resources" (section 3.12) analyzes potential impacts on all known cultural resources within the project area.

"Socioeconomics" (section 3.13) examines the social and economic impacts on the quality of life for neighboring communities near the proposed mine.

"Tribal Values and Concerns" (section 3.14) discusses the high potential for the proposed mine to directly, adversely, and permanently affect numerous cultural artifacts, sacred seeps and springs, traditional ceremonial areas, resource gathering localities, burial locations, and other places and experiences of high spiritual and other value to Tribal members.

"Environmental Justice" (section 3.15) has been removed in compliance with Executive Orders 14148 and 14173.

"Livestock and Grazing" (section 3.16) describes the loss to public use of Federal and State lands—including livestock grazing—from implementation of the proposed action or alternatives.

The analyses contained in chapter 3 were developed from issues identified during the scoping process. The relevant issues are only briefly recapped in chapter 3. The reader is directed to chapter 1, appendix E, or the November 2017 report titled "Resolution Copper Project and Land Exchange Environmental Impact Statement: Final Summary of Issues Identified Through Scoping Process" for full details (SWCA Environmental Consultants 2017b). The geographic area included for analysis is unique to each resource and encompasses areas in which direct or indirect impacts would be expected to occur. The anticipated impacts on each resource are analyzed for all phases of the project (construction, operation, and post-closure); in some cases, the analysis may focus on the time period that would cause the maximum impact on that resource.

As with the issues, for brevity's sake, several other discussions in the EIS are only summarized, with the full details found elsewhere. For "Analysis Methodology, Assumptions, and Uncertain and Unknown Information," the intent is to provide enough information in the EIS for the reader to understand what tools were chosen for the analysis and any limitations of those tools. For "Relevant Laws, Regulations, Policies, and Plans," the intent is to briefly list the most pertinent items for the reader. Most of this information is captured in a detailed memorandum for the project record; a guide to the additional information available in these memoranda is included in appendix K.

The "Affected Environment" section describes the existing conditions for the resource. Existing conditions include effects of past, present, and ongoing actions that are occurring or have occurred within the analysis area.

The “Environmental Consequences” section describes the impacts of the proposed action or alternatives on the environment. Impacts include both the direct effects and indirect effects of the proposed action or alternatives. Direct effects are caused by the action and occur at the same time and in the same place. Indirect effects are caused by the action and are later in time and/or farther removed in distance but are still reasonably foreseeable. Where alternatives have similar (though not necessarily identical) impacts, all alternatives may be discussed together, to be followed if needed by a discussion of the impacts that differ substantially between the alternatives.

The “Environmental Consequences” section also describes the cumulative impacts of the proposed action or alternatives. A cumulative impact is one that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, which are those Federal or non-Federal activities not yet undertaken for which there are existing decisions, funding, or identified proposals (36 CFR 220.3). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

As noted above, cumulative impacts are the combination of impacts from the proposed action or alternatives with other past, present, and reasonably foreseeable future actions. Past and present actions contribute to the existing condition of the affected environment in the project area and are included under the “Affected Environment” heading. The additional effects of the proposed action or alternatives are discussed under the “Environmental Consequences” heading. To assess cumulative impacts, those effects must then be considered in conjunction with the effects of “reasonably foreseeable” future actions, as long as they overlap in both space and time.

A “reasonably foreseeable” action is one that is likely to occur in the future and does not include those that are speculative. The Forest Service compiled a list of future actions to form the basis for the cumulative effects analysis and applied specific criteria to determine whether they were reasonably foreseeable or speculative (Newell et al. 2020); the list of reasonably foreseeable actions was updated twice more, in 2023 and 2024 (Debauche 2023; SWCA Environmental Consultants 2024). Only the effects of those actions determined to be reasonably foreseeable—and determined to overlap spatially and temporally with effects from the proposed action or alternatives—are included in the “Cumulative Effects” section of each resource (Debauche 2023; SWCA Environmental Consultants 2020b).

Chapter 4 describes the process undertaken for the cumulative effects analysis and the resulting outcome. This changed since the DEIS, with the intention of developing a more quantitative and specific cumulative effects analysis. Chapter 4 also includes additional, expansive discussions, including the effects of future meteorological trends and regional water supplies. The cumulative effects analyzed in chapter 4 are summarized in each resource section in chapter 3.

As described in chapter 2, the Forest Service developed a comprehensive set of mitigation measures that, where practical and technically feasible to implement, would serve to avoid, minimize, rectify, reduce, or compensate for resource impacts identified during effects analyses conducted for this EIS. Concurrent with these mitigation measures, monitoring plans have been developed that would be used to gauge the effectiveness over time of each mitigation measure. If prior experience or analysis shows that a given mitigation measure is likely to reduce but is unlikely to eliminate an impact, an assessment was made to characterize the nature and scale of the anticipated residual impact. Thus, each chapter 3 resource section includes discussions of applicable mitigation measures, monitoring plans, and unavoidable adverse impacts.

3.2 Geology, Minerals, and Subsidence

3.2.1 Introduction

This section presents an overview of the geology and mineral resources within the analysis area, analyzes the estimated extent, amount, and timing of potential land subsidence resulting from underground mining activities, and the potential impacts on cave and karst resources, paleontological resources, and mining claims.

Some aspects of the analysis are briefly summarized in this section. Additional details not included are captured in the project record (Newell and Garrett 2018a).

> **Overview**
>
> Perhaps the most dominant feature of the proposed Resolution Copper Mine is the great size and depth of the ore body; for this reason, Resolution Copper plans to extract the ore from below, using gravity, in a technique known as "block caving" or "panel caving." However, removal of such a large volume of rock would result in a subsidence crater at the Oak Flat Federal Parcel. The subsidence crater would be approximately 1.8 miles wide and between 800 and 1,115 feet deep. Along with a discussion of subsidence impacts, this section of the EIS describes known geological characteristics at each of the major facilities of the proposed mine, including alternative tailings storage locations, and how the development of the project may impact existing cave and karst features, paleontological resources, mining claims, and geological hazards.

3.2.1.1 Changes from DEIS

We received a number of detailed comments on the DEIS regarding subsidence and mining techniques. To assist in review and response to comments, we reconvened the Geology and Subsidence Workgroup. These comments did not result in major changes to modeling technique but did lead to a number of clarifications of model outcomes in this section. The Geology and Subsidence Workgroup also assisted in guiding changes to the subsidence monitoring plans for the project.

Other comments were concerned with seismic analyses. New seismic studies were completed for the Skunk Camp location, along with specific investigations into activity of mapped faults within the footprint of the tailings storage facility. A number of other field investigations were conducted at the Skunk Camp location between the DEIS and FEIS. A complete listing of these new investigations is included in this section and referenced in later resource sections where appropriate.

The cumulative effects analysis was revised for the FEIS to better quantify impacts and is described in detail in chapter 4 and summarized in this section. Any mitigations developed between the DEIS and FEIS are summarized in appendix J, and if applicable to geology and subsidence, are analyzed for effectiveness in this section.

3.2.1.2 Changes from the January 2021 Rescinded FEIS

Since January 2021, this section has been revised to include a discussion of the ramifications of the "Rosemont ruling" on the Resolution Copper Project and updated to reflect analysis of consistency with the new "Tonto National Forest Land Management Plan," implemented in December 2023.

3.2.2 Analysis Methodology, Assumptions, and Uncertain and Unknown Information

3.2.2.1 Analysis Area

The analysis area for geology, minerals, and subsidence considers the potential direct effects of panel cave mining, the associated recovery of economic minerals, the footprint disturbance of all proposed facilities, and the exchange of Federal lands for private lands ("offered lands"). These areas are shown in figure 3.2.2-1.

Indirect effects are those caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Potential indirect effects on geology and minerals could be related to the following:

- The area of groundwater dewatering, which could impact hydrogeological and geotechnical properties, as well as result in additional subsidence. Assessment of additional subsidence from groundwater dewatering is discussed in Section 3.7.1, Groundwater Quantity and Groundwater-Dependent Ecosystems.
- The reactivation of geological structures, such as joints and faults directly adjacent to the area of panel caving and subsidence, or in the region. These impacts are assessed in this section.
- Subsidence-related impacts on caves, karst resources, and mine shafts and adits in the analysis area. These impacts are assessed in this section.
- Changes to mineral availability as a result of the proposed land exchange, which in some cases may remove land parcels from mineral entry.

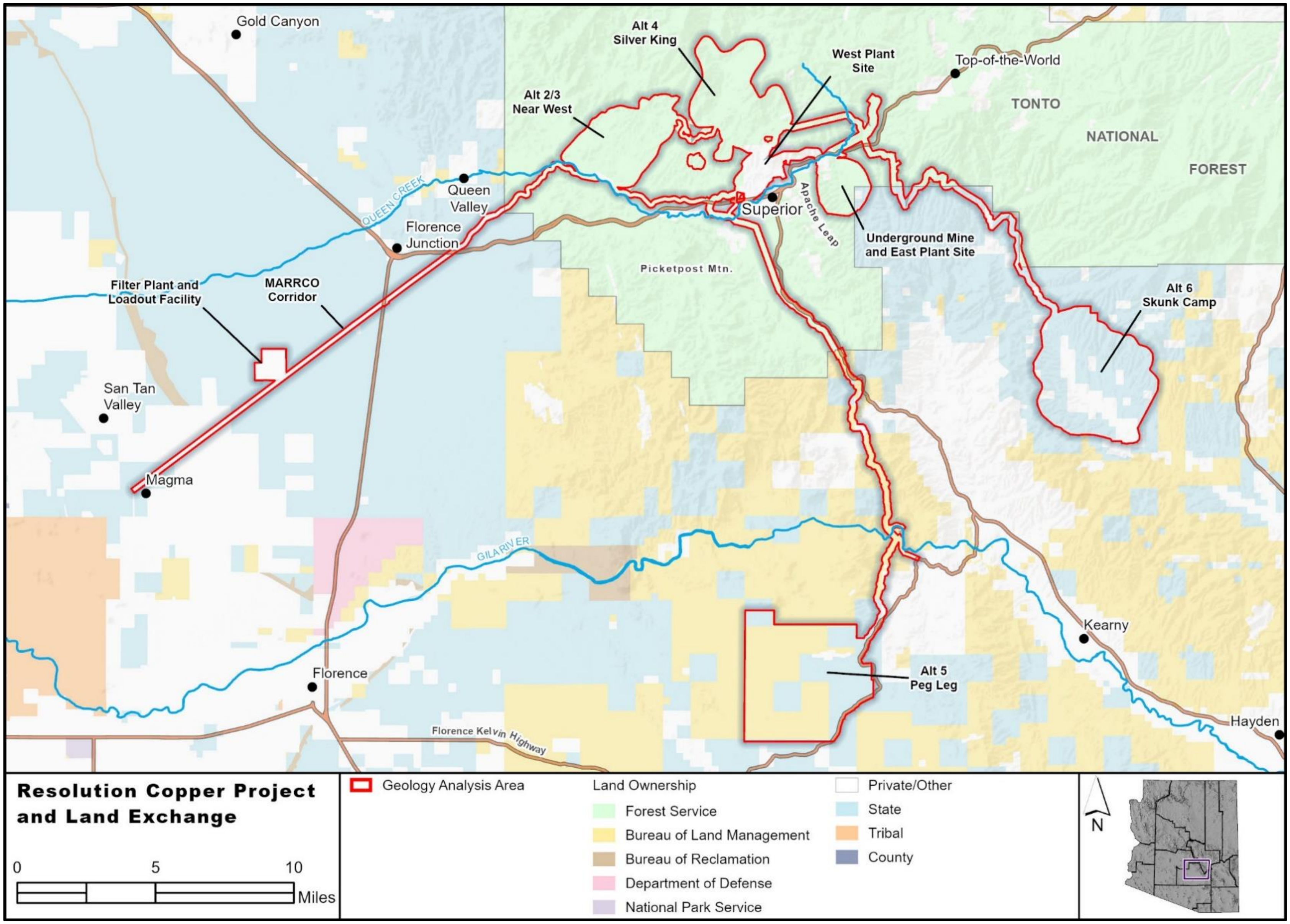


Figure 3.2.2-1. Geology, minerals, and subsidence analysis area

3.2.2.2 Surface Subsidence Review

Note that two different types of subsidence have been raised as concerns for the Resolution Copper Project. This section of the EIS addresses surface subsidence that occurs at the mine site due to the block-cave mining itself. Possible subsidence resulting from groundwater pumping for the mine water supply is addressed in section 3.7.1.

The understanding of regional and local geology relied on USGS maps, geological mapping data provided by Resolution Copper, and mineral resource information from Resolution Copper reports and published resource information. Subsidence effects were originally assessed in the GPO (Resolution Copper 2016c), but Resolution Copper conducted further modeling of the proposed caving operations, estimated the extent and depth of ground surface subsidence, and evaluated the potential impact on Apache Leap, Devil's Canyon, and the serviceability of U.S. 60 (Garza-Cruz and Pierce 2017, 2018).

The Tonto National Forest formed a Geology and Subsidence Workgroup to direct and evaluate this work. In 2017 and 2018, the Geology and Subsidence Workgroup submitted five formal data requests to Resolution Copper and participated in two site visits and seven technical meetings as part of the review. This review is documented in "Resolution Copper Project and Land Exchange Environmental Impact Statement: Geologic Data and Subsidence Modeling Evaluation Report" (BGC Engineering USA Inc. 2018a).

Resolution Copper developed an estimate of surface subsidence based on a three-dimensional numerical model of the proposed panel caving operation using an industry-standard model called FLAC3D (Garza-Cruz and Pierce 2017). The numerical model simulated caving and predicted ground surface subsidence, fracture limits, and cave angle (figure 3.2.2-2). The fracture limit consists of an area around the actual caved area in which the ground surface could be broken with open tension cracks and is the outer limit of any potential large-scale surface cracking (or fracturing). Cave angle is a key factor in estimating the extent of the surface subsidence. The model estimates a subsidence cave angle on the order of 70 to 78 degrees (angle varies with depth), with the cave fractures breaking through to the surface by year 6 of operations.

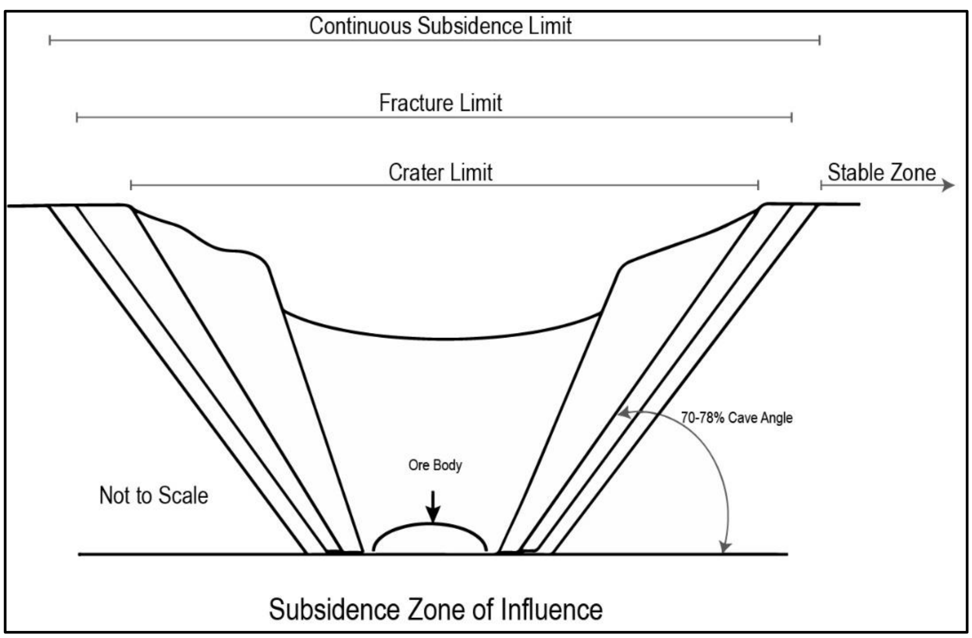


Figure 3.2.2-2. Conceptual cross section of the block-cave and subsidence zone

After reviewing Resolution Copper's geological data and subsidence modeling, the Geology and Subsidence Workgroup concluded the following:

- All aspects of geological data collection, including drilling, sample recovery, core logging, data management, and laboratory testing, met or exceeded industry standards.
- Resolution Copper's interpretations of geological structures, faults, rock properties, geotechnical data, and assumptions are reasonable.
- Geological data outside the mineralized zone, as well as for the Camp and Gant Faults, are not as well represented statistically as in the mineralized zone. To address this, conservative modeling assumptions and sensitivity analyses were used to account for sparse data in these areas.
- Resolution Copper's interpretations of subsidence are reasonable; therefore, the Geology and Subsidence Workgroup did not propose any alternative interpretations. However, there are numerous input variables and several layers of interpretation involved in modeling surface subsidence. There are several areas of uncertainty and some areas of sparse or low confidence data; actual surface subsidence could vary from the modeled results.

There is a great deal of interpretation required throughout the entire process, from data collection to testing and analysis, to model input and interpretations, and sensitivity runs. There are two approaches that consider the certainty of the geological and subsidence models. Both approaches were included in the Geology and Subsidence Workgroup review and are discussed in more detail in BGC Engineering USA Inc. (2018a).

- One approach to address uncertainty is empirical, meaning the model results are compared with what has been observed at other similar mines with similar geological settings. The modeled cave angle was compared with the observed cave angles from a database of more than 100 cave mining operations throughout the world, including both historical mines that have ceased to operate and those still producing (Woo et al. 2013); the historic database suggests a range from 72 to 84 degrees, which corresponds well with the modeled results (BGC Engineering USA Inc. 2018a). A probabilistic study also was conducted and predicted cave angles from 74 degrees to 79 degrees (two standard deviations), with an average of 77 degrees (Cancino et al. 2019b). In a similar way, the conservativeness of the key rock units (Whitetail Conglomerate and Apache Leap Tuff units) was assessed by comparing results to actual measurements collected using underground instruments during the construction of Shaft #10.
- A second approach to address uncertainty is to vary the input parameters to reasonable upper and lower limits to see the resulting cave geometric response (i.e., sensitivity analyses).

Post-DEIS Activities for Geology and Subsidence Workgroup

The Forest Service reconvened the Geology and Subsidence Workgroup after receipt of public comments on the DEIS, in order to help evaluate and review comments and develop necessary analysis in response to the comments.

The Geology and Subsidence Workgroup review is summarized in BGC Engineering USA Inc. (2020a) and resulted in the following:

- Further evaluation of the reasonableness and applicability of alternative mining techniques, other than block caving. After evaluation of additional industry references, safety concerns, and concerns about data availability, the conclusion remains that alternative mining techniques are unreasonable for the Resolution deposit. This is discussed in more detail in chapter 2.

- Evaluation of whether two purported faults identified in the public comments were excluded from the subsidence analysis. After review, the Geology and Subsidence Workgroup determined that both of these faults already were known and explicitly included in the subsidence modeling.
- Evaluation of an attempt to assign uncertainty to the subsidence modeling. In reality, the Geology and Subsidence Workgroup already incorporated uncertainty into the subsidence modeling effort and disclosed a range of possible outcomes in the DEIS. The approach suggested in public comments was evaluated and the results of this analysis are included in this section.
- Evaluation of comments related to seismic hazard analysis. The Geology and Subsidence Workgroup found that comments on seismicity did not reflect the full suite of seismic analysis conducted for the site, and misconstrued the seismic design parameters. These comments resulted in no changes; however, as noted below, additional investigations were completed regarding site-specific seismic hazards at the Skunk Camp location, and the possibility of active faulting in the Skunk Camp location.
- Collaboration to review and rework the subsidence monitoring plan to address Forest Service concerns and concerns raised in public comments. This step was identified by the Forest Service in the DEIS (mitigation measure FS-222), and resulted in a revised subsidence monitoring plan (Davies 2020a). This plan is discussed in more detail in the "Mitigation Effectiveness" section below.
- Evaluation of other methods of describing outcomes of the subsidence modeling, specifically addressing the concern that ground movement beyond the limits of the subsidence area might jeopardize Apache Leap. Further discussion of how to interpret the subsidence modeling outcomes is included in this section.
- Further evaluation of possible induced seismicity from the block caving, which is included in this section.

3.2.2.3 Geological Hazards

Three types of geological hazards are evaluated: the potential for induced seismicity or reactivation of faults caused by the project; public access to the subsidence area; and the potential for rockfall or other changes to Apache Leap. Potential seismic hazards that could affect the mine or tailings storage facility are analyzed primarily through site-specific seismic hazard analyses. The potential for induced seismicity is analyzed primarily using analog data observed at other mining sites. The potential for changes to Apache Leap is derived from the subsidence modeling results, and by assessing the changes in stresses and movement caused by the subsidence.

Many of the various rock units and tailings have potential to be acid generating when exposed to oxygen and moisture, resulting in the potential to create water quality problems. This issue is fully evaluated in section 3.7.2 and is not included here as a geological hazard.

3.2.2.4 Paleontological Resources

The probability of finding paleontological resources can be broadly predicted from the geological units present in the analysis area.

3.2.2.5 Caves and Karst Resources

Some cave resources are known to exist in the analysis area, derived from general knowledge of geology and recreation Forest Service specialists. Aside from these known resources, the probability of finding cave resources can be broadly predicted from the geological units present in the analysis area.

3.2.2.6 Unpatented Mining Claims

The known unpatented mining claims associated with the analysis area were taken from comprehensive claims databases administered by the BLM. The focus of this analysis is on claims that are not related to the Resolution Copper Project, but that could be impacted by the project.

3.2.3 Affected Environment

Primary Legal Authorities and Technical Guidance Relevant to the Geology, Minerals, and Subsidence Analysis

- U.S. mining laws, implemented through regulation for administration of locatable minerals (36 CFR 228 Subpart A)
- Paleontological Resources Preservation Act (16 U.S.C. 470aaa through 470aaa-11), implemented through Paleontological Resources Preservation regulations (36 CFR Chapter 2, Part 291)
- Federal Cave Resources Protection Act of 1988 and its implementing regulations at 43 CFR Part 37

3.2.3.1 Relevant Laws, Regulations, Policies, and Plans

Metals and other mineral resources on NFS lands are managed in accordance with the Mining and Minerals Policy Act of 1970, which states that the Federal Government should "foster and encourage private enterprise in the development of economically sound and stable industries, and in the orderly and economic development of domestic resources to help assure satisfaction of industrial, security, and environmental needs." Administration of locatable mineral resources on NFS lands follows direction in Federal regulations (36 CFR 228 Subpart A); locatable minerals are those subject to claim and development under the General Mining Law of 1872, as amended.

The Multiple-Use Mining Act of 1955 reaffirms the right to conduct mining activities on public lands, including mine processing facilities and the placement of mining tailings and waste rock. Although a right to conduct mining activities exists, proposals must comply with applicable Federal and State environmental protection laws, and the Forest Service can require reasonable measures, within its authority, to minimize impacts on surface resources (see 30 U.S.C. 612 and 36 CFR 228.1). Mining claim location and demonstration of mineral discovery are not required for approval of locatable minerals operations subject to Forest Service regulations at 36 CFR 228 Subpart A.

One of the alternatives would involve construction of a tailings storage facility on BLM land instead of NFS land. BLM operates under different mining regulations (43 CFR 3809), but also has limited discretion for approving mining operations, provided the mine complies with applicable Federal and State environmental protection laws. As noted in chapter 1, BLM would require the submittal of a separate mining plan of operations to determine whether unnecessary or undue degradation would occur (43 CFR 3809.11(a)) and could require reasonable mitigation measures if determined necessary.

The Alternative 6 tailings storage facility does not involve any Federal land, although the pipeline and/or power line corridors would cross Tonto National Forest lands. Activities and resource impact occurring on lands occupied by the tailings storage facility would not be regulated under either Forest Service or BLM regulations, though Resolution Copper committed to using the same environmental protection measures and mitigation.

Ramifications of the Rosemont Copper Ruling

DISTRICT COURT RULING AND APPEAL

In 2007, Augusta Resource Corporation, the parent company of Rosemont Copper Company (Rosemont), submitted a preliminary mine plan of operations (MPO) to the Coronado National Forest for development of a proposed open-pit copper mine. The proposed mine would produce 1.25 billion tons of waste rock and 660 million tons of tailings. The Forest Service evaluated five action alternatives, each of which would allow Rosemont to place 1.9 billion tons of material onto nearby NFS land on which it has mining claims.

The FEIS and draft record of decision was released in December 2013. In June 2017, the Forest Service issued a ROD adopting the FEIS and approving Rosemont's MPO with modifications.

After the Forest Service issued the ROD, several organizations and Tribal Governments filed suits that alleged violations of the Mining Law of 1872, the Organic Act of 1897, NEPA, and the Administrative Procedure Act. Another suit was based on the ESA. Rosemont intervened as a defendant in all three suits, and the suits were consolidated in the District of Arizona.

In 2019, the District Court granted summary judgment to plaintiffs in the first two suits, vacating the FEIS and ROD on the ground that the Forest Service's decision was inconsistent with the Mining Law and other Federal mining statutes, with NEPA, and with the Administrative Procedure Act.[34]

In its decision, the District Court disagreed with both grounds upon which the Forest Service had relied in approving Rosemont's MPO. First, the court held that the Forest Service had improperly relied on Section 612 of the Multiple-Use Act in concluding that Rosemont had not only a right to conduct mining on its valid claims, but also a right to all "uses reasonably incident thereto" on its mining claims, whether or not those claims were valid. The court wrote, "Nothing within the Multiple Use Act grants an implied right to use the surface outside of a claim."[35]

Second, the District Court held that the Forest Service had improperly assumed the validity of Rosemont's mining claims where the material would be placed. As noted above, a mining claim is valid only if valuable minerals have been found on the claim.[36] Because the administrative record shows that no valuable minerals have been found on Rosemont's claims, the District Court held that the Forest Service acted arbitrarily and capriciously in assuming that the claims were valid.

The District Court wrote:

> As Rosemont had unpatented mining claims covering those 2,447 acres, the Forest Service accepted, without question, that those unpatented mining claims were valid. This was a crucial error as it tainted the Forest Service's evaluation of the Rosemont Mine from the start.[37]

The court wrote further:

> The administrative record before the Forest Service reflected that there was no location of a valuable mineral deposit underlying the unpatented mining claims covering the 2,447 acres in question; as such, the record reflected that the unpatented claims were invalid. Nonetheless, the Forest Service assumed that the claims were valid, assumed that Rosemont had the right to use

---

[34] *Ctr. for Biological Diversity v. U.S. Fish & Wildlife Serv., 409 F. Supp. 3d 738 (D. Ariz. 2019).*

[35] *Ctr. for Biological Diversity, 409 F. Supp. 3d at 759.*

[36] See 30 U.S.C. §§ 22, 23, 26; *Cole, 252 U.S. at 296.*

[37] *Ctr. for Biological Diversity, 409 F. Supp. 3d at 747.*

> those 2,447 acres to support its mining operation (i.e., by dumping 1.9 billion tons of its waste on that land), and from those assumptions attempted to minimize the environmental and cultural impacts stemming from Rosemont's purported rights connected to their invalid unpatented mining claims.

The decision from the Arizona District Court was appealed to the Ninth Circuit Court of Appeals in February 2021. On May 12, 2022, the Circuit Court upheld the Arizona District Court's decision.

FURTHER COURT REVIEW

In February 2023, the court for the District of Nevada issued a decision for a proposed lithium mine on land near Thacker Pass administered by the BLM. The district court found that the Ninth Circuit Rosemont decision applied to the Thacker Pass case. In Thacker Pass, the district court found that BLM's approval of the project violated the FLPMA as it relates to the approximately 1,300 acres of land that would be buried under waste rock, because BLM did not first make a mining rights validity determination as to those lands.

The court concluded that BLM's decision as it relates to approval of land to be used for waste dumps violated FLPMA (43 U.S.C. 1732(b)) and is therefore arbitrary and capricious under the Administrative Procedure Act. The court remanded "for BLM to fix the error—to determine whether Lithium Nevada possesses valid rights to the waste dump and mine tailings land it intends to use for the Project."

The District Court wrote:

> The Court accordingly finds that the appropriate analysis under Rosemont looks through BLM's surface-management regulations to the Mining Law itself, and Rosemont makes clear that the approving federal agency must evaluate the mining project proponent's rights under lands they intend to use for waste dumps before they approve the use of that land for that purpose.

A similar ruling occurred in March 2023 related to the Eureka Moly case, in which a judge relied on the same principles to remand the record of decision back to the BLM.

IMPLICATIONS FOR THE RESOLUTION COPPER PROJECT

The court decisions resulting from the Rosemont Copper Project would likely have a bearing on some of the Resolution Copper Project alternatives, but not on others.

Alternatives 2, 3, and 4 would place tailings on unpatented mining claims on NFS land. Alternative 5 would place tailings on unpatented mining claims on BLM land. If one of these alternatives was selected for implementation, it is likely that the validity of these claims would need to be evaluated before the Forest Service or BLM could authorize the use of those lands for tailings storage.

Alternative 6 (Preferred Alternative) does not place tailings on unpatented claims on Federal land. Implementation of this alternative would not likely be influenced by court decisions relating to the Rosemont Copper Project.

3.2.3.2 Existing Conditions and Ongoing Trends

Regional Geology – East Salt River Valley, Superior Basin, and Oak Flat

The project is located within a geological region known as the Basin and Range province, near the boundary with another geological region known as the Arizona Transition Zone. The Basin and Range physiographic province is generally characterized by a series of mountain ranges separated by broad valleys filled with geologically young alluvium. The mountain ranges are typically bounded by faults that run northwest-southeast and north-south (Wong et al. 2013). At the northeastern edge of the Basin and

Range province is the Arizona Transition Zone, a mountainous region that rises toward the highlands of the Colorado Plateau in northeastern Arizona. The Arizona Transition Zone is geologically complex, but generally consists of belts of linear rugged ridges, separated by relatively narrow valleys.

West of Whitlow Ranch Dam and Gonzales Pass the East Salt River valley begins—a 30- to 40-mile-wide alluvial valley that is typical of the Basin and Range. The Desert Wellfield is located in the East Salt River valley, where groundwater is readily accessible in the extensive, thick, alluvial aquifers. General elevation of this area is about 1,500 feet amsl.

The area roughly east of Whitlow Ranch Dam and west of Apache Leap is called the Superior Basin. This area is where the town of Superior, the West Plant Site, and the Alternative 2 tailings storage facility are located. The Superior Basin is about 10 miles wide, and generally flat, but unlike the East Salt River valley, young alluvium is limited to areas along washes and the main drainage of Queen Creek. Between drainages, low ridges formed of older geological units dominate the Superior Basin. The most distinctive landform immediately in the Superior Basin is Picketpost Mountain, an isolated butte of Tertiary-aged rock[38] with a peak at 4,378 feet. Queen Creek originates in the Oak Flat Plateau, cuts a deep canyon through the Apache Leap escarpment, and flows west through the town of Superior before continuing southwestward across the Superior Basin. The Superior Basin generally lies about 2,200 to 2,900 feet amsl.

East of Superior lies the rugged Oak Flat Plateau, with an elevation of roughly 4,000 to 4,600 feet amsl. Oak Flat is about 3 miles wide, with the eastern edge formed by Devil's Canyon. On the west, the prominent Apache Leap escarpment forms the division between Oak Flat and the Superior Basin. The East Plant Site is located on Oak Flat, and the Resolution ore deposit is located below Oak Flat.

Regional Geological Units

Previous researchers and Resolution Copper have mapped the geology of the analysis area. The most recent detailed geological map is a compilation of published USGS mapping and Resolution Copper geological mapping (Hart 2016). A number of other useful sources also exist, including the GPO (Resolution Copper 2016c; Spencer et al. 1996). A summary of the main geological units from oldest to youngest is presented in this section, and these are intended to be used in conjunction with the tables and figures reproduced in Newell and Garrett (2018a).

Regional geology of the Superior Basin and Oak Flat is shown in figure 3.2.3-1 and shown as a conceptual cross section in figure 3.2.3-2. The abbreviations of the most common mapping units are included in the following text, which are commonly used on geological maps.

[38] The use of technical geological terms has been intentionally limited in the EIS. However, the relative age of geological units can be important to understanding and some geological time periods are commonly used to describe units. The following ages are the most commonly used, in order from youngest to oldest. The term "consolidated" means the unit is hard rock, whereas unconsolidated units are still loose, like soil or sand:

Quaternary – Refers to geologically young, largely unconsolidated units, that are less than 2.6 million years old.
Tertiary – Refers to geological units, largely consolidated, that are between 66 and 2.6 million years old.
Cretaceous – Refers to consolidated geological units that are about 145 to 66 million years old.
Paleozoic – Refers to consolidated geological units that are about 541 to 252 million years old.
Precambrian – Refers to the oldest geological units in the analysis area, older than 541 million years.

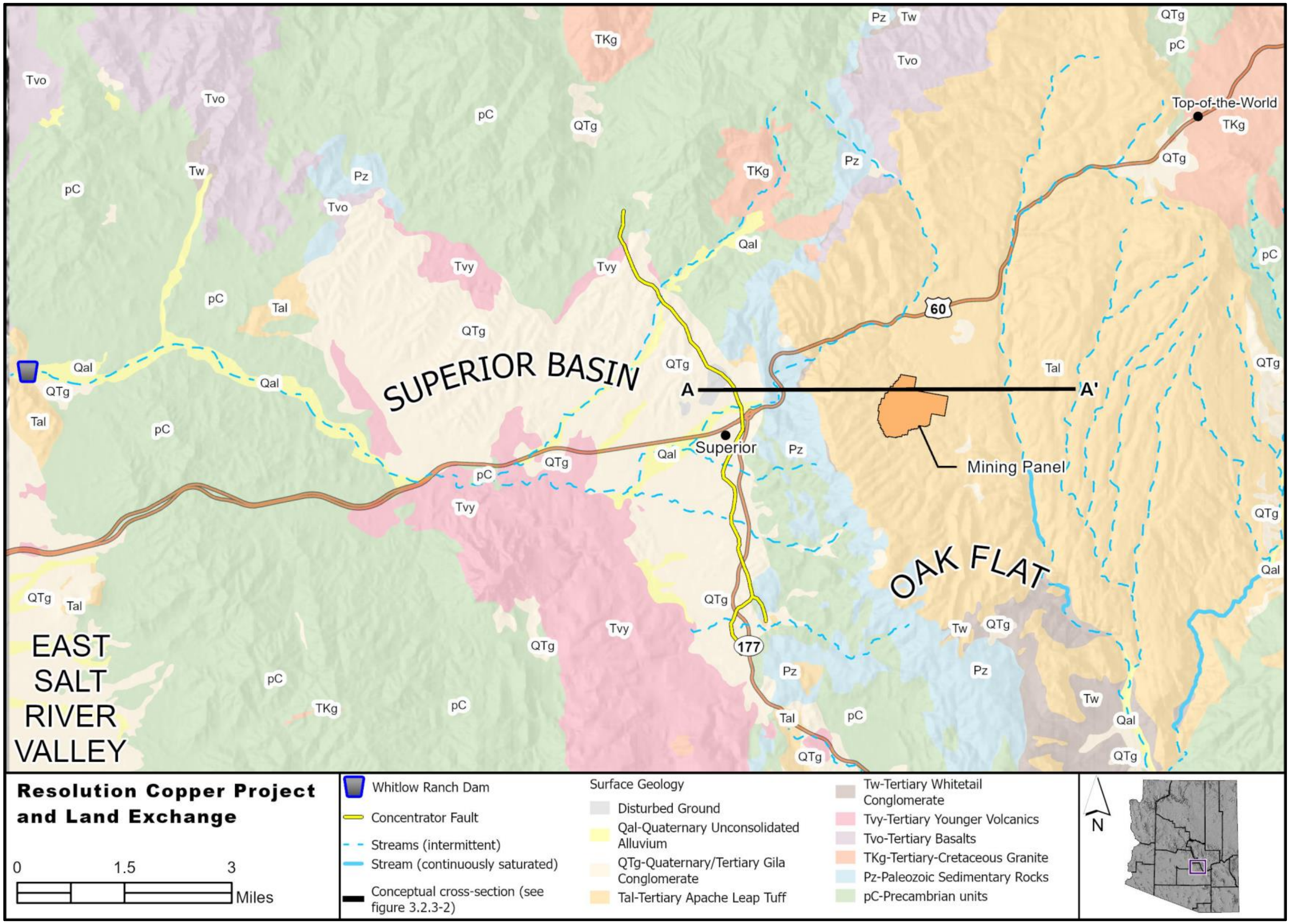


Figure 3.2.3-1. Generalized geological map of Superior Basin and Oak Flat

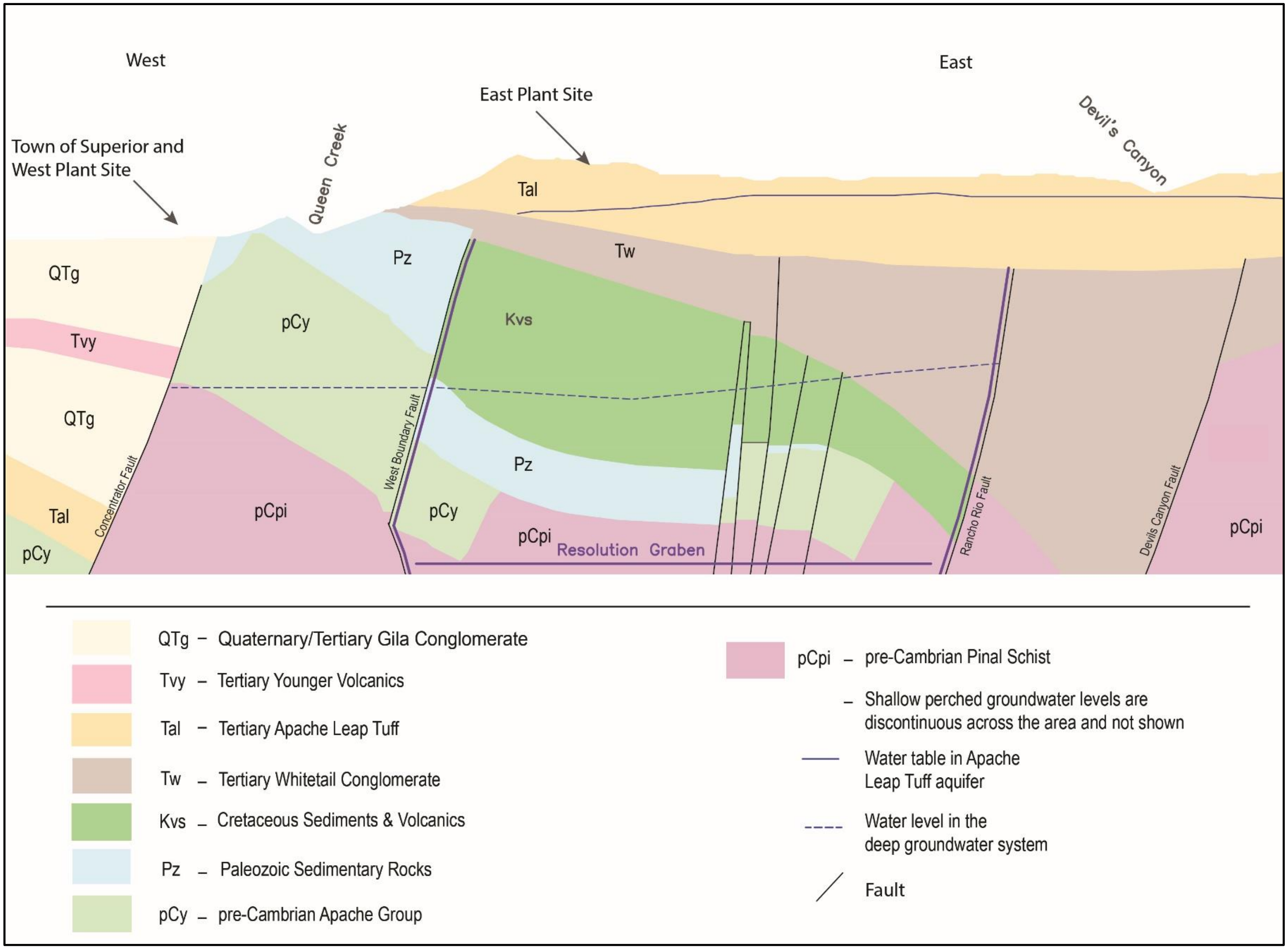


Figure 3.2.3-2. Generalized geological cross section (A–A')

PRECAMBRIAN UNITS

The oldest rock units in the analysis area are more than 1 billion years old and include the Pinal Schist (pCpi); the Apache Group (pCy), which includes sedimentary and metamorphic units like shale, quartzite, limestone, and basalt; and the Troy Quartzite. Intrusions of granite, granodiorite, diorite, and diabase are found throughout these sedimentary units. These rocks underlie the entire analysis area but are only exposed in the western part of the Superior Basin.

PALEOZOIC SEDIMENTARY UNITS

Overlying the Precambrian units are sequences of Paleozoic-age (Pz) sedimentary formations. From oldest to youngest these include the Bolsa Quartzite, the Martin Formation, the Escabrosa Limestone, and the Naco Limestone. These units are well-exposed in the hills rising toward the Apache Leap escarpment.

CRETACEOUS-TERTIARY VOLCANIC UNITS

Numerous types of volcanic intrusions, including sills, dikes, and stocks of granite and diorite are located throughout the area. One well-known unit is the Silver King quartz diorite north of the town of Superior. A particularly thick sequence of Cretaceous-age volcanoclastic rock (Kvs) has been observed within the Resolution Graben (the Graben is described in more detail later in this section), but these units are not known to outcrop anywhere in the analysis area (Kloppenburg 2017).

TERTIARY VOLCANOCLASTIC UNITS

Two units of key importance to both the analysis of subsidence and the analysis of impacts from groundwater drawdown are the Tertiary-aged Whitetail Conglomerate (Tw) and the Apache Leap Tuff (Tal). The older and deeper of these two geological units is the Whitetail Conglomerate, which consists of non-volcanic conglomerate and sandstone, as well as sedimentary breccia and mudstone. Overlying the Whitetail Conglomerate is the Apache Leap Tuff. The Apache Leap Tuff is a welded tuff of volcanic ash. It caps the Oak Flat Plateau and forms the escarpment of Apache Leap. The Apache Leap Tuff also forms the most important aquifer unit in the area, supporting the perennial flow in springs and in Devil's Canyon. The Whitetail Conglomerate is important hydrologically because it largely isolates groundwater in the Apache Leap Tuff from dewatering taking place in the deep groundwater system (see section 3.7.1).

GILA CONGLOMERATE

The Gila Conglomerate (Qtg) is widespread throughout the Superior Basin and elsewhere in Arizona, including at the Skunk Camp location. The Gila Conglomerate consists of coarse gravel, cobbles, and boulders, many of which are derived from the Tertiary volcanics. The formation outcrops predominantly on the west side of the Concentrator Fault in the Superior Basin, is over 3,000 feet thick in places, and forms much of the surface geology near the Alternative 2 and Alternative 3 tailings storage facility. The Gila Conglomerate has portions that are unconsolidated or only weakly consolidated, as well as consolidated areas. The Gila Conglomerate is generally Tertiary aged but has also been mapped along with Quaternary deposits. For the purposes of the mapping presented in this section, it is presented as both Quaternary and Tertiary deposits.

QUATERNARY ALLUVIAL DEPOSITS

Quaternary deposits (Qal) consist of recent and near-recent stream deposits in basins, fans, terraces, floodplains, and channel deposits, as well as landslide and colluvial deposits. Particles range in size from clay, silt, and sand, to gravels, cobbles, and boulders. These deposits are generally unconsolidated but may be weakly to strongly cemented by calcite (i.e., caliche deposits). These deposits underlie most streams in the area, forming shallow, alluvial aquifers that store and transmit groundwater, and in places support riparian vegetation and perennial flow (see section 3.7.1).

Structural Geology and Faults

Many of the faults of importance to the structural geology in the analysis area are typical of Basin and Range faults. These are north- to northwest-trending normal faults with downward movement to the west, with movement dating from Tertiary time (Hehnke et al. 2012). The Superior Basin is bounded by the Concentrator Fault to the east and by the Elephant Butte Fault to the west. The Concentrator Fault is historically important as it displaces the Magma ore vein to an unknown depth and therefore defined the western limit of production in the Magma Mine. The Elephant Butte Fault is a major west-side-down normal fault that is located along the west side of Gonzales Pass and crosses Queen Creek east of Queen Valley near Whitlow Ranch Dam (Ferguson and Skotnicki 1996).

The Resolution ore deposit, lying about 4,500 to 7,000 feet below Oak Flat, is located in a structural feature called the "Resolution Graben." A graben is a block of earth's crust that is bounded by faults. The area within a graben has moved down relative to the area outside of the graben. The Resolution Graben is bounded by the West Boundary, North Boundary, South Boundary, Conley Springs, and Rancho Rio Faults. The Resolution Graben is hydrologically important because these faults tend to impede groundwater flow (WSP USA 2019). As such, much of the lowering of groundwater levels due to the dewatering that has taken place in the deep groundwater system since 2009 has been limited to the Resolution Graben (see section 3.7.1).

The analysis area has undergone multiple episodes of folding and faulting since the Precambrian. Geological structures, and rotation, thickness, and offset of the geological units in the area (see figure 3.2.3-2) are the result of this series of large-scale structural movements and deformation. The late Cretaceous to early Tertiary Laramide Orogeny caused northeast-trending shortening, which resulted in basement core uplifts and folding along range-front thrust faults across large portions of the western United States (Kloppenburg 2017). Laramide-style compression was followed later in the Tertiary by regional extension, which resulted in fault-block style deformation—which creates the alternating mountain and valley topography that characterizes the region.

Mineral Resources

GENERAL MINERAL OCCURRENCE

Mineral occurrences in the analysis area include a range of metallic, non-metallic, and industrial minerals. There is a more than 100-year history of silver and copper mining near the analysis area, and several operations continue to contribute to the region's economy. In addition to the nearby formerly producing Magma and Silver King mines, over 30 (active or inactive) mines are regionally located near what is known as the "Copper Triangle." These represent a variety of operations but primarily include copper, gypsum, and marble mining. The closest currently active major copper mines are the Ray Mine, approximately 9 miles south of the analysis area, the Pinto Valley Mine, approximately 14 miles northeast of the analysis area, and the Carlota Mine, also northeast of the analysis area. These mines are open-pit operations, but, like the Resolution ore deposit, they are large tonnage, low-grade copper porphyry deposits (Kloppenburg 2017).

RESOLUTION ORE DEPOSIT

The Resolution ore deposit is approximately 64 million years old and is a porphyry copper-molybdenum deposit. It lies approximately 4,500 to 7,000 feet below Oak Flat. As defined by the 1 percent copper shell, the deposit extends over an area of at least 1.2 miles in an east-northeast direction, and 0.9 mile in a north-northwest direction. A detailed description of the deposit and associated mineralization is included in Hehnke et al. (2012).

Rock types with diabase, limestone, and local breccia host and control the strongest copper mineralization. Quartz-rich sedimentary rocks and Cretaceous-Tertiary intrusive rocks demonstrate the strongest molybdenum mineralization. The highest copper grades (greater than 3 percent) are located in the upper central portion of the deposit associated with a large hydrothermal breccia body and hosted primarily in breccia and diabase. The total mineral resource at the Resolution ore deposit is currently estimated (indicated and inferred) to be 1,970 million tons (1,787 million metric tonnes), with an average grade of 1.54 percent copper and 0.035 percent molybdenum (Rio Tinto 2018).

The location and geometry of the mineralization are structurally controlled by several generations of faulting that occurred before, during, and after mineralization. Chalcopyrite is the dominant copper mineral in the deposit, with lesser chalcocite and bornite. Molybdenum occurs primarily as molybdenite. The deposit is associated with hydrothermal alteration and includes a strong pyrite "halo" in the upper areas of the deposit, containing up to 14 percent pyrite. This mineralization has ramifications for water quality, as all of these are sulfide-bearing minerals and have the potential to interact with oxygen and cause water quality problems (acid rock drainage), as discussed in detail in section 3.7.2.

Tailings Storage Facility for Alternatives 2 and 3 – Near West

GENERAL GEOLOGY

The proposed tailings storage facility site for Alternatives 2 and 3, known as the Near West site, is located approximately 3 miles west of the town of Superior and 3 miles east of the community of Queen Valley, between Roblas Canyon on the west and Potts Canyon on the east. A number of geological units underlie the tailings storage facility footprint. Quaternary alluvial deposits are found along the washes, separated by a series of parallel ridges formed of older rocks. The majority of the area is underlain by Gila Conglomerate, with older Pinal Schist under the southwestern portion of the proposed tailings embankment, and smaller areas of Precambrian Apache Group, Paleozoic sedimentary rocks, Tertiary Apache Leap Tuff, and other volcanics (Spencer and Richard 1995).

FOUNDATION CONSIDERATIONS

The Near West location is unique out of the alternative tailings locations in that Resolution Copper has completed geotechnical investigations at the site (Golder Associates Inc. 2017; Klohn Crippen Berger Ltd. 2017). Findings from site investigations (Klohn Crippen Berger Ltd. 2017) and other studies (Klohn Crippen Berger Ltd. 2018a, 2018b) at the Near West site include the following foundation considerations, which would need to be factored into the design:

- Some units exhibit weak foundation conditions. These include zones with weak clay layers, zones of potentially collapsible soils (including in the Gila Conglomerate), and weakness parallel to foliation (in the Pinal Schist). These conditions potentially could affect embankment stability.
- Dissolution features, such as voids and open joints, are present in the Mescal Limestone (part of the Apache Group), particularly near the contact between the limestone and an intruded diabase. Resolution Copper has noted open joints in numerous units, including the Gila Conglomerate, and a single high-angle fault with approximately 6 feet of normal displacement was also observed in the Gila Conglomerate. Heavy fracturing was observed in the Pinal Schist. These conditions potentially could affect embankment stability or seepage movement and capture.
- An abandoned mine, Bomboy Mine, is within the southwest corner of the tailings storage facility.

Tailings Storage Facility for Alternative 4 – Silver King

GENERAL GEOLOGY

The Alternative 4 – Silver King tailings storage facility site is approximately 2 miles from the West Plant Site and would occupy the lower end of Silver King Canyon, the lower portion of Whitford Canyon, and Peachville Wash. The Silver King site is approximately 5 miles northeast the Alternative 2 tailings storage facility site and shares similar foundation geology. The majority of the geology underlying the tailings facility footprint is Precambrian Pinal Schist, but numerous other geological units are present, including Apache Group units, Bolsa Quartzite, and Tertiary volcanic rocks. Unconsolidated Quaternary alluvial deposits are limited to ephemeral drainages.

Historical mining and exploration have taken place within or near the Silver King site, though the tailings storage facility footprint has been designed to avoid existing mining operations at the Silver King Mine itself (Klohn Crippen Berger Ltd. 2018c), which is 0.7 mile east of the site. The Silver King Mine workings are not expected to extend within the footprint of the tailings storage facility. Silverona Mine, Fortuna Mine, Black Eagle Mine, and "Unnamed Mine" are located near or in Peachville Wash. Also, the McGinnel Claim is at the intersection of the Main and Concentrator Faults, approximately 0.5 mile north of Silver King Wash, and within the footprint of the tailings facility.

FOUNDATION CONSIDERATIONS

No site-specific geotechnical investigations have been performed at the Silver King site. In general, many of the site characteristics at Silver King are anticipated to be similar to the Near West site, where geological units are the same. The following foundation considerations have been noted that would need to be factored into the design:

- One major difference noted by Klohn Crippen Berger (2018c) is the presence of potentially liquefiable (e.g., loose granular deposits that are saturated or will become saturated) soils in the Quaternary alluvium and in landslide deposits associated with weak foliation in Pinal Schist. These conditions potentially could affect embankment stability.
- Abandoned mine workings within the tailings storage facility footprint could collapse beneath the tailings piles (Klohn Crippen Berger Ltd. 2018c), but none are known specifically to exist at this time.

Tailings Storage Facility for Alternative 5 – Peg Leg

GENERAL GEOLOGY

Most of the project facilities are located within the East Salt River valley (filter plant and loadout facility, Desert Wellfield), the Superior Basin (West Plant Site, tailings storage facilities under Alternatives 2, 3, and 4), and Oak Flat (East Plant Site). However, two of the alternative tailings storage facilities are located at some distance from the Superior Basin: Alternative 5 (Peg Leg) and Alternative 6 (Skunk Camp).

The Alternative 5 tailings storage facility (also known as the Peg Leg location), is located approximately 15 miles south of the West Plant Site and south of the Gila River, in a flat, northwest- to southeast-trending valley with Donnelly Wash (a tributary to the Gila River) as its main drainage (figure 3.2.3-3). This drainage lies at the eastern edge of the Basin and Range province and is typical of that geology. Alternative 5 is primarily underlain by a flat valley of Quaternary alluvial material, bounded by sedimentary and granitic rocks, although these hard rock areas do not rise to a great height and instead form a series of low hills at the margins of the valley.

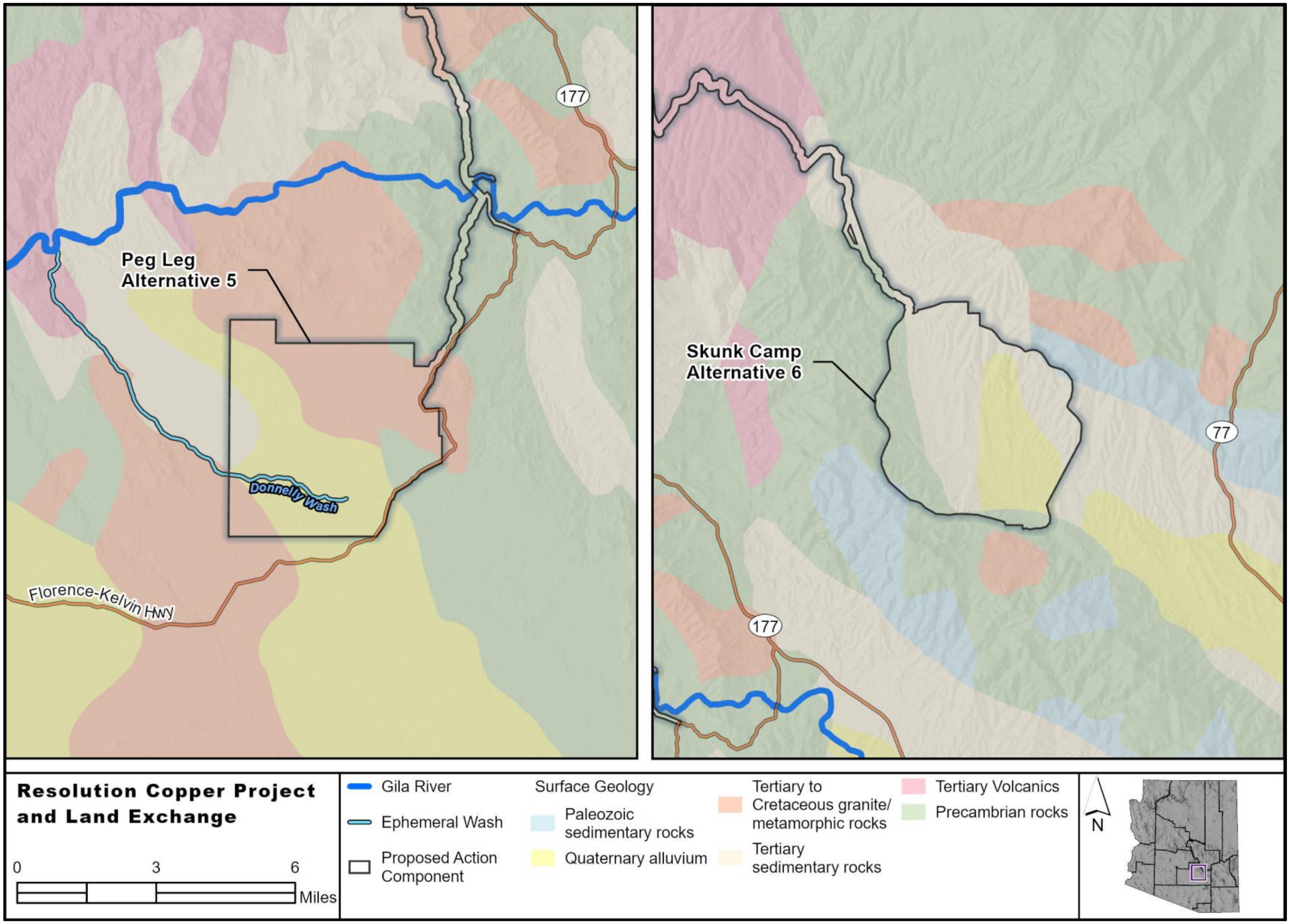


Figure 3.2.3-3. Generalized geological map of Peg Leg and Skunk Camp locations

The PAG tailings for Alternative 5 would be located to the east side of the facility and would be underlain by granitic rocks that include Precambrian Ruin Granite and Tertiary Tea Cup Granodiorite. The NPAG tailings would be located on alluvial deposits, including some travertine near the western boundary of the project site (Golder Associates Inc. 2018a).

FOUNDATION CONSIDERATIONS

- Current foundation characterization for the Peg Leg site is based on surficial geology mapping, site reconnaissance, geophysical surveys (electrical resistivity, refraction seismic surveys, and gravity surveys), local well logs, and regional literature (Fleming, Kikuchi, et al. 2018; Golder Associates Inc. 2018a; Hydrogeophysics Inc. 2017). Fracture zones have been mapped on the bedrock surface near the Peg Leg tailings storage facility site, but there are no known active seismic features in the vicinity, and seismicity is expected to be similar to the Near West location.
- The Precambrian Ruin Granite and Tertiary Tea Cup Granodiorite are expected to have low permeability and high strength. However, well logs in the tailings storage facility area reviewed by Golder Associates (2018a) indicate that the granitic bedrock may be highly decomposed and weathered in areas, even to significant depths, which could indicate higher permeability and lower strength in these areas. These conditions potentially could affect embankment stability or seepage movement and capture.
- The presence of travertine may indicate shallow perched groundwater zones exist. These conditions potentially could affect embankment stability or seepage movement and capture.

Tailings Storage Facility for Alternative 6 – Skunk Camp

GENERAL GEOLOGY

Alternative 6 (also known as the Skunk Camp location) is located in a narrow northwest- to southeast-trending valley with Dripping Spring Wash (a tributary to the Gila River) as its main drainage. The Quaternary alluvium within the valley is bounded to the southwest by the Dripping Spring Mountains, and to the northeast by the Pinal and Mescal Mountains.

Underlying geological units are similar to Alternatives 2, 3, and 4, primarily Precambrian units such as Pinal Schist, overlain by Apache Group units, and Troy Quartzite (see figure 3.2.3-3). The valley itself is infilled with Gila Conglomerate, estimated to be over 1,500 feet thick in some locations. Quaternary alluvium partially covers the conglomerate and is present along the valley bottom and drainages. Occasional travertine deposits have been observed in valley walls.

ADDITIONAL SITE INVESTIGATION

A number of field investigations at Skunk Camp were finished and reported after publication of the DEIS (Fleming, Shelley, et al. 2018; KCB Consultants Ltd. 2019; Montgomery and Associates Inc. 2019a, 2020e, 2020g; WestLand Resources Inc. and Montgomery and Associates Inc. 2020; Wong et al. 2020a). These investigations included the following:

- Field mapping, including ground-truthing of geology maps, mapping surficial geological units, and surface fault assessment (KCB Consultants Ltd. 2019)
- Conducting a reconnaissance of existing groundwater wells (Fleming, Shelley, et al. 2018; Montgomery and Associates Inc. 2020g)
- Conducting a surface geophysics (seismic refraction and electrical resistivity) to determine depth of alluvium. Three lines total were surveyed: one in November 2018 (KCB Consultants Ltd. 2019) and two in January 2020 (Montgomery and Associates Inc. 2020g).

- Digging test pits (6) to log near-surface stratigraphy, obtain samples for laboratory testing, and conduct infiltration tests (KCB Consultants Ltd. 2019)
- Installing drill holes (12 air-rotary; 13 diamond) to map stratigraphy, conduct downhole geophysics, conduct in-situ density tests, conduct falling head tests and packer tests, obtain soil and rock samples for laboratory testing, measure groundwater levels, and obtain water quality samples (KCB Consultants Ltd. 2019)
- Installing 14 wells/piezometers in boreholes in the area of the tailings storage facility (KCB Consultants Ltd. 2019), and an additional 9 wells (some nested) downstream along Dripping Spring Wash (Montgomery and Associates Inc. 2020g)
- Conducting slug tests (7), specific capacity tests (2), variable rate pumping tests (2), and constant rate pumping and recovery tests (2) for wells in the area of the tailings storage facility (KCB Consultants Ltd. 2019); a separate round of constant rate pumping and recovery tests (7) and injection tests (2) in the area of the tailings storage facility (Montgomery and Associates Inc. 2019a); and additional constant rate pumping and recovery tests (4) and injection tests (2) downstream along Dripping Spring Wash (Montgomery and Associates Inc. 2020g)
- Measuring water quality from 42 groundwater samples from 22 locations and 29 surface water samples from 14 locations (Montgomery and Associates Inc. 2020e)
- Conducting laboratory geotechnical tests on soil and rock samples, including unconfined compression tests, grain sizing, hydrometers, Atterberg limits, specific gravity, Proctor compaction, hydraulic conductivity, and geochemical sampling (KCB Consultants Ltd. 2019)
- Measuring groundwater levels at 29 locations (Montgomery and Associates Inc. 2020e)
- Surveying seeps and springs in the project area. Twenty-three potential springs were identified in the Skunk Camp area. Three springs were not located and 20 were surveyed. Fifteen of these are persistent enough to warrant long-term monitoring (WestLand Resources Inc. and Montgomery and Associates Inc. 2020).
- Conducting a site-specific seismic hazard assessment (Wong et al. 2020a)

The additional site investigations generally confirmed and did not fundamentally alter the understanding of the geology or hydrology at the location. Specific outcomes include the following:

- The thickness of the Quaternary alluvial deposits generally is less than 100 feet in depth. Where present, drilling identified thickness of alluvium from 11 to 75.5 feet (KCB Consultants Ltd. 2019).
- The thickness of the Gila Conglomerate was not fully characterized, as the base was only encountered in four drill locations. At those locations the Gila Conglomerate ranged up to 985 feet in thickness (KCB Consultants Ltd. 2019). Combined with historic drill data, the maximum thickness is still estimated to be over 1,500 feet in some areas.
- The presence of previously mapped faults was not identified within the tailings storage facility footprint, by surface expression or in deep drilling. The Dripping Springs fault was confirmed by drilling outside the facility footprint, and based on aquifer testing there may be enhanced flow associated with this fault (Montgomery and Associates Inc. 2020a).
- Hydraulic conductivity of Quaternary alluvium based on site-specific aquifer tests ranges from 5.4 to 496 feet per day, with a geometric mean of 28.9 feet per day. This range is slightly less than, but generally confirms the hydraulic conductivity previously assumed in the DEIS for the

water quality modeling (500 feet per day).[39] Hydraulic conductivity of the Gila Conglomerate was not used in the previous water quality modeling; site-specific aquifer tests show variability across the basin ranging from 0.005 to 2.7 feet per day, with an overall geometric mean of 0.5 feet per day (Montgomery and Associates Inc. 2020c).

- Groundwater level depth measured at the Skunk Camp location ranges from about 70 to 560 feet below land surface, with the shallowest water levels near the center of the basin beneath the alluvial channels (Montgomery and Associates Inc. 2020a). This is consistent with the previous site investigation that found depths to groundwater ranging from 70 feet to 180 feet below land surface (Fleming, Shelley, et al. 2018).

FOUNDATION CONSIDERATIONS

Foundation characterization is based on recent site reconnaissance visits, limited well logs, regional geological maps, and assumptions based on similar sites given the similar geology (i.e., Near West) (Fleming, Shelley, et al. 2018; Klohn Crippen Berger Ltd. 2018e). The following foundation considerations were noted that would need to be factored into the design; each of these are further informed by the site-specific investigations at the Skunk Camp location (in italics):

- Potential strength reduction could result in areas due to saturation of the Gila Conglomerate. These conditions potentially could affect embankment stability. *Strength tests on Gila Conglomerate, including soaked samples, were carried out during the site investigations, confirming a characterization of Gila Conglomerate as a weak rock* (KCB Consultants Ltd. 2019).
- Gila Conglomerate varies across the site, and has been noted to be less cemented and coarser grained than at the Near West site, especially on the north end of the site; this unit may therefore exhibit higher permeability at the Skunk Camp site, compared with the Near West site, which could impact seepage within the basin. These conditions potentially could affect embankment stability or seepage movement and capture. *As noted above, the site investigation included site-specific aquifer tests to specifically define the permeability of Gila Conglomerate at the Skunk Camp location* (KCB Consultants Ltd. 2019).
- Potential for groundwater flow paths—it is not known whether the faults on-site act as preferential flow paths or low-permeability boundaries for groundwater flows at this time. *As noted above, the site investigation suggests that the faults may act as preferential flow paths for groundwater flow* (Montgomery and Associates Inc. 2020a).
- The presence of travertine may indicate shallow perched groundwater zones exist. These conditions potentially could affect embankment stability or seepage movement and capture. *Perched groundwater generally was not observed during on-site drilling* (KCB Consultants Ltd. 2019).

Geological Hazards

SEISMIC HAZARDS

Seismic hazards are the potential hazards caused by earthquakes. They can include strong ground shaking, surface faulting, liquefaction, and landslides. The Arizona Mining Guidance Manual (Arizona Department of Environmental Quality 2004) provides guidance for appropriate methods for assessment of seismic hazards and estimates of design earthquake recommendations for tailings embankments and other

[39] For reference, the typical range of hydraulic conductivity for sandy material is about 1 to 1,000 feet per day. All values of hydraulic conductivity for the alluvial material fall within this general range.

mine-related facilities and infrastructure in Arizona, under the auspices of the APP program. Other national, international, and industry design standards are discussed in detail in Section 3.10.1, Tailings and Pipeline Safety.

Lettis Consultants International (LCI) completed site-specific seismic hazard analyses for the proposed Near West tailings storage facility (Wong et al. 2017), the mine site (Wong et al. 2018), and the proposed Skunk Camp tailings storage facility (Wong et al. 2020a). These analyses were subsequently reviewed for completeness by the project team (Zellman and Cook 2020b).

Summaries regarding historical and induced seismicity, active surface faults, and the seismic hazard analysis methods performed for the Resolution Copper Project are provided in the following sections.

Historical Seismicity

LCI compiled a catalog of historical seismicity that includes magnitudes and locations for earthquakes beyond the 200-km (approximately 124-mile) radius for each of their seismic hazard investigation sites. The rate of historical natural seismicity within the region around these sites is relatively low, compared with other areas in western North America.

The largest earthquake in these catalogs is a magnitude (M) 7.4 earthquake that occurred in 1887 in northern Sonora, Mexico, approximately 200 miles southeast of the Resolution Copper Project (DuBois et al. 1982; Suter and Contreras 2002). Ground shaking was felt throughout Arizona and as far north as Albuquerque, New Mexico, and would also have been felt in the project area. DuBois et al. (1982) report that the maximum felt intensity was between a Modified Mercalli[40] (MM) intensity of XI and XII. The mine site and proposed tailings embankments plot within the MM VI (strong) intensity contour, near the VII (very strong) contour. A closer, M 7.0 earthquake from 1830 is included in the earthquake catalogs. However, DuBois et al. (1982) consider the event suspect based on poor constraints and documentation, so LCI (Wong et al. 2020a; Wong et al. 2018; Wong et al. 2017) excluded the event from their analyses.

[40] The Modified Mercalli scale is a method of measuring the intensity of an earthquake at a given location, and is based on the real-world effects people would experience and observe. The intensities are generally described as follows:

XII (catastrophic) – Damage is total. Waves are seen on ground surfaces, and lines of sight and level are distorted. Objects are thrown upward into the air.
XI (extremely dangerous) – Few, if any, structures remain standing. Bridges are destroyed. Broad fissures occur in the ground and underground pipelines are completely out of service. Earth slumps and land slips occur in soft ground. Rails are bent greatly.
X (extreme) – Most masonry and frame structures destroyed with foundations. Rails are bent.
IX (violent) – Even specially designed structures receive considerable damage. Damage is great in even well-built substantial buildings, with partial collapse and foundation shifts.
VIII (severe) – Generally considerable damage occurs in ordinary substantial buildings with partial collapse, with greater damage in poorly built structures, including fall of chimneys, columns, monuments, and walls. Heavy furniture is overturned.
VII (very strong) – Generally damage is negligible in buildings of good design and construction, damage is slight to moderate in well-built ordinary structures, and considerable damage occurs in poorly built or badly designed structures.
VI (strong) – Generally noted as being felt by all, and strong enough to frighten many; strong enough to move some heavy furniture; and slight damage like falling plaster.
V (moderate) – Generally noted as being moderate. It is felt by nearly everyone, and many are awakened. Some dishes and windows are broken, and unstable objects overturned. Pendulum clocks may stop.
IV (light) – Generally noted as being relatively light. It typically can be felt indoors by many but outdoors by only a few people; at night, some people are awakened; dishes, windows, and doors are disturbed, and walls make cracking sounds; and standing vehicles will rock noticeably.
III (weak) – Many people do not recognize it as an earthquake, standing vehicles may rock slightly, and vibrations are similar to the passing of a truck.
II (weak) – Felt only by a few persons.

Notable historical local seismicity within about 31 miles of the mine includes a M 5.0 event in 1922 and four events with magnitudes ranging from M 3.5 to M 3.9 between 1963 and 1972. The M 5.0 earthquake occurred near Miami, Arizona, approximately 13 miles east-northeast of the East Plant Site (DuBois et al. 1982), but the location and size of the event are highly uncertain because this event was recorded on a seismograph over 80 miles away, in Tucson (Wong et al. 2008). The event was felt in the town of Miami, but no structural damage was reported (DuBois et al. 1982). LCI (Wong et al. 2018) surmised that the felt intensity likely would have been MM IV (light).

Induced Seismicity

Seismicity that occurs because of human activity is commonly referred to as "induced seismicity" (National Academy of Sciences 2013). There are two types of mine-induced seismicity (Gibowicz and Kijko 1994; Richardson and Jordan 2002). Type A events are relatively small (< M 1), are related directly to mining activities (i.e., digging, blasting), and occur at or near the active mining face. Type B events have larger magnitudes and are the result of shear failure along a pre-existing structure (i.e., fault, joint bedding plane, or other zones of weakness). They may occur on structures that are not exposed at the active mine face but that are affected by the perturbed stress field.

Induced seismicity has been recognized and observed in mines around the world, but not all mines exhibit seismicity (Gibowicz and Kijko 1994). Over 100 years of worldwide observations of induced mine seismicity show that induced events of greater than M 5 are rare, whereas events of M 3 or less are more common. A USGS earthquake catalog of induced events spanning August 2013 to 2019 shows two areas of mine-related earthquakes in Arizona. One area in southeastern Arizona is near Morenci (up to M 3.1), over 120 miles east of the analysis area. The other area is in northeastern Arizona, south of Shonto (up to M 2.9) (U.S. Geological Survey 2018b), approximately 300 miles north of the analysis area. These minor magnitudes are within the range of seismicity currently observed in the region. However, the USGS mining event catalog indicates these events were caused by mining-related explosions, not earthquakes induced by mining (U.S. Geological Survey 2018b). The closest occurrences of mining-induced seismicity exceeding M 3 likely are the coal mines in eastern Utah's Book Cliffs and coal mines in western Colorado (Wong 1993).

In response to public comments, the Geology and Subsidence Workgroup undertook additional assessment of the potential for induced seismicity related to the Resolution Copper Project and its potential effects. Specifically, the question of whether induced seismicity might result in damage to Apache Leap was assessed.

The potential for the occurrence of mining-induced seismicity related to the Resolution Copper Project and its potential effects were addressed in the following documents:

- A BGC Engineering USA Inc. (2018b) memorandum that addressed general characteristics and causes of mining-induced seismicity based on global observations.
- A letter report by Wong (2020) summarizes potential ground motions from caving-induced fault slip, the potential for induced seismicity related to the proposed tailings storage facility, and the potential impact to Apache Leap.

Active Faults

An active fault is a fault that has moved in the relatively recent geological past and is thus likely to experience slip again at some unknown time in the future. The ADEQ (2004) defines an active fault as one that shows evidence of movement in the past 35,000 years. Assessments of active faulting commonly include a review of known Quaternary faults, which are faults that have moved during the Quaternary period (present to 2.6 million years ago). As part of their assessment of active faults that could potentially impact the proposed Resolution Copper Mine or tailings storage facilities, LCI (2017, 2018, 2020) performed two tasks: (1) reviewed the USGS Quaternary fault and fold database (U.S. Geological Survey 2018a) and active faults compiled by the Arizona Geological Survey, and (2) performed desktop and field-based mapping at the proposed Near West and Skunk Camp tailings storage facility sites.

There are no known Quaternary faults mapped at any of the proposed Resolution Copper Mine facilities. The nearest mapped Quaternary fault relative to the mine and the Near West tailings storage facility site is the Sugarloaf fault zone (U.S. Geological Survey 2018a), which is about 35 miles northwest of the mine and 30 miles southeast of the proposed Near West tailings storage facility site (Wong et al. 2017). The nearest mapped Quaternary fault relative to the Skunk Camp tailings storage facility is the Whitlock Wash Fault Zone, which is about 32 miles southeast of the site.

LCI performed desktop and field-based analysis of Tertiary faults in 2017[41] at the proposed Near West tailings storage facility site. LCI (Hartleb 2020) and KCB Consultants Ltd. (2020e) investigated Tertiary faults at the proposed Skunk Camp tailings storage facility site. At the Near West tailings storage facility site, the Concentrator and Conley Springs faults were assessed. At the proposed Skunk Camp tailings storage facility site, the Dripping Springs and Ransome faults were assessed. LCI (Hartleb 2020) and KCB Consultants Ltd. (2020e) found no evidence of Quaternary movement on any of these faults.

Numerous faults near Oak Flat bound the Resolution Graben and are key to how the subsidence area would develop. These faults were incorporated into the subsidence modeling, and none of these faults are considered to be Quaternary faults.

Seismic Hazard Analyses Performed for Proposed Resolution Tailings Storage Facilities

A number of public comments concerned the design parameters used for the proposed tailings storage facility with respect to seismic activity, or the process used to determine those parameters. Guidelines pertaining to seismic hazards are addressed in appendix E of ADEQ (2004). With respect to tailings storage facilities, the guidance:

- States the tailings storage facility design should be based on a design earthquake that ranges between the “maximum probable earthquake” and the “maximum credible earthquake.”
- Defines maximum probable earthquake as the largest earthquake possible within a 100-year recurrence interval.
- Defines maximum credible earthquake as the maximum earthquake that appears capable of occurring under the presently known tectonic framework.
- States that the design earthquake evaluation should consider:
    1. All known active faults within 200 km (124 miles) of the site.
    2. Active faults are those which have ruptured in the past 35,000 years.
- States that typical design parameters resulting from a seismic hazard analysis include:
    1. Earthquake magnitude and distance from site, and
    2. Peak horizontal acceleration and design ground-motion acceleration time histories for use in deformation analysis.

[41] This is unpublished work that is referenced in later reports by LCI but that has not been reviewed as part of the project record.

LCI performed seismic hazard analysis for the proposed Near West location (Wong et al. 2017), Resolution Copper Mine site (Wong et al. 2018), and Skunk Camp location (Wong et al. 2020a). The studies were performed in accordance with ADEQ (2004) guidance and included the following:

- Seismic source characterization of aerial and crustal fault sources
- Field-based fault reconnaissance at the proposed Near West and Skunk Camp tailings storage facility sites
- An evaluation of regional seismicity
- Site-specific probabilistic seismic hazard analysis (PSHA)
- Deterministic seismic hazard analysis (DSHA)
- Determination of design earthquake ground motions
- Development of single-component horizontal time histories

On behalf of Tonto National Forest, BGC Engineering USA Inc. (Zellman and Cook 2020b, 2020c) performed an independent evaluation of the three LCI seismic hazard studies (LCI 2017, 2018, and 2020). BGC Engineering USA Inc. (Zellman and Cook 2020a) also reviewed the LCI (Hartleb 2020) and KCB Consultants Ltd. (2020e) assessments of Tertiary faults at the proposed Skunk Camp site. BGC Engineering USA Inc. concluded that in general, LCI's seismic hazard assessments were performed in accordance with ADEQ (2004) regulatory guidance, and that LCI (Hartleb 2020) and KCB Consultants Ltd. (2020e) provided sufficient evidence to argue against the presence of active faults at the proposed Skunk Camp tailings storage facility site. This is discussed further in section 3.10.1.

LANDSLIDES AND ROCKFALL

Landslides, in the form of general "earth slides," have been mapped in several locations near the analysis area (Arizona Geological Survey 2018). These include (1) immediately north of U.S. 60, approximately 0.5 mile northeast of the town of Superior, (2) less than 1.0 mile southwest of the mine, and another approximately 2.0 miles south of the mine, and (3) immediately adjacent to and within the northwestern footprint area of the Silver King alternative tailings storage facility site.

Public concern has been raised about the stability of Apache Leap itself, in light of the subsidence that would occur on Oak Flat. The height and steepness of the Apache Leap escarpment speaks to the strength of the Apache Leap Tuff and its overall stability. Observations related to Resolution Copper's ongoing exploration work confirm the stability of the Apache Leap Tuff, including the strength of the rock observed as Shaft #10 was sunk (Tshisens 2018b).

The stability of Apache Leap is also demonstrated by actual monitoring of the Apache Leap escarpment using LiDAR techniques, which has taken place since 2011 and is still ongoing. This monitoring uses 11 measurement stations and has an accuracy to 0.2 foot. No significant movement has been observed since monitoring began; all movements are attributable to vegetation changes or to small rockfalls (Maptek Pty Ltd. 2011, 2012, 2014a, 2014b, 2015, 2016, 2017).

ABANDONED MINES

Abandoned mine workings or adits pose a safety hazard if they are not properly sealed from public access, and are also a concern with respect to stability of foundations for tailings embankments built in historical mining areas.

Historic-era mining features have been noted on several of the offered land parcels, most notably the Apache Leap South End Parcel on the west side of Oak Flat. Here there are multiple historical mining features and remnants of old mining-related roads, including small open cuts, shafts, tunnels, raises, crosscuts, and more extensive underground workings. The major underground mines in this area were principally known as the Grand Pacific and Belmont mines. Entrances to these mines are found on portions of the parcel and appear to date to the early 1900s. The Dripping Springs Parcel has also been noted for historic mine activity.

The historic Bomboy Mine was identified in the vicinity of the embankment of the Alternative 2 tailings storage facility site, in Roblas Canyon. This was an underground copper mine started in 1916, with last production noted in 1971.

Paleontological Resources

Paleontological resources are the fossilized remnants of life. The majority of rock types in the analysis area are igneous (volcanic and plutonic), volcaniclastics, metamorphic rocks, and coarse clastic sedimentary rocks, which are either environments that never had biological activity or were environments that were not conducive to the preservation of fossils or evidence of biological activity. The only formations with potential for paleontological resources are the sequence of Paleozoic sedimentary rocks, namely the Naco Limestone, the Escabrosa Limestone, and the Martin Limestone. These rocks outcrop in the Apache Leap escarpment below the Apache Leap Tuff and extend down to the western edge of the town of Superior.

The following are descriptions of the potential fossil-bearing formations and the fossils typically associated within those formations:

<u>Naco Limestone.</u> The Naco Limestone is roughly 300 million years old, and is a medium- to thin-bedded, gray, white, pale blue to pink limestone (Resolution Copper 2016c). Shallow-shelf marine fossils are common and locally abundant in Naco Limestone and they include foraminifera (especially fusulinids), brachiopods, mollusks (gastropods, clams and other bivalves, cephalopods), tabulate and rugose corals, sponges, bryozoans, echinoderms (crinoids), and rarely, vertebrates like shark teeth and fish bones (Reid 1966; Resolution Copper 2016c).

<u>Escabrosa Limestone.</u> The Escabrosa Limestone is roughly 350 million years old and is equivalent to the Redwall Limestone prevalent in the Grand Canyon. It is a thick-bedded, cliff-forming, resistant, white to dark gray limestone (Blainer-Fleming et al. 2013; Resolution Copper 2016c). This formation potentially contains mostly crinoids and rugose corals with some brachiopods and trilobites. However, it is sparsely fossiliferous and preservation of these fossils is generally poor because they are worn, fragmented, and nearly inseparable from the host limestone.

<u>Martin Limestone.</u> The Martin Limestone is roughly 400 million years old and contains dark to light gray limestone and shale (Pye 1959; Resolution Copper 2016c). This formation can be fossiliferous and potentially contains brachiopods, crinoids, and corals (Blainer-Fleming et al. 2013).

Cave Resources and Karst Landforms

In addition to their preservation of fossils, limestone units also have the potential for cave formation by dissolution of the carbonate rock by groundwater. Of the three Paleozoic limestone formations discussed in the previous section, the Naco and the Escabrosa have the greatest potential for cave formation. According to Huddle and Dobrovolny (1952), the Escabrosa Limestone formation contains karst features that are infilled with rubble breccia and Naco Limestone, indicating extensive karst topography in Central Arizona more than 300 million years ago. The Kartchner Caverns of the Whetstone Mountains of southern Arizona (near Benson), for example, are formed in the Escabrosa Limestone. There are no caves currently mapped in the Paleozoic limestone units within the analysis area and, due to the extensive intrusions and veins, cave formation is likely limited to small, discontinuous cavities.

While several karst features have been noted in Queen Creek Canyon upstream of Superior, only one existing cave has been identified in the area: Hawks Claw Cave is located near Alternative 2 tailings storage facility site.

Unpatented Mining Claims

Numerous unpatented mining claims—both lode and placer—are located within the footprint of the mine components. These are summarized in the GPO in appendix A and figure 3.2-1 (Resolution Copper 2016c) for Alternatives 2 and 3, and have been compiled separately for Alternatives 4, 5, and 6 (Garrett 2019b).

- No unpatented claims unrelated to Resolution Copper are located within the Oak Flat Federal Parcel, or on the East Plant Site.
- The West Plant Site is privately owned. No unpatented claims unrelated to Resolution Copper are located around the periphery of the West Plant Site.
- The MARRCO corridor right-of-way is already existing and in use. No unpatented claims unrelated to Resolution Copper are located within the MARRCO corridor.
- Unpatented claims unrelated to Resolution Copper are located within the various alternatives tailings storage facility footprints and/or the tailings pipeline corridor footprints. In section 3.2.4, impacts on these claims are assessed specific to each alternative.

3.2.4 Environmental Consequences of Implementation of the Proposed Mine Plan and Alternatives

3.2.4.1 Alternative 1 – No Action Alternative

Under the no action alternative, the mine would not be constructed, block caving would not occur, and there would be no impacts from subsidence, induced seismicity, increased potential for landslides or rockfall, impacts on caves, karst, or paleontological resources, or impacts on mining claims.

3.2.4.2 Impacts Common to All Action Alternatives

Effects of the Land Exchange

The land exchange would have effects on geology and mineral resources.

The Oak Flat Federal Parcel would leave Forest Service jurisdiction. The role of the Tonto National Forest under its primary authorities in the Organic Administration Act, Locatable Regulations (36 CFR 228 Subpart A), and Multiple-Use Mining Act is to ensure that mining activities minimize adverse environmental effects on NFS surface resources. The removal of the Oak Flat Federal Parcel from Forest Service jurisdiction negates the ability of the Tonto National Forest to regulate effects on these resources from the proposed mine and block caving. With respect to mineral development, no unpatented mining claims other than those associated with Resolution Copper are located on the Oak Flat Federal Parcel (see figure 1.3-2 in the GPO (Resolution Copper 2016c)).

The offered land parcels would enter either Forest Service or BLM jurisdiction. Section 3003 of PL 113-291 specifies that any land acquired by the United States is withdrawn from all forms of entry, appropriation, or disposal under the public land laws, location, entry, and patent under the mining laws, and disposition under the mineral leasing, mineral materials, and geothermal leasing laws.

Specific management of mineral resources on the offered lands would be determined by the agencies, but in general when the offered lands enter Federal jurisdiction, mineral exploration and development would not be allowed. Given these restrictions, no or little mine-related activity would be expected to occur on the offered lands.

The land exchange also effectively ends the mineral withdrawal currently in place for the 760-acre Oak Flat Withdrawal Area. After a land exchange occurs, this area would be privately held and would be open to mineral exploration and mineral development that would not otherwise occur. Because no exploration has taken place within this area, the potential for future mining activities is not known.

If the land exchange does not occur, not only would mineral exploration not take place within the 760-acre Oak Flat Withdrawal Area, but subsidence caused by block caving would not be allowed to impact the Withdrawal Area. This would potentially result in less of the Resolution ore deposit being developed, and the resulting surface disturbance and resource impacts would be less than those disclosed in the EIS.

Effects of Forest Plan Amendment

No components of the 2023 forest plan directly relate to geology, minerals, and subsidence that require amendment (U.S. Forest Service 2023d).

Effects of Compensatory Mitigation Lands

The compensatory mitigation lands are not anticipated to affect geological resources or subsidence. These lands are protected by conservation easements or similar mechanisms and mining would not occur on these lands.

Effects of Recreation Mitigation Lands

The recreation mitigation lands are not anticipated to affect geological resources or subsidence. Since these existing roads and trails, as well as new planned routes, are on NFS lands that are open to mineral development, they may now or in the future overlap with unpatented claims. If conflicts arise between surface use for mineral exploration, surface use for the development of mineral resources associated with unpatented claims, and surface use for recreation, the conflicts would be resolved as appropriate under Forest Service mineral regulations.

Summary of Applicant-Committed Environmental Protection Measures

A number of environmental protection measures are incorporated into the design of the project that would act to reduce potential impacts on geology and mineral resources or reduce potential impacts from subsidence and other geological hazards. These are non-discretionary measures, and their effects are accounted for in the analysis of environmental consequences.

In appendix E of the GPO (Resolution Copper 2016a), Resolution Copper has committed to various measures to reduce impacts from subsidence:

- Subsidence will be monitored to collect data to validate model calibration and refinements; to develop threshold and alarm levels for early warning and detection of subsidence impacts before surface impacts occur; to identify surface movements due to mining of the Resolution ore body; and to implement corrective actions and contingency plan.
    - Apache Leap, Queen Creek Canyon, and the surface area above the planned underground mine are currently monitored (prior to mining) using light detection and ranging (LiDAR), interferometry synthetic aperture radar (InSAR), and select rock spires using digital tilt meters.

  - During mining, the surface area above the ore deposit would be subdivided into a no-go zone, consistent with the limit of the subsidence fracture zone (where no person may enter) and a restricted public access zone consistent with the continuous subsidence limit (where Resolution Copper personnel are permitted for geotechnical monitoring and inspections). These zones would be reassessed during mining based on information collected from cave propagation monitoring. Surface subsidence will be monitored through the use of available industry best practice and demonstrated technology, including extensometer, survey prisms, and crack displacement monitors; time domain reflectometer (TDR) cables; aerial photography; InSAR; microseismic monitoring system; and smart markers and cave trackers.
  - Post-mining monitoring would continue for at least 15 years. Resolution Copper would continue to monitor the impact of surface subsidence on key infrastructure:
    - Apache Leap, cliffs, and pillars
    - Queen Creek and Devil's Canyons
    - U.S. 60
    - The surface subsidence area and Oak Flat campground
- Resolution Copper will document and store all the results of surface subsidence inspection and monitoring. Results will be reported annually to the Forest Service for the Apache Leap SMA. The reporting would include a summary of subsidence management actions undertaken to protect the Apache Leap SMA, a summary of observed and/or reported subsidence impacts, and a summary of cave performance and subsidence development based on monitoring.

Additional applicant-committed environmental protection measures by Resolution Copper are identified in the revised subsidence monitoring plan (Davies 2020a) and would reduce impacts from subsidence to Apache Leap, Queen Creek Canyon, or Devil's Canyon. The revised plan further specifies the monitoring techniques and equipment to be used and their specific purpose, including the following:

- InSAR: to measure changes in surface displacement across a very large area
- Aerial photogrammetry using drones: to measure vertical and lateral displacements and highly detailed observation of subsidence progression
- Robotic prism network: to validate remote measurements through surveying of fixed markers
- LiDAR: to scan specific features like Apache Leap, to monitor for toppling/rotational displacements
- TDR: to monitor subsurface deformations and tracking of cave propagation to the surface
- Open holes: to monitor cave propagation using simple borehole cameras or weighted probes
- Cave smartmarkers and beacons with detectors: to monitor cave growth, propagation, and flow of material into the drawbells
- Wireless in-ground monitoring (Geo4Sight): to monitor subsurface deformation, including magnitude and direction
- Inclinometers: to monitor near-surface displacements and deformation, particularly used to validate wireless in-ground monitoring
- Soil extensometers (multi-point): to monitor very shallow displacements of overburden
- Surface monuments: to monitor vertical and lateral displacements to calculate angular distortion
- Crack mapping: to monitor tension cracking at the surface

The revised subsidence monitoring plan also identifies specific triggers for action, based on percent exceedance of anticipated limits of the subsidence modeling:

- Level 1: subsidence extending farther than the model results, by less than 30 percent. Responses to this trigger level focus on data validation and more intensive monitoring.
- Level 2: subsidence extending farther than the model results, by 30 to 60 percent. Responses to this trigger level can include reduction or modification of the amounts and locations of ore removal.
- Level 3: subsidence extending farther than the model results, by more than 60 percent. Responses to this trigger level can include cessation of mining.

Subsidence Impacts

TIMING AND EXTENT OF SUBSIDENCE CRATER DEVELOPMENT, INCLUDING UNCERTAINTY

Resolution Copper proposes to use panel caving for underground mining at about 4,500 to 7,000 feet beneath the ground surface. The total mineralized rock to be removed is estimated to be about 1.4 billion tons of ore. Caving of this ore material is induced by undercutting the ore zone, which removes its ability to support the overlying rock material. Fractures then spread throughout the area to be extracted, causing it to collapse and form a cave, which then propagates upward. This caving of the ore is predicted to be accompanied by surface subsidence. Subsidence occurs when the underground excavation caves and movement of material propagate all the way to the surface, and the land surface is subsequently deformed.

The depth of the land surface depression is a result of the properties of the collapsed rock material and the amount of rock removed below it. The geographic extent of surface disturbance is a function of the rock properties, local geological structure, regional geological stresses, and the amount of material removed through mining. The predicted surface subsidence is depicted in figure 3.2.4-1, at 6, 10, 15, 20, 30, and 41 years after the start of mining.

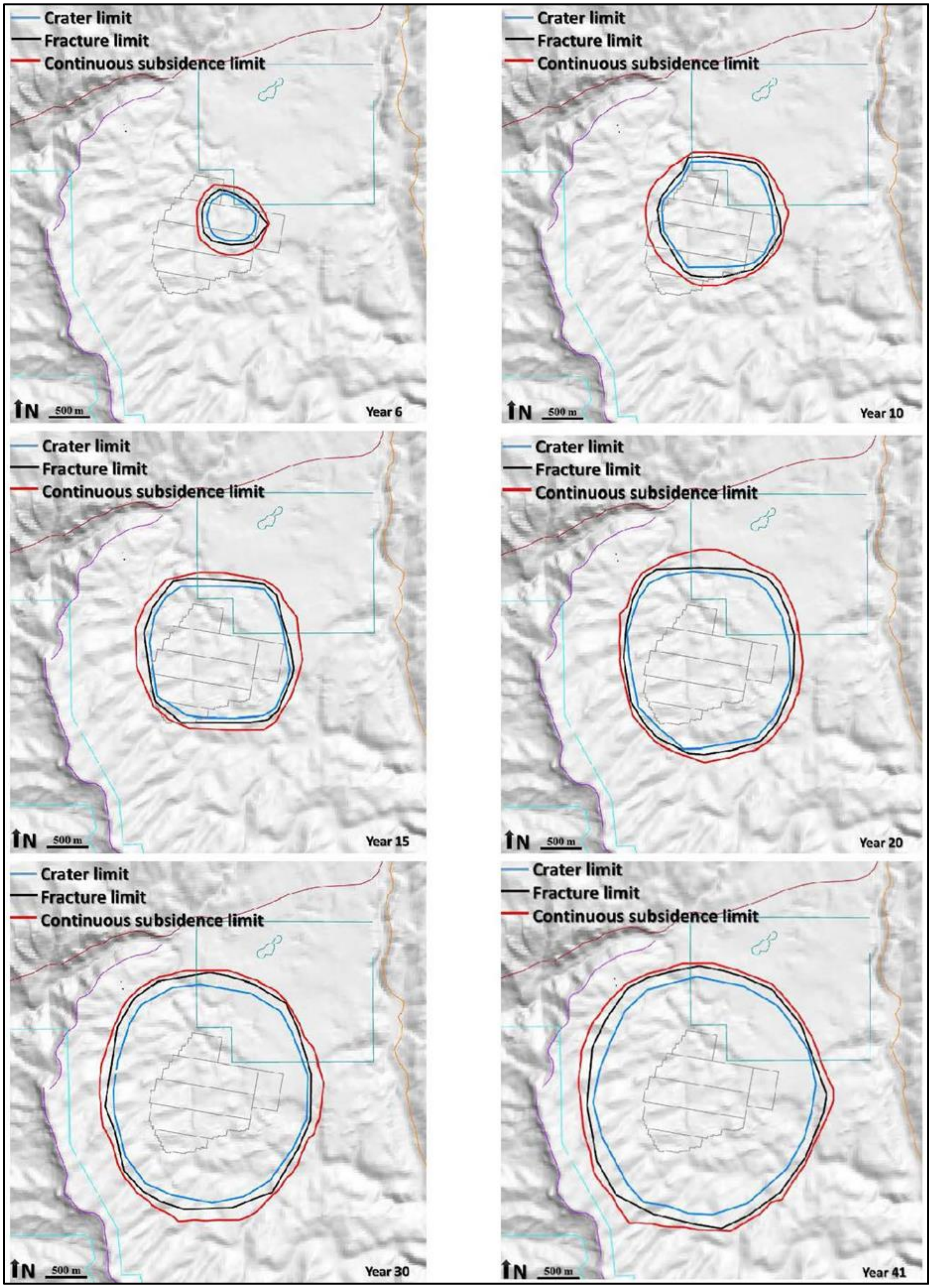


Figure 3.2.4-1. Evolution over time of the crater, fracture, and continuous subsidence limits predicted to exist (reproduced from Garza-Cruz and Pierce (2017))

Figure 3.2.4-1 illustrates three areas: the crater limit, fracture limit, and continuous subsidence limit.

- The crater limit is the area of active caving, directly above the ore body. The surface in this area would be actively mobilized and moving during mining. This is defined in the subsidence model as areas with more than 6 to 7 feet of vertical displacement.
- The fracture limit is at the fringe of the crater limit and is the area where visible fracturing would be expected, including radial cracks and possible rotation and toppling of rocks. For the purposes of the EIS analysis, the fracture limit is generally considered to be the area where physical impacts from subsidence are likely to occur. This area is defined in the subsidence model as areas where the total measure of strain exceeds 0.5 percent.
- The continuous subsidence limit is characterized by small rock deformations that can only be detected using high-resolution monitoring equipment. If deformations are significant enough, in some cases they can create small hairline cracks in the surface of concrete but would not be visible in the soil or on the ground. This area is also commonly referred to as the elastic zone because the deformations are usually below the threshold where rock fractures. This area is defined in the subsidence model by a combination of horizontal strain and angular distortion.

Figure 3.2.4-2 provides a detailed depiction of the anticipated subsidence at the end of the mine life; the fracture limit is estimated to extend to within approximately 1,115 feet (340 m) from Apache Leap, and to approximately 3,445 feet (1,050 m) from Devil’s Canyon. The fracture limit area is roughly 1.8 miles (2,900 m) in diameter.

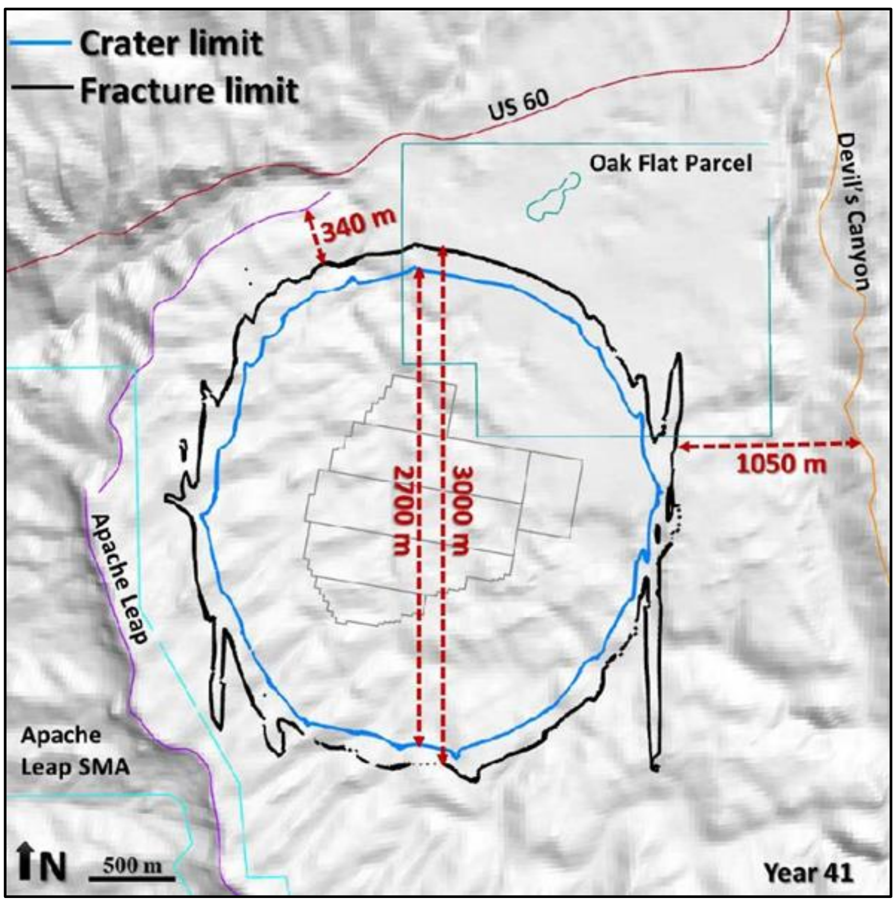


Figure 3.2.4-2. Final anticipated subsidence crater boundaries at end of mine life (reproduced from Garza-Cruz and Pierce (2017))

The Geology and Subsidence Workgroup requested a number of sensitivity model runs as part of the evaluation of the subsidence model (BGC Engineering USA Inc. 2018a; Garza-Cruz and Pierce 2018). These model runs assess what would change if various input parameters or assumptions in the model were different, including rock mass strength, in-situ stress regime, fault strength, and bulked rock porosity. The size of the fracture limit under these different sensitivity runs does not differ substantially from the base case model, and while at least one sensitivity run brings it closer to the boundary of the Apache Leap SMA, it remains outside that boundary. Similarly, under all scenarios the first breakthrough of subsidence occurs in year 6 or 7 of mining, and subsidence ends very soon after ore extraction ends.

The primary difference in results among all the sensitivity model runs is the ultimate depth of the subsidence crater. Under the base case model, an ultimate depth of about 800 feet is anticipated. Under other sensitivity runs, the depth of the subsidence crater can vary between 800 and 1,115 feet.

POTENTIAL IMPACTS ON FOREST SURFACE RESOURCES

Noticeable changes to surface resources would occur within the crater and fracture limits. The subsidence modeling indicates that the crater and fracture limits do not extend beyond the Oak Flat Federal Parcel, except onto Arizona State Trust land to the southeast. There are no anticipated subsidence impacts on surface resources on the Tonto National Forest, after the land exchange occurs.

POTENTIAL IMPACTS ON APACHE LEAP AND OTHER RESOURCES

While the fracture limit predicted by the subsidence model remains distant from Apache Leap, and Resolution Copper modelers concluded that there would be no anticipated damage to Apache Leap, there are still smaller modeled changes that are anticipated for Apache Leap. The Geology and Subsidence Workgroup assessed predictions of horizontal displacement, vertical displacement, strain, and angular distortion.

- Roughly 1.5 feet (0.4 to 0.5 m) of horizontal and vertical displacement is anticipated at Apache Leap. Horizontal and vertical displacement by itself does not necessarily lead to damage. It is the differential vertical displacement that can lead to rock mass damage if it is extensive and is predicted by the angular distortion as discussed below.
- The angular distortion at Apache Leap is anticipated to be less than 1×10^{-3} meter/meter (BGC Engineering USA Inc. 2018a; Morey 2018b). The approximate threshold for damage is 3×10^{-3}, indicating that damage would not be expected at Apache Leap (BGC Engineering USA Inc. 2018a; Garza-Cruz and Pierce 2017).

The Geology and Subsidence Workgroup generally agreed with the conclusion that damage to Apache Leap would not be anticipated and found that many of the modeling choices were conservative (i.e., these choices would tend to overestimate the extent of subsidence, not underestimate it). However, after assessing a number of sensitivity analyses, some remaining uncertainties were recognized, including BGC Engineering USA Inc. (2018a):

- The geographic extent of subsidence changes with the rock mass properties of the Apache Leap Tuff and Whitetail Conglomerate formations. When rock mass properties were reduced by 25 percent during a sensitivity run, the fracture limit extended closer to Apache Leap. However, even during this sensitivity run, angular distortion at Apache Leap did not exceed the 3×10^{-3} threshold for damage.
- The geographic extent of subsidence also changes with assumed fault strength. When fault strength was reduced during a sensitivity run, the fracture limit extended closer to Apache Leap. However, even during this sensitivity run, angular distortion at Apache Leap did not exceed the 3×10^{-3} threshold for damage.

Considering these uncertainties, the Geology and Subsidence Workgroup identified that the combination of horizontal displacement and vertical settlement could potentially cause angular distortion to locally exceed the damage threshold at Apache Leap and lead to localized rock block failure, but large-scale failures are not anticipated (BGC Engineering USA Inc. 2018a). A localized rock block failure refers to the gradual movement or sudden fall of one or more individual rock blocks due to progressive ground movement over time; these small rockfalls are a possibility but not anticipated to be substantially different from those observed in ongoing monitoring. Large-scale failure refers to progressive or sudden failure of a large mass of rock in response to ground movements over time; large failures, collapses, or major rockfalls are not anticipated and are considered to be unlikely.

After receipt of public comments, the Geology and Subsidence Workgroup further explored the possibility of damage to Apache Leap. The Geology and Subsidence Workgroup considered different metrics or comparisons and reviewed results from other mines (Karami and Henderson 2020; Pierce 2020). The most appropriate comparison was found to be damage criteria for buildings. The edge of the fracture limit would experience angular distortions that—if a building were present—would cause moderate to severe damage. This type of damage would include distortion of door and window frames, noticeable floor tilting, leaning or bulging walls, and cracks up to 1 inch wide (Pierce 2020). By contrast, angular distortions experienced at Apache Leap—if a building were present—would cause negligible damage, limited to hairline cracks (less than 0.004 inch wide). This level of damage to a natural rock structure likely would not result in any noticeable changes and would only be observable with sensitive monitoring instruments.

In addition to Apache Leap, similar concerns were raised for Devil's Canyon and U.S. 60. These locations are located even farther than Apache Leap from the fracture limit. Damage is not anticipated at these locations, subject to the same uncertainties described in this section.

SUBSIDENCE MODELING UNCERTAINTY ANALYSIS

The Tonto National Forest explicitly analyzed the uncertainty of the subsidence modeling by looking at a wide range of model runs, as described above. One set of public comments endeavored to analyze the uncertainty associated with the modeling and to calculate a percentage possibility that the subsidence zone would reach Apache Leap. The Geology and Subsidence Workgroup determined that the assumptions made in the public comments were not valid, as they were not based on the actual modeling results used in the DEIS. However, the Geology and Subsidence Workgroup considered this alternative approach to assessing model uncertainty using more appropriate inputs (Garza-Cruz and Pierce 2020b; Karami and Henderson 2020).

This approach requires that a standard deviation be determined for the range of subsidence modeling results. In this case, the standard deviation of the fracture limit is estimated at about 360 feet. The base case modeling indicates that the fracture limit remains about 1,100 feet away from Apache Leap at the end of mining. This indicates that the fracture limit remains over three standard deviations away from Apache Leap; the probability that the fracture limit would extend to Apache Leap instead of where the base case modeling indicates is less than 0.2 percent.[42] It should be noted that this approach was not found to be particularly valid by the Geology and Subsidence Workgroup, and the actual subsidence modeling runs remains the most appropriate means for assessing the possible range of outcomes for the subsidence area.

[42] This assumes a normal probability curve. For a normal probability curve, about 99.7 percent of results will lie within three standard deviations of the mean. This analysis is only concerned with one side of the curve (a fracture limit greater than the mean), so roughly 0.15 percent of values would be greater than three standard deviations from the mean.

MINE INFRASTRUCTURE AND EFFECT OF SUBSIDENCE MONITORING

As noted, a number of applicant-committed environmental protection measures related to subsidence monitoring would occur. The intent of this monitoring is to understand the real-world progression of the block caving and subsidence. Public comments have raised the concern that once block caving begins, such monitoring would provide useful information but would ultimately not be effective at preventing impacts on Apache Leap or other areas if the subsidence modeling turns out to be incorrect.

While it is accurate that subsidence would progress unchecked once block caving begins, there are several aspects of the mine plan that would make the subsidence monitoring effective at preventing damage to Apache Leap or U.S. 60.

The mine plan calls for the block caving to occur in six discrete panels, described in detail in GPO section 3.2.9.1 (Resolution Copper 2016c). The phasing of these panels is to mine from east to west, or in other words, starting farther from Apache Leap and working toward Apache Leap. In this manner, the results of subsidence monitoring from the initial panel caving would be available prior to any mining near Apache Leap. This would allow time for modifications to be made to the mine plan, if necessary, before damage occurred at Apache Leap.

In addition, the primary mine infrastructure at the East Plant Site is located closer to the subsidence fracture limit than Apache Leap. In the event that real-world subsidence is more extensive than anticipated by the subsidence modeling, the infrastructure needed to continue mining would be anticipated to be impacted prior to impacts occurring at Apache Leap. This would allow time for modifications to be made to the mine plan before damage occurred at Apache Leap.

Geological Hazards

INDUCED SEISMICITY

In general, the primary requirement for inducing seismicity is human activity that changes the state of stress in highly pre-stressed rocks (Gibowicz and Lasocki 2001). Mining and subsidence at the project site could impact the existing state of stress.

The potential for induced seismicity was summarized by (BGC Engineering USA Inc. 2018b) and assessed by Wong (2020a). It is not possible to make specific predictions about mine-induced seismicity at the proposed Resolution Copper Mine. However, the potential surface effects for induced earthquakes that might occur at the proposed mine could include ground shaking on a local scale, which could include the town of Superior. While mine-induced seismicity is possible, based on 100 years of worldwide observations, events greater than magnitude 5 are rare, and events of magnitude 3 or less are more common. This is observed in the most recent mine-related earthquakes in Arizona, which ranged from magnitude 2.9 to 3.1. For reference, damage to structures is rarely observed for earthquakes less than magnitude 5. Surface faulting as a result of induced seismicity is not expected as the magnitude of possible induced seismic events falls far below the observed threshold (about magnitude 6.5) for generating surface faulting (Youngs et al. 2003).

In response to public comments, the Geology and Subsidence Workgroup further assessed whether induced seismicity might result in damage to Apache Leap (BGC Engineering USA Inc. 2018b; Cancino et al. 2019a; Wong 2020). Ground motions were estimated for events of the magnitude described above. These ground motions were correlated to potential damage using the Modified Mercalli scale described earlier in this section. Immediately above the block-cave zone, the estimated ground motions correlate with MM intensity IV (Light). This level of movement typically is felt indoors with noticeable rocking, with disturbance to dishes, windows, and doors, but no damage occurs. At Apache Leap, the estimated ground motions correlate with MM intensity II-III to IV (Weak to Light). At the lower end, these motions rarely are recognized as earthquakes and are similar to the passing of a large truck.

Induced mine seismicity is possible, but unlikely to be of sufficient magnitude to cause structural damage or damage to Apache Leap.

SUBSIDENCE AREA ACCESS

With the exception of the southeastern portion, the entirety of the subsidence area would be on Resolution Copper private land, after exchange of the Oak Flat Federal Parcel. Access to the subsidence area would be restricted on these lands using fencing, berms, signage, and natural barriers or steep terrain (25 to 30 percent or greater).

The southeastern portion of the subsidence area would be on Arizona State Trust land; the future ownership or use of this land is not known. Regardless of ownership, it is anticipated that the entire subsidence area would be under the jurisdiction of both the Arizona State Mine Inspector, requiring adherence to the Arizona mining code, and MSHA, requiring adherence to national mining regulations. Both these entities take public safety into account when regulating and inspecting mines and would dictate access restrictions.

Paleontological Resources

No known paleontological resources, or surface geological units amenable to paleontological resources (Naco, Escabrosa, and Martin limestones), would be impacted by subsidence or other activities at the East Plant Site, West Plant Site, MARRCO corridor, or filter plant and loadout facility.

Caves and Karst Resources

No known cave/karst resources, or surface geological units amenable to cave/karst resources (Naco and Escabrosa limestones), would be impacted by subsidence or other activities at the East Plant Site, West Plant Site, MARRCO corridor, or filter plant and loadout facility. Several caves have been identified in the vicinity of these facilities (Umbrella Cave, Superior High School Cave); these are considered in section 3.8 as suitable wildlife habitat but would not be impacted or disturbed by the project footprint.

Unpatented Mining Claims

No unpatented mining claims unassociated with Resolution Copper would be impacted by activities at the East Plant Site, West Plant Site, MARRCO corridor, or filter plant and loadout facility.

The development of the Resolution Copper Mine potentially could encourage additional exploration and staking of mining claims on Federal lands at the periphery of the mine. This type of activity has been observed to be spurred by the permitting or development of known ore bodies. This ultimately could drive additional ground disturbance for well pads and access roads; any such development would be subject to Forest Service analysis and permitting. Known exploration projects have been considered for cumulative effects.

3.2.4.3 Alternative 2 – Near West Proposed Action

Paleontological Resources

No known paleontological resources have been observed within the footprint of the Alternative 2 tailings storage facility. Naco and Escabrosa limestone have not been observed at the surface under the Alternative 2 tailings storage facility footprint. A small outcropping of Martin limestone is located on the west side of the tailings storage facility footprint. Although paleontological resources have not been observed here, this geological formation has the potential to host fossils, and this outcrop likely would be destroyed during tailings storage facility construction (Klohn Crippen Berger Ltd. 2018a).

Caves and Karst

No known cave/karst resources, or surface geological units amenable to cave/karst resources (Naco and Escabrosa limestones), would be impacted by the footprint of the Alternative 2 tailings storage facility (Klohn Crippen Berger Ltd. 2018a).

Unpatented Mining Claims

A number of unpatented lode and placer claims are located within the footprint of the Alternative 2 tailings storage facility and tailings pipeline corridor footprint that are not associated with Resolution Copper (see figure 1.3-2 in the GPO). These include the Bomboy Placer claim and about 10 to 20 lode claims within the tailings storage facility footprint, along with 20 to 30 lode claims within the tailings pipeline corridor.

3.2.4.4 Alternative 3 – Near West – Ultrathickened

Impacts from Alternative 3 would be identical to those under Alternative 2 for caves, karst, paleontological resources, and mining claims.

3.2.4.5 Alternative 4 – Silver King

Paleontological Resources

No known paleontological resources, or surface geological units amenable to paleontological resources (Naco, Escabrosa, and Martin limestones), would be impacted by the footprint of the Alternative 4 tailings storage facility. All three of these units are in the vicinity but are not exposed at the surface within the tailings facility footprint (Klohn Crippen Berger Ltd. 2018c).

Caves and Karst

No known cave/karst resources, or surface geological units amenable to cave/karst resources (Naco and Escabrosa limestones), would be impacted by the footprint of the Alternative 4 tailings storage facility. Both of these units are in the vicinity but are not exposed at the surface within the tailings facility footprint (Klohn Crippen Berger Ltd. 2018c).

Unpatented Mining Claims

A number of unpatented lode claims are located within the footprint of the Alternative 4 tailings storage facility and tailings pipeline corridor footprint that are not associated with Resolution Copper. Roughly 70 to 80 unpatented claims, associated with three different owners, are within the tailings storage facility footprint.

3.2.4.6 Alternative 5 – Peg Leg

Paleontological Resources

No known paleontological resources, or surface geological units amenable to paleontological resources (Naco, Escabrosa, and Martin limestones), would be impacted by the footprint of the Alternative 5 tailings storage facility (Golder Associates Inc. 2018a).

Caves and Karst

No known cave/karst resources, or surface geological units amenable to cave/karst resources (Naco and Escabrosa limestones), would be impacted by the footprint of the Alternative 5 tailings storage facility (Golder Associates Inc. 2018a).

Unpatented Mining Claims

A number of unpatented lode claims are located within the footprint of the Alternative 5 tailings storage facility and tailings pipeline corridor footprint that are not associated with Resolution Copper. Roughly 80 to 90 unpatented claims, associated with two different owners, are located along the tailings pipeline corridor.

3.2.4.7 Alternative 6 – Skunk Camp

Paleontological Resources

No known paleontological resources, or surface geological units amenable to paleontological resources (Naco, Escabrosa, and Martin limestones), would be impacted by the footprint of the Alternative 6 tailings storage facility (Klohn Crippen Berger Ltd. 2018d).

Caves and Karst

No known cave/karst resources, or surface geological units amenable to cave/karst resources (Naco and Escabrosa limestones), would be impacted by the footprint of the Alternative 6 tailings storage facility (Klohn Crippen Berger Ltd. 2018d).

Unpatented Mining Claims

While the Alternative 6 tailings storage facility is located on Arizona State Trust lands and private lands and therefore no Federal unpatented mining claims are present, a number of unpatented lode claims are located within the footprint of the Alternative 6 tailings pipeline corridor that are not associated with Resolution Copper. Roughly 10 to 20 unpatented claims, associated with five different owners, are located along the tailings pipeline corridor.

3.2.4.8 Cumulative Effects

Full details of the cumulative effects analysis can be found in chapter 4. The following represents a summary of the cumulative impacts resulting from the project-related impacts described in section 3.2.4, Environmental Consequences, that are associated with geology and mineral resources, when combined with other reasonably foreseeable future actions.

The following actions were determined through the cumulative effects analysis process to be reasonably foreseeable, and have impacts that likely overlap in space and time with impacts from the Resolution Copper Project:

- Pinto Valley Mine Expansion
- Ripsey Wash Tailings Project
- Ray Land Exchange and Proposed Plan Amendment

The cumulative effects analysis area for mineral resources extends throughout the Copper Triangle area and includes the offered lands as well, as mineral development would not be allowed on these lands as per PL 113-291. The metric used to quantify cumulative impacts to geology and mineral resources is the acreage of physical disturbance, mineral extraction, or loss of access, that would prevent any mineral resources—if present—from being accessed by future generations.

The three reasonably foreseeable future actions above, combined with the Resolution Copper Project, represent about 34,300 acres of the 1.4-million-acre cumulative effects analysis area, or about 2.4 percent. This represents the area within which mineral resources, if present, would be lost to future generations.

3.2.4.9 Mitigation Effectiveness

Mitigation Identifier and Title	Authority to Require
FS-GS-01: New stipulations on subsidence monitoring plan	Required – Forest Service

We developed a robust monitoring and mitigation strategy to avoid, minimize, rectify, reduce, or compensate for resource impacts that have been identified during the process of preparing this EIS. Appendix J contains descriptions of mitigation measures that are being required by the Forest Service and mitigation measures voluntarily brought forward and committed to by Resolution Copper. Appendix J also contains descriptions of monitoring that would be needed to identify potential impacts and mitigation effectiveness.

This section contains an assessment of the effectiveness of design features associated with mitigation and monitoring measures found in appendix J that are applicable to geology, minerals, and subsidence. See appendix J for full descriptions of each measure noted below.

Mitigation Effectiveness and Impacts of Forest Required Mitigation Measures Applicable to Geology, Minerals, and Subsidence

Appendix J contains mitigation and monitoring measures being required by the Forest Service under its regulatory authority or because these measures are required by other regulatory processes (such as the Biological Opinion). These measures are assumed to occur, and their effectiveness and impacts are disclosed here. The unavoidable adverse impacts disclosed below take the effectiveness of these mitigations into account.

New stipulations on subsidence monitoring plan (FS-GS-01): The subsidence monitoring plan was included as an applicant-committed environmental protection measure, and as such the effects of implementing the plan are already incorporated into the project impacts. The subsidence monitoring plan is being discussed in the mitigation section as well for two reasons:

1. A mitigation measure included in the DEIS required that a final subsidence monitoring plan be completed and approved by the Forest Service prior to signing a decision. Collaborative review of the subsidence monitoring plan by the Geology and Subsidence Workgroup resulted in a revised subsidence monitoring plan (Davies 2020a).
2. We further identified additional stipulations that were not included in the revised subsidence monitoring plan that we view as necessary components to ensure that monitoring is implemented appropriately and with proper oversight.

Due to the potential for damage to Apache Leap, a Tonto National Forest surface resource, these stipulations will be required of Resolution Copper. The two additional stipulations are as follows:

- Given the highly technical nature of the monitoring, the Forest Service foresees the need for independent outside experts to assist in the review of subsidence monitoring results, through the duration of the operations phase. Annual and quarterly monitoring reports, as well as any updated subsidence modeling reports, shall be submitted to the Forest Service and reviewed by an independent third-party subsidence expert to work on behalf of the Forest Service, to be funded by Resolution Copper.

- Specific triggers would require convening a technical workgroup. Participants would include the following: Resolution Copper Mine management and appropriate subsidence experts, Forest Service personnel, and an independent third-party subsidence expert to work on behalf of the Forest Service, to be funded by Resolution Copper.

Measure FS-GS-01 focuses on all aspects of the subsidence monitoring, including monitoring equipment, techniques, frequency, trigger levels, and remedial actions. We concluded that this monitoring would be effective at identifying potential effects of subsidence in time to inform a response to prevent damage. The phasing of the panel caving is such that remedial actions can be taken if monitoring indicates subsidence impacts are more extensive than anticipated. The subsidence monitoring plan is therefore anticipated to be effective at mitigating any damage to Apache Leap or other Tonto National Forest surface resources. There would be no additional physical impacts associated with this mitigation except for negligible surface disturbance associated with monitoring equipment.

Mitigation Effectiveness and Impacts of Resolution Committed Mitigation Measures Applicable to Geology, Minerals, and Subsidence

Appendix J contains mitigation and monitoring measures committed by Resolution Copper in contractual, financial, or other agreements. Due to these commitments these measures are assumed to occur and their effectiveness and impacts if they were to occur are disclosed here; however, there are no committed mitigations for geology, minerals, and subsidence, which is reflected in the unavoidable adverse impacts disclosed below.

Mitigation Effectiveness and Impacts of Resolution Voluntary Mitigation Measures Applicable to Geology, Minerals, and Subsidence

Appendix J contains mitigation and monitoring measures brought forward voluntarily by Resolution Copper and committed to in correspondence with the Forest Service. These measures are assumed to occur but are not guaranteed to occur. Their effectiveness and impacts if they were to occur are disclosed here; however, the unavoidable adverse impacts disclosed below do not take the effectiveness of these mitigations into account. No additional mitigation measures were voluntarily brought forward for geology, minerals, and subsidence.

Unavoidable Adverse Impacts

Unavoidable adverse impacts would occur through disturbance caused by the subsidence, to a small area of Martin limestone with potential paleontological resources (Alternatives 2 and 3), and to unpatented mining claims not associated with the Resolution Copper Project (all tailings facilities and/or pipeline corridors). Impacts on cave/karst resources and to the public from geological hazards from access to the subsidence area, induced seismicity, or damage to Apache Leap are not considered likely to occur.

3.2.4.10 Other Required Disclosures

Short-Term Uses and Long-Term Productivity

Construction of the project would convert some undeveloped lands into an industrial mining operation, and construction of mine facilities would alter the area's topography. Impacts related to subsidence and the tailings storage facilities would permanently impact long-term productivity.

Irreversible and Irretrievable Commitment of Resources

Irreversible commitment of geological and mineral resources would occur with the excavation and relocation of approximately 1.4 billion tons of rock and with the recovery of approximately 40 billion pounds of copper, as well as the burying of any mineral resources below the alternative tailings facilities.

With respect to paleontological and cave/karst resources, a commitment of resources is considered to be irretrievable when project impacts limit the future use or productivity of a nonrenewable resource over a limited amount of time—for example, structures built on top of paleontologically sensitive geological units that might later be removed. A commitment of resources is considered to be irreversible when project impacts cause a nonrenewable resource to be permanently lost—for example, destruction of significant fossils and loss of associated scientific data.

An irreversible commitment of paleontological resources could occur at the Alternative 2 and 3 tailings storage facility location, where potentially fossil-bearing rocks associated with the Martin limestone could be destroyed in site preparation or buried permanently.

3.3 Soils, Vegetation, and Reclamation

3.3.1 Introduction

> **Overview**
>
> The proposed mine would disturb large areas of ground, not only from the mining and processing facilities, but also from the subsidence crater and tailings storage facility. Ground disturbance has the potential to destroy native vegetation, including species given special status by the Forest Service, and encourage noxious or invasive weeds. Ground disturbance also affects soils. Soils are a nonrenewable resource and can experience long-term impacts through compaction, accelerated erosion, and loss of productivity. After closure of the mine, reclamation can partially restore the function of these disturbed areas, but success depends on the stability of the tailings, on the closure design, and on how readily vegetation can be reestablished.

This section discusses the effects of the project on soils, soil productivity, vegetation communities, noxious and invasive weeds, and special status plant species. Soils, which comprise mineral and organic material, provide the necessary structure, water, gases, and nutrients needed to support diverse microbial communities and growth and propagation of plants. Ground disturbance would potentially remove or destroy soil cover and vegetation, directly and indirectly impacting the quality, health, integrity, and stability of a soil, thereby degrading its productivity and capacity to sustain plant growth.

Soil and vegetation work together to form and support an ecosystem. The project would fundamentally change large areas of the landscape and remove these ecosystems for decades during the life of the mine. However, during reclamation and closure, these ecosystems can be recovered to a degree in some areas, particularly at the tailings storage facility. This section identifies what these ecosystems look like today, the management vision for how these ecosystems ideally would function in the long term (also known as the desired condition), and an assessment of whether the tailings landform can reach desired conditions over the long term, through reclamation and revegetation efforts.

3.3.1.1 Changes from DEIS

Many of the changes we made to section 3.3 reflect additional data or details received regarding the Skunk Camp tailings storage location (Alternative 6). This includes more detail on anticipated reclamation activities and their anticipated effectiveness for meeting future desired conditions of the landscape, and soil and vegetation conditions in the field. As described in chapter 2, Alternatives 5 and 6 no longer have alternative pipeline routes to reach the tailings storage facility, but only a single route each. We revised the Alternative 6 pipeline route, in large part to address potential impacts to habitat and resources along Mineral Creek. As a result of these route changes, we updated all calculations of acreage impacts used in the analysis. The analysis also includes any potential effects related to compensatory mitigation lands brought forward as part of the CWA Section 404 permitting process.

Since publication of the DEIS, we initiated and concluded Endangered Species Act (ESA) Section 7 consultation with the FWS. The final biological opinion is included as FEIS appendix P. The details and conclusions of impacts to threatened and endangered plant species and any designated critical habitat are contained in the final biological opinion, with summary information in this section.

Several species protection measures have been developed as part of Section 7 consultation. These are incorporated into the analysis as new applicant-committed environmental protection measures.
New mitigation measures have also been brought forward to directly address habitat impacts, including measures developed by Resolution Copper in consultation with the AGFD. These measures are analyzed in the “Mitigation Effectiveness” discussion in this section. The cumulative effects analysis has been revised for the FEIS to better quantify impacts. Cumulative effects are described in detail in chapter 4 and summarized in this section.

3.3.1.2 Changes from the January 2021 Rescinded FEIS

From 2023 to 2025, an analysis was completed, and a memorandum was prepared to assess any changes to the ESA species list and critical habitat designations to determine whether reinitiation of Section 7 Consultation was warranted (Gladding 2025). This was driven largely by the two wildfires (Telegraph Fire and Carlota Fire), one of which burned large portions of the analysis area in the summer of 2021, but also due to new information on the Arizona hedgehog cactus (*Echinocereus arizonicus* spp. *arizonicus*). The Carlota Fire burned outside the analysis area but within occupied Arizona hedgehog cactus habitat. Details of the fire impacts and new Arizona hedgehog cactus information have been added to the EIS. SWCA updated the official ESA species list to check for any new species and confirmed that one new ESA-listed plant species needed to be addressed in this EIS.

Since January 2021, further details have been developed on reclamation procedures for the tailings storage facility and the pipeline/power line corridor and these have been incorporated into the analysis. Changes since January 2021 also include revisions to the cumulative effects analysis based on updates to the list of potentially reasonably foreseeable actions.

In December 2023, the revised "Tonto National Forest Land Management Plan" (forest plan) was implemented (U.S. Forest Service 2023d). The forest plan uses Ecological Response Units (ERUs) to describe ecosystem types mapped on the Tonto National Forest. A quantitative analysis of acreages of ERUs affected has been included in this revision to assess whether the proposed project is consistent with the revised forest plan. The revised forest plan describes Species of Conservation Concern (SCC), which are 52 species identified that are native to and known to occur in the analysis area and for which there are substantial concerns about the species' ability to persist within the analysis area. This section has been updated to reflect analysis of consistency with the revised forest plan; additional SCC have been included in this revision to support that analysis. Forest Service Sensitive Species is no longer a valid designation under the forest plan revision. However, previous analyses of Forest Service Sensitive Species were retained in this document.

3.3.2 Analysis Methodology, Assumptions, and Uncertain and Unknown Information

3.3.2.1 Analysis Area

This section includes a discussion of soils, revegetation, vegetation communities, special status plant species, and noxious weeds. The project area footprint (including all alternatives and facility components) is the analysis area for soils, soil productivity, and revegetation potential, as it encompasses all ground-disturbing activities. The analysis area for vegetation communities, noxious and invasive weeds, and special status plant species includes the project footprint with a 1-mile buffer, as well as areas along Queen Creek and Devil's Canyon, where changes to vegetation communities from groundwater drawdown and changes in surface water hydrology may occur. The buffer for the compensatory mitigation parcels was set at 0.25 mile to account for all direct and indirect impacts of those proposed activities. The soils analysis area is shown in figure 3.3.2-1, the vegetation analysis area is shown in figure 3.3.2-2, and the ERU analysis area is shown in figure 3.3.2-3.

The area beyond the project footprint is informed by the water analyses for riparian areas (analyzed in section 3.7.1), reduction in surface runoff due to the project (analyzed in section 3.7.3); air quality analyses, particularly those focused on the generation and likely dispersion of fugitive dust (analyzed in section 3.6); lighting effects (analyzed in section 3.11), and the potential for noxious weed invasion (Foxcroft et al. 2010). According to the air quality analysis, ambient air quality standards would be achieved at the project footprint boundaries; for that reason, the 1-mile buffer is sufficient to address potential impacts from ambient air quality changes. Additional light associated with project construction and facilities is anticipated to increase the average night sky brightness by 1 to 9 percent (Dark Sky Partners LLC 2018). With the additional light increase of 1 to 9 percent over existing conditions, the 1-mile buffer would be sufficient to capture potential project-related impacts on plants from additional light.

The temporal parameters for this analysis involved the time frames for (1) construction: mine years 1 through 9; (2) operation: mine years 6 through 46; and (3) closure and reclamation: mine years 46 through 51–56. This analysis also extends to the time it takes to complete reclamation, because arid soils and vegetation communities in the analysis area can take very long periods (hundreds to thousands of years) to recover and reestablish.

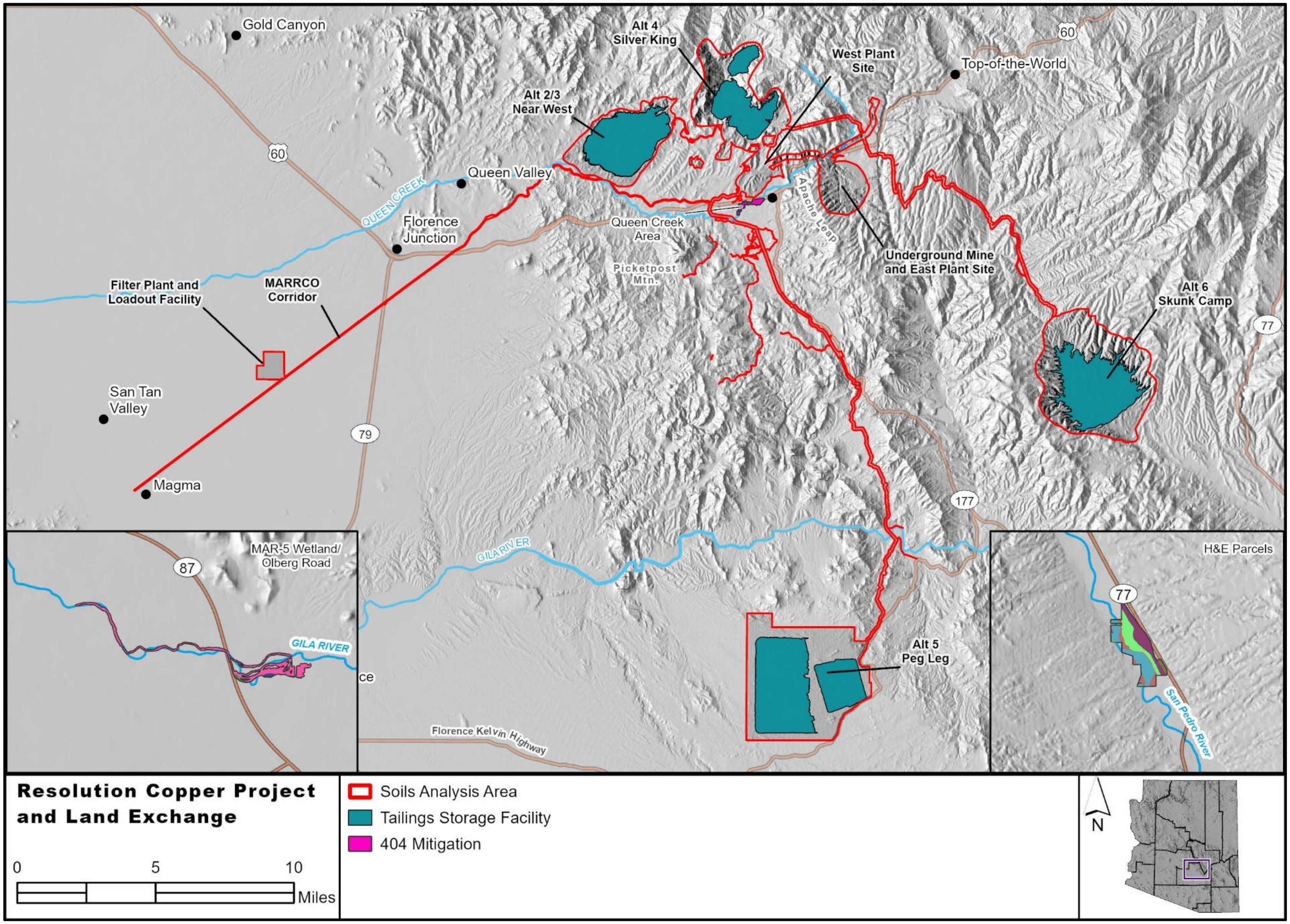


Figure 3.3.2-1. Soils analysis area

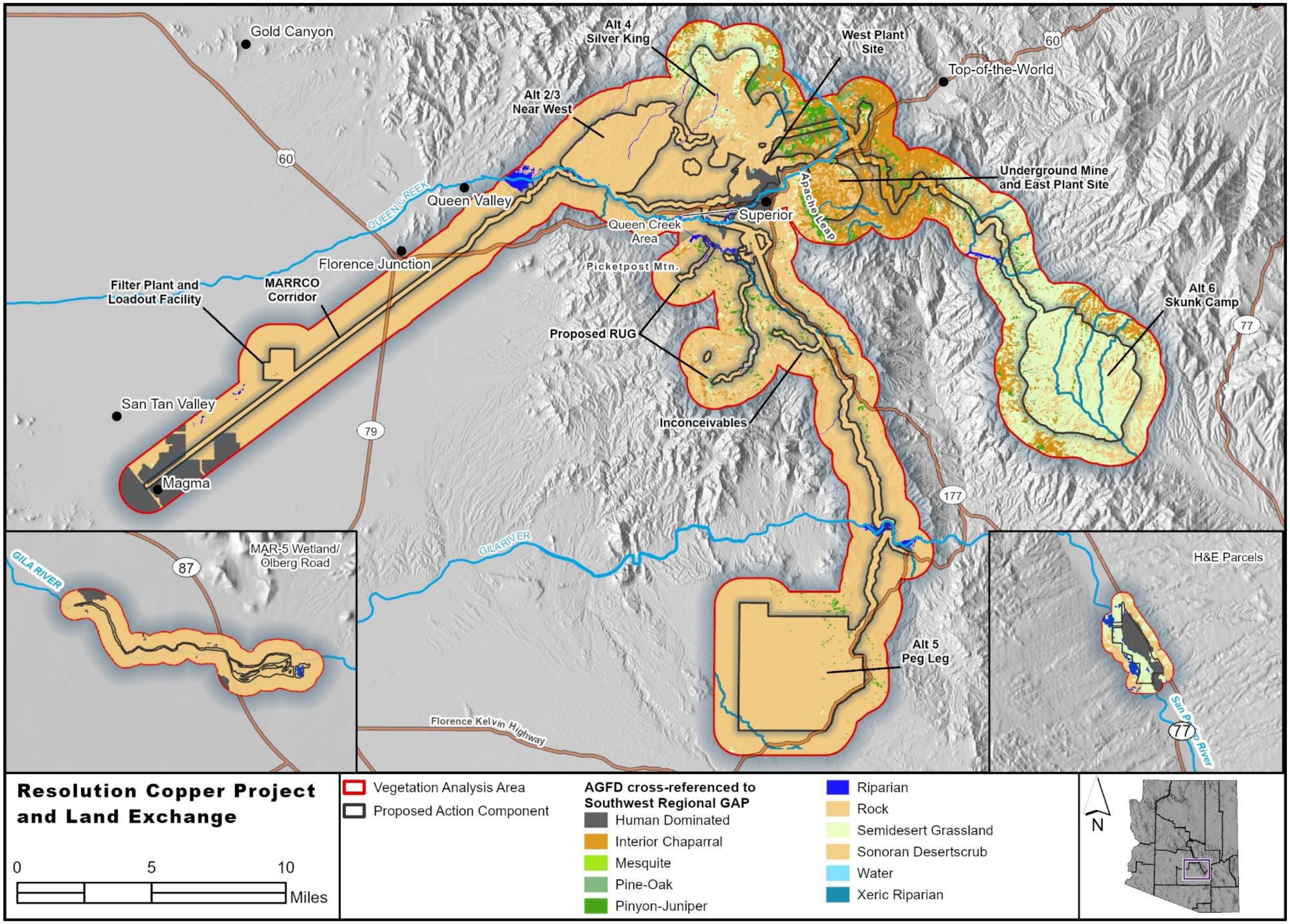


Figure 3.3.2-2. Vegetation analysis area

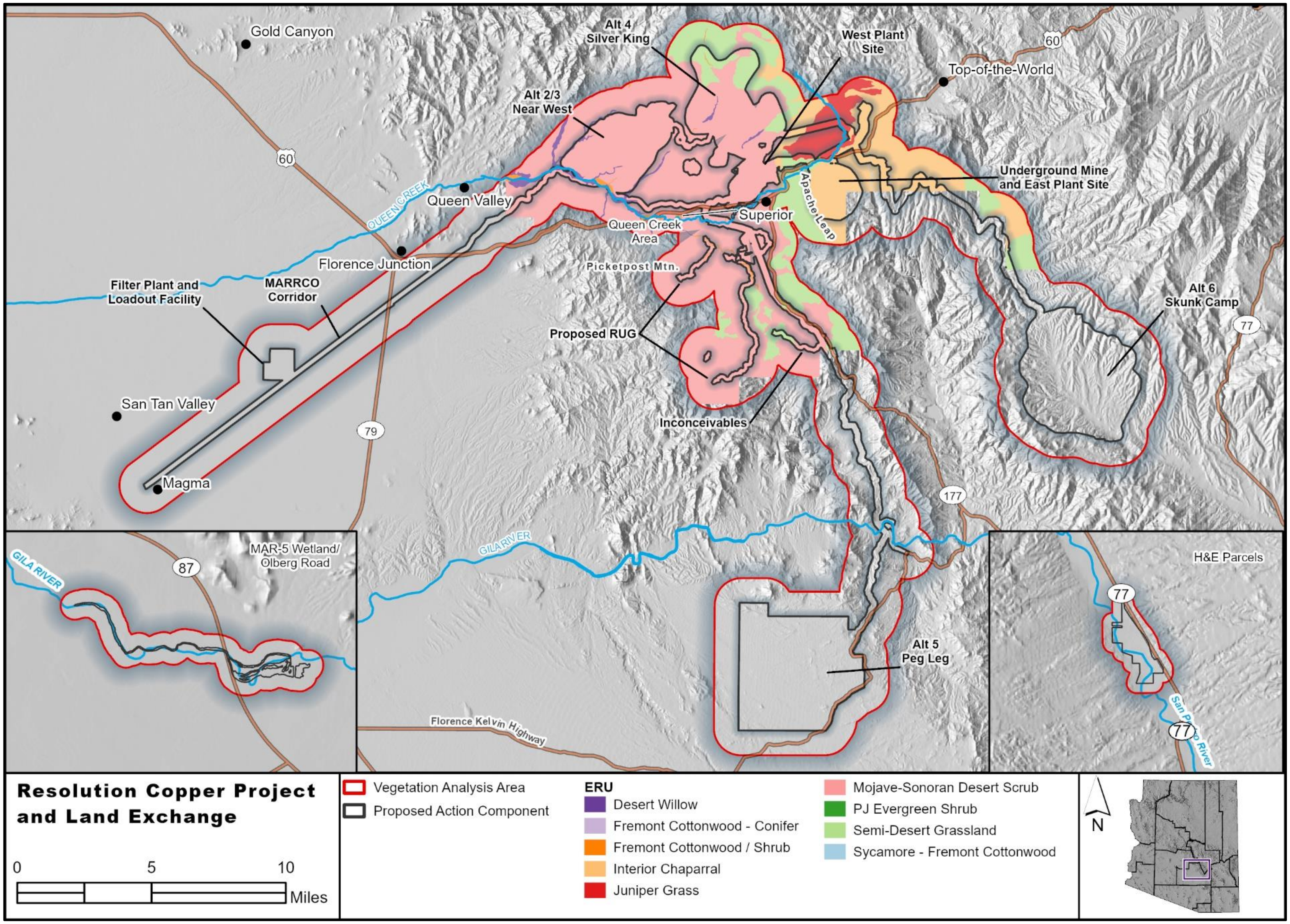


Figure 3.3.2-3. Ecological Response Units analysis area

3.3.2.2 Soils Analysis

The goal of the soils analysis is to identify the potential impacts on soil resources from all project activities and alternatives. In this analysis, soils are considered nonrenewable resources, as their formation in desert environments (particularly those characteristics that control biological community establishment) takes place over hundreds to thousands of years (Webb et al. 1988; Williams et al. 2013). Soil losses within the project footprint are, therefore, treated as permanent unless (1) soils are salvaged and reapplied during the construction and reclamation processes, (2) revegetation efforts successfully stabilize soils and reduce long-term erosion, and (3) soil productivity is returned to pre-mine conditions.

No single data set covers the entire project footprint; therefore, two data sources were combined for the soils analysis: (1) the USDA National Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database (2017); and (2) the Forest Service General Terrestrial Ecosystem Survey (GTES) (U.S. Forest Service 2018f), applied where SSURGO data were unavailable. Where available, SSURGO data (Natural Resources Conservation Service 2017) provided information regarding general soil morphological characteristics, soil depth, soil productivity, soil fertility, and soil wind and water erosion potential (Natural Resources Conservation Service 2018). For this analysis, soil productivity is defined as "capacity of soil, in its normal environment, to support plant growth" (Minnesota Forest Resources Council 1999). GTES data provide some information on erosion susceptibility in other areas (U.S. Forest Service 2018f). In areas lacking SSURGO data, information regarding the nature and thickness of alluvial deposits and soil cover was taken from the "Near West Tailings Storage Facility Geotechnical Site Characterization Report" (corresponding directly to Alternatives 2 and 3) and extrapolated to other alternatives (Klohn Crippen Berger Ltd. 2017). Data and interpretations could be reasonably extrapolated across alternatives, as all sites occur within similar ecosystems of central Arizona. Site-specific interpretations of soil map units and erosion potential are limited by the resolution and accuracy of GIS data, which varied by data source and survey effort. Details of the soils analysis approach are available in Newell (2018g).

After publication of the DEIS, KCB Consultants Ltd. (2020c) provided a site investigation and laboratory testing report for the soils occurring within the footprint of the preferred alternative, in response to Forest Service mitigation measures FS-223 and FS-224 that were identified in the DEIS. Soil samples collected from within the Skunk Camp tailings storage facility footprint were analyzed for physical and geochemical characteristics to inform reclamation strategies.

3.3.2.3 Revegetation Analysis

The goal of the revegetation analysis is to provide a site-specific assessment of current conditions and guidance for future revegetation efforts throughout the life of the project. Revegetation success depends on several controlling environmental variables (precipitation or water availability, climate, soil or revegetation substrate, reclamation techniques, etc.); therefore, no individual study includes enough information to project rates of revegetation success. For this analysis, a meta-analysis drew data from many sources to model revegetation rates. The analysis does not reflect outcomes for individual project components but instead relies on conceptual reclamation plans and provides a range of possible revegetation outcomes that could be expected at a given time after reclamation has commenced. The first step in the meta-analysis was to gather relevant case studies from published scientific literature, technical reports, and semi-quantitative field observations. Two attributes were compiled from each study: (1) the number of years since reclamation commenced, and (2) the minimum and maximum observed percent vegetation cover at the given time. The results from each study were combined into a single figure for visual interpretation. Details of the data sources and the analysis approach are provided in Bengtson (2019).

The assessment of revegetation relies in part on the reclamation plans that have been prepared by Resolution Copper, both as part of the GPO (section 6.0) and during alternatives development for the different tailings storage facilities. These reclamation plans largely describe the expected timing, type, and location of reclamation activities and provide the reclamation goals to be achieved. These conceptual reclamation plans are briefly summarized in this section.

A further level of reclamation detail would be developed in the final reclamation plans. For those alternatives with tailings storage facilities on NFS land (Alternatives 2, 3, and 4), the reclamation plans would be approved by the Forest Service and used to guide bonding estimates. As an example, the GPO identifies only that reseeding would occur and proposes a likely seed mix. Details in the final reclamation plan would identify surface preparation (ripping or tilling), site amendments (straw or fertilizers), a final seed mix, whether, where, and how any direct planting would be done, the need for supplemental watering, and performance standards that would need to be met through monitoring of revegetation progress. A similar approval/bonding process would occur with BLM for the Alternative 5 tailings storage facility.

Alternative 6 does not involve a tailings storage facility on Federal land. In this case, reclamation plans for the tailings storage facility would be reviewed by state agencies as part of their permitting process, including the Arizona State Mine Inspector, and the ADEQ under the jurisdiction of the APP program. Under Alternative 6, the only reclamation plans the Forest Service would review and approve would be those associated with the pipeline and power line corridors on NFS lands.

After publication of the DEIS, detailed reclamation and closure plans for the general project (Tetra Tech Inc. 2020) and the tailings storage facility under the preferred alternative (KCB Consultants Ltd. 2020c) were completed. The plans specify revegetation methods, including seedbed preparation, soil amendments, seed mixes, and outline monitoring parameters and success criteria.

3.3.2.4 Vegetation Communities, Noxious Weeds, and Special Status Plant Species Analysis

This analysis identifies the potential impacts on vegetation, vegetation communities, and special status plant species from all activities associated with each project alternative, including closure and reclamation (see table E-1 in appendix E for details associated with each alternative). The analysis also evaluates the increased likelihood of introduction and/or spread of noxious weed species in the analysis area.

The factors for analysis identified during the NEPA scoping process, survey, and records data provided as part of this project, as well as a scientific examination using current literature on species and how environmental changes (human or natural) affect species and their habitat, constitute the foundation of this analysis.

The uncertainties and unknown information, as well as assumptions, of this analysis include (1) limitations in the use of geographic information system (GIS) data (e.g., mapping data may have inaccuracies and resulting calculations could be an overestimation or underestimation) or data come from different sources for different portions of the analysis area; however, the analysis area contains similar overall environments and data sources have been reasonably extrapolated to cover the entire analysis area; (2) lack of current scientific data on how certain environmental changes affect species (e.g., there are only a few studies available regarding dust effects on plants); and (3) reliance on other, previous resource analyses as informational sources for the conclusions reached in this current analysis may inadvertently reiterate the assumptions, uncertainties, or unknown information inherent in these prior studies.

The analysis of reclamation success relies in part on the desired conditions for the lands, which are the expectations for how the landscape should appear and function over the long term. For the purposes of this analysis, desired conditions were informed both by internal work by the Tonto National Forest on the ongoing revision to the draft forest plan, which was published in the Federal Register in December 2019, along with the DEIS, and the forest plan, published in December 2023. The desired conditions used in this section are meant to allow an assessment of reclamation success but should not be construed as management direction from the Tonto National Forest.

After publication of the DEIS, WestLand Resources Inc. (2020l) provided a vegetation assessment for the preferred alternative in response to Forest Service mitigation measure FS-225 contained in the DEIS, to identify the general vegetation, the density and abundance of native and non-native species, the presence of special status plant species, and potential special status plant species habitat within the Skunk Camp tailings storage facility.

3.3.3 Affected Environment

3.3.3.1 Relevant Laws, Regulations, Policies, and Plans

A summary of the principal legal authorities pertinent primarily to reclamation is shown in the accompanying text box. A complete listing and brief description of the laws, regulations, reference documents, and agency guidance used in this soils and vegetation effects analysis may be reviewed in Newell (2018g).

Primary Legal Authorities and Technical Guidance Relevant to the Soils and Vegetation Effects Analysis

- Forest Service locatable mineral regulations (36 CFR 228 Subpart A), specifically:
  - Minimizing adverse environmental impacts on NFS surface resources (36 CFR 228.8)
  - Requirements for reclamation (36 CFR 228.8(g))
- Forest Service Manual 2500, Chapter 2550 – Soil Management
- Arizona Native Plant Law (ARS 3-904)
- Federal Noxious Weed Act of 1974
- Arizona Mined Land Reclamation Program
- State of Arizona Noxious Weed Statute (ARS 3-201, Arizona Administrative Code R3-4-245)
- Taylor Grazing Act (43 U.S.C. 315-315(o))
- Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701–1782)
- BLM Instruction Memorandum No. AZ-IM-2017-009: Updated Bureau of Land Management Sensitive Species List for Arizona

Ecological Response Units

The Tonto National Forest, as described in the forest plan, uses ERUs to provide management direction for the vegetation communities found on the Tonto National Forest. ERUs are “mapped ecosystem types based off biophysical themes that represent the range of conditions (e.g., dominant species, vegetation associations, soils, landscape features, and climate) that prevail under natural disturbance regimes (e.g., fire, insects, and disease)” (U.S. Forest Service 2023d:80).

The forest plan describes desired conditions for each ERU at three spatial scales: landscape scale, mid-scale, and fine scale. These desired conditions described for each scale within each ERU provides guidance for project design and activities that will help achieve the desired conditions over time. The desired conditions for each ERU include the descriptions for a range of conditions. While each project and each acre within a mapped ERU are not expected to reach the ERU target, individual projects should be designed to help move the ecosystem toward the desired conditions. The culmination of projects and averaged conditions within the forest is expected to move the ERU toward its target desired conditions over time (U.S. Forest Service 2023d).

3.3.3.2 Existing Conditions and Ongoing Trends

Soil Occurrence and Characteristics

The project area footprint, including all components and alternatives, is characterized by Basin and Range geomorphology (Peterson 1981), with soils formed in alluvium, eolian deposits, colluvium, and thin residuum (overlying bedrock outcrops). In general, the deepest soils are formed within expansive alluvial fan piedmonts or alluvial deposits within the bottoms of canyons. Shallower soils form as thin alluvial or colluvial deposits along ridges and hillslopes (overlying shallow bedrock), or as shallow soils overlying calcium carbonate-cemented horizons (petrocalcic horizons) that form root-restrictive layers.

There are 42 soil units mapped in the analysis area (including the combination of map units from SSURGO and GTES datasets), with the majority of these individual map units being minor and constituting less than 1.0 percent of the area of each alternative. These map units are delineated in figure 3.3.3-1. The predominant soil units mapped for each action alternative are detailed in data provided later in table 3.3.3-3, which includes descriptions of each predominant map unit's morphological characteristics, soil depths, soil productivity (either annual biomass production or dominant vegetation community), and soil fertility. Areas covered by SSURGO (Natural Resources Conservation Service 2017) data contain the most detailed soil descriptions, whereas data from other sources were used to extrapolate soils-related data to areas covered by GTES data (U.S. Forest Service 2018f). Data provided later in table 3.3.3-3 include only predominant soil map unit information; details of acreages of all individual map units are provided in Newell (2018g). Soil mapping is at an insufficient scale to delineate the location of each soil unit with respect to a specific disturbance feature for each alternative.

Soils across all project alternatives display characteristics that are unique to arid and semi-arid environments, which influence ecological function and response to disturbance. For example, soil resources such as water and nutrients display extreme variation through space and time, as pulses in precipitation drive pulses in biological and chemical cycles and processes (Abella 2017). Arid and semi-arid soils display distinct surface features such as desert pavements and biotic soils that provide critical soil cover (in areas where vegetation is sparse) and play an active role in the capture of dust and formation of dust-rich vesicular horizons, which strongly influence the distribution and storage of water (Williams 2011; Williams et al. 2013). Desert pavements form a single layer of surface rock fragments that resemble smooth pavement surfaces (Wood et al. 2005), whereas biotic soils formed by cyanobacteria, mosses, lichens, bacteria, algae, and fungi that grow around soil mineral particles create a living soil cover (Eldridge and Greene 1994; Williams et al. 2012).

Fertile islands are also ubiquitous surface features in these soils, where nutrients, organic material, macro- and microbiological activity, and water availability are elevated in surface soils beneath the canopies of perennial vegetation as compared with the soils of surrounding plant interspaces (Schlesinger et al. 1996). Surface soils further contain soil seedbank, which in most deserts is limited to the upper 2 inches of soil (Scoles-Sciulla and DeFalco 2009). Surface topography and soil cover drive the distribution of water and infiltration across arid soil surfaces in arid environments. Soil water runs off smooth surfaces with low infiltration only to be captured along rougher surfaces with greater infiltration potential and stored where soil water-holding capacity is high (Wood et al. 2005). Similarly, slope drives the redistribution of water, with drainages capturing and storing the majority of water runoff, leading to different community composition in those areas compared with or to adjacent upland areas (Schwinning et al. 2010).

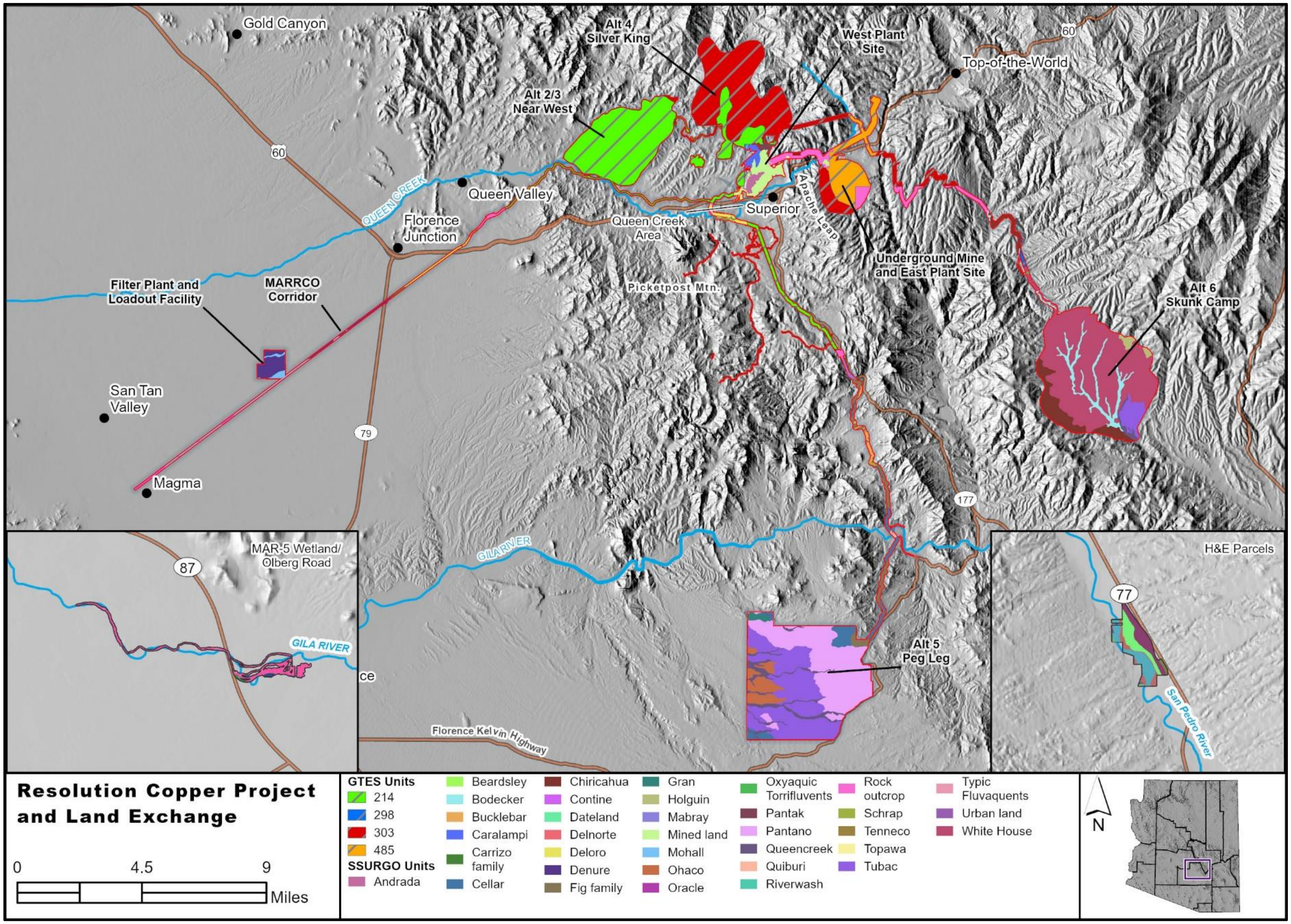


Figure 3.3.3-1. Soil map units as delineated from SSURGO (Natural Resources Conservation Service 2017) and GTES (U.S. Forest Service 2018f) datasets

SOIL DATA SPECIFIC TO PREFERRED ALTERNATIVE

After the publication of the DEIS, KCB Consultants Ltd. (2020c) provided a site investigation and laboratory test for the soils occurring within the preferred alternative to address Forest Service mitigation measures FS-223 and FS-224. The geology around the tailings storage facility footprint consists of a basement of Precambrian Pinal schist overlain by younger Precambrian deposits, siltstone, sandstone, limestone, basalt, and quartzite. Above the Precambrian deposits, Paleozoic sedimentary quartzite and limestone rocks are intruded by Cretaceous and Tertiary tuffs and conglomerates. The Skunk Camp tailings storage facility entirely overlies a deposit of Tertiary conglomerate (i.e., Gila Conglomerate). Surface and deep core soil samples collected from within the preferred alternative tailings storage facility footprint—consisting of deposits of alluvium, Quaternary Pediment, and Gila Conglomerate—were analyzed for physical and geochemical characteristics via a laboratory test. In general, the Gila Conglomerate within the facility footprint consists of shallow soil deposits overlying bedrock and is low in organic matter and plant available nutrients, which are typical traits of soils in arid climates. Gila Conglomerate, the predominant soil type occurring within the facility footprint, is the intended reclamation cover material and is described in more detail below.

Soils Suitability for Reclamation

According to the GPO (Resolution Copper 2016c), soils within much of the project footprint (particularly those within Alternatives 2 and 3) are primarily bedrock-controlled, and only a thin veneer of soils could be salvaged for previous reclamation and revegetation efforts (Resolution Copper 2016c). The GPO states that, where possible, soil would be salvaged for reuse during reclamation. The geotechnical study for the Near West tailings storage facility (Klohn Crippen Berger Ltd. 2017) has identified thick alluvial deposits in drainages within the footprint and borrow areas of the proposed facility (alluvial deposits 6 to 35 feet thick); however, the alluvium has been allocated for construction of drains and filters. These bedrock-controlled soils (alluvium and colluvium up to 5 feet in thickness (Klohn Crippen Berger Ltd. 2017) and thicker alluvial soils in drainages are typically capable of supporting vegetation communities ranging from Sonoran Desertscrub and to Interior Chaparral Semi-Desert Grasslands (see data provided later in table 3.3.3-4).

Alternative 5 has both shallow, bedrock-controlled soils (up to 20 inches deep) and deeper soils formed along alluvial fan terraces (more than 60 inches deep). These soils have low organic matter (approximately 1 percent) and near neutral to slightly alkaline pH conditions that support annual rangeland productivity ranging from 350 to 600 lb biomass/acre/year (Natural Resources Conservation Service 2017).

Alternative 6 has both bedrock-controlled soils (alluvium and colluvium up to 5 feet in thickness (Klohn Crippen Berger Ltd. 2017) and deeper soils formed in alluvial fans (more than 60 inches deep) (Natural Resources Conservation Service 2017). These soils have low organic matter (approximately 1 percent) and slightly acidic to slightly alkaline pH conditions that support annual rangeland productivity ranging from 600 to 800 lb biomass/acre/year (Natural Resources Conservation Service 2017).

While some volume of soils would be salvaged (as practicable) for project reclamation, most of the capping material for the proposed tailings storage facility would be derived from excavation during construction of project infrastructure. The tailings storage facility reclamation and closure plan (KCB Consultants Ltd. 2020c) provides a site investigation and laboratory test of the potential closure materials occurring within the preferred alternative footprint in response to mitigation measures FS-223 and FS-224. In the study, 29 soil samples were analyzed for their physical and geochemical characteristics to inform reclamation suitability of the available materials. Gila Conglomerate, which is present in sufficient quantities to serve as capping material for the preferred alternative, was verified as the preferred closure material for reclamation.

Gila Conglomerate was selected for the following reasons (Klohn Crippen Berger Ltd. 2016):

1. availability of material and ease of extraction,
2. favorable chemical and physical properties, and
3. its potential to support plant growth.

The characteristics of this material as a closure material and plant-growth medium are described in more detail in Epstein (2020). In general, Gila Conglomerate is a slightly acidic to slightly alkaline material (pH 6.7 to 8.2), is not potentially acid generating, and has a high (>2) net neutralization potential (Klohn Crippen Berger Ltd. 2016). Gila Conglomerate has both high saturated hydraulic conductivity (1.03×10^{-3} cm/s) and low water-holding capacity (0.13 cm/cm) (KCB Consultants Ltd. 2020c). Organic matter ranges from 0.1 to 2.2 percent, which is on scale with organic matter measured in natural surface soils in the area (Klohn Crippen Berger Ltd. 2016). Total Nitrogen ranges from less than 0.1 to 0.2 percent, and organic carbon ranges from 0.03 to 1.3 percent (Klohn Crippen Berger Ltd. 2016). Gila Conglomerate bedrock and soils formed from Gila Conglomerate parent material have been shown to support native and warm- and cool-season perennial grasses, annual forbs, and perennial forbs, some shrubs, and trees (Lawson 2012; Lawson 2011; Milczarek et al. 2011; Romig et al. 2006; Vinson et al. 1999). Revegetation studies on Gila Conglomerate–derived soils have shown that vegetation cover may range from 2.8 to 26 percent less than 1 year after reclamation treatments were applied (Lawson 2012; Lawson 2011). For surfaces capped by crushed Gila Conglomerate bedrock, another study showed that vegetation cover varied from 11 to 71 percent 1 year after treatment, and by year 12, vegetation cover ranged from 23 to 77 percent (Milczarek et al. 2011). These studies further indicate that soil amendments, such as organic amendments and mulch treatments, may help increase the success of revegetation when crushed Gila Conglomerate bedrock is the plant growth medium, by increasing soil water-holding capacity and soil fertility and decreasing erosion susceptibility (Klohn Crippen Berger Ltd. 2016; Lawson 2011; Milczarek et al. 2011; Vinson et al. 1999).

Estimates of Salvage Volumes

The GPO identified different geological units that would be salvaged during site preparation as being favorable for different uses for final cover (see table 4.6-1 in Resolution Copper (2016c)):

- Alluvial material. Primarily used for drains and filters for seepage control.
- Apache Leap Tuff. Primarily used for drains and filters, and for armoring of tailings embankment and seepage control embankments.
- Gila Conglomerate. Used for starter dams, drains and filters, and closure cover.
- Pinal Schist. Primarily used for armoring of tailings embankment, seepage control embankment, and diversion channels.

With respect to the final reclamation cover, the GPO originally estimated that over 8,000 acre-feet (13 million cubic yards) of Gila Conglomerate material would be available for cover during reclamation for the proposed action (Alternative 2), based on salvage from two borrow areas of about 350 acres, roughly to a depth of about 20 feet (table 3.3.3-1). With the development of different tailings alternatives, the specific borrow areas have changed. The types and available volumes of closure cover material under the preferred alternative are summarized in table 3.3.3-2.

Table 3.3.3-1. Estimated locations and amounts of available reclamation cover material

	Alternatives 2 and 3	Alternative 4	Alternative 5	Alternative 6
Proposed borrow area acreage	209 acres (one location)	247 acres (one location)	721 acres (five locations)	390 acres (two locations)
Primary geology of borrow area	Gila Conglomerate	Gila Conglomerate	Alluvium and Gila Conglomerate; some granite	Gila Conglomerate
Estimated volume of cover material available*	4,180 acre-feet (6.7 million cubic yards)	4,940 acre-feet (8 million cubic yards)	14,400 acre-feet (23.2 million cubic yards)	7,800 acre-feet (12.5 million cubic yards)
Approximate depth of cover from borrow areas for tailings storage facility†	1.3 feet	2.2 feet	2.7 feet	1.8 feet

* Assumes excavation to a depth of 20 feet

† Based on planar acreage of tailings storage facility. Accounting for slopes (at 3H:1V) would require minimal additional material (less than a 5% increase).

Table 3.3.3-2. Locations and estimated amounts of required and available reclamation cover material under the preferred alternative

Material	Source	Volume Required (Myd^3)	Volume Available
Troy quartzite or Gila Conglomerate riprap	Quartz deposit at the right abutment of the main embankment (Troy quartzite) or excavation of the closure diversion channel (Gila Conglomerate)	0.1	Estimation not provided; sufficient cover is available
Gila Conglomerate embankment slope cover and tailings surface cover	Excavation from the closure diversion channel and/or ridges west of the tailings storage facility	13.9	>14.0 Myd^3
Organics	Clearing and grubbing the tailings storage facility footprint	0.7	>0.8 Myd^3

Source: KCB Consultants Ltd. (2020c)

Note: Myd^3 = million cubic yards

The conceptual reclamation plans for the tailings storage facilities call for a minimum of 1.5 feet of cover, and the borrow areas proposed are roughly sufficient to provide this material for the tailings storage facility. Additional cover material would be obtained from salvage of surface soils within the footprint of the facility.

Previous investigations have looked at the possibility of the closure cover being a mix of materials, such as Gila Conglomerate and NPAG tailings (Klohn Crippen Berger Ltd. 2016). Geochemical characterization tests have been conducted on these materials and identified that there may be some potential for elevated metals in stormwater runoff. See section 3.7.2 for details of the geochemical tests conducted for NPAG tailings, and tests on Gila Conglomerate have been described in several other reports (Klohn Crippen Berger Ltd. 2016, 2017).

Note that several mitigations are required that would provide for detailed estimates of soil available for salvage, salvaged soil storage techniques, potential preparation techniques (like excavation and crushing for Gila Conglomerate), conducting of appropriate tests to identify any potential water quality concerns for the selected cover material, and preparation of detailed reclamation plans that specify the cover materials to be used (see section 3.3.4.9). The predominant soil units mapped for each action alternative are detailed in table 3.3.3-3, which includes descriptions of each predominant map unit's morphological characteristics, soil depths, soil productivity (either annual biomass production or dominant vegetation community), and soil fertility.

Vegetation Occurrence and Characteristics

VEGETATION COMMUNITIES

Twelve vegetation communities and land cover types occur within the analysis area. These communities and land cover types, along with the acres for each, are given in table 3.3.3-4 and are shown in figure 3.3.3-2. The vegetation community GIS data used for this analysis comprised a specialized dataset developed by the AGFD that is a crosswalk between the larger scale (Brown 1994; Brown et al. 2007) and Southwest Regional Gap Analysis Project (SWReGAP) vegetation communities data and, more specifically, a modified SWReGAP layer that was used in the AGFD's statewide modeling process (data obtained from AGFD on August 27, 2018).

A brief description of each of the vegetation communities in the analysis area is provided here, with more technical description included in Newell (2018g). These vegetation community descriptions are based on SWReGAP regional land cover types which may not reflect the exact conditions on-site. Within each alternative footprint, a variety of combinations of different vegetation communities are present. Note that where specific vegetation data are shown to be lacking, several mitigations are required that would provide for collection of this information (see section 3.3.4.9).

Table 3.3.3-3. Predominant soils by alternative

Alternative	Total Acres*	Map Unit Symbol (data source)	Map Unit Name	Map Unit Description and Soil Composition	Productivity† (pounds of biomass per acre or dominant vegetation community)	Fertility‡	Acreage within Map Unit§	Percentage of Alternative
Alternative 2 – Near West Proposed Action	9,875	214 (GTES)	CEMI2, LATR	Klohn Crippen Berger Ltd. (2017) identified the majority of soils and soil parent material within the Near West project footprint to be formed in Undifferentiated Quaternary Deposits (Qs).¶ These surfaces are covered in slope wash and colluvium, and recent alluvium in narrow drainages low-relief areas underlain by bedrock (up to 5 feet in thickness). The material comprises gravel (10%–50%), silt and clay (28%–45%), and sand (10%–50%). Material is generally thinner along ridges and thicker along concave backslopes and toe-slopes. Active channels and drainages contain localized deposits of Recent Alluvium (Qal) and Old Alluvium (Qoa). Qal deposits are located adjacent to active channels reaches thicknesses of 6 to 35 feet (within the Near West footprint) and comprises uncemented, loose to dense sand (25%–80%) and gravel (10%–55%), silt and clay (2%–40%), and trace boulders (up to 24-inch diameter). Qoa deposits are located along the margins of active channels and include partially cemented to well-cemented gravel (40%–60%), sand (25%–40%), silt and clay (18%–30%), with some cobbles and boulders (up to 24-inch diameter). Carbonate cementation varies by deposit age. Old Lacustrine (Qoa-Lu) units occur in limited areas as 1- to 4-foot-thick deposits overlying Gila sandstone, and include gravel <10%, clay and silt (37%–78%), and sand (20%–28%).	Sonoran Desertscrub	No information available	5,274	53
		485 (GTES)	QUTU2	The majority of areas are covered by Qs deposits (along ridges and hillslopes) with some of Qal and Qoa deposits (adjacent to active channels).* See unit descriptions above.	Interior Chaparral	No information available	1,457	15
Alternative 3 – Near West – Ultrathickened	9,885	214 (GTES)	CEMI2, LATR	Similar to Alternative 2 Near West Proposed Action (see above)	Sonoran Desertscrub	No information available	5,274	53
		485 (GTES)	QUTU2	Similar to Alternative 2 Near West Proposed Action (see above)	Interior Chaparral	No information available	1,457	15

Alternative	Total Acres*	Map Unit Symbol (data source)	Map Unit Name	Map Unit Description and Soil Composition	Productivity† (pounds of biomass per acre or dominant vegetation community)	Fertility‡	Acreage within Map Unit§	Percentage of Alternative
Alternative 4 – Silver King	10,072	214 (GTES)	CEMI2, LATR	No direct observations from Klohn Crippen Berger Ltd. (2017) were available to inform interpretations regarding soils or quaternary deposit thickness.* Based on extrapolation (from aerial imagery and geological mapping), most canyon bottoms are likely to contain Qal and Qoa deposits (adjacent to active channels) with some Qs deposits along ridges and hillslopes. See unit descriptions above, in this table.	Sonoran Desertscrub	No information available	1,002	10
		303 (GTES)	FOSP2, QUTU2, GRANITE OUTCROP	No direct observations from Klohn Crippen Berger Ltd. (2017) were available to inform interpretations regarding soils or quaternary deposit thickness.* Based on extrapolation (from aerial imagery and geological mapping), most areas are covered by Qs deposits (along ridges and hillslopes) with some Qal and Qoa deposits (adjacent to active channels). See unit descriptions above, in this table.	Mix of Semi-Desert Grasslands and Sonoran Desertscrub	No information available	5,345	53
		485 (GTES)	QUTU2	No direct observations from Klohn Crippen Berger Ltd. (2017) were available to inform interpretations regarding soils or quaternary deposit thickness.* Based on extrapolation (from aerial imagery and geological mapping), most areas are covered by Qs deposits (along ridges and hillslopes) with some discrete Qal and Qoa deposits (adjacent to active channels). See unit descriptions above, in this table.	Interior Chaparral	No information available	1,457	14
Alternative 5 – Peg Leg	16,917	74 (SSURGO)	Pantano-Anklam-Rock outcrop complex, 3 to 20 percent slopes	The Pantano soil series are well-drained soils formed on steep alluvial and colluvial slopes and have a loamy matrix with ≥ 35% rock fragments. Soils are shallow, overlying fractured bedrock at 20-inch depths. The Anklam soil series are well-drained soils formed on moderate to steep alluvial slopes and have a loamy matrix with ≥ 35% rock fragments. Soils are shallow, overlying fractured bedrock at 10- to 20-inch depths. Granite or other bedrock outcrops cover 20% of the soil surface.	Pantano: 350 lb/acre Anklam: 500 lb/acre Bedrock: negligible	Organic Matter: 0.5%–1% pH: 6.1–8.4	4,243	25

Alternative	Total Acres*	Map Unit Symbol (data source)	Map Unit Name	Map Unit Description and Soil Composition	Productivity† (pounds of biomass per acre or dominant vegetation community)	Fertility‡	Acreage within Map Unit§	Percentage of Alternative
		98 (SSURGO)	Tubac-Rillino complex, 3 to 25 percent slopes	The Tubac soil series are well-drained soils formed along alluvial fan terraces and basin floors with 0%–8% slopes. Soil textures are fine clay to sandy clay loam with 2% rock fragments, with diagnostic argillic horizons from 11–44 inches. Soils reach depths of 44–60+ inches. The Rillino soil series are well-drained soils formed along alluvial fan terraces with 1%–50% slopes. Soil textures range from sandy loam to loam with 15%–35% rock fragments. Soils reach depths of 60+ inches, with calcic (calcium carbonate-rich) soils at a depth of 5–20 inches.	Tubac: 600 lb/ac Rillino: 400 lb/ac	Organic Matter: 1%	4,210	25
Alternative 6 – Skunk Camp	15,043	485 (GTES)	QUTU2	No direct observations from (Klohn Crippen Berger Ltd. 2017) were available to inform interpretations regarding soils or quaternary deposit thickness.* Based on extrapolation (from aerial imagery and geological mapping), most areas are covered by Qs deposits (along ridges and hillslopes) with some discrete Qal and Qoa deposits (adjacent to active channels). See unit descriptions above, in this table.	Interior Chaparral	No information available	1,343	8
		104 (SSURGO)	White House-Stronghold complex, 5 to 60 percent slopes	The White House soil series are well-drained soils formed in alluvial fans, with 0%–60% slopes. Soil textures range from sandy clay to clay with less than 35% rock fragments. Soils reach depths of 60+ inches, with argillic horizons from 3–39 inches. The Stronghold soil series are well-drained soils formed in alluvial fan remnants, with 1%–60% slopes. Soil textures range from loamy sand to loam with less than 35% rock fragments. Soils reach depths of 60+ inches, with a calcic (calcium carbonate–rich) horizon from 1–60 inches.	White House: 800 lb/acre Stronghold: 600 lb/acre	Organic Matter: >1% pH: 5.6–8.4	7,130	47

* Total acreage includes physical disturbance footprint of all facilities, including subsidence area, as well as disturbance associated with Silver King road realignment and recreation mitigation.

† Productivity data are reported as pounds of biomass per acre per year, as derived from SSURGO datasets where data are available (Natural Resources Conservation Service 2017). No productivity data are available for areas mapped by GTES data; dominant vegetation communities (as reported in table 3.3.3-4) are used as a proxy for productivity.

‡ Limited soil fertility data are available from SSURGO datasets (Natural Resources Conservation Service 2017). No soil fertility data are available for areas mapped by GTES data (U.S. Forest Service 2018f).

§ See Newell (2018g).

¶ Soil composition data within Tonto National Forest lands are derived from the Near West Tailings Storage Facility Geotechnical Site Characterization Report (Klohn Crippen Berger Ltd. 2017). Data were specific to the Near West tailings storage facility but have been extrapolated (as appropriate) to other alternatives.

Table 3.3.3-4. Vegetation communities and land cover types in the analysis area

Vegetation Community or Landform Type	Alternatives 2 and 3 (acres)	Alternative 4 (acres)	Alternative 5 (acres)	Alternative 6 (acres)
Human dominated	5,646	5,646	5,646	5,646
Interior Chaparral	9,382	11,500	9,483	16,180
Open-pit mine	3	3	3	3
Pine-Oak	183	359	183	372
Pinyon-Juniper	1,571	1,856	1,996	2,138
Riparian	1,809	1,747	2,109	1,765
Rock	102	103	102	93
Semi-Desert Grasslands	3,415	6,683	3,248	21,483
Sonoran Desertscrub	72,764	69,484	100,645	68,899
Wash	0	0	0	4
Water	15	15	15	15
Xeric Riparian	1,010	1,130	1,331	2,240
Total Acres	**95,900**	**98,526**	**124,761**	**118,838**

Note: Acreages in this table are rounded to the nearest whole number.

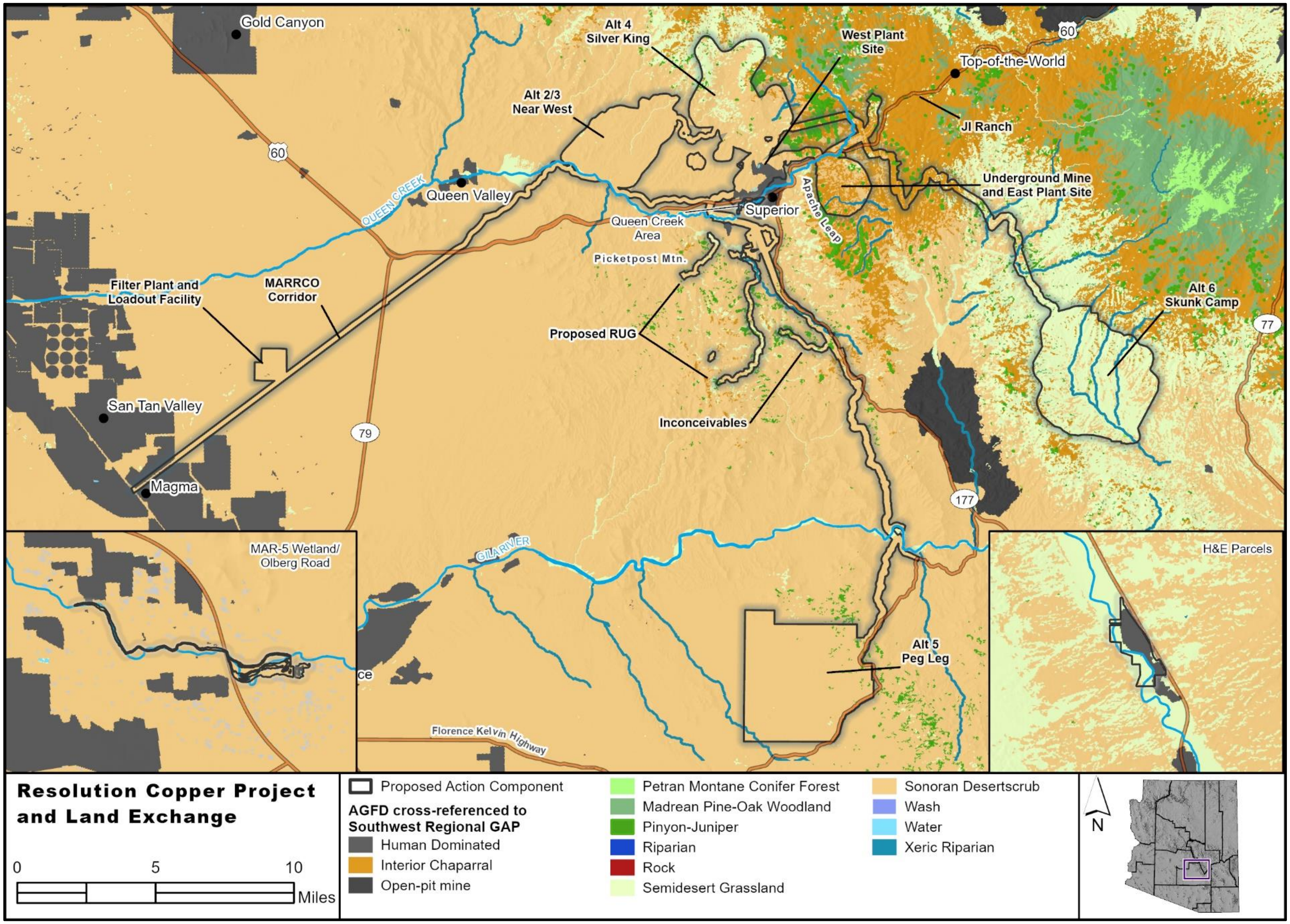


Figure 3.3.3-2. Vegetation communities and land cover types

Desert Ecosystems (Sonoran Desertscrub)

This vegetation community generally dominates in broad valleys, lower bajadas, plains, and low hills of lower elevations. Trees are sparse and the understory is bare ground or sparse grass and shrubs, typically whitethorn, creosote, and bursage. Cacti are also present, such as saguaro, prickly pear, and cholla. Common trees are palo verde, catclaw acacia, mesquite, and ironwood. On slopes, plants are often distributed in patches around rock outcrops where suitable soil exists.

Semi-Desert Grasslands

Typically occurring roughly 3,000 to 5,000 feet in elevation, this vegetation community is dominated by diverse perennial grasses, which vary depending on region. Shrubs also occupy these grasslands, with predominant shrubs, including mesquite, snakeweed, creosote, and catclaw acacia.

Interior Chaparral

Typically occurring roughly 3,000 to 7,000 feet in elevation, this vegetation community consists of chaparral on side slopes that transition into pinyon-juniper woodlands. Chaparral is a term describing an ecosystem dominated by desert shrubs, grasses, and scrub oak. Interior chaparral has an open canopy and open space either bare or covered with grasses and forbs.

Pinyon-Juniper Woodland

Typically occurring roughly 4,500 to 7,000 feet in elevation, these woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges, and are characterized by being an open forest dominated by low, bushy, evergreen junipers, and pinyon pines. Annual and perennial grasses, forbs, and shrubs typically abound beneath the woodland overstories.

Ponderosa Pine-Evergreen Oak

Typically occurring roughly 5,000 to 7,500 feet in elevation, these woodlands occur on mountains and plateaus generally south of the Mogollon Rim. Ponderosa pine intermingled with oak species predominate, mingled with patchy shrublands or grasslands.

Xeric Riparian

Xeric riparian or xeroriparian vegetation typically occurs along washes or arroyos that receive concentrated runoff during storms. Although often dry, the intermittent flows in these washes greatly affect the vegetation by providing additional periodic soil moisture. Channels are often clear of vegetation, but shrubs and small trees are located along the banks, such as acacia, mesquite, palo verde, and desert broom. Xeroriparian vegetation can vary from sparse to thick, depending on the amount of moisture received.

Riparian

Riparian corridors are located along medium to large perennial streams in canyons and desert valleys, supported by the presence of persistent groundwater. Dominant trees can include willow, cottonwood, mesquite, ash, walnut, and sycamore. Understory is usually present, including herbaceous vegetation, grasses, and wetland species along streambanks. Note that a full discussion of all areas determined to be dependent on groundwater is included in section 3.7.1, including potential impacts caused by mine dewatering.

Mesquite

This vegetation community occurs as upland shrublands that are concentrated in the extensive grassland-shrubland transition in foothills and piedmont in desert ecosystems. Substrates are typically derived from alluvium, often gravelly without a well-developed argillic or calcic soil horizon that would limit infiltration and storage of winter precipitation in deeper soil layers. *Prosopis* spp. and other deep-rooted shrubs exploit this deep soil moisture that is unavailable to grasses and cacti. Vegetation is typically dominated by velvet mesquite, one-seed juniper, and succulents.

ECOLOGICAL RESPONSE UNITS

Six ERUs lie within the analysis area. These ERUs, along with the acreages of each, are given in table 3.3.3-5 and are shown in figure 3.3.2-3.

A brief description of each of the ERUs in the analysis area is provided here, with more details for each ERU found in the revised forest plan (U.S. Forest Service 2023d), “Ecological Response Units of the Southwestern United States” (Wahlberg 2014), and “Regional Riparian Mapping Project” (Triepke et al. 2018).

Desert Ecosystems (Sonoran Desertscrub)

The Desert Ecosystems ERU within the analysis area consists of the Mojave-Sonoran Desert Scrub (MSDS) ERU, which is representative of the Sonoran Desertscrub plant community. MSDS-ERU supports succulents, desert grasses, desert scrub, and some herbaceous cover with varying levels of overall cover. On NFS land, the MSDS-ERU is typically located on steeper mountain slopes and characterized by saguaro (*Carnegiea gigantea*), paloverde (*Parkinsonia* spp.), and small shrubs and trees such as brittlebush (*Encelia farinosa*), fairyduster (*Calliandra eriophylla*), and jojoba (*Simmondsia chinensis*). Ephemeral drainages can hold dense vegetation such as catclaw acacia (*Senegalia greggii*) and wolfberry (*Lycium* spp.). Historically, fires were rare to absent in desert ecosystems, resulting in high-severity effects on desert species, which typically do not have adaptations to fire. Invasive plant species are a concern for this ERU because invasive grass species in particular can provide fuel to introduce uncharacteristic fires into these desert areas.

Semi-Desert Grasslands

The Semi-Desert Grasslands ERU is a low-elevation grassland and shrubland that typically occurs adjacent to and above desert communities and below interior chaparral and woodlands. Species composition and dominance varies and can include a variety of native and nonnative perianal and annual grasses with a shrub or tree component with variable percent cover. Some portions of this ERU currently exist in a disclimax state where shrubs and scrub vegetation are dominant due to past land use practices. Historically, fires occurred relatively frequently and served to maintain open conditions, prevent shrub invasion, and retain species diversity.

Interior Chaparral

Interior Chaparral ERU is a shrub dominated ecosystem that is typically located on mountain foothills and lower slopes where desert landscapes transition into wooded evergreens. Species composition and dominance vary but often include manzanita (*Arctostaphylos* spp.), crucifixion thorn (*Canotia holacantha*), desert ceanothus (*Ceanothus greggii*), mountain mahogany (*Cercocarpus* spp.), little-leaved mountain mahogany (*Cercocarpus intricatus*), bitterbrush (*Purshia* spp.), silktassels (*Garrya* spp.), Stansbury cliffrose (*Purshia stansburiana*), shrub live oak (*Quercus turbinella*), and sumacs (*Rhus* spp.). Fire is the primary natural disturbance in this ERU.

Juniper Grass

The Juniper Grass ERU occurs in warmer, drier settings just below and often intergrading with the pinyon-juniper zone. Trees occur as individuals in smaller groups and can range from young to old. A dense matrix of native grasses and forbs is characteristic of this ERU. Shrubs are typically absent or scattered. Disturbances, including fire, insects, and disease, are low-severity and high-frequency. Historical long-term fire suppression and grazing in this ERU has led to filling in of canopy gaps, increased tree density, and reduced composition, density, and vigor of herbaceous understory.

Pinyon-Juniper Evergreen Shrub

The Pinyon-Juniper Evergreen Shrub ERU is typically found on lower slopes between chaparral and montane forests. Dominant tree and shrub species include twoneedle pinyon (*Pinus edulis*), single leaf pinyon (*P. monophyla*), Utah juniper (*Juniperus osteosperma*), oneseed juniper (*J. monosperma*), alligator juniper (*J. deppeana*), manzanita, mountain mahogany, bitterbrush, silktassels, Stansbury cliffrose, turbinella oak (*Quercus turbinella*), and sumacs. Pinyon may be absent in some areas; however, juniper is always present. Oaks (*Quercus* spp.) are subordinate but become more common in mild climate zones. This ERU typically has longer fire intervals and less severe fire events, compared with Interior Chaparral. Historically, this ERU had tree canopy cover greater than 10 percent at later successional stages. Like for the Juniper Grass ERU, historic long-term fire suppression in this ERU has led to the filling in of canopy gaps, increased tree density, and a reduced composition, density, and vigor of herbaceous understory.

Riparian

Riparian ERUs mapped within the analysis area include the Desert Willow ERU, Fremont Cottonwood–Conifer ERU, Fremont Cottonwood/Shrub ERU, and Sycamore–Fremont Cottonwood ERU. Riparian species composition and community structure are influenced by moisture regimes, water availability, flood regime, climate, soils, and other landscape features. Some riparian species are groundwater dependent.

The Desert Willow ERU often occurs along ephemeral drainages or drier reaches of interrupted alluvial channels. Typical species include desert willow (*Chilopsis linearis*), netleaf hackberry (*Celtis laevigata*), and mesquite (*Prosopis* spp.). The Fremont Cottonwood–Conifer ERU typically contains Fremont cottonwood (*Populus fremontii*), along with velvet mesquite (*Prosopis velutina*) and juniper (*Juniperus* spp.). The Fremont Cottonwood/Shrub ERU can be dominated by Fremont cottonwood, Goodding’s willow (*Salix gooddingii*), and velvet ash (*Fraxinus velutina*) and often include willow species (*Salix* spp.), boxelder (*Acer negundo*), and desert willow. This ERU also supports a mesquite bosque subtype. The Sycamore–Fremont Cottonwood ERU is typically dominated by Fremont cottonwood, with other riparian species such as boxelder, velvet ash, Arizona walnut (*Juglans major*), and willow species occurring.

Table 3.3.3-5. Ecological Response Units on NFS lands in the analysis area

Ecological Response Unit	Alternatives 2 and 3 (acres)	Alternative 4 (acres)	Alternative 5 (acres)	Alternative 6 (acres)
Desert Ecosystem–Mojave-Sonoran Desert Scrub	41,545	38,786	31,153	31,279
Semi-Desert Grasslands	4,604	9,313	5,676	6,332
Interior Chaparral	4,360	5,218	4,360	8,598
Juniper Grass	2,368	2,382	2,368	2,619
Pinyon-Juniper Evergreen Shrub	<1	<1	<1	<1
Riparian Total	*1,945*	*1,748*	*1,652*	*1,665*
Desert Willow	1,310	1,100	1,026	1,026
Fremont Cottonwood–Conifer	0	0	0	9
Fremont Cottonwood/Shrub	558	571	550	544
Sycamore–Fremont Cottonwood	76	76	76	86
Total Acres	**54,821**	**57,447**	**45,209**	**50,493**

Note: ERU acreages are only on the Tonto National Forest. Acreages in this table are rounded to the nearest whole number. Total acreages may not sum exactly due to rounding.

VEGETATION SURVEYS SPECIFIC TO PREFERRED ALTERNATIVE

WestLand Resources Inc. (2020l) performed a vegetation assessment within the tailings storage facility footprint of the preferred alternative in response to Forest Service mitigation measure FS-225 after publication of the DEIS. The vegetation assessment identified vegetation alliances, the density and abundance of native and non-native species, the presence of special status plant species, and potential special status plant species habitat within the proposed disturbance area.

The vegetation assessment included remote sensing and ground-truthing methods to create a vegetation alliance map. BLM Assessment, Inventory, and Monitoring (AIM) Strategy and the Spring Stewardship Institute's Springs Ecosystem Inventory Protocols were performed to assess the presence, density, and abundance of vegetation in disturbance areas.

The vegetation survey resulted in the identification of four vegetation alliances within the tailings storage facility footprint: Juniper Woodland Alliance, Shrubland Alliance Sparsely Vegetated Area, Mesquite-Catclaw Acacia Alliance, and Pondweed Dominated Earthen Tank.

In total, 175 plant taxa were observed in the survey area. Thirteen non-native species were observed: Russian thistle (*Salsola tragus*), desert mustard (*Brassica tournefortii*), shepherd's purse (*Capsella bursa-pastoris*), London rocket (*Sisymbrium irio*), Malta star thistle (*Centaurea melitensis*), stork's bill (*Erodium cicutarium*), common mallow (*Malva neglecta*), tree tobacco (*Nicotiana glauca*), tamarisk (*Tamarix* cf. *chinensis*), oats (*Avena* sp.), red brome (*Bromus rubens*), Bermudagrass (*Cynodon dactylon*), stinkgrass (*Eragrostis cilianensis*), and goldentop grass (*Lamarckia aurea*). Red brome, stork's bill, and London rocket were the most widespread of the non-native occurrences, with limited distribution of the remaining species.

The Arizona hedgehog cactus (*Echinocereus triglochidiatus* var. *arizonicus*), a federally listed endangered species, was not observed during the vegetation assessment of the Alternative 6 tailings storage facility and no suitable habitat was found to be present.

SPECIAL STATUS PLANT SPECIES

Special status plant species addressed include species listed under the ESA for Gila and Pinal Counties, Species of Conservation Concern (SCC), Tonto National Forest Sensitive Plant Species, as well as BLM Sensitive Plant species for the BLM Gila District Office. See Newell (2018g) for a complete list of all species addressed and their potential for occurrence.

Special status plant species with the potential to occur in the analysis area are broken out by action alternative in table 3.3.3-6, including information on their habitat components and geographic ranges. Figure 3.3.3-3 depicts the designated critical habitat for ESA-listed plant species in and near the analysis area. The only special status plant species critical habitat present is for acuña cactus, which occurs in the project area for Alternative 5.

Table 3.3.3-6. Special status plant species with the potential to occur in the analysis area

Common Name (*Scientific Name*)	**Status**	**Habitat**	**Alternatives 2 and 3**	**Alternative 4**	**Alternative 5**	**Alternative 6**
Acuña cactus (*Echinomastus erectocentrus* var. *acunensis*)	ESA: E with critical habitat. Found in Maricopa, Pinal, and Pima Counties	Occurs in valleys and on small knolls and gravel ridges of up to 30% slope in the Palo Verde-Saguaro Association of the Arizona Upland subdivision of the Sonoran Desertscrub. Elevation between 1,198 and 3,773 feet amsl (U.S. Fish and Wildlife Service 2016a).	Unlikely to occur.	Unlikely to occur.	May occur where small knolls and gravel ridges of up to 30% slope are present near the tailings facility and along pipeline corridor routes. Critical habitat for the species is located adjacent to the tailings facility and along the pipeline fence line.	Unlikely to occur.
Arizona hedgehog cactus (*Echinocereus arizonicus* ssp. *arizonicus*)	ESA: E No critical habitat. Found in Maricopa, Pinal, and Gila Counties.	Found on dacite or granite bedrock, open slopes, in narrow cracks, between boulders, and in the understory of shrubs in the ecotone between Madrean Evergreen Woodland and Interior Chaparral. Elevation between 3,400 and 5,300 feet amsl (Tonto National Forest 2000).	Known to occur, where soils of igneous origin (primarily Shultze granite and dacite) are present on the East Plant Site and subsidence area.	Known to occur at the East Plant Site and in subsidence area. May occur in tailings facility area.	Known to occur at the East Plant Site and in subsidence area.	Known to occur at the East Plant Site and in subsidence area. Known to occur along pipeline and transmission line routes.
Chiricahua Mountain alumroot (*Heuchera glomerulata*)	Tonto National Forest: S, SCC	Found on north-facing shaded rocky slopes, near seeps, springs, and riparian areas, often in humus soil. Elevation between 4,000 and 9,000 feet amsl in pine-oak, ponderosa pine, and mixed conifer woodlands (Tonto National Forest 2000).	Unlikely to occur.	May occur in tailings facility area.	Unlikely to occur.	May occur.
Gila rock daisy (*Perityle gilensis* var. *gilensis*)	Tonto National Forest: SCC	Occurs in rock crevices and small pockets of soils near vertical cliffs, associated with Arizona upland Sonoran Desert and chaparral just below pinyon pine at elevations ranging from 1,529–4,170 feet amsl (Arizona Game and Fish Department 2025).	Known to occur in West Plant Site. May occur at the East Plant Site, tailings corridor and facility, borrow sites, and in the MARRCO corridor.	Known to occur in West Plant Site. May occur at the East Plant Site, tailings corridor and facility, borrow sites, and in the MARRCO corridor.	Known to occur in West Plant Site. May occur at the East Plant Site and in the MARRCO corridor.	Known to occur in West Plant Site. May occur at the East Plant Site, in the MARRCO corridor, and along pipeline and transmission routes.

Common Name (*Scientific Name*)	Status	Habitat	Alternatives 2 and 3	Alternative 4	Alternative 5	Alternative 6
Hohokam agave; also known as Murphey agave (*Agave murpheyi*)	Tonto National Forest: S, SCC	Found on mountainous slopes in dry chaparral and desert areas, also near drainage systems in desert scrub (Arizona Game and Fish Department 2025). Elevation between 1,300 and 2,400 feet amsl (Tonto National Forest 2000).	Unlikely to occur.	Unlikely to occur.	May occur.	Unlikely to occur.
Mapleleaf false snapdragon (*Mabrya* [*Maurandya*] *acerifolia*)	Tonto National Forest: S, SCC	Occurs on rock overhangs, bare rock/talus/scree, and cliffs in Lower Sonoran Desert vegetation communities (Arizona Game and Fish Department 2025). Elevation around 2,000 feet amsl (Tonto National Forest 2000).	May occur at tailings facility and borrow sites.	May occur.	May occur.	May occur.
Parish's Indian mallow (*Abutilon parishii*)	Tonto National Forest: S BLM: S	Occurs in mesic situations in full sun within higher elevation Sonoran desertscrub, desert grassland, and Sonoran deciduous riparian forest. Elevation between 3,000 and 4,800 feet amsl (Tonto National Forest 2000).	Known to occur at tailings facility. May occur at the West Plant Site, at borrow sites, and in the MARRCO corridor.	May occur at the West Plant Site, borrow sites, tailings facility area, and in the MARRCO corridor.	May occur at the West Plant Site, at the borrow sites, and in the MARRCO corridor.	May occur at the West Plant Site, at the borrow sites, and in the MARRCO corridor.

Notes:

The analysis area for each alternative includes all project components (i.e., West Plant Site, East Plant Site, tailings storage facility, etc.).

The Tonto National Forest status for these species has been updated to conform to the 2023 "Tonto National Forest Land Management Plan." The 2023 forest plan identifies 52 "Species of Concern" on the Tonto National Forest, and the "Sensitive Species" category as described in the 1985 forest plan is no longer valid. However, no previously evaluated species or its former status have been deleted from this table for the purposes of this revision, and formerly Sensitive Species continue to be identified as such. Species that are now Species of Concern but that previously were not evaluated have been added to this table.

Status Definitions

Tonto National Forest:

S = Sensitive. Under the 1985 forest plan, these are species identified by a Regional Forester for which population viability is a concern, as evidenced by a significant current or predicted downward trends in population number or density or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution. This status is no longer valid under the 2023 forest plan.

SCC = Species of Conservation Concern. Under the 2023 "Tonto National Forest Land Management Plan," these are species that are native to and known to occur on the Tonto National Forest and for which there are substantial concerns about the species' ability to persist on the Tonto National Forest.

Endangered Species Act (ESA):

E = Endangered. Endangered species are those in imminent jeopardy of extinction. Take as defined under the ESA generally does not apply to listed plant species. However, limited protection of listed plants is provided to the extent that the ESA prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law. These prohibitions apply equally to live or dead plants, their progeny, and parts or products derived from them. Clearly labeled seeds of cultivated origin of threatened plants are exempt.

Bureau of Land Management (BLM):

S = Sensitive. Species that could easily become endangered or extinct in the state.

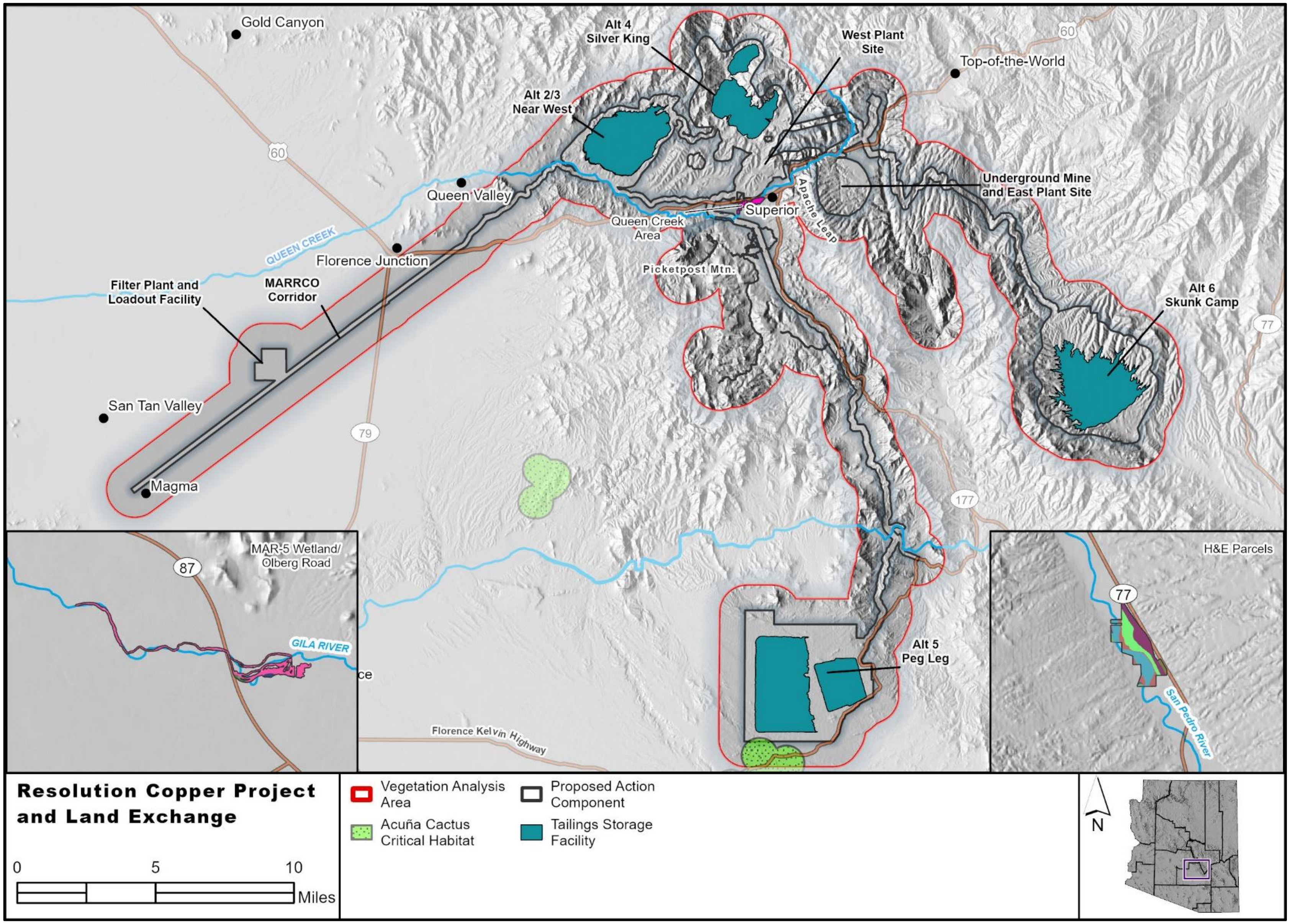


Figure 3.3.3-3. Designated critical habitat for ESA-listed plant species

Baseline data of species-specific surveys for special status plants species included sample surveys of portions of some of the alternatives for four species: Arizona hedgehog cactus (*Echinocereus arizonicus* ssp. *arizonicus*), mapleleaf false snapdragon (*Mabrya* [*Maurandya*] *acerifolia*), Hohokam agave (*Agave murpheyi*), and Parish's Indian mallow (*Abutilon parishii*). For Arizona hedgehog cactus, survey data from WestLand Resources Inc., Tonto National Forest, and SWCA Environmental Consultants were used for this analysis. These surveys encompassed approximately 4,738 acres and covered most of the East Plant Site and subsidence area, as well as portions of the transmission corridor from Silver King to Oak Flat, and Alternative 6. Approximately 172 individual Arizona hedgehog cacti were located within the project area during these surveys. An additional 1,159 individuals were located during surveys within the analysis area but outside the project footprint. Following the 2021 Telegraph Fire, surveys were conducted to assess the effects on the Arizona hedgehog cactus within the analysis area and found that no Arizona hedgehog cacti were affected by the fire within the project area; however, approximately 4,558 acres of the analysis area was affected by the fire, impacting 46.8 percent of the species' range within the analysis area (Gladding 2025). The portions of the analysis area that were impacted by the Telegraph Fire had an overall mortality rate (44.4 percent), which was only a sample survey of 18 Arizona hedgehog cacti within the analysis area and the Telegraph Fire boundary and cannot be attributed to the fire. While rates of mortality for the Arizona hedgehog cactus increased in the portions of the analysis area affected by the fire, the increased rates did not change the overall baseline conditions for this species (WestLand Resources Inc. 2022). Tonto National Forest documented 342 Arizona hedgehog cactus individuals within the Carlota Fire boundary before the fire (U.S. Forest Service 2023a). The Emergency BA determined that at least three AHC plants were negatively impacted by fire-suppression activities. Tonto National Forest conducted post-fire survivorship monitoring on 224 Arizona hedgehog cactus individuals in September 2023 (U.S. Forest Service 2023c). Of the 217 individuals found, 108 (49.8 percent) were dead, and 109 (50.2 percent) were stressed, fair, or healthy. Of the 109 living individuals, 71 (65 percent) were in healthy or fair condition, while 38 (35 percent) were in stressed condition.

For mapleleaf false snapdragon, 336 acres of suitable habitat was surveyed, and none were detected. For Hohokam agave, 239 acres of suitable habitat was surveyed, and none were detected. For Parish's Indian mallow, 949 acres of suitable habitat was surveyed and approximately 90 plants were observed on and around the bluffs in the area just west of Perlite Spring in the northeastern portion of the proposed tailings facility of Alternatives 2 and 3. Some of the observed plants were outside the random sample survey area as well. Additionally, approximately 40 Parish's Indian mallow plants were also detected during survey in the area south of Roblas Canyon in the northwestern portion of the proposed tailings facility of Alternatives 2 and 3 (WestLand Resources Inc. 2017a).

ARIZONA NATIVE PLANT LAW SPECIES

Numerous native plant species are protected from destruction under the Arizona Native Plant Law (Title 3 Arizona Administrative Code Chapter 3); the law also encourages salvage of these species. The Arizona Department of Agriculture enforces the Arizona Native Plant Law (Arizona Department of Agriculture 2019). Within the four given categories—Highly Safeguarded, Salvage Restricted, Salvaged Assessed, and Harvest Restricted—most are common species except for within the Highly Safeguarded category, which includes rare species. Thus, most species designated as Highly Safeguarded are also ESA endangered or threatened species or sensitive species under other land management agency policies. Therefore, those species that are identified in this analysis as protected under the Arizona Native Plant Law are addressed under more stringent regulations; a separate analysis for Arizona Native Plant Law species is not considered necessary for any of the action alternatives.

NOXIOUS AND INVASIVE WEEDS (INCLUDING FEDERAL, STATE, AND TONTO NATIONAL FOREST LISTS)

Eighty-nine Federal, Tonto National Forest, and Arizona Department of Agriculture noxious and invasive weed species were evaluated for this analysis. There was overlap between the different species lists, and species numbers do not double-count species. See Newell (2018g) for a table of species and their status listings. Of those listed noxious and invasive weed species, Alternatives 2 and 3 have 33 species known to occur or possible to occur within the analysis area; Alternative 4 has 38 species known to occur or possible to occur within the analysis area; Alternative 5 has 26 species known to occur or possible to occur within the analysis area; and Alternative 6 has 31 species possible to occur within the analysis area.

EFFECT OF WOODBURY, WHITLOW, SAWTOOTH, TELEGRAPH, AND CARLOTA FIRES

In June 2019, the Woodbury Fire burned 123,875 acres northwest of Superior in the Superstition Wilderness Area of the Tonto National Forest, fueled by grass, brush, and chaparral vegetation (InciWeb 2019). In April 2020, the Whitlow Fire burned 842 acres of vegetation west of Superior on the Tonto National Forest (12 News 2020), followed in June 2020 by the Sawtooth Fire, which burned 24,729 acres north of Superior on the Tonto National Forest (InciWeb 2020). Although these fires largely did not burn within the project footprint (the Whitlow Fire did burn 15 acres along the MARRCO corridor), the fires have influenced the vegetation communities on the Tonto National Forest within the same watershed potentially impacted by the project. This may increase erosion and the prevalence of non-native and invasive plant species in the local area and potentially impact downstream water quality. The Carlota Fire started near Top-of-the-World, Arizona, on July 26, 2023, and burned approximately 344 acres (USFS 2023a). This fire did not burn within the project footprint, analysis area, or JI Ranch property, but it did burn within the Arizona hedgehog cactus range where individuals are known to occur (U.S. Forest Service 2023a). This additional fire would also influence vegetation communities within the same watershed potentially impacted by the project.

In June–July 2021, the Telegraph Fire burned 180,757 acres, portions of which include project components: the East Plant Site, 230-kV power line corridor (preferred alternative), tailings pipeline corridor (preferred alternative), and JI Ranch (mitigation area) (WestLand Resources Inc. 2022). This fire also occurred within portions of the analysis area and the Arizona hedgehog cactus range. However, none of the previously known Arizona hedgehog cactus in the project area burned in the fire (WestLand Resources Inc. 2022). Although the Telegraph Fire did not drastically alter the baseline environment, all fires can have landscape effects, such as those discussed in the previous paragraph.

Existing Disturbance within Mine Area and Selected Lands

A variety of land use disturbances have affected the condition of vegetation and soils within and near the project area footprint. Historical and ongoing mining and mineral exploration, land development, grazing, recreation, and fires have left a legacy of disturbances to the landscape (table 3.3.3-7). Total acreage of each disturbance type within the project footprint varied by alternative. Most alternatives had approximately 1,300 to 1,400 acres of previous disturbance, with the exception of Alternative 4, which had 2,719 acres of previous disturbance (which included 1,528 acres of fire disturbance). More information regarding the nature and extent of disturbance is provided in Newell (2018g).

Table 3.3.3-7. Existing disturbance acreage by alternative (calculated within the project footprint)

Alternative	Facilities Disturbance (acreage)	Road Disturbance* (acreage)	Fire Disturbance (acreage)	Total Disturbance (acreage)
Alternative 2 – Near West Proposed Action	1,086	372	1,161	**2,619**
Alternative 3 – Near West – Ultrathickened	1,086	372	1,161	**2,619**

Alternative	Facilities Disturbance (acreage)	Road Disturbance* (acreage)	Fire Disturbance (acreage)	Total Disturbance (acreage)
Alternative 4 – Silver King	1,083	379	2,590	**4,052**
Alternative 5 – Peg Leg	1,088	329	1,472	**2,889**
Alternative 6 – Skunk Camp	1,086	799	10,743	**12,628**

* Single-track recreational trails excluded from area calculations.

Existing Vegetation and Soil Trends

Relatively little long-term monitoring and evaluation of soil and vegetation health exists for the analysis area. Most of the monitoring available has been undertaken for assessment for rangeland health and livestock grazing suitability (see section 3.16 for discussion of livestock grazing).

Long-term monitoring of soil and vegetation conditions was conducted on the Millsite grazing allotment, managed by the Forest Service, which includes the area of the Alternative 2 and 3 tailings storage facility. Range monitoring has been conducted in this area from 1956 through 2003. The most recent trends between 1991 and 2003 indicate that the overall state of vegetation is in very poor to poor condition, with largely downward trends. Soils are similar, rated mostly poor condition, but with a stable trend (U.S. Forest Service 2010c). These trends in vegetation and soil conditions are likely the result of historic-era grazing and other disturbances (U.S. Forest Service 2010c).

Some additional rangeland health assessments have been conducted for the Teacup Allotment, managed by the BLM, which includes the area of the Alternative 5 tailings storage facility. In 2013, it was observed that overall the soil on the allotment was stable, and the allotment exhibited biotic integrity and was in a productive and sustainable condition (Bureau of Land Management 2017a).

Compensatory Mitigation Lands

Permitting under Section 404 of the CWA will require some level of compensatory mitigation to offset direct and indirect impacts to waters of the U.S. The compensatory mitigation package proposed by Resolution Copper has been approved by the USACE and is described in section 2.3.1.3 as well as appendix D of the FEIS. The compensatory mitigation parcels include MAR-5 Wetland/Olberg Road, H&E Farm Parcels, and Queen Creek. Refer to the biological assessment (SWCA Environmental Consultants 2020a) for more details and analysis on this.

Vegetation along the active channel at the H&E Farm CWA Compensatory Mitigation Parcel consists of narrow but dense stands of mesoriparian and xeroriparian trees and shrubs, including large-statured mesquite (*Prosopis* sp.) and tamarisk (*Tamarix* spp.) that are approximately 25 feet tall, with a few cottonwood (*Populus* spp.) and patches of singlewhorl burrobrush (*Hymenoclea monogyra*) (WestLand Resources Inc. 2020k). Vegetation on the floodplain terraces consists of moderately dense, medium- to large-statured mesquite and tamarisk, and vegetation within the historical agricultural fields on the eastern portion of the site consists of sparsely populated small to medium-statured mesquite and lotebush (*Ziziphus obtusifolia*) (WestLand Resources Inc. 2020k).

Dense stands of mature catclaw acacia (*Senegalia greggii*) and velvet mesquite (*Prosopis velutina*) shrubs occur along the drainage at the Queen Creek CWA Compensatory Mitigation Parcel, reaching approximately 16 feet tall and creating approximately 95 percent cover (WestLand Resources Inc. 2020k). The floodplain of the Queen Creek CWA Compensatory Mitigation Parcel contains moderately dense (approximately 65 percent canopy cover) mesquite shrublands, and the uplands are dominated by creosote bush (*Larrea tridentata* var. *tridentata*) (WestLand Resources Inc. 2020k).

Following in-stream discharge of CAP water, the MAR-5 Wetland CWA Compensatory Mitigation Parcel contains cattails (*Typhus* spp.), young Goodding's willow, and tamarisk in the Gila River with creosote bush and desert forbs occurring in the floodplain (WestLand Resources Inc. 2020k). The Olberg Road site contains dense stands of tamarisk, approximately 20 feet tall, with floodplain terrace containing creosote and desert forbs (WestLand Resources Inc. 2020k).

3.3.4 Environmental Consequences of Implementation of the Proposed Mine Plan and Alternatives

3.3.4.1 Alternative 1 – No Action Alternative

Under the no action alternative, the proposed project would not be constructed and potential impacts on soils, vegetation communities, special status plant species, and noxious weeds would not occur. Impacts on soil and vegetation resources from existing disturbances (e.g., recreation, livestock grazing, mining and development, wildfires) would continue.

3.3.4.2 Impacts Common to All Action Alternatives

The proposed project would include three phases: construction, operations, and closure/reclamation. All phases have the potential to affect (1) soil resources, (2) revegetation potential, (3) vegetation communities, (4) special status plant species, and (5) noxious weeds, as detailed in the following text.

Effects of the Land Exchange

The selected Oak Flat Federal Parcel would leave Forest Service jurisdiction. The role of the Tonto National Forest under its primary authorities in the Organic Administration Act, Locatable Minerals Regulations (36 CFR 228 Subpart A), and Multiple-Use Mining Act is to ensure that mining activities minimize adverse environmental effects on National Forest System surface resources; this includes effects on the soil and vegetation that occur on the Oak Flat Federal Parcel. The removal of the Oak Flat Federal Parcel from Forest Service jurisdiction negates the ability of the Tonto National Forest to regulate effects on these resources, or manage them to achieve desired conditions, including for control of noxious and invasive weeds.

The offered parcels would come under Federal jurisdiction. Specific management of the soil and vegetation resources of those parcels would be determined by the agencies to meet desired conditions or support appropriate land uses. In general, these parcels contain a variety of ecosystems like those found in the analysis area, including riparian, xeroriparian, semi-desert grassland, and desert ecosystems, that would come under Federal jurisdiction.

Effects of Forest Plan Amendment

SOIL PRODUCTIVITY

The forest plan provides guidance for management of lands and activities on the Tonto National Forest. Forest plan components guide project and activity decision-making and are required in the forest plan. They include desired conditions, objectives, standards, guidelines, and suitability of lands (U.S. Forest Service 2023d:15-17).

A review of all components of the 2023 forest plan was conducted to identify the need for amendment due to the effects of the project (SWCA Environmental Consultants 2025). The review determined that all of the action alternatives would be inconsistent with one guideline related to soil productivity: SL-G-02 (see table 1.4.3-1). A plan amendment would be required for each action alternative that would except the alternatives from complying with this single guideline.

The effect of excepting the single guideline for soils includes minor adverse effects of vegetation removal, erosion and sedimentation, soil compaction, runoff potential, soil fertility, revegetation potential, and soil carbon budget. The excepted guideline would apply only to the area of soil disturbance on NFS land. The amount of area affected varies by alternative as follows: Alternatives 2 and 3 – 7,200 acres; Alternative 4 – 7,900 acres; Alternative 5 – 2,700 acres; and Alternative 6 – 2,500 acres (see chapter 2 for a description of the alternatives). This ranges from roughly 0.3 percent of the Tonto National Forest (Alternative 4) to 0.1 percent of the forest (Alternative 6).

Thirty-five desired conditions, 11 guidelines, three standards, and one objective pertaining to soil resources would not be excepted by the amendment and would remain applicable to the entire Tonto National Forest, including the area of disturbance. The single excepted guideline would continue to apply to the remaining acres of the Tonto National Forest not included in the areas of disturbance noted above. Considering the limited area of impact, required mitigation measures, design, features, applicant-committed environmental protection measures, and forest plan components pertaining to soil resources not included in the amendment, the single guideline would not hinder the Forest Service's ability to maintain or restore soil productivity. Refer to sections 3.3.4.2 and 3.3.4.9 for information on mitigation and applicant-committed measures.

Effect of Compensatory Mitigation Lands

Permitting under Section 404 of the CWA will require some level of compensatory mitigation to offset direct and indirect impacts to waters of the U.S. The compensatory mitigation package approved by the USACE is included as appendix D of the FEIS. The overall purpose of the compensatory mitigation lands (descriptions presented below) is to improve riparian vegetation and associated habitat in order to mitigate for losses of similar habitat associated with waters of the U.S. While minor surface disturbance would occur during restoration activities, overall the effect on soils and vegetation within the compensatory mitigation lands would be beneficial to the watersheds in which they occur, including Queen Creek, the Gila River, and the San Pedro River.

- MAR-5 Wetland/Olberg Road. The conceptual mitigation strategy consists of removal and control of exotic tree species (principally tamarisk), combined with native plant species reseeding, to allow for the establishment and maintenance of a riparian habitat dominated by native tree species. The MAR-5 Wetland site was established in 2015. Proposed mitigation activities for the MAR-5 Wetland site include continued scheduled CAP water discharges, limited tamarisk removal and control, and seeding of native plant species. The Olberg Road site would represent new mitigation activities and is located adjacent to the existing MAR-5 Wetland site. Mitigation activities at the Olberg Road restoration site consist of tamarisk removal and control within the entire 23-acre site, followed by seeding of native plant species. Exotic tree species removal and control, combined with seeding of native plant species, at both sites would allow for the establishment and maintenance of a riparian habitat dominated by native tree species and would eliminate a large, local source of exotic tree species seed from that section of the Gila River. The entire area encompasses 146 acres of lands; only the 23-acre Olberg Road mitigation parcel is part of the compensatory mitigation package.
- Queen Creek. This site is located downstream of the town of Superior, along Queen Creek. Resolution Copper would establish a conservation easement covering approximately 79 acres along 1.8 miles of Queen Creek to restrict future development of the site and provide protected riparian and wildlife habitat. Within a 33-acre area being considered as part of the compensatory mitigation package, conceptual mitigation elements include the removal of tamarisk to allow riparian vegetation to return to its historic composition and structure and promote more natural stream functions. The restriction on future development of the site and mitigation elements would provide protected riparian and wildlife habitat.

Proposed mitigation activities for the Queen Creek site would include ecological improvements to the riparian habitat. Within the xeroriparian corridor, limited removal of sparsely populated tamarisk and other invasive species would occur, followed by planting and seeding of native plant species. In portions of the site where there are anthropogenic disturbances, selective debris would be removed while avoiding disturbance to existing mature woody vegetation; seeding of native plant species would follow. The remaining portions of the mitigation site would be preserved, providing protection to riparian habitat.

- H&E Farm. The H&E Farm is a 500-acre property owned by The Nature Conservancy. Proposed mitigation activities include earthwork to reconnect historic tributaries. The earthwork is proposed to reestablish the San Pedro River's access to its floodplain and terrace and enhance the wetland features present in the area. The soils across the site on the terraces are compacted and causing earth fissures and sinkholes on the parcel which will continue if no intervention occurs. Grading in some areas would reestablish the natural alluvial fan and floodplain terrace structure. Planting and seeding native species is planned to restore a more native vegetation community along the bank of the river, and is intended to mirror previous mitigation strategies implemented by The Nature Conservancy as well as ongoing mitigation at the AGFD's Lower San Pedro Wildlife Area that is contiguous to the western and northern boundaries of the H&E Farm parcel. The terrace area to be reestablished encompasses 300 acres, and the wetland area to be reestablished encompasses 15 acres. The remainder of the property would be conserved in the current condition.

Effects of Recreation Mitigation Lands

The recreation mitigation lands are anticipated to minimize future impacts to soils and vegetation by reducing the haphazard development of unauthorized trails that has led to the degradation of habitat and impacts to plant species. The recreation mitigation lands would protect soil resources in the area from erosion by encouraging use of the proposed trail system while discouraging the use of existing unauthorized trails or the creation of new unauthorized trails. The disturbance to soil and vegetation caused by implementing recreation mitigation has been incorporated into the acreage calculations used in this section.

Summary of Applicant-Committed Environmental Protection Measures

A number of environmental protection measures are incorporated into the design of the project that would act to reduce potential impacts on soils and vegetation. These are non-discretionary measures, as they are currently part of the GPO, and their effects are accounted for in the analysis of environmental consequences.

From the GPO (Resolution Copper 2016c), Section 4.5, "Water Resources," Resolution Copper has outlined a variety of measures to reduce impacts on soils:

- Road embankment slopes will be graded and stabilized with vegetation or rock as practicable to prevent erosion;
- During construction and operations, diversions will be constructed around the affected areas to minimize erosion. A number of best management practices, including check dams, dispersion terraces, and filter fences, also will be used during construction and operations; and
- Off-road vehicle travel across Tonto National Forest will generally be avoided.

Resolution Copper has also developed a noxious weed plan (Resolution Copper 2019) to reduce impacts on vegetation:

- Newly reclaimed areas on Tonto National Forest will be monitored for weeds and invasive plants for the first 5 years after reclamation. Infestations of invasive species would be treated as soon as they are identified, or as soon as weather conditions are appropriate for treatment.
- Additionally, in the "Baseline EA Decision Notice," Resolution Copper stipulated that on NFS lands, seed mixes used in reclamation will be certified free of seeds listed on the Forest Service's noxious weed list and contain only species native to the project area. Seed mixes will be developed from a native species seed list approved by the Forest Service.

Additional conservation measures specific to Arizona hedgehog cactus were also developed as part of consultation with the FWS, and are included in the final Biological Opinion (see appendix P of this FEIS). These measures apply to both pipeline construction and maintenance, and power line construction and maintenance including vegetation management for fire safety purposes. These conservation measures include such measures as:

- Prior to any ground-disturbing activities, suitable habitat within the project area will be surveyed for Arizona hedgehog cactus.
- Before construction begins within the Arizona hedgehog cactus known range, a biological monitor shall establish and clearly flag Arizona hedgehog cactus avoidance areas where individual cacti will be left in place based on preconstruction surveys.
- Prior to any ground-disturbing activities, a biological monitor, a Forest Service–approved entity, shall salvage Arizona hedgehog cacti that are inside the construction footprint in areas where ground disturbance will occur.
- Healthy salvaged Arizona hedgehog cacti that occur in areas that will be disturbed will be replanted outside the construction footprint but within the analysis area on Federal lands.
- Prior to relocation and salvage efforts, Resolution Copper would work with the FWS and the Forest Service to develop an Arizona hedgehog cactus relocation, salvage, and monitoring plan. The plan would provide criteria for determining which cacti are suitable for immediate relocation as well as measures to collect seed or to salvage healthy stems from individuals that otherwise could not be salvaged.
- A mechanical mower for routine vegetation maintenance would not be used within Arizona hedgehog cactus occupied habitat.
- For vegetation maintenance and line maintenance work, vehicles would drive only on existing roads and utility access routes to access the right-of-way. Vehicles would not be driven off-road within the right-of-way.
- During vegetation management work, crews would check for Arizona hedgehog cactus under target plants prior to treatment. If crews find a cactus, they will implement appropriate conservation measures to avoid the cactus.
- During manual vegetation maintenance work, if an Arizona hedgehog cactus occurs underneath and is shaded by a shrub to be cut, the target shrub will be left untreated. In very rare circumstances, the nurse plant may be selectively trimmed in a manner to maintain the same shading protection for the Arizona hedgehog cactus. No more than 30 percent of the nurse plant may be trimmed.

The project reclamation and closure plan (Tetra Tech Inc. 2020) and the tailings storage facility reclamation and closure plan (KCB Consultants Ltd. 2020c) expand on environmental protection measures that are discussed in detail below.

Desired Future Conditions

Desired future conditions were informed by internal work by the Tonto National Forest on the revised forest plan. These desired conditions are based on ERUs, which are mapped ecosystem types that represent the range of conditions that occur under natural disturbance regimes. The desired future conditions of ERUs that occur in the analysis area are described here by ERU. The distribution and condition of these ERUs are strongly tied to the health of soils, climate, topography, and other environmental factors. Table 3.3.4-1 gives the acreages and percentages of potential impacts on ERUs within the analysis area and by alternative.

Additionally, each ERU will be capable of supporting post-mining land uses after project decommissioning. Specific post-mining land uses are as follows (Tetra Tech Inc. 2020).

For the East Plant Site, West Plant Site, MARRCO corridor, filter plant and loadout facility, power line and pipeline corridor, and tailings storage facility:

- wildlife habitat,
- livestock grazing,
- recreation, and
- historical preservation at the East Plant Site and West Plant Site.

For the subsidence area:

- wildlife habitat.

Table 3.3.4-1. Acres of impact of the project on ERUs on NFS lands within each action alternative footprint with percentage of analysis area impacted and percentage of Tonto National Forest impacted

Ecological Response Unit	Alternatives 2 and 3			Alternative 4			Alternative 5			Alternative 6		
	Acres Impacted	**Analysis Area Impacted (percent-age of area)**	**Impacted on Tonto National Forest (percent-age of area)**	**Acres Impacted**	**Analysis Area Impacted (percent-age of area)**	**Impacted on Tonto National Forest (percent-age of area)**	**Acres Impacted**	**Analysis Area Impacted (percent-age of area)**	**Impacted on Tonto National Forest (percent-age of area)**	**Acres Impacted**	**Analysis Area Impacted (percent-age of area)**	**Impacted on Tonto National Forest (percent-age of area)**
Desert Ecosystem–Mojave-Sonoran Desert Scrub	6,245	15.0	0.8	5,783	14.9	0.7	1,751	5.6	0.2	1,316	4.2	0.2
Semi-Desert Grasslands	158	3.4	<0.1	1,372	14.7	0.4	194	3.4	0.1	74	1.2	<0.1
Interior Chaparral	409	9.4	0.1	409	7.8	0.1	409	9.4	0.1	520	6.0	0.2
Juniper Grass	166	7.0	<0.1	166	7.0	<0.1	166	7.0	<0.1	147	5.6	<0.1
Pinyon-Juniper Evergreen Shrub	0	0	0	0	0	0	0	0	0	0	0	0
Riparian Total	*186*	*9.6*	*0.3*	*180*	*10.3*	*0.3*	*78*	*4.7*	*0.1*	*71*	*4.2*	*0.1*
Desert Willow	106	8.1	1.2	128	11.6	1.4	34	3.3	0.4	34	3.3	0.4
Fremont Cottonwood–Conifer	0	0	0	0	0	0	0	0	0	0	0	0
Fremont Cottonwood/Shrub	76	13.6	0.2	47	8.3	0.1	39	7.1	0.1	34	6.3	0.1
Sycamore–Fremont Cottonwood	5	6.1	<0.1	5	6.1	<0.1	5	6.1	<0.1	2	2.4	<0.1
Total	**7,164**	**13.1**	**0.3**	**7,909**	**13.8**	**0.3**	**2,597**	**5.7**	**0.1**	**2,128**	**4.2**	**0.1**

Notes:

Acreages in this table are rounded to the nearest whole number. Total acreages may not sum exactly due to rounding.

The table presents the acres of project footprint within each ERU; percentage of that ERU within the overall analysis area that could be changed by the project on NFS lands only; and percentage of the ERU category that could be changed by the project on the Tonto National Forest.

The Oak Flat Federal Parcel was excluded.

DESERT ECOSYSTEMS (SONORAN DESERTSCRUB)

The Desert Ecosystems ERU in the analysis area includes the Lower Colorado River Valley subdivision of Sonoran Desertscrub and Arizona Upland subdivision of Sonoran Desertscrub, the desired future conditions of which include the following:

- Vegetation community composition and structure should include the following: 10 to 25 percent perennial grass and cacti cover, presence of saguaro and mesquite (*Prosopis* sp.) that provide habitat for cavity nesting birds, and limited infestation of non-native grasses (ideally less than 1 percent cover) to mitigate for fine-fuel potential to increase fire susceptibility.
- Fires should be infrequent and localized with return intervals greater than 200 years.
- Suitable habitat for federally listed and rare or special status animal and plant species is preserved.

SEMI-DESERT GRASSLANDS

The Semi-Desert Grasslands ERU is limited to the semi-desert grasslands vegetation community, the desired future conditions of which include the following:

- Vegetation community composition and structure should include the following: a variety of cool- and warm-season understory plants, less than 10 percent tree and shrub canopy cover, and limited cover by non-native species.
- Native herbaceous vegetation cover provides fine fuels to support stand-replacement fires; however, non-native annual vegetation cover should be limited to mitigate the spread, intensity, and severity of uncharacteristic fire.
- Habitat is preserved to support wildlife.

INTERIOR CHAPARRAL

The desired future conditions for the Interior Chaparral ERU and vegetation community include the following:

- Vegetation community composition and structure should include the following: dense thickets of closed shrub canopy cover (40 percent cover on dry sites to 80 percent cover on wet sites) dominated by shrub live oak (*Quercus turbinella*), thick shrub litter, annual regeneration of native grasses and forbs (in most years), and low cover by non-native annual species.
- Stand-replacing fires should occur at 35- to 100-year fire return intervals to support diverse community ages at the landscape scale; native fire-adapted species resprout vigorously after fire to prevent excessive erosion; and non-native annual vegetation cover is kept to a minimum to avoid uncharacteristic fire.
- Habitat is preserved to support wildlife.

JUNIPER GRASS

The desired future conditions for the Juniper Grass ERU and vegetation community include the following:

- Vegetation composition and structure vary from sparse to closed, with shrubs averaging less than 30 percent canopy cover. Vegetation is generally uneven aged and open in appearance.
- Snags are scattered, and source woody debris increases with succession.

- Ground cover is capable of carrying surface fire, with fires typically being frequent and low severity.

PINYON-JUNIPER EVERGREEN SHRUB

The desired future conditions for the Pinyon-Evergreen Shrub ERU and vegetation community include the following:

- Vegetation community composition and structure are dominated by trees except in the case of recent disturbance, with canopy cover ranging from 10 to 29.9 percent. The understory is dominated by low- to moderate-density shrubs, overall averaging more than 30 percent canopy cover, with native perennial grasses and annual and perennial forbs present in the interspaces. At least one juniper species is always present.
- Fires are typically mixed severity.
- Patch size ranges from 1 acre to tens of acres. Groups of plants are typically even-aged in structure, with all ages represented across the landscape.

RIPARIAN

Riparian areas are dynamic with species composition and community structure influenced by factors that include moisture regimes; the availability of water; the timing, magnitude, and frequency of flooding; and climate, soils, and geomorphology. The revised forest plan details broad direction for Riparian ERUs in general (U.S. Forest Service 2023d).

The desired future conditions for Riparian ERUs include the following:

- Riparian plant communities consist mostly of native species in a healthy state, with a diversity of seral states, and experience periodic flooding to promote emergence of diverse riparian plant communities. Invasive plant species do not degrade ecological conditions, and upland plant species do not encroach on riparian vegetation at uncharacteristic levels.
- Fires burn infrequently, with mixed severity, and are generally localized.
- Habitat is maintained to support both aquatic and terrestrial species.

Reclamation Plans and Effectiveness

CONCEPTUAL RECLAMATION PLANS

General Reclamation Goals and Strategies

Reclamation plans are required under several regulatory programs, including by the Forest Service as part of a final mining plan of operations, by ADEQ as part of the APP program, and by the Arizona State Mine Inspector. The primary goals of reclamation are to stabilize areas of surface disturbance, control erosion, minimize overall disturbance to the extent practicable, prepare areas for post-mining land use, and ensure long-term protection of the surrounding land, water, and air. Reclamation and closure standards are established by these programs that must be met by the company, and financial assurance or bonding is required to ensure the capability exists to conduct and complete reclamation activities.

The following discussion is based on the conceptual reclamation plans that have been prepared by Resolution Copper and are included in the GPO and by the project reclamation and closure plan (Tetra Tech Inc. 2020).

Key tenets guiding the Resolution Copper reclamation plans are implementing reclamation as soon as practicable (including concurrent reclamation while the mine is still operational, where feasible), return disturbed areas to near-natural conditions, salvage soil resources (where practicable) for later use in reclamation, and monitor to ensure that reclamation is successful and reclamation and closure standards are met.

The general reclamation steps identified by Resolution Copper in the GPO (see section 6 in Resolution Copper (2016c)) are as follows:

- Decommission facilities (remove equipment, chemicals, furnishings)
- Demolish or dismantle structures and buildings, including pipelines, storage tanks, and power lines. This includes removing foundations up to 3 feet below grade. Some facilities like pipelines, wells, or power lines may be transferred to third parties for continued use where beneficial.
- Recontour and regrade disturbed areas, including roads not needed for future uses. Many stormwater controls (diversion ditches, seepage collection ponds) need to stay in place permanently or for decades after closure of the mine to control water quality (analyzed in detail in section 3.7.2).
- Replace growth media, using salvaged soils or borrow soils (largely Gila Conglomerate)
- Seeding or planting
- Monitoring and maintenance

Concurrent reclamation performed while mine operations are taking place will consist of reclaiming the outer slopes of the tailings storage facility where practicable. The initiation of concurrent reclamation may vary based on progression of tailings storage facility construction and also varies by alternative. Concurrent reclamation of the tailings storage facility may begin at mine year 12 under Alternative 2; at mine year 30 under Alternative 3; and at mine year 10 under Alternative 6 (Klohn Crippen Berger Ltd. 2018a, 2018b, 2018d; Tetra Tech Inc. 2020). The initiation of concurrent reclamation for Alternatives 4 and 5 is undetermined.

The project reclamation and closure plan (Tetra Tech Inc. 2020) provides facility-specific reclamation details that are described in the subsections below.

West Plant Site Reclamation

The West Plant Site facilities, including proposed rock stockpiles, ore processing facilities, conveyor systems, a process water pond, and surface infrastructure to support underground mining, will be located within an area of existing disturbance. Facilities will be removed, and land will be reclaimed during site decommissioning. A historical cooling tower and three roads will not be demolished or removed.

East Plant Site Reclamation

The East Plant Site will contain the underground mine, access shafts, ore handling systems, and surface support facilities. Upon site decommissioning, most facilities will be removed, and the land will be reclaimed. Facilities that support post-mining land use, such as select roads, will remain on-site.

Subsidence Area Reclamation

The subsidence area created from underground mining activities will not be reclaimed. The area will be fenced for safety and subsidence monitoring will be performed.

MARRCO Corridor Reclamation

The MARRCO corridor, owned by Resolution Copper, has Arizona Water Company facilities, water lines, a Qwest fiber-optic line, an El Paso Natural Gas pipeline, a power line, and a telephone line in its right-of-way. Under the preferred alternative, Resolution Copper will construct the Desert Wellfield, a pump station, water pipelines, and additional power lines within the right-of-way. The existing facilities will remain post-closure and the new Resolution Copper facilities will be removed, and the land will be reclaimed during site decommissioning. Prior to closure, the railroad and utility lines may be decommissioned or remain on-site to support post-closure land use. The ultimate ownership of the MARRCO corridor right-of-way may change, and those arrangements will be determined prior to closure.

Filter Plant and Loadout Facility Reclamation

Resolution Copper will construct a new rail loop, buildings, concrete containment, an electrical substation, laydown yards, and a parking lot at the filter plant and loadout facility. The buildings will be removed, and the land will be reclaimed upon site decommissioning.

Pipeline and Power Line Corridor Reclamation

Pipelines and power lines for mining operations will pass through a corridor from ore processing facilities to the tailings storage facility. Facilities will be removed, and the land will be reclaimed upon site decommissioning. Access roads and the facilities necessary for monitoring and maintenance will remain on-site.

Tailings Reclamation Plans

The largest area of disturbance from the proposed project is the tailings storage facility, and virtually all of the area taken up by the tailings can be reclaimed. Specific details for closure of the tailings storage facilities differ by alternative (Golder Associates Inc. 2018a; KCB Consultants Ltd. 2020c, 2021; Klohn Crippen Berger Ltd. 2018a, 2018b, 2018c, 2018d, 2018e; Tetra Tech Inc. 2022). In general, closure of the tailings storage facilities takes place in several phases:

- Final deposition of the tailings is managed so that the PAG tailings are ultimately covered with NPAG tailings to prevent contact with oxygen (not applicable to Alternative 4).
- At the same time, the recycled water pond is allowed to gradually shrink through evaporation or water use (not applicable to Alternative 4).
- Engineered seepage controls remain in place as long as monitoring indicates they are needed to protect downstream water quality. Seepage collection ponds would remain in place to collect seepage and stormwater. Until water quality is acceptable for release to the environment (this is typically determined by ADEQ through the APP program), the collected water is either pumped back to the recycled water pond while it exists, or the ponds are engineered to allow the water to evaporate once the recycled water pond is gone. Note that specific release criteria would be developed in detailed reclamation plans, which are a required mitigation by the Forest Service (see section 3.3.4.9).
- When surfaces are no longer going to be disturbed, growth media are placed on the surface and any treatments or additives are used. Generally, about 1.5 feet of growth media are planned for, but would vary across the surface, depending on needs. Rock armoring would be used in places where erosion is a concern on slopes or along stormwater conveyance channels. Seeding or planting would then take place on the growth media. Note that specific closure materials, depths, and preparations would be developed in detailed reclamation plans, which are a required mitigation by the Forest Service (see section 3.3.4.9).

Fully successful reclamation would either meet the desired conditions for the landscape or be sufficient to support the chosen post-mine land uses. A fully reclaimed tailings storage facility should be a stable landform (low risk of large slumps or collapses), have a stable surface either vegetated or armored (low risk of erosion from water or wind), have no long-term water quality concerns from runoff or seepage, and be sustainable without active management. Long-term sustainability requires a balanced interaction of growth media, water, and vegetation. The growth media act to store moisture, which supports the vegetation, but are vulnerable and need to be protected from erosion during storm events. Vegetation helps anchor the growth media and slow runoff, allowing it to infiltrate into the soil. Post-closure monitoring and comparison to clear success criteria is the means to ensure the balance of growth media, water, and vegetation is functioning properly.

A detailed tailings storage facility reclamation and closure plan (KCB Consultants Ltd. 2020c) for the preferred alternative was prepared in response to mitigation measure FS-226 and was described in the January 2021 Rescinded FEIS. The tailings storage facility reclamation and closure plan was further revised after the January 2021 FEIS was rescinded. The revised version of the Alternative 6 reclamation and closure plan was submitted to the Forest Service in October 2022 (KCB Consultants Ltd. 2021).

The revised version of the Alternative 6 reclamation and closure plan includes an analysis of the ability of spray evaporators to manage the volumes of seepage produced, and consideration for use of constructed wetlands in lieu of evaporation.

This plan is specific to the Skunk Camp location, which is not located on NFS lands. Reclamation at this location would not be conducted under the jurisdiction of the Forest Service. The plan described below is solely that proposed by Resolution Copper and may not reflect Forest Service requirements for reclamation activities. Two State agencies likely would have roles in reviewing and approving reclamation plans at this location: the Arizona State Mine Inspector, and the ADEQ under the jurisdiction of the APP program.

After the January 2021 FEIS was rescinded, an additional reclamation and closure plan specific to the Alternative 6 pipeline/power line corridor was submitted to the Forest Service (Tetra Tech Inc. 2022). This reclamation and closure plan is different from the reclamation and closure plan for the tailings storage facility and was prepared specifically to address requirements for reclaiming the pipeline/power line corridor under a special use authorization.

Preferred Alternative Reclamation Plan

The tailings storage facility reclamation and closure plan (KCB Consultants Ltd. 2020c) describes the reclamation strategies and facility designs to ensure the tailings storage facility is stable and functional upon project decommissioning. Additionally, this plan outlines a change to the DEIS, in which the preferred alternative initially routed the tailings storage facility catchment to Mineral Creek post-closure; the design has been updated to include routing the catchment to Dripping Spring Wash after project decommissioning, in order to maintain as much runoff as possible to the downstream watershed. Key components of the tailings storage facility reclamation and closure plan are described below.

The stages of tailings storage facility reclamation include the following:

- Life of Mine Progressive Reclamation – Years 1 to 41 of Mine Life
    - This reclamation stage includes landform deposition and surface reclamation, excavation of the closure diversion channel, and managing seepage from the tailings storage facility. Progressive reclamation takes place on surfaces of the tailings embankment that have reached their final configuration; progressive reclamation is anticipated to begin in mine year 10.

- End of Operations – Year 41 of Mine Life
  - The end of operations stage includes the cessation of tailings deposition at the facility.
- Closure Transition Period – Years 42 to 51 of Mine Life
  - This stage will occur for approximately 10 years after the end of mine operations. Activities include surface shaping to the facility's final configuration, revegetating, final construction of ditches and channels, water management, and monitoring to refine performance criteria. The recycle pond over the PAG cell will be closed during this time frame.
- Closure: Active Care – Years 51 to 120 of Mine Life
  - This stage will occur from roughly 10 to 80 years following the end of mine operations and will include active water management and monitoring to ensure closure criteria are met.
- Closure: Passive Care Phase 1 – Years 120 to 290 of Mine Life
  - For around 80 to 250 years after the cessation of mine operations, the first phase of passive care will include only monitoring. The tailings storage facility will be capable of managing seepage and flow without active management.
- Closure: Passive Care Phase 2 – >290 Years of Mine Life
  - At 250 years and beyond the end of mine operations, the tailings storage facility will function without management and some features (e.g., finger drain collection pipes, grout curtain, shallow pumpback well) will be decommissioned. Monitoring frequency will decrease at this stage.

Materials that include Gila Conglomerate, riprap, and organic growth medium will be used during reclamation of the tailings storage facility to achieve the reclamation goals of preventing erosion, controlling surface water, preventing tailings oxidation, and revegetating the facility surface. Processed Gila Conglomerate will be the primary closure cover material for reclamation at the facility. The facility surface and embankment slopes will be reclaimed with 1 to 2 feet and 2 to 3 feet, respectively, of Gila Conglomerate. The Gila Conglomerate for reclamation cover will be salvaged from clearing and grubbing the facility footprint and from excavating the closure diversion channel and surrounding ridges, which will provide more than the 14 million cubic yards (Myd^3) of cover material required for reclamation. An estimated 0.1 Myd^3 of riprap to line channels and ditches to prevent erosion from water runoff will be sourced from a Troy quartzite borrow or from coarse Gila Conglomerate excavated from channels and ridges. Organics, which will serve as a growth medium for revegetation, will be salvaged during facility construction. Organics will be applied at a thickness of less than 0.1 foot to areas that will be revegetated, and the salvaged material from facility construction will supply a sufficient volume (more than 0.8 Myd^3) of material. To control fugitive dust during reclamation activities, Resolution Copper will employ mitigation measures such as limiting vehicle access, using water carts, and working during favorable wind conditions.

Water control features to manage stormwater and seepage are included in the tailings storage facility design. The facility will be shaped to shed water toward the tailings surface channels and ditches which ultimately drain to the closure diversion channel. Additional ditches will allow surface runoff to flow to natural drainages away from tailings infrastructure. Channels and ditches will be lined with riprap (or other coarse cover) to prevent erosion and ensure effective water control at the facility. Revegetating slopes will further protect against erosion.

Monitoring will be performed at the tailings storage facility to ensure reclamation goals are met regarding physical stability, geochemical stability, and ecological functionality. Success criteria for each category will be established and may change through adaptive management. For example, erosion will be monitored to assess physical stability, water quality will be monitored to assess geochemical stability, and vegetation density will be monitored to assess ecological function.

Temporary Shutdown

A project shutdown of between 90 days and 3 years will be considered temporary. Temporary shutdowns must include reclamation to control erosion, sedimentation, and fugitive dust emissions. Additional activities will include water management and embankment monitoring at the tailings storage facility.

Revegetation Techniques and Strategies

Reclamation will include revegetating disturbed areas as similarly to pre-disturbance conditions as possible while also supporting post-mining land use goals (e.g., low-intensity grazing, public recreation, wildlife habitat). Reclamation cover material composed of processed Gila Conglomerate will serve as the growth medium for revegetation. Seedbeds will be prepared by roughening the soil surface. Growth media amendments (e.g., mulch, biochar, compost) will be applied immediately prior to seeding to facilitate vegetation establishment by increasing nutrient availability, erosion resistance, and water-holding capacity of the soil. Fertilizer use will be limited to encourage native species establishment and to limit noxious weed prevalence. Fertilizers may be applied when plant nutrient requirements and plant response to cultural treatments limit revegetation success.

Seeding will occur as soon as practicable after seedbed preparation by broadcast seeding with a hydroseeder or other similar methods. Resolution Copper has indicated that seeding prior to monsoon season (July to September) is optimal for precipitation conditions to encourage germination; however, seeding may also occur in October to utilize fall and winter precipitation. Some studies suggest that seeding during the cool season is advantageous, allowing warm-season species to begin growth earlier and grow larger than seeding prior to the warm season (Jordan 1981; Monsen et al. 2004). Irrigation will not be used to water revegetated areas. Seed mixes composed of annual and perennial grasses and forbs were selected to represent the ecotypes occurring within project facility boundaries. Trees and shrubs are anticipated to establish naturally after project decommissioning but may be planted if revegetation success criteria are not met. Seed mixes to be used by Resolution Copper appear in Attachment B of the project reclamation and closure plan (Tetra Tech Inc. 2020).

Revegetation activities may begin during concurrent reclamation (at mine year 10) and continue through final reclamation. Monitoring will commence to assess revegetation success and inform reclamation strategies through adaptive management. Monitoring will occur for at least 5 years after final reclamation to ensure that the desired plant communities establish in the reclaimed areas. After 5 years of monitoring, regulatory agencies may implement additional remedial measures for disturbed areas.

Revegetation will be considered successful if vegetation communities are native and self-sustaining and if the areas support post-mining land use goals. Success criteria for each ERU that is revegetated (Desert Ecosystems, Semi-Desert Grasslands, Interior Chaparral, Juniper Grass, and Riparian) have been defined by enumerating species diversity of grasses, forbs, succulents, and shrubs, and percent canopy cover. Additionally, canopy cover, species diversity, and the prevalence of non-native species in reclaimed areas will be compared with reference areas to assess success criteria. The reference areas will be established within or adjacent to the project footprint in characteristic vegetation communities that reflect pre-disturbance conditions and desired post-mining land conditions. Adaptive management may be used to inform reseeding efforts, seed mixes, and success criteria.

Expected Timing of Reclamation Activities

Decommissioning and demolishing structures and regrading/recontouring all take place during the 5-year closure period described in the GPO. For tailings, the closure periods are longer because they depend on management of the recycled water pond:

- Alternative 2. The slopes and tailings beaches are reclaimed in the first 5 years. It is estimated to take 25 years for the recycled water pond to be drawn down and reclaimed (Klohn Crippen Berger Ltd. 2018a). Active water management would continue as long as necessary. Note that specific release criteria would be developed in detailed reclamation plans, which are a required mitigation by the Forest Service (see section 3.3.4.9).
- Alternative 3. The slopes and tailings beaches, as well as the recycled water pond, are reclaimed in the first 9 years (Klohn Crippen Berger Ltd. 2018b). Active water management would continue as long as necessary.
- Alternative 4. The slopes and tailings piles are reclaimed in the first 5 years (Klohn Crippen Berger Ltd. 2018c). Active water management would continue as long as necessary.
- Alternative 5. The slopes and tailings piles are reclaimed in the first 5 years. An estimated 30 years is needed for water quality management, but would continue as long as necessary (Golder Associates Inc. 2018a).
- Alternative 6. Similar to Alternative 2, the slopes and tailings beaches are reclaimed in the first 5 years. It is estimated to take 10 years for the recycled water pond to be drawn down and reclaimed (KCB Consultants Ltd. 2020c). Active water management would continue through the Active Care phase of reclamation (10 to 80 years after the end of mine operations). During the Active Care phase of reclamation collected seepage cannot be pumped back to the recycle pond, which would already be closed, and would exceed the amount that could be managed solely with evaporation. Water management will not be necessary in the Passive Care phases of reclamation (beyond 80 years after the end of mine operations) due to the tailings storage facility passively managing flow via evaporation.

EXPECTED EFFECTIVENESS OF RECLAMATION PLANS

As noted, the reclamation plans prepared to date by Resolution Copper and included in the GPO are conceptual in nature. The following discussion is based on the anticipated effectiveness of the conceptual plans.

A meta-analysis was completed to constrain the level of vegetation cover (and potential variability) that could be expected at a given time point after reclamation and revegetation efforts have commenced (see analysis details and source data in Bengtson (2019). The analysis included case studies from Arizona and New Mexico primarily from mining or mineral exploration activities, which reflect similar characteristics in vegetation communities, climate, soils, and disturbance types to the proposed project.[43]

Results of the meta-analysis are shown in figure 3.3.4-1. Each vertical bar in the figure represents the range in vegetation cover observed from a single year in a given case study. (Some case studies provided multiple years of data.) The combined results of all analyzed case studies illustrate the range in observed vegetation cover (percentage of vegetation cover) that have been recorded previously. The analysis

[43] The meta-analysis is meant to capture the general potential for revegetation efforts to be successful but is not specific to the Resolution Copper Project. Limitations to consider in interpreting outcomes of the meta-analysis include the following: (1) variability in revegetation outcomes, (2) semi-quantitative nature of analysis, (3) sensitivity of outcomes to the degree of initial disturbance, and (4) lack of specificity of outcomes to any project components.

demonstrates the following relationships (from Arizona and New Mexico case studies), which would also be expected for Resolution Copper revegetation efforts:

- Vegetation cover (by native and non-native species) of 8 percent or greater is consistently established by mine year 10.
- Vegetation can be as low as 0 percent, as observed in year 1 for one case study or a high as 100 percent in mine year 4.5 in another case study, with significant variation among and within the years after reclamation.
- From the case studies illustrated in figure 3.3.4-1, vegetation cover may plateau around mine year 12; however, analysis of additional case studies is needed to confirm this trend.

Overall, these findings indicate that, irrespective of the revegetation and reclamation methods applied, a minimum of 8 percent of vegetation cover (including both native and non-native species) can consistently be established within project disturbance areas. While this level of vegetation growth would provide some soil cover and erosion control functions, it does not necessarily reflect the desired future conditions envisioned by the Forest Service. The revegetation response is expected to be influenced by the nature of the surface disturbance, while irrigation or active soil management interventions could enhance revegetation success thereby reducing erosional losses and net negative impacts on soil productivity. More specific outcomes are discussed under “Closure and Reclamation Impacts” later in this section.

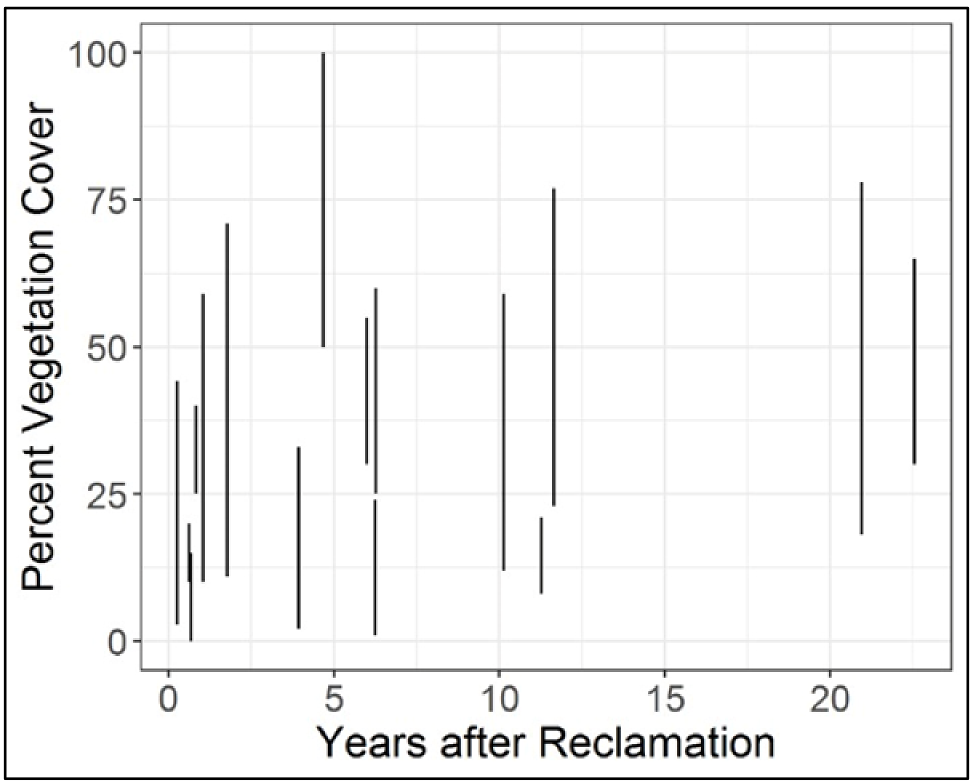


Figure 3.3.4-1. Meta-analysis summary. Each vertical bar represents the range in vegetation cover (percentage) observed from a single year (shown in years after reclamation) from a given case study. Data shown include only case studies from Arizona and New Mexico (see Bengtson (2019)).

Construction/Operational Impacts

SOILS

Project ground-disturbing activities would potentially compact soils, accelerate erosion and soil loss, contaminate soils, and reduce soil productivity. The longevity of these impacts on soil productivity and revegetation potential would depend on the nature of the disturbance and vary by project component and alternative. Most potential impacts on soil resources are common to all action alternatives; however, the level of impact is dependent on the nature of disturbance. For this analysis, the levels of impact, soil productivity responses, and revegetation success potential are summarized as six disturbance response groups, which are detailed in tables 3.3.4-2 and 3.3.4-3. Possible impacts include the following:

- Soils exposed by grading, excavation, subsidence, and vegetation clearing would be subject to accelerated wind and water erosion—all disturbances that decrease soil productivity. Erosion may also cause sediment losses and delivery to downstream washes and streams (see Section 3.7.2, Groundwater and Surface Water Quality).
- Topsoil mixing, compaction, removal, or redistribution may cause changes or losses to soil structure, seedbank, fertility, microbial communities, biotic soils, and water availability, which can negatively affect vegetation communities and further challenge revegetation efforts and success. Likewise, soil productivity and function would be lost for any soils that are not salvaged.
- Temporary loss of habitat while vegetation and soils recover from disturbance.
- Permanent soil productivity losses would occur where soils are covered, removed, or no longer available (i.e., covered by permanent structures or not reclaimed) to support vegetation or wildlife habitat. Tailings, waste-rock materials, exposed subsurface soils, or capping media used in reclamation may further challenge vegetation reestablishment.
- Waste materials may be a source of soil contamination (if not properly contained). Ground-disturbing activities could re-expose contaminated subsurface soils.

Soil salvage is one possible mitigation to erosional soil loss and productivity losses. While there are some advantages to storing soils, long-term soil stockpiling causes a number of biological and chemical changes requiring amelioration before soils are reapplied during reclamation (Strohmayer 1999). Specifically, long-term storage causes increases in soil bulk density, decreases in a soil's water-holding capacity, changes to soil chemistry and nutrient cycling (e.g., development of anaerobic conditions, accumulation of ammonium, loss of organic carbon), losses of microbial community viability, and native soil seedbank losses (reviewed in (Strohmayer 1999)). In most arid ecosystems, the soil seedbank is limited to the upper 2 inches of soil (Scoles-Sciulla and DeFalco 2009); therefore, the process of salvaging even the upper 6 to 8 inches of soil can severely dilute seed concentrations (Abella et al. 2013). Moreover, seedbank viability has been shown to diminish by 68 percent over 2 years of stockpiling (Golos and Dixon 2014) and lose all germination potential within 5 years of storage (Scoles-Sciulla and DeFalco 2009).

A detailed analysis acreages of impacts on individual soil types is available in Newell (2018g).

Table 3.3.4-2. Disturbance response groups

Disturbance Response Group	Disturbance Type and Description	Level and Type of Impact on Long-term Soil Productivity	Relative Revegetation Potential
No disturbance	No disruption of soils or vegetation, e.g., areas within a facility remaining undisturbed	No impacts	Revegetation efforts are unneeded
Drive and crush	Minimal disturbance from minor grading or vegetation mowing; surface soils and some vegetation remain intact, e.g., transmission line right-of-way	Minor impacts on soil productivity from compaction; some increased potential for erosion if vegetation is removed or soils are disrupted	High potential: Soil nutrients, cover, organic matter, microbiota, and seedbank remain intact, supporting revegetation success
Excavation with soil salvage	Soils are removed, salvaged, and replaced within disturbed surfaces, e.g., portions of the tailings storage facility	Moderate impacts on soil productivity due to topsoil redistribution; increased erosion potential, if revegetation is unsuccessful or delayed; potential for soil contamination in tailings or waste storage areas	Moderate potential: If salvaged soils are reapplied immediately, they will maintain some nutrients, organic matter, microbiota, and seedbank to enhance revegetation success
Excavation without soil salvage	Soils are removed or covered permanently, no soil salvage occurs, inert capping material used as plant growth medium, e.g., portions of the tailings storage facility	Major impacts on soil productivity due to loss of topsoils; increased erosion potential, if revegetation is unsuccessful or delayed; potential for soil contamination in tailings or waste storage areas	Low to moderate potential: Soil capping material lacks nutrients, organic matter, microbiota, and seedbank, limiting potential revegetation success
Subsidence area	Soils and vegetation are redistributed as subsidence proceeds	Minor to moderate impacts on soil productivity, erosion potential, and existing vegetation depending on subsidence rates	Variable potential: No active revegetation planned; natural regeneration may occur as soil resources are redistributed
Structural loss	Soils covered by a permanent structure	Soil productivity effectively lost in perpetuity; erosion losses are minimal under covered surfaces	Revegetation would not occur

Table 3.3.4-3. Disturbance, reclamation, and revegetation outcomes for major facilities by tailings alternative

Facility or Alternative	Facilities or Disturbance Remaining Post-decommissioning; *Other Reclamation Considerations**	Primary (P) and Secondary (S) Disturbance Response Groups	Acres of Total Facility Disturbance and Impacts on Productivity†	High Water Erosion Potential (percentage of area)‡	High Wind Erosion Potential (percentage of area)‡
East Plant Site facility (all action alternatives)	Headframes and hoists for groundwater monitoring; paved or graveled roads necessary for monitoring; subsidence area; *contact water basins would be closed*	P: Subsidence Area S: Excavation without soil salvage; Structural loss; No disturbance	189	14	0
West Plant Site facility (all action alternatives)	Roads necessary to support the reclamation and closure; stormwater diversion infrastructure; *process water ponds and contact water basins would be closed*	P: Excavation with and without soil salvage S: Structural loss; No disturbance	940§	15	0
Filter plant and loadout facility and MARRCO corridor (all action alternatives)	Other MARRCO corridor or bridge infrastructure may remain (depending on other intended uses); *all tanks and ponds would be closed*	P: Excavation with and without soil salvage; Drive and crush S: Structural loss; No disturbance	1,238§	7	0

Facility or Alternative	Facilities or Disturbance Remaining Post-decommissioning; *Other Reclamation Considerations**	Primary (P) and Secondary (S) Disturbance Response Groups	Acres of Total Facility Disturbance and Impacts on Productivity†	High Water Erosion Potential (percentage of area)‡	High Wind Erosion Potential (percentage of area)‡
Power transmission facilities (common to all action alternatives)	Power transmission facilities (e.g., electrical substations, transmission lines, power centers) to remain if post-mining use is identified	P: Drive and crush; Excavation with and without soil salvage S: Structural loss; No disturbance	670¶	25	0
Near West Proposed Action tailings storage facility (Alternative 2)	Roads and berms necessary to support the reclamation and closure; *concurrent reclamation of outer slopes; gradual reduction and closure of seepage ponds; 1.5-foot-thick rock armor (growth medium) shell on tailings*	P: Excavation with and without soil salvage S: Structural loss; No disturbance	5,071 (9,885)	0	0
Near West – Ultrathickened tailings storage facility (Alternative 3)	Roads and berms necessary to support the reclamation and closure; *concurrent reclamation of cyclone sand embankment slopes PAG ponds evaporated over time; NPAG and PAG tailings slopes and surfaces covered in in erosion-resistant capping material (growth medium)*	P: Excavation with and without soil salvage S: Structural loss; No disturbance	5,071 (9,885)	0	0
Silver King (Alternative 4)	Upstream stormwater diversion features (cutoff walls and channels); roads and berms necessary to support the reclamation and closure; *concurrent reclamation of sloped face of stacks; store and release cover design; tailings covered in in erosion-resistant capping material (growth medium)*	P: Excavation with and without soil salvage S: Structural loss; No disturbance	5,684 (10,072)	0	0
Peg Leg (Alternative 5)	Stormwater diversion channels, dropchutes, cutoff walls; roads and berms necessary to support the reclamation and closure; *reclamation begins at end of mine operations; PAG covered in 10 feet of NPAG material; all tailings covered in 1 to 2 feet of erosion-resistant capping material (growth medium)*	P: Excavation with and without soil salvage S: Structural loss; No disturbance	12,094 (16,917)	0	0
Skunk Camp (Alternative 6)	Upstream stormwater diversion features (diversion walls, channels, and other stormwater control elements); roads and berms necessary to support the reclamation and closure; *reclamation begins at end of mine operations; PAG covered in 10 feet of NPAG material; all tailings covered in 1 to 2 feet of erosion-resistant capping material (growth medium)*	P: Excavation with and without soil salvage S: Structural loss; No disturbance	10,772 (15,043)	0	15

* All disturbed surfaces not covered by a permanent structure would be reclaimed and revegetated; reclamation and decommissioning plans are detailed in chapter 2.

† The acreage shown in parentheses for each alternative represents the total acreage for the entire alternative where activities could occur, which includes areas such as the East Plant Site and subsidence area, as well as mitigation lands. Some of these areas are not anticipated to be physically disturbed but lie within facility fence lines. Mitigation areas would be disturbed but overall would result in improved land conditions. The acreage not in parentheses represents the disturbed acreage that is likely to be revegetated—the tailings storage facility, pipeline corridors, and borrow areas—and represents an area that may recover productivity in the future. Other areas—such as the East Plant Site, West Plant Site, filter plant and loadout facility, and transmission lines—could also be revegetated like the tailings storage facility and pipeline. However, they also may be reclaimed for other uses and therefore are not included.

‡ Wind and water erosion potential are provided as tan approximate percentage for an entire facility or alternative. Details on how erosion susceptibility was determined are provided in Newell (2018g). No erosion data are available where SSURGO data are unavailable.

§ The acreage shown (1,238) consists of the MARRCO corridor (685 acres) and the filter plant and loadout facility (553 acres). Under Alternative 4, the filter plant/loadout activities would occur at the West Plant Site, and there would be no separate filter plant and loadout facility. However, the West Plant Site acreage would increase from 940 to 1,064.

¶ The transmission line acreage is common for Alternatives 2, 3, 4, and 5. However, for Alternative 6 the acreage differs due to colocation of transmission lines with the tailings pipeline.

VEGETATION COMMUNITIES, SPECIAL STATUS PLANT SPECIES, NOXIOUS WEEDS

Construction

All action alternatives would involve the removal of vegetation during construction activities, resulting in the direct loss of plant communities. Construction of tailings facilities for all alternatives would continue throughout most of mine life as areas would not be disturbed until necessary. The primary impacts on vegetation communities during construction of the action alternatives would be associated with

- removal and/or crushing of natural, native species;
- increased potential for noxious and invasive weed establishment and spread;
- decreased plant productivity from fugitive dust;
- plant community fragmentation; and
- changes in plant growth and seasonal phenology from artificial lighting.

Vegetation Communities

Vegetation removal could have a variety of effects on vegetation communities ranging from changes in community structure and composition within the project footprint to alteration of soils. This could result in further loss of soil and vegetation, as well as increased sediment input to water resources. This impact would occur in localized areas of disturbance.

Soil disturbance may lead to the increased potential for the introduction and colonization of disturbed areas by noxious and invasive plant species, which may lead to changes in vegetation communities, including a possible shift over time to more wildfire-adapted vegetation that favors noxious or invasive exotic species over native species. This potential impact would be greatest in vegetation communities that are not adapted to fire, such as Arizona Upland and Lower Colorado River subdivisions of Sonoran Desertscrub. In more fire-adapted communities, such as Interior Chaparral and Semi-Desert Grasslands, these impacts could still occur, but the intensity of the impacts would decrease as native vegetation in these communities may respond positively to fire.

Fugitive dust from construction activities has the potential to affect photosynthetic rates and decrease plant productivity. Dust can have both physical and chemical impacts (Farmer 1993; Goodquarry 2011; Havaux 1992; Sharifi et al. 1997; Thompson et al. 1984; Walker and Everett 1987). Physical impacts of windborne fugitive dust on plants could include blockage and damage to stomata, shading, and abrasion of leaf surface or cuticle. Dust can increase leaf temperature; inhibit pollen germination; reduce photosynthetic activity, respiration, transpiration, and fruit set; decrease productivity; alter community structure; and contribute to cumulative impacts (e.g., drought stress on already stressed species or allow the penetration of phytotoxic gaseous pollutants, such as sulfur dioxide, nitrogen dioxide, and ozone). Some studies, however, indicate that plant species living in high light conditions are flexible to adapting to lower light conditions (e.g., desert plants) (Alves et al. 2002; Barber and Andersson 1992; Werner et al. 2002) and that some plant species show improved growth with increased dust deposition (i.e., limestone) (Brandt and Rhoades 1972). The overall impact on vegetation from fugitive dust would be localized near sources of dust and would be highest near areas of ground disturbance during construction activities and would decrease with the completion of construction activities.

The construction of project facilities would fragment vegetation communities and create edge areas. Edge areas have different microclimatic conditions and structure and may be characterized by compacted soils and increased runoff that can lead to changes in species composition and vegetation structure.

Artificial lighting associated with the construction phase of the proposed project is less defined but is assumed to be less intense that associated with the operations phase and to vary in location and intensity through the 1- to 9-year time period. Specific impacts would be similar to those described in the "Construction/Operational Impacts" section; impacts on species groups are also provided in subsequent sections.

Special Status Plant Species

The primary direct and indirect impacts on special status plant species during construction of the proposed project would be similar to those described in this section for vegetation communities and would be associated with

- removal and/or crushing of special status plant species from construction of project facilities,
- increased potential for noxious and invasive weed establishment and spread,
- decreased plant productivity from fugitive dust,
- plant community fragmentation,
- changes in plant growth and seasonal phenology from artificial lighting, and
- inability to reestablish pre-mining populations.

Vegetation removal and ground disturbance may affect special status plant species through decreased productivity from fugitive dust and the potential for changes to habitat from a decline in productive soils and from the increased potential for noxious and invasive weed establishment and spread.

All action alternatives would impact Arizona hedgehog cactus through direct loss of individual plants where they occur, as well as habitat changes from subsidence at the East Plant Site and Oak Flat site as well as other ground-disturbing activities.

A detailed analysis of potential impacts on Arizona hedgehog cactus from the preferred alternative is included in the biological assessment (SWCA Environmental Consultants 2020a) and was also conducted through consultation with the FWS. The resulting biological opinion found that the project may affect, and is likely to adversely affect the Arizona hedgehog cactus (U.S. Fish and Wildlife Service 2020a). The biological opinion took into account specific mitigation measures developed during Section 7 consultation; these are described in more detail in section 3.3.4 regarding a conservation easement for Arizona hedgehog cactus preservation at JI Ranch.

Noxious Weeds

The primary direct and indirect impacts associated with noxious weeds during construction of the proposed project would be associated with

- increased potential for introduction and spread of noxious and invasive weeds,
- changes to habitat from noxious and invasive weed establishment and spread, and
- direct and indirect impacts on and competition with native vegetation and special status plant species.

The proposed project, under any action alternative, would increase the potential for noxious weed cover, and produce vegetation assemblages that could alter natural fire regimes. Noxious weeds are often fire adapted and so perpetuate increased fire risk once established or following a fire. However, these impacts would be minimized on Tonto National Forest–administered lands with the implementation of the

"Resolution Copper Project Noxious Weed and Invasive Species Management Plan on National Forest System Lands" (Resolution Copper 2019).

This impact would be highly likely to occur in areas disturbed by construction activities and is possible in adjacent habitats.

Operations

Vegetation Communities

Operation of the proposed mine and associated facilities would result in impacts on vegetation communities. The primary impacts of operations would be associated with

- subsidence,
- potential reduction in surface water flows and groundwater availability to riparian vegetation,
- increased potential for noxious and invasive weed establishment and spread,
- decreased plant productivity from fugitive dust, and
- changes in plant growth and seasonal phenology from artificial lighting.

During the operations phase of the proposed mine there would be impacts on vegetation communities from subsidence. Subsidence of the ground surface is anticipated to occur beginning approximately 6 years after initiation of mining activities. It is anticipated to continue until approximately 40 years after initiation of mining activities.

Within the cave zone, the development of a subsidence area would change the slope, aspect, surface water flow direction and rate, and surface elevation and would impact the seed bank on approximately 1,329 acres. This would likely modify the vegetation communities within portions of the cave limit. Within the fracture limit (1,579 acres), the potential impacts would be similar to the cave limit; however, the intensity would be decreased as this area would have reduced surface impacts. The zone of continuous subsidence (1,686 acres) would have limited potential for localized impacts on vegetation communities as it would have minimal surface impacts.

In areas near the mine site, water usage would reduce water in the regional aquifer and would reduce surface water and groundwater levels downstream of the mine in Devil's Canyon and Queen Creek. Surface water amounts would be reduced, and timing/persistence of surface water would decrease. These potential decreases in groundwater and surface water would occur over a long period of time but could cause changes in riparian vegetation extent or health, and the reduction in streamflow could impact aquatic plant species, which need standing or flowing water or moist soils. As a result, the amount or volume of water within perennial pools or moisture in soils could decrease, which could result in indirect impacts on riparian vegetation and sensitive plant species through long-term habitat alteration, causing changes in the health of individual plants or populations, or even death and long-term elimination of certain plant species at these locations. Potential impacts from all action alternatives on vegetation communities in the analysis area could result from decreased surface water flow and groundwater drawdown, which could convert vegetation communities to those that are better adapted to drier conditions and result in long-term changes in the health of and reductions in the extent of riparian vegetation. Impacts on these groundwater-dependent ecosystems are analyzed in detail in section 3.7.1.

No impacts on vegetation communities are anticipated from water quality impacts at any of the tailings locations during operations as any stormwater that comes in contact with the tailings piles would be contained in the tailings facilities or in seepage ponds downstream. Water quality impacts associated with seepage that potentially could reach surface waters is analyzed in detail in section 3.7.2; specific impacts on vegetation communities are not anticipated from the potential increases in metals in surface water described in that section.

Potential impacts on vegetation communities from increased noxious and invasive weed establishment and spread would be similar in nature to those described earlier in this section for the construction phase; however, as ground-disturbing activities would be reduced during the operations phase, the magnitude of potential impacts would be greatly reduced.

Potential impacts on vegetation communities from fugitive dust would be similar in nature to those described earlier in this section for construction; however, the magnitude of impacts would be reduced as dust-producing activities would be less during the operations phase.

Artificial lighting associated with the operations phase of the proposed project would increase overall brightness in the night sky by 1 to 9 percent on average; therefore, impacts on plant species may occur. However, these impacts are not well understood or researched in current literature since much of the literature focuses on non-light-emitting diode (LED) lights. One thing that is known about LED lights and plants is that LED lights are best for growing plants indoors (Mitchell and Sutte 2015). Additionally, the potential impacts, if realized, would be associated within the direct vicinity of the main operations areas, i.e., where the most lights are concentrated to increase overall night-sky brightness. The potential impacts from light would lessen with distance from the light source. The main impact on plant species of lighting associated with the operations phase of the proposed project is through the plants' photoreceptors, and since plants are not mobile, they cannot move away from stimuli like this. The addition of artificial light at night could impact seed germination, stem elongation, leaf expansion, induce flowering, flower development, fruit development, and leaf senescence, i.e., loss of a cell's power of division and growth (Briggs 2006). In addition, artificial night lighting may lead to changes in plant growth and seasonal phenology as well as the interaction between some species and pollinators (Bennie et al. 2016). This may lead to decreased fitness of some plant species and could lead to changes in plant community structure over time near areas with artificial lighting. These impacts would be greatest near light sources and would decrease with distance from the sources.

Special Status Plant Species

Under all action alternatives, special status plant species, including Arizona hedgehog cactus, may be impacted during operations through subsidence; increased potential for noxious and invasive weed establishment and spread; fugitive dust; and changes in plant growth and seasonal phenology from artificial lighting.

Within the subsidence area, individual Arizona hedgehog cactus may be destroyed during subsidence events in the cave limit and to a lesser extent within the fracture limit. Within the cave limit and to a lesser extent the fracture limit, the changes to existing habitat could create and/or remove habitat suitable for Arizona hedgehog cactus and other species status plant species.

Potential impacts on special status plant species from noxious and invasive weed establishment and spread, fugitive dust, and artificial lighting would be similar in nature to those described earlier in this section for vegetation communities; however, the magnitude of impacts would be greater for special status plant species as they generally have more specific habitat requirements, smaller ranges, and smaller population size.

Noxious Weeds

Potential impacts from noxious weeds during operations would be similar in nature to those previously described for the construction phase; however, as there would be less ground disturbance during operations, the magnitude of impacts would be reduced. However, these impacts would be minimized on

Tonto National Forest–administered lands with the implementation of the "Resolution Copper Project Noxious Weed and Invasive Species Management Plan on National Forest System Lands" (Resolution Copper 2019).

Closure and Reclamation Impacts

Closure and reclamation of the proposed mine and associated facilities would result in short- and long-term impacts on vegetation and soil resources. During this phase, facilities would be decommissioned, sites would be regraded (as needed) and reclaimed, soil or capping material would be applied along tailings and other surfaces (as needed), erosion control measures would be implemented, and disturbed areas would be revegetated. The goal of this phase would be to reestablish vegetation on all disturbed areas, to reduce soil erosion potential, and, over time, create stable, functioning ecosystems. Specific details regarding the potential to reestablish stable, functioning ecosystems as they relate to the desired future conditions identified by the Forest Service (described earlier) are discussed in the following sections. Note that the physical stability and safety of the tailings facility are described in section 3.10.1.

Note that the reclamation and closure plans require removal of all tailings and concentrate pipelines during closure. These pipeline corridors will have been stabilized after construction, and at the time of closure any reestablished vegetation will have been in place for decades. Removal of the pipelines will again disturb these areas, requiring revegetation activities to be repeated at mine closure.

It is conceivable that some infrastructure will remain in place if it serves a purpose for another user. Most likely this only applies to the water pipelines along the MARRCO corridor or the power lines. It is unlikely tailings or concentrate pipelines would be transferred to a different owner for a new use.

POTENTIAL TO ACHIEVE DESIRED FUTURE CONDITIONS

Projecting the outcomes of reclamation and the potential to achieve desired future conditions can be challenging for any project because several factors, including precipitation, temperature, topography, existing native and non-native seedbank), type and magnitude of disturbance, and reclamation methods (e.g., planting/seeding methods, weed management, soil salvage or capping media), all interact to influence success of revegetation efforts (see Bengtson (2019)). While the meta-analysis does provide some constraint on revegetation trends that could be expected on a mining facility (see "Expected Effectiveness of Reclamation Plans" earlier in this section and Bengtson (2019)), this analysis only addresses potential vegetation cover, and not the function of the ecosystem as a whole, including all of its biotic and abiotic components. A conservative strategy to estimate the time required to reach desired future conditions is to constrain natural rates of recovery from disturbance (in the absence of revegetation or other management interventions), because natural recovery estimates reflect the potential outcomes if reclamation efforts fail to accelerate vegetation reestablishment.

In a comprehensive investigation of natural recovery from 47 studies in the Mojave and Sonoran Deserts, Abella (2010) estimated that perennial plant cover requires 76 years to recover, and complete recovery of pre-disturbance species compositions would require, on average, 215 years. Another literature review from the Mojave and Sonoran Deserts estimated that biomass recovery may require 50 to 300 years, and complete recovery of the functioning ecosystem could require up to 3,000 years (Lovich and Bainbridge 1999). These two studies include results from many types of disturbance with differing levels of disturbance magnitude (Abella 2010; Lovich and Bainbridge 1999) with varying environmental conditions that can impact recovery rates (e.g., soil type, landform, and physical attributes of the site; see Lathrop and Archbold (1980)). Despite the disparate estimates in natural recovery rates, there are two notable observations that have implications for projecting trends toward desired future conditions.

First, recovery generally follows natural succession, which is the "sequential, directional changes in species composition of a vegetation assemblage" (Webb et al. 1988). While short-lived, early-succession communities may recover in a matter of a few years to decades (Abella 2010; Lathrop and Archbold 1980; Prose et al. 1987), recovery for some long-lived, late-succession plant communities could require thousands of years, following the sequence of soil development (Lovich and Bainbridge 1999; Webb et al. 2003; Webb et al. 1988).

Second, the type and magnitude of disturbance strongly influences the nature and rates of ecosystem recovery (Abella 2010; Webb et al. 1987). For example, recovery of ground-clearing disturbances requires more time than other non-ground-clearing disturbances, because ground clearing can severely compact soils or remove surface resources (e.g., seedbank, microbial communities, fertile islands, nutrients, biotic soils, desert pavements, etc.) (Abella 2010). Likewise, the type and intensity of ground disturbance can influence recovery (Abella 2010; Lovich and Bainbridge 1999). For example, excavation disturbance generally requires approximately 100 years to recover pre-disturbance levels of biomass, and less-intense disturbance that only disrupts surface soils may require only around 20 years for biomass recovery (Lathrop and Archbold 1980). Ground disturbance impacts may be species specific, as soil compaction, topsoil removal, and changes to ephemeral drainages seems to hinder recovery of longer lived species or those sensitive to soil compaction (Prose et al. 1987). The shape of the disturbance footprint may also play a role, as some research suggests that recovery of linear disturbances (i.e., roads, pipeline corridors, transmission line corridors), is accelerated by the availability of seeds and propagules from adjacent undisturbed areas, whereas wider or larger disturbance areas lack nearby propagule sources (Abella 2010).

The findings of these natural recovery studies, the outcomes of the meta-analysis (Bengtson 2019), and species-specific resource studies have been used to constrain the potential for reclamation efforts to achieve desired future conditions. Trends toward desired future conditions largely vary based on the level and nature of disturbance across all project components (see tables 3.3.4-2 and 3.3.4-3). In general, fast-growing and early-successional plant species and those tolerant of a variety of conditions would be the first to reestablish after reclamation, recovering over years to decades. In contrast, some slower growing, late-successional species may also reestablish but may require centuries or even millennia to reach pre-disturbance levels of ecosystem function. In areas where ground disturbance is relatively low, and soil resources (e.g., nutrients, organic matter, microbial communities) and vegetation propagules (e.g., seedbank or root systems to resprout) remain relatively intact, it would be expected that vegetation communities could rebound to similar pre-disturbance conditions in a matter of decades to centuries. In contrast, the tailings storage facility, which would be covered in non-soil capping material (such as Gila Conglomerate) would provide, at best, some habitat structure for generalist wildlife species. It is expected that biodiversity and ecosystem function of the tailing storage facility may never reach the original, pre-disturbance conditions even after centuries of recovery. The following sections detail the estimated potential, as well as some time constraint, for individual vegetation communities to reach their respective desired future conditions and potential impacts on soil resources, special status plant species, and noxious weeds.

Soils

Healthy soils are the basis for a stable, functioning ecosystem—providing a plant growth medium, habitat for burrowing animals, water and nutrients to support plant communities, and harboring seeds and plant propagules. During the closure and reclamation project phase, the reestablishment of vegetation and improvements to soil conditions (through soil management or application of amendments) would offset impacts from construction, operations, and maintenance.

Even with optimal soil management intervention, the legacy of impacts on soil health and productivity may last centuries to millennia, impacting the ability of the ecosystem to meet its desired future conditions. For example, natural recovery from compaction (associated with heavy equipment traffic) is estimated to require 92 to 124 years (Webb 2002). Similarly, biotic soils and desert pavements, which trap fine-grained dust to form vesicular soil horizons, naturally prevent erosion, influence the distribution of soil nutrients, and control soil water dynamics, develop over hundreds to thousands of years (Anderson et al. 2002; Felde et al. 2014; Haff and Werner 1996; Williams 2011; Williams et al. 2012; Williams et al. 2013). The following impacts on soils would be expected during and in the years following closure and reclamation:

- Losses of topsoil resources (e.g., fine-grained soil particles, soil fertility, compaction, natural soil structure, water-holding capacity, biotic soils) during construction, operations, and maintenance may be considered permanent, as these resources accumulate over hundreds to thousands of years of soil formation. It is expected that erosion control and revegetation efforts during closure and reclamation would stop the continued loss of these resources.
- Some soil function may be enhanced through application of soil amendments (e.g., mulch, organic matter application) by increasing soil fertility, erosion resistance, and soil water-holding capacity, which would improve soil productivity.
- Over time, as soil formation proceeds (over hundreds to thousands of years), soil health and function would improve as dust accretes to increase natural soil fertility and water-holding capacity, soil structure redevelops and improves soil hydrologic function, organic matter and nutrients accumulate, bioturbation mixes soil resources, plants and microorganisms continue to colonize soils, biotic soils and desert pavements reform, and carbon and nitrogen are fixed within the soil.
- The productivity of the soil and its ability to support healthy and resilient vegetation communities (which meet an ecosystem's desired future conditions) would increase as soil formation proceeds over centuries and millennia.

These changes to soil function and productivity through time are considered in the following sections that detail the potential to achieve desired future conditions. The time frames for the recovery of soil function would largely depend on the initial level of disturbance (see table 3.3.4-2), with those soils that have had the least-impacted disturbance type (and have the greatest soil resources remaining) recovering the fastest.

Desert Ecosystems (Sonoran Desertscrub)

Under optimal conditions, and with sufficient revegetation efforts and resource inputs (e.g., soil amendments and watering), fast-growing perennial shrubs, forbs, grasses, cacti, and mesquite trees would rebound within a few years to a few decades. Saguaro are slow-growing, and larger (older) individuals have low transplant survival rates (Elliot 2003). Managing the fine fuels associated with non-native grasses to maintain fire intervals greater than 100 years may not be possible, even in undisturbed and low-disturbance areas. Overall, the habitat may be suitable for generalist wildlife and plant species, but rare plants and wildlife with specific habitat requirements would be unlikely to return.

Semi-Desert Grasslands

Under optimal conditions, and with sufficient revegetation efforts and resource inputs (e.g., soil amendments and watering), many native grasses would return within a few years to a few decades. Tree and shrub canopy cover can be limited with management intervention. Managing non-native vegetation cover to limit the intensity of uncharacteristic fires may not be possible on the landscape scale. Because many important grass species would recover in the short-term, much of the habitat function of these ecosystems would be likely to return.

Interior Chaparral

Under optimal conditions, and with sufficient revegetation efforts and resource inputs (e.g., soil amendments and watering), recovery of shrubs (particularly shrub live oak; see Tirmenstein (1999)), shrub litter, and regeneration of grasses and forbs should be achievable over decades to centuries on most disturbance types other than the tailings storage facility. While management of non-native species may not be achievable, support of stand-replacing fires at 35- to 100-year intervals that promote resprouting of fire-adapted species may be achievable with management interventions. Much of the habitat function should return to these habitats after decades to centuries for generalist species but may not return for sensitive species with specific habitat requirements.

Pinyon-Juniper Woodland

Under optimal conditions, reestablishment of multi-aged woodlands with complex structure and sparse ground cover of shrubs, perennial grasses, and forbs would be achievable with management intervention and resource inputs for most disturbance types, with the exception of the tailings storage facility. However, very old trees would take centuries to reestablish. Support of low-intensity ground fires should be possible with management intervention. Habitat structure would return for most generalist wildlife species but would likely require decades to centuries.

Ponderosa Pine-Evergreen Oak

Given optimal conditions, revegetation efforts, management interventions, and resource inputs, reestablishment of old-growth tree stands with sparse shrub and herbaceous groundcover should be achievable on most disturbance types with the exception of the tailings storage facility. Recreating a functional ecosystem that is resilient to a variety of human and natural disturbances may be challenging to achieve, even with intense management interventions. Habitat structure would return for most generalist wildlife species but would likely require decades to centuries.

Xeroriparian

With maintenance or recovery of the optimal hydrologic conditions, and with some management interventions, the reestablishment of most xeroriparian communities would return for all disturbance types with the exception of the tailings storage facilities. However, these communities may recover around the tailings facilities, under the appropriate conditions. Habitat structure would return for most generalist wildlife species but would likely require decades to centuries.

Riparian

Riparian community composition is expected to vary based on soil and hydrologic conditions; however, in general site-appropriate communities are expected to reestablish (given suitable management intervention and revegetation efforts) on all disturbance types with the exception of the tailings storage facilities. However, these communities may reestablish adjacent to the tailings storage facility. Habitat structure would return for most generalist wildlife species but would likely require decades to centuries.

Special Status Plant Species

Impacts on special status plant species during closure/reclamation would be similar to those described for vegetation communities. However, as special status plant species generally have specific habitat requirements, it is unlikely that reclaimed areas would retain or develop those habitat requirements over more than a small portion of the areas previously disturbed.

Noxious Weeds

Reclamation of disturbed areas would decrease but not eliminate the likelihood of noxious weeds becoming established or spreading in and adjacent to the project area. In areas where reclamation activities would occur, there would likely be reduced soil stability and an initial increase in the potential for noxious and invasive weed establishment and spread due to ground disturbance and decreased competition for space, light, and water. Efforts to reclaim these areas would lessen the potential for weed establishment and spread in the long term; however, it is anticipated that reclaimed areas would have a higher density of these non-native species than were present before ground-disturbing activities, even at completion of reclamation activities.

3.3.4.3 Alternative 2 – Near West Proposed Action

Potential impacts on soils, vegetation communities, and special status plant species, as well as impacts from noxious weeds, would be as described earlier under "Impacts Common to All Action Alternatives" and "Potential to Achieve Desired Future Conditions." Alternative 2 would remove or modify approximately 9,885 acres of vegetation and impact 9,885 total acres of soils (see table 3.3.4-3). This area represents all areas where activities could occur, though some areas are within fence lines and not anticipated to be physically impacted. This area also included mitigation lands, where disturbance would happen but result in an overall improvement in land condition. Of the disturbed area, 5,071 acres associated with the tailings facility, pipeline, and borrow areas would potentially be revegetated and would recover productivity to some extent, as described under "Impacts Common to All Action Alternatives." Other areas—such as the East Plant Site, West Plant Site, and filter plant and loadout facility—could also be revegetated like the tailings storage facility and pipeline, but also may be reclaimed for other uses. The acres of potential impacts on vegetation communities and special status plant species habitat by alternative are given in tables 3.3.4-4 and 3.3.4-5.

Financial Assurance for Closure and Post-Closure Activities

Alternative 2 potentially involves long time periods of post-closure maintenance and monitoring related to revegetation and reclamation of the tailings storage facility. This raises the concern for the possibility of Resolution Copper's going bankrupt or otherwise abandoning the property after operations have ceased. If this were to happen, the responsibility for these long-term activities would fall to the Forest Service. The Forest Service would need to have financial assurance in place to ensure adequate funds to undertake these activities for long periods of time—for decades or even longer.

The authority and mechanisms for ensuring long-term funding is discussed in section 1.5.7. The types of activities that would likely need to be funded could include the following:

- Monitoring of the success of revegetation
- Implementing remedial actions if revegetation success criteria are not met
- Monitoring of the post-closure landform for excessive erosion or instability, and performance of any armoring
- Maintenance and monitoring of post-closure stormwater control features
- Monitoring the water quality of stormwater runoff associated with the closure cover, to determine ability to release stormwater back to the downstream watershed

Additional financial assurance requirements for long-term maintenance and monitoring are part of the Arizona APP program and include the following:

> The applicant or permittee shall demonstrate financial responsibility to cover the estimated costs to close the facility and, if necessary, to conduct post-closure monitoring and maintenance by providing to the director for approval a financial assurance mechanism or combination of mechanisms as prescribed in rules adopted by the director or in 40 Code of Federal Regulations section 264.143 (f)(1) and (10) as of January 1, 2014. (ARS 49-243; also see Arizona Administrative Code R18-9-A203 for specific regulations and methods allowed for financial assurance)

The Arizona State Mine Inspector also has authority to require a mine reclamation plan and financial assurance for mine closure (Arizona Administrative Code Title 11, Chapter 2). The primary focus of these regulations is surface disturbance and revegetation.

3.3.4.4 Alternative 3 – Near West – Ultrathickened

Potential impacts on soils, vegetation communities, special status plant species, and noxious weeds would be the same in magnitude and nature as those described for Alternative 2 as they have the same footprint, and differences in the tailings facility construction and operation would not increase or decrease potential impacts between the two alternatives.

Financial assurance for closure and post-closure activities would be the same as described for Alternative 2.

3.3.4.5 Alternative 4 – Silver King

Potential impacts on soils, vegetation communities, special status plant species, and from noxious weeds would be as described under "Impacts Common to All Action Alternatives" and "Potential to Achieve Desired Future Conditions." Alternative 4 would remove or modify approximately 10,072 acres of vegetation and impact 10,072 total acres of soils (see table 3.3.4-3). This area represents all areas where activities could occur, though some areas are within fence lines and not anticipated to be physically impacted. This area also included mitigation lands, where disturbance would happen but result in an overall improvement in land condition. Of the disturbed area, 5,684 acres associated with the tailings facility and pipeline would potentially be revegetated and would recover productivity to some extent, as described under "Impacts Common to All Action Alternatives" and "Potential to Achieve Desired Future Conditions." Other areas—such as the East Plant Site, West Plant Site, and filter plant and loadout facility—could also be revegetated like the tailings storage facility and pipeline, but also may be reclaimed for other uses. The acres of potential impacts on vegetation communities and special status plant species habitat by alternative are given in tables 3.3.4-4 and 3.3.4-5.

Financial assurance for closure and post-closure activities would be the same as described for Alternative 2.

3.3.4.6 Alternative 5 – Peg Leg

Potential impacts on soils, vegetation communities, special status plant species, and from noxious weeds would be as described under "Impacts Common to All Action Alternatives." Alternative 5 would remove or modify approximately 16,917 acres of vegetation. The disturbance would impact 16,917 acres of soils (see table 3.3.4-3). This area represents all areas where activities could occur, though some areas are within fence lines and not anticipated to be physically impacted. This area also included mitigation lands, where disturbance would happen but result in an overall improvement in land condition. Of the disturbed area, 12,094 acres associated with the tailings facility and pipeline would potentially be revegetated and would recover productivity to some extent, as described under "Impacts Common to All Action Alternatives" and "Potential to Achieve Desired Future Conditions." Other areas—such as the East Plant Site, West Plant Site, and filter plant and loadout facility—could also be revegetated like the tailings storage facility and pipeline, but also may be reclaimed for other uses. The acres of potential impacts on vegetation communities and special status plant species habitat by alternative are given in tables 3.3.4-4 and 3.3.4-5. Alternative 5 would impact for Acuña cactus critical habitat on about 12 acres.

The regulatory framework under the State of Arizona to require financial assurance for long-term closure activities is the same as described for Alternative 2. However, for the tailings facility, financial assurance requirements would be required by BLM, not the Forest Service. Like the Forest Service, BLM also has regulatory authority to require financial assurance for closure activities, contained in their surface management regulations (43 CFR Subpart 3809). BLM considers that the financial assurance must cover the estimated cost as if BLM were hiring a third-party contractor to perform reclamation of an operation after the mine has been abandoned. The financial assurance must include construction and maintenance costs for any treatment facilities necessary to meet Federal and State environmental standards.

3.3.4.7 Alternative 6 – Skunk Camp

Potential impacts on soils, vegetation communities, special status plant species, and from noxious weeds would be as described under "Impacts Common to All Action Alternatives" and "Potential to Achieve Desired Future Conditions." Alternative 6 would remove approximately 15,043 acres of vegetation and impact 15,043 acres of soils (see table 3.3.4-3). This area represents all areas where activities could occur, though some areas are within fence lines and not anticipated to be physically impacted. This area also included mitigation lands, where disturbance would happen but result in an overall improvement in land condition. Of the disturbed area 10,772 acres associated with the tailings facility, pipeline, and borrow areas would potentially be revegetated and would recover productivity to some extent, as described under "Impacts Common to All Action Alternatives." Other areas—such as the East Plant Site, West Plant Site, and filter plant and loadout facility—could also be revegetated like the tailings storage facility and pipeline, but also may be reclaimed for other uses. The acres of potential impacts on vegetation communities and special status plant species habitat by alternative are given in tables 3.3.4-4 and 3.3.4-5.

The regulatory framework under the State of Arizona to require financial assurance for long-term closure activities is the same as described for Alternative 2. However, Alternative 6 differs from the other alternatives because the tailings facility would not be located on lands managed by the Forest Service (as in Alternatives 2, 3, and 4) or BLM (Alternative 5). For Alternative 6, the Federal financial assurance mechanisms would not be applicable.

Table 3.3.4-4. Acres of vegetation communities to be disturbed within each action alternative footprint

Vegetation Community or Landform Type	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 4 (acres)	Alternative 5 (acres)	Alternative 6 (acres)
Total Acres	9,938	9,938	10,584	16,972	15,160
Human Dominated	439	439	441	449	438
Interior Chaparral	1,238	1,238	1,367	1,243	1,924
Mesquite	0	0	0	0	12
Pine-Oak	2	2	3	2	42
Pinyon-Juniper	49	49	115	136	124
Riparian	97	97	85	83	44
Semi-Desert Grasslands	93	93	1,376	106	7,628
Sonoran Desertscrub	7,903	7,903	7,026	14,776	4,209
Water	15	15	15	15	15
Xeroriparian	102	102	156	162	724

Note: Acreages in this table are rounded to the nearest whole number.

Table 3.3.4-5. Acres of modeled habitat for special status plant species potentially occurring within each action alternative footprint

Common Name (Scientific Name)	Status	Alternatives 2 and 3 Project Footprint (acres) Percentage of Modeled Habitat in Project Area Analysis Area (acres) Percentage of Modeled Habitat in Analysis Area	Alternative 4 Project Footprint (acres) Percentage of Modeled Habitat in Project Area Analysis Area (acres) Percentage of Modeled Habitat in Analysis Area	Alternative 5 Project Footprint (acres) Percentage of Modeled Habitat in Project Area Analysis Area (acres) Percentage of Modeled Habitat in Analysis Area	Alternative 6 Project Footprint (acres) Percentage of Modeled Habitat in Project Area Analysis Area (acres) Percentage of Modeled Habitat in Analysis Area
Acuña cactus (*Echinomastus erectocentrus* var. *acunensis*)	ESA: E with critical habitat. Found in Maricopa, Pinal, and Pima Counties.	6,900 70% 47,710 73%	5,792 56% 41,957 62%	13,748 82% 78,419 77%	3,181 21% 41,590 46%
Arizona hedgehog cactus (*Echinocereus arizonicus* spp. *arizonicus*)	ESA: E No critical habitat. Found in Maricopa, Pinal, and Gila Counties.	816 8% 6,562 10%	816 8% 6,892 10%	816 5% 6,562 6%	913 6% 8,945 10%

Common Name (Scientific Name)	Status	Alternatives 2 and 3 Project Footprint (acres) Percentage of Modeled Habitat in Project Area Analysis Area (acres) Percentage of Modeled Habitat in Analysis Area	Alternative 4 Project Footprint (acres) Percentage of Modeled Habitat in Project Area Analysis Area (acres) Percentage of Modeled Habitat in Analysis Area	Alternative 5 Project Footprint (acres) Percentage of Modeled Habitat in Project Area Analysis Area (acres) Percentage of Modeled Habitat in Analysis Area	Alternative 6 Project Footprint (acres) Percentage of Modeled Habitat in Project Area Analysis Area (acres) Percentage of Modeled Habitat in Analysis Area
Chiricahua Mountain alumroot (*Heuchera glomerulata*)	Tonto National Forest: S, SCC	41 0% 754 1%	45 0% 1,064 2%	41 0% 754 1%	47 0% 1,071 1%
Hohokam agave aka Murphey agave (*Agave murpheyi*)	Tonto National Forest: S, SCC	2,958 30% 27,883 43%	1,127 11% 26,846 40%	1,343 8% 33,791 33%	1,127 8% 26,846 30%
Mapleleaf false snapdragon (*Mabrya [Maurandya] acerifolia*)	Tonto National Forest: S, SCC	5,973 61% 34,851 53%	2,749 26% 28,782 43%	12,124 72% 64,042 63%	1,263 8% 27,690 31%
Parish's Indian mallow (*Abutilon parishii*)	Tonto National Forest: S BLM: S	351 4% 4,383 7%	2,739 26% 8,129 12%	1,872 11% 12,615 12%	8,609 58% 24,643 28%

Notes:

Modeling was based on the combination of the vegetation community and elevational parameters for each species. Modeled habitat includes areas outside the current range of some species and is used here as a conservative estimate of impacts. It was necessary to use modeled habitat since the only baseline survey and suitable habitat data available were only for four species within Alternatives 2 and 3.

Acreages in this table are rounded to the nearest whole number. As with any modeling exercise, these numbers are not an exact representation of how much habitat for each species may actually be present in each alternative.

Status Definitions

Tonto National Forest:

S = Sensitive. Species identified by a Regional Forester for which population viability is a concern, as evidenced by a significant current or predicted downward trends in population number or density or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

SCC = Species of Conservation Concern. Under the 2023 forest plan: Species that are native to and known to occur on the Tonto National Forest and for which there are substantial concerns about the species' ability to persist on the Tonto National Forest.

Endangered Species Act (ESA):

E = Endangered. Endangered species are those in imminent jeopardy of extinction. The ESA specifically prohibits the take of a species listed as endangered. Take is defined by the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to engage in any such conduct.

Bureau of Land Management (BLM):

S = Sensitive. Species that could easily become endangered or extinct in the state.

Impacts along the Pipeline and Power Line Corridor

Pipelines and power lines would be constructed within a corridor linking project facilities with tailings storage facility infrastructure. Water and tailings pipelines 10 to 34 inches in diameter would be mostly buried within the corridor everywhere except along the bridges over Queen Creek and Devil's Canyon. Power line towers and access roads will also be constructed for use during mine operations. Pipeline and power line infrastructure that is necessary for post-closure monitoring will remain in place and any other facilities will be removed and reclamation, including revegetation, will occur. Soil loss from construction and operations in the pipeline and power line corridor is expected to be minimal after compliance with applicant-committed environmental protection measures (SWPPPs and erosion and sediment controls), and post-closure after reclamation when the surface has stabilized from revegetation.

As noted previously, the reclamation and closure plans require removal of all tailings and concentrate pipelines during closure. These pipeline corridors will have been stabilized after construction, and at the time of closure any reestablished vegetation will have been in place for decades. Removal of the pipelines will again disturb these areas, requiring revegetation activities to be repeated at mine closure.

It is conceivable that some infrastructure will remain in place if it serves a purpose for another user. Most likely this only applies to the water pipelines along the MARRCO corridor or the power lines. It is unlikely tailings or concentrate pipelines would be transferred to a different owner for a new use.

After the January 2021 FEIS was rescinded, an additional reclamation and closure plan specific to the Alternative 6 pipeline/power line corridor was submitted to the Forest Service (Tetra Tech Inc. 2022). This reclamation and closure plan was prepared specifically to address requirements for reclaiming the pipeline/power line corridor under a special use authorization.

3.3.4.8 Cumulative Effects

Full details of the cumulative effects analysis can be found in chapter 4. The following represents a summary of the cumulative impacts resulting from the project-related impacts described in Section 3.3.4, Environmental Consequences, that are associated with soil and vegetation resources, when combined with other reasonably foreseeable future actions.

The following actions were determined through the cumulative effects analysis process to be reasonably foreseeable, and have impacts that likely overlap in space and time with impacts from the Resolution Copper Project:

- ADOT Pinal County North-South Corridor
- ADOT Vegetation Treatment
- AGFD Wildlife Water Catchment Improvement Projects
- Arizona Public Service Company (APS) Herbicide Use within Authorized Power Line Rights-of-Way on NFS Lands
- Oak Wells Wind Project
- Ray Land Exchange and Proposed Plan Amendment
- Ripsey Wash Tailings Project
- Superior to Silver King 115-kV Relocation Project
- Tonto National Forest Travel Management Plan

The cumulative effects analysis area for soils and vegetation includes all watersheds impacted by ground disturbance. The metrics used to quantify cumulative impacts to soils and vegetation resources are (1) the acreage of physical disturbance in each vegetation community, (2) soil type, and (3) any critical habitat within the cumulative effects area.

- Vegetation Communities. The seven reasonably foreseeable future actions above, combined with the Resolution Copper Project, represent about 158,000 acres within the 591,000-acre cumulative effects analysis area, or about 26.7 percent of the area. Within this area, the greatest impact is on the Upland Sonoran Desertscrub vegetation type (loss of 64,700 acres) and the Interior Chaparral vegetation type (loss of 31,400 acres).
- Soil Types. Within the disturbed area, the greatest impact would be on the White House-Stronghold complex soil type (loss of 7,100 acres). About 53 percent of the disturbed area (17,000 acres) is composed of soil types that are known to be highly susceptible to erosion.
- Critical Habitat. The nine reasonably foreseeable future actions, combined with the Resolution Copper Project, would disturb about 229 acres within critical and special habitats. Most of this is related to Gila chub and consists of potential impacts from the Resolution Copper Project along Mineral Creek; the biological opinion found that the Resolution Copper Project may affect, but is unlikely to adversely affect, Gila chub (see appendix P of the FEIS).

Effects of Future Meteorological Trends

Globally, meteorological trends are producing warmer and drier conditions, but those effects are especially pronounced in the American Southwest (Dugan 2018). Around the project area, groundwater levels have measurably decreased (see section 3.7.1) and groundwater and surface water is expected to further diminish with mining operations requiring aquifer dewatering. Drier conditions and warmer temperatures may affect the vegetation biomass and species assemblage within the project area.

Under the preferred alternative, several vegetation communities are expected to be revegetated during reclamation. However, some species anticipated to establish from reseeding may not establish under future meteorological trends. One solution to successfully revegetate in light of these trends is to obtain native seeds from local growers, which may be adapted to the local weather conditions.

3.3.4.9 Mitigation Effectiveness

Mitigation Identifier and Title	Authority to Require
FS-SV-01: Resource salvage	Required – Forest Service
FS-SV-02: JI Ranch	Required – Forest Service and Biological Opinion
FS-SV-03: Revised reclamation and closure plans	Required – Forest Service
FS-WR-01: GDEs and water well mitigation	Required – Forest Service
FS-WR-02: Clean Water Act 404 compensatory mitigation plan	Required – U.S. Army Corps of Engineers
FS-WR-04: Replacement of water in Queen Creek	Required – Forest Service
RC-SV-04: Interim management of 7B Ranch	Committed – Resolution Copper

We developed a robust monitoring and mitigation strategy to avoid, minimize, rectify, reduce, or compensate for resource impacts that have been identified during the process of preparing this EIS. Appendix J contains descriptions of mitigation measures that are being required by the Forest Service and mitigation measures voluntarily brought forward and committed to by Resolution Copper. Appendix J also contains descriptions of monitoring that would be needed to identify potential impacts and mitigation effectiveness.

This section contains an assessment of the effectiveness of design features associated with mitigation and monitoring measures found in appendix J that are applicable to soils, vegetation, and reclamation. See appendix J for full descriptions of each measure noted below.

Mitigation Effectiveness and Impacts of Forest Required Mitigation Measures Applicable to Soils, Vegetation, and Reclamation

Appendix J contains mitigation and monitoring measures being required by the Forest Service under its regulatory authority or because these measures are required by other regulatory processes (such as the Biological Opinion). These measures are assumed to occur, and their effectiveness and impacts are disclosed here. The unavoidable adverse impacts disclosed below take the effectiveness of these mitigations into account.

Resource salvage (FS-SV-01). This measure allows for Tribal access for salvage of culturally important resources within the mine footprint prior to disturbance. In addition, to the extent practicable, Resolution Copper will salvage select vegetation within the tailings storage facility footprint. The salvage of vegetation would not result in any additional ground disturbance and would be effective at offsetting some loss of vegetation through salvage and replanting. Not all salvaged vegetation would likely survive transplantation, and many decades might be required before areas are available for replanting. The amount of vegetation salvaged would be a small portion of that lost.

JI Ranch (FS-SV-02). This measure conserves 100 acres of JI Ranch, which is suitable habitat for Arizona hedgehog cactus. Conservation would not prevent potential loss of individual cacti within the footprint, but would be effective at reducing impacts to the overall population of the cactus.

Revised reclamation and closure plans (FS-SV-03). Implementing reclamation and closure plans ensures that the post-closure landscape is successfully revegetated to the extent practicable and that the landforms are stable and safe. This measure is effective at partially replacing habitat and vegetation over the long term within the footprint of all mine components, reducing long-term effects on surface water quality from erosion, and improving long-term resilience and safety of the tailings storage facility.

GDEs and water well mitigation (FS-WR-01). This measure would replace water sources for any riparian areas associated with springs or perennial streams (groundwater-dependent ecosystems) impacted by drawdown from the mine dewatering and block caving. Though this measure could change the overall natural character of riparian areas, it would be effective at preserving riparian vegetation and aquatic habitats.

Clean Water Act Section 404 compensatory mitigation plan (FS-WR-02). The compensatory mitigation parcels would offer conservation of riparian habitat, as well as overall improvement in the health and stability of riparian habitats, by minimizing invasive non-native species and returning conditions to a more natural state. This measure would be effective at replacing xeroriparian habitat lost within the project footprint.

Replacement of water in Queen Creek (FS-WR-04). This measure would replace the storm runoff in Queen Creek that otherwise would be lost to the subsidence area. It would be highly effective at minimizing the effects felt in Queen Creek caused by reduction in the watershed area, specifically impacts to surface water quantity and riparian habitat. Note that other stormwater losses would still occur under Alternatives 2, 3, and 4.

Mitigation Effectiveness and Impacts of Resolution Committed Mitigation Measures Applicable to Soils, Vegetation, and Reclamation

Appendix J contains mitigation and monitoring measures committed by Resolution Copper in contractual, financial, or other agreements. These measures are assumed to occur, and their effectiveness and impacts are disclosed here. However, the unavoidable adverse impacts disclosed below do not take the effectiveness of these mitigations into account as they are not within the authority of the Forest Service to ensure.

Interim management of 7B Ranch (RC-SV-04). This measure potentially will be effective at improving vegetation conditions on 7B Ranch, in the interim period before BLM management of the lands begins under the appropriate land management plan. At a basic level, the overall habitat on the offered parcel would be transferred and would be effective at partially offsetting habitat lost within the project footprint. Greater benefits would occur as interim management improves the mesquite bosque or riparian habitat.

Mitigation Effectiveness and Impacts of Resolution Voluntary Mitigation Measures Applicable to Soils, Vegetation, and Reclamation

Appendix J contains mitigation and monitoring measures brought forward voluntarily by Resolution Copper and committed to in correspondence with the Forest Service. These measures are assumed to occur but are not guaranteed to occur. Their effectiveness and impacts if they were to occur are disclosed here; however, the unavoidable adverse impacts disclosed below do not take the effectiveness of these mitigations into account. No additional mitigation measures were voluntarily brought forward for soils, vegetation, and reclamation.

Unavoidable Adverse Impacts

The required mitigation described would only partially offset project impacts. While some habitat would be preserved and other habitat would be replaced, the unavoidable adverse effects remain as described earlier in this section, including the complete loss during operations of soil productivity, vegetation, and functioning ecosystems within the area of disturbance, and eventual recovery after reclamation (though not likely to the level of desired conditions or potentially over extremely long time frames). Impacts on special status plant species, where they occur, and the spread of noxious and invasive weeds (though reduced by applicant-committed environmental protection measures) would also be unavoidable adverse effects.

3.3.4.10 Other Required Disclosures

Short-Term Uses and Long-Term Productivity

Productivity loss for soils would be limited to the disturbed areas affected by land clearing, grading, and construction; subsidence; and areas permanently occupied by tailings. It is not expected that the tailings would ever be removed, or that the subsidence area would be filled, and effects on soils and some land uses would be permanent.

Reclamation efforts are anticipated to reestablish vegetation in all areas other than the subsidence area.

Test plots at the West Plant Site have demonstrated that it is possible to successfully revegetate under certain conditions, and research has demonstrated successful revegetation on Gila Conglomerate in the same geographic area; however, it is not known whether the areas would return to current conditions or the length of time that would be needed to successfully reclaim the site. The goal of reclamation is to create a self-sustainable ecosystem that would promote site stability and repair hydrologic function. While pre-project habitat conditions are not likely to be achieved, it is likely that some level of wildlife habitat would eventually be reestablished in most areas, reestablishing some level of long-term productivity.

Irreversible and Irretrievable Commitment of Resources

Soils are a finite resource, and any loss of soils resulting from their removal for tailings storage and from erosion and delivery to downstream channels is irreversible. The loss of soil productivity is effectively irreversible because a stable new plant community would take an extremely long time to redevelop on the surface of the tailings and waste-rock facilities (decades or centuries). The area of the subsidence area and tailings storage facility would constitute an irreversible loss of soil that would be lost in perpetuity.

Irretrievable effects on soils and vegetation would take place at disturbed areas until reclamation is successfully accomplished or only temporary in nature, particularly along rights-of-way. Soils and vegetation in these areas would eventually return to full functionality, possibly within years or decades.

3.4 Noise and Vibration

3.4.1 Introduction

Development, operation, and reclamation of the mine could result in an increase in noise and vibrations in the immediate vicinity of mine facilities. Activities that could increase noise and vibrations include blasting, underground conveyance of ore, processing operations, operations at the filter plant and loadout facility, and operations at the tailings facilities. Increases in traffic associated with worker commuting, material delivery, and mine product shipment could also contribute to an overall increase in noise on area roads and highways.

Noise and vibration (both blasting and non-blasting related) associated with mining activities would vary spatially and temporally throughout the life of the project, depending on the phase.

> **Overview**
>
> Any large-scale earthmoving operation, such as mining, will inevitably result in increased machinery-generated noise and vibration above previous ambient levels for a given location. The proposed Resolution Copper Mine differs from many mining operations in that most sounds and vibrations from blasting and ore removal would occur far underground and not be perceptible at the surface. There would, however, be increases in noise and vibration throughout the construction and operational phases of the mine from facility-building activity, haul truck traffic, and employee vehicles moving to and from the mine. The text section below provides a detailed analysis of estimated impacts from noise and vibration under the GPO and each of the alternatives.

This section describes noise and vibrations from blasting and non-blasting activities, during both construction and operation, for each alternative. Additional details not included may be found in the project record (Newell 2018d). Note that noise and vibration impacts on wildlife are addressed in section 3.8.

3.4.1.1 Changes from the DEIS

We have made several changes to the noise and vibration analysis in response to comments received on the DEIS. We added analysis for block caving's potential to cause noise and vibration impacts. We also refined the analysis for Alternative 4 – Silver King to include the noise impacts anticipated from the relocation of the filter plant and the resulting train traffic to and from the West Plant Site.

We revised the cumulative effects analysis for the FEIS to better quantify impacts. It is described in detail in chapter 4 and summarized in this section. Any mitigations developed between the DEIS and FEIS are summarized in appendix J and, if applicable to noise and vibration, are analyzed for effectiveness in this section.

3.4.1.2 Changes from the January 2021 Rescinded FEIS

For the noise and vibration section, the only changes since January 2021 are revisions to the cumulative effects analysis based on updates to the list of potentially reasonably foreseeable actions, and an update to reflect analysis of consistency with the new "Tonto National Forest Land Management Plan," implemented in December 2023.

3.4.2 Analysis Methodology, Assumptions, and Uncertain and Unknown Information

3.4.2.1 Analysis Area

The spatial analysis area consists of the area in which predicted noise and vibration caused by the project attenuate to background levels. The analysis generally evaluated land uses within 2 miles of each mine component, which encompasses the area in which predicted noise would be noticeable. The noise and vibration analysis area is shown in figure 3.4.2-1.

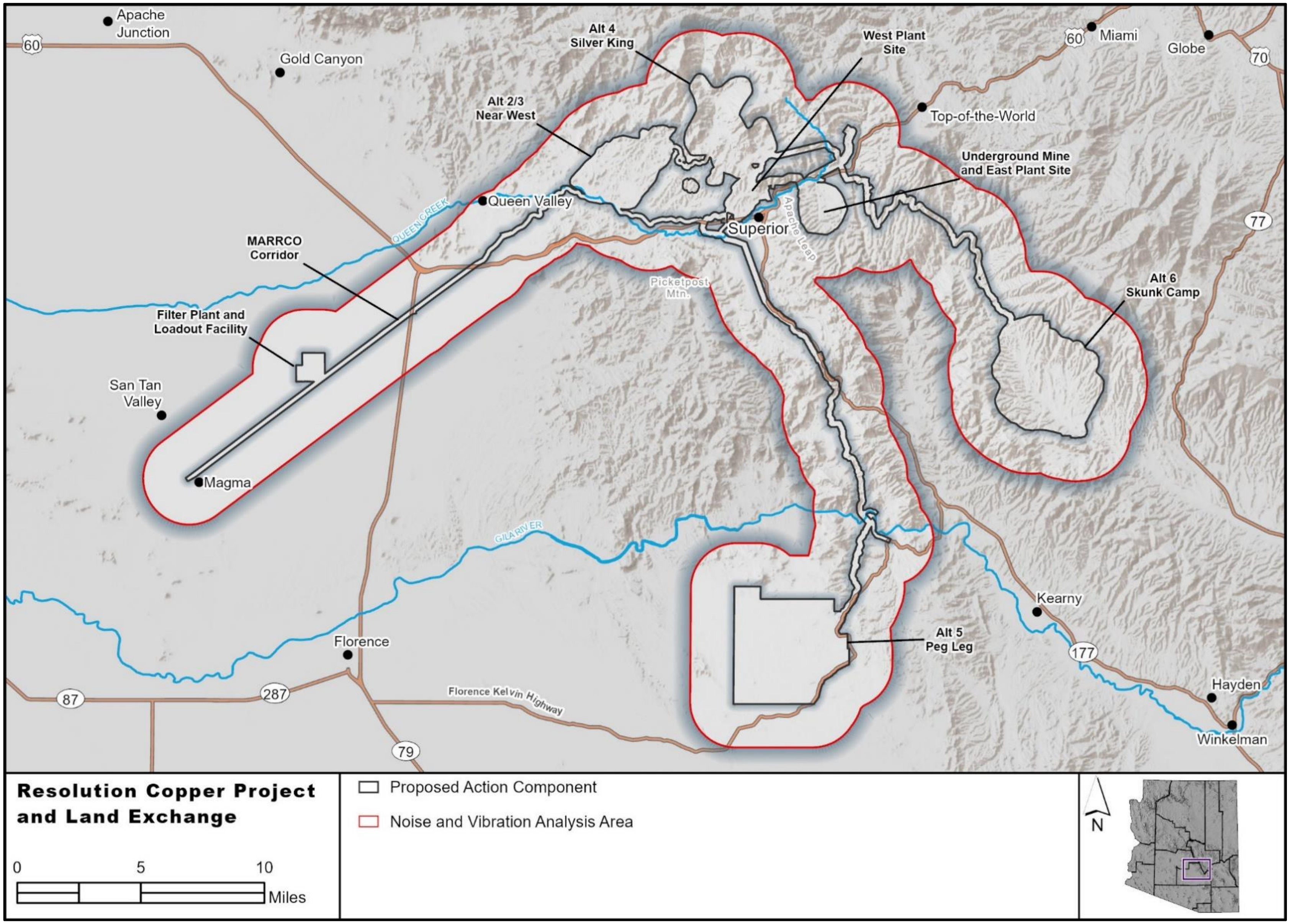


Figure 3.4.2-1. Noise and vibration analysis area

3.4.2.2 Noise Analysis Methodology

The following sections describe the analysis methodology, assumptions, and uncertainties involved in modeling noise and vibration, respectively.

Sensitive Receptors

The noise analysis focuses on noise levels at areas where there are existing or future land uses that are particularly sensitive to noise, known as "noise sensitive areas." These are as follows:

- Areas potentially affected by noise from the West Plant Site or traffic: Residences in Superior and residences along U.S. 60 and Main Street
- Areas potentially affected by noise from the East Plant Site: Oak Flat campground and Apache Leap Special Management Area
- Areas potentially affected by noise from the filter plant and loadout facility: Westernstar Road, Lind Road, Felix Road, and Attaway Road
- Areas potentially affected by noise from the Alternative 2 and 3 tailings storage facility: Hewitt Station, residences in Queen Valley, Boyce Thompson Arboretum, and Arizona National Scenic Trail (northwest of Superior)
- Areas potentially affected by noise from the Alternative 4 tailings storage facility: Arizona National Scenic Trail (northwest of Superior)
- Areas potentially affected by noise from the Alternative 5 tailings storage facility: Arizona National Scenic Trail (near Zellweger Wash)
- Areas potentially affected by noise from the Alternative 6 tailings storage facility: Dripping Springs Road and Arizona National Scenic Trail (near Kelvin)

Within each of these general areas, a specific location was selected for modeling of predicted noise impacts from the project, referred to as a "sensitive receptor." The specific location of each sensitive receptor was placed where predicted noise levels were expected to be highest for that area; these receptors are described further in section 3.4.3.

Background Noise Measurements

In order to conduct noise modeling, an understanding of background noise levels is required. Background noise levels were measured at six locations, corresponding to the noise sensitive areas described under "Sensitive Receptors." Note that background noise levels were not collected specifically for the Alternative 6 tailings storage facility but were assumed to be similar to the Alternative 5 tailings storage facility based on the general area and land use.

Background noise levels are monitored for several days or weeks in order to account for variation between day and night, and weekends and weekdays. The background noise data are then reviewed to identify any anomalies, such as fireworks, thunder, rainfall, high wind, or very close activity (like a nearby off-road vehicle). While these types of noises do occur in the analysis area, they happen infrequently or may affect the monitoring equipment more than they would a human listener. The goal of background noise measurements is to obtain a "typical" background level, while acknowledging that occasional louder noises would also occur.

- East Plant Site. Monitored June 7 through 20, 2016.
- West Plant Site. Monitored June 7 through 10, and June 22 through July 5, 2016.

- Alternative 2 and 3 tailings storage facility. Monitored June 7 through 16, and June 20 through July 5, 2016 (summer conditions), and monitored November 15 through 23, and November 28 through December 6, 2017 (winter conditions).
- Filter plant and loadout facility. Monitored June 7 through 16, and June 20 through July 5, 2016.
- Alternative 4 tailings storage facility. Monitored November 14 through 18, 2017, and January 5 through 15, 2018.
- Alternative 5 tailings storage facility (also used for Alternative 6 tailings storage facility). Monitored November 14 through December 27, 2017.

In order to check whether the background noise levels measured in the field were reasonable, they were checked against the expected noise levels based on similar types of land uses, and also checked against several previous studies conducted for the West Plant Site in 2015. These comparisons, which are described in section 3.4.4, are important because they confirm that the background noise measurements are a reasonably accurate estimate of current baseline conditions and because they also verify that background noise from these six monitoring locations can reasonably be used for all 16 sensitive receptors for which project noise levels are predicted.

Construction Phase – Blasting Noise Modeling

Construction activities include the construction of the underground tunnel to convey ore from the underground production area to the West Plant Site. The tunnel construction would use underground drilling and explosives, generating airblast noise (or more technically, peak air overpressure, which is a measure of the pressure wave generated by the blast).

The predictive model for airblast noise is based on information from the U.S. Bureau of Mines (Siskind et al. 1980) and surface mining regulations (30 CFR 816.67). The model predicts the amount of explosive that can be used, given the distance (as measured at a slant through the ground) between an underground source and a sensitive receptor, and given a desired limit on airblast noise.

Construction Phase – Non-Blasting Noise Modeling

Construction activities occur both underground and aboveground. Construction-phase noise modeling focuses on the aboveground construction of the West Plant Site, the filter plant and loadout facility, and the East Plant Site. Each of these has a focused construction period with increased noise levels that would last from 12 to 18 months.

Underground construction of tunnels and infrastructure would continue throughout the operations phase of the project, as would construction of the tailings storage facility. These construction noise impacts are therefore incorporated into the operational modeling.

To model construction noise, different types of equipment were identified that would be used at each site (i.e., dozers, graders, pickup trucks). Typical noise levels from these types of equipment have been documented by the U.S. Environmental Protection Agency (EPA) (Bolt et al. 1971) and Federal Highway Administration (Knauer et al. 2006). The assumption is made that all equipment is running simultaneously at the middle of each construction site, and the spread of sound waves is modeled, without accounting for any shielding effects from topography or structures. Specific construction assumptions include the following:

- West Plant Site. Construction activities occur over an 18-month period, and include improving the main site entrance at Lone Tree Road, improving Silver King Mine Road, and constructing a number of buildings (administration, warehouse, contractor laydown yard, concentrator site, and new substation).

- East Plant Site. Construction activities occur near Shafts 9 and 10 over a 12-month period, and include expansion of the shaft pad and construction of surface infrastructure that supports the underground operations. Shaft construction is analyzed as part of the blasting noise analysis.
- Filter plant and loadout facility. Construction activities occur over an 18-month period, and include construction of the filter plant, and improvements along the MARRCO corridor (rail line, pipelines, wells, pipeline booster station sites, and access points), and improvements along Skyline Drive.

Operations Phase – Non-Blasting Noise Modeling

Noise modeling for the operational phase identifies the quantity and type of equipment in use, the expected sound level from the equipment, and what percentage of the time it would be used. The noise modeling also takes into account noise from project road and rail traffic. In order to avoid underestimating impacts, all equipment is modeled as if it were operating simultaneously and under weather conditions favorable to sound propagation.

The modeling takes into account the combined effect of multiple noise sources, and factors that tend to attenuate sound like reflection from surfaces, screening by topography or obstacles, and terrain effects like elevation.

The noise modeling produces the following results. The metrics listed—Leq(h) and Ldn—are common noise metrics, and detailed explanations are included in Newell (2018d):

- The hourly equivalent sound level, Leq(h), at the location of each sensitive receptor
- The 24-hour day-night average sound level, Ldn, at the location of each sensitive receptor
- Noise contours showing how sound from the project propagates over the surrounding area. Noise contours graphically display how the combined project noise would be distributed over the surrounding area; they are similar to topography elevation maps. Equal noise levels are represented by continuous lines around a source.

The results shown in this section include the noise predicted from the project, the anticipated future noise range (background noise added to predicted project noise), and the incremental increase in noise over background levels.

3.4.2.3 Vibration Analysis Methodology

Construction Phase – Blasting Vibration Modeling

The construction of the underground tunnel would also generate ground-borne vibrations. The predictive model for blasting vibrations is based on information from the U.S. Bureau of Mines (Nicholls et al. 1971; Siskind et al. 1980) and surface mining regulations (30 CFR 816.67). The predictive model for blast vibrations predicts the amount of explosive that can be used, given the distance between an underground source and a sensitive receptor, and given a desired limit on vibrations.

Background vibration measurements were taken at the same locations as the background noise measurements, at approximately the same time. To provide context, the analysis compares the predicted vibrations with measured background vibrations, and also assesses real-world vibration measurements that were collected during blasting at the East Plant Site in 2018.

Construction and Operations Phase – Non-Blasting Vibration Modeling

Non-blasting vibration occurs from train movement, construction activities, stationary equipment, and other mobile equipment. Ground-borne vibrations were predicted using the type of equipment generally causing the greatest vibrations (an earthmoving truck), using estimates from the Federal Transit Administration (Quagliata et al. 2018).

3.4.3 Affected Environment

3.4.3.1 Relevant Laws, Metrics, Regulations, Policies, and Plans

No single regulatory agency or threshold is applicable to non-blasting noise generated by activities at the project sites. A full discussion of noise thresholds of significance appropriate for mining activities can be found elsewhere (Newell 2018d).

Primary Legal Authorities and Technical Guidance Relevant to the Noise and Vibration Effects Analysis

- U.S. Department of Housing and Urban Development standards
- Pinal County Excessive Noise Ordinance
- Federal Highway Administration and Arizona Department of Transportation (ADOT) standards
- Office of Surface Mining Reclamation and Enforcement
- Federal Transit Administration
- Occupational Safety and Health Administration
- Mine Safety and Health Administration

3.4.3.2 Selected Thresholds

A variety of thresholds are used to put the predicted noise and vibration modeling results in context. These thresholds are being used for the purposes of the NEPA analysis. Note that these thresholds are likely not applicable to the project in a legal or regulatory sense, and in many cases have very specific applications or specific limitations that are not included explicitly in this analysis.

Blasting Noise Thresholds (Peak Air Overpressure)

The selected threshold for airblast level is at or below 120 unweighted decibels (dB), which is based on results presented in U.S. Bureau of Mines RI 8485 (Siskind et al. 1980) and represents a reasonable maximum threshold to avoid impacts on structures and humans.

Non-Blasting Noise Thresholds

Thresholds of interest for non-blasting noise include the following:

- For the Ldn metric, the selected threshold is 65 A-weighted decibels (dBA). This is based on the U.S. Department of Housing and Urban Development’s Acceptability Standards.
- For the Leq(h) metric, the selected threshold is 55 dBA. This is based on the Pinal County Excessive Noise Ordinance for residential areas during nighttime hours.

- For the Leq(h) metric, an additional selected threshold is 66 dBA. This is based on the ADOT Noise Abatement Criteria for external noise at residential areas (activity class “B”).
- An additional threshold applied to all metrics is the incremental increase in noise over background, with a threshold of 15 dBA. This is based on the ADOT substantial noise increase criteria and was selected as an approach to avoid the possibility of baseline noise monitoring influencing results.

Blasting Vibration Thresholds

The selected threshold for ground-borne vibrations is 0.1884 inches per second, peak particle velocity (PPV in/sec.), which is below the human tolerable threshold of 0.5 PPV in/sec., and represents a worst-case threshold. The selected value is also considered reasonable because blasting activities at the mine site are proposed at significant depths, primarily resulting in low-frequency components. However, once blasting commences and vibration monitoring is conducted, if blasting is found to mostly generate frequencies above 3 hertz (i.e., corresponding to high frequency), the selected threshold could increase to 0.5 PPV in/sec.

Non-Blasting-Vibration Thresholds

The selected threshold is at or below 0.04 PPV in/sec. (80 vibration decibels (VdB)), which is based upon results presented in Federal Transit Administration 2018 guidelines (Quagliata et al. 2018).

3.4.3.3 Existing Conditions and Ongoing Trends

The information presented in the following subsections are presented in more detail in the report titled “Sound and Vibration Analysis Report” (Tetra Tech Inc. 2019) and the memorandum titled “Blasting Monitoring Review Memorandum” (Rodrigues 2018).

Land Use and Sensitive Receptor Identification

Land uses within 2 miles of each mine component (i.e., West Plant Site, East Plant Site, filter plant and loadout facility, MARRCO corridor, tailings storage facility alternatives) were grouped and categorized into three main land uses: (1) residential, (2) commercial, and (3) recreation/conservation. Sensitive receptors were then identified and are shown in figure 3.4.3-1.

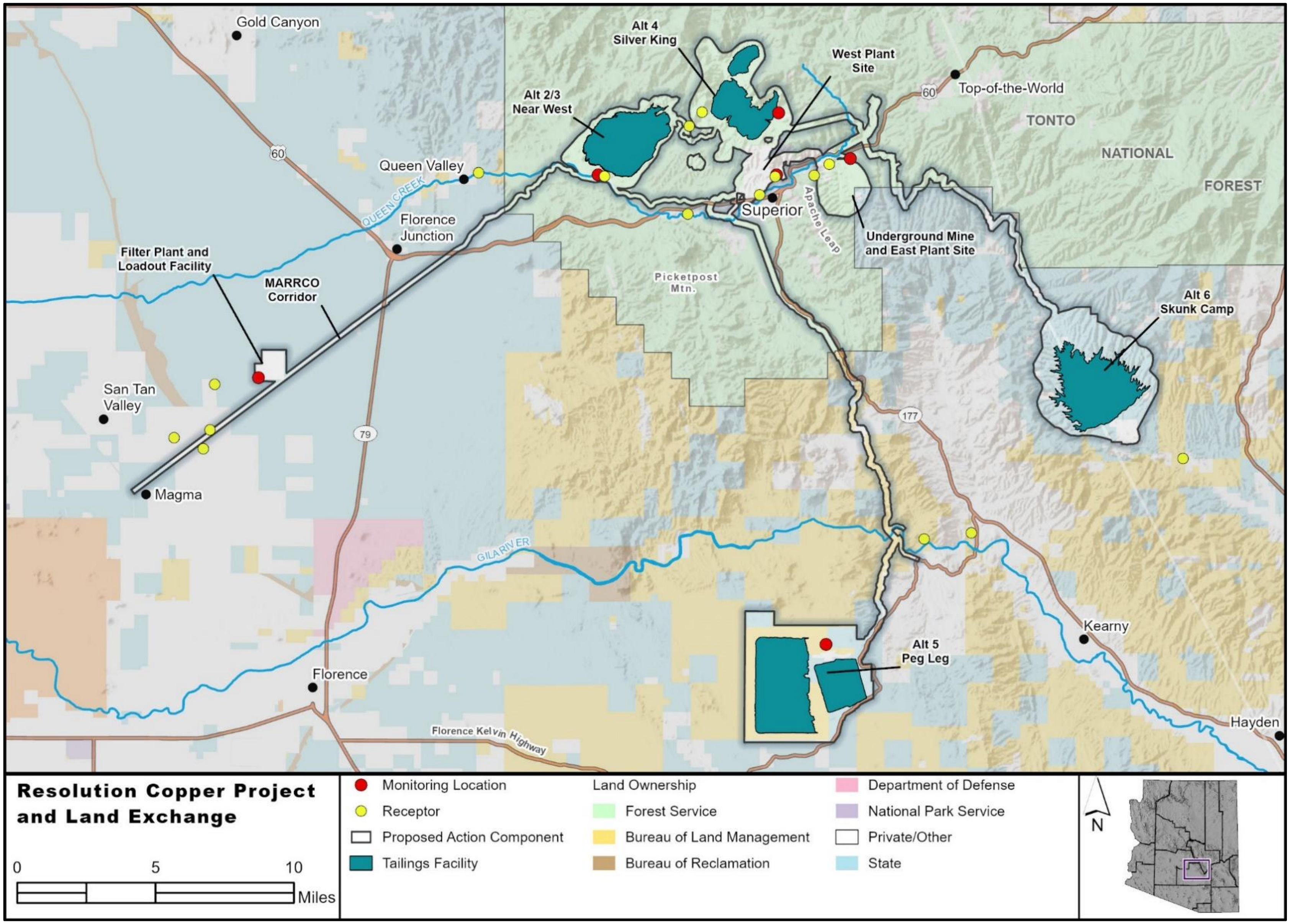


Figure 3.4.3-1. Land use, sensitive areas/receptors identification, and measurement locations

Background Measurement Locations and Descriptions

Background noise and vibration measurements were conducted during two periods, representing the acoustical environment during the spring/summer months (i.e., fewer residents and less outdoor recreation) and fall/winter months (i.e., more residents and more outdoor recreation). The following briefly describes the measurement locations:

- East Plant Site measurement: placed near the edge of the East Plant Site, approximately 650 feet from the existing Shaft 10 and 0.8 mile from the Oak Flat campground and U.S. 60 route. Nearby land uses include recreation/conservation uses and two sensitive receptors (Oak Flat campground and the Apache Leap Special Management Area). Noise anomalies removed from the data set included rainfall, thunder, and operation of the existing East Plant Site. These were removed because the East Plant Site noise expected to occur during operations is part of the predicted modeling, not part of the background.
- West Plant Site measurement: placed near the West Plant Site facility property line and adjacent to the town of Superior (incorporated county land), where the nearest residential property line is approximately 260 feet to the south. Land uses within a 2-mile radius include residential, commercial, and recreation/conservation use. Nearby land use represented at this location is residential and includes one sensitive receptor (residences in the town of Superior). Noise anomalies removed from the data set included rainfall, thunder, fireworks, and operation of the existing West Plant Site. These were removed because the West Plant Site noise expected to occur during operations is part of the predicted modeling, not part of the background.
- Near West tailings storage facility measurement: placed on private land, a residential property at 32898 Hewitt Station Road, within the Tonto National Forest, approximately 1,000 feet from the edge of the proposed Near West tailings storage facility. To avoid data contamination from residential activities, the monitoring location was 550 feet from the residence. Nearby land uses include residential and recreation/conservation uses and four sensitive receptors (Hewitt Station, the section of the Arizona National Scenic Trail near the Near West tailings storage facility, residences in Queen Valley, and Boyce Thompson Arboretum). Noise anomalies removed from the data set included rainfall, thunder, and limited activities of all-terrain vehicles (ATVs) during the summer months and excessive wind, noise from the ranch, rainfall, and ATVs during the winter months.
- Filter plant and loadout facility measurement: placed at the proposed facility location, where the nearest residential property line is approximately 1.6 miles to the west along Skyline Drive. Nearby land uses include residential near Westernstar Road, Lind Road, Felix Road, and Attaway Road. Noise anomalies removed from the data set included rainfall and thunder. Because this location is isolated from any significant noise source, there were no identified primary noise sources.
- Silver King tailings storage facility measurement: placed at the proposed facility location. Nearby land uses include residential and recreation/conservation uses and one sensitive receptor (a section of the Arizona National Scenic Trail located 2 miles to the west). Noise anomalies removed from the data set included excessive wind and light rainfall. Because this location is isolated from any significant noise source, there were no identified primary noise sources.
- Peg Leg tailings storage facility measurement: placed at the proposed facility location. Nearby land uses include recreation/conservation uses and one sensitive receptor (a section of the Arizona National Scenic Trail located 2.4 miles to the east). Noise anomalies removed from the data set included excessive wind. Although this location was near a substation, the monitor placement was far enough from the substation to avoid data contamination. Because this location is isolated from any significant noise source, there were no identified primary noise sources. This

location also serves as the source of background noise for Alternative 6, given the similar rural setting. Future background noise measurements may be collected at Alternative 6 if differences are identified in background noise levels.

Interpretation of Background "Ambient" Noise Measurements

Noise levels within the analysis area showed relatively low levels and exhibited typical diurnal patterns. The predominant sources in the measured adjusted noise levels (i.e., after removal of identified anomalies) at each of the measurement locations were (1) for the East Plant Site: wildlife and vehicle traffic from Magma Mine Road and U.S. 60, (2) for the West Plant Site: wildlife and community sources from the town of Superior, (3) for the Near West tailings storage facility: operations from nearby ranches, light vehicle traffic on local roadways, and wildlife, (4) for the filter plant and loadout facility: wildlife and aircraft overflights, (5) for the Silver King tailings storage facility: wildlife and light traffic from campers, and (6) for the Peg Leg tailings storage facility: wildlife and aircraft overflights.

In general, the measured adjusted noise levels were within the expected ranges for the given land use, except for the East Plant Site measurement location, where measured levels were approximately 5 to 10 decibels (dB) higher than expected ranges. However, the higher measured data (i.e., 5–10 dB) is reasonable because the expected range assumes an isolated location and does not consider any influence from the nearby U.S. 60 route. Table 3.4.3-1 summarizes the project sites and associated sensitive receptors, land uses, and expected and measured noise level ranges.

Interpretation of West Plant Site Previous Study Noise Measurements

ARCADIS Inc. conducted two noise studies along the West Plant Site property line adjacent to the town of Superior. The first study, "West Plant Noise Monitoring Study" (ARCADIS U.S. Inc. 2015b), included three measurement locations and collected noise data from May 7 through 15, 2015. Of the three locations, one was placed similar to the West Plant Site measurement location discussed earlier in this section and shown in figure 3.4.3-1. The study found that noise levels at this location ranged from 39 to 65 dBA, Leq(h); however, 65 dBA was noted as an anomaly where noise levels typically ranged between 40 to 50 dBA Leq(h).

The second study, titled "Lower Smelter Pond Noise Monitoring Report Superior, Arizona" (ARCADIS U.S. Inc. 2015a), included four measurement locations and collected noise data from August 18 to September 17, 2015. Three measurement locations were along the West Plant Site southern property line and one was within the residential area near the lower smelter pond. The study found that noise levels at these locations were as high as 75 to 80 dBA, Leq(h) during sludge removal activities, but noise levels typically ranged from 31 to 50 dBA Leq(h).

Noise levels from ARCADIS Inc. studies further confirm that the background noise levels at the West Plant site (39–47 dBA daytime, 33–47 dBA nighttime) are reasonably accurate and representative of adjacent residences in the town of Superior.

Table 3.4.3-1. Background measured noise levels and expected ranges for sensitive receptors based on land use

Project Site	Sensitive Receptors	Land Use Type	Data Source	Sound Level (dBA)		
				Ldn	Daytime Leq(h)	Nighttime Leq(h)
West Plant Site	***Noise Measurement Location***		***Measured***	***43–53***	***39–47***	***33–47***
	Residences in Superior	Residential and Commercial	Expected	48–54	48–54	38–44
	Residences between U.S. 60 and Main Street	Residential and Commercial	Expected	48–54	48–54	38–44
East Plant Site	***Noise Measurement Location***		***Measured***	***52–54***	***45–50***	***45–48***
	Oak Flat campground	Recreation/Conservation	Expected	41–44	41–45	31–33
	Apache Leap Special Management Area	Residential/Recreation/Conservation	Expected	41– 54	41–54	31–44
Near West tailings storage facility	***Noise Measurement Location***		***Measured***	***40–46***	***36–43***	***32–39***
	Hewitt Station	Residential	Expected	35–45	35–45	31–33
	Queen Valley	Residential	Expected	36–42	36–42	26–32
	Boyce Thompson Arboretum	Recreation/Conservation	Expected	41–44	41–45	31–33
	Arizona National Scenic Trail (northwest of Superior)	Recreation/Conservation	Expected	33–35	32–37	25–30
Filter plant and loadout facility	***Noise Measurement Location***		***Measured***	***38–48***	***38–45***	***27–41***
	Westernstar Road	Residential	Expected	36–45	35–45	28–35
	Lind Road	Residential	Expected	36–45	35–45	28–35
	Felix Road	Residential	Expected	36–45	35–45	28–35
	Attaway Road	Residential	Expected	36–45	35–45	28–35
Silver King tailings storage facility	***Noise Measurement Location***		***Measured***	***35–46***	***31–41***	***27–39***
	Arizona National Scenic Trail (northwest of Superior)	Recreation/Conservation	Expected	33–35	32–37	25–30
Peg Leg tailings storage facility (measured) and Skunk Camp tailings storage facility (assumed)	***Noise Measurement Location***		***Measured***	***34–52***	***30–51***	***26–46***
	Arizona National Scenic Trail (near Zellweger Wash)	Recreation/Conservation	Expected	33–35	32–37	25–30

Note: Noise measurements were collected as described below:

West Plant Site: June 7–10, 2016, and June 22–July 5, 2016

East Plant Site: June 7–20, 2016

Near West tailings storage facility: June 7–16, 2016, June 20–July 5, 2016, November 15–23, 2017, and November 28–December 6, 2017

Filter plant and loadout facility: June 7–16, 2016, and June 20–July 5, 2016

Silver King tailings storage facility: November 14–18, 2017, and January 5–15, 2018

Peg Leg tailings storage facility: November 14–December 27, 2017

Interpretation of Project Area Background "Ambient" Vibration Measurements

The vibration levels at the measurement location were at levels that could be perceived by humans (table 3.4.3-2), but considerably below the U.S. Bureau of Mines RI 8507 threshold of 0.5 PPV in/sec., which is tolerable by 95 percent of humans for an event occurring in a 1-second duration. Based on the maximum values, vibration levels recorded were highest at the West Plant Site—0.07 PPV in/sec. (85 VdB)—which exceeds the Federal Transit Administration's threshold for residential annoyance of 0.04 PPV in/sec. (80 VdB). Average values for vibration levels did not exceed any thresholds of interest.

Table 3.4.3-2. Background vibration measurement summary

Project Site	Measurement Period	Average PPV, in/sec.	Maximum PPV, in/sec.	Maximum VdB
West Plant Site	June 7–July 5, 2016	0.0034	0.0723	85
East Plant Site	June 7–July 5, 2016	0.0031	0.013	70
Near West tailings storage facility	June 7–July 5, 2016	0.0035	0.0164	72
Filter plant and loadout facility	June 7–July 5, 2016	0.0077	0.0186	73
Silver King tailings storage facility	November 15–December 12, 2017	0.0033	0.0048	62
Peg Leg tailings storage facility	November 15–December 12, 2017	0.0057	0.0175	73

Notes:

VdB = calculated vibration decibel using a vibration reference of 10^{-6} in/sec. and a crest factor of 4 (i.e., representing a difference of 12 VdB).

Shaded cells indicate an exceedance of a selected threshold (0.04 PPV in/sec., or 80 VdB) by background measurements.

Interpretation of East Plant Site Additional Noise and Vibration Measurements

In January 2018, blasting activities commenced at the East Plant Site 4,000 level (i.e., 4,000 feet below surface) and occurred periodically between January 30 and March 19, 2018. Blasting time histories indicate that 29 blasting activities took place during this period, during both daytime and nighttime hours. Noise and vibration data from blasting events were continuously monitored and recorded. Each event incorporated an average loading of 225 pounds of explosives distributed in a patterned hole system consisting of approximately 50 to 60 holes. The blasting monitoring data show that vibration levels from blasting activities were not distinguishable from background ground-vibration levels.

To determine whether the blasting events influenced background noise levels, the noise data set from January/March 2018 (which included blasting events) was compared with the noise data set from June 2016 (which did not include any blasting events and was used to establish the background acoustic environment). Table 3.4.3-3 presents a summary of noise monitoring data collected during the 2016 and 2018 periods.

The two data sets are comparable overall for most metrics. The 2018 noise data exhibited a wider range, with the minimum values generally lower than the 2016 background measurements, and the maximum values generally higher than the 2016 background measurements. The L10 (noise level exceeded 10 percent of the time) and Lmax (maximum sound level) metrics are both widely used to describe noise from intermittent or individual events, though very short individual events (like blasting) are unlikely to show up in the L10 values. The 2018 daytime L10 and Lmax metrics had a wide range but were overall higher than the 2016 background noise measurements, suggesting blasting noise may have been detected. However, a direct comparison of noise levels (collected every second) immediately before, during, and after each blasting event does not show any clear effects (Ituarte-Villarreal 2020; Tetra Tech Inc. 2019).

Table 3.4.3-3. East Plant Site noise data comparison (with blasting and no-blasting activities)

Noise Level Ranges for Each Measurement Period								
Ldn, dBA	Daytime Leq(h), dBA				Nighttime Leq(h), dBA			
	Leq	L10	L90	Lmax	Leq	L10	L90	Lmax
Measurement Period (June 7–20, 2016)								
51.9–54.2	45.2–49.7	47.5–52.2	43.7–46.8	52.1–60.3	45.3–47.7	47.6–50.1	44.3–46.4	49.9–57.9
Measurement Period (January 30–March 19, 2018)								
48.5–58.5	44.1–55.4	48.7–62.3	41.6–53.3	52.5–65.9	41.5–51.2	46.3–56.6	40.3–49.8	48.6–62.8

Notes:

Ldn = Day-night average noise level, a 24-hour average with annoyance penalty of 10 dBA for nighttime noise levels.

Daytime Leq(h) = Equivalent sound level for period between 7:00 a.m. and 10:00 p.m.

Nighttime Leq(h) = Equivalent sound level for period between 10:00 p.m. and 7:00 a.m.

L10 = sound level was exceeded 10 percent of the time (overall monitoring period).

L90 = sound level was exceeded 90 percent of the time (overall monitoring period).

Lmax = Maximum sound level recorded during the measurement period.

Shaded cells indicate an exceedance of a selected threshold (55 dBA for Leq or 65 dBA for Ldn) by background measurements.

Representativeness of Baseline Noise Monitoring

Public comments on the DEIS raised several concerns on the representativeness of the selected baseline monitoring data: whether the time frame captured anticipated daily, weekly, or seasonal variation; and whether any ongoing activities or other disturbances (such as airplane noise) skewed the data. For the latter, the specific concern is that skewing the baseline noise levels higher would tend to minimize the noise impact caused by the mine.

Previous sections described the methodology used for the EIS and directly address these two concerns. We accounted for daily and weekly variation in the duration and frequency of the monitoring which, in general, continually took place at 5-minute intervals for a period of no less than 4 weeks. This accounts for daily variation and weekday/weekend variation. Seasonal variation is accounted for by conducting two separate monitoring periods: one in the spring/summer, and one in winter.

Noise monitoring methodologies generally call for review of raw data and removal of any anomalous high measurements. We used this protocol to process the monitoring data prior to use.

As a cross-check, we assessed baseline noise measurements against expected background noise levels for different land uses and found them to be similar (see table 3.4.3-1). The following section describes our method for evaluating noise impacts, effectively preventing background measurements from skewing modeled results. We assessed results for the total modeled noise (background noise plus predicted mine noise), and for the incremental increase over background levels. Even if background noise levels were misinterpreted, the incremental noise impact would identify significant increases.

3.4.4 Environmental Consequences of Implementation of the Proposed Mine Plan and Alternatives

Direct impacts from noise and vibration during construction and operational phases have been modeled for the project (AMEC Foster Wheeler Environment and Infrastructure 2017; Rodrigues 2018; Tetra Tech Inc. 2019).

3.4.4.1 Alternative 1 – No Action

As detected in the 2016 background noise measurements, certain noise-producing activities are currently taking place on Resolution Copper private property at the West Plant Site and East Plant Site. Under the no action alternative, these activities would continue. Noise and vibration levels do not rise above any selected thresholds under background conditions.

3.4.4.2 Impacts Common to All Action Alternatives

Effects of Land Exchange

The selected Oak Flat Federal Parcel would leave Forest Service jurisdiction. The role of the Tonto National Forest under its primary authorities in the Organic Administration Act, Locatable Regulations (36 CFR 228 Subpart A), and Multiple-Use Mining Act is to ensure that mining activities minimize adverse environmental effects on National Forest System surface resources; this includes effects on the natural setting from noise that could occur on the Oak Flat Federal Parcel. The Oak Flat Federal Parcel would become private at the completion of the NEPA process, and the Forest Service would not have the ability to require mitigation for effects from noise on the lands; however, no adverse noise effects were identified to occur from the East Plant Site operations.

The offered parcels would come under Federal jurisdiction. Specific management of the natural setting of those parcels would be determined by the agencies to meet desired conditions or support appropriate land uses and would include noise considerations.

Effects of Forest Plan Amendment

No components of the 2023 forest plan directly relate to noise and vibration that require amendment.

Effects of Compensatory Mitigation Parcels

It is anticipated that restoration and earthwork activities associated with the three compensatory mitigation sites would be short term in duration and intensity. Impacts would be similar to typical site construction noise-generating activities to include the use of handheld, gas-operated equipment, and earthmoving equipment such as backhoe loaders and excavators. We anticipate minor impacts associated with mitigation site activities and they would not adversely affect potential noise receptors in the vicinity of the sites.

Effects of Recreation Mitigation Lands

The recreation mitigation lands are anticipated to result in noise impacts related to off-highway vehicle (OHV) use. Noise impacts associated with recreational use on new trail networks are anticipated to be similar to current noise levels associated with motorized and non-motorized use on existing trails and routes within the area. No noise impacts beyond current levels are anticipated for the existing roads and trails.

Effects of Block Caving Noise

Public comments suggested that the underground block caving process might have related noise and vibration effects. Literature and available studies to support potential noise and vibration impacts associated with block caving are limited. However, noise and vibration resulting from underground activities at the mine site were analyzed. Findings associated with on-site monitoring of blasting activities at the East Plant Site were applied to block caving in "Interpretation of East Plant Site Additional Noise and Vibration Measurements" in section 3.4.3.3. Blasting would be more noticeable than the slow collapse of rock through draw points, as it is more energetic and focused. Based on field measurements, vibration levels from blasting activities associated with block caving should not be distinguishable from background ground-vibration levels. Blasting noise associated with block caving may be detectible; noise levels are anticipated to be minor and not adversely affect potential noise receptors.

Summary of Applicant-Committed Environmental Protection Measures

A number of environmental protection measures are incorporated into the design of the project that would act to reduce potential impacts on noise and vibration. These are non-discretionary measures and their effects are accounted for in the analysis of environmental consequences.

The GPO (2016c) outlined applicant-committed environmental protection measures by Resolution Copper in the "Environmental Protection Elements" section.

- Mining activities, primary crushing and conveying, will take place underground, and exhaust fans will be equipped with silencers for noise reduction. Milling will take place within a fully enclosed building.

3.4.4.3 Alternatives 2 and 3 – Near West – Modified Proposed Action

Construction Phase – Blasting Noise and Vibration Impacts

In order to analyze ground-borne vibrations associated with construction of the underground tunnel, 10 structures in the town of Superior were selected as representative samples based on the shortest slant distance to the tunnel. Sections of the tunnel would also run along the Apache Leap SMA sensitive receptor, where the shortest slant distance is approximately 1,536 feet (near the westerly side) and 3,506 feet (near the easterly side) (figure 3.4.4-1).

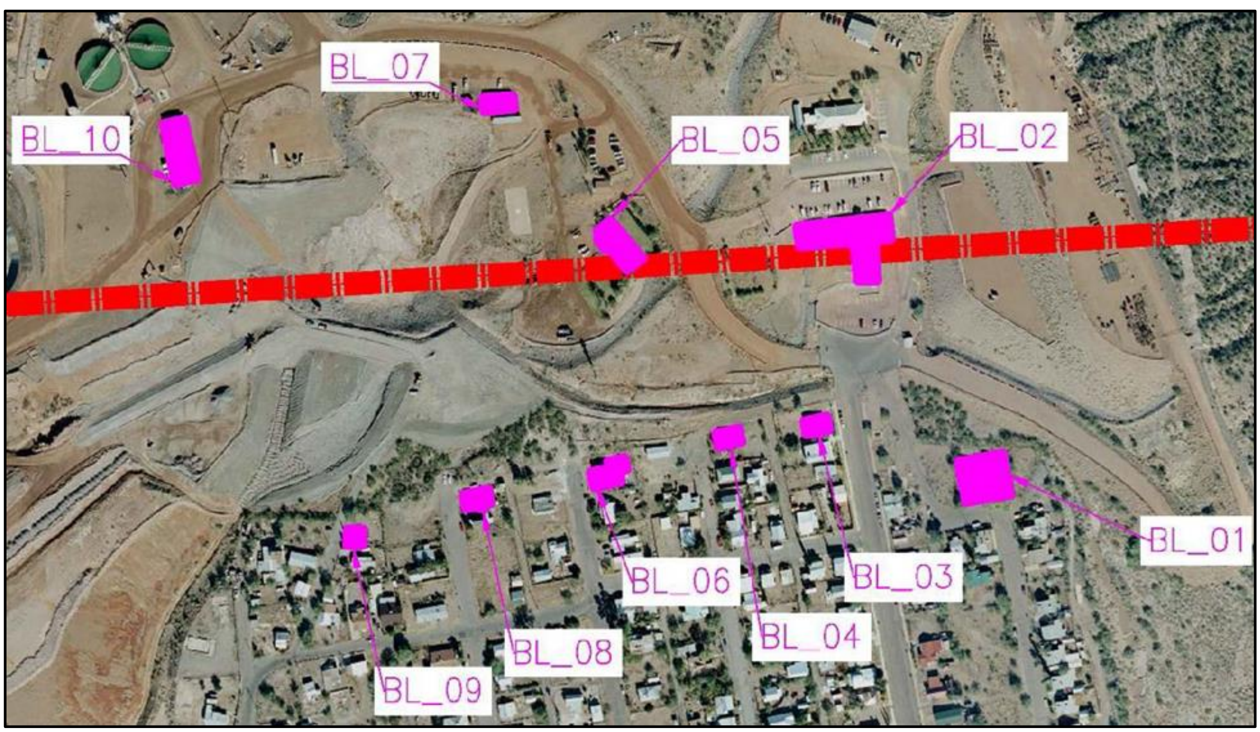


Figure 3.4.4-1. Locations of buildings analyzed for selected vibration threshold near West Plant Site and underground tunnel

The explosive load per delay presented in table 3.4.4-1 are calculated based on the selected vibration threshold, sensitive receptor locations, tunnel alignment, and profile data. At the nearest sensitive receptor (BL_5), located on the West Plant Site facility property, the blast loading should be kept below 9 kilograms TNT equivalent (kg TNTe) per delay. Impacts on the Apache Leap SMA could also be limited by keeping the blast loading below 37 kg TNTe/delay.

Table 3.4.4-1. Calculated explosive loading at sensitive receptor samples based on selected vibration threshold

Sensitive Receptor	Slant Distance (feet)	Allowable Explosive Load per Delay (kg TNTe)
BL_1	1,235	24
BL_2 (*located on West Plant Site facility property*)	864	12
BL_3	1,114	19
BL_4	1,061	18
BL_5 (*located on West Plant Site facility property*)	758	9
BL_6	1,101	19
BL_7 (*located on West Plant Site facility property*)	1,023	16
BL_8	1,135	20
BL_9	1,210	23
BL_10 (*located on West Plant Site facility property*)	775	9
Apache Leap SMA	1,535	37

Note: Calculated allowable explosive load per delay is based on 0.1884 PPV in/sec. vibration threshold.

Airblast impacts could be more notable near the vent raise and portal openings; analysis for these areas is shown in table 3.4.4-2. The vent raise location is approximately 1,600 feet and the portal opening is approximately 2,792 feet from the closest sensitive receptor (identified as BL_10). The vent raise location is also approximately 5,981 feet from the westerly side of the Apache Leap SMA boundary. Blasting loading should be kept below 35 kg TNTe at the vent raise and 120 kg TNTe at the portal opening.

Table 3.4.4-2. Calculated explosive loading at sensitive receptor samples based on airblast selected threshold

Source Location	Sensitive Receptor	Slant Distance (feet)	Allowable Explosive Load per Delay (kg TNTe)	Estimated Results	
				Airblast Level, dB	PPV in/sec.
Vent raise	BL_10	1,600	35	118	0.170
	Apache Leap SMA	5,981	380	114	0.157
Portal opening	BL_10	2,792	120	118	0.186

The exact blasting plan for the tunnel would depend on conditions encountered during construction and has not yet been developed; explosive loads kept under these limits are not anticipated to result in adverse impacts from vibration.

Construction Phase – Non-Blasting Noise Impacts

Table 3.4.4-4, later in this section, shows noise level estimates from the construction of the operational facilities would range from 89 dBA at 50 feet to 63 dBA at 1,000 feet. Construction activities would occur for 10 hours during daytime weekday shifts. The most appropriate noise threshold for daytime activities is the Leq(h) of 66 dBA, based on ADOT residential criteria. Past 1,000 feet, noise levels do not exceed this threshold. The overall levels should be lower, because (as discussed in section 3.4.2) these estimates exclude attenuation factors and trend toward quieter construction equipment since the source data were developed. Beyond 1,000 feet, construction noise is not anticipated to result in adverse impacts.

Operations Phase – Non-Blasting Noise Impacts

Table 3.4.4-5, later in this section, shows that noise impacts in Leq(h) metric are not expected to occur based on the predicted minimum and average noise level ranges, whether looking at overall combined noise levels (project noise plus background noise), or the incremental noise increase over background levels.

If the maximum of each range is used, incremental increases are at or above the selected threshold of 15 dBA at following sensitive receptors:

- Residential receptors near U.S. 60 and Main Street.
- Recreational users within Apache Leap SMA.
- Recreational users of nearby section of the Arizona National Scenic Trail.

Residential receptors near U.S. 60 and Main Street would also experience future levels (project noise plus background noise) above 55 dBA (Pinal County nighttime noise threshold limit), but below 66 dBA (ADOT's modified Noise Abatement Criteria "B" for residential uses). Because residential receptors near U.S. 60 and Main Street are within incorporated lands in the town of Superior, ADOT's modified Noise Abatement Criteria would be more applicable.

Table 3.4.4-6, later in this section, shows that predicted future noise levels in Ldn metric would comply with the selected threshold of 65 Ldn. Nearby sections of the Arizona National Scenic Trail would experience increases in noise above the incremental threshold of 15 dBA, but only under maximum conditions. The maximum condition assumes all equipment operating simultaneously during the quietest period; this would be an infrequent and unlikely occurrence. Figures 3.4.4-2 and 3.4.4-3 show the predicted noise contours propagation over the surrounding area of the mine site associated with Alternatives 2 and 3.

Operations Phase – Non-Blasting Vibration Impacts

Table 3.4.4-3 shows that ground-borne vibration PPV in/sec. are not expected to exceed the selected threshold of 0.04 PPV in/sec. (80 VdB) at 50 feet or more from the source. The calculated vibration levels in 25-foot increments from the source show 0.0315 PPV in/sec. (78 VdB) at 50 feet, which is less than the selected threshold.

Beyond 50 feet, vibration during operations is not anticipated to result in adverse impacts.

Table 3.4.4-3. Predicted non-blasting vibration impacts during operations, Alternatives 2 and 3

Feet from Source	Calculated Non-Blasting Vibration Levels	
	PPV in/sec.	VdB
25	0.0890	87
50	0.0315	78
75	0.0171	73
100	0.0111	69
125	0.0080	66
150	0.0061	64
175	0.0048	62
200	0.0039	60
225	0.0033	58
250	0.0028	57
275	0.0024	56
300	0.0021	55

Note: Shaded cells indicate an exceedance of selected threshold of 0.04 PPV in/sec. (80 VdB).

Table 3.4.4-4. Estimated noise levels from construction activities

Sound Source	Quantity			Utilization Factor	dBA Leq(h)*				
	West Plant Site	East Plant Site	Filter Plant and Loadout Facility	%	50	100	250	500	1,000
Dozer	6	5	1	40	81	75	67	61	55
Grader	3	3	1	40	81	75	67	61	55
Compactor	2	2	1	20	73	67	59	53	47
Scraper	3	3	1	40	81	75	67	61	55
Water truck	2	1	1	40	80	74	66	60	54
Fuel/lube truck	1	1	1	40	80	74	66	60	54
Excavator	2	2	1	40	81	75	67	61	55
Loader	1	1	0	40	86	70	62	56	50
Haul truck	1	1	0	40	80	74	66	60	54
Pickup truck	3	3	0	40	51	45	37	31	25
Combined Noise Levels					**89**	**83**	**75**	**69**	**63**

Source: Tetra Tech (2018)

Note: Shaded cells indicate an exceedance of selected threshold of 66 dBA for Leq(h).

* Calculations assume only one sound source is in operation.

Table 3.4.4-5. Predicted noise impacts during operations, Alternatives 2 and 3, Leq(h) metric

Project Site	Sensitive Receptors	Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase over Background Levels		
			Min	Avg	Max	Min	Avg	Max
West Plant Site	***Noise Measurement Location****	***47***	***47***	***49***	***50***	***3***	***5***	***14***
	Residences in Superior	47	47	49	50	3	5	14
	Residences U.S. 60 and Main Street†	53	53	55	57	3	4	15
East Plant Site	***Noise Measurement Location****	***61***	***61***	***61***	***61***	***11***	***12***	***16***
	Oak Flat campground‡	43	43	49	51	1	1	12
	Apache Leap SMA‡	46	46	50	51	1	2	15
Near West tailings storage facility	***Noise Measurement Location****	***43***	***43***	***45***	***46***	***3***	***4***	***11***
	Hewitt Station	44	44	46	47	4	5	12
	Residences in Queen Valley‡	<10	26	40	43	<1	<1	<1
	Boyce Thompson Arboretum	24	33	41	43	<1	<1	1
	Arizona National Scenic Trail (northwest of Superior)‡	51	51	51	52	9	11	26
Filter plant and loadout facility/ MARRCO corridor	***Noise Measurement Location****	***47***	***47***	***48***	***49***	***4***	***6***	***20***
	Westernstar Road	<10	27	42	45	<1	<1	<1
	Lind Road	32	33	43	45	<1	<1	6
	Felix Road	26	30	42	45	<1	<1	3
	Attaway Road	13	27	42	45	<1	<1	<1

Note: Shaded cells indicate an exceedance at a sensitive receptor (not noise measurement locations) of selected threshold of 55 dBA for Leq(h) for project plus background levels, and 15 dBA for increase over background levels.

Min = Minimum, Avg = Average, Max = Maximum

* Prediction location is not a sensitive receptor and included for comparison to the existing measured noise levels (see table 3.4.3-1).

† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).

‡ The expected lower level was applied to be conservative (see table 3.4.3-1).

Table 3.4.4-6. Predicted noise impacts during operations, Alternatives 2 and 3, Ldn metric

Project Site	Sensitive Receptors	Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase over Background Levels		
			Min	Avg	Max	Min	Avg	Max
West Plant Site	***Noise Measurement Location****	***54***	***54***	***56***	***57***	***4***	***5***	***11***
	Residences in Superior	54	54	56	57	4	5	11
	Residences U.S. 60 and Main Street†	59	59	60	60	6	7	11
East Plant Site	***Noise Measurement Location****	***67***	***67***	***67***	***67***	***13***	***16***	***26***
	Oak Flat campground‡	50	51	54	55	1	2	10
	Apache Leap SMA‡	52	55	56	56	2	2	4
Near West tailings storage facility	***Noise Measurement Location****	***48***	***49***	***50***	***50***	***4***	***5***	***9***
	Hewitt Station	50	50	51	51	5	6	10
	Residences in Queen Valley‡	<10	36	44	46	<1	<1	<1
	Boyce Thompson Arboretum	31	41	45	46	<1	<1	1
	Arizona National Scenic Trail (northwest of Superior)‡	58	58	58	58	12	15	25
Filter plant and loadout facility/ MARRCO corridor	***Noise Measurement Location****	***53***	***53***	***54***	***54***	***6***	***8***	***15***
	Westernstar Road	<10	38	46	48	<1	<1	<1
	Lind Road	30	39	46	48	<1	<1	1
	Felix Road	24	38	46	48	<1	<1	<1
	Attaway Road	11	38	46	48	<1	<1	<1

Note: Shaded cells indicate an exceedance at a sensitive receptor (not noise measurement locations) of selected threshold of 65 dBA for Ldn for project plus background levels, and 15 dBA for increase over background levels.

Min = Minimum, Avg = Average, Max = Maximum

* Prediction location is not a sensitive receptor and included for comparison to the existing measured noise levels (see table 3.4.3-1).

† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).

‡ The expected lower level was applied to be conservative (see table 3.4.3-1).

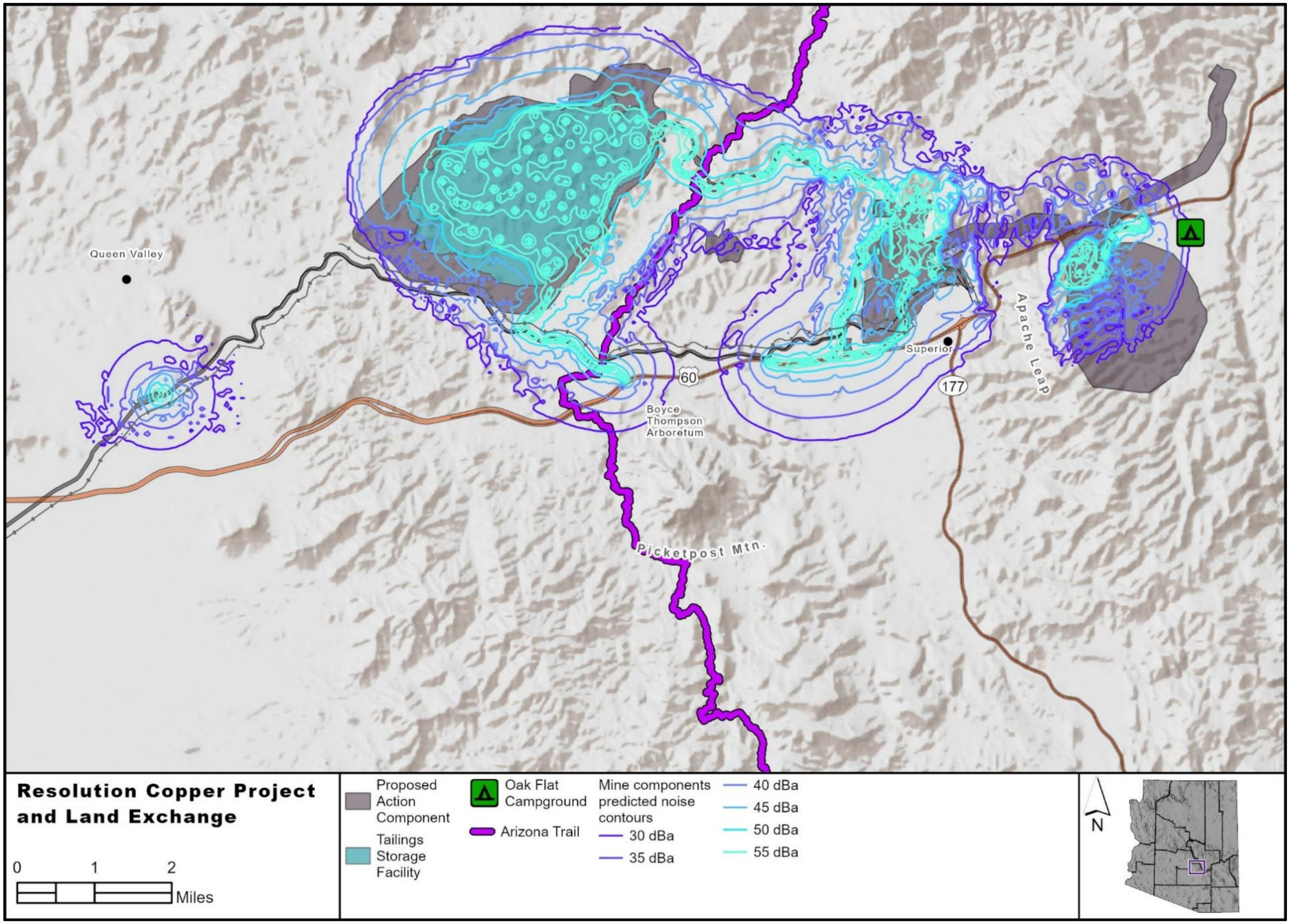


Figure 3.4.4-2. Predicted noise contours associated with Alternatives 2 and 3 (1 of 2)

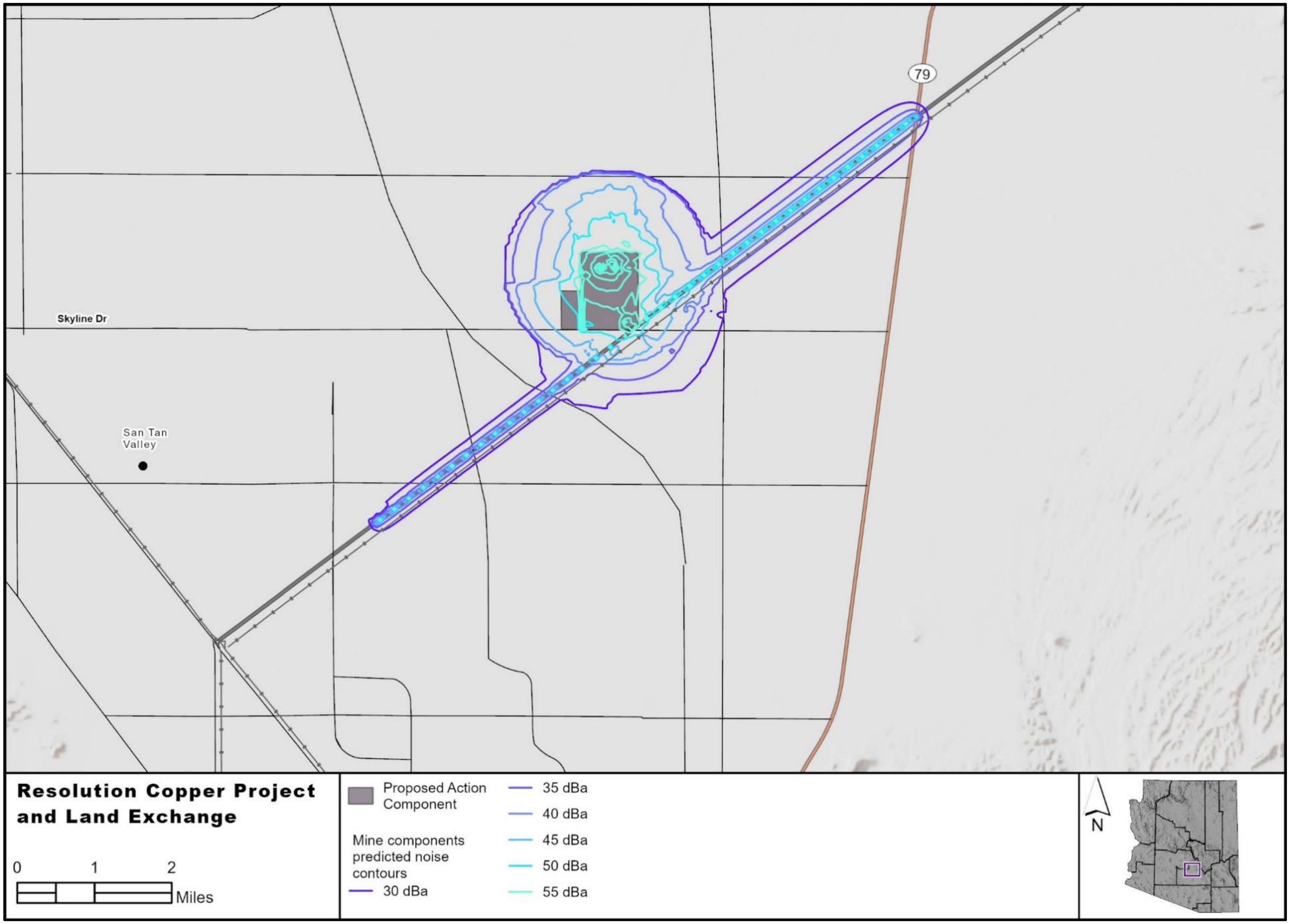


Figure 3.4.4-3. Predicted noise contours associated with Alternatives 2 and 3 (2 of 2)

3.4.4.4 Alternative 4 – Silver King

Alternative 4 would have identical impacts as Alternatives 2 and 3 for construction blasting noise, construction blasting vibration, construction non-blasting noise, and operations non-blasting vibration. Only operational noise impacts would differ and are described here.

Similar to Alternatives 2 and 3, table 3.4.4-7 shows that noise impacts in Leq(h) metric are not expected to occur based on the predicted minimum and average noise level (whether looking at overall combined noise levels (project noise plus background noise), or the incremental noise increase over background levels). If the maximum of each range is used, incremental increases are at or above the selected threshold of 15 dBA at the following receptors:

- Residential receptors near U.S. 60 and Main Street.
- Recreational users within Apache Leap SMA.

The maximum condition assumes all equipment operating simultaneously during the quietest period; this would be an infrequent and unlikely occurrence.

Residential receptors near U.S. 60 and Main Street would also experience future levels above 55 dBA, but below 66 dBA, based on maximum values. Table 3.4.4-8 shows that predicted future noise levels in Ldn metric would comply with all the selected thresholds. Figure 3.4.4-4 shows the predicted noise contours for Alternative 4.

Table 3.4.4-7. Predicted noise impacts during operations, Alternative 4, Leq(h) metric

Project Site	Sensitive Receptors	Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase over Background Levels		
			Min	Avg	Max	Min	Avg	Max
West Plant Site	***Noise Measurement Location****	***47***	***47***	***49***	***50***	***3***	***5***	***14***
	Residences in Superior	47	47	49	50	3	5	14
	Residences U.S. 60 and Main Street†	53	53	55	57	3	4	15
East Plant Site	***Noise Measurement Location****	***61***	***61***	***61***	***61***	***11***	***12***	***16***
	Oak Flat campground	43	43	49	51	1	1	12
	Apache Leap SMA	46	46	50	51	1	2	15
Filter plant and loadout facility/ MARRCO corridor	***Noise Measurement Location****	***20***	***28***	***42***	***45***	***<1***	***<1***	***1***
	Westernstar Road	<10	27	42	45	<1	<1	<1
	Lind Road	32	33	43	45	<1	<1	6
	Felix Road	26	30	42	45	<1	<1	3
	Attaway Road	21	28	42	45	<1	<1	1
Silver King tailings storage facility	***Noise Measurement Location****	***52***	***52***	***52***	***52***	***11***	***14***	***25***
	Arizona National Scenic Trail (northwest of Superior)	43	43	44	45	4	6	16

Notes: Shaded cells indicate an exceedance at a sensitive receptor (not noise measurement locations) of selected threshold of 55 dBA for Leq(h) for project plus background levels, and 15 dBA for increase over background levels.

Min = Minimum, Avg = Average, Max = Maximum

* Prediction location is not a sensitive receptor and is included for comparison with the existing measured noise levels (see table 3.4.3-1).

† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).

Table 3.4.4-8. Predicted noise impacts during operations, Alternative 4, Ldn metric

Project Site	Sensitive Receptors	Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase over Background Levels		
			Min	Avg	Max	Min	Avg	Max
West Plant Site	***Noise Measurement Location****	***54***	***54***	***56***	***57***	***4***	***5***	***11***
	Residences in Superior	54	54	56	57	4	5	11
	Residences U.S. 60 and Main Street†	59	59	60	60	6	7	11
East Plant Site	***Noise Measurement Location****	***67***	***67***	***67***	***67***	***13***	***16***	***26***
	Oak Flat campground	50	51	54	55	1	2	10
	Apache Leap SMA	52	55	56	56	2	2	4
Filter plant and loadout facility/ MARRCO corridor	***Noise Measurement Location****	***18***	***38***	***46***	***48***	***<1***	***<1***	***<1***
	Westernstar Road	<10	38	46	48	<1	<1	<1
	Lind Road	30	39	46	48	<1	<1	1
	Felix Road	24	38	46	48	<1	<1	<1
	Attaway Road	19	38	46	48	<1	<1	<1
Silver King tailings storage facility	***Noise Measurement Location****	***57***	***57***	***57***	***57***	***11***	***14***	***22***
	Arizona National Scenic Trail (northwest of Superior)	49	49	50	51	5	6	14

Notes: Shaded cells indicate an exceedance at a sensitive receptor (not noise measurement locations) of selected threshold of 65 dBA for Ldn for project plus background levels, and 15 dBA for increase over background levels.

Min = Minimum, Avg = Average, Max = Maximum

* Prediction location is not a sensitive receptor and is included for comparison with the existing measured noise levels (see table 3.4.3-1).

† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).

Operations Phase – Operation Noise Impacts to Residences – Superior

The relocation of the filter plant to the West Plant Site is unique to Alternative 4; in addition to the filter plant operations, this also would result in train traffic to and from the West Plant Site.

Residential receptors would experience future processing operation noise levels similar to that of noise levels associated with filter plant operations which are modeled between 45 and 48 dBA (project noise plus background noise). These predicted noise levels would be below the Pinal County noise threshold limit of 55 dBA. Because residential receptors are within incorporated lands within the town of Superior, ADOT's modified Noise Abatement Criteria of 66 dBA would be more applicable.

Future train noise impacts associated with the MARRCO have been estimated following the Simplified Estimation Procedure (SEP) identified in the Canadian Transportation Agency's Railway Noise Measurement and Reporting Methodology (Canadian Transportation Agency 2011) Appendix A.
The SEP provides a simplified calculation method to determine potential noise impacts associated with rail projects. The procedure is based on the number of train pass-bys which includes options for the number of train locomotives, number of cars, approximate train speed in kilometers per hour (kmh), approximate distance in meters from potential receptors, and adjustment factors. It is assumed for this SEP calculation, that there will be two 50-car trains per day with one locomotive with an average speed of 50 kmh (31 miles per hour (mph)), which is the minimum speed identified as part of the SEP estimation process. The base sound level of equivalent sound level (Leq) (16h) has also been applied and assumes that all rail traffic will occur during the 16-hour period of 7 a.m. to 11 p.m. (Canadian Transportation Agency 2011). Distance and speed have been converted from metric units (meters and kmh) to imperial units (feet and mph). Potential noise receptors have been identified using aerial imagery with an estimated closest distance of 200 feet from the MARRCO alignment.

Residential receptors are predicted to experience future MARRCO operation noise levels of approximately 52 dBA during a 16-hour period from 7 a.m.–11 p.m., which would be below the Pinal County noise threshold limit of 55 dBA (table 3.4.4-9).

Table 3.4.4-9. Predicted MARRCO noise impacts calculations, Alternative 4

Step 1	Description	Sound Level L_{eq} (16h) (dBA)
1	Single train pass-by noise level	52
2	Adjustment factor for multiple trains*	55
3	Adjustment factor for distance†	52

* Adjustment factor of +3 dBA applied for two trains during period

† Adjustment factor of −3 dBA applied for distance from receptor of 200 feet (60 m).

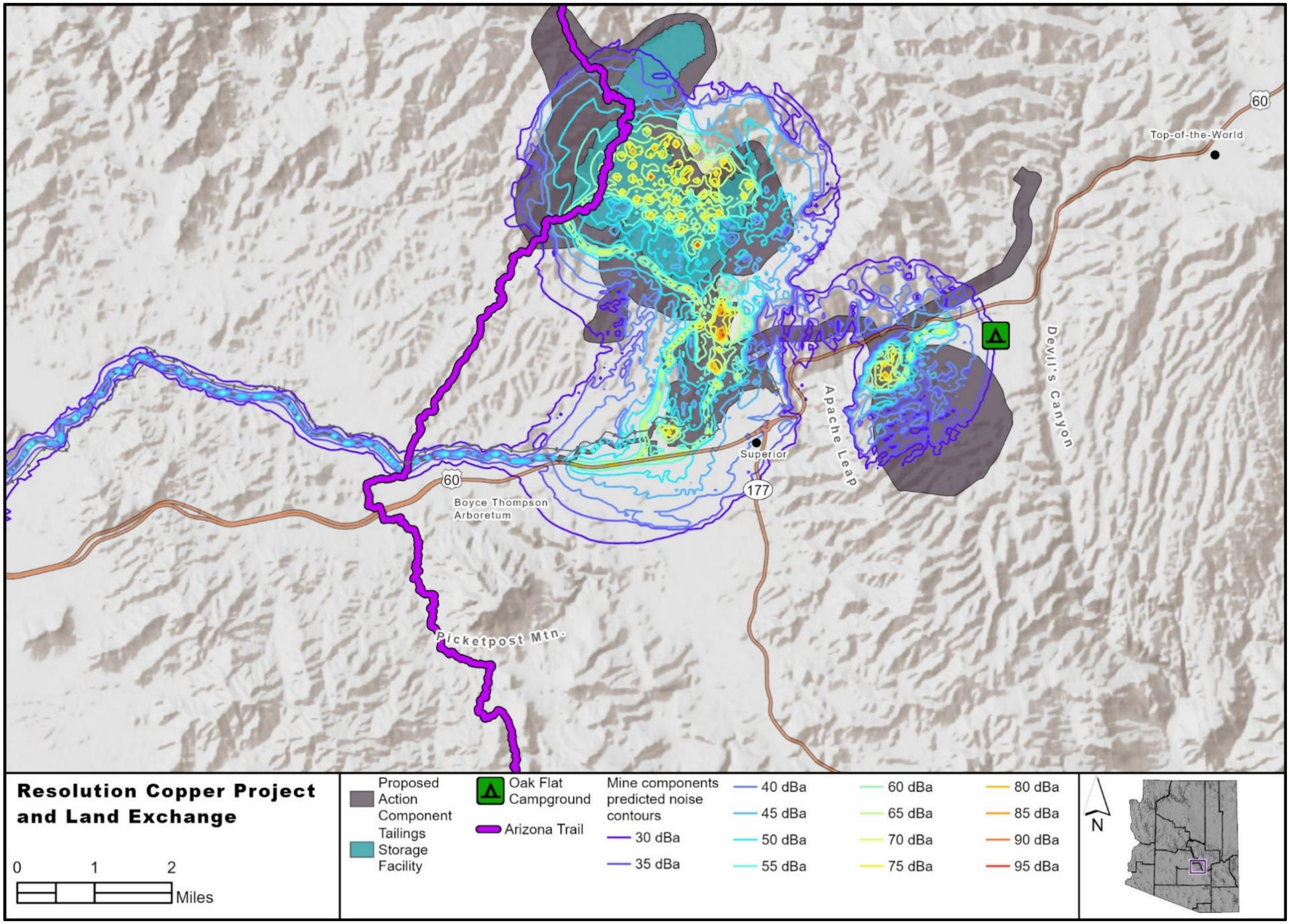


Figure 3.4.4-4. Predicted noise contours associated with operations, Alternative 4

3.4.4.5 Alternative 5 – Peg Leg

Alternative 5 would have identical impacts on Alternatives 2 and 3 for: construction blasting noise, construction blasting vibration, construction non-blasting noise, and operations non-blasting vibration. Only operational noise impacts would differ and are described here.

Similar to Alternatives 2 and 3, table 3.4.4-10 shows that noise impacts in Leq(h) metric are not expected to occur based on the predicted minimum and average noise level (whether looking at overall combined noise levels (project noise plus background noise), or the incremental noise increase over background levels). If the maximum of each range is used, incremental increases are at or above the selected threshold of 15 dBA at the following receptors:

- Residential receptors near U.S. 60 and Main Street.
- Recreational users within Apache Leap SMA.

The maximum condition assumes all equipment operating simultaneously during the quietest period; this would be an infrequent and unlikely occurrence.

Residential receptors near U.S. 60 and Main Street would also experience future levels above 55 dBA, but below 66 dBA, based on maximum values. Table 3.4.4-11 shows that predicted future noise levels in Ldn metric would comply with all the selected thresholds. Figure 3.4.4-5 shows the predicted noise contours for Alternative 5.

Table 3.4.4-10. Predicted noise impacts during operations, Alternative 5, Leq(h) metric

Project Site	Sensitive Receptors	Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase over Background Levels		
			Min	Avg	Max	Min	Avg	Max
West Plant Site	***Noise Measurement Location****	***47***	***47***	***49***	***50***	***3***	***5***	***14***
	Residences in Superior	47	47	49	50	3	5	14
	Residences U.S. 60 and Main Street†	53	53	55	57	3	4	15
East Plant Site	***Noise Measurement Location****	***61***	***61***	***61***	***61***	***11***	***12***	***16***
	Oak Flat campground‡	43	43	49	51	1	1	12
	Apache Leap SMA‡	46	46	50	51	1	2	15
Filter plant and loadout facility/ MARRCO corridor	***Noise Measurement Location****	***47***	***47***	***48***	***49***	***4***	***6***	***20***
	Westernstar Road	<10	27	42	45	<1	<1	<1
	Lind Road	32	33	43	45	<1	<1	6
	Felix Road	26	30	42	45	<1	<1	3
	Attaway Road	13	27	42	45	<1	<1	<1
Peg Leg tailings storage facility	***Noise Measurement Location****	***56***	***56***	***57***	***57***	***6***	***9***	***30***
	Arizona National Scenic Trail (near Zellweger Wash)	34	35	48	51	<1	<1	9

Notes: Shaded cells indicate an exceedance at a sensitive receptor (not noise measurement locations) of selected threshold of 55 dBA for Leq(h) for project plus background levels, and 15 dBA for increase over background levels.

Min = Minimum, Avg = Average, Max = Maximum

* Prediction location is not a sensitive receptor and is included for comparison with the existing measured noise levels (see table 3.4.3-1).

† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).

‡ The expected lower level was applied to be conservative (see table 3.4.3-1).

Table 3.4.4-11. Predicted noise impacts during operations, Alternative 5, Ldn metric

Project Site	Sensitive Receptors	Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase over Background Levels		
			Min	Avg	Max	Min	Avg	Max
West Plant Site	***Noise Measurement Location****	***54***	***54***	***56***	***57***	***4***	***5***	***11***
	Residences in Superior	54	54	56	57	4	5	11
	Residences U.S. 60 and Main Street†	59	59	60	60	6	7	11
East Plant Site	***Noise Measurement Location****	***67***	***67***	***67***	***67***	***13***	***16***	***26***
	Oak Flat campground‡	50	51	54	55	1	2	10
	Apache Leap SMA‡	52	55	56	56	2	2	4
Filter plant and loadout facility/ MARRCO corridor	***Noise Measurement Location****	***53***	***53***	***54***	***54***	***6***	***8***	***15***
	Westernstar Road	<10	38	46	48	<1	<1	<1
	Lind Road	30	39	46	48	<1	<1	1
	Felix Road	24	38	46	48	<1	<1	<1
	Attaway Road	11	38	46	48	<1	<1	<1
Peg Leg tailings storage facility	***Noise Measurement Location****	***62***	***62***	***62***	***62***	***10***	***13***	***28***
	Arizona National Scenic Trail (near Zellweger Wash)	40	41	50	52	<1	1	7

Notes: Shaded cells indicate an exceedance at a sensitive receptor (not noise measurement locations) of selected threshold of 65 dBA for Ldn for project plus background levels, and 15 dBA for increase over background levels.

Min = Minimum, Avg = Average, Max = Maximum

* Prediction location is not a sensitive receptor and is included for comparison with the existing measured noise levels (see table 3.4.3-1).

† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).

‡ The expected lower level was applied to be conservative (see table 3.4.3-1).

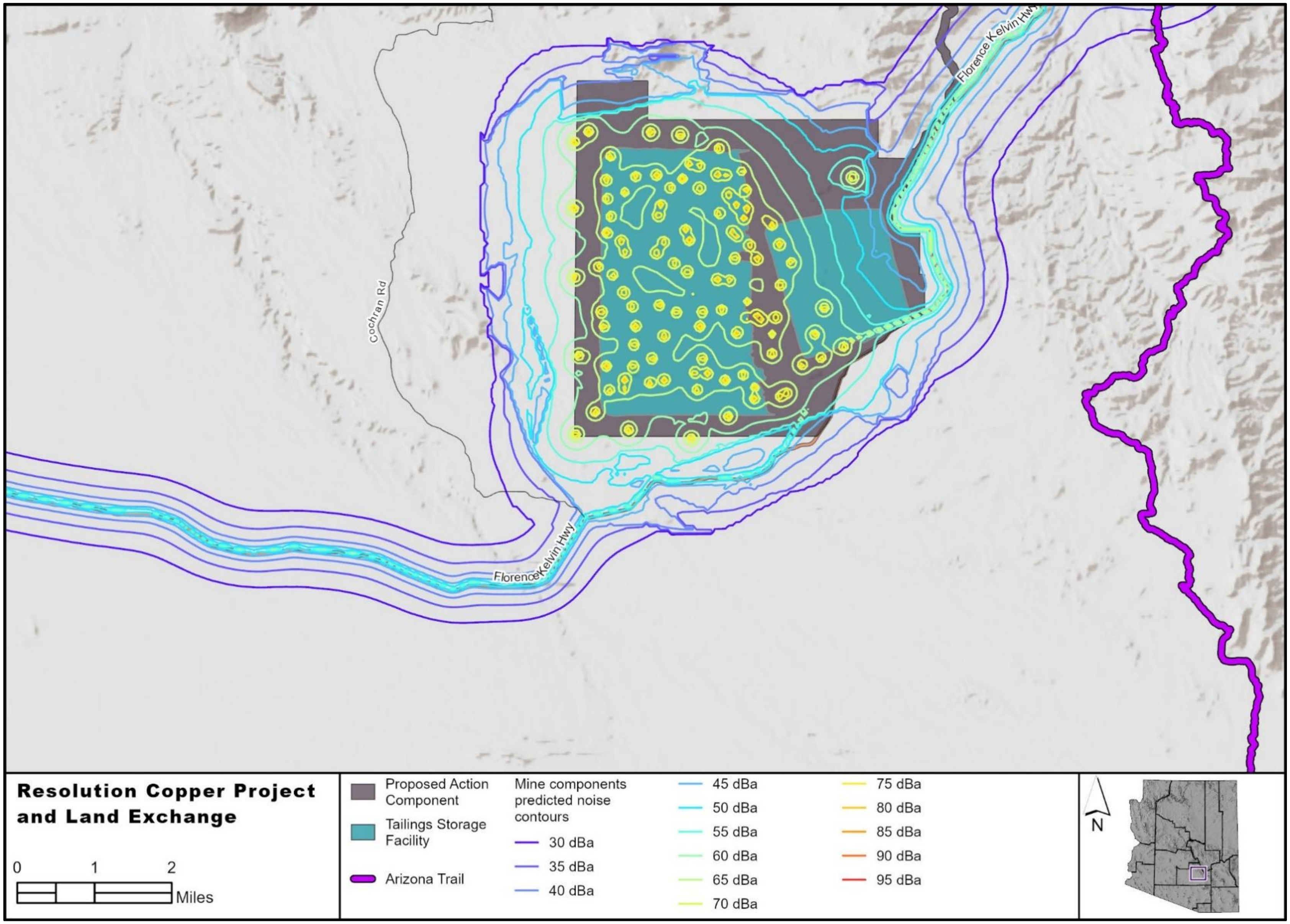


Figure 3.4.4-5. Predicted noise contours associated with operations, Alternative 5

3.4.4.6 Alternative 6 – Skunk Camp

Alternative 6 would have identical impacts on Alternatives 2 and 3 for construction blasting noise, construction blasting vibration, construction non-blasting noise, and operations non-blasting vibration. Only operational noise impacts would differ and are described here.

Table 3.4.4-12 shows that noise impacts in Leq(h) metric are not expected to occur based on the predicted minimum and average noise level, except along Dripping Springs Road. There, the expected sound levels exceed the Leq(h) selected threshold of 55 dBA but are below the selected threshold of 66 dBA. If the maximum of each range is used, incremental increases are at or above the selected threshold of 15 dBA at the following receptors:

- Residential receptors near U.S. 60 and Main Street.
- Recreational users within Apache Leap SMA.
- Residential/recreational users along Dripping Springs Road.

The maximum condition assumes all equipment operating simultaneously during the quietest period; this would be an infrequent and unlikely occurrence.

Residential receptors near U.S. 60 and Main Street would also experience future levels above 55 dBA, but below 66 dBA, based on maximum values. For the Ldn metric, noise levels along Dripping Springs Road are also above the selected threshold of 65 dBA, as shown in table 3.4.4-13. Figure 3.4.4-6 shows the predicted noise contours for Alternative 6.

Table 3.4.4-12. Predicted noise impacts during operations, Alternative 6, Leq(h) metric

Project Site	Sensitive Receptors	Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase over Background Levels		
			Min	Avg	Max	Min	Avg	Max
West Plant Site	***Noise Measurement Location****	***47***	***47***	***49***	***50***	***3***	***5***	***14***
	Residences in Superior	47	47	49	50	3	5	14
	Residences U.S. 60 and Main Street†	53	53	55	57	3	4	15
East Plant Site	***Noise Measurement Location****	***61***	***61***	***61***	***61***	***11***	***12***	***16***
	Oak Flat campground‡	43	43	49	51	1	1	12
	Apache Leap SMA‡	46	46	50	51	1	2	15
Filter Plant and Loadout Facility/ MARRCO corridor	***Noise Measurement Location****	***47***	***47***	***48***	***49***	***4***	***6***	***20***
	Westernstar Road	<10	27	42	45	<1	<1	<1
	Lind Road	32	33	43	45	<1	<1	6
	Felix Road	26	30	42	45	<1	<1	3
	Attaway Road	13	27	42	45	<1	<1	<1
Skunk Camp tailings storage facility	Arizona National Scenic Trail (near Kelvin)§	<10	26	48	51	<1	<1	<1
	Dripping Springs Road	60	60	60	60	10	12	34

Notes: Shaded cells indicate an exceedance at a sensitive receptor (not noise measurement locations) of selected threshold of 55 dBA for Leq(h) for project plus background levels, and 15 dBA for increase over background levels.

Min = Minimum, Avg = Average, Max = Maximum

* Prediction location is not a sensitive receptor and is included for comparison with the existing measured noise levels (see table 3.4.3-1).

† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).

‡ The expected lower level was applied to be conservative (see table 3.4.3-1).

§ The lower and upper levels are based on the Peg Leg noise measurement location (see table 3.4.3-1).

Table 3.4.4-13. Predicted noise impacts during operations, Alternative 6, Ldn metric

Project Site	Sensitive Receptors	Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase over Background Levels		
			Min	Avg	Max	Min	Avg	Max
West Plant Site	***Noise Measurement Location****	***54***	***54***	***56***	***57***	***4***	***5***	***11***
	Residences in Superior	54	54	56	57	4	5	11
	Residences U.S. 60 and Main Street†	59	59	60	60	6	7	11
East Plant Site	***Noise Measurement Location****	***67***	***67***	***67***	***67***	***13***	***16***	***26***
	Oak Flat campground‡	50	51	54	55	1	2	10
	Apache Leap SMA‡	52	55	56	56	2	2	4
Filter plant and loadout facility/ MARRCO corridor	***Noise Measurement Location****	***53***	***53***	***54***	***54***	***6***	***8***	***15***
	Westernstar Road	<10	38	46	48	<1	<1	<1
	Lind Road	30	39	46	48	<1	<1	1
	Felix Road	24	38	46	48	<1	<1	<1
	Attaway Road	11	38	46	48	<1	<1	<1
Skunk Camp tailings storage facility	Arizona National Scenic Trail (near Kelvin)§	<10	34	49	52	<1	<1	<1
	Dripping Springs Road	67	67	67	67	15	18	33

Notes: Shaded cells indicate an exceedance at a sensitive receptor (not noise measurement locations) of selected threshold of 65 dBA for Ldn for project plus background levels, and 15 dBA for increase over background levels.

Min = Minimum, Avg = Average, Max = Maximum

* Prediction location is not a sensitive receptor and is included for comparison with the existing measured noise levels (see table 3.4.3-1).

† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).

‡ The expected lower level was applied to be conservative (see table 3.4.3-1).

§ The lower and upper levels are based on the Peg Leg noise measurement location (see table 3.4.3-1).

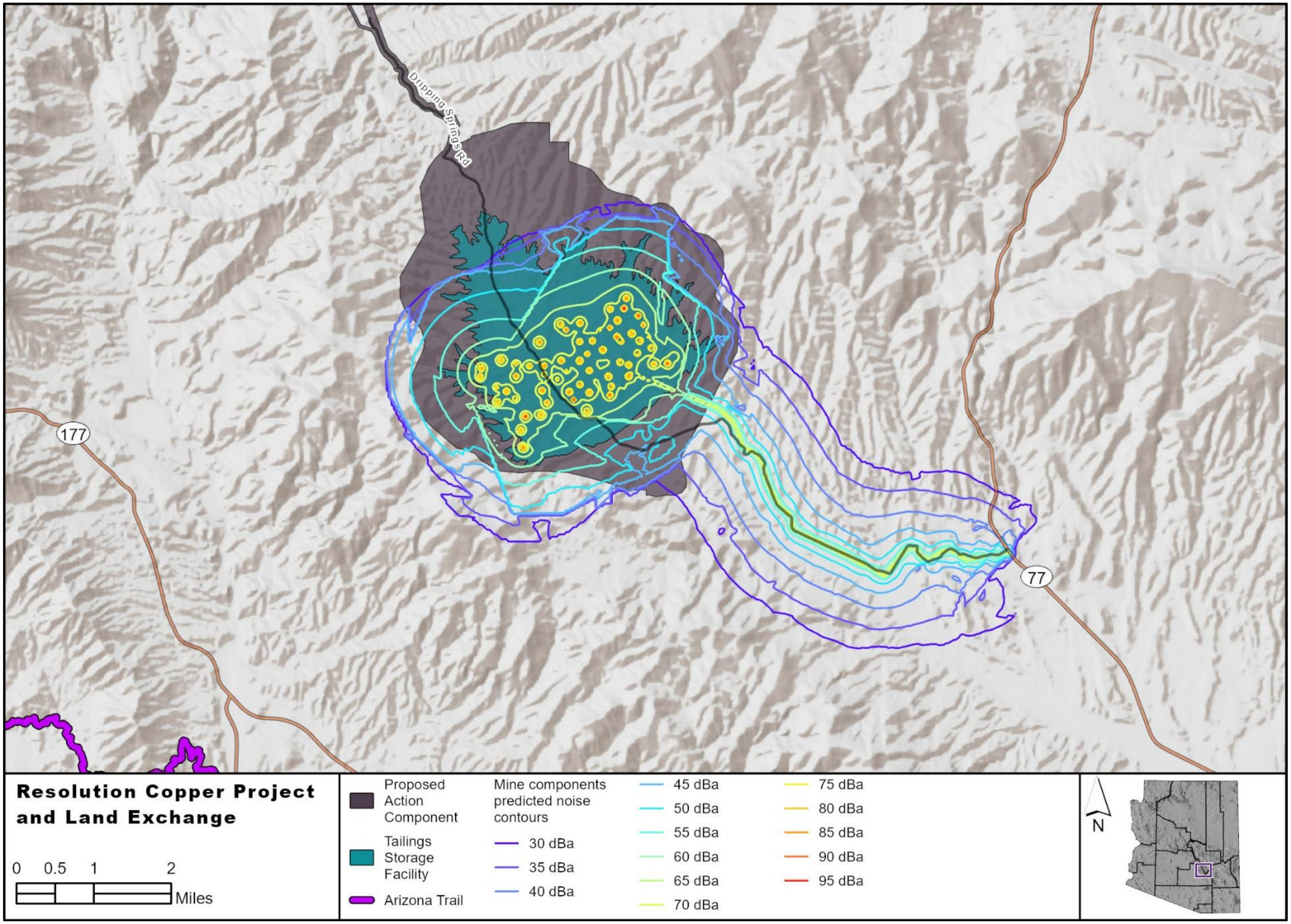


Figure 3.4.4-6. Predicted noise contours associated with operations, Alternative 6

3.4.4.7 Cumulative Effects

Full details of the cumulative effects analysis can be found in chapter 4. The following represents a summary of the cumulative impacts resulting from the project-related impacts described in Section 3.4.4, Environmental Consequences, that are associated with noise and vibration, when combined with other reasonably foreseeable future actions.

The following actions were determined through the cumulative effects analysis process to be reasonably foreseeable, and have impacts that likely overlap in space and time with impacts from the Resolution Copper Project:

- ADOT Pinal County North-South Corridor
- Ray Land Exchange and Proposed Plan Amendment
- Superior West Exploration Project

The cumulative effects analysis area for noise and vibration extends 2 miles from the project footprint to allow for overlap of the direct/indirect effects from any RFFAs. The metric used to quantify noise and vibration cumulative impacts is the acreage of area within the cumulative effects analysis area where combined noise levels exceed 55 dBA. The threshold of 55 dBA is the most stringent threshold used in the FEIS and is specifically applicable to residential areas.

The area where noise levels are expected to exceed 55 dBA for the Resolution Copper Project is approximately 29,000 acres (based on the noise modeling contours), and the combined area of the three reasonably foreseeable future actions where noise levels are expected to exceed 55 dBA within the cumulative effects analysis area is approximately 43,300 acres (assumed to be a 0.5-mile radius from the boundaries of the actions). Combined, noise levels above 55 dBA could be present in about 24.5 percent (72,300 acres) of the 296,000-acre cumulative effects analysis area.

3.4.4.8 Mitigation Effectiveness

Mitigation Identifier and Title	Authority to Require
RV-NV-01: Dripping Springs Road mitigations	Voluntary – Resolution Copper

We developed a robust monitoring and mitigation strategy to avoid, minimize, rectify, reduce, or compensate for resource impacts that have been identified during the process of preparing this EIS. Appendix J contains descriptions of mitigation measures that are being required by the Forest Service and mitigation measures voluntarily brought forward and committed to by Resolution Copper. Appendix J also contains descriptions of monitoring that would be needed to identify potential impacts and mitigation effectiveness.

This section contains an assessment of the effectiveness of design features associated with mitigation and monitoring measures found in appendix J that are applicable to noise and vibration. See appendix J for full descriptions of each measure noted below.

Mitigation Effectiveness and Impacts of Forest Required Mitigation Measures Applicable to Noise and Vibration

Appendix J contains mitigation and monitoring measures being required by the Forest Service under its regulatory authority or because these measures are required by other regulatory processes (such as the Biological Opinion). These measures are assumed to occur, and their effectiveness and impacts are disclosed here; however, there are no required mitigations for noise and vibration, which is reflected in the unavoidable adverse impacts disclosed below.

Mitigation Effectiveness and Impacts of Resolution Committed Mitigation Measures Applicable to Noise and Vibration

Appendix J contains mitigation and monitoring measures committed by Resolution Copper in contractual, financial, or other agreements. Due to these commitments these measures are assumed to occur and their effectiveness and impacts if they were to occur are disclosed here; however, there are no committed mitigations for noise and vibration, which is reflected in the unavoidable adverse impacts disclosed below.

Mitigation Effectiveness and Impacts of Resolution Voluntary Mitigation Measures Applicable to Noise and Vibration

Appendix J contains mitigation and monitoring measures brought forward voluntarily by Resolution Copper and committed to in correspondence with the Forest Service. These measures are assumed to occur but are not guaranteed to occur. Their effectiveness and impacts if they were to occur are disclosed here; however, the unavoidable adverse impacts disclosed below do not take the effectiveness of these mitigations into account.

Dripping Springs Road mitigations (RV-NV-01). Resolution Copper proposes to implement road improvements and speed limits on Dripping Springs Road near existing residences. This action seeks to mitigate impacts related to noise, dust, and traffic and is relevant only to Alternative 6. This could be used for the life of operations but may be most beneficial during the initial construction period of the embankment. This is the only location disclosed in the analysis with a potential exceedance of noise thresholds, and the proposed mitigations would be effective at eliminating this impact. Gila County has legal authority to maintain the Dripping Springs Road. Therefore, Resolution Copper will need to work with Gila County to implement the measures, including reduced speeds and selective paving.

Unavoidable Adverse Impacts

No impacts above selected thresholds were identified from construction blasting noise and vibration (provided explosive loading is appropriately limited), from construction non-blasting noise (beyond 1,000 feet from active equipment), or from operational vibrations (beyond 50 feet from active equipment).

For operational noise, with the exception of Dripping Springs Road, the only impacts identified above selected thresholds were associated with the maximum range of impacts, which is an infrequent and unlikely scenario that suggests that all equipment is running simultaneously and during the quietest period (i.e., lowest background levels observed). Under most conditions, the analysis indicates that no impacts would be expected from project noise. Application of mitigation on Dripping Springs Road would eliminate those operational noise impacts as well.

After mitigation, no unavoidable adverse impacts are anticipated from noise or vibration; however, this mitigation is considered voluntary and while assumed to occur cannot be guaranteed.

3.4.4.9 Other Required Disclosures

Short-Term Uses and Long-Term Productivity

Noise and vibration levels did not rise beyond threshold of concern under most conditions, but the noise and vibration associated with the surrounding environment from mining and associated activities would be short term (during the estimated 51- to 56-year life of the mine, including construction, operations, and reclamation) and are expected to end with mine reclamation.

Irreversible and Irretrievable Commitment of Resources

Irretrievable commitment of resources would consist of the lost opportunity to enjoy natural soundscapes because of adjacent, mine-related noise during the construction, mining, closure, and reclamation phases of the project. Because the mine-related noise would cease after closure of the mine, noise impacts to the environment would not be considered an irreversible commitment of resources.

3.5 Transportation and Access

3.5.1 Introduction

The analysis presented in this section of the EIS examines the most likely effects on regional and local roadway transportation systems under each of the alternatives. This section summarizes the roads and intersections in the area, along with their background traffic levels and level of service, and assesses the impacts from mine traffic to traffic volume, level of service, and changes in transportation routes and public access.

Some aspects of the analysis are briefly summarized in this section. Additional details not included are in the project record (Newell 2018h).

Overview

Transportation of personnel, equipment, supplies, and materials related to development, operation, and closure/reclamation of the proposed Resolution Copper Mine would, under any alternative, substantially increase traffic in the greater Superior area. The anticipated increase in mine-related traffic is unlikely to alter regional traffic patterns, level of service, or future transportation-related projects, but may adversely affect access to NFS facilities through road closures and other changes to the existing transportation system.

3.5.1.1 Changes from the DEIS

We updated the transportation analysis in response to comments received from the public and to incorporate new information requested from Resolution Copper, including two addenda to the traffic analysis report, which are described in the methodology section below. We also further discuss assumptions that are key to the analysis, including data collection methodologies, annual growth, carpooling, and heavy vehicles.

In the DEIS, the transportation analysis focused on intersections, which are where most traffic conflicts occur. For the FEIS, we updated state highway descriptions to describe details such as shoulders and passing lanes, and now include evaluation of highway segments between intersections as well.

Refined FEIS analysis also includes morning and evening peak period analysis, an expanded analysis of potential railroad impacts on traffic, and analysis of traffic safety considerations. We also updated applicant-committed environmental protection measures.

Additionally, the analysis incorporates a change in traffic patterns for the mine. Employees no longer are anticipated to use the Main Street/Magma Mine Road to access the West Plant Site, but instead will use the Main Street/Lonetree (Smeltertown) Road access point.

New mitigation measures were brought forward to directly address transportation impacts, including measures developed by Resolution Copper in consultation with the Town of Superior. These are disclosed in the “Mitigation Effectiveness” discussion in this section. The cumulative effects analysis was revised for the FEIS to better quantify impacts. It is described in detail in chapter 4 and summarized in this section.

3.5.1.2 Changes from the January 2021 Rescinded FEIS

As discussed below, since traffic modeling requires assumptions about the baseline amount of traffic prior to construction, the traffic modeling necessarily requires selecting a real-world year when construction would start. The modeling used 2022 as an assumed construction start date.

When the FEIS was first published in January 2021, this assumed construction date was still within reason (see appendix R, response to comment TR14). Now, at the time of republication, construction starting in 2022 is clearly an impossibility.

The uncertainty of the start date was recognized in the January 2021 Rescinded FEIS. At that time—given the assumptions made in the traffic modeling for increase in traffic in the area, compared to state transportation officials' anticipated increases—we estimated that the traffic modeling would remain valid for any construction date through 2025. Given the additional delays, this estimate has been revisited in order to validate that the traffic analyses are still reliable for disclosure. This is discussed in section 3.5.4.1 below.

For the transportation and access section, the only other changes since January 2021 are revisions to the cumulative effects analysis based on updates to the list of potentially reasonably foreseeable actions and an update to reflect analysis of consistency with the new "Tonto National Forest Land Management Plan," implemented in December 2023.

3.5.2 Analysis Methodology, Assumptions, and Uncertain and Unknown Information

3.5.2.1 Analysis Area

The transportation and access analysis area for the proposed mine facilities and alternatives includes the roads adjacent to the proposed mine, roads that would provide regional access to the proposed mine and its facilities, roads within or cut off by the perimeter fence that would be inaccessible to the public from mine activities, the proposed primary access roads and utility maintenance roads, as well as numerous less-frequently used and/or recreational routes that may potentially be affected by a general increase in area traffic. This 82,188-acre analysis area is depicted in figure 3.5.2-1. The analysis area for transportation and access issues includes within its boundaries approximately 141 miles of State highways, 418 miles of Pinal County–owned and local roads, and 533 miles of NFS roads.

Temporary haul and mine operations roads within the mine perimeter fence would not be part of the NFS transportation system. However, in order to capture all potential disturbance, we include any impacts that would result from the creation, use, and disposal of temporary or long-term mine haul and service roads in the total site disturbance acreage calculations in this section.

Figure 3.5.3-2 also depicts several key intersections and transportation road segments used in the transportation analysis. Intersections with increased traffic because of the mine are the critical locations that most affect the level of service (LOS), which is a qualitative measure of how intersection or roadway capacity is perceived by drivers. Traffic impact modeling focuses on these key intersections. Additional highway segment analysis evaluated the sensitivity of U.S. 60, SR 79, SR 177, and SR 77 to added mine traffic.

To support this modeling, existing peak-hour turning movement counts were collected at 16 intersections within the analysis area. Twenty-four-hour bidirectional traffic volume, speed, and classification counts were collected along 16 roadway segments within the analysis area. At ADOT's direction (February 2015), Resolution Copper collected data during both the summer and winter seasons of 2016 and 2017 to provide a conservative estimate of average daily traffic and peak-hour turning movements (Southwest Traffic Engineering LLC 2020c).

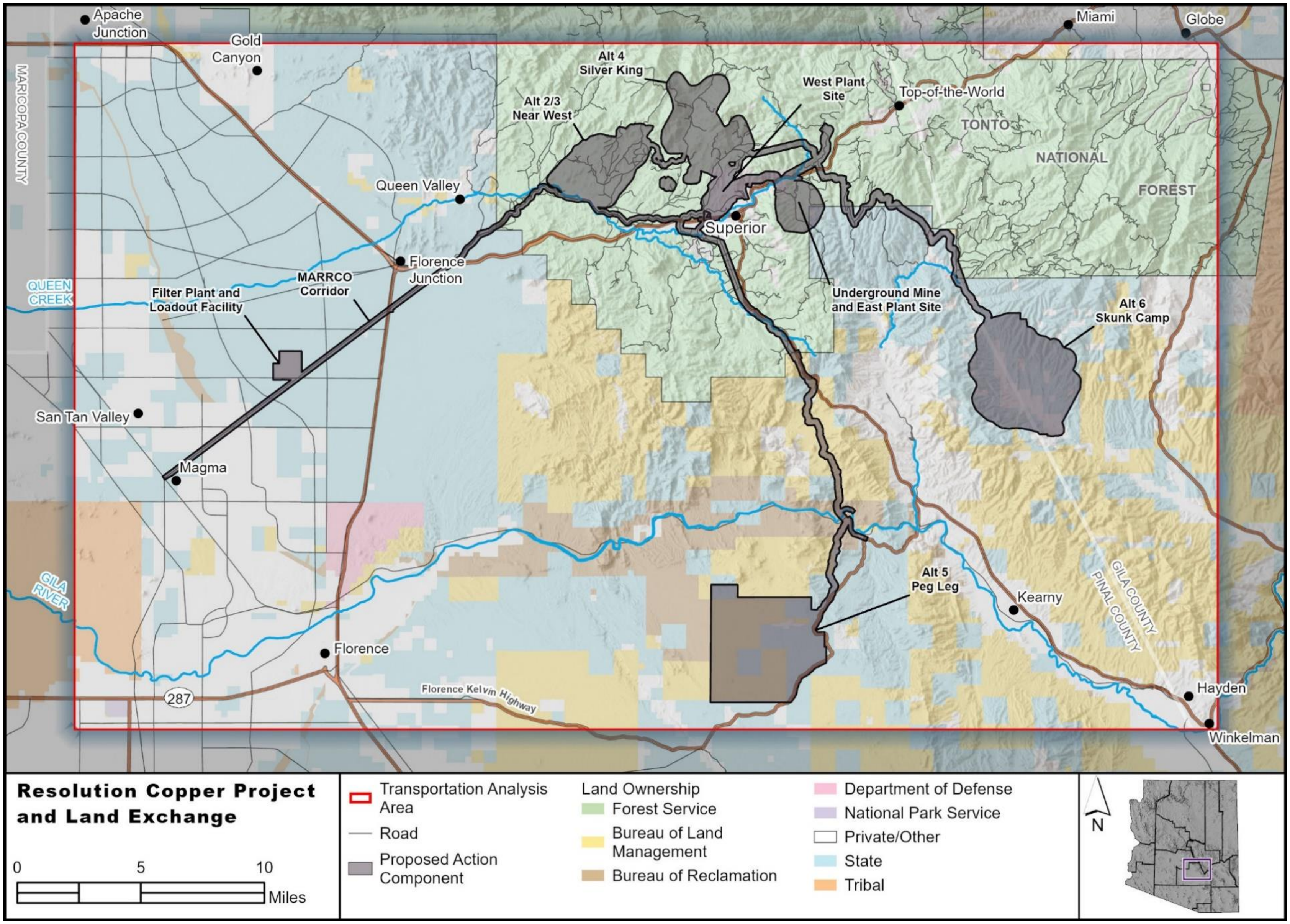


Figure 3.5.2-1. Transportation and access analysis area

Because traffic projections use future growth in non-mine traffic, traffic impact analysis assumes a specific year at which construction and normal operations begin. Traffic projections assumed a peak construction year of 2022, with normal operations beginning in 2027. However, to minimize the possibility of underrepresenting potential traffic concerns and to ensure a conservative analysis of potential impacts, the analysis assumes the peak construction year (2022) includes concurrent construction of the East Plant Site, the West Plant Site, the tailings storage facility, the filter plant, and the loadout facility. Traffic generated during the resulting peak construction year represents the greatest increase in traffic possible over background conditions. Moreover, as another conservative assumption the analysis assumed all of the traffic associated with the mine expansion would occur exclusively during the p.m. peak hour and not be spread across the entire day.

Normal operations would begin in 2027, 5 years after peak construction. Normal operations consist of a combination of employee trips and material supply deliveries for the East Plant Site, the West Plant Site, the tailings storage facility, the filter plant, and the loadout facility. Traffic employee and supply trips generated during normal operations are about half of those generated during the peak year of construction.

At the time of republication of the FEIS, the use of years 2022 for construction and 2027 for operations is no longer a valid assumption. The only effect that selection of these specific years has on the traffic analysis is the determination of future background traffic volumes, which are combined with the new traffic from the project. An analysis of assumed traffic growth rates compared with traffic growth reported by ADOT was conducted in order to validate that the background traffic estimates remained appropriately conservative and would not undercount traffic, which would in turn underestimate potential traffic impacts. This analysis can be found in Newell (2018h). The validation analysis concludes that the background traffic estimates for U.S. 60 in Superior that were used for the EIS (a) are greater in magnitude than the ADOT projections for this road segment; (b) are such that analyses related to construction (2022) appear to remain valid past 2030; and (c) are such that analyses related to for operations (2027) appear to remain valid past 2033.

For consistency with the underlying analysis reports, the years 2022 and 2027 continue to be referenced in this section. However, the analysis for 2022 represents construction conditions regardless of the year in which they actually occur, and the analysis for 2027 represents operational conditions regardless of the year in which they actually occur.

Distribution for the project-generated trips is based on the relative accessibility of cities and towns near the site. Based on an assumed location of material suppliers and the availability of employee housing, the expected trips generated for both the construction and the normal operation of the facility share a similar distribution. Trips from the west represent 85 percent of generated trips, with 68 percent from the Phoenix/Mesa metropolitan area via U.S. 60, and 17 percent from the San Tan Valley/Florence area via SR 79. The remaining 15 percent of generated trips are expected from the east, with 10 percent from Globe via U.S. 60, and 5 percent from SR 177 south of Superior.

Much of the analysis contained in this section can be found in the traffic impact analysis studies (Southwest Traffic Engineering LLC 2017, 2018, 2020b, 2020c). Many details of NFS roads can be found in the travel management plan prepared by the Tonto National Forest (U.S. Forest Service 2019c).

Note that there are analysis and methodology differences between the different traffic studies, including the original study in 2017, prior to the DEIS, and the first and second addenda in 2020, produced in response to DEIS comments. The differences were considered in the EIS analysis (Hussein and Miles 2020).

3.5.3 Affected Environment

3.5.3.1 Relevant Laws, Regulations, Policies, and Plans

Primary Legal Authorities and Technical Guidance Relevant to the Transportation and Access Analysis

- "Roadway Design Guidelines," ADOT, January 2021, including revisions through January 2025
- "Traffic Guidelines and Processes," ADOT, June 2015, including revisions through August 2021
- "Low Volume Roads Engineering Best Management Practices Field Guide," Gordon Keller, PE, and James Sherar, PE, July 2003
- Forest Service Handbook 7709.56 (Road Preconstruction), July 2011
- Forest Service Handbook 7709.59 (Road System Operations), February 2009
- Forest Service Manual 7710 (Transportation Planning Handbook), March 2022
- "Guidelines for Geometric Design of Low-Volume Roads," American Association of State Highway and Transportation Officials, 2019
- "A Policy on Geometric Design of Highways and Streets," American Association of State Highway and Transportation Officials, 2018

Forest Service Guidance

FSH 7709.59, "Road System Operations and Maintenance" (U.S. Forest Service 2009), provides guidance for planning, traffic management, investment sharing (cost share), highway safety, traffic studies, road maintenance, and other NFS road operations and maintenance activities. Such road system operations and maintenance are part of the process of managing NFS roads and road uses to best meet land and resource management objectives.

Before any roads are added to or removed from the NFS road system, they must undergo travel analysis, as described in FSM 7703.26 (U.S. Forest Service 2022), "Adding Roads to the Forest Transportation System." Travel analysis considers the values affected by roads, including access to and use of, protection of, and administration of NFS lands; public health and safety; valid existing rights; and long-term road funding opportunities and obligations. Environmental analysis for roads includes effects on associated ecosystems; introduction of invasive species; effects on threatened and endangered species and areas with significant biodiversity, cultural resources, fish and wildlife habitat, water quality, and visual quality; effects on recreation opportunities; and effects on access to NFS lands. Travel analysis requirements are met for the NFS roads analyzed in this EIS. Roads on private land and roads under the jurisdiction of entities other than the Forest Service are not required to undergo travel analysis. Road width, surfacing, and grades for segments of the access roads that would be NFS roads must meet or exceed Forest Service standards or have appropriate professional engineering justification and Forest Service approval for deviations from Forest Service standards.

NFS lands within the analysis area are generally accessed by high-clearance vehicle roads, known as maintenance level 2 roads. Forest Service upkeep of maintenance level 2 roads typically occurs as needed, depending on funding, and usually in response to damage caused by use and/or erosion. Should the proponent desire or require maintenance to a higher standard to reliably and comfortably allow standard passenger car use, highway-legal truck use, or other specific vehicular use of an NFS road, the proponent must be authorized in writing to perform such maintenance or provide funding to the Forest Service sufficient to allow the Forest Service to perform or contract for the performance of the needed maintenance.

State and Other Guidance

ADOT has jurisdiction over State highways, State routes, and State-owned airports, as well as jurisdiction over all State-owned transportation systems or modes. ADOT has the responsibility to contribute the most desirable design parameters consistent with safety, service, environment, and cost effectiveness and to apply these parameters with sound engineering judgment on routes under State jurisdiction. The "Roadway Design Guidelines" (Arizona Department of Transportation 2021), with revisions and amendments, and the "Guidelines for Highways on Bureau of Land Management and U.S. Forest Service Lands" (Wheat Scharf Associates and ADOT/FHWA/BLM/USFS Steering Committee 2008) guide the roadway designer in exercising sound engineering judgment in applying design parameters. The 2021 guidelines are complementary to commonly used national standards, including the American Association of State Highway and Transportation Officials' "A Policy on Geometric Design of Highways and Streets"(American Association of State Highway and Transportation Officials 2004) and the "Roadside Design Guide," (American Association of State Highway and Transportation Officials 2011) and are to be used in conjunction with these documents. The American Association of State Highway and Transportation Officials' policies reflect general nationwide practices and are not necessarily applicable to the conditions in Arizona. ADOT has transportation jurisdiction over State highways and State routes on NFS and BLM land. The jurisdiction is not exclusive, as the Federal agency is still the underlying land owner. The roles and responsibilities of each agency are defined in a highway easement deed obtained for the parcel or corridor. Where the design values provided in the ADOT manual differ from those presented in the American Association of State Highway and Transportation Officials' guidelines, the ADOT manual takes precedence. ADOT's "Guidelines for Highways on Bureau of Land Management and U.S. Forest Service Lands" (Wheat Scharf Associates and ADOT/FHWA/BLM/USFS Steering Committee 2008) are applicable only to ADOT roads on BLM and NFS lands.

Access and Authorizations

The Tonto National Forest and BLM manage Federal lands that are open to access by the public, subject to appropriate management restrictions. The Tonto National Forest currently manages in accordance with the "Tonto National Forest Land Management Plan" (U.S. Forest Service 2023d), implemented in December 2023. The BLM manages lands in the analysis area under either the "Phoenix Resource Management Plan/Environmental Impact Statement, Record of Decision" (Bureau of Land Management 1989) or under the "Records of Decision, Final Safford District Resource Management Plan and Environmental Impact Statement" (Bureau of Land Management 1991, 1994b). Any roads, pipeline corridors, or power line corridors associated with the project placed on Federal lands must be approved by the appropriate agency, in conformance with management direction. Authorization could occur under several regulations, which will depend on the final decisions by the agency. Authorization of easements for the Tonto National Forest would occur either as part of approval of a mining plan of operations under mineral regulations (36 CFR 228 Subpart) or as a special use authorization under land use regulations (36 CFR 251). Similarly, BLM authorization of easements would occur either as part of approval of a mining plan of operations (43 CFR 3809) and/or as easements (43 CFR 2800).

Arizona State Trust lands are managed under the provisions of the Federal Enabling Act that provided for Arizona's statehood in 1912. Approximately 9.2 million acres throughout the state are currently held in trust. Although this is at ASLD's discretion, State Trust lands may be leased as a means of providing annual revenue for 14 officially recognized beneficiary agencies and entities (the largest recipient by far is Arizona K–12 education). Trust lands are less frequently for sale through a process of competitive bidding. For the purposes of this EIS, it is assumed that any State Trust lands underlying the two alternative tailings storage facility locations where State lands are present (Alternative 5 – Peg Leg or Alternative 6 – Skunk Camp) would be sold rather than leased, if that location were to be selected. That same assumption may be applied to the State Trust lands located within the predicted subsidence area at the East Plant Site.

3.5.3.2 Existing Conditions and Ongoing Trends

Highways and Roads Description

The following is a list of existing transportation systems within the analysis area. The systems described include State highways, county roads, and NFS roads. Figure 3.5.2-1 depicts the roadway system facilities in relation to the project boundary.

STATE HIGHWAYS

- U.S. 60 primarily has an east-west alignment and is a four-lane divided highway between Goldfield Road (Apache Junction) and the SR 177 interchange in Superior. This segment has a posted speed limit ranging from 55 to 65 mph, four 12-foot lanes, and 6- to 10-foot shoulders on both sides of the highway. East of the SR 177 interchange to Miami, U.S. 60 is a two-lane undivided highway with a posted speed of 50 mph, 12-foot lanes and 4- to 8-foot shoulders. This 17-mile segment contains average longitudinal slopes of 5 to 7 percent. There are over 3 miles of passing lanes with an additional 1.5 miles of passing zone pavement marking for eastbound and westbound traffic. The cross-section has no curb, gutter, or sidewalk facilities within the project boundary, though recent construction in 2017 added curbs and gutters with sidewalks through Superior. U.S. 60 is considered a regional route linking Superior, Miami, and Globe to the Phoenix/Mesa metropolitan area. U.S. 60 also includes a two-way left-turn lane between Silver King Mine Road (NFS Road 229) and SR 177.
- SR 177 is an undivided two-lane highway beginning at the intersection of U.S. 60/SR 177 and extending south toward Kearny, Arizona. This segment has 12-foot lanes and 4-foot shoulders with no curb, gutter, or sidewalk facilities within the project boundary. This 32-mile segment contains average longitudinal slopes of 3 to 8 percent and approximately 9 miles of passing zones pavement marking for northbound and southbound traffic. The posted speed limit on SR 177 is 25 mph at the intersection of U.S. 60/SR 177 and increases to 55 mph once headed outside the town of Superior.
- SR 79 has a north-south alignment and is a two-lane, undivided highway with 12-foot lanes and 8-foot paved shoulders. The posted speed limit on SR 79 is 65 mph. SR 79 provides a route from U.S. 60 south to Florence, Arizona. This 17-mile segment contains average longitudinal slopes of 1 to 5 percent and 12 miles of passing zones pavement marking for both northbound and southbound traffic. The cross-section has no curb, gutter, or sidewalk facilities along SR 79 within the project boundary. Approximately 2 miles south of U.S. 60, SR 79 crosses the existing MARRCO corridor.
- SR 77 has a north-south alignment and is a two-lane, undivided highway with 12-foot lanes and 4-foot shoulders. The posted speed limit on SR 77 is 50 mph. The segment from U.S. 60 east of Globe to SR 177 in Winkelman is 33 miles long with over 7 miles of passing zones pavement marking and 1 mile of passing lane provided for northbound and southbound traffic. This segment contains average longitudinal slopes of 3 to 8 percent. The cross-section has no curb, gutter, or sidewalk facilities within the project boundary.

COUNTY ROADS AND LOCAL ROADS

- Main Street in Superior is an undivided two-lane local roadway with an east-west alignment. Curb, sidewalks, and bike lanes are present along the north and south sides of the roadway. West of Lonetree Road, Main Street is posted 35 mph. East of Lonetree Road, Main Street is posted 25 mph.
- Lonetree Road (Smeltertown Road) is a two-lane graded dirt road, providing access to various mining operations north of Main Street. The roadway has no posted speed limit, curb, gutter, or sidewalks.
- Magma Avenue is a two-lane paved local roadway along a north-south alignment located in Superior. The roadway provides curb, gutter, sidewalks, and on-street parking along the eastern and western sides of the roadway. The posted speed limit on Magma Avenue is 25 mph.
- Skyline Drive is a two-lane roadway with no curb, gutter, or sidewalk facilities. Skyline Drive is closed to through traffic east of Laine Road. Any access restrictions on this roadway will conform with State trust land requirements. The speed limit on Skyline Drive is 50 mph west of Quail Run Lane and 45 mph east of Quail Run Lane. There are existing overhead utility lines along the north side of the roadway. Low-density residential development is present on the north side of the roadway between Schnepf Road and Quail Run Lane and south of Skyline Drive east of Quale Run Lane. An RV park is on the south side of the roadway at Sierra Vista Drive. In general, the land surrounding Skyline Drive is largely undeveloped or used as farmland.
- Quail Run Lane is an undivided, two-lane roadway with a posted speed limit of 50 mph. The roadway has a north-south alignment, and does not provide curb, gutter, or sidewalk facilities.
- Sierra Vista Drive is an unpaved, two-lane dirt roadway with a posted speed limit of 25 mph. The roadway has a north-south alignment and no curb, gutter, or sidewalk facilities.
- Schnepf Road is an undivided two-lane roadway with a north-south alignment and a posted speed limit of 50 mph. There are dirt shoulders along both sides of the roadway and no sidewalk facilities.
- Combs Road has an east-west alignment and a posted speed limit of 50 mph. One travel lane is provided in each direction, with dirt shoulders along both sides of the roadway and no sidewalk facilities.
- Florence-Kelvin Highway has an east-west alignment and a posted speed of 50 mph. The roadway is both gravel surfaced and paved; it provides one travel lane in each direction. There are no curb, gutter, or sidewalk facilities along this route within the analysis area.
- Dripping Springs Road has an east-west alignment and no posted speed limit. The roadway is unpaved and provides one lane of travel in each direction. There are no curb, gutter, or sidewalk facilities.

NATIONAL FOREST SYSTEM ROADS

- Silver King Mine Road (also known as NFS Road 229) exists as a graded dirt roadway with a north-south alignment, providing access to State lands and various existing mining operations. There is no posted speed limit on Silver King Mine Road (NFS Road 229). Silver King Mine Road intersects U.S. 60 from the north. South of U.S. 60, the roadway is known as Apache Tear Road (NFS Road 989). Commonly used NFS roads in the project area are shown in figure 3.5.3-1.

- Apache Tear Road (NFS Road 989) is a graded dirt roadway that begins at a cattle guard adjacent to U.S. 60 and extends south, providing access to State lands, various mining operations, and the Town of Superior’s water plant. Apache Tear Road (NFS Road 989) has a posted speed limit of 25 mph.
- Hewitt Station Road (NFS Road 357) is an unpaved, graded dirt road providing access to State lands as well as other recreational and off-road vehicle NFS roads and motorized trails north of U.S. 60. Several dirt parking/staging areas for recreational users exist including the Silver King OHV Staging Area immediately north of the U.S. 60 near the intersection of NFS Road 357 and NFS Road 8 and the Hewitt Station OHV Staging Area on NFS Road 357 about 1 mile north of the intersection with NFS Road 357 and Queen Valley Road. Cattle guards are located across the east portion of NFS Road 357 at the intersection with U.S. 60 and across the west end of NFS Road 357 and the forest boundary. There is no posted speed limit. There are currently access restrictions traveling west-east and east-west along NFS Road 357 where it crosses private property. Tow vehicles with UTV trailers use both the Hewitt Station and Silver King OHV Staging Areas to unload vehicles and access the routes north of these areas; however, recent observations indicate horse trailer parking at Silver King OHV Staging as well.
- Magma Mine Road (NFS Road 469) is a two-lane undivided paved roadway with no curb, gutter, or sidewalk facilities which provides access to mining operations south of U.S. 60. The Forest Service classifies Magma Mine Road (NFS Road 469) as a level 4 road. There is no posted speed limit. Beyond its intersection with East Oak Flats Road (NFS Road 2438), Magma Mine Road becomes NFS Road 315 with a level 2 road classification. This section of Magma Mine Road (NFS Road 315) is paved with a single lane. Magma Mine Road splits from NFS Road 315 approximately 5,800 feet from its intersection with East Oak Flats Road (NFS Road 2438), becoming a private road designated as NFS Road 2432.
- East Oak Flats Road (NFS Road 2438). Approximately 1,400 feet from U.S. 60, Magma Mine Road intersects with East Oak Flats Road (NFS Road 2438). East Oak Flats Road (NFS Road 2438) was an unpaved loop road classified as a level 2 road by the Forest Service, but was changed in the October 2021 Tonto National Forest travel management plan (U.S. Forest Service 2021e) to a motorized trail. There is no posted speed limit.
- NFS Road 3153 intersects East Oak Flats Road (NFS Road 2438) and is an unpaved dead-end road classified as a level 2 road by the Forest Service. There is no posted speed limit. Current Forest Service documentation identifies this road as closed.

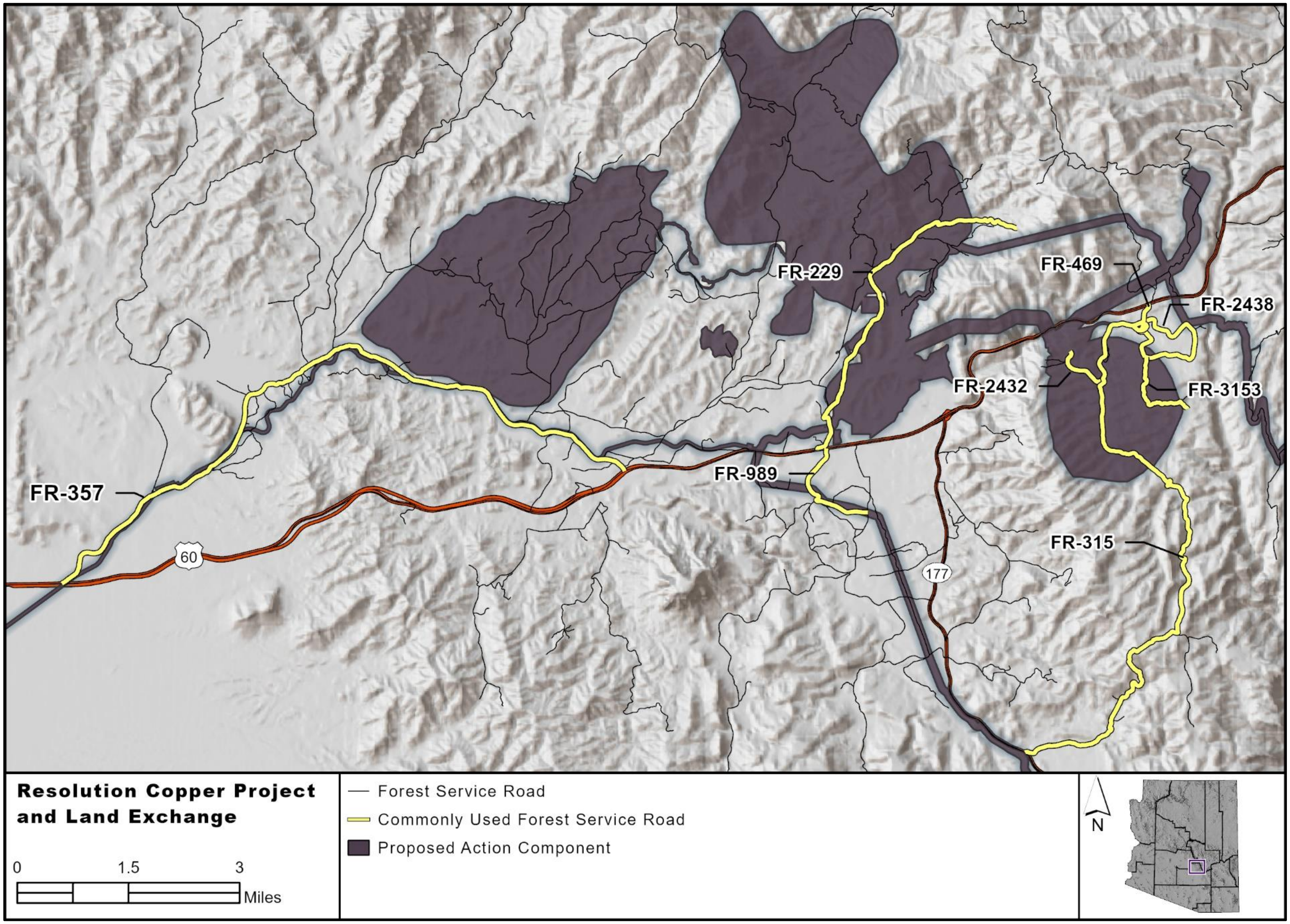


Figure 3.5.3-1. Commonly used NFS roads in the project area

Background Traffic Volume Counts

Resolution Copper collected peak-hour turning movement counts in August 2015, November 2016, and March 2018 based on discussions with ADOT staff, to capture summer and winter traffic pattern variations (Southwest Traffic Engineering LLC 2017, 2018). At ADOT's direction, counts were collected on Fridays between the hours of 7:00 a.m. and 10:00 p.m., because Friday historically is the weekday with the most traffic on U.S. 60. Traffic volume counts collected during November 2016 generally were higher than August 2015, and the daily traffic volumes during both counts showed a single p.m. peak characteristic (with no discernable a.m. peak). Background traffic analysis is based on the November p.m. peak hour to provide for a conservative analysis of the entire project. Filter plant and tailings facility alternatives are based on the March 2018 p.m. peak-hour data. Additional a.m. peak-hour analysis was completed for select intersections within the town of Superior to assess any acute traffic concerns created by employee commute patterns to the West Plant Site.

Resolution Copper completed turning movement counts at the following intersections, as shown in figure 3.5.3-2:

- Magma Mine Road (NFS Road 469)/U.S. 60
- SR 177/Eastbound U.S. 60 ramps
- SR 177/Westbound U.S. 60 on-ramp
- Ray Road/Heiner Street/Westbound U.S. 60 off-ramp
- Main Street/U.S. 60
- NFS Road 989/U.S. 60
- Silver King Mine Road (NFS Road 229)/U.S. 60
- Hewitt Station Road (NFS Road 357)/U.S. 60
- Main Street/Lonetree Road (Smeltertown Road)
- Main Street/Magma Avenue
- Skyline Drive/Quail Run Lane
- Skyline Drive/Sierra Vista Drive
- Skyline Drive/Schnepf Road
- Combs Road/Schnepf Road
- Florence-Kelvin Highway/SR 79
- Florence-Kelvin Highway/SR 177
- Florence-Kelvin Highway/Peg Leg Road
- SR 77/Dripping Springs Road

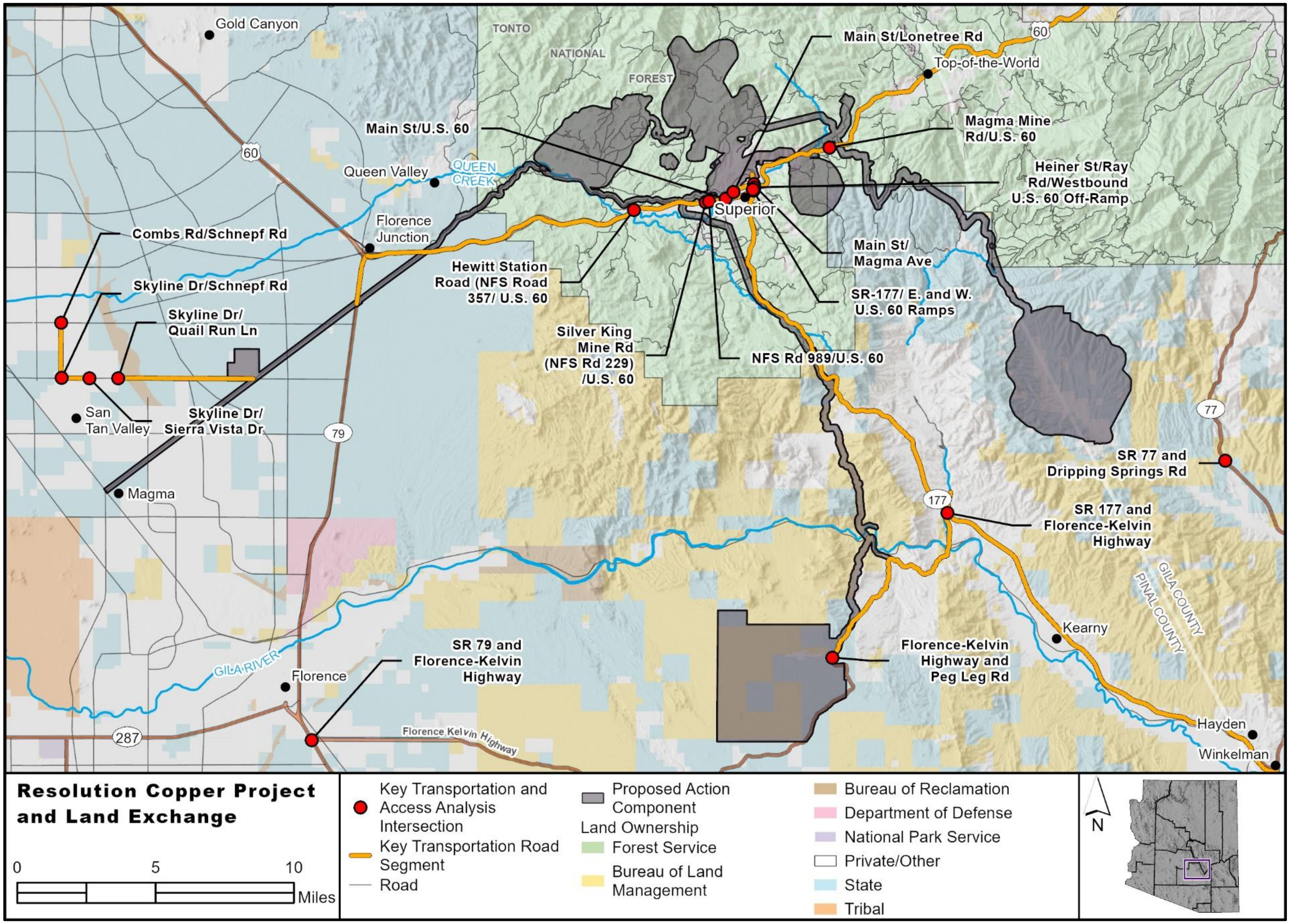


Figure 3.5.3-2. Key intersections and road segments analyzed through traffic counts

In addition to intersection vehicle-turning movement counts, 24-hour bidirectional traffic volumes, vehicle speed, and vehicle classification counts were collected along roadway segments within or adjacent to the analysis area. These roadway segments are also depicted in figure 3.5.3-2:

- Magma Avenue, north of Copper Road
- Main Street, east of Pinal Avenue
- Main Street, west of Pinal Avenue
- U.S. 60, west of Silver King Mine Road (NFS Road 229)
- U.S. 60, between Silver King Mine Road (NFS Road 229) and Main Street
- U.S. 60, between Main Street and SR 177
- U.S. 60, west of Magma Mine Road (NFS Road 469)
- U.S. 60, east of Magma Mine Road (NFS Road 469)
- SR 79, between U.S. 60 and the MARRCO Railroad Line
- Skyline Drive, east of Quail Run Lane
- Skyline Drive, between Sierra Vista Drive and Schnepf Road
- Schnepf Road, between Skyline Drive and Hash Knife Draw Road
- Schnepf Road, between Hash Knife Draw Road and Combs Road
- Florence-Kelvin Highway, east of Peg Leg Road
- Florence-Kelvin Highway, east of SR 177
- SR 177, north and south of Florence-Kelvin Highway

Background Level of Service

Resolution Copper conducted an operational analysis of all existing intersections for the weekday p.m. peak hour using the nationally accepted methodology set forth by the Highway Capacity Manual at the time of analysis (Transportation Research Board 2000). Additional peak-hour operational analysis occurred for select intersections with the highest concentration of mine-related traffic (Southwest Traffic Engineering LLC 2020b).

The analysis used Synchro (a traffic operations analysis software). In accordance with Highway Capacity Manual procedures, Synchro reports LOS and average vehicular delay (measured in seconds per vehicle) estimates to calculate the LOS for individual movements and/or approaches.

LOS is a qualitative measure of the traffic operations at an intersection or on a roadway segment that is ranked from LOS A (little or no congestion), to LOS F, which signifies severe congestion. LOS D typically is considered adequate operation at both signalized and unsignalized intersections in developed areas.

At unsignalized intersections, LOS is predicted/calculated for those movements which must either stop for or yield to oncoming traffic and is based on average control delay for the movement. Control delay is the portion of total delay attributed to a traffic control device, such as stop signs. The average delay criteria for LOS at each intersection type is shown in table 3.5.3-1.

Table 3.5.3-1. Level of service criteria

LOS Rank	Signalized Intersection Average Delay (seconds per vehicle)	Unsignalized Intersection Average Delay (seconds per vehicle)
A	≤ 10 seconds	≤ 10 seconds
B	10 seconds to ≤ 20 seconds	10 seconds to ≤ 15 seconds
C	20 seconds to ≤ 35 seconds	15 seconds to ≤ 25 seconds
D	35 seconds to ≤ 55 seconds	25 seconds to ≤ 35 seconds
E	55 seconds to ≤ 80 seconds	35 seconds to ≤ 50 seconds
F	> 80 seconds	> 50 seconds

Existing, or background, LOS were calculated for the p.m. peak hour of study intersections. All study intersections currently are unsignalized. The resulting delay and associated LOS for each intersection are detailed in table 3.5.3-2. All intersections in the analysis area currently operate with a LOS C or better for all movements during the peak hour under current conditions.

Table 3.5.3-2. Existing (2016) peak hour level of service and delay

Intersection	Peak Hour (p.m.)	
	LOS Rank	Delay (seconds per vehicle)
Combs Road/Schnepf Road		
Eastbound Left	C	18.9
Eastbound Through/Right	C	15.6
Westbound Left	B	11.4
Westbound Through/Right	B	11.3
Northbound Left	C	15.6
Northbound Through/Right	B	11.6
Southbound Left	B	10.5
Southbound Through/Right	C	24.9
Skyline Drive/Sierra Vista Drive		
Eastbound Left/Through	A	7.7
Southbound Left/Right	A	9.9
Skyline Drive/Quail Run Lane		
Eastbound Left/Through/Right	A	8.1
Westbound Left/Through/Right	A	7.8
Northbound Left/Through/Right	A	8.6
Southbound Left/Through/Right	A	7.4
Hewitt Station Road (NFS Road 357)/Westbound U.S. 60*		
Northbound Left/Through	A	0.0
Southbound Through/Right	A	0.0
Hewitt Station Road (NFS Road 357)/Eastbound U.S. 60*		
Southbound Left	A	0.0
Silver King Mine Road (NFS Road 229)/U.S. 60*		
Eastbound Left	A	8.9

Intersection	Peak Hour (p.m.)	
	LOS Rank	Delay (seconds per vehicle)
Westbound Left	A	8.6
Northbound Left/Through/Right	C	18.6
Southbound Left/Through/Right	C	18.5
Main Street/Lonetree Road (Smeltertown Road)*		
Eastbound Left	A	7.3
Southbound Left/Right	A	8.8
Main Street/U.S. 60†		
Eastbound Left/Through	A	9.1
Southbound Left	C	22.7
Southbound Right	B	10.8
Main Street/Magma Avenue		
Eastbound Left/Through/Right	A	7.4
Westbound Left/Through/Right	A	7.7
Northbound Left/Through/Right	A	7.9
Southbound Left/Through/Right	A	7.5
Heiner Street/Ray Road/Westbound U.S. 60 Off Ramp		
Eastbound Left/Right	A	9.4
Westbound Left/Through/Right	A	9.6
Northbound Left/Through	A	7.5
SR 177/Eastbound U.S. 60 Ramps		
Eastbound Left/Through/Right	A	9.6
Southbound Left/Through	A	7.6
Magma Mine Road (NFS Road 469)/U.S. 60		
Eastbound Left	A	0.0
Westbound Left	A	7.9
Northbound Left/Through/Right	C	16.8
Southbound Left/Through/Right	A	0.0
Florence-Kelvin Highway/SR 79		
Westbound Left/Right	A	9.8
Southbound Left	A	7.8
Florence-Kelvin Highway/SR 177		
Eastbound Left/Right	A	9.1
Northbound Left/Through	A	7.5
Dripping Springs Road/SR 77		
Eastbound Left/Right	A	9.1
Northbound Left/Through	A	7.4

* Differences appear between the original traffic study (Southwest Traffic Engineering LLC 2018) and addendum #1 (Southwest Traffic Engineering LLC 2020b). The original traffic study was determined to be the most appropriate with respect to these intersections.

† Differences appear between the original traffic study (Southwest Traffic Engineering LLC 2018) and addendum #1 (Southwest Traffic Engineering LLC 2020b). LOS and Delay values re-evaluated using 2020 analysis year, due to updated intersection geometry on U.S. 60. This is reflected in Southwest Traffic Engineering LLC (2020b).

3.5.4 Environmental Consequences of Implementation of the Proposed Mine Plan and Alternatives

3.5.4.1 Alternative 1 – No Action

Traffic Volume/Level of Service

Under the no action alternative, no mine expansion would occur and the existing transportation patterns and existing infrastructure in the analysis area would continue (Southwest Traffic Engineering LLC 2017, 2020b).

While normal background growth and area development will increase traffic, intersections in the analysis area generally are expected to operate within an acceptable LOS in years 2022 and 2027 (see table 3.5.4-3 later in this section). The exception would be the Combs Road/Schnepf Road intersection, which is expected to operate with a side street LOS E/F by year 2022 through 2027. A traffic signal may be required at this intersection, along with exclusive turn lanes for all approaches, to alleviate delays expected to occur with or without the project.

Transportation Routes

Under the no action alternative, existing transportation routes would not change. There would be no direct, indirect, or cumulative effects on the transportation routes as a result.

Changes in Access

Public access to NFS land and transportation infrastructure would not be impacted under the no action alternative because there would be no new roads, updates to existing roads, or closures of existing roads under this alternative. There would be no direct, indirect, or cumulative effects on changes in access as a result.

3.5.4.2 Impacts Common to All Action Alternatives

Effects of the Land Exchange

The land exchange would have significant effects on transportation and access. The Oak Flat Federal Parcel would leave Forest Service jurisdiction, and with it public access would be lost to the parcel itself, as well as passage through the parcel to other destinations, including Apache Leap and Devil's Canyon. These locations have other means of access, but those routes may not be as direct or convenient. Resolution Copper may keep portions of the property open for public access, as feasible.

The offered land parcels would enter either Forest Service or BLM jurisdiction. The eight parcels would have beneficial effects; they would become accessible by the public and be managed by the Federal Government for multiple uses. Roads and access would be managed in accordance with the appropriate management plans and agency direction.

Effects of Forest Plan Amendment

No components of the 2023 forest plan directly relate to transportation and access that require amendment.

Effects of Compensatory Mitigation Lands

Activities on the compensatory mitigation lands would involve some transportation of equipment to each location, but the traffic volumes would be negligible (a few vehicles) and are short-lived. These parcels are preserved for conservation and would have no long-term effects on traffic patterns or transportation.

Effects of Recreation Mitigation Lands

The recreation mitigation lands are not anticipated to affect transportation but will improve access to recreation opportunities on NFS lands. Staging areas have been strategically located to be close to recreation areas while being accessible to passenger vehicles, and in close enough proximity to the town of Superior to encourage use. The recreation mitigation lands will facilitate access to recreational opportunities currently unavailable to recreationists in and around Superior as well as those traveling from the Phoenix metropolitan area. Access to the Inconceivables area is provided in the recreation mitigation lands; this area is not readily accessible under current conditions.

Summary of Applicant-Committed Environmental Protection Measures

A number of environmental protection measures are incorporated into the design of the project that would act to reduce potential impacts on transportation and access. These are non-discretionary measures and their effects are accounted for in the analysis of environmental consequences.

The GPO (Resolution Copper 2016c) outlined applicant-committed environmental protection measures by Resolution Copper in Appendix K, "Road Use Plan:"

- Public access to the lands in the vicinity of the East Plant Site would be maintained via SR 177 and NFS Road 315 as well as U.S. 60 and NFS Road 469 (until access is no longer possible).
- A number of best management practices for road construction and maintenance were identified in the GPO:
  - To the extent practicable, vegetation will not be removed except from those areas to be directly affected by road reconstruction activities.
  - Cut-and-fill slopes for road reconstruction will be designed to prevent soil erosion.
  - Drainage ditches with cross drains will be constructed where necessary. Disturbed slopes will be revegetated, mulched, or otherwise stabilized to minimize erosion as soon as practicable following construction.
  - Road embankment slopes will be graded and stabilized with vegetation or rock as practicable to prevent erosion.
  - Runoff from roads will be handled through best management practices, including sediment traps, settling ponds, berms, sediment filter fabric, wattles, etc. Design of these features will be based on an analysis of local hydrologic conditions.
  - Off-road vehicle travel will generally be avoided.
  - During construction and operations, diversions will be constructed around affected areas to minimize erosion. A number of best management practices including check dams, dispersion terraces, and filter fences also will be used during construction and operations.
- Specific NFS road improvements and maintenance are also specified in the GPO; these are summarized here together with known impacts on NFS roads. The GPO notes several replacement roads that provide periphery access around the tailings facility; these roads are anticipated to be located within the fence line that excludes public access and therefore these roads are not considered to replace any through-access lost from the tailings facility.

- Realignment of NFS Road 229/Silver King Mine Road is envisioned under all alternatives. The physical disturbance from this realignment is incorporated into the assessment of impacts. Note that under Alternatives 2, 3, 5, and 6, the realignment of Silver King Mine Road is meant to provide through-access to the highlands north of the West Plant Site. For Alternative 4 this is true as well, but the presence of the tailings facility in this area restricts through-access to administrative uses only.

Partially in response to public comments on the DEIS and further review by the Forest Service, Resolution Copper submitted a revised road use plan (Resolution Copper 2020b). A number of specific mitigation measures were developed to respond to impacts disclosed during the NEPA process. These new mitigation measures were incorporated into the revised plan; those new requirements of the plan are discussed in the “Mitigation Effectiveness” section.

Four additional measures were identified in the traffic impact studies (Southwest Traffic Engineering LLC 2017, 2020b) and subsequent sensitivity analysis review (Hussein and Miles 2020) as being recommended to improve LOS and potential safety impacts caused by mine traffic. These are discussed further as a potential mitigation measure in the “Mitigation Effectiveness” section.

Mine-Related Traffic

Increased traffic associated with the mine during peak construction (2022) and normal operations (2027), includes four main traffic generators:

1. East Plant Site
2. West Plant Site
3. San Tan Valley filter plant and loadout facility
4. Tailings storage facility (four alternate locations)

There are four alternative locations for the tailings and storage facility (located at either the Near West, Silver King, Peg Leg, or Skunk Camp location), with each location having unique access roads, as shown in figure 3.5.4-1. All alternatives, except for Silver King, place the filter plant and loadout facility in the San Tan Valley. The Silver King alternative places the filter plant and loadout facility at the West Plant Site. This section focuses on the impacts that are common to all action alternatives; the impacts associated specifically with each alternative are summarized in the next sections. Table 3.5.4-1 describes the intersections that would be impacted by the East Plant Site, West Plant Site, and the San Tan Valley filter plant and loadout facility.

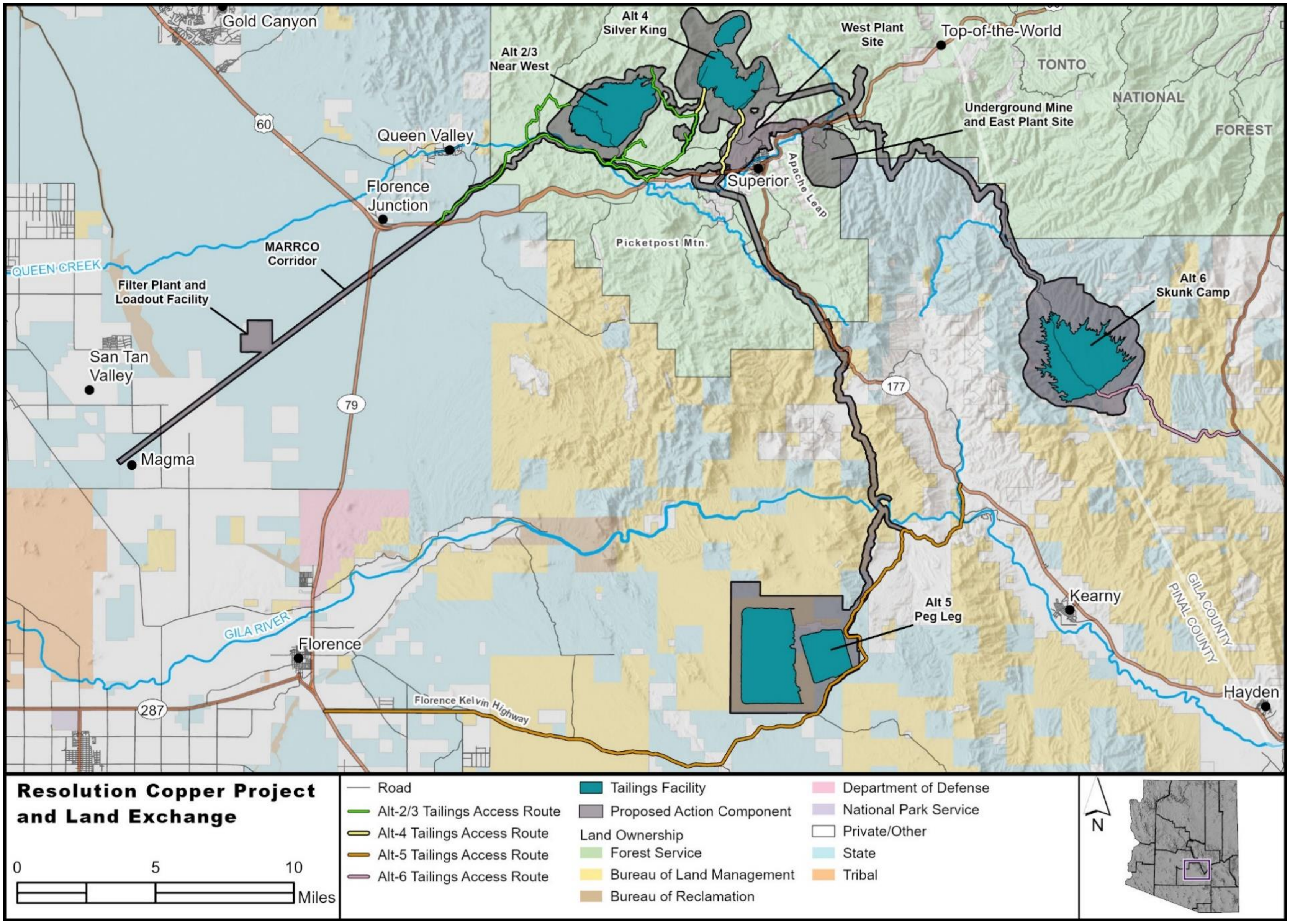


Figure 3.5.4-1. Access roads for alternative tailings storage facility

Table 3.5.4-1. Intersections impacted by all action alternatives

Facility	Intersections Impacted
East Plant Site	U.S. 60 and Magma Mine Road
West Plant Site	Main Street and Lonetree Road (Smeltertown Road) Main Street and U.S. 60 Heiner Street/Ray Road/Westbound U.S. 60 off-ramp SR 177 and eastbound U.S. 60 ramps U.S. 60 and Silver King Mine Road U.S. 60 and Hewitt Station Road
San Tan Valley filter plant and loadout facility (except Silver King alternative)	Skyline Drive and Sierra Vista Drive Skyline Drive and Quail Run Road Schnepf Road and Combs Road

Table 3.5.4-2 shows the total number of trips expected during peak construction and normal operations. This table shows both the a.m. trips (assumed inbound) and p.m. trips (assumed outbound). There are 1,618 daily trips expected during construction and 758 daily trips during normal operations.[44] In general, traffic impacts are more significant during peak construction than operations, as there are more employee commute trips.

Table 3.5.4-2. Site-generated trips

Facility	Peak Construction		Normal Operations	
	Employee Trips a.m. / p.m. (vehicle trips per hour)	Material/ Equipment Trips a.m. / p.m. (vehicle trips per hour)	Employee Trips a.m. / p.m. (vehicle trips per hour)	Material/ Equipment Trips a.m. / p.m. (vehicle trips per hour)
East Plant Site	219 / 219	11 / 11	166 / 166	11 / 11
West Plant Site	498 / 498	11 / 11	156 / 156	11 / 11
Tailings storage facility	Site-generated trips related to tailings storage facility alternatives, see table 3.5.4-7			
San Tan Valley filter plant and loadout facility	30 / 30	8 / 8	9 / 9	3 / 3

Note: Peak-hour employee and material/equipment trips are assumed to be inbound during the a.m. peak hour and outbound during the p.m. peak hour. Southwest Traffic Engineering LLC (2017) assessed a single, daily peak hour based on the sum of trips generated during the a.m. and p.m. peak periods. This was later updated at select intersections to include a detailed analysis of both a.m. and p.m. operations separately (Southwest Traffic Engineering LLC 2020b). The a.m. and p.m. peak analysis revealed the single peak hour approach assumed in the 2017 analysis was conservative.

The analysis includes assumptions designed to estimate peak-hour employee trips based on the number of employees working at each facility:

- There would be several different employee types and shift times/lengths at the mining facilities. A shift reduction factor of 0.66 was applied to estimate the number of employees traveling to/from the site during the peak hour.
- It was assumed that employees would arrive during the a.m. peak hour, and depart during the p.m. peak hour.

[44] The values in this sentence are calculated for Alternative 2 and are the combination of traffic in tables 3.5.4-2 and 3.5.4-7.

- To factor in employee carpooling, it was assumed that each vehicle entering the site would carry an average of 1.7 employees. This is based on data provided by Resolution Copper for observed carpooling behavior of staff at the existing Resolution Copper Mine.

Intersection Traffic Volume and Level of Service

Table 3.5.4-3 shows the delay and LOS for each intersection movement or lane group (i.e., one or more movements sharing one lane), with and without the project, during peak construction (year 2022) and normal operations (year 2027). A 2 percent compound annual growth rate was used to estimate projected background traffic volumes in years 2022 and 2027 (Southwest Traffic Engineering LLC 2017, 2020b).

With increasing traffic, due to normal background growth and development of the area, except for the Combs Road/Schnepf Road intersection, the intersections in the analysis area are generally expected to operate within an acceptable LOS in years 2022 and 2027 (see table 3.5.4-3). Project-related traffic would decrease LOS below ADOT accepted standards at the following intersections:

- The Combs Road/Schnepf Road intersection, southbound, degrades from LOS E to LOS F; this occurs under the no action alternative as well.
- The Main Street/U.S. 60 intersection, southbound left-turn lane, degrades to LOS F in the morning and LOS E in the evening during construction. During operations, this movement degrades to LOS E in the evening. The southbound right-turn lane degrades to LOS F in the evening during construction, then returns to LOS C during operations.
- The SR 177/U.S. 60 intersection, eastbound, degrades from LOS A to LOS E during construction.
- The Magma Mine Road/U.S. 60 intersection, northbound lane group, degrades from LOS C to LOS F during operations.

Highway Segment Traffic Volume and Level of Service

An analysis of affected highway segments potentially impacted by mine traffic assessed the worst-case scenario of all mine-related traffic using a single segment of highway in a day. A 2 percent compound annual growth rate was used to estimate projected background traffic volumes in years 2022 and 2027 (Southwest Traffic Engineering LLC 2017, 2020b, 2020c).

The following assumptions were made to complete the highway segment capacity analysis:

- For segments with more than two lanes, we conservatively assumed the minimum truck traffic to be 20 percent. The average truck percentage based on available data was consistently less than 20 percent.
- For segments with two lanes, we assumed truck traffic to be 10 percent. This is the highest percentage provided in the Federal Highway Administration LOS criteria.
- Background highway segment volumes are based on 2018 traffic volumes provided by ADOT's Traffic Data Management System.

As shown in figure 3.5.4-2, the combination of background traffic and all Resolution Copper daily traffic results in no highway segment operating below LOS B in years 2022 (representing construction) or 2027 (representing operations). Figure 3.5.4-2 also reflects the additional vehicle capacity these affected highway segments can serve before approaching LOS D.

Table 3.5.4-3. Level of service and delay for p.m. / a.m. peak during peak construction (2022) and normal operations (2027)

Intersection	2022 without Project		2022 with Project		2027 without Project		2027 with Project	
	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)
Combs Road/Schnepf Road								
Eastbound Left	C	24.8	D	25.9	D	31.5	D	31.8
Eastbound Through/Right	C	20.4	C	24.9	D	25.4	D	26.7
Westbound Left	B	12.1	B	12.3	B	12.3	B	12.4
Westbound Through/Right	B	12.3	B	12.6	B	12.8	B	12.9
Northbound Left	C	18.5	C	21.8	C	21.0	C	21.8
Northbound Through/Right	B	12.7	B	12.9	B	13.4	B	13.5
Southbound Left	B	11.1	B	11.3	B	11.5	B	11.5
Southbound Through/Right	E	42.4	E	47.1	F	67.5	F	67.7
Skyline Drive/Sierra Vista Drive								
Eastbound Left/Through	A	7.7	A	7.8	A	7.9	A	7.9
Southbound Left/Right	B	10.1	B	10.4	B	10.6	B	10.7
Skyline Drive/Quail Run Lane								
Eastbound Left/Through/Right	A	8.5	A	9.1	A	8.8	A	8.9
Westbound Left/Through/Right	A	8.0	A	8.4	A	8.1	A	8.2
Northbound Left/Through/Right	A	9.0	A	9.4	A	9.3	A	9.4
Southbound Left/Through/Right	A	7.6	A	7.9	A	7.7	A	7.8
Hewitt Station Road (NFS Road 357)/Westbound U.S. 60								
Northbound Left/Through	Intersection impacted by tailings storage facility alternatives, see table 3.5.4-8							
Southbound Through/Right								
Hewitt Station Road (NFS Road 357)/Eastbound U.S. 60								
Southbound Left	Intersection impacted by tailings storage facility alternatives, see table 3.5.4-8							
Silver King Mine Road (NFS Road 229)/U.S. 60								
Eastbound Left	Intersection impacted by tailings storage facility alternatives, see table 3.5.4-8							
Westbound Left								
Northbound Left/Through/Right								
Southbound Left/Through/Right								

Intersection	2022 without Project		2022 with Project		2027 without Project		2027 with Project	
	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)
Main Street/Lonetree Road (Smeltertown Road)*								
Eastbound Left	A / A	0.0 / 0.0	A / A	7.4 / 9.7	A / A	0.0 / 0.0	A / A	0.0 / **7.6**
Southbound Left/Right	A / A	9.2 / 9.1	C / B	20.9 / 11.2	A / A	9.3 / 9.2	A / B	9.5 / 12.7
Main Street/U.S. 60*								
Eastbound Left/Through	A / A	9.3 / 8.2	A / B	9.4 / 14.9	A / A	9.5 / 8.3	B / A	10.4 / 8.9
Southbound Left	D / B	25.7 / 14.2	E / F	67.0 / >120	D / B	28.3 / 14.9	E / D	45.6 / 26.2
Southbound Right	B / A	11.1 / 9.7	F / B	111.9 / 10.0	B / A	11.4 / 9.8	C / A	15.8 / 9.8
Heiner Street/Ray Road/Westbound U.S. 60 Off-Ramp†								
Eastbound Left/Right	A	9.6	C	17.1	A	9.7	B	10.2
Westbound Left/Through/Right	A	9.9	B	13.5	A	9.9	B	10.4
Northbound Left/Through	A	7.6	A	8.7	A	7.6	A	7.7
SR 177/Eastbound U.S. 60 Ramps†								
Eastbound Left/Through/Right	A	9.8	E	43.5	B	10.0	B	11.1
Southbound Left/Through	A	7.7	A	8.0	A	7.7	A	7.8
Magma Mine Road (NFS Road 469)/U.S. 60								
Eastbound Left	A	0.0	A	0.0	A	0.0	A	0.0
Westbound Left	A	8.0	A	8.3	A	8.1	A	8.2
Northbound Left/Through/Right	C	19.3	D	31.0	C	21.9	F	>120
Southbound Left/Through/Right	A	0.0	A	0.0	A	0.0	A	0.0

Note: Shaded cells indicate a LOS of E or F, which is considered inadequate by ADOT.

* Southwest Traffic Engineering LLC (2017) assessed a single, daily peak hour based on the sum of trips generated during the a.m. and p.m. peak periods. This was later updated at select intersections to include a detailed analysis of both a.m. and p.m. operations separately (Southwest Traffic Engineering LLC 2020b). The a.m. and p.m. peak analysis revealed the single peak hour approach assumed in the 2017 analysis was conservative.

† LOS and delay information based on Southwest Traffic Engineering LLC (2017). This analysis assumed a relatively large portion of mine-related traffic during peak construction would travel to/from an existing mine facility located just north of Superior, Arizona. This traffic would use Magma Avenue. In response to DEIS comments from the Town of Superior and to reduce traffic on local roads, it is now proposed that all mine-related traffic associated with the West Plant Site facilities will use the existing entrance at the Main Street/Lonetree Road (Smeltertown Road) intersection during construction and operations.

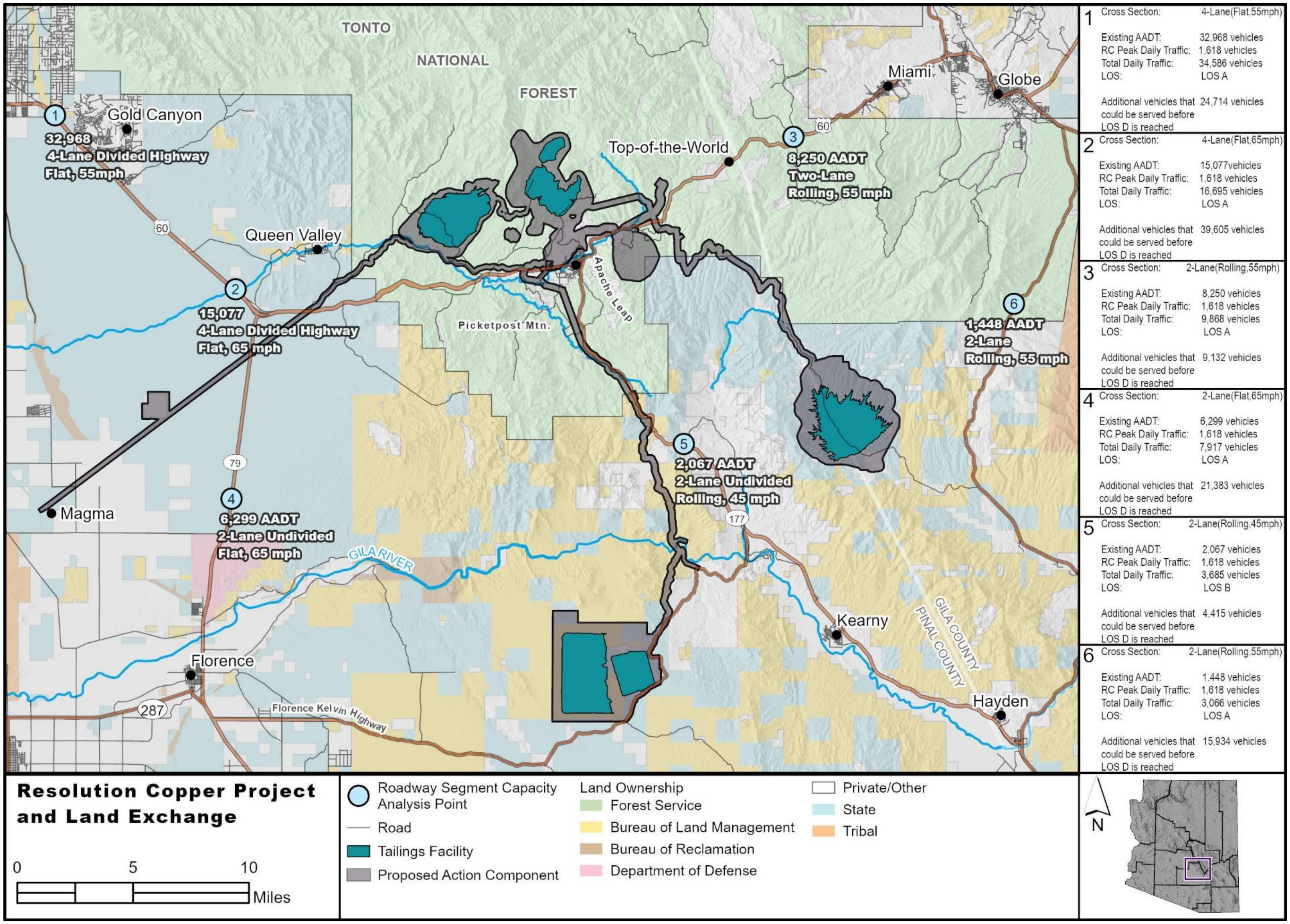


Figure 3.5.4-2. Roadway segment capacity

Transportation Routes and Changes in Access

Changes in access to the NFS road system as a result of the proposed activities at the East Plant Site, West Plant Site, and filter plant and loadout facility are shown in table 3.5.4-4. Approximately 8.0 miles of NFS roads are expected to be decommissioned or lost.

The primary impacts occur from the subsidence area development and include large portions of NFS Roads 315 and 3153. These roads provide access to areas that include Apache Leap and Devil's Canyon as well as connectivity to other NFS roads. Access would still be available to these areas, but those routes may not be as direct or convenient. Resolution Copper may keep portions of the property open for public access, as feasible, but the roads that pass through the Oak Flat Federal Parcel are not expected to remain open.

All alternatives would involve impacts on Silver King Mine Road and NFS Road 229, which provide through travel to the highlands north of Superior, as well as to private inholdings in the Tonto National Forest. All alternatives would maintain access to these areas; for Alternative 4, access would be administrative due to the presence of the tailings storage facility.

Table 3.5.4-4. Miles of NFS roads decommissioned and lost for East Plant Site, West Plant Site, and filter plant and loadout facility

Facility	Tonto National Forest NFS Roads Decommissioned and Lost (miles)*	Resolution Copper Applicant-Committed Improvements and Maintenance
West Plant Site: Total Roads	2.54	
NFS Road 1010	0.37	Level 1
NFS Road 229	2.17	Portions reconstructed to level 3
East Plant Site/Subsidence Area: Total Roads	5.45	
NFS Road 2432	0.78	None
NFS Road 2433	0.23	None
NFS Road 2434	0.29	None
NFS Road 2435	0.28	None
NFS Road 2438	0.32	None
NFS Road 3153	1.19	None
NFS Road 3791	0.1	None
NFS Road 315	2.28	None
San Tan Valley Filter Plant and Loadout Facility: Total Roads	0.0	None

Notes: Roads intersected by pipeline corridors or transmission line corridors are considered to remain open.

Level 1 – Basic custodial care; Level 2 – High-clearance vehicles; Level 3 – Suitable for passenger cars

* Includes West Plant Site, East Plant Site, subsidence area, and maximum impact acreage for Silver King Mine Road alignment. Road segments less than 0.05 mile not shown.

Roadway Maintenance

Transportation of personnel, equipment, supplies, and materials related to mine development, operation, and reclamation could increase roadway maintenance requirements. Increased traffic can contribute to earlier and more extensive deterioration of road surfaces, therefore requiring more frequent and higher levels of maintenance.

Road maintenance and repair activities currently are the responsibility of the governing jurisdiction (Town of Superior, Pinal County, or ADOT). Resolution Copper will also need to obtain Forest Service

Road Use Permits, which grant Resolution Copper the authorization to perform road maintenance or reconstruction on NFS roads. These permits are part of the decision to be authorized in the ROD resulting from this EIS process. All roadways, including the primary roadways used by the project (U.S. 60, SR 177, and SR 79), are designed to incorporate growth in background traffic volumes into the design life of the pavement structure. Increases in traffic are accounted for in the design of existing roadways and do not require separate mitigation. One location brought forth for mitigation by Resolution Copper is the section of Main Street from U.S. 60 to Lonetree Road. The current road use plan uses the existing West Plant Site entrance at the Main Street/Lonetree Road intersection as the only allowed entrance during construction and operations for employees and deliveries. Based on the concentration of traffic onto this single section of Main Street, Resolution Copper agreed to cover increased maintenance costs for road degradation caused by mine traffic (Southwest Traffic Engineering LLC 2020a). A more detailed discussion of the economic effects of increased traffic in the vicinity of the Resolution Copper Project is available in Section 3.13, Socioeconomics.

Material/equipment trips during peak construction and normal operation may require oversize loads. However, the exact size and timing of these loads currently are not known. Arizona law requires overweight/oversize vehicles delivering supplies on the Arizona transportation system to obtain permits from ADOT at the time of travel, and this information is not required as part of the EIS process. These permits outline specific criteria for use of such transports and include separate engineering analysis. Resolution Copper will also need to obtain Forest Service Road Use Permits for such vehicles traveling on NFS roads. These permits are part of the decision to be authorized in the ROD resulting from this EIS process.

Railroads

Arizona regulates rail traffic to prevent excessive delays. Rail speeds are governed by Federal law and ARS 40-845, which limits gate down times to a maximum of 15 minutes per occurrence. Resolution Copper intends to follow Federal and State law to prevent delays when rail use is instituted (Southwest Traffic Engineering LLC 2020b).

According to the GPO (Resolution Copper 2016c), during the peak production years of the mine an average of 0.8 train sets per day is expected to enter/exit the San Tan Valley filter plant and loadout facility via the MARRCO corridor, with a typical train set being 100 cars in length. The typical covered hopper rail car is upwards of 65 feet in length with an estimated 75 feet for each engine required to pull a 11,000-ton load. This results in a total train length of approximately 7,000 feet. Per the current Federal Rail Authority crossing inventory database, the MARRCO corridor is currently rated for a travel speed between 5 and 10 mph (Federal Railroad Administration Office of Safety Analysis 2020). No gate-down time for switching is anticipated at the connection to the main rail line. The estimated increase to gate-down time at the Attaway Road/Judd Road intersection is one occurrence of 8–15 minutes each day, consistent with Federal and State law. Also, Federal Rail Authority data indicate no trains currently cross this location or the other MARRCO corridor crossing locations between 6:00 a.m. and 6:00 p.m.

Alternative 4 – Silver King requires approximately two trains per day during peak operations to deliver materials along the MARRCO corridor from the West Plant Site to the main rail line. The trains are expected to arrive and depart during the night shift. Due to their overnight operations, the trains are expected to be inconsequential to the operations of the road network.

For safety purposes, it is recommended that Resolution Copper work with ADOT to update signage at highway and NFS road/railroad-grade crossings.

Safety

Collision data on U.S. 60 at Silver King Mine Road and Main Street were obtained from ADOT's Traffic Records Section and reviewed as part of the traffic impact analysis to determine if any trends could be observed. Selection of these intersections was based on proximity to the town of Superior and the concentration of mine-related traffic in the vicinity. Outside of these intersections, mine-related traffic represents less than 2 percent of daily traffic. Records for the most recent 5-year period are shown in table 3.5.4-5 (Southwest Traffic Engineering LLC 2020b).

Table 3.5.4-5. U.S. 60 intersection crash summary

Year	U.S. 60/Silver King Mine Road	U.S. 60/Main Street
2014	0	1 (rear-end)
2015	0	1 (left-turn)
2016	0	0
2017	0	0
2018	0	0
5-Year Total	**0**	**2**

The available collision data do not reveal any crash patterns or trends at the study intersections that require mitigation by the Resolution Copper expansion.

A single left-turn collision was reported at the U.S. 60/Main Street intersection in 2015 (pre-construction conditions completed on U.S. 60). However, with an additional 611 eastbound left-turn trips at this intersection during construction, along with 133 eastbound left-turn mine trips during normal operations, this intersection will require monitoring for potential safety mitigation, as described in the "Mitigation Effectiveness" section (Southwest Traffic Engineering LLC 2020b).

Moreover, as discussed in the "Highway Segment Traffic Volume and Level of Service" subsection above, the impacts of additional heavy vehicles to SR 77, SR 79, and SR 177 were evaluated.
We anticipate 66 heavy vehicles daily as part of the peak construction and continuing operation of the West Plant Site, East Plant Site, and tailings storage facility. After accounting for trip distribution on each highway, the added truck traffic represents up to 2 percent increase in the total number of trucks on these facilities, compared with existing volumes. There were no recorded bicycle collisions on either SR 177 or SR 77 and only a single pedestrian collision on the impacted segment of SR 177 since 2009.
The available crash data do not reveal any existing crash patterns or trends that would be adversely impacted by the 2 percent increase in heavy vehicle usage.

Changes in Access

Resolution Copper mine-related trips will not establish new access onto U.S. 60 or other state highways under any of the proposed action alternatives. No permits for new access to ADOT facilities are anticipated at this time.

3.5.4.3 Alternative 2 and Alternative 3 – Near West

Mine-Related Traffic

Table 3.5.4-6 summarizes the facility footprint and intersections impacted by mine-related traffic at each tailings storage facility alternative. For Alternatives 2 and 3, the tailings storage facility is located at the same site and the traffic impacts are the same; therefore, the results for these two alternatives have been grouped together.

Table 3.5.4-6. Footprint and intersections impacted by each tailings storage facility location

Alternative	Footprint within Tailings Storage Facility Fence Line (acres)	Intersections Impacted by Traffic
Alternatives 2 and 3 – Near West	4,903	U.S. 60 and Hewitt Station Road
Alternative 4 – Silver King	5,660	U.S. 60 and Silver King Mine Road
Alternative 5 – Peg Leg	10,781	SR 79 and Florence-Kelvin Highway SR 177 and Florence-Kelvin Highway Florence-Kelvin Highway and Peg Leg Road
Alternative 6 – Skunk Camp	9,281	SR 77 and Dripping Springs Road

Table 3.5.4-7 shows the total number of trips expected during the peak hour for each alternative (50 percent of trips are assumed to be inbound and 50 percent outbound during the peak hour). Alternatives 2 and 3 involve 64 daily trips during construction and 46 daily trips during normal operations.

Table 3.5.4-7. Site-generated trips during peak hour for each alternative

Alternative	Peak Construction		Normal Operations	
	Employee Trips (vehicle trips per hour)	Material/ Equipment Trips (vehicle trips per hour)	Employee Trips (vehicle trips per hour)	Material/ Equipment Trips (vehicle trips per hour)
Alternatives 2 and 3 – Near West	42	22	24	22
Alternative 4 – Silver King	66	22	36	22
Alternative 5 – Peg Leg	44	22	24	22
Alternative 6 – Skunk Camp	42	22	24	22

Note: Peak-hour employee and material/equipment trips are assumed to be inbound during the a.m. peak hour and outbound during the p.m. peak hour.

Analysis includes assumptions designed to estimate peak-hour employee trips based on the number of employees working at each facility:

- There would be several different employee types and shift times/lengths at the mining facilities. A shift reduction factor of 0.66 was applied to estimate the number of employees traveling to/from the site during the peak hour.
- It was assumed that employees would arrive during the a.m. peak hour, and depart during the p.m. peak hour.
- To factor in employee carpooling, it was assumed that each vehicle entering the site would carry an average of 1.7 employees. This is based on data provided by Resolution Copper for observed carpooling behavior of staff at the existing Resolution Copper Mine.

Intersection Traffic Volume and Level of Service

Table 3.5.4-8 shows the delay and LOS for each alternative (Southwest Traffic Engineering LLC 2017, 2018, 2020b), with and without the project, during peak construction (year 2022) and normal operations (year 2027).

Table 3.5.4-8. Level of service and delay for tailings storage facility alternate locations for p.m. / a.m. during peak construction (2022) and normal operations (2027)

Alternative	Intersection	2022 without Project		2022 with Project		2027 without Project		2027 with Project	
		LOS Rank p.m. / a.m.	Delay (seconds per vehicle)	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)
Alternatives 2 and 3 – Near West Location	**Hewitt Station Road (NFS Road 357)/Eastbound U.S. 60**								
	Northbound Through/Right	A	0.0	A	0.0	A	0.0	A	0.0
	Southbound Left/Through	B	10.6	B	11.3	B	10.9	B	11.4
	Hewitt Station Road (NFS Road 357)/Westbound U.S. 60								
	Northbound Left/Through	C	15.1	C	15.6	C	15.5	C	16.4
	Southbound Through/Right	B	13.7	B	12.1	B	13.9	B	12.9
Alternative 4 – Silver King Location	**Silver King Mine Road (NFS Road 229)/U.S. 60***								
	Eastbound Left	A	9.2	B	13.1	A	9.5	B	11.0
	Westbound Left	A	8.6	B	11.2	A	8.8	A	9.9
	Northbound Left/Through/Right	C	18.6	F	>120	C	20.9	E	45.4
	Southbound Left/Through/Right	C	17.8	F	105.7	C	19.4	D	33.1
Alternative 5 – Peg Leg Location	**Florence- Kelvin Highway/SR 79**								
	Westbound Left/Right	B	10.1	B	10.4	B	10.4	B	10.6
	Southbound Left	A	7.9	A	7.9	A	7.9	A	8.0
	Florence-Kelvin Highway/SR 177								
	Eastbound Left/Right	A	9.3	A	9.9	A	9.5	A	9.9
	Northbound Left/Through	A	7.6	A	7.6	A	7.6	A	7.6
	Florence-Kelvin Highway/Peg Leg Road								
	Eastbound Left/Right	n/a	n/a	A	8.8	n/a	n/a	A	8.7
	Northbound Left/Through	n/a	n/a	A	7.3	n/a	n/a	A	7.3
Alternative 6 – Skunk Camp Location	**Dripping Springs Road/SR 77**								
	Eastbound Left/Right	A	9.1	A	9.8	A	9.2	A	9.8
	Northbound Left/Through	B	7.4	A	7.4	A	7.4	A	7.5

Alternative	Intersection	2022 without Project		2022 with Project		2027 without Project		2027 with Project	
		LOS Rank p.m. / a.m.	Delay (seconds per vehicle)	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)	LOS Rank p.m. / a.m.	Delay (seconds per vehicle)
Alternatives 2, 3, 5, and 6	**Silver King Mine Road (NFS Road 229)/U.S. 60†**								
	Eastbound Left	A / A	9.0 / 8.1	B / A	12.5 / 8.2	A / A	9.3 / 8.3	B / A	10.7 / 8.3
	Westbound Left	A / A	8.8 / 8.0	A / B	8.7 / 10.5	A / A	9.0 / 8.1	A / A	8.9 / 9.1
	Northbound Left/Through/Right	C / B	20.3 / 11.8	D / D	32.1 / 25.2	C / B	23.1 / 12.3	D / C	27.9 / 17.0
	Southbound Left/Through/Right	C / B	20.0 / 12.9	E / C	41.8 / 18.7	C / B	22.8 / 13.6	D / C	28.0 / 16.2

Notes: Shaded cells indicate a LOS of E or F, which is considered inadequate by ADOT; n/a = not applicable.

* LOS and delay information based on Southwest Traffic Engineering LLC (2017).

† Southwest Traffic Engineering LLC (2017) assessed a single, daily peak hour based on the sum of trips generated during the a.m. and p.m. peak periods. This was later updated at select intersections to include a detailed analysis of both a.m. and p.m. operations separately (Southwest Traffic Engineering LLC 2020b). The a.m. and p.m. peak analysis revealed the single peak hour approach assumed in the 2017 analysis was conservative.

For Alternatives 2 and 3, the intersections adjacent to the tailings storage facility alternatives are expected to continue operating at an adequate LOS during both peak construction and normal operations. No right- or left-turn lanes are required at the study intersections providing access to the tailings storage facility alternatives. The northbound land group at the Silver King Mine Road/U.S. 60 intersection degrades from LOS C to LOS F during construction, and to LOS E during operations. The southbound lane group degrades from LOS C to LOS F during construction, and returns to LOS D during operations.

Transportation Routes and Changes in Access

Mine development has the potential to permanently alter, add, or decommission NFS roads or temporarily restrict access to NFS roads and lands, which could impact forest users and permittees. Some roads cut off by the perimeter fence would result in dead-end conditions. Ongoing and future travel management planning would determine which, if any, of these dead-end roads should be closed or decommissioned. These new conditions would result in site-specific and user-specific impacts, depending upon an individual's preference for using an NFS road.

Under all action alternatives, public access would not be allowed on any roads within the perimeter fence for security purposes and in order to protect public health and safety. This may conflict with the ongoing travel management goals of maintaining NFS roads for public use to the degree reasonable. All NFS roads and unauthorized roads on NFS land within the perimeter fence or roads on NFS land outside the perimeter fence that would no longer be accessible would be either decommissioned, rerouted to connect to another road, changed to administrative-only access, or have a turnaround constructed near the perimeter fence. Roadway decommissioning details would be developed by the Forest Service when the time for permanent closure is closer and more information is available. The NFS roads expected to be decommissioned or otherwise lost to public access for Alternatives 2 and 3 are shown in table 3.5.4-9.

Approximately 21.7 miles of NFS roads are expected to be decommissioned or lost. The roads impacted by the tailings storage facility are largely local to the tailings area and one route does provide through travel to other areas of the Tonto National Forest. Access would still be available to these areas but those routes may not be as direct or convenient.

All NFS roads that would be used by Resolution Copper and also remain open to the public would be maintained by Resolution Copper, and road improvements would be made when needed to maintain public safety. Table 3.5.4-10 describes the disturbance from new access roads associated with each alternative.

Table 3.5.4-9. Miles of NFS roads decommissioned and lost for Alternatives 2 and 3 tailings storage facility

Facility	Tonto National Forest NFS Roads Decommissioned and Lost (miles)	Resolution Copper Applicant-Committed Improvements and Maintenance
Alternatives 2 and 3 – Near West: Total Roads*	21.70	
NFS Road 2386	0.20	Portions restored to level 1
NFS Road 1903	2.68	None
NFS Road 1907	1.82	None
NFS Road 1909	0.36	None
NFS Road 1910	0.41	None
NFS Road 1912	0.54	None
NFS Road 1913	0.29	None
NFS Road 1914	0.29	None

Facility	Tonto National Forest NFS Roads Decommissioned and Lost (miles)	Resolution Copper Applicant-Committed Improvements and Maintenance
NFS Road 1915	0.39	None
NFS Road 1916	0.22	None
NFS Road 1917	0.40	None
NFS Road 1918	0.23	None
NFS Road 1919	0.40	None
NFS Road 2359	2.22	None
NFS Road 2360	1.33	None
NFS Road 2361	0.37	None
NFS Road 2362	0.31	None
NFS Road 2363	0.37	None
NFS Road 2364	0.59	None
NFS Road 2366	0.05	None
NFS Road 2380	0.96	None
NFS Road 252	3.36	Portions reconstructed to level 2
NFS Road 3450	0.26	None
NFS Road 518	2.41	None
NFS Road 982	1.10	Portions reconstructed to level 2
NFS Road 3455	0.08	None
NFS Road 357	0.06	Maintained (level not specified)

Notes: Level 1 – Basic custodial care; Level 2 – High-clearance vehicles; Level 3 – Suitable for passenger cars

* Includes tailings facility (within fence line) and borrow area footprints; does not include pipeline or transmission line corridors, which are assumed to allow roads to remain open. Road segments less than 0.05 mile not shown.

Table 3.5.4-10. New access roads for tailings storage facility alternatives

Alternative	New Access Roads
Alternatives 2 and 3 – Near West	This alternative would include rerouting Silver King Mine Road (NFS Road 229) to maintain through-access.
Alternative 4 – Silver King	This alternative involves rerouting of Silver King Mine Road for deliveries to the West Plant Site. The new access road would be about 1 mile in length. The new access road reduces the use of Silver King Mine Road (NFS Road 229) to 0.4 mile, but infrequent use along NFS Road 229, north of the MARRCO corridor would continue for accessing the SRP substation.
Alternative 5 – Peg Leg	This alternative would include rerouting Silver King Mine Road (NFS Road 229) to maintain through-access. Most access roads would follow existing routes. However, some new access roads would be needed along the tailings conveyance pipeline corridor. Additional access roads for the tailings pipeline alignment would include 2.2 miles or 9 acres of new disturbance.
Alternative 6 – Skunk Camp	This alternative would include rerouting Silver King Mine Road/NFS Road 229 to maintain through access. New access roads would be needed along the tailings conveyance pipeline corridor, including 4 acres of new disturbance. The main access road would follow the collocated pipeline/powerline corridor for 19 miles from West Plant Site to tailings storage facility, using existing roads where possible.

3.5.4.4 Alternative 4 – Silver King

Mine-Related Traffic

Table 3.5.4-6 summarizes the facility footprint and intersections impacted by mine-related traffic at each tailings storage facility alternative. Table 3.5.4-7 shows the total number of trips expected during the peak hour for each alternative (50 percent of trips are assumed to be inbound and 50 percent outbound during the peak hour). Alternative 4 involves 88 trips in the peak hour during construction and 58 trips in the peak hour during normal operations. Alterative 4 is unique in that it also involves relocating the filter plant and loadout facility from San Tan Valley to the West Plant Site. Thus, more employees are needed for the Silver King alternative than the other alternatives. In general, more employees are needed during peak construction than normal operations.

Intersection Traffic Volume and Level of Service

Table 3.5.4-8 shows the delay and LOS for each alternative, with and without the project, during peak construction (year 2022) and normal operations (year 2027). For Alternative 4, the Silver King Mine Road/U.S. 60 intersection, northbound, degrades from LOS C to LOS F during construction, and to LOS E during operations. The southbound lane group degrades from LOS C to LOS F during construction, and returns to LOS D during operations.

Transportation Routes and Changes in Access

The NFS roads expected to be decommissioned or otherwise lost to public access for Alternative 4 are shown in table 3.5.4-11.

Approximately 17.7 miles of NFS roads are expected to be decommissioned or lost. The roads impacted by the tailings storage facility provide through-travel to other areas of the Tonto National Forest, including some recreation loops and private inholdings (including Silver King Mine). Access would still be available to the recreation areas but those routes may not be as direct or convenient. Administrative access would be maintained on NFS Road 229 in order to provide through-travel to private inholdings.

All NFS roads that would be used by Resolution Copper and also remain open to the public would be maintained by Resolution Copper, and road improvements would be made when needed to maintain public safety. Table 3.5.4-11 describes the disturbance from new access roads associated with each alternative.

Table 3.5.4-11. Miles of NFS roads decommissioned and lost for Alternative 4 tailings storage facility

Facility	Tonto National Forest NFS Roads Decommissioned and Lost (miles)*	Resolution Copper Applicant-Committed Improvements and Maintenance
Alternative 4 – Silver King: Total Roads	17.70	
NFS Road 229	1.97	Portions reconstructed to level 3
NFS Road 1010	0.32	None
NFS Road 1053	1.46	None
NFS Road 2358	0.22	None
NFS Road 2371	0.38	None
NFS Road 2374	0.78	None
NFS Road 2375	0.41	None
NFS Road 2386	0.20	Portions restored to level 1

Facility	Tonto National Forest NFS Roads Decommissioned and Lost (miles)*	Resolution Copper Applicant-Committed Improvements and Maintenance
NFS Road 2389	0.82	None
NFS Road 2442	0.39	None
NFS Road 2443	0.12	None
NFS Road 2444	0.18	None
NFS Road 2445	0.61	None
NFS Road 2446	0.14	None
NFS Road 2447	0.65	None
NFS Road 2448	1.18	None
NFS Road 2449	0.25	None
NFS Road 2450	0.06	None
NFS Road 2451	0.12	None
NFS Road 2452	1.43	None
NFS Road 3152	0.55	Portions reconstructed to level 3
NFS Road 3787	0.14	None
NFS Road 650	3.62	None†
NFS Road 982	1.70	None†

Note: Level 1 – Basic custodial care; Level 2 – High-clearance vehicles; Level 3 – Suitable for passenger cars

* Includes tailings facility (within fence line) and borrow area footprints; does not include pipeline or transmission line corridors, which are assumed to allow roads to remain open. Road segments less than 0.05 mile not shown.

† The GPO indicates reconstruction of portions of these roads to level 2, but those actions were specific to the tailings storage facility at the Near West location.

3.5.4.5 Alternative 5 – Peg Leg

Mine-Related Traffic

Table 3.5.4-6 summarizes the facility footprint and intersections impacted by mine-related traffic at each tailings storage facility alternative. Table 3.5.4-7 shows the total number of trips expected during the peak hour for each alternative (50 percent of trips are assumed to be inbound and 50 percent outbound during the peak hour). Alternative 5 involves 66 trips in the peak hour during construction and 46 trips in the peak hour during normal operations.

Intersection Traffic Volume and Level of Service

Table 3.5.4-8 shows the delay and LOS for each alternative, with and without the project, during peak construction (year 2022) and normal operations (year 2027). For Alternative 5, the intersections adjacent to the tailings storage facility alternatives are expected to continue operating at an adequate LOS during both peak construction and normal operations.

Transportation Routes and Changes in Access

Alternative 5 would not result in the loss or decommissioning of any additional NFS roads due to the tailings storage facility. BLM estimates that the Alternative 5 footprint would directly affect approximately 29 miles of inventoried routes, with additional indirect effects from through disruption of existing routes. The BLM land in the area is designated under OHV regulations as “Limited to Existing Roads and Trails.” The area includes existing primitive roads and trails, and the tailings facility would cause the loss of access and disrupt the continuity of existing routes. BLM also has identified potential loss of access to mining activities and grazing facilities as concerns for Alternative 5.

3.5.4.6 Alternative 6 – Skunk Camp

Mine-Related Traffic

Table 3.5.4-6 summarizes the facility footprint and intersections impacted by mine-related traffic at each tailings storage facility alternative. Table 3.5.4-7 shows the total number of trips expected during the peak hour for each alternative (50 percent of trips are assumed to be inbound and 50 percent outbound during the peak hour). Alternative 5 involves 64 trips in the peak hour during construction and 46 trips in the peak hour during normal operations.

Traffic Volume and Level of Service

Table 3.5.4-8 shows the delay and LOS for each alternative, with and without the project, during peak construction (year 2022) and normal operations (year 2027). For Alternative 6, the intersections adjacent to the tailings storage facility alternatives are expected to continue operating at an adequate LOS during both peak construction and normal operations.

Transportation Routes and Changes in Access

Alternative 6 would be wholly located on private lands (after assumed acquisition of State Trust lands) and would impact 5.7 miles of Dripping Springs Road. BLM has identified the potential loss of access to mining activities and grazing facilities as concerns for Alternative 6.

3.5.4.7 Cumulative Effects

Full details of the cumulative effects analysis can be found in chapter 4. The following represents a summary of the cumulative impacts resulting from the project-related impacts described in Section 3.5.4, Environmental Consequences, that are associated with transportation and access, when combined with other reasonably foreseeable future actions.

The following actions were determined through the cumulative effects analysis process to be reasonably foreseeable, and have impacts that likely overlap in space and time with impacts from the Resolution Copper Project:

- ADOT Pinal County North-South Corridor
- Ray Land Exchange and Proposed Plan Amendment
- Ripsey Wash Tailings Project
- Silver Bar Mining Regional Landfill and Cottonwood Canyon Road

The cumulative effects analysis area for transportation is the roads adjacent to the mine and the regional transportation routes, since traffic from both the Resolution Copper Project and other reasonably foreseeable future actions would potentially travel these same routes. The metric used to quantify traffic and access cumulative impacts is the combined additional volume of traffic on road segments. Increased traffic impacts would be felt by residents, travelers, and users either on road segments or at intersections, and increased volume over existing levels is associated with reductions in level of service, increased travel times, and potential for increased accidents.

The transportation and access cumulative effects analysis area includes approximately 150 miles of major roadways and approximately 38 miles of minor roadways. The locations identified where overlaps in project-related traffic could occur are SR 177 and U.S. 60.

- SR 177. Based on the analysis in section 3.5.4, the current traffic load on SR 177 is 2,067 vehicles per day, with an anticipated 1,618 vehicles per day added by the Resolution Copper Project. The analysis further estimates that SR 177 could accept an additional 4,415 vehicles before reaching unacceptable levels of service (see figure 3.5.4-2 segment #5). Given the minimal number of vehicles from the Ripsey Wash Tailings Project (155 per day), and the assumption that a portion of the Ray Land Exchange traffic would replace existing Ray Mine traffic on SR 177, the cumulative effect on SR 177 would be unlikely to reach unacceptable levels due to the combination of Resolution Copper Project traffic with traffic from these three reasonably foreseeable future actions.
- U.S. 60. Based on the analysis in section 3.5.4, the current traffic load on U.S. 60 is 15,077 vehicles per day, with an anticipated 1,618 vehicles per day added by the Resolution Copper Project. The analysis further estimates that U.S. 60 could accept an additional 39,605 vehicles per day before reaching unacceptable levels of service (see figure 3.5.4-2 segment #2). The amount of traffic from Silver Bar landfill is unknown, but it appears the cumulative effect on U.S. 60 would be negligible due to the large available capacity of the roadway, and the route would be unlikely to reach unacceptable levels due to the combination of Resolution Copper Project traffic with traffic from these three reasonably foreseeable future actions.
- The proposed ADOT Pinal County North-South Corridor could reduce current traffic volumes on SR 177 and U.S. 60 by shifting trips on these roadways to the new roadway. Furthermore, the anticipated trips associated with the Resolution Copper Project would also use a new roadway built within the North-South Corridor. This would increase trip distribution on all major roadways serving the area, thus reducing the likelihood of any of the roadways reaching unacceptable levels of service due to the combination of Resolution Copper Project traffic with traffic from these four reasonably foreseeable future actions.

The new Queen Creek Bridge and Waterfall Canyon Bridge on U.S. 60 have ongoing construction that will last into 2026, resulting in occasional restrictions and closures. The previous bridges had reached the end of their lifespans and no longer met current bridge design standards, necessitating their replacement. The restrictions and closures are unlikely to overlap in time with the Resolution Copper Project.

3.5.4.8 Mitigation Effectiveness

Mitigation Identifier and Title	Authority to Require
FS-TA-01: New mitigation aspects of revised road use plan	Required – Forest Service
FS-RC-03: Mitigation for adverse impacts to recreational trails (Tonto National Forest multi-use trail plan)	Required – Forest Service
RC-SO-06: Agreement with Town of Superior to cover direct costs	Committed – Resolution Copper

We developed a robust monitoring and mitigation strategy to avoid, minimize, rectify, reduce, or compensate for resource impacts that have been identified during the process of preparing this EIS. Appendix J contains descriptions of mitigation measures that are being required by the Forest Service and mitigation measures voluntarily brought forward and committed to by Resolution Copper. Appendix J also contains descriptions of monitoring that would be needed to identify potential impacts and mitigation effectiveness.

This section contains an assessment of the effectiveness of design features associated with mitigation and monitoring measures found in appendix J that are applicable to transportation and access. See appendix J for full descriptions of each measure noted below.

Mitigation Effectiveness and Impacts of Forest Required Mitigation Measures Applicable to Transportation and Access

Appendix J contains mitigation and monitoring measures being required by the Forest Service under its regulatory authority or because these measures are required by other regulatory processes (such as the Biological Opinion). These measures are assumed to occur, and their effectiveness and impacts are disclosed here. The unavoidable adverse impacts disclosed below take the effectiveness of these mitigations into account.

New mitigation aspects of revised road use plan (FS-TA-01). Implementing the revised road use plan would help reduce the conflicts with existing traffic and recreational road users that would occur during construction and operations. However, implementation of the plan would not be effective at maintaining the current level of service for some intersections, and these traffic impacts would remain. New mitigation measures aimed at reducing disclosed impacts would be incorporated. These mitigation measures would be effective at reducing the impacts of road and pipeline crossing, especially with the Arizona National Scenic Trail, maintaining access east of Oak Flat, maintaining access for recreation activities, and reducing traffic impacts in the town of Superior by changing the location of employee access to the West Plant Site.

Mitigation for adverse impacts to recreational trails (Tonto National Forest multi-use trail plan) (FS-RC-03). Implementation of this plan would replace over 20 miles of motorized and non-motorized trail on Tonto National Forest around Superior. The Oak Flat area is heavily used for recreation, and the loss of Federal land base due to the land exchange (and the tailings storage facilities for some alternatives) would put pressure on remaining recreation areas. This plan would be effective at expanding the motorized and non-motorized travel routes and recreational opportunities in a sustainable manner consistent with Tonto National Forest management direction.

Mitigation Effectiveness and Impacts of Resolution Committed Mitigation Measures Applicable to Transportation and Access

Appendix J contains mitigation and monitoring measures committed by Resolution Copper in contractual, financial, or other agreements. These measures are assumed to occur, and their effectiveness and impacts are disclosed here. However, the unavoidable adverse impacts disclosed below do not take the effectiveness of these mitigations into account as they are not within the authority of the Forest Service to ensure.

Agreement with Town of Superior to cover direct costs (RC-SO-06). There is the potential for impacts to the transportation network within the town of Superior, including increased road maintenance costs due to traffic from the mine, and the potential for mitigation measures related to increased traffic volume and public safety. Resolution Copper has reached agreement with the Town of Superior to offset costs to the Town that are a direct result of the mine. This measure would be effective at eliminating these transportation impacts.

Mitigation Effectiveness and Impacts of Resolution Voluntary Mitigation Measures Applicable to Transportation and Access

Appendix J contains several other potential future mitigation measures that the Forest Service is disclosing as potentially useful in mitigating adverse effects, but for which there is no authority to require. There is no expectation that these measures would occur, and therefore the effectiveness is not considered in the EIS. No potential future mitigation measures were identified that are applicable to transportation and access.

Unavoidable Adverse Impacts

Increased traffic associated with mine worker commuting and truck traffic to and from the mine is expected to result in impacts that cannot be avoided or fully mitigated, including increased traffic congestion and increased risk of traffic accidents. Decreases in LOS to subpar levels (LOS E or F) would occur at several intersections due to mine traffic during both peak construction years and normal operations.

Access to the Oak Flat area, including Devil's Canyon and Apache Leap, would be maintained to an extent, but would use less-direct routes than NFS Road 315, which currently provides the primary access. Loss of access to these areas would be mitigated, but not fully.

Loss of access to the highlands north of the West Plant Site would be fully offset for Alternatives 2, 3, 5, and 6 by rerouting the road. Loss of access to the general public under Alternative 4 would not be mitigated by this measure, as only administrative access would be maintained.

All alternatives, including Alternative 6, could result in some loss of access to other authorized land uses (e.g., mineral exploration, livestock grazing, wildlife hunting) in the area around the tailings storage facilities.

3.5.4.9 Other Required Disclosures

Short-Term Uses and Long-Term Productivity

Impacts from increased mine-related traffic would be short term and would cease when the mine is closed.

Irreversible and Irretrievable Commitment of Resources

Irretrievable impacts on transportation and access would occur as a result of an increase of traffic on State, County, and public NFS roads from mining and related activities within the analysis area and from the reduction of public access to roads within the perimeter fence. Because mine-related traffic would cease after mine closure, traffic impacts would not be considered an irreversible commitment of resources. Existing roads that would be decommissioned within the perimeter fence of the mine would constitute both an irreversible and irretrievable commitment of resources. Roads that are permanently covered with tailings or within the subsidence area would be an irreversible commitment, whereas those that are cut off to public access by the perimeter fence could potentially be restored or rerouted following mine closure and therefore are considered to be an irretrievable commitment of resources.

3.6 Air Quality

3.6.1 Introduction

Overview

Motorized mine equipment and vehicles, potential large-scale ground surface disturbance and conveyance, and placement of mine tailings can adversely affect air quality through emissions and wind-borne particulates generated during mining operations. Short- and long-term local air quality monitoring records, as well as regional monitoring of National Ambient Air Quality Standards (NAAQS), ozone (O_3), hazardous air pollutants (HAPs), anticipated effects on visibility, and other Federal and State emissions standards are key factors that help to analyze potential project impacts. Class I and Class II sensitive areas are of specific concern.

Air quality conditions are a valuable resource from an aesthetic and human health perspective, and they are subject to specific regulations that aim to protect that resource. Local and regional aspects of air quality may be affected by the proposed action and alternatives during construction, operations, and closure and reclamation. The applicable regulations and policies establish thresholds for evaluating air quality impacts, and this section includes a description of the existing environment and potential consequences (impacts on air quality) of the proposed action and alternatives under that regulatory framework. The regulatory framework protects aesthetic and human health conditions. Beyond regulation of specific contaminants, the Forest Service has further responsibility to consider the impacts of air quality to special areas like wilderness and national parks, and these effects are also considered in this section. We briefly summarize some aspects of the analysis in this section. Additional details not included are captured in the project record (Newell, Garrett, et al. 2018).

3.6.1.1 Changes from the DEIS

We received many public comments concerned with whether the air quality modeling adequately captures extreme wind or dust events. We added a discussion of the baseline monitoring conducted to support the modeling effort and the adequacy of that monitoring to capture such extreme weather events.

Since the maximum air quality impacts among the alternatives have highly similar results, in order to minimize bulk in the DEIS document we had kept results for the alternatives in reference materials, and presented results for only Alternative 2 in the DEIS text. We have now included results for all alternatives for comparison.

The cumulative effects analysis was revised for the FEIS to better quantify impacts and is described in detail in Chapter 4 and summarized in this section. Any mitigations developed between the DEIS and FEIS are summarized in appendix J and if applicable to air quality, are analyzed for effectiveness in this section.

3.6.1.2 Changes from the January 2021 Rescinded FEIS

The estimate of greenhouse gas emissions has been revised to reflect several changes. First, estimates of electricity use and the associated greenhouse gas emissions have been updated to reflect more current demand estimates. Second, in response to public comments, an estimate of greenhouse gas emissions from smelting has been added to the disclosure.

Further analysis to demonstrate conformity has been added to this section, the cumulative effects analysis was revised based on updates to the list of potentially reasonably foreseeable actions, and the section has been updated to reflect analysis of consistency with the new “Tonto National Forest Land Management Plan,” implemented in December 2023.

3.6.2 Analysis Methodology, Assumptions, and Uncertain and Unknown Information

3.6.2.1 Analysis Area

The full analysis area consists of the area modeled for potential air quality impacts (the "near field" and "far field" areas) and can be seen in figure 3.6.2-1. The physical nature of the emission, along with the location, operating times, and amount of emissions are developed for each emission source. The ambient air quality impacts are assessed at locations (receptors) that begin at the fence line or ambient air boundary of each of the plant sites (East Plant Site, West Plant Site, tailings storage facility, filter plant and loadout facility). The applicable regulations and policies have established thresholds for evaluating air quality impacts and include special provisions for sensitive areas (Class I areas such as national parks and wilderness areas, and certain sensitive Class II areas); these sensitive areas fall within the analysis area as well.

3.6.2.2 Methodology

Baseline Monitoring

Resolution Copper has established a baseline monitoring program, collecting baseline air quality and meteorological data since 2012 at three sites in the project area. Meteorological data were collected near the East Plant Site and West Plant Site and at the Hewitt station, which is near the base of the Near West (alternative) tailings storage facility. The collected data are representative of conditions near the project sources and used as input for dispersion modeling of emissions and impacts. The modeling effort used 2 years of meteorological data (2015 and 2016) as input to estimate impacts near each site.
The monitoring also collected baseline ambient air quality data at the same time, including nitrogen oxides (NO_X), sulfur dioxide (SO_2), ozone, particulate matter equal to and less than 10 microns in aerodynamic diameters (PM_{10}), and particulate matter equal to and less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$) at the East Plant Site, and PM_{10} and $PM_{2.5}$ at the West Plant Site. A monitoring plan that describes methods and procedures, designed to meet the requirements of 40 CFR Part 58, Appendix A and Appendix E, was approved for use in modeling by the PCAQCD in 2011 and again in 2016 (Air Sciences Inc. 2016; Walch 2019). Quarterly data summaries have been prepared and submitted to PCAQCD for review and comment, documenting ongoing system checks, data review, calibrations, and audits.

The modeling effort for the DEIS was completed in 2018, prior to the acceptance of the 2017 data, which continued to be collected by Resolution Copper; subsequently, Hampson et al. (2020) confirmed that modeling with the 2017 data would not change the modeled impacts. The monitoring effort effectively captures the adverse air quality conditions, including periods with high wind speeds, adverse stagnant air conditions, and the highest background air quality concentrations in the project area. EPA modeling protocols require only 1 year of on-site data for regulatory, permitting efforts; the modeling effort used 2 years' worth of data, which exceeds EPA requirements.

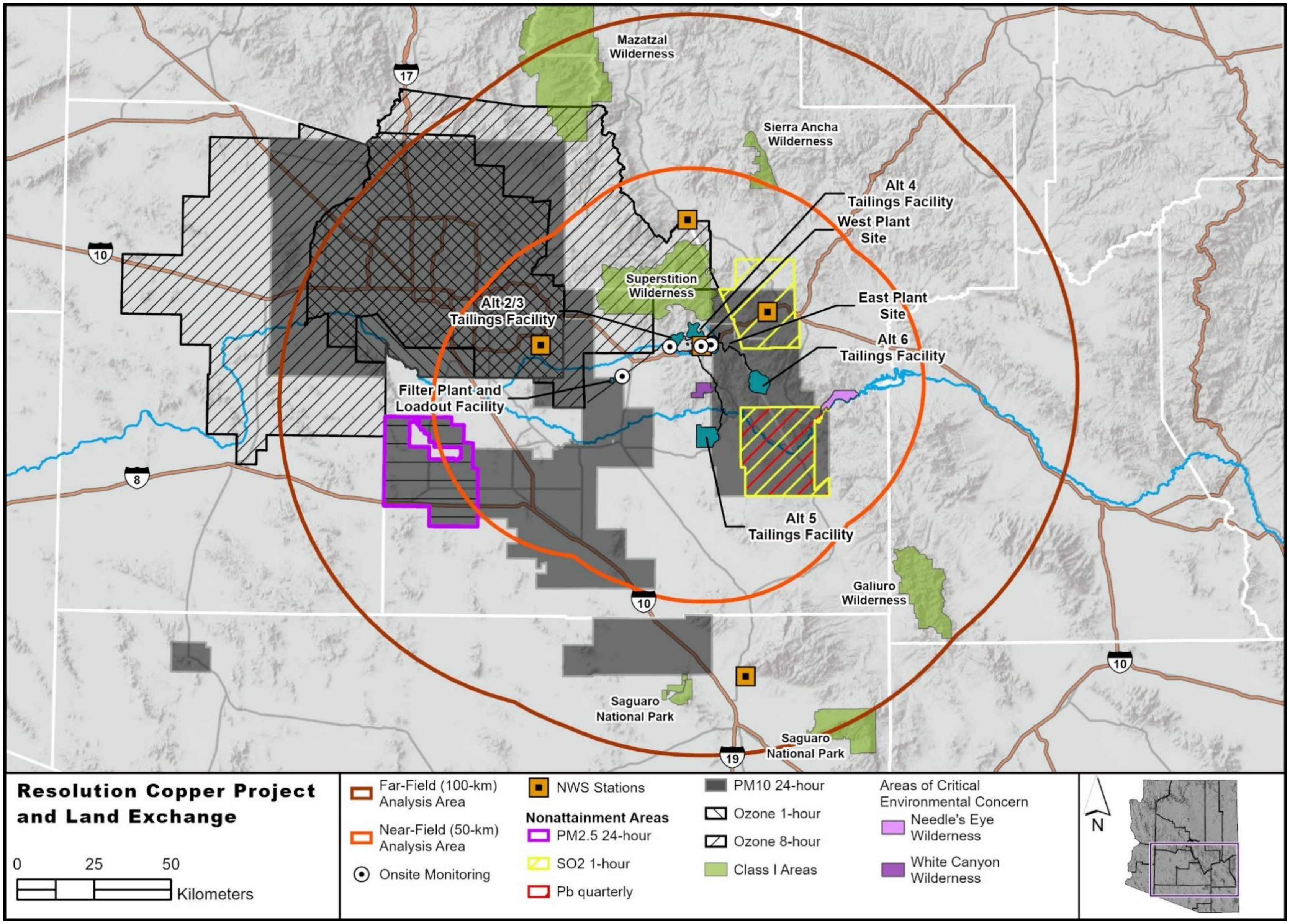


Figure 3.6.2-1. Analysis area showing proposed action and alternatives, sensitive areas, and meteorological monitoring sites

Air Quality Modeling and Direct Emission Amounts

The assessment of air quality impacts is a complex process that begins with identifying and characterizing the air emission sources and quantifying emission rates from the proposed action, based on the GPO. Air Sciences Inc. (2019b) identified the physical nature of the emissions, along with the location, operating times, and amount of emissions for each emission source. Modeling of these emissions, combined with background concentrations, is evaluated at the ambient air boundary[45] of each plant site (East Plant Site, West Plant Site, each alternative tailings storage facility, filter plant and loadout facility). Those boundaries are shown in figure 3.6.2-1.

Based on guidance from the ADEQ, the EPA, 40 CFR Part 51 Appendix W, and the Forest Service, analysts examined the impacts within 50 km ("near field") of the site locations with one model, and impacts beyond 50 km ("far field") with a different dispersion model (Arizona Department of Environmental Quality 2015; U.S. Forest Service et al. 2010). The EPA approves the AERMOD modeling system to determine impacts in the near field of the source or facility. A separate model platform, CALPUFF, is used to determine far field impacts from 50 to 100 km from the facility or operation. Each model requires a separate set of meteorological data to capture the atmospheric dispersion characteristics, and each model produces a gridded output of impacts at ground-level receptors. While the AERMOD dispersion models used 2 continuous years of site-specific meteorological data (2015–2016), the CALPUFF model used 3 years of gridded data (2015–2017).

Emissions vary over the life of the mine, with the maximum potential emissions occurring in year 14 (Air Sciences Inc. 2019b). At this point in time, process sources would be operating at maximum capacity. Depending on the source release characteristics, the emission sources were characterized as point, area, volume, or line sources. For example, *point* sources are used to model emissions that are released through a vent, stack, or opening. *Area* sources are used to model fugitive emissions sources such as wind erosion from disturbed surfaces, reentrained dust from roadways, and tailpipe emissions from motor vehicles. *Volume* sources are used to characterize emissions from material transfer processes; and emissions from roadways were modeled as *line* sources. Each group involves a different approach to characterizing emissions and estimating impacts at nearby receptors (Air Sciences Inc. 2018b). The total emissions for year 14 are provided in table 3.6.2-1 and include emissions for Alternative 2 (Air Sciences Inc. 2018c).

Table 3.6.2-1. Total annual controlled emissions for proposed action (tons/year)

Source Category	CO	NO_X	$PM_{2.5}$	PM_{10}	SO_2	VOC
Process	20.6	44.4	29.2	49.5	15.0	69.3
Fugitive	28.8	5.5	45.4	276.4	1.8	0.2
Mobile	566.0	68.5	3.2	2.9	1.0	33.2
Total	**615.9**	**118.4**	**77.8**	**328.9**	**17.8**	**102.7**

Notes: Totals may not sum exactly due to rounding.

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter 2.5 microns in diameter or smaller; PM_{10} = particulate matter 10 microns in diameter or smaller; SO_2 = sulfur dioxide; VOC = volatile organic compound

For an overall comparison of the potential air emissions from each alternative, the greatest potential difference in the estimated criteria pollutants, PM_{10} and $PM_{2.5}$, which are primarily fugitive dust emissions) and emissions of NO_X (from diesel-fired engines) can be reviewed. Total lead emissions

45 The "ambient air boundary" represents the location where air quality is modeled, including both background air quality and contributions from the project. NAAQS must be met at this boundary and beyond. For this project, the fence line at each facility along with an established area of restricted access was used to represent the ambient air boundary. Public access is excluded within this area. Therefore, ensuring that regulatory standards are met at this point is protective of public health.

would be 0.023 ton/year (46 pounds/year), and impacts are analyzed through a screening technique based on the fractional level in PM_{10} (Randall 2020b).

In addition to these criteria pollutant[46] emissions, there are small amounts of HAPs emitted from the proposed project (Newell, Garrett, et al. 2018). The estimated potential HAP emissions from the project are less than the major source thresholds (10 tons/year of any one HAP or 25 tons/year of all HAPs) under the National Emission Standards for Hazardous Air Pollutants (40 CFR 63). Therefore, the project would be classified as an area source and would be subject only to limited Maximum Achievable Control Technology standards for area sources, as listed in that regulation.

To meet regulatory requirements of the PCAQCD and the ADEQ, Resolution Copper performed dispersion modeling and impact analyses in support of their permit application to construct this facility. The proposed action qualifies as a “minor source” for PCAQCD and ADEQ permitting purposes. This assessment uses the dispersion modeling analysis to demonstrate compliance with NAAQS within 50 km of the project area. Details of the AERMOD permitting analysis, input, receptor grids, settings, and results are provided in Air Sciences Inc. (2018c). The Forest Service is using the same model to understand and disclose impacts in the EIS.[47] In addition to the ambient air boundary and surrounding nested receptor grid, impacts are also specifically assessed at identified Sensitive Areas and Class I areas (such as the Superstition Wilderness Area),[48] which are depicted in figure 3.6.2-1.

Within the 50-km distance from the proposed action sites, the analysis also addresses impacts on air quality, acid deposition, and plume blight at sensitive areas. Sensitive areas within this range include the Superstition Wilderness, the White Canyon Wilderness Area, and the Needle’s Eye Wilderness.

The Class I areas that Air Sciences Inc. evaluated include Galiuro Wilderness, Mazatzal Wilderness, Saguaro National Park and Saguaro Wilderness Area, and the Sierra Ancha Wilderness. The analysis of these areas includes air quality impacts, compared with ambient standards and prevention of significant deterioration (PSD) increments, visibility or haze, and deposition of total sulfur and nitrogen.

CALPUFF modeling is used to evaluate impacts on air quality related values (visibility, deposition) in accord with guidance issued by FLAG (U.S. Forest Service et al. 2010). Impacts on air quality concentrations in Class I areas were evaluated using AERMOD impacts within the 50-km grid for receptors closer than 50 km, and impacts were evaluated at Class I areas beyond 50 km at the farthest 50-km receptor in the direction of the Class I Area. This approach is also in conformance with EPA guidance for assessing impacts at those receptors. Details of the CALPUFF modeling are provided in Air Sciences Inc. (2018c).

Generally, air quality impacts from a source decrease with distance from that source. As a first step, areas are screened from analysis using the standard source/distance (U.S. Forest Service et al. 2010) method based on the total emissions of PM_{10}, SO_2, NO_X, and sulfuric acid (H_2SO_4) in tons per year divided by the distance to the area in kilometers. Using this method, Air Sciences Inc. screened several areas as too far:

[46] “Criteria pollutants” are regulated by the Clean Air Act, and each criteria pollutant has a numeric NAAQS that must be met. There are six basic criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (further divided into PM_{10} and $PM_{2.5}$), and sulfur dioxide (SO_2).

[47] Note that while the same air quality model may be used, the specific output may differ between PCAQCD permitting requirements and Forest Service NEPA requirements. The results shown in the DEIS reflect the total emissions from the project, regardless of whether they are applicable to the PCAQCD permit process.

[48] “Class I” areas are defined by the Clean Air Act and receive special consideration for air quality impacts. A Class I area must be specifically designated by the EPA; these usually include national parks, wilderness areas, monuments, and other areas of special national and cultural significance. Most of the rest of the country is considered a “Class II” area. However, in some cases, sensitive Class II areas (such as the White Canyon Wilderness) are treated similarly to Class I areas.

the Pine Mountain Wilderness, Mount Baldy Wilderness, and Sycamore Canyon Wilderness (Air Sciences Inc. 2018c).

Impacts on visibility and deposition are compared with the established acceptable levels of impact at receptors in each Class I area, using both the 24-hour maximum and the annual emission rates to assess visibility and deposition, respectively. Maximum impacts for each Class I and sensitive Class II area are tabulated for each parameter.

Indirect Emission Amounts

Modeling for compliance with air quality standards is based on direct emissions from point and area sources for the various components of the project. Additional emissions can be indirectly caused by the project by the expected increase in road traffic for employee travel or deliveries and are estimated in table 3.6.2-2 (Newell, Garrett, et al. 2018).

Table 3.6.2-2. Total annual indirect emissions for proposed action caused by employee traffic and deliveries (tons/year)

Source Category	CO	NO_X	$PM_{2.5}$	PM_{10}	SO_2	VOC
Employees	64.4	3.0	5.5	22.6	0.2	0.7
Deliveries	1.3	3.7	4.7	19.4	0	0.3
Total	**65.7**	**6.6**	**10.1**	**42.0**	**0.2**	**1.0**

Notes: Totals may not sum exactly due to rounding.

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter 2.5 microns in diameter or smaller; PM_{10} = particulate matter 10 microns in diameter or smaller; SO_2 = sulfur dioxide; VOC = volatile organic compound

Future Meteorological Trends and Greenhouse Gas Emissions

While global surface air temperatures have increased over the past century, changes in the Southwest have caused markedly increased average annual temperatures and reduced water storage due to early spring snowpack runoff (Dugan 2018; Garfin et al. 2013). It is extremely likely that anthropogenic factors have caused most of the increase in global surface temperatures and emissions of greenhouse gases (Romero-Lankao et al. 2014), which include carbon dioxide (CO_2), nitrous oxide, and methane, among others. The trends in temperature and effects of snowmelt runoff, with declining river flow, are predicted to continue into the foreseeable future (Garfin et al. 2013). Any net change in greenhouse gas emissions brought about by the proposed action would affect atmospheric concentrations of greenhouse gases and so might act to exacerbate or mitigate future meteorological trends.

There are four primary sources of direct and indirect greenhouse gas emissions associated with the proposed action: (1) fossil fuel combustion during mining, (2) fossil fuel combustion during electricity generation to support mining operations, (3) fossil fuel combusted during transport of concentrate to a smelting location, and (4) emissions associated with the smelting process.

1. The proposed action would lead to direct emissions of up to 173,000 tonnes of CO_2 equivalents (CO2e) annually (Air Sciences Inc. 2018b).[49] The primary source would be fossil fuel combusted by mobile sources with a minor contribution from process combustion sources.

[49] These emission estimates are based on the peak year (year 14).

2. The proposed action's need for electricity would lead to the indirect emission of up to 773,000 tonnes CO2e annually.[50]
3. Shipping copper concentrate from Superior, Arizona, to sites for further processing is estimated to result in the release of 83,000 tonnes CO2e annually (if shipped by rail to Salt Lake City, Utah) and 91,800 tonnes CO2e annually if shipped to China; this includes rail and oceanic transport (Garrett 2020b).[51]
4. While the level of smelting-related emissions varies greatly depending on the concentration of the copper concentrate, the throughput of the smelter, and the source of energy used (Alexander et al. 2021; Liu et al. 2022; Nilsson et al. 2017), this assessment relies on the global average of 1.43 tonnes CO2e per tonne of copper smelted as reported in International Energy Agency (2022). Based on the estimated annual output of 453,593 tonnes of copper, annual smelting-related emissions are estimated to be 648,000 tonnes CO2e annually.

In total, it is estimated that for the peak production period, not taking into account the net zero carbon commitments from Resolution Copper by 2050, the proposed action would result in greenhouse gas emission of up to 1,681,000 tonnes CO2e annually. Given the average annual output of the proposed action (453,593 tonnes of copper), the greenhouse gas emission intensity[52] would be 3.7 tonnes CO2e per tonne of copper.[53]

Health Risk Assessment

For the purposes of the NEPA analysis, the ability to meet air quality standards is considered protective of public health;[54] therefore, a separate health-based analysis of individual constituents, particularly those associated with particulate emissions, is not necessary in order to disclose impacts on human health (SWCA Environmental Consultants 2018b).

However, an additional analysis provides an estimation of the health risk assessment of impacts of trace metals' air quality concentrations and deposition rates for regulated HAPs[55] that are emitted by sources in the proposed action and alternatives.[56] The trace metals would be emitted as a small fraction of particulate matter emissions from those sources.

---

[50] Estimates of indirect greenhouse gas emissions rising from the off-site generation of electricity have changed over time. The January 2021 Rescinded FEIS identified indirect greenhouse gas emissions from the off-site generation for 315 MW to be 878,000 tonnes CO2e using efficiency projections for the SRP power generation sources. This estimate has been updated twice since publication of the January 2021 Rescinded FEIS (Tipple 2022; Yilmaz 2022). The most recent calculations reflect the assumption that, from 2033 through 2050, electricity usage will range from 200 MW to 400 MW, with a median demand of 352 MW (Tipple 2022), with associated annual CO2e emissions of approximately 773,000 tonnes CO2e. Tipple (2022) assumes that in 2050, this source of CO2e is assumed to decrease to 0 based on Rio Tinto's net-zero commitment. This reduction would likely be accomplished through agreements with SRP to provide only renewably generated power to the project (see appendix J, measure RC-AQ-01). However, this commitment is not enforceable and has not been relied upon for this disclosure.

[51] The actual destination of the concentrate is unknown, as it will likely be sold to an entity other than Resolution Copper. The lack of this information makes estimating most impacts from transportation and smelting speculative, as the distance of travel, type of transportation, airshed of the smelting, and the type of smelting technology are completely unknown. However, because impacts from greenhouse gas emissions are global in nature and not dependent on location, providing greenhouse gas estimates for transportation and smelting is considered a reasonable disclosure.

[52] Greenhouse gas emission intensity refers to the amount of CO2e emitted per unit of copper produced.

[53] Calculated as 1,681,000 tonnes of CO2e released, divided by 453,593 tonnes of copper produced.

[54] The NAAQS are promulgated to protect human health with an adequate margin of safety (see Clean Air Act 109(b) and 40 CFR 50.2).

[55] HAPs are defined in Section 112(b) of the Clean Air Act.

[56] Air Sciences Inc. (2019a), appendix A, includes emission rates for the listed HAPs that would be emitted.

This evaluation is undertaken as a conservative screening effort, using modeled annual PM_{10} ambient concentrations at off-site receptors, and using a conservative estimate of deposition velocity of the PM_{10} size group. The analysis also includes data for air quality concentrations provided by Air Sciences Inc. (2019a) regarding a screening-level Human Health Risk Assessment. Deposition results were compared with Regional Screening Levels for residential soils (U.S. Environmental Protection Agency 2019). Air quality and deposition calculations are based on the receptor with the maximum annual impact of PM_{10} concentration (7.27 micrograms per cubic meter ($\mu g/m^3$)) from the dispersion modeling results. Impacts at other receptors would be less than the calculated risk values.

This approach assesses risk by calculating a “total Hazard Quotient”; based on EPA guidance, if the Hazard Quotient remains below a value of 1, the risk to human health is acceptable. To calculate the total Hazard Quotient, the projected concentration or deposition of each HAP is divided by the screening level. The results for all the HAPs are then summed to give the total Hazard Quotient. The results indicate that the impact for each of the trace metals air concentration and deposition rate is below the respective Regional Screening Levels, and the calculated total Hazard Quotient for the air quality concentration and deposition rates of all combined metals is less than 1.0. This finding indicates that the combined impacts of all trace metal HAPs are below a level of concern for Human Health Risk Assessment.

A separate analysis addressed the potential for a “cancer cluster” in the area of the proposed action and alternatives. During public comment periods, claims have been made by residents about higher cancer rates in the Globe/Superior area attributed to the mining history of the area; for the most part, these claims have not cited sources of literature. No standalone studies were identified that specifically investigate a higher incident rate of cancer in the Globe or Superior areas. General statistics on cancer occurrence are mixed when the cancer rate of the local region is compared with the Arizona average cancer rate. Databases from the Arizona Department of Health Services and Centers for Disease Control and Prevention (CDC) show that Pinal and Gila Counties have a lower cancer rate than the Arizona average. However, data from the Arizona Department of Health Services for Superior/Kearny from 2005–2009 show an elevated cancer rate, compared with the Arizona average. Overall, from available data, there does not appear to be any compelling evidence that a cancer cluster exists in the area (SWCA Environmental Consultants 2018b).

While acknowledging that mine workers within the boundaries of the mine facilities have a greater potential for exposure to hazardous chemicals, the MSHA enforces specific health and safety standards, as well as monitoring for worker safety. Resolution Copper will directly address worker health and safety regulations in compliance with MSHA rules. For the purposes of the NEPA analysis, compliance with required MSHA rules is considered to be protective of mine worker health and safety. Worker health and safety regulations are not evaluated further under NEPA requirements (SWCA Environmental Consultants 2018b).

Further background about these estimations can be found in Newell, Garrett, et al. (2018).

Presence of Asbestiform Minerals or Naturally Occurring Radioactive Materials

An analysis was conducted to identify the presence of asbestiform minerals that could become part of the tailings, as well as naturally occurring radioactive materials. A summary of these investigations is contained in Section 3.7.2, Groundwater and Surface Water Quality. The investigation determined that substantial information exists to answer these questions, and neither asbestos nor radioactive materials are present in the ore body above typical background concentrations.

3.6.3 Affected Environment

3.6.3.1 Relevant Laws, Regulations, Policies, and Plans

A wide range of Federal, State, and local requirements regulate air quality impacts of mine operations. Many of these require permits before the mine operations begin; others may require approvals or consultations, mandate the submission of various reports, and/or establish specific prohibitions or performance-based standards (Newell, Garrett, et al. 2018; U.S. Forest Service et al. 2010).

Primary Legal Authorities and Technical Guidance Relevant to the Air Quality Effects Analysis

- Pinal County has been delegated responsibility under the Clean Air Act, and County, State, and Federal air quality regulations would be met through issuance of a Class II air permit (West Pinal PM10 Moderate Nonattainment Area, Chapter 4 Article 1 of the PCAQCD Code of Regulations)
- ADEQ has asserted responsibility for the Federal and State regulations for issuing an air permit for Alternative 6 (Skunk Camp tailings storage facility) because it is within both Pinal County and Gila County through Arizona Administrative Code Title 18 Chapter 2, Article 3.
- Additional Forest Service guidance for air quality–related values (deposition and visibility) contained in U.S. Forest Service et al. (2010)
- General Conformity Rule (Clean Air Act Section 176(c)(4); implementing regulations in 40 CFR 93); applicable only to Alternatives 5 and 6

3.6.3.2 Existing Conditions and Ongoing Trends

Resolution Copper conducted air quality and meteorological monitoring at the proposed project area. The locations of the monitors are shown in figure 3.6.2-1. Particulate matter (PM_{10} and $PM_{2.5}$) has been monitored at the West Plant monitoring site and the East Plant monitoring site. NO_2, SO_2, and O_3 have been monitored at the East Plant Site. The results of the Resolution Copper air quality monitoring program are shown in figure 3.6.3-1, along with the applicable ambient standards. The data show some year-to-year variability, but there is no evident trend, except for the 1-hour SO_2 levels.

All monitoring data show compliance with the applicable standards, except potentially for ozone (the 3-year average, fourth highest daily maximum ozone level, is used to evaluate compliance with the standard). The arithmetic average of the last 3 years of ozone monitoring is 0.072 part per million (ppm) (truncated), which is above the current ambient standard of 0.070 ppm. The data show the variability over the 5-year period and include relatively high PM_{10} and $PM_{2.5}$ levels in 2013. Although there is no distinct trend except for the annual $PM_{2.5}$ at the West Plant Site, the West Plant Site shows an annual average increase of 0.4 $\mu g/m^3$ per year in $PM_{2.5}$ concentrations over the monitoring period. The hourly NO_2 and SO_2 levels have steadily declined over this period, until 2017.

Resolution Copper collected meteorological data at three sites near the proposed mine operations, including the East Plant Site, West Plant Site, and Hewitt location, and used data from 2 years (2015–2016) to conduct the near-field air quality impact analysis. The data include wind speed, wind direction, stability category, and temperature. The data show a strong prevailing wind pattern at all sites with the dominant prevailing wind from the northeast quadrant for the East Plant Site and West Plant Site, and from the southeast quadrant for the Hewitt location. A secondary prevailing wind from the west and southwest is evident at all sites.

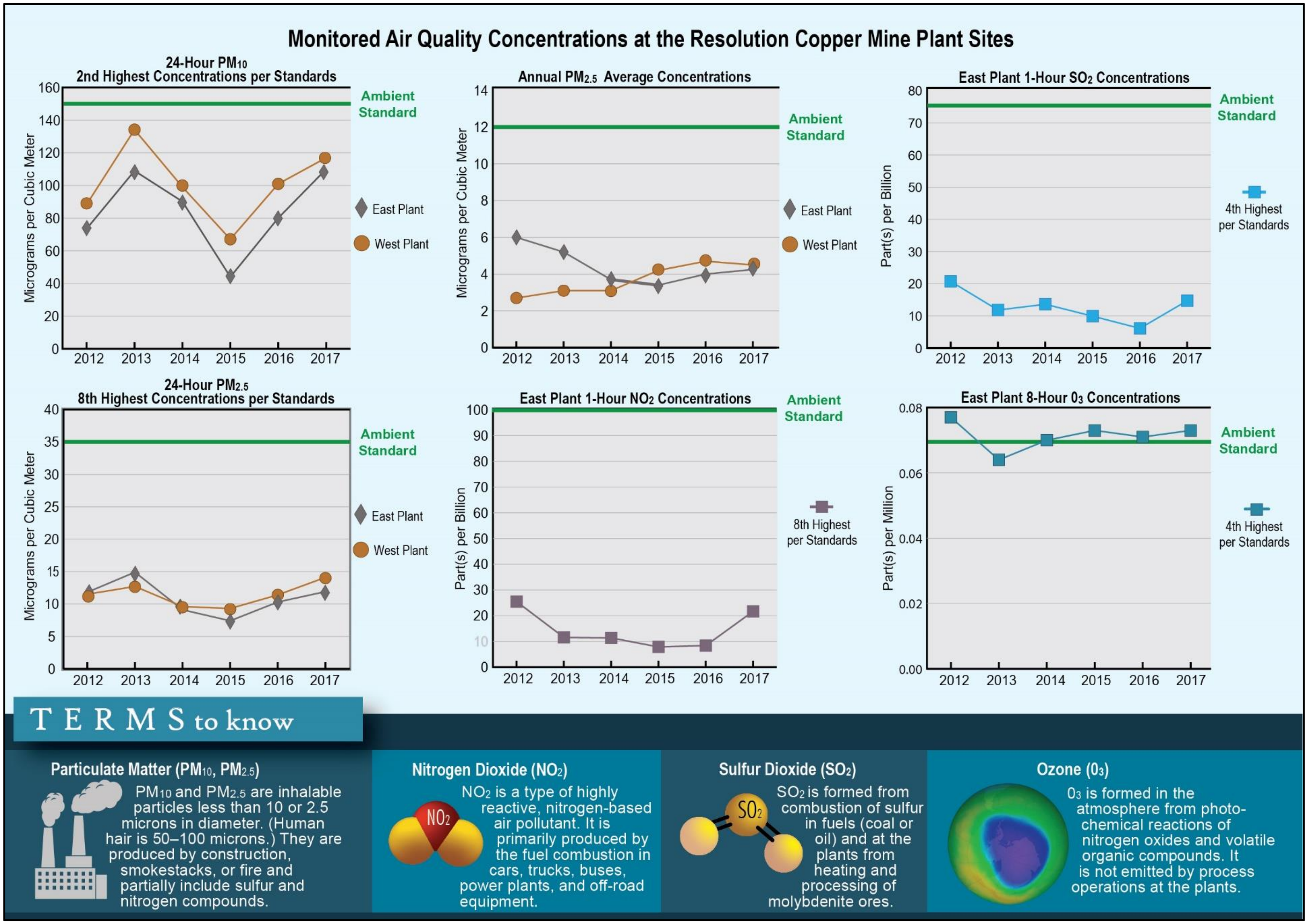


Figure 3.6.3-1. Monitoring results for PM_{10}, $PM_{2.5}$, NO_2, SO_2, and O_3 relative to standards under 40 CFR 50

Conformity

The General Conformity Rule was established under Clean Air Act Section 176(c)(4) and implemented in 40 CFR 93; it serves to ensure that Federal actions do not inhibit State attainment plans for areas designated as non-attainment or maintenance. The rule effectively applies to all Federal actions that take place in areas designated as non-attainment or maintenance.

The East Plant Site and Alternative 6 (Skunk Camp tailings storage facility, the Lead Agency preferred alternative) are both wholly located within the Hayden PM_{10} Nonattainment Area, and the filter plant and loadout facility is located in the West Pinal PM_{10} Nonattainment Area. A Conformity Analysis is required for major Federal actions that have direct and indirect emissions greater than the 100 tons/year threshold specified in 40 CFR 93 Part B 153(B)(1). For these two sites, the direct emissions include both point sources and fugitive sources on PM_{10}. As provided in appendix A of Air Sciences Inc. (2019b), the total PM_{10} controlled emissions are 79.0 tons/year for the East Plant, including both fugitives and point sources, and 238 tons/year for Alternative 6 (Skunk Camp tailings storage facility). The combined total exceeds the 100 tons/year threshold. Total potential PM_{10} emissions from the filter plant and loadout facility are less than 100 tons/year, and a conformity analysis is not required for the West Pinal PM_{10} Nonattainment Area.

There are two compliance options to demonstrating conformity, including (1) the issuance of a permit under the Federal New Source Review Program, which is implemented by PCAQCD and ADEQ for this location, and addresses the emission units in the proposed action or the preferred alternative, and (2) dispersion modeling that demonstrates that the proposed action or preferred alternative will not cause or contribute to an exceedance of the ambient air quality standard.

The cumulative dispersion modeling analysis (Hampson et al. 2020) uses representative meteorological and background air quality data and demonstrates that the PM_{10} impacts will comply with the ambient air quality standards at all receptors within the Hayden non-attainment area. With the consideration of the new source review permitting requirement and the demonstrated compliance through dispersion modeling, a formal conformity review can be accepted through dispersion modeling at an appropriate time.

SCREENING TO ASSESS EFFECTS OF SILT CONTENT

With respect to this demonstration, concerns were raised in comments on the DEIS about the silt content value (3 percent) used in the modeling analysis. Additional informal comments were raised after January 2021, resulting in additional screening analysis to demonstrate conformity. The percent silt content is used to estimate fugitive PM_{10} and $PM_{2.5}$ emissions from roadways and exposed surfaces that will handle ore or tailings storage. A review of the silt content data showed that the general silt content level was provided by Randall and Hampson (2020b), relying on a statewide factor for road silt content (3 percent) (U.S. Environmental Protection Agency 2003) and an ore-body analysis of 20 samples that led to an average silt content of 1.79 percent applicable to the tailings storage facility. The value 3 percent was used throughout the fugitive dust calculations for both ore and roadway silt content at the tailings storage facility and East Plant Site.

In order to demonstrate that the silt content, if changed, would not lead to exceedances of air quality standards, further screening analysis of silt content and impacts was undertaken. Two separate screening exercises were performed to assess the potential effects of the silt content assumptions on the air quality modeling used to demonstrate conformity.

SCREENING BASED ON TOTAL EMISSIONS

The first screening exercise considered the change in total PM_{10} emissions using different silt content values for ore/tailings (process sources) and for roadways. Adjustments to silt content were made based on other estimates, including the use of a sector-specific silt content factor of 17 percent as provided in table 13.2.2-1 of EPA's Emission Factors for Stationary Sources (AP-42) (U.S. Environmental Protection Agency 2006).

Using a silt content value of 17 percent for roadways (based on a sector-specific value) and an ore/tailings silt content of 2 percent (based on site-specific samples), the screening calculation estimated emissions changes for the East Plant Site and tailings storage facility PM_{10} emissions are shown in table 3.6.3-1, comparing the PM_{10} emissions with the original 3 percent silt content data that were used in the modeling. Note that the analysis used hourly emission rates (pounds/hour) because those values would be used to determine the 24-hour compliance, not the annual tons/year emission rate. The screening adjustment shows that total PM_{10} emissions would be reduced under this scenario for both the East Plant Site and the tailings storage facility in the preferred alternative, which would lead to a reduced PM_{10} impact when compared with the EIS modeling results.

Table 3.6.3-1. Comparison of EIS PM_{10} emissions to revised screening calculation based on silt content

Location	Emissions Component	Silt Content Used	PM_{10} Emissions (pounds/hour)
EIS Modeling Calculation			
East Plant Site	Surface – Excluding fugitives	N/A	8.2
	Surface – Roadway	3%	1.7
	Underground – Excluding fugitives	N/A	8.9
	Underground – Fugitives (ore)	3%	41.5
	Subtotal		*60.3*
Tailings storage facility	Emissions Excluding fugitives	N/A	0.63
	Fugitives (roadway)	3%	1.11
	Fugitives (ore)	3%	83.16
	Subtotal		*84.9*
Total			145.2
Revised Screening Calculations			
East Plant Site	Surface – Excluding fugitives	N/A	8.2
	Surface – Fugitives (roadway)	17%	9.63
	Underground – Excluding fugitives	N/A	8.9
	Underground – Fugitives (ore)	2%	27.67
	Subtotal		*54.4*
Tailings storage facility	Emissions excluding fugitives	N/A	0.63
	Fugitives (roadway)	17%	6.29
	Fugitives (ore)	2%	55.44
	Subtotal		*62.36*
Total			116.76

Therefore, the first screening method indicates that the emission rates and resulting dispersion modeling impacts, relied upon in the EIS, using the 3 percent silt content data, are satisfactorily conservative and sufficient to be used to demonstrate conformity with the air quality standards.

SCREENING BASED ON AIR QUALITY STANDARDS

A subsequent analysis (Air Sciences Inc. 2020) has been conducted to characterize emissions and impacts from the unpaved plant roads at the project sites. The updated silt content in this analysis was based on data in table 13.2.2-1 in the EPA's Compilation of Air Pollutant Emission Factors, AP-42, Section 13.2.2. The road silt content for several surface mining and material hauling operations was considered, including taconite mining and western surface coal mining sites. A value of 5.1 percent silt content was selected as a conservative estimate of plant road silt content. The fugitive dust adjustments were based on the silt content formulation in Equation 1a of AP-42 Section 13.2.2, as referenced above. The adjustment increased the PM_{10} facility-wide emission rate from 219 pounds/hour to 313 pounds/hour. The PM_{10} emissions from the tailings storage facility, which is within the non-attainment area, increased from 68 pounds/hour to 107 pounds/hour.

The recalculated fugitive dust PM_{10} emission rates from unpaved roadways were used to adjust modeled impacts for the individual facilities. Results were assessed for two receptors at each project site: the receptor with the overall maximum impact from all project sources and the receptor with the highest impact from the individual site. The site-specific project impacts were recalculated from the original modeling by adjusting the emissions of fugitive dust from roadways by an appropriate ratio for each site. Those impacts were added back to the background concentration, along with the modeled impact from other site-specific sources, and the modeled impacts from other facilities.

The results, provided in Air Sciences Inc. (2020) and shown in table 3.6.3-2, show that the adjusted PM_{10} total impacts remain well below the ambient air quality standards, and they demonstrate through modeling that the project will not lead to exceedance of the standard at the project sites, including those in the non-attainment area.

Regional Climatology

The regional climate is characterized as semiarid; there are often long periods with little or no precipitation (Western Regional Climate Center 2018). Precipitation falls in a bimodal pattern: most of the annual rainfall within the region occurs during the winter and summer months, with dry periods mainly in the spring and fall. The total average annual precipitation varies between 15.7 and 18.8 inches, with 52 percent of the precipitation falling between November and April. Although there may be snow at higher elevations, it does not typically accumulate in the region. Precipitation usually occurs with steady, longer duration frontal storm events during the winter months (December through March). Rain events during the summer months (July to early September) are typically of shorter duration with more intensity associated with thunderstorms.

Table 3.6.3-2. Results of additional screening conducted for silt content

	Ambient Air Quality Standard for PM_{10} (µg/m^3) = 150					
	24-hour PM_{10} Concentration (µg/m^3)					
	East Plant Site		**West Plant Site**		**Tailings Storage Facility**	
Ratio Adjusted Calculation:DEIS Calculation	**1.00**		**1.54**		**1.57**	
	Maximum Concentration (µg/m^3)	**Maximum Facility Impact (µg/m^3)**	**Maximum Concentration (µg/m^3)**	**Maximum Facility Impact (µg/m^3)**	**Maximum Concentration (µg/m^3)**	**Maximum Facility Impact (µg/m^3)**
DEIS Maximum Impact + Background (DEIS) at Boundary Receptor	85.4	80.4	97.0	84.3	74.0	72.1
Paired-sum Background Concentration	24.4	16.9	70.6	56.9	69.4	63.3
Facility Impact	59.4	62.5	1.0	21.1	4.0	8.2
Impact from Other Project Sources	1.6	1.0	25.4	6.3	0.6	0.7
Adjusted Facility Impacts	59.4	62.5	1.6	32.4	6.3	12.8
Adjusted Facility Impacts + Other Sources + Background	85.4	80.4	97.6	95.7	76.2	76.8
Percent of AAQS	*57%*	*54%*	*65%*	*64%*	*51%*	*51%*

Source: See table 3 in Air Sciences Inc. (2020).

3.6.4 Environmental Consequences of Implementation of the Proposed Mine Plan and Alternatives

3.6.4.1 Alternative 1 – No Action

Under the no action alternative, there would be no impacts on air quality from proposed mining and associated activities. Existing and ongoing impacts on air quality from fugitive dust and vehicle emissions are expected to increase over time with continued population growth in central Arizona. However, it is expected that monitoring and remedial actions by Maricopa County, Pinal County, and ADEQ would be effective in keeping these gradual changes within NAAQS.

3.6.4.2 Direct and Indirect Effects Common to All Action Alternatives

Effects of the Land Exchange

The land exchange would have limited effects on air quality. The Oak Flat Federal Parcel would leave Forest Service jurisdiction; no significant effects are expected. However, the Tonto National Forest would lose its authority to provide direction and support to management activities in order to meet minimum air standards.

The offered lands parcels would enter either Forest Service or BLM jurisdiction, allowing those agencies to secure authority over management activities pertaining to air quality. However, it is important to note that the air quality currently existing within the offered lands parcels is unlikely to experience significant change after transfer to Federal jurisdiction. These parcels are primarily inholdings of surrounding Forest Service– or BLM-managed lands and likely reflect air quality of the surrounding areas that are already managed to achieve these air quality standards.

Effects of Forest Plan Amendment

No components of the 2023 forest plan that directly relate to air quality require amendment.

Effects of Compensatory Mitigation Lands

While some earth moving would be conducted related to mitigation activities on the compensatory mitigation lands, this would be short-lived, temporary, and negligible. Overall, there are no emissions or air quality impacts associated with these lands.

Effects of Recreation Mitigation Lands

The recreation mitigation lands are not anticipated to affect air quality substantially, either by construction or by future use. Since the majority of the trails are existing user-created routes, earth-moving activities required for trail construction would be short lived, temporary, and negligible.
The recreation lands are anticipated to be part of the larger recreation road and trail network, and the level of use would be similar to existing conditions and cause similar emissions, though specific routes may change. Since the majority of the trails are existing user-created routes, emissions already occur from recreational use of these areas.

Summary of Applicant-Committed Environmental Protection Measures

A number of environmental protection measures are incorporated into the design of the project that would act to reduce potential impacts on air quality. These are non-discretionary measures, and their effects are accounted for in the analysis of environmental consequences.

From the GPO (Resolution Copper 2016c), Resolution Copper has committed to a variety of measures to reduce potential impacts on air quality:

- Dust control on roads, including regular watering, road base maintenance and dust suppression, paving select access roads to the East Plant Site and West Plant Site with asphalt, and setting reasonable speed limits on access roads within the operational footprint.
- Dust control at the tailings storage facility, including delivering tailings to the storage facility via distribution pipelines and continuously wetting the tailings during active deposition. During non-active periods, dust emissions would be managed by establishing a temporary vegetative cover on construction areas that would be inactive and exposed for longer than 12 months, wetting inactive beaches and embankment surfaces with irrigation from sprinkler systems, and treatment with chemical or polymer dust suppressants, if necessary.
- Dust control at East Plant Site, including periodic water and/or chemical dust suppressant, normal mining controls such as wet drilling and the wetting of broken rock, application of water suppression spray to control dust ore conveyance, dedicated exhaust ventilation systems and/or enclosures for crushers and transfer points underground, performing primary crushing and conveying underground, and saturating underground exhaust ventilation.
- Dust control at West Plant Site, including housing main active ore stockpiles in fully covered buildings, applying water suppression spray to control dust ore conveyance, processing ore in a new enclosed building, and enclosing conveyor transfer points within the concentrator building. Once arriving at the concentrator complex, the ore would either be processed immediately or stockpiled in an enclosed structure for future processing.
- Dust control during shipping, including bagging molybdenum concentrate at the concentrator facility before shipping and enclosing loadout building and storage shed.

Other applicant-committed environmental protection measures by Resolution Copper include those outlined in the "Final Air Quality Impacts Analysis Modeling Plan" (Air Sciences Inc. 2018a) and Resolution Copper's current air quality permit, including the following:

- Use of low-sulfur diesel in mobile and stationary equipment;
- Use of a scrubber to control SO_2 emissions from the drying of molybdenum concentrate at the West Plant Site;
- Use of Tier 4 diesel engines (or greater); and
- Use of fencing, berms, locking gates, signage, natural barriers/steep terrain (25 to 30 percent or greater), and site security measures to limit access roads and other locations near areas of heavy recreational use. These same methods would be required to limit public access within the mine site (i.e., the air modeling boundary) to prevent public exposure to mine emissions.

Air Quality Impact Assessment

The dispersion modeling effort described in section 3.6.3 is used to characterize ambient air quality impacts at receptors in the area of each of the proposed facilities (East Plant Site, West Plant Site, filter plant, and loadout facility), as well as the alternative tailings storage facility locations. Air Sciences Inc. generated a composite receptor grid of the impacts from the separate model runs for these facilities and used the grid to evaluate impacts; in other words, the emissions from each facility were modeled separately but then combined to assess impacts. The maximum impact for each of the criteria air pollutants over the composite receptor grid determines the direct effects of the proposed action and the alternatives. The impacts include the model results of emissions from the proposed action and alternatives added to a "background" air quality value that represents the ongoing impacts from other sources (including natural sources) in the area, and in effect represents the cumulative impact of the proposed action and other sources (Air Sciences Inc. 2018b). The background concentrations are based in part on the Resolution Copper data from the monitoring sites (see figure 3.6.3-1). These impacts are then compared with the appropriate standard, some of which have specific time components (i.e., 8-hour average). Details of the analysis are provided in Air Sciences Inc. (2019b).

Results of the modeled maximum impacts at all receptors for each of the criteria air pollutants are shown in table 3.6.4-1 for the proposed action (Alternative 2 – Near West Proposed Action). The emissions from the mining and processing operations at the East Plant Site, West Plant Site, and tailings storage facility boundary are taken from the year of maximum ore production (year 14) and added to the impacts from the maximum erodible area for the affected tailings storage facility.[57] Annual impacts are based on the annual average emission rate for each source; maximum hourly impacts are based on the hourly maximum emission rate for all sources; and 24-hour maximum impacts are based on the maximum 24-hour emission rate for the sources. None of the predicted results are anticipated to exceed the NAAQS at the ambient air boundary/fence line. The screening analysis of lead impacts is based on a ratio of lead to PM_{10} concentrations, using quarterly data from 2003 (Randall 2020b).

Air quality impacts were modeled for each alternative, but the results are largely the same. Maximum impacts for other alternatives would be very similar to those shown in table 3.6.4-1. Detail of the results of other alternative air quality modeling are and summarized in table 3.6.4-2.

For all alternatives, the maximum total impacts for CO, 1-hour NO_2, and short-term SO_2 (24 hours or less) would occur at or near the boundary of the East Plant Site due to the large number of combustion sources at that site. The maximum annual impacts for NO_2 would occur at the filter plant and loadout facility and the maximum annual SO_2 impacts would occur at the West Plant Site, although both impacts would be well below the applicable ambient air quality standards.

[57] For the tailings facilities, the largest source of contaminants is fugitive dust, which largely depends on the amount of ground disturbed and exposed to wind. Therefore, assuming the largest exposed area—even at years before buildout occurs—ensures that air quality impacts are not underestimated.

Table 3.6.4-1. Maximum air quality impacts for proposed operations and Alternative 2 – Near West Proposed Action

Pollutant	Averaging Period	Model Result/Form of Standard	Proposed Action Impact Only (μg/m^3)	Background (μg/m^3)	Total Maximum Impact (μg/m^3)	Standard (μg/m^3)	Total Maximum Impact as a Percentage of Standard
CO	1-hour	2nd high in any 3 years	4,531	3,550	8,081	40,500	20
CO	8-hour	2nd high in any 3 years	1,040	2,519	3,559	10,000	36
NO_2	1-hour	98th percentile over 2 years	138	9	146	188	78
NO_2	Annual	Max annual over 2 years	2	3	5	100	5
PM_{10}	24-hour	3rd high over 2 years	26	71	97	150	65
PM_{10}	Annual*	Max annual over 2 years	7	17	25	50	49
$PM_{2.5}$	24-hour	98th percentile over 2 years	11	6	18	35	51
$PM_{2.5}$	Annual	Average annual over 2 years	2	4	6	12	49
SO_2	1-hour	99th percentile over 2 years	92	24	117	196	59
SO_2	3-hour	2nd high over 2 years	56	31	86	1,300	7
SO_2	24-hour*	2nd high over 2 years	9	11	20	365	6
SO_2	Annual*	Max annual over 2 years	1	2	3	80	4
Lead	Quarterly	Highest quarterly average	0.002	0.04	0.042	0.15	28

Note: μg/m^3 = micrograms per cubic meter

* Not a Federal standard

Table 3.6.4-2. Modeling maximum impact result for all alternatives

Pollutant	Averaging Time	Alternative 2 Proposed Action ($\mu g/m^3$)	Alternative 3 Near West ($\mu g/m^3$)	Alternative 4 Silver King ($\mu g/m^3$)	Alternative 5 Peg Leg ($\mu g/m^3$)	Alternative 6 Skunk Camp ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Below NAAQS
CO	1 hour	8,080.8	8,080.7	8,099.8	8,079.8	8,090.5	40,000.0	Yes
	8 hours	3,558.8	3,558.8	3,559.7	3,558.2	3,559.3	10,000.0	Yes
NO_2	1 hour	146.4	146.4	149.8	146.5	148.1	188.0	Yes
	1 year	4.7	4.7	4.7	4.2	4.2	100.0	Yes
PM_{10}	24 hours	96.8	96.8	97.1	99.5	97.0	150.0	Yes
	1 year	24.5	24.4	24.5	23.5	21.2	50.0	Yes
$PM_{2.5}$	24 hours	17.7	17.7	17.8	17.7	17.8	35.0	Yes
	1 year	5.9	5.9	6.0	5.9	5.9	12.0	Yes
SO_2	1 hour	116.6	116.6	117.1	116.6	116.6	196.0	Yes
	3 hours	86.4	86.4	86.4	86.4	86.4	1,300.0	Yes
	24 hours	20.4	20.4	20.4	20.4	20.4	365.0	Yes
	1 year	2.9	2.9	2.9	2.9	2.9	80.0	Yes

Source: Air Sciences Inc. (2019b)

As can be noted from table 3.6.4-1, maximum 1-hour NO_2 impacts would be about 78 percent of the standard, based on the average of the daily maximum 1-hour 98th percentile value over a 2-year period, which is calculated with a background NO_2 concentration that is based on a diurnally and seasonally derived value in accordance with EPA guidance.[58] Figure 3.6.4-1 shows the maximum impact for the 1-hour NO_2 design value at receptors around the East Plant Site and West Plant Site for Alternative 2 – Near West Proposed Action.[59] The overall maximum would occur at the ambient air boundary of the East Plant Site, with the relatively higher values toward the north and east of the East Plant Site. Predicted impacts are reduced substantially with distance from the East Plant Site ambient air boundary. The impacts are analyzed and depicted on a nested grid of receptors (see figure 3.6.4-1).

The maximum design value 24-hour average impacts for $PM_{2.5}$ would occur at the eastern boundary of the East Plant Site, as shown in figure 3.6.4-2 (also for Alternative 2 – Near West Proposed Action). The maximum 24-hour average impacts, as well as the annual average impacts for $PM_{2.5}$ and PM_{10}, occur at or near the boundaries of the East Plant Site, West Plant Site, and tailings storage facility. The predicted highest impacts tend to be captured within the 100-m grid spacing, within 1 km of the ambient air boundary. Impacts at most of the receptors around the East Plant Site and other project sites would be less than one-half of the design value ambient standard.[60] Maximum $PM_{2.5}$ impacts for the other alternatives are equivalent to Alternative 2, and are also located around the East Plant Site boundary.

The maximum design value 24-hour average impacts for PM_{10} would also occur at the eastern boundary of the West Plant Site, as shown in figure 3.6.4-3 (for Alternative 6 – Skunk Camp Preferred Action). The predicted highest impacts within the PM_{10} nonattainment area, including the Skunk Camp tailings storage facility, demonstrate that modeling shows compliance with the PM_{10} standard throughout the nonattainment area, including the boundaries of the tailings storage facility site.

Following the initial modeling for the proposed action, additional modeling was conducted for all of the alternatives. Comparative results of the impacts for criteria air pollutants are shown in table 3.6.4-2, demonstrating that all impacts are below the ambient air quality standards. Maximum impacts among the alternatives vary by less than 3 percent.

A separate analysis of ozone formation and secondary $PM_{2.5}$ formation was conducted (Air Sciences Inc. 2018c) based on total emissions using the thresholds provided by EPA (2017). Results indicate that the maximum impacts would be below the established thresholds of impact for both of these pollutants, as provided by the guidance. The calculated secondary $PM_{2.5}$ would be 0.23 $\mu g/m^3$ for the 24-hour maximum impact and 0.008 $\mu g/m^3$ for the maximum annual impact. Adding these results to the calculations for primary $PM_{2.5}$ impacts would not change the data that are provided in table 3.6.4-1.

[58] 40 CFR 51, Appendix W, §8.3.2(c)(iii)

[59] In figures 3.6.4-1 and 3.6.4-2, the impacts are analyzed and depicted on a nested grid, with a sub-grid of receptors at 100-m spacing out to 1 km from the ambient air boundary, a 500-m grid spacing from 1 to 5 km from the boundary, nested 1,000- and 2,500-km grid spacing beyond that distance, and 25-m receptors along the ambient air boundaries and nearby roadways. The more densely nested 100-m sub-grid is clearly depicted in the figure, and the higher impacts are captured largely within this sub-grid of receptors.

[60] The design value of the ambient air quality standard refers to the calculation of compliance with the standard. For example, the design value of the 1-hour NO_2 standard is the 3-year average of the annual 98th percentile of the highest daily 1-hour O_3 concentration.

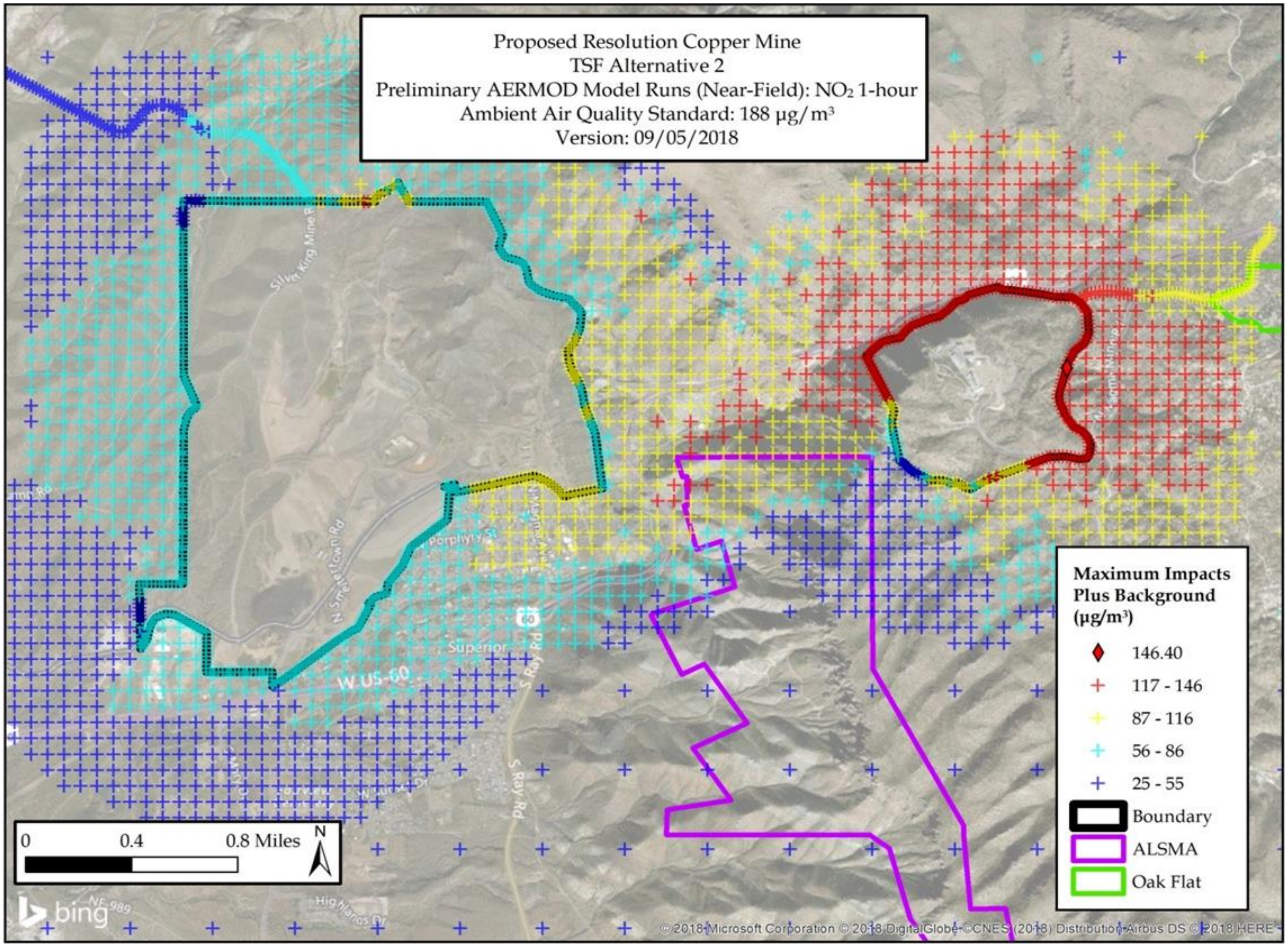


Figure 3.6.4-1. Maximum 1-hour 98th percentile NO_2 impacts at receptors near East Plant Site and West Plant Site for Alternative 2 – Near West Proposed Action

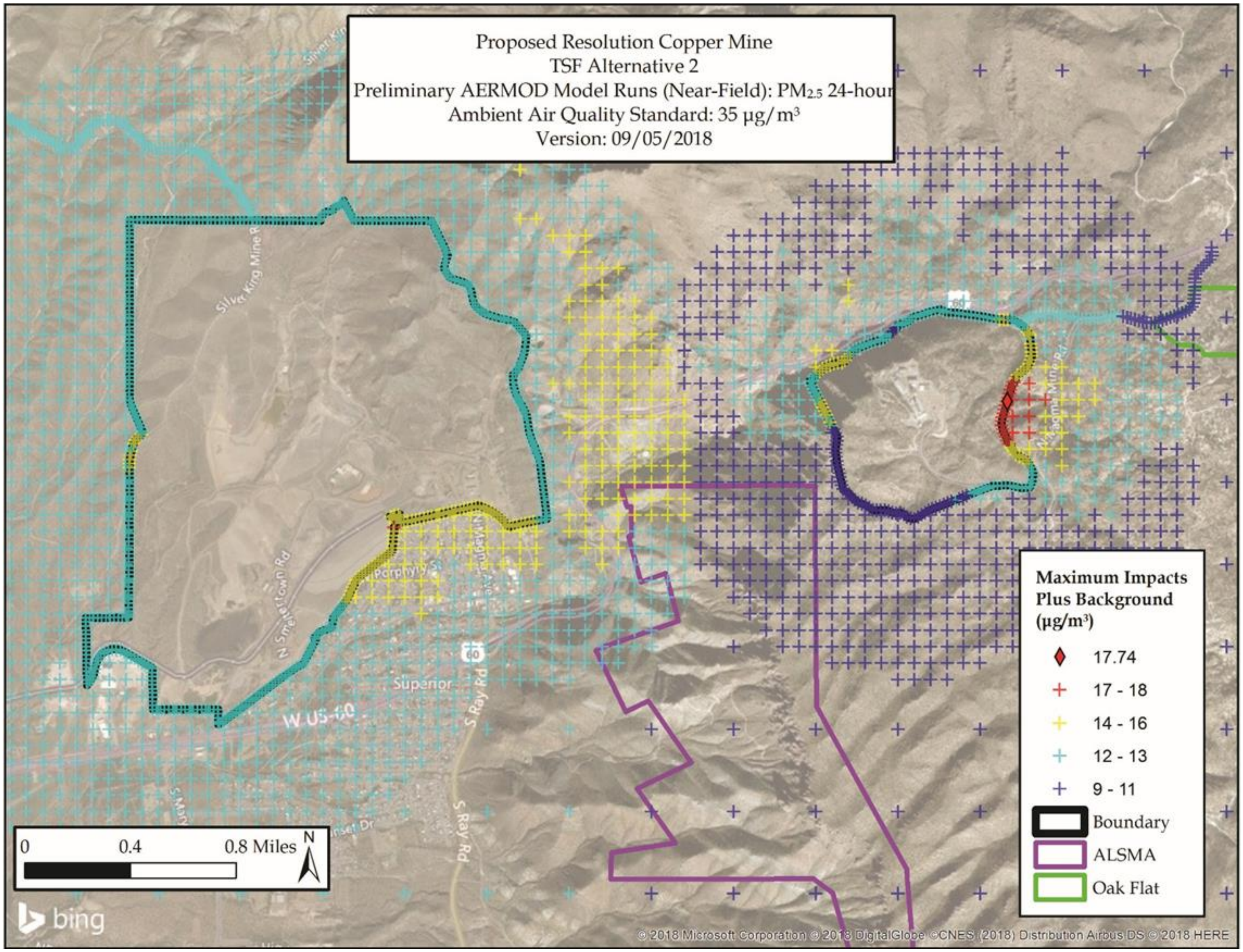


Figure 3.6.4-2. Maximum 24-hour 98th percentile $PM_{2.5}$ impacts at receptors near the East Plant Site and West Plant Site for Alternative 2 – Near West Proposed Action

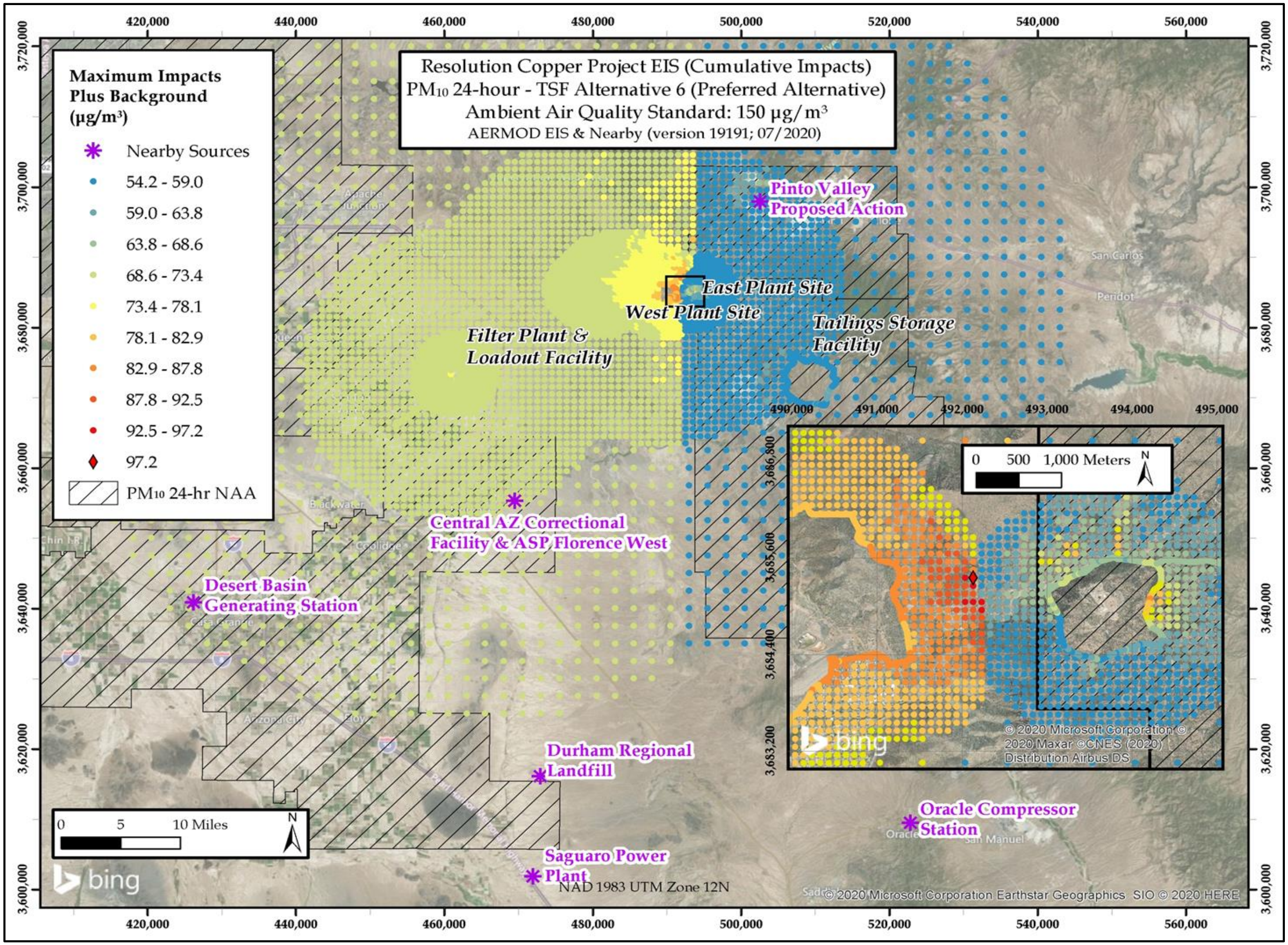


Figure 3.6.4-3. Maximum 24-hour 98th percentile $PM_{2.5}$ impacts at receptors near the tailings storage facility for Alternative 6 – Skunk Camp

Impacts at Sensitive Areas

As designated during the scoping process, the Forest Service identified specific sensitive areas that include Class I areas and other areas such as wilderness. Areas within 50 km of the proposed action are modeled using the AERMOD platform, and impacts on acid deposition and visibility at areas from 50 to 100 km are analyzed using the CALPUFF modeling platform. These models use different characterizations to conduct the analyses (see Air Sciences Inc. (2019b)).

Table 3.6.4-3 provides the projected maximum incremental air quality impact for any of the alternatives at all receptors in each designated area. Representative background concentrations were not added to the modeled impacts. The analysis focuses on determining whether impacts at the Class I areas and sensitive Class II areas are of concern, and since the air quality impacts are below established significance levels, additional analysis with background concentrations is not warranted. Among the alternatives, and all the Class I areas, the impacts from Alternative 4 are greatest at the Superstition Wilderness, but they remain well below the PSD increments. Impacts represent the maximum among the alternatives; impacts for the other alternatives are less than the reported value and may be below 50 percent of that impact.

All impacts are projected to be less than the PSD increments at the Class I areas and, except for the Superstition Wilderness, would have an insignificant[61] impact at those areas. The highest 24-hour impacts of PM_{10} and $PM_{2.5}$ emissions on air quality at the Superstition Wilderness consume up to 50 percent of the Class I PSD increments for those standards but are well below ambient standards, when background concentrations are added. Impacts are greatest at the area boundary and decrease rapidly with distance toward the remainder of the area. All ambient air quality impacts at the (Class II) White Canyon Wilderness are well below the Class II PSD increments. The maximum impacts at this area are for $PM_{2.5}$; and the maximum PM_{10} impact is only 8 percent of the PSD Class II increments.

Impacts on the deposition of nitrogen (N) and sulfur (S) from the proposed action have also been projected through the same modeling platforms. Impacts are compared with the designated deposition analysis thresholds (DAT) (U.S. Forest Service et al. 2011). The DAT value for S is 5 grams/hectare/ year (g/ha/year) and for N is 10 g/ha/year. Results for the maximum deposition at each area among all the alternatives are provided in table 3.6.4-4, for both the S and N deposition estimates for the proposed action. There is little difference among the impacts of the alternatives at each of the sensitive areas.

[61] Comparisons with the PSD Class I Significant Impact Levels are provided for information only. No formal further analysis is required because the proposed action and alternatives do not trigger review and approval under the PSD regulations.

Table 3.6.4-3. Maximum ambient air quality impacts at identified sensitive areas

Pollutant*	Averaging Period	Class I Areas						Class II Areas		
		PSD Class I Increment (μg/m^3)	Superstition Wilderness (μg/m^3)	Sierra Ancha Wilderness (μg/m^3)	Mazatzal Wilderness (μg/m^3)	Galiuro Wilderness (μg/m^3)	Saguaro National Park (μg/m^3)	PSD Class II Increment (μg/m^3)	White Canyon Wilderness† (μg/m^3)	Needle's Eye Wilderness† (μg/m^3)
NO_2	Annual	2.5	0.109	0.007	0.008	0.009	0.010	25	0.60	0.011
PM_{10}	24-hour	8.0	4.26	0.463	0.394	0.476	0.793	30	2.46	0.454
PM_{10}	Annual	4.0	0.318	0.018	0.020	0.027	0.028	17	0.168	0.030
$PM_{2.5}$	24-hour	2.0	1.57	0.123	0.125	0.139	0.173	9	0.834	0.146
$PM_{2.5}$	Annual	1.0	0.119	0.006	0.009	0.007	0.008	4	0.053	0.010
SO_2	3-hour	25	4.41	0.380	0.294	0.251	0.340	512	2.55	0.334
SO_2	24-hour	5	0.994	0.080	0.076	0.053	0.054	91	0.478	0.066
SO_2	Annual	2	0.008	0.002	0.001	0.003	0.002	20	0.023	0.003

Notes: μg/m^3 = micrograms per cubic meter; shaded columns show standard for comparison for the Class I and Class II areas evaluated in this table

* See table 3.6.4-1 for more detail on specific standards.

† PSD Class II Increments apply to White Canyon Wilderness and Needle's Eye Wilderness.

Table 3.6.4-4. Maximum deposition analysis impacts at sensitive areas

Constituent	DAT Value (g/ha/year)	Superstition Wilderness (g/ha/year)	White Canyon Wilderness (g/ha/year)	Sierra Ancha Wilderness (g/ha/year)	Mazatzal Wilderness (g/ha/year)	Galiuro Wilderness (g/ha/year)	Saguaro National Park (g/ha/year)	Needle's Eye Wilderness (g/ha/year)
Sulfur	5	1.42	0.77	0.16	0.10	0.05	0.02	0.22
Nitrogen	10	4.18	2.94	0.33	0.19	0.15	0.05	1.06

Note: g/ha/year = grams per hectare per year

Visibility impacts are analyzed separately depending on the distance from the source of emissions. Within 50 km, impacts on plume blight[62] at the Superstition Wilderness and the White Canyon Wilderness are based on designated vistas within those areas. The impacts are generated under the PLUVUE II analysis (U.S. Environmental Protection Agency 1992), which focuses on a single plume and is analyzed only for meteorological conditions during daylight hours. The analysis is directionally dependent, and where appropriate a representative characterization of the 24-hour emissions of SO_2, NO_X, and PM_{10} were combined into a single plume. Results are provided for each of the observer locations in the two areas in table 3.6.4-5, indicating the number of daylight hours per year that a plume is perceptible at the indicated vistas for Alternatives 2 and 3. Perceptibility is based on the absolute contrast threshold, |C|, of 0.02 and a color contrast for gray terrain, ΔE, of 1.0 (figure 3.6.4-4).

Over the extended areas, the visibility of a plume against terrain features is affected by the height of the terrain and the position of the observer. The frequencies reported represent a general characterization of plume impacts when viewing terrain; there would be generally a 2 to 6 percent probability of a visible plume during daylight hours in the Superstition Wilderness. The impact at any one location could be different based on the terrain and the distance of the plume from the source(s). The plume may be visible in one direction but not in the opposite direction, for example. The frequency of a visible plume impact against the blue sky, however, would generally decrease with farther distances from the source(s). The effect or frequency of cloudy conditions is not taken into account in this analysis.

Table 3.6.4-5. Annual total and percentage of daylight hours of perceptible plume blight at observer locations in sensitive areas, Superstition Wilderness, and White Canyon Wilderness

Observer Location	|C| Sky	ΔE Sky	|C| Terrain	ΔE Terrain
Montana Mountain (Superstition Wilderness)	206 (4.7%)	189 (4.3%)	170 (3.9%)	136 (3.1%)
Government Hill (Superstition Wilderness)	204 (4.7%)	182 (4.1%)	110 (2.5%)	89 (2.0%)
Iron Mountain (Superstition Wilderness)	194 (4.4%)	177 (4.0%)	177 (4.0%)	143 (3.3%)
Mound Mountain (Superstition Wilderness)	166 (3.8%)	147 (3.4%)	169 (3.8%)	138 (3.1%)
Superstition Mountain ridgeline (Superstition Wilderness)	133 (3.0%)	141 (3.2%)	283 (6.4%)	248 (5.6%)
White Canyon (White Canyon Wilderness)	11 (0.2%)	9 (0.2%)	28 (0.6%)	14 (0.3%)

Note: There is a total of 4,386 hours of daylight per year.

[62] Plume blight is a visual impairment of air quality that manifests itself as a coherent plume.

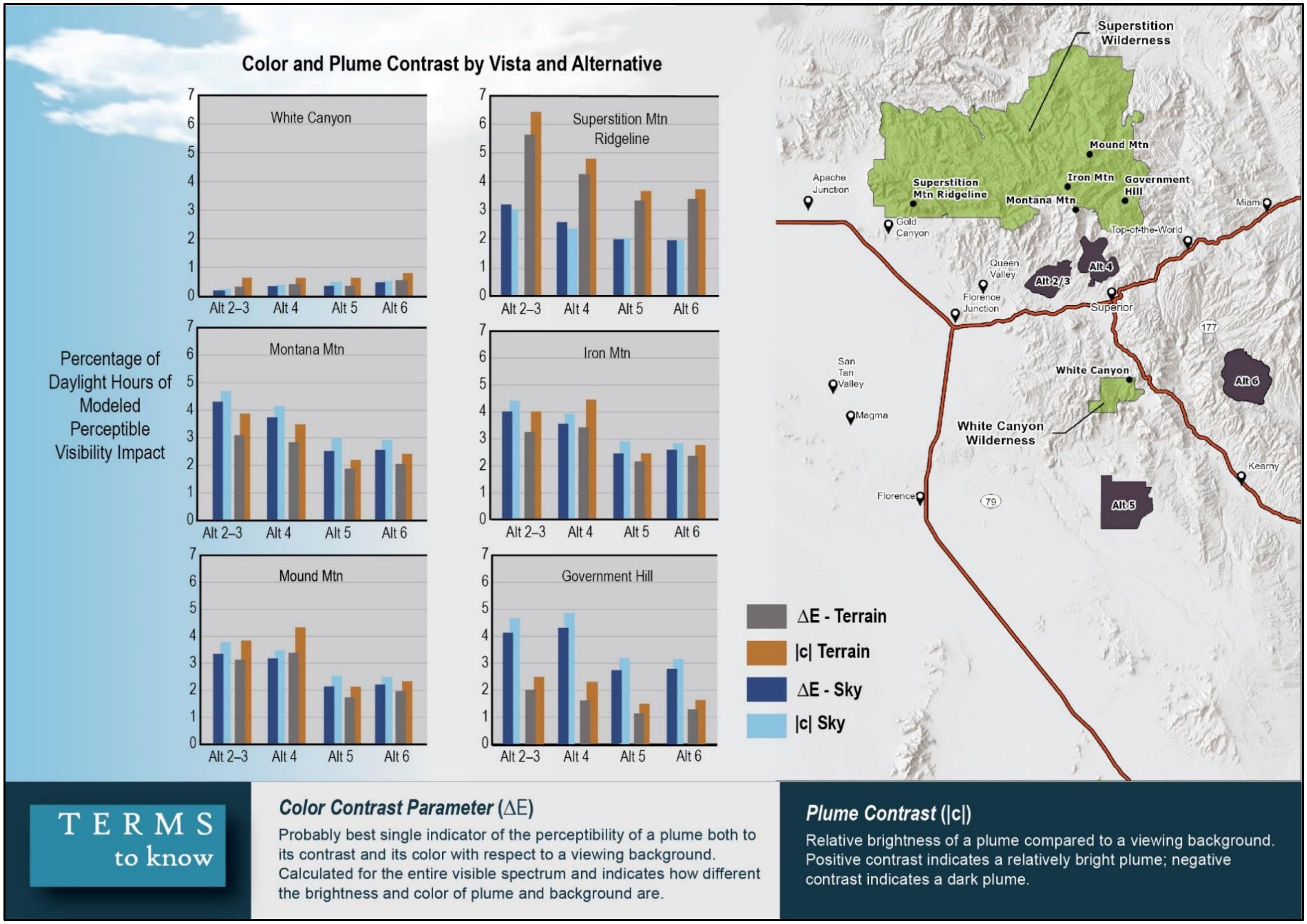


Figure 3.6.4-4. Near-field visibility of plume blight based on the absolute contrast threshold, |C|, of 0.02 and a color contrast for gray terrain, ΔE, of 1.0

Beyond 50 km, visibility impacts are predicted based on regional haze, which is a general condition in the impact area based on maximum concentrations of the impacts at those areas. Data for SO_2, NO_X, sulfates, and nitrates are used to evaluate these impacts. Annual average natural conditions are added to the predicted impacts that would occur from the proposed action. Results are shown in table 3.6.4-6 for the highest 98th percentile of the daily percentage of extinction among the alternatives. A threshold value of 5 percent from a single source is considered a significance threshold for conducting an additional impact analysis, and a 10 percent cumulative impact is considered a perceptible impact. All impacts are well below the 5 percent threshold that requires further analysis, demonstrating that impacts on regional haze at these locations would not be perceptible for any of the alternatives.

Table 3.6.4-6. Impacts of 98th percentile daily regional haze extinction levels in Class I areas

Affected Area	Proposed Action (%)
Threshold	**5**
Sierra Ancha Wilderness	0.35
Mazatzal Wilderness	0.15
Galiuro Wilderness	0.16
Saguaro National Park	0.17

The analysis of air quality impacts for the proposed action and alternatives shows that all impacts would be within the ambient air quality standards and well below the PSD increments. The proposed emission sources would comply with applicable regulations, and impacts on air quality-related values would be within the established thresholds for levels of acceptability.

3.6.4.3 Cumulative Effects

Full details of the cumulative effects analysis can be found in chapter 4. The following represents a summary of the cumulative impacts resulting from the project-related impacts described in Section 3.6.4, Environmental Consequences, that are associated with air quality, when combined with other reasonably foreseeable future actions.

The following actions were determined through the cumulative effects analysis process to be reasonably foreseeable, and have impacts that likely overlap in space and time with impacts from the Resolution Copper Project:

- ADOT Pinal County North-South Corridor
- LG Energy Solution Battery Production
- Pinto Valley Mine Expansion
- Ray Land Exchange and Proposed Plan Amendment
- Ripsey Wash Tailings Project
- Merrill Ranch Master Planned Community Project

The ADOT Pinal County North-South Corridor, LG Energy Solution Battery Production, and Merrill Ranch are reasonably foreseeable future actions but have not advanced to project design or any level of environmental review. Therefore, at this time, no emission estimates (construction or operations) for these projects have been completed. All three projects would generate emissions during construction from use of construction equipment and fugitive dust from ground disturbance. Furthermore, these three projects would generate long-term emissions from associated vehicle trips, with the LG Energy Solution Battery

Production facility potentially also generating direct and indirect emissions from manufacturing processes. Given the lack of detail on these projects currently, estimating their cumulative contribution to air quality impacts is not feasible. However, all three projects are expected to cumulatively contribute both localized and regional emissions.

With respect to the projects that have quantifiable emissions, the cumulative effects analysis area is identical to the modeling analysis area used to assess direct and indirect impacts to air quality; this area encompasses up to 62 miles (100 kilometers (km)) from the project. This area is much greater than the area where impacts were modeled to occur (all air quality standards were met at the project fence line), and is sufficiently large to encompass other emission sources that could combine with the project emissions to impact air quality. In lieu of modeling, the metric used to quantify the cumulative impacts to air quality is tons of emissions within the general airshed. The primary source of emissions from most mines is particulate matter; this analysis focuses on PM_{10} and $PM_{2.5}$ as the metrics of interest. The combined cumulative impact to regional emissions is shown in table 3.6.4-7. No mine plans have been submitted for the Ray Mine Land Exchange parcels, but it was assumed that any mining activities on these parcels would replace existing emissions from the Ray Mine.

Table 3.6.4-7. Increase in annual regional emissions of particulate matter from Resolution Copper Project and reasonably foreseeable future actions

Region	Emissions of PM_{10} (tons/year)	Emissions of $PM_{2.5}$ (tons/year)
Gila County	10,926	3,414
Maricopa County	98,106	20,052
Pinal County	25,942	4,376
Statewide	320,245	81,992
Cumulative Effects		
Resolution Copper Project	329	78
Pinto Valley Mine	238	45
Ripsey Wash Tailings Project	90	7
Ray Mine	No increase	No increase
Percent increase over three-county area	*0.5%*	*0.5%*

3.6.4.4 Mitigation Effectiveness

Mitigation Identifier and Title	Authority to Require
FS-SV-03: Revised reclamation and closure plans	Required – Forest Service
RC-AQ-01: SRP solar participation agreement	Committed – Resolution Copper

We developed a robust monitoring and mitigation strategy to avoid, minimize, rectify, reduce, or compensate for resource impacts that have been identified during the process of preparing this EIS. Appendix J contains descriptions of mitigation measures that are being required by the Forest Service and mitigation measures voluntarily brought forward and committed to by Resolution Copper. Appendix J also contains descriptions of monitoring that would be needed to identify potential impacts and mitigation effectiveness.

This section contains an assessment of the effectiveness of design features associated with mitigation and monitoring measures found in appendix J that are applicable to air quality. See appendix J for full descriptions of each measure noted below.

Mitigation Effectiveness and Impacts of Forest Required Mitigation Measures Applicable to Air Quality

Appendix J contains mitigation and monitoring measures being required by the Forest Service under its regulatory authority or because these measures are required by other regulatory processes (such as the Biological Opinion). These measures are assumed to occur, and their effectiveness and impacts are disclosed here. The unavoidable adverse impacts disclosed below take the effectiveness of these mitigations into account.

Revised reclamation and closure plans (FS-SV-03). Implementing reclamation and closure plans ensures that the post-closure landscape is successfully revegetated to the extent practicable and that the landforms are stable and safe. This measure is effective at ensuring that air quality is not impacted by fugitive dust from unstable and unvegetated landforms in the long term.

Mitigation Effectiveness and Impacts of Resolution Committed Mitigation Measures Applicable to Air Quality

Appendix J contains mitigation and monitoring measures committed by Resolution Copper in contractual, financial, or other agreements. These measures are assumed to occur, and their effectiveness and impacts are disclosed here. However, the unavoidable adverse impacts disclosed below do not take the effectiveness of these mitigations into account as they are not within the authority of the Forest Service to ensure.

SRP solar participation agreement (RC-AQ-01). This measure would be effective at reducing overall greenhouse gas emissions from the project by using solar-generated power. While effective at eliminating greenhouse gas emissions, the amount of power offset by this agreement is relatively limited. Resolution Copper optioned 4.6 percent of a 100-MW facility, or less than 5 MW. The anticipated power usage of the facility in full operation is ultimately as high as 352 MW. Resolution Copper anticipates similar agreements in the future to meet net-zero carbon commitments by 2050.

Mitigation Effectiveness and Impacts of Resolution Voluntary Mitigation Measures Applicable to Air Quality

Appendix J contains mitigation and monitoring measures brought forward voluntarily by Resolution Copper and committed to in correspondence with the Forest Service. These measures are assumed to occur but are not guaranteed to occur. Their effectiveness and impacts if they were to occur are disclosed here; however, the unavoidable adverse impacts disclosed below do not take the effectiveness of these mitigations into account. No additional mitigation measures were voluntarily brought forward for air quality.

Unavoidable Adverse Impacts

For the proposed action and all alternatives, emissions from project-related activities would meet applicable Federal and State standards for air quality but the increase in air pollutant concentrations and greenhouse gas emissions would constitute impacts that cannot be avoided.

3.6.4.5 Other Required Disclosures

Short-Term Uses and Long-Term Productivity

Impacts on air quality (increased air pollutant concentrations but below applicable air quality standards) from mining and associated activities would be short term (during the estimated 51- to 56-year life of the mine, including construction, operations, and reclamation) and are expected to end with mine reclamation and return to pre-mining levels, assuming adequate revegetation success to stabilize dust emissions from disturbed areas.

Irreversible and Irretrievable Commitment of Resources

During the construction and mining phases of the project, air pollutant concentrations would be higher throughout the analysis area than current levels but within applicable air quality standards; thus, air quality is not impacted for other uses in the airshed and these effects would not be considered irretrievable. Following mine closure and successful reclamation, pollutant concentrations would return to pre-mining levels, and there would be no long-term irreversible commitment of resources.