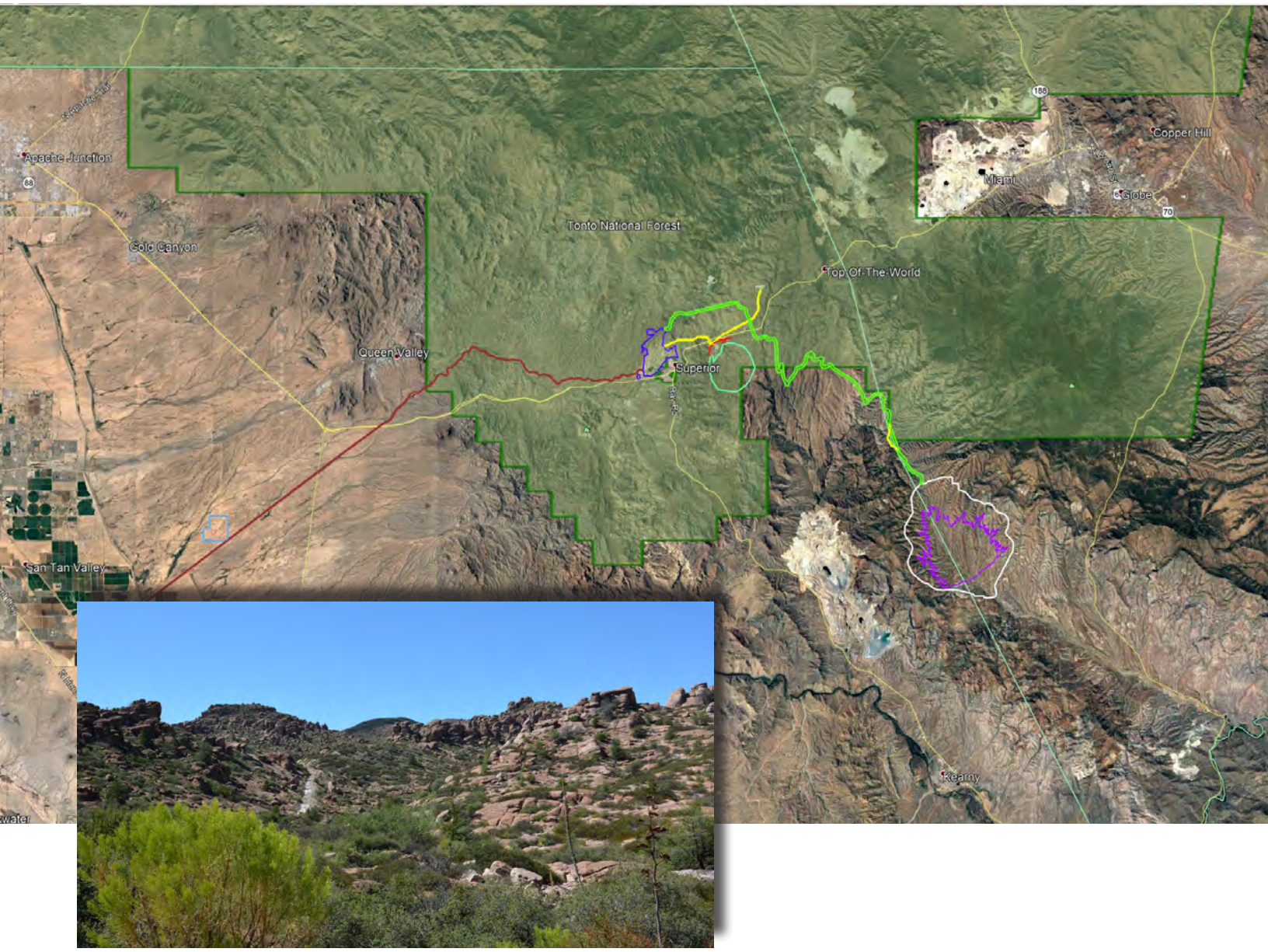
United States Department of Agriculture

FINAL Environmental Impact Statement

Resolution Copper Project and Land Exchange



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Front Cover photo captions:

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

Bottom Left: Oak Flat Federal Parcel

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Disclaimer: The Section 508 amendment of the Rehabilitation Act of 1973 requires that the information in federal documents be accessible to individuals with disabilities. The U.S. Forest Service has made every effort to ensure that the information in the Final Environmental Impact Statement for Resolution Copper Project and Land Exchange is accessible. However, this appendix is not fully compliant with Section 508, and readers with disabilities are encouraged to contact John Scaggs by phone at 602-225-5292 or by email at john.scaggs@usda.gov if they would like access to the information.

CLEAN WATER ACT 404(B)(1) ALTERNATIVES ANALYSIS

Resolution Copper

Prepared for:

United States Army Corps of Engineers

On Behalf of:

RESOLUTION COPPER

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September 10, 2020

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1. INTRODUCTION

Resolution Copper Mining, LLC (Resolution, or the Applicant) proposes to develop and operate an underground copper and molybdenum mine near Superior, Arizona. As proposed, the construction of the tailings storage facility (TSF), associated pipelines, and appurtenant infrastructure requires the discharge of fill to surface water features that the U.S. Army Corps of Engineers (Corps) has determined (Corps File No. SPL-2016-00547) to be potentially jurisdictional waters of the United States (waters of the U.S.) pursuant to a preliminary jurisdictional determination (PJD). As these potentially jurisdictional waters of the U.S. will be impacted by discharges of dredged or fill material resulting from portions of Resolution's planned mine development, Resolution has made application for a Clean Water Act (CWA) Section 404 permit for these discharges.

Because portions of Resolution's planned mine development occur on lands managed by the U.S. Forest Service (USFS) Tonto National Forest (TNF), Resolution submitted a General Plan of Operations (GPO) to the TNF in 2013 and subsequently amended it (Resolution 2016) to account for the USFS plan completeness review and the Southeast Arizona Land Exchange (land exchange) authorized in the National Defense Authorization Act (NDAA) for Fiscal Year 2015. The TNF deemed the GPO to be complete for the purpose of initiating review under the National Environmental Policy Act (NEPA) and subsequently published an Environmental Impact Statement (EIS) for the planned mine development and land exchange. Section 3003 of the NDAA authorized the exchange of lands between the federal government and Resolution and directed the USFS to prepare a single EIS as the basis for all decisions under federal law related to Resolution's proposed mine development and any related major federal action significantly affecting the quality of the human environment. The NEPA analysis will ultimately lead to the issuance of a Record of Decision (ROD) by the USFS for Resolution's planned mining-related activities on National Forest System lands. The Corps is acting as a cooperating agency in the EIS process to meet its NEPA obligation for issuance of a CWA Section 404 permit.

Independent of the requirement to develop the EIS pursuant to NEPA and Section 3003 of the NDAA, an analysis of alternatives is required as part of Section 404 permitting in order to demonstrate compliance with guidelines established under CWA Section 404(b)(1) (40 CFR Part 230; the Guidelines) for avoidance, minimization, and mitigation of impacts to waters of the U.S. A demonstration of compliance with the Guidelines is required before a Section 404 permit may be issued. The 404(b)(1) alternatives analysis is intended to ensure that no discharge 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" (40 CFR Part 230.10(a)).

As discussed above, the Final EIS (FEIS) analyzes Resolution's planned mine development activities, as well as the congressionally authorized land exchange. Because only certain elements of Resolution's overall mine development activities involve a discharge of dredged or fill material into potential waters

of the U.S. (i.e., the construction of the TSF, associated pipelines, and auxiliary infrastructure), only those activities are required to be analyzed by the Corps under the Guidelines. This 404(b)(1) alternatives analysis has been developed to support compliance with the Guidelines, identify the basic and overall project purpose, describe the alternatives selected for detailed analysis, evaluate the practicability of each selected alternative, and discuss the environmental effects of practicable alternatives to ultimately inform the determination of which alternative is the Least Environmentally Damaging Practicable Alternative (LEDPA) under the Guidelines. Information contained in this analysis of alternatives builds on the descriptions contained in the Practicability Analysis (WestLand 2019) included with the Draft EIS (DEIS; USFS 2019b), comments received on the DEIS, and information developed through a series of workgroup meetings with the Corps, USFS, and Environmental Protection Agency (EPA) following publication of the DEIS. This 404(b)(1) alternatives analysis will be used in the Corps permitting decision-making process.

2. PROJECT DESCRIPTION AND PURPOSE

2.1. MINE DEVELOPMENT BACKGROUND

Resolution's planned mine development is located near Superior in Pinal County, Arizona (**Figure 1**) in an area commonly referred to as the Copper Triangle and specifically within the Pioneer Mining District. Mine exploration and operations have been conducted in the area since the early 1860's, when the discovery of silver led to the development of the Silver King Mine. Magma Copper Company (Magma) took over the Silver King Mine and operated it as the Magma Mine from 1912 until the concentrator was finally shut down in 1996. After Magma's shutdown, the Resolution ore deposit was discovered 1.2 miles south of the existing Magma Mine and 7,000 feet below the ground surface.

Resolution was formed as a limited liability company in 2004 by Rio Tinto and BHP Billiton. Since 2004, Resolution has steadily worked to investigate and delineate the Resolution ore body, develop a mine design, prepare environmental and engineering studies to support the mine permitting and approvals effort, and conduct multiple community outreach efforts and public meetings to inform and involve the public as plans were developed. These efforts led to the submittal of the GPO to the USFS in November 2013.

Resolution proposes the development of the Resolution ore body using panel caving, a type of cave mining. The copper and molybdenum ore will be mined, undergo primary crushing underground, and then be sent to a concentrator facility to be constructed at the existing West Plant Site north of Superior. Concentrate produced at the West Plant Site will be transported offsite for additional processing, while the resulting tailings will be transported via a pipeline to the proposed TSF location. Under the current proposed operating conditions and Life of Mine (LOM) planning parameters, the Resolution ore body is sufficient to support the concentrator operations for approximately 41 years. As currently configured, operations are anticipated to result in the mining of approximately 1.4 billion tons of copper and molybdenum ore and the production of approximately 1.37 billion tons of tailings.

2.2. PROJECT DESCRIPTION

Although the mining process in general, and the planned locations of the ore and processing facilities in particular, are described in the GPO, locations for the TSF, pipelines, and auxiliary infrastructure are the primary subject of the alternatives analysis in the EIS and the sole focus of this 404(b)(1) alternatives analysis document. As configured, only the development of the TSF, pipelines, and auxiliary infrastructure (collectively, the "Project" for purposes of this 404(b)(1) alternatives analysis document) require a discharge of dredged or fill material into potential waters of the U.S. Discharge of fill for the development of these features, particularly the TSF, consists mostly of the levelling of existing topography through cut and fill of the natural ground surface. Materials to be discharged to potential waters of the U.S. during this process would consist primarily of native soil and rock taken from the footprint of the constructed features during the grading process.

Processing of the copper and molybdenum ore from the Resolution ore body will result in the production of two physically, mineralogically and geochemically distinct types of tailings: 1) the scavenger or non-potentially acid generating (NPAG) tailings, and 2) the pyrite or potentially acid generating (PAG) tailings. Scavenger tailings contain less than 0.1 percent of pyrite by weight (Duke HydroChem 2016) and will account for approximately 84 percent, or approximately 1.15 billion tons, of the tailings produced during the LOM. In contrast, pyrite tailings contain a much higher amount of pyrite (>20% by weight) and will account for 16 percent, or approximately 0.22 billion tons, of the tailings produced during the LOM (KCB 2018a). These two very distinct types of tailings, and the management requirements for each (especially the pyrite tailings) informed the design and operation of the proposed TSF alternatives evaluated in both the FEIS and this document.

2.3. PURPOSE AND NEED FOR THE PROJECT

The Applicant's overall project purpose and need is to construct and operate a TSF and associated infrastructure capable of storing approximately 1.37 billion tons of tailings produced through milling copper and molybdenum ore from the Resolution ore body (plus approximately 12 million cubic yards of on-site borrow material used to construct the starter embankments), along with the pipelines and associated infrastructure needed to transport tailings to the TSF and recycled water from the TSF back to the concentrator facility. Capacity to deposit approximately 1.37 billion tons of tailings is required to allow for utilization of the Resolution ore body to the extent described in the GPO (mining of approximately 1.4 billion tons of ore). The Applicant's basic project purpose is mine tailings storage, which is not water-dependent. However, the proposed discharge will not affect a special aquatic site, so the rebuttable presumption in 40 C.F.R. § 230.10(a)(3) is not triggered.

3. FORMULATION OF PROJECT ALTERNATIVES

The USFS and cooperating agencies (including the Corps)[1] have analyzed a number of alternative TSF designs and locations for detailed analysis in the EIS. This evaluation is contained in the EIS and other documents cited herein but will be summarized in the balance of this document to explain the selection of the alternatives analyzed in detail for compliance with the Guidelines. This 404(b)(1) alternatives analysis document relies on the detailed analysis of TSF alternatives contained in the EIS and supporting documents. Most of these alternatives, and the methodology for identifying them, are discussed in detail in the *Resolution Copper Project and Land Exchange Environmental Impact Statement DRAFT Alternatives Evaluation Report, November 2017* (SWCA 2017) and *Appendix F: Alternatives Considered but Dismissed from Detailed Analysis* of the DEIS (USFS 2019b). The Skunk Camp TSF alternative was also identified for detailed analysis in the DEIS and FEIS. This 404(b)(1) alternatives analysis was designed to be consistent with, and relies on, the detailed analysis of TSF alternatives contained in these documents to support the analysis of the alternatives for compliance with the Guidelines.

The USFS utilized information gathered from public scoping, government-to-government consultation with Native American groups, and alternatives workshops to identify public values and develop screening criteria for reviewing alternative TSF development scenarios. Some of the key public issues raised during this scoping analysis were public health and safety, proximity to existing communities, and protection of aquatic and wildlife habitat (SWCA 2017). With these issues in mind, the USFS began evaluating the regional landscape to identify TSF locations as potential alternatives to that TSF location proposed in the GPO. The USFS systematically evaluated dozens of potential tailings locations and technologies for both the full volume and partial volumes (split volume storage) of tailings. The identification and evaluation of alternatives, in addition to varying the proposed location of the TSF, also included a process that prioritized alternatives through the following: the potential for use of previously disturbed, or 'brownfield', sites for TSF development, the use of multiple sites for the placement of tailings, and finally differing the types of tailings embankments and tailings processing/placement technologies, including filtered or 'dry stack' tailings, at proposed TSF locations. The discussion of these screened alternatives in this 404b1 alternatives analysis include sixteen brownfield locations (**Section 3.1.1**), the potential use of multiple sites (**Section 3.1.2**), fifteen alternative combinations of TSF locations and tailings processing/placement technologies (**Sections 4.1** and **4.2**), three alternatives evaluated using a preliminary environmental effects screening analysis (**Section 4.3**), a potential filtered TSF at the Skunk Camp location (**Section 4.4**), and four TSF alternatives considered in detail (**Section 5**). The next sections of this document maintain this process and structure in reviewing the resulting alternatives from the USFS alternatives screening process within the added context of the Guidelines.

[1] Henceforth in this document, references to the USFS in the context of development of the FEIS should be understood to include the agencies cooperating in the development of that document, including (but not limited to) the Corps.

3.1. GEOGRAPHIC SCOPE FOR TSF ALTERNATIVES

Transport distance for tailings is a significant factor in determining the economic and technological practicability of recovering the copper and molybdenum ore from the Resolution ore body, and the placement of tailings is not functionally independent of the fixed locus of that ore body. The USFS evaluated a broad landscape up to 200 miles from the East and West Plant sites to identify initial potential alternative locations for the TSF. Factors considered in this evaluation included existing mines or 'brownfield' areas, locations within a reasonable proximity to the Resolution mine site, favorable topography, sufficient storage capacity, and a configuration suitable for tailings impoundment construction as described in the GPO. Potential use of brownfield sites for TSF development was prioritized in this evaluation.

3.1.1. Brownfield Sites

The USFS evaluated brownfield sites associated with other current and previous mining operations not under the ownership of Resolution in locations up to 200 miles from the Resolution ore deposit. This evaluation includes 15 brownfield sites not under Rio Tinto or Resolution Copper ownership, as well as the future subsidence zone anticipated from mining the Resolution ore deposit itself, as potential areas for the storage of tailings that might be available and practicable as alternatives to the development of a new TSF in a previously undisturbed location (SWCA 2017). These brownfield sites are shown in **Figure 2.** The evaluation considered whether the brownfield site had ongoing or publicly stated planned future mining operations, had other ongoing site activities, and had the capacity to contain a necessary volume of tailings (factors relating to the availability of the site under the Guidelines as well as its ability to meet the project purpose). Included in the evaluation of capacity for tailings storage was an investigation of the use of multiple brownfield sites so site capacity was evaluated for both storage of the total volume of tailings and storage of only the total volume of pyrite tailings. If sites were available and practicable under these initial screening factors, they would be further evaluated to determine if they were within a practicable distance for the transportation of tailings. The evaluated sites are listed in **Table 1**.

Based on the brownfield site evaluation, it was ultimately determined that none of the brownfield sites are available, feasible, or reasonable alternatives for TSF locations, and the use of these brownfield sites are dismissed from detailed analysis. Eight of the sites are currently in operation or have proposed future operations that would make them unavailable for the storage of tailings from the Resolution ore body. These sites are therefore determined to be impracticable due to lack of availability and are dismissed from further analysis. The availability assessment reflected in **Table 1** does not consider such other salient factors as whether the owner of the sites in question would be willing to sell the land to Resolution or otherwise allow the deposition of tailings to be generated by the planned Resolution operation, whether the deposition of the Resolution tailings (or a portion thereof) would be consistent with approved site closure/reclamation strategies, or the feasibility of transporting tailings to the sites. A location identified as being "available" in **Table 1** simply means that there are

Table 1. Brownfields Sites Investigated for Potential Tailings Storage (adapted from SWCA 2017 [revised])

Site Name	Ownership	Mining Activity Status	Approximate Distance (miles)[2]	Available	Capacity for Both Tailings Types	Capacity for Pyrite Tailings Only	Other Factors	Alternative Dismissed
Ajo	Freeport-McMoRan	Copper mine, potential for future operation	120	No	No	No	N/A	Yes
Carlota	KGHM International Ltd.	Copper mine, current operation	10	No	No	No	N/A	Yes
Casa Grande	ASARCO LLC	Copper mine, closed operation	49	Yes	No	No	N/A	Yes
Copper Queen	Freeport-McMoRan	Copper mine, closed operation, tourism	145	No	No	No	N/A	Yes
Copperstone	Kerr Mines Incorporated	Gold mine, closed operation	190	Yes	No	No	N/A	Yes
Sierrita	Freeport-McMoRan	Copper mine, current operation	100	No	No	No	N/A	Yes
Johnson Camp	Excelsior Mining Corp.	Copper mine, potential for future operation	100	No	No	No	N/A	Yes
Miami and Inspiration	Freeport-McMoRan	Copper mine, closing	15	Yes	No	Yes	WQARF Site	Yes
Miami Unit and Copper Cities	BHP Copper Inc.	Copper mine, closing	15	Yes	No	Yes	WQARF Site	Yes
Pinto Valley Mine	Pinto Valley Mining Corp.	Copper mine, current operation	11	No	Yes	Yes	N/A	Yes
Ray Mine	ASARCO	Copper mine, current operation	11	No	Yes	Yes	N/A	Yes
Resolution Copper Subsidence Zone	Resolution Copper	Copper mine, potential for future operation	3	Yes	No	Yes	Safety	Yes

[2] Distances measured in aerial miles between the Resolution ore body and the brownfield facilities. The total length to construct appropriate infrastructure (pipelines, etc.) would be considerably longer.

Site Name	Ownership	Mining Activity Status	Approximate Distance (miles)[2]	Available	Capacity for Both Tailings Types	Capacity for Pyrite Tailings Only	Other Factors	Alternative Dismissed
San Manuel	BHP Copper Inc.	Copper mine, closed operation	45	Yes	No	Yes	Proximity to San Pedro River	Yes
Cyprus Tohono	Freeport-McMoRan	Copper mine, potential for future operation	70	No	No	No	N/A	Yes
Twin Buttes	Freeport-McMoRan	Copper mine, potential for future operation	95	No	No	No	N/A	Yes
United Verde	Phelps Dodge Corporation	Copper mine, closed operation	115	Yes	No	No	N/A	Yes

no current operations occurring on the site and no indications of planned future mining operations. An additional site, the Copper Queen site in Bisbee, Arizona is currently used for tourism and was considered unavailable as a potential tailings storage site. Use of this site would also require an extensive pipeline traversing over 145 straight-line miles and crossing multiple divisions of federal, state, tribal, and private lands such as to be technologically and logistically impracticable.

All but two of the alternatives lack sufficient capacity to accommodate the total volume of tailings from the Resolution ore body and, therefore, do not meet the purpose and need for this project. The closed operations at Casa Grande, Copperstone, and United Verde lack the capacity to completely contain even the pyrite portion of the anticipated tailings and would require the operation of multiple TSFs solely for the pyrite tailings (SWCA 2017). These operations also do not meet the project purpose and need and were therefore dropped from further consideration and analysis.

The Miami and Inspiration site, the Miami Unit and Copper Cities sites, and the San Manuel site are dismissed from further analysis due to environmental considerations related to potential ground and surface water quality impacts associated with the storage of the pyrite tailings (SWCA 2017). The Miami and Inspiration site and the Miami Unit and Copper Cities sites are located within the Pinal Creek Water Quality Assurance Revolving Fund (WQARF) site and are currently undergoing closure and remediation activities for impacts to groundwater. Similarly, storage of the pyrite tailings in the San Manuel pit was determined to have the potential to deliver poor quality groundwater to the San Pedro River, given the characteristics of the pyrite material and the pit's proximity to the river (SWCA 2017). As such, none of these three alternatives are considered logistically and/or technologically practicable alternatives for a TSF.

Use of the final brownfield site, the future subsidence zone anticipated from mining the Resolution ore deposit itself, was assessed as a potential TSF location. The usage scenario at this site entailed placement of either conventional or dry stack tailings on the land above the mining panels which would gradually become the subsidence pit. The subsidence pit would continue to be filled with tailings as mining continued and the subsidence expanded over time. Safety concerns to operations and personnel both aboveground and belowground from the deposition of tailings above the active panel caving operations (SWCA 2017) make this alternative impracticable and it is therefore removed from further consideration.

3.1.2. Multiple TSF Locations

The potential for use of multiple sites for the storage for tailings was investigated by the USFS as part of the evaluation of brownfield TSF locations (SWCA 2017; USFS 2019b, 2020) and was also considered in the development of the alternatives evaluated in this 404(b)(1) alternatives analysis. In general, the use of multiple smaller sites for the storage of tailings is problematic from an operations, maintenance, and environmental perspective given the need to duplicate infrastructure at multiple smaller TSFs when compared to a single TSF site. Splitting the footprint of a TSF designed for a given

capacity into multiple smaller TSFs designed to store that same capacity often results in a greater overall footprint, given the need to duplicate infrastructure.

Impoundment embankments, pipelines, seepage controls, and other auxiliary infrastructure (e.g., roads, power, pumping stations, buildings, vehicle storage/maintenance, and various environmental-management measures such as stormwater ponds, run-off collection, and run-on diversion structures) are required for the operation of a TSF of any size. All these structural components and appurtenant features would need to be constructed and operated at each of the smaller TSFs in a multiple TSF scenario. Starter dam, embankment, and capping materials would be required for each of the multiple TSF locations. Separate tailings delivery and recycle water return pipelines would also be necessary for each TSF, further increasing the disturbance footprint. As described in **Section 3.2.2**, the transport of the two types of tailings, scavenger (NPAG) and pyrite (PAG), will be through separate pipelines, further increasing the infrastructure needs associated with multiple TSFs. The duplicative infrastructure required for multiple TSF sites as compared to use of a single site would be expected to result in a larger combined footprint of impact for the multiple TSF over a single TSF of the same storage capacity.

In addition to the consideration of the physical footprint of a single TSF facility in one location versus multiple TSF footprints dispersed over a larger area, the use of multiple TSFs also spreads the potential for environmental effects to additional locations. Effects such as impacts to the aquatic ecosystem, visual impacts, land use compatibility, ground and surface water quality, and air quality would occur at multiple locations, rather than a single location. These effects would be spread over a much larger area when considering the separate facilities, as would the potential for impacts from process upsets, pipeline failures, or seepage. Operating multiple TSF sites when a single site with the necessary capacity exists increases both the operations and maintenance requirements and potential environmental impacts from process upsets.

Given the extensive infrastructure requirements for multiple TSFs and the potential spread of environmental effects to multiple locations, the use of multiple TSFs compared to a single TSF was not carried forward in this analysis.

3.2. TAILINGS IMPOUNDMENT DESIGN, CONSTRUCTION, AND OPERATION

Numerous aspects of TSF design, construction, and operation such as embankment type (e.g., upstream, centerline, modified centerline, and downstream embankments), foundation treatment and lining options, management of pyrite tailings, and deposition methods (e.g., conventional thickened, high-density thickened/thin lift, and filtered, or 'dry-stack') were assessed in the formulation of TSF alternatives, as described in the DEIS (USFS 2019b). Pertinent aspects of tailings impoundment design, construction, and operation considered in this analysis are discussed below in the context of the Guidelines. Additional detail is available in the DEIS (USFS 2019b).

3.2.1. Tailings Embankment

There are four main embankment types for constructing a raised TSF, which are known as upstream, centerline, modified centerline, and downstream. The names of the types refer to the direction of movement of the TSF embankment's centerline in relation to the starter dam initially constructed at the toe of the TSF impoundment. Filtered tailings stacks also require an outer structural zone to meet stability requirements. The differences in embankment design for each of the TSF alternatives are included in the TSF descriptions in **Section 5**.

Upstream Raised Embankment

For a TSF using an upstream raised embankment, the starter dam is constructed at the ultimate TSF toe and successive embankments, or 'lifts,' are constructed with the crest of each berm offset towards the interior of the TSF or 'upstream' of the starter dam. This form of embankment is constructed of the tailings themselves and is generally considered the least robust and resilient embankment type as it relies on a well-drained shell and the strength of the tailings themselves for stability. The upstream method of embankment construction, which had been proposed in the GPO, was formally dismissed as part of the USFS alternatives analysis for the FEIS.

Downstream Raised Embankment

For a TSF using a downstream raised embankment, the starter dam is constructed within the ultimate impoundment and successive berms, or 'lifts,' are constructed with the crest of each berm offset towards the exterior of the TSF or 'downstream' of the starter dam. This form of embankment is typically constructed for containment of water for reservoirs or flood control. This can be a very robust and resilient embankment type because the embankment stability is not reliant on the strength of the tailings but it generally requires the largest volume of material to construct. Due to the large volume required for this embankment type, it can present a challenge for three-sided embankments and areas where topography and land ownership constrains the TSF footprint. This embankment type is proposed for the secondary pyrite tailings storage embankment within the larger Peg Leg and Skunk Camp TSF alternatives.

Centerline Raised Embankment

For a TSF with a centerline raised embankment, the starter dam is constructed within the ultimate impoundment and successive berms, or 'lifts', are constructed with the crest of each berm directly above the starter dam and previous lift, the embankment crest not moving either towards or away from the TSF interior. As with the downstream embankment, this embankment type requires a relatively large volume of materials for construction and is a very robust and resilient embankment type. This embankment type is proposed for storage of the scavenger tailings embankments for the Peg Leg and Skunk Camp TSF alternatives.

Modified Centerline Embankment

Some of the TSF alternatives considered in detail in the FEIS and in this 404(b)(1) alternatives analysis document utilize what are known as 'modified centerline' embankments. As described in Chapter 2 of the FEIS (USFS 2020), modified centerline embankments do move 'upstream' of the starter dam over time and involve some construction of embankments over tailings, but contain a more substantial structural zone as compared to an 'upstream' embankment design. The Near West 'Wet' and Near West 'Dry' TSF alternatives propose use of this embankment method.

3.2.2. Tailings Processing and Placement Technologies

The processing and placement method used for the deposition of tailings can be a determining factor in the design of the TSF and generally has a great effect on the delivery of tailings from the concentrator facility to the TSF for storage. Where differences in tailings placement methods are pertinent to the analysis of alternatives, this information is included in the TSF descriptions in **Section 5**. All TSF alternatives described in Chapter 2 of the FEIS (USFS 2020) consist of separation and thickening of the scavenger and pyrite tailings at the concentrator facility. Thickening tailings involves the mechanical process of removing some water from the tailings while still maintaining a concentration of water that allows the tailings to be transported via pipeline. The two types of tailings, scavenger and pyrite, are transported to the TSF facility though separate pipelines within the same corridor. Brief descriptions of tailings placement technologies evaluated are provided below.

Sub-aqueous Deposition of Pyrite Tailings

In this method of tailings placement, pyrite tailings are thickened at the concentrator to 50 to 55 percent solids and then transported to the TSF via pipeline. Sub-aqueous deposition of pyrite tailings (i.e., deposition in a manner that keeps the pyrite tailings submerged below water) is a Best Management Practice (BMP) method used to prevent and minimize acid rock drainage (ARD) by preventing the tailings from being exposed to oxygen in the air that would interact with the sulfides in the pyrite tailings. For all alternatives except Silver King (Filtered), the pyrite tailings are discharged sub-aqueously into the reclaim pond from a barge in a separate area to the scavenger tailings deposition area. Near West 'Wet' includes the reclaim pond and pyrite tailings area within the scavenger beach (not in a separate cell).

Near West 'Dry', Peg Leg and Skunk Camp alternatives all store pyrite tailings in physically separate cells, although there are differences in these cells across the TSF alternatives. The Peg Leg and Skunk Camp pyrite cells are contained by independent downstream embankments. The Near West "Dry" pyrite cell is physically isolated with a splitter berm and therefore not structurally stable without the abutting scavenger tailings. The Peg Leg pyrite cells are separate from the scavenger impoundment, whereas, the Near West 'Dry' and Skunk Camp pyrite cells would ultimately be encapsulated by the scavenger impoundment. As a result, the reclaim water pond would only overlie the pyrite tailings, reduced in size from that typically needed for Near West 'Wet'. Limited and small low spots that

accumulate water either released from the tailings or stormwater on the scavenger surface would also be directed to the pyrite tailings cell.

Tailings Placement via Conventional Thickened Deposition

In this method of tailings placement, scavenger tailings are thickened at the concentrator facility to 50 to 60 percent solids by weight and transported to the TSF via pipeline. At the TSF, the scavenger tailings are processed through hydrocyclones to produce a coarse particle tailings stream used to construct the embankment, and the finer particle tailings stream is deposited into the interior of the impoundment. Hydrocyclones require the input tailings stream to be between 30 to 40 percent solids by weight. The underflow from the hydrocyclones, used for construction material, typically has higher solids content by weight, often greater than 60 percent. The overflow, a finer particle tailings stream, therefore a higher water content. Typically, the finer particle tailings stream is directly discharged into the facility with the high water content. For the Near West 'Wet' TSF alternative, the finer particle tailings stream is assumed to be thickened and discharged at 50 to 55 percent solids by weight.

Tailings Placement via High-Density Thickened/Thin Lift Deposition

Similar to conventional thickened deposition, tailings are transported to the TSF via pipeline after thickening at the concentrator facility. Additional thickeners located at the TSF facility remove and recycle water to further thicken the tailings prior to deposition. These tailings are deposited at between 60 to 70 percent solids by weight. Like conventional thickened tailings, the scavenger tailings are processed through hydrocyclones to produce a coarse particle tailings stream (the underflow) used to construct the embankment, and a finer particle tailings stream (the overflow) that is deposited into the interior of the impoundment. The high-density thickened deposition also involves additional thickening of the overflow to between 62 to 65 percent solids by weight to remove water prior to deposition, with placement of those tailings in thin layers, called "thin-lift," to further reduce entrained water through evaporation and thus reduce seepage. Alternatives that incorporate this type of tailings placement technology include the Near West 'Dry', Peg Leg, and Skunk Camp TSF alternatives.

Filtered Tailings ('Dry-Stack')

In this method of tailings placement, tailings are transported to the TSF via pipeline where they are filtered to reduce the moisture content to approximately 85 percent solids by weight. This process reduces the moisture content to the point where transportation and placement via pipeline is no longer possible and placement of the dewatered tailings in the TSF must be accomplished via mechanical means, such as by truck or conveyor and spreading/compacting equipment. Filtered tailings impoundments can be constructed in horizontal lifts using a structural outer shell that supports the non-structural zone upstream.

Key considerations when assessing the reasonableness, practicality, and benefits of a tailings management strategy are the precedents and lessons learned from case histories. Most dry-stack

tailings facilities operate with throughput capacity between 2,000 and 10,000 tons per day (tpd) with dam heights of less than 200 feet. The current demonstrated industry maximum throughput capacity for operating dry-stack facilities at other mines is approximately 20,000 tpd to more recently approximately 30,000 tpd. Operation at that rate, however, essentially requires two TSFs to allow for conventional thickened tailings deposition during upset conditions where filtered tailings cannot be produced properly. The proposed concentrator facility for the Resolution Copper Project will have a throughput of approximately 132,000 tpd and a dam height of approximately 1000 feet for the Silver King Filtered TSF alternative. To date, the maximum slope height of filtered tailings stack achieved is approximately 200 feet (further detail can be found in **Appendix A**: *Resolution Copper Mining, LLC – Mine Plan of Operations and Land Exchange – USFS Alternatives Data Request #3-F, Information on Potential Tailings Alternatives*). Although the dry-stack technology needed to meet the overall project purpose is unproven, this method was carried forward for further analysis in the Silver King TSF alternative in the EIS (USFS 2019b, 2020) and this document for the sake of completeness.

4. ANALYSIS OF PROJECT ALTERNATIVES

After dismissal of the brownfield alternatives, fifteen alternative TSF locations (**Figure 3**), including the GPO location, were further evaluated by USFS and screened using criteria developed from the public and agency scoping processes (SWCA 2017; USFS 2019b) and the design criteria described above. Although these fifteen alternatives were ultimately dismissed from further consideration, they ultimately gave rise to the four alternatives considered in detail in this 404(b)(1) alternatives analysis (**Section 5**). The general evaluation criteria included locations that are within approximately 20 miles of the West Plant Site, sites that avoid landscape barriers such as mountains or rivers, sites outside rugged terrain too steep for TSF development, and sites potentially near existing or historic mining operations. The alternatives have also been independently analyzed by the Corps as part of this 404(b)(1) alternatives analysis. The screening process entailed an assessment of whether or not each location was available, logistically practicable, or technologically practicable for use as a TSF site in the context of the Guidelines. As outlined in **Table 2**, all fifteen TSF alternatives were dismissed from further consideration due to availability and/or practicability issues. An alternative is "practicable" under the Guidelines if it is available and capable of being implemented after taking into consideration cost, existing technology, and logistics in light of overall project purposes (40 C.F.R. § 230.3(l) & 230.10(a)(2)). The rationale for dismissal of each site is explained in further detail below.

Three additional potential TSF locations, BGC B, Peg Leg, and Mineral Creek (**Figure 3**) were identified and carried through to a preliminary environmental effects screening, wherein it was determined that development of a TSF at these proposed locations would have obvious adverse environmental consequences precluding their selection as the LEDPA. A final preliminary environmental effects screening was conducted for the proposed TSF at the Skunk Camp location to assess whether a filtered tailings TSF was feasible and could potentially reduce the footprint of the TSF as compared to a conventional thickened tailings TSF. The evaluation found that the filtered

tailings TSF at Skunk Camp would instead have a similar or larger footprint than the conventional slurry TSF. Based on this information, the Skunk Camp Filtered Tailings TSF design alternative was also dropped from further analysis.

4.1. TSF Locations Dismissed from Consideration Due to Lack of Availability

Most of the TSF alternatives screened in **Table 2** were dismissed from further consideration due to lack of availability. The availability issues and rationale for dismissal of each of the sites is provided below.

4.1.1. ASLD Lands Associated with the BGC A and Far West Alternatives

The BGC A and Far West TSF alternatives are located approximately 14 miles southwest of Superior Arizona (**Figure 3**) and located primarily on Arizona State Trust Lands managed by the Arizona State Land Department (ASLD). The ASLD land underlying both alternatives has been proposed as the location for a future 175,000-acre residential and commercial development known as Superstition Vistas (Superstition Vistas 2013; **Figure 4**). Placing a TSF within this planned area development would decrease the amount of land available and reduce property values within the viewshed of the TSF. ASLD has stated (**Appendix B**) that it will not sell land in the Superstition Vistas to Resolution for the development of a TSF and both alternatives were dropped from further consideration (WestLand 2020a; **Appendix C**).

4.1.2. Lands Associated with the BOR Mineral Withdrawal

The BGC C, BGC D, SWCA 1, and SWCA 2 TSF alternatives are located along the Gila River west of Kearny and east of Florence (**Figure 3**). The Lower East TSF alternative is located along Queen Creek west of Superior (**Figure 3**). Lands underlying portions of all five of these TSF alternatives have been withdrawn from mineral entry by the Bureau of Reclamation (BOR; **Figure 5**) and Resolution has no mining claims located at these sites that predate the withdrawal. The BOR withdrawal is related to use of these lands by the Salt River Project (SRP) and the San Carlos Irrigation Project (SCIP) for water storage and diversion and/or power generation, transmission, and distribution (WestLand 2020a; **Appendix C**). Information provided to the USFS and Corps indicates that these withdrawals have no expiration, or 'sunset date,' and remain in force as long as the purpose for withdrawal still exists. BOR has provided information to the USFS indicating these lands remain unavailable for TSF development (USFS 2020). These 5 TSF alternatives were therefore dropped from further consideration.

Table 2. Alternative TSF Locations Dismissed from Consideration (adapted from USFS 2019b, Appendix B [revised])

Alternative Location	Available	Logistically Practicable	Technologically Practicable	Dismissed
BGC A	No – includes ASLD lands not available for purchase.	N/A	N/A	Yes – not available.
BGC C	No – includes lands withdrawn from mineral entry by BOR.	N/A	N/A	Yes – not available. A reconfiguration of BGC C became DEIS Alternative 5 (Peg Leg)
BGC D	No – includes lands withdrawn from mineral entry by BOR.	N/A	No – proximity to the Gila River presents impracticable technological challenges related to seepage.	Yes – not available and not technologically practicable.
Dry-Stack at GPO	Yes	No – water management issues (fully unsaturated pyrite would exceed WQ standards and result in long-term WQ issues) and pipeline corridor make this logistically impracticable.	No – dry-stack technology not proven at scale and impoundment is ~1,000 feet high, an unprecedented height for TSF embankments in North America or for a dry stack embankment anywhere in the world (highest currently are ~200 feet).	Yes – neither logistically nor technologically practicable. Reconfigurations based on conventional and high-density thickened tailings became DEIS Alternatives 2 and 3 (Near West 'Wet' and 'Dry').
Far West	No – includes ASLD lands not available for purchase.	N/A	N/A	Yes – not available
Hewitt Canyon	No – location in proximity to Superstition Wilderness Class I airshed would prevent air permit compliance.	No – location in proximity to Superstition Wilderness Class I airshed would prevent air permit compliance.	N/A	Yes – not available or logistically practicable.
Lower East	No – includes lands withdrawn from mineral entry by BOR.	N/A	N/A	Yes – not available.

Alternative Location	Available	Logistically Practicable	Technologically Practicable	Dismissed
Silver King	No – conventional tailings deposition design at this location was not available because of historic cemetery, private lands, and adverse mineral estate.	N/A	No – presence of historic mine workings.	Yes – not available or logistically practicable. Reconfiguration of methodology and footprint became DEIS Alternative 4 (Silver King Dry-Stack).
SWCA 1	No – appurtenant features (seepage collection, etc.) on lands withdrawn from mineral entry by BOR.	Yes	No – proximity to the Gila River and terrain present challenges for seepage and stormwater management.	Yes – not available and not technologically practicable.
SWCA 2	No – includes lands withdrawn from mineral entry by BOR.	Yes	No – proximity to the Gila River and terrain present challenges for seepage and stormwater management.	Yes – not available and not technologically practicable.
SWCA 3	Yes	No – rugged topography makes it unlikely to have available capacity for all tailings volume and presents substantial difficulties for infrastructure, structures, and equipment.	No – location is on steep ridge crest and occupies portions of both the Queen Creek and Gila River watersheds, requiring substantial engineering controls to minimize seepage from multiple locations.	Yes – neither logistically nor technologically practicable
SWCA 4	No – partially located on Superstition Wilderness and therefore not available.	N/A	N/A	Yes – not available.
Telegraph Canyon	No – tributary to creek reach listed as candidate for Scenic River Area designation.	N/A	N/A	Yes – not available.
Upper Arnett	No – tributary to creek reach listed as candidate for Scenic River Area designation.	N/A	N/A	Yes – not available.
Whitford Canyon	No – location in proximity to Superstition Wilderness Class I airshed would prevent air permit compliance.	No – location in proximity to Superstition Wilderness Class I airshed would prevent air permit compliance.	N/A	Yes – not available or logistically practicable.

4.1.3. Lands Associated with the Superstition Wilderness

The Hewitt Canyon and Whitford Canyon TSF alternatives are located in proximity to the Superstition Wilderness, and SWCA 4 is located within the wilderness boundary (**Figure 6**). Air Sciences Inc. (ASI) prepared a technical memorandum (ASI 2019) describing the regulatory constraints associated with the Class I airshed of the wilderness. The USFS determined that even if the TSFs were operated and controlled to industry standards, they are so close to the wilderness boundary as to be incompatible with the protection of the Class I airshed (ASI 2019; **Appendix D**). Further, no emissions offsets are available to mitigate potential air quality impacts (ASI 2019). These TSF alternatives are not available or logistically practicable and were therefore dropped from further consideration.

Related to the above, the location of the SWCA 4 TSF alternative partially within the Superstition Wilderness boundary precludes its availability for development of a TSF. This alternative was also dropped from further consideration.

4.1.4. Wild and Scenic River Candidate Reaches

The Telegraph Canyon and Upper Arnett TSF locations (**Figure 3**) were dismissed from further consideration because, in addition to other unique natural resource values, these two creeks are tributaries to reaches previously listed as candidates for designation as Scenic River Areas (USFS 1993) under the National Wild and Scenic River System (16 U.S.C. 1271 et seq.). This system allows for the preservation of certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. Both Arnett and Telegraph creeks contain reaches which have outstandingly remarkable scenery and fisheries resource values that are protected under a restrictive land use and resource management framework (USFS 2017, 2019a). Because of the anticipated impacts to these sensitive resources, both of these TSF alternatives were dropped from further consideration (WestLand 2020a; **Appendix C**).

4.2. TSF Locations Dismissed from Consideration Due to Impracticability

The Dry-Stack at GPO and SWCA 3 (**Figure 3**) TSF alternatives were dismissed from further detailed consideration based on practicability issues. The Dry-Stack at GPO TSF was determined to be both logistically and technologically impracticable. Water management issues related to fully unsaturated pyrite tailings in the Dry-Stack at the GPO TSF would result in exceedances of water quality standards and long-term water quality issues. Additionally, the dry-stack technology proposed for use in this TSF is not proven or commercially available at the scale proposed for the Resolution project and the resulting impoundment is ~1,000 feet high, an unprecedented height for TSF embankments in North America or for a dry stack embankment anywhere in the world (the highest of which is ~200 feet in height). For these reasons, this alternative was dropped from further consideration (WestLand 2020a; **Appendix C**).

The SWCA 3 TSF was also determined to be both logistically and technologically impracticable. The rugged topography of the location makes the proposed TSF unlikely to have available capacity for the proposed tailings volume and makes impossible the safe and effective construction and operation of the embankment and associated infrastructure (USFS 2019b). The location of this TSF on a steep ridge crest puts it in portions of both the Queen Creek and Gila River watersheds and would require substantial engineering controls to minimize seepage from multiple locations. This alternative was therefore dropped from further consideration (WestLand 2020a; **Appendix C**).

4.3. PRELIMINARY ENVIRONMENTAL EFFECTS SCREENING ANALYSIS

Three additional potential TSF locations, BGC B, Peg Leg, and Mineral Creek (**Figure 3**) were identified and carried through to a preliminary environmental effects screening, wherein it was determined that development of a TSF at these proposed locations would have adverse environmental consequences precluding their selection as the LEDPA, and these sites were therefore dismissed from further analysis. The preliminary environmental effects screening for the BGC B, Peg Leg, and Mineral Creek locations, including the rationale for dismissal from further analysis, is provided below.

4.3.1. BGC B

The BGC B TSF alternative is located east of Florence in Pinal County on lands administered by the Bureau of Land Management (BLM) and ASLD (**Figure 3**), and the proposed BGC B footprint includes an approximately 3-mile stretch of the Florence Kelvin Highway (**Figure 7**). BGC B is situated approximately 6 miles west of the Peg Leg TSF alternative and 20 miles directly southwest of the West Plant Site, which is described in the DEIS as the location from which the tailings will ultimately be transferred to the TSF (USFS 2019b). Notable landscape features between BGC B and the West Plant Site include the Gila River, which occurs approximately 3.8 miles north of BGC B. This TSF alternative is located at the furthest distance from the West Plant Site and, due to both terrain and distance, the overall tailings pipeline length would be much longer than 20 miles and longer than the Peg Leg TSF alternative pipelines.

WestLand Resources, Inc. (WestLand) conducted a desktop evaluation of the BGC B site and identified approximately 124 acres of drainage features exhibiting a potential Ordinary High Water Mark (OHWM) within the BGC B TSF footprint (**Figure 7**). The linework depicted in **Figure 7** reflects only the BGC B footprint and does not include associated pipelines and other appurtenant TSF infrastructure, which would have additional impacts to OHWM. Additionally, the Florence-Kelvin Highway, which bisects the southern portion of the BGC B footprint (**Figure 7**) would require a substantial reroute, which would add considerably more impacts.

Development of the Skunk Camp TSF alternative, including the appurtenant infrastructure and pipeline, would result in approximately 129 acres of direct impacts to potential waters of the U.S. The BGC B TSF footprint alone contains approximately 124 acres of potential waters of the U.S.

(**Figure 7**) that would be directly impacted without the addition of the appurtenant features (e.g., roads, power, pumping stations, buildings, vehicle storage/maintenance, and various environmental-management measures such as stormwater ponds, run-off collection, and run-on diversion structures) required to construct and operate the TSF. These appurtenant features would also be anticipated to have direct and indirect impacts on OHWM. A tailings pipeline between BGC B and the West Plant site would also require several more miles of tailings pipeline beyond that required for the Peg Leg and Skunk Camp TSF alternatives, and the BGC B pipeline would necessarily cross the Gila River. Development of a tailings pipeline across the Gila River would potentially impact species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA), including southwestern willow flycatcher (*Empidonax traillii extimus*) and yellow-billed cuckoo (*Coccyzus americanus*), which utilize the Gila River between Kearny and Florence for breeding and/or a migration travel corridor (WestLand 2016a, 2016b, 2019a, b).

The higher acreage of impacts to OHWM compared to Skunk Camp and the potential environmental consequences of constructing and operating a tailings pipeline across the Gila River preclude BGC B from consideration as the LEDPA. The BGC B alternative is therefore dropped from further analysis (WestLand 2020b; **Appendix E**).

4.3.2. Peg Leg

The Peg Leg TSF alternative The Peg Leg TSF Alternative is located in Pinal County, Arizona (**Figure 8**), and proposes the construction of two separate impoundments with a dual-embankment approach, a centerline embankment for containment of approximately 1.15 billion tons of scavenger tailings and a downstream embankment for containment of approximately 0.22 billion tons of pyrite tailings (pyrite tailings are managed separately due to their potential for acid generation). These impoundments would be located on a mix of public lands managed by the BLM and State Trust lands (**Figure 3**) that would need to be purchased from the ASLD prior to construction and operation of the TSF. The transportation corridor for the pipelines, roads, and powerline between West Plant and the TSF would be located on a combination of lands owned by the USFS, BLM, BOR, Department of Defense, ASLD, and Resolution. Similar to the Near West 'Dry' Alternative, pyrite tailings would be discharged sub-aqueously into a separate impoundment, a BMP for pyrite tailings. However, with the Peg Leg TSF Alternative, the pyrite facility would be contained behind a separate downstream embankment and separated into smaller operating cells to reduce pond size, seepage, and water required during the life of mine (LOM). These two impoundments would total approximately 10,782 acres in size with the ultimate height of the scavenger and pyrite impoundments reaching 310 and 200 feet in height, respectively.

WestLand conducted a desktop evaluation of OHWM at the Peg Leg TSF Alternative site and identified approximately 182.5 acres of drainage features exhibiting a potential OHWM within the TSF footprint (**Figure 8**). An additional 27.8 acres of OHWM would be directly impacted by the TSF design infrastructure (**Figure 8**) evaluated in the DEIS (USFS 2019b). Important to note is that the

OHWM impact linework depicted in **Figure 8** reflects only the direct impacts from the Peg Leg footprint and this TSF infrastructure, but does not include: (1) indirect impacts from 'dewatering' of downgradient reaches through upgradient fills; (2) direct impacts from construction in the power and pipeline corridor, or (3) direct impacts from the complete suite of infrastructure that would be required to operate this TSF (e.g., stormwater ponds, run-off collection, run-on diversion structures, onsite roads, buildings, and vehicle storage/maintenance). As noted above, the 27.8 acres of direct impact associated with TSF infrastructure reflects impacts from only the limited infrastructure evaluated in the DEIS.

Development of the Skunk Camp TSF alternative, including all of the appurtenant infrastructure and pipelines, would result in approximately is 188.3 acres of direct and indirect impacts to potential waters of the U.S., of which 172.6 are permanent direct and indirect impacts from construction of the TSF and appurtenant infrastructure. The remaining approximately 15.7 acres of impacts are associated with construction in the power and pipeline corridor. Of these approximately 172.6 acres of impacts associated with the construction of the TSF and associated infrastructure, approximately 43.4 acres represent indirect impacts associated with dewatering of downstream features identified as potential waters of the U.S. in the PJD. Direct impacts to potential waters of the U.S. associated with the construction of the TSF and associated infrastructure at the Skunk Camp site are approximately 129.2 acres.

The Peg Leg TSF design as evaluated in the DEIS (USFS 2019b) contains approximately 210.3 acres of potential waters of the U.S. (**Figure 8**) that would be directly impacted by the construction of the TSF and a limited amount of associated infrastructure. This represents a nearly 63% increase in direct impacts to potential waters of the U.S. from TSF and associated infrastructure construction as compared to the Skunk Camp alternative. The relative difference is likely even greater because the full infrastructure of the Peg Leg TSF has not been designed (i.e., impacts to potential waters of the U.S. from construction of necessary on-site features such as roads, pumping stations, buildings, and stormwater control features have not been estimated)[3].

In addition, pipelines running between Peg Leg and the West Plant site would necessarily cross the Gila River. Development of a tailings pipeline across the Gila River would potentially impact species listed as threatened or endangered by the USFWS under the ESA, including southwestern willow flycatcher and yellow-billed cuckoo, which utilize the Gila River between Kearny and Florence for breeding and/or a migration travel corridor (WestLand 2016a, 2016b, 2019a, b).

The significantly higher acreage of impacts to potential waters of the U.S. associated with the construction of a TSF and some associated infrastructure at the Peg Leg site, as compared to the

[3] Like the Skunk Camp alternative, the Peg Leg alternative would also have direct impacts to potential waters of the U.S. associated with construction in the power and pipeline corridor, as well as indirect impacts to potential waters of the U.S. downstream of the TSF as a result of dewatering. These impacts cannot be quantitatively estimated at this time, but there is no reason to believe they would be appreciably lower than comparable impacts associated with the Skunk Camp TSF.

Skunk Camp site (at least 81.1 acres, or a 63% increase), along with the potential adverse environmental consequences of constructing and operating a tailings pipeline across a portion of the Gila River known to be utilized by listed endangered species clearly preclude the selection of the Peg Leg TSF as the LEDPA if there are any other practicable alternatives. The Peg Leg TSF alternative, therefore, will not be analyzed in detail in the 404(b)(1) alternatives analysis.

4.3.3. Mineral Creek

The Mineral Creek TSF alternative (**Figure 3**) was developed after the initial TSF evaluation and screening analysis was completed and was therefore carried through to a preliminary environmental effects screening. The Mineral Creek TSF alternative location appears to be available and both logistically and technologically practicable for the development of a TSF. However, before detailed design and engineering documentation for a TSF at this location were prepared, other significant adverse environmental consequences were identified and deemed sufficient to preclude this location from being selected as the LEDPA.

Mineral Creek, located within the HUC-10 Mineral Creek – Gila River watershed (HUC 1505010002), is a north to south trending drainage originating in the foothills of the Pinal mountains, joining the Gila River just south of Kelvin, Arizona (**Figure 9**). The drainage is spatially intermittent with an approximately 4-mile-long reach (**Figure 9**) considered continuously saturated (Montgomery and WestLand 2017). Vegetation composition along the continuously saturated reaches of Mineral Creek consists of mixed stands of Arizona sycamore (*Platanus wrightii*), velvet mesquite (*Prosopis velutina*), and gray thorn (*Ziziphus obtusifolia*), with a few Goodding's willow (*Salix gooddingii*). Intermittent patches of seepwillow (*Baccharis salicifolia*) and singlewhorl burrobrush (*Ambrosia monogyra*) occur along the terraces. Approximately nine miles of Mineral Creek in this area has been designated by the USFWS as critical habitat (**Figure 9**) for the native and endangered Gila chub (*Gila intermedia*). Of this 9-mile-long reach, approximately 5.16 miles would be permanently lost within the footprint of this TSF. Approximately seven miles of Mineral Creek in this area has been proposed by the USFWS as critical habitat (**Figure 9**) for the western distinct population segment of the yellow-billed cuckoo. Of this 7-mile-long reach, approximately four miles of proposed this proposed critical habitat would be permanently lost within the footprint of the TSF. Based on this impact, this alternative has been dropped from further consideration (WestLand 2020a; **Appendix C**).

4.4. Skunk Camp Filtered Tailings ('Dry-Stack') Design

In an agency workgroup meeting following publication of the Draft EIS, the EPA requested that the filtered, or 'dry-stack,' technology also be evaluated for the proposed TSF at the Skunk Camp location to assess whether the filtered tailings TSF was feasible and could potentially reduce the footprint of the TSF as compared to a conventional thickened tailings TSF. KCB Consultants Ltd. (KCB) prepared a conceptual Filtered Tailings Impoundment Layout and Staging memorandum (KCB 2020a; **Appendix F**) to evaluate the likely footprint of a Skunk Camp filtered tailings TSF. This memorandum

was developed based on the assumption that the filtered tailings technology would be feasible and commercially available at the scale of the Resolution project in time for production. Regardless, the KCB evaluation found that the filtered tailings TSF at Skunk Camp would instead have a larger footprint than the conventional slurry TSF and would require additional back-up storage area (KCB 2020a). Based on this information, the Skunk Camp Filtered Tailings TSF design alternative was dropped from further analysis.

4.5. Screening and Analysis Summary

As none of the alternatives discussed above met the general screening criteria defined herein and the criteria for practicability under the Guidelines, they were dismissed from further consideration in the FEIS (SWCA 2017, USFS 2020) and this 404(b)(1) alternatives analysis. Due to concerns about tailings embankment safety and the potential for adverse environmental consequences from TSF failure, the upstream method of tailings embankment construction was dismissed from further analysis, as well. This screening analysis did, however, identify three new TSF alternatives at two of the previously investigated locations. The Near West 'Wet' and 'Dry' Alternatives resulted from the screening and analysis performed for the Dry-Stack at GPO Alternative. The Silver King location was identified for analysis as a potential dry-stack TSF. These three alternatives are described and considered in detail in both the FEIS and this 404(b)(1) alternatives analysis document.

A fourth alternative site, initially named Upper Dripping Springs Wash, was also brought forward for consideration during the scoping period. The initial screening of this alternative, later renamed the Skunk Camp Alternative, did not identify any high-level availability or practicability issues with this alternative location. The alternative footprint includes only ephemeral drainages, does not contain any potential wetlands, and avoids seeps and springs in the area. The Skunk Camp Alternative proposes tailings placement via High-Density Thickened/Thin Lift Deposition (KCB 2020b) and was carried forward for detailed review in both the FEIS and this practicability analysis document.

4.6. Alternatives Considered in Detail

Five TSF alternatives are considered for detailed analysis in the FEIS (USFS 2020), including the Peg Leg TSF alternative. As the Peg Leg TSF alternative could not be selected as the LEDPA (**Section 4.3.2**), this alternative will not be analyzed in detail in this 404(b)(1) alternatives analysis document. The four TSF alternatives considered in detail in this document occur in a variety of locations and utilize several different embankment types and tailings deposition and placement technologies. The alternative site names and corresponding tailings processing and deposition information are as follows:

- Near West 'Wet' TSF (conventional thickened tailings)
- Near West 'Dry' TSF (high-density thickened/thin lift tailings)
- Silver King TSF (dry-stack tailings)
- Skunk Camp TSF (high-density thickened/thin lift tailings)

These final TSF alternatives are fully analyzed in the FEIS to disclose impacts to the natural and social environment. Per the Guidelines, the evaluation of these alternatives provided herein will focus on practicability, impacts to the aquatic ecosystem, and other significant adverse environmental consequences.

5. TSF ALTERNATIVES DESCRIPTION AND PRACTICABILITY DETERMINATION

This section describes the four TSF alternatives identified for detailed analysis (**Figure 10**) by the Corps and provides descriptions for each, including the acreages of impacted undisturbed land reported to the nearest acre. An alternative is to be deemed practicable, "if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes" (40 CFR Part 230.3(l) & 230.10(a)). The alternatives considered in this analysis have been evaluated for these elements of practicability. Details of each alternative are followed by a determination of the alternative's practicability based on the criteria defined in the Guidelines at 40 CFR Part 230.10(a)). Project-specific practicability criteria applied to this analysis of TSF alternatives is discussed in **Section 5.1**.

5.1. PROJECT-SPECIFIC PRACTICABILITY CRITERIA

A critical element in determining the logistical and technological practicability of a TSF alternative is the ability (or lack thereof) to capture and control seepage from the TSF in a manner that reliably allows the facility to meet all applicable standards and obtain and operate in compliance with required environmental permits. Numerical models were developed for each TSF to predict the amount of uncollected seepage for each TSF alternative (M&A 2019a, 2019b). These seepage models were developed based on the hydrogeological setting of each TSF site and represent steady-state conditions assuming operational conditions at full TSF build-out. Levels of engineering seepage controls were also developed for implementation at each TSF site and are described in detail in the FEIS (USFS 2020).

The levels of engineering control and estimated efficiency are based on Best Available Demonstrated Control Technology (BADCT) for seepage controls as defined by the Arizona Department of Environmental Quality (ADEQ), as well as other discharge control technologies considered by the Applicant. Engineering controls to reduce seepage are characterized in the models by level, or efficiency, of control. These levels are specific to each alternative and location. Descriptions of each TSF alternative's levels are described in **Section 5.2** and tables taken from the *Resolution Copper Project Summary of DEIS Tailings Alternatives Seepage Control Levels* (KCB 2019) are included as **Appendix G** of this document. It should be noted that the seepage engineering controls included within each defined level are slightly different for each TSF alternative due to site-specific conditions. However, the greater the number of controls required in each level, and the presence of higher level controls, denote an increased degree of complexity in terms of those engineered controls, which in turn corresponds to a greater difficulty in reliably controlling seepage at the location.

The numerical models, described above and explained in detail in the DEIS, were used to estimate the uncaptured seepage in acre-feet per year (AF/yr). GoldSim models taking into account these engineered controls were then used to predict potential transport of any uncollected seepage through the aquifer to surface water receptors. In order to operate a TSF, Resolution must obtain an Aquifer Protection Permit (APP) from ADEQ, which will require it to demonstrate that discharges from APP-regulated facilities will not cause or contribute to an exceedance of Aquifer Water Quality Standards (AWQS) at the Point of Compliance (POC), or, if the AWQS for a pollutant has been exceeded at the POC at the time of permit issuance, that the discharge will not further degrade aquifer water quality for that pollutant at the POC [A.R.S. § 49-243(B)(2)-(3); A.A.C. R18-9-A202(A)(8)(a)]. Seepage must also not cause or contribute to the exceedance of any ADEQ surface water quality standards where groundwater may emerge and contribute to surface flow [A.A.C. R18-11-405(b)].

The concentrations of regulated constituents in the seepage were modeled both with and without the background water quality. An analysis of the total predicted concentrations (modeled plus background) of pollutants was used to calculate the preliminary allowable seepage rate in AF/yr that would allow each TSF to operate over the LOM and post-closure (245 years) periods without exceeding water quality standards. The total predicted concentrations are compared to the ADEQ groundwater and surface water quality standards at the POCs downgradient of each TSF footprint (750 ft downgradient for groundwater, consistent with A.R.S. § 49-244(2)(b)(iii); site-specific locations for surface water). In terms of analysis of potential effect of seepage on downstream surface waters, POCs were established for various alternatives at the location where groundwater that may have been impacted by the seepage is likely to emerge and potentially impact the quality of a surface water. The surface water POC for Near West 'Wet,' 'Dry,' and Silver King alternatives is in the last groundwater model cell nearest to Whitlow Ranch Dam, which provides the majority of surface flow at the dam. The surface water POC for Peg Leg and Skunk Camp alternatives is located in groundwater just before the confluence of Gila River at Donnelly Wash and Dripping Spring Wash, respectively. The background water quality, surface water flow rate, and distance to the POC are critical in determining the potential seepage impacts to downstream surface water quality.

For each alternative, a maximum uncollected seepage rate was modeled that would allow compliance with aquifer water quality standards at the groundwater POCs and surface water quality standards at the surface water POCs noted above, as is necessary in order to secure an APP. If exhaustive and multiple seepage controls are installed and the TSF cannot meet standards and secure an APP, then it was determined that the TSF is technologically impracticable for the purposes of this assessment.

5.2. DETAILED EVALUATION OF ALTERNATIVES

A description and discussion on the practicability of each TSF alternative selected for analysis in detail is provided in the following sub-sections. The alternatives evaluated are as follows:

- Near West 'Wet' TSF
- Near West 'Dry' TSF
- Silver King TSF
- Skunk Camp TSF

5.2.1. Near West 'Wet' TSF Alternative

5.2.1.1. Description

The Near West 'Wet' TSF Alternative (Alternative 2 in the DEIS) proposes the construction of a modified centerline embankment on USFS lands (**Figure 10**) with approximately 1.37 billion tons of tailings storage capacity using conventional thickened tailings deposition. The associated tailings transportation corridor would also be located on USFS and private lands owned by Resolution. This TSF alternative would be approximately 4,909 acres in size with an ultimate embankment crest reaching 520 feet in height.

The location of the Near West 'Wet' TSF is underlain by a mix of different age bedrock incised with narrow channels infilled with alluvial, colluvial and undifferentiated sediments (KCB 2018a). Gila Conglomerate makes up 55 percent of the Near West 'Wet' TSF overall foundation, while a mixture of limestones, sandstones and quartzites are located along the footprint of the scavenger starter dam, the TSF embankment, and the northern portion of the TSF. The conglomerate, limestone, and sandstone sediments all possess a potential for reduced foundation strength, especially if exposed to long-term saturation, and have potential to allow seepage into adjacent canyons (KCB 2018a).

The proposed Near West 'Wet' TSF is located near the center of Superior Basin, which drains ultimately into Queen Creek. Stormwater diversion channels would be required for this TSF alternative to redirect flow from the 4.91-square-mile upper watershed of Bear Tank Canyon to adjacent watershed of Roblas Canyon and Potts Canyon (SWCA 2018).

The Queen Creek aquifer in the vicinity of the Near West TSF location is relatively small with groundwater levels approximately 50 feet below ground surface and in relatively close proximity to the TSF footprint. As such, extensive seepage controls would be required for this alternative, including the following (KCB 2018a, 2019):

Level 0

- Underdrain system comprising a drainage blanket and finger drains beneath the entirety of the embankment to drain to seepage collection ponds

Level 0-1

- Extension of embankment underdrains beneath the entirety of the starter dam and into the impoundment under the entire scavenger tailings beach area
- In each drainage channel surrounding the TSF there would be a primary seepage collection system including lined seepage collection ponds, cutoff walls and pump back wells to return and recycle the collected seepage
  - A total of 12 cutoff walls would be excavated through alluvium, filled with compacted granular fill and grouted to competent bedrock

Level 1

- Further extension of the underdrain system an additional 200 feet into the impoundment beyond the beach area
- Lined channels downgradient of the embankment to direct captured seepage to the primary seepage collection system
- Foundation treatments and/or selective engineered low permeability layers in areas of the foundation where Gila Conglomerate not present
- Placement of an engineered low permeability layer for the pyrite tailings starter facility
- Encapsulation of pyrite into the low permeability scavenger tailings fines and sealing of the scavenger foundation with fines
- Addition of grout curtains extending to 100 feet below ground paired with each cutoff wall as part of the primary seepage collection system

Level 2

- Further extensions and deepening of the grout curtains described in Level 1 to target higher permeability zones and potential seepage pathways

Level 3

- Auxiliary seepage collection system downgradient of the primary seepage collection system in drainages surrounding the TSF facility comprising additional cutoff walls, seepage collection ponds, and wells to pump the collected and recycle water back to the TSF

Level 4

- Low permeability liners in areas of the foundation where Gila Conglomerate not present
- Engineered low permeability liner for the entire pyrite cell
- Addition of an auxiliary grout curtain extending to 100 feet below ground paired with cutoff walls as part of the auxiliary seepage collection system; total of 7.5 miles in length
- Up to 21 pump back wells between the auxiliary seepage collection system and Queen Creek

Seepage modeling studies indicate that by using Levels 0 through 4 (KCB 2018a, 2019) of the engineered seepage controls detailed above, this facility would have uncollected seepage rates of 20.7 AF/yr and that the concentration of selenium will ultimately exceed state-established surface water

quality standards at the surface water POC described above. Montgomery & Associates (2019b) modeled a preliminary allowable maximum uncollected seepage rate of 3 AF/yr for compliance with surface water quality standards, well below the 20.7 AF/yr estimate. This allowable rate of uncollected seepage was based on the constituent (selenium) that resulted in the lowest seepage rate prior to exceeding the regulatory threshold.

5.2.1.2. Practicability of Alternative

The Near West 'Wet' TSF Alternative is determined to be not technologically practicable. Although this alternative would meet the overall project purpose, the allowable seepage rate needed for this TSF alternative to avoid exceeding the Aquatic and Wildlife warm water quality standard for selenium is unachievable, even with the extensive engineering seepage controls described above. Under these circumstances, it is unlikely that Resolution could secure the and comply required APP from ADEQ. Therefore, this alternative is not technologically practicable and is therefore not carried forward for further analysis.

It should be noted also that seepage from this tailings facility would result in increased dissolved copper loading of Queen Creek, which has been determined to be impaired for copper by ADEQ. This alternative would increase the copper loading in Queen Creek by 7 to 22 percent, potentially interfering with the state's efforts to reduce the loading in this impaired feature. Even if seepage could be controlled to the point where this alternative were technologically practicable, it is likely these controls would need to be located in the lands withdrawn from mineral entry by the BOR, which are not available for this purpose.

5.2.2. Near West 'Dry' TSF Alternative

5.2.2.1. Description

The Near West 'Dry' TSF Alternative also proposes the construction of a modified centerline embankment on USFS lands (**Figure 10**) with approximately 1.37 billion tons of tailings storage capacity. The approximate TSF footprint is 4,909 acres in size with an ultimate embankment crest 510 feet in height. The tailings transportation corridor would also be located on USFS and private lands owned by Resolution (KCB 2018b). Compared to the 'Wet' Alternative, the Near West 'Dry' Alternative physically separates the pyrite and scavenger tailings with a splitter berm (a physical, rather than structural barrier) and proposes high-density thickening/thin lift deposition of scavenger tailings. By isolating pyrite tailings and high-density thickening the scavenger tailings, drier conditions are maintained, resulting in reduced seepage into the foundation.

The proposed Near West 'Dry' TSF Alternative has a very similar footprint to the Near West 'Wet' TSF Alternative and, therefore, possesses similar geologic and hydrologic conditions. This alternative would require upstream stormwater diversions and all of the same Levels 0 through 4 of extensive engineered seepage controls as the Near West 'Wet' TSF Alternative described above. However, this

configuration allows the interior finger drain system to function more effectively for greater seepage capture. This more effective seepage capture, in combination with the Levels 0 through 4 seepage controls (KCB 2018a, 2019), the physical separation of pyrite and scavenger tailings, and high-density thickening the scavenger tailings, is modeled to result in 2.7 AF/yr of uncollected seepage, which is essentially equal to the modeled allowable maximum seepage of 3 AF/yr (Montgomery 2019b) needed to meet surface water quality standards at the POC identified for this alternative. At this rate, no chemical constituents are anticipated in concentrations above established surface and groundwater quality standards.

5.2.2.2. Practicability of Alternative

The Near West 'Dry' TSF Alternative is not practicable. Although this alternative has the capacity to meet the overall project purpose and is technologically practicable, the site is not available. Although Near West 'Dry' is technologically practicable, the extensive seepage control system required for this alternative necessitates the placement of seepage controls within the lands withdrawn from mineral entry by the BOR. As described above, the BOR withdrawal is related to use of these lands by SRP and SCIP for water storage and diversion and/or power generation, transmission, and distribution. BOR has provided information to the USFS indicating these lands remain unavailable for TSF development and that the placement of seepage controls within these lands would be incompatible with the withdrawal and their intended future use. Based on this information, the Near West 'Dry' TSF alternative is unavailable and was therefore dismissed from further detailed analysis.

With regard to technological practicability, the Near West 'Dry' TSF Alternative would require implementation of a degree of engineering control beyond what is typical of large-scale copper porphyry tailings facilities. Individually, the seepage control measures have been implemented at small, medium and large-scale projects, but the engineering controls described for this alternative combine a multitude of the available seepage controls and would be implemented on a larger scale than typical. Like the Near West 'Wet' TSF Alternative, this alternative would still require an extreme and extensive seepage control system, in comparison to the other TSF designs, in order to maintain ADEQ water quality standards. However, more extensive finger drains and thickening of tailings reduces overall seepage, allowing the engineered controls to capture enough seepage to meet water quality standards and potentially secure and comply with an APP from ADEQ. Based on the predicted uncollected seepage rates being so close to the allowable maximum rates to achieve compliance with water quality standards, this TSF alternative would need to consistently capture 99.5 percent of seepage. As noted in the FEIS (USFS 2020), "the high capture efficiency required of the engineered seepage controls could make meeting water quality standards under this alternative challenging. The number and types of engineered seepage controls represent significant economic and engineering challenges." Uncaptured seepage from this tailings facility would result in dissolved copper loading of Queen Creek, an impaired water. This alternative would increase the copper loading in Queen Creek by 1 to 2 percent, potentially impeding the state's efforts to reduce the loading in this impaired feature.

5.2.3. Silver King TSF Alternative

5.2.3.1. Description

The Silver King TSF Alternative (**Figure 10**) proposes the construction of two separate impoundments using the dry-stack method, one with approximately 1.15 billion tons of scavenger tailing capacity and one with 0.22 billion tons of pyrite tailing capacity. In contrast to the other TSF alternatives, the dry-stack TSF would not require an embankment, but rather the compacted zone of tailings around the perimeter of the dry-stack facility provides structural support (USFS 2019b). Both the TSF and pipeline corridor would be located on USFS lands. Due to topography and land constraints, scavenger and pyrite tailings would need to be placed in separate impoundments. Given the nature of dry stack tailings, the pyrite tailings would be placed and maintained unsaturated, as opposed to sub-aqueous deposition, and therefore would be exposed to continual wetting and drying cycles associated with natural precipitation (average of 18 inches per year). This TSF alternative would be approximately 5,661 acres in size, and the ultimate embankment crests for scavenger and pyrite would reach 1,040 feet and 750 feet in height, respectively.

The location of the Silver King TSF sits across the Concentrator, Main, and Conley Springs faults. It is predominantly underlain by Quaternary deposits overlaying Pinal Schist bedrock. A complex geologic sequence of Pinal Schist, Tertiary Gila Conglomerate, Mescal Limestone, Apache Group, Bolsa Quartzite, Dripping Spring Quartzite, and Tertiary Tuff occur along the southwestern portion of the TSF with Quartz Diorite occurring along the northeastern corner, all of which is covered by Quaternary deposits and incised with alluvial filled channels. Additionally, the Pinal Schist unit is known to have reduced strength along foliations, which appear at the southeastern portion of the TSF (KCB 2018c).

The proposed Silver King TSF is situated at the northeast edge of the Superior Basin, which drains into Queen Creek and Potts Canyon and ultimately to the Whitlow Ranch Dam. Due to the topography, land constraints, and large volume of tailings, large diversion dams, underground tunnels, and pipelines would be required to reroute surface water from large upstream drainage basins, particularly from Comstock Wash and Whitford Canyon, around the TSF.

The Queen Creek aquifer in this area is relatively small with groundwater levels approximately 100 to 300 feet below the surface of the TSF. The three faults beneath the TSF are likely leaky barriers to groundwater flow, causing higher groundwater levels to the northeast of the faults (KCB 2018c). Seepage controls proposed for this alternative include the following (KCB 2018a, 2019):

Level 0

- Dewatering of tailings to 85-percent solids prior to placement in a dry-stack
- Underdrain system comprising a drainage blanket beneath the entirety of the compacted structural zone of the dry-stacked tailings

Level 1

- Lined channels downgradient of the tailings facility to direct captured seepage to the primary seepage collection system
- Primary seepage collection system in drainages surrounding the TSF comprising multiple lined seepage collection ponds, cutoff walls and pump-back wells to return the collected seepage
  - Cutoff walls will be excavated through the small amount of alluvium present, filled with compacted granular fill and grouted to competent bedrock

Level 2

- Targeted grouting of fractures in the foundation
- Pump back wells down gradient of the primary seepage collection cutoff walls

Seepage modeling studies determined that Levels 0 to 2 controls (KCB 2018a, 2019) would only reach 90 percent efficiency, leading to uncollected seepage rates of 9 AF/yr with Level 2 controls, which exceeds the preliminary modeled maximum allowable seepage of 6 AF/yr (Montgomery 2019a) needed to meet surface water quality standards at the POC identified for this alternative. As such, selenium is modeled to exceed surface water quality standards beginning in model year 59 (USFS 2020).

5.2.3.2. Practicability of Alternative

The Silver King TSF Alternative is not logistically or technologically practicable. Although the land for this alternative is available, the dry-stack technology is not proven at this scale and seepage quantities are modeled to result in exceedances of surface water quality standards in downstream surface waters.

The current proven maximum throughput capacity for operating dry-stack facilities is approximately 30,000 tpd (at the La Coipa mine in Chile), or approximately 23 percent of the Resolution Copper Project's anticipated initial operating capacity of approximately 132,000 tpd. Most filtered tailings capacities in operation are less than 10,000 tpd. Furthermore, with land constraints and capacity requirements, the Silver King TSF would reach heights of 750 (pyrite tailings) and 1,040 feet (scavenger tailings), both unprecedented heights for existing TSFs, and for which structural stability is unknown. For comparison, the embankment heights for the other proposed TSF alternatives for the project range between 200 and 520 feet in height.

As noted above, development of this alternative would result in concentrations of selenium in Queen Creek above state-established surface water quality standards. In addition, seepage from this tailings facility would result in dissolved copper loading of Queen Creek, which has been determined to be impaired for copper by ADEQ. This alternative would increase the copper loading in Queen Creek by 11 to 21 percent, potentially interfering with the state's efforts to reduce the loading in this impaired feature.

Additionally, the filtered tailings are placed partially saturated and exposed to the natural elements, an approach that is inconsistent with current BMPs for pyrite tailings that are highly pyritic and acid generating. Such designs are more prone to wetting and drying cycles than typical TSF systems, resulting in low pH and an increase in Total Dissolved Solids (TDS), as well as elevated metals in seepage during the LOM. Only the dry-stack design is as affected by the cyclical wetting and drying that leads to oxidation.

Given the lack of demonstrated dry-stack technology at the scale contemplated by the project, as well as projected exceedance of state surface water quality standards as a result of seepage, this alternative would not be considered logistically or technologically practicable. This alternative is not carried forward for further analysis.

5.2.4. Skunk Camp TSF Alternative

5.2.4.1. Description

The Skunk Camp TSF Alternative design proposes a dual embankment approach incorporating a robust centerline embankment for the scavenger tailings and a downstream embankment for the pyrite tailings. The Skunk Camp TSF alternative is located on a mix of private and ASLD-managed State Trust lands (**Figure 10**) that would have to be purchased prior to construction and operation of the TSF. If it is otherwise a practicable alternative, an area not presently owned by the Applicant which could reasonably be obtained, utilized, expanded or managed in order to fulfill the basic purpose of the proposed activity may be considered (40 CFR Part 230.10(a)(2)).

Two potential pipeline corridors were analyzed for this TSF alternative in the DEIS: 1) the North Pipeline Corridor, and 2) the South Pipeline Corridor. Both corridors would be located on USFS, private, and State Trust lands. The North Pipeline Corridor (**Figure 12**) is the preferred corridor due to a smaller disturbance footprint, shorter length, lower required operating pressure, and lower pumping requirements. This pipeline corridor was subsequently updated (USFS 2020) due to public and agency comments on the DEIS and now results in less impacts to potential waters of the U.S. that are almost exclusively temporary in nature (WestLand 2020c). Impacts to surface water features including potential waters of the U.S. associated with the pipeline construction are anticipated to be largely temporary impacts.

The cross-valley design of the Skunk Camp TSF requires far less material to construct the embankment compared to three-sided ring-impoundment TSF design needed at Near West, thus reducing construction and operational complexity (KCB 2018d). Much like the Near West 'Dry' TSF alternative, the pyrite tailings are physically isolated from the scavenger and are sub-aqueously placed into separate smaller operating cells located at the northern end of the scavenger tailings to reduce pond size, seepage, evaporative losses, and water required to maintain a water cover over the pyrite tailings. The ultimate footprint would be approximately 4,140 acres in size with the ultimate height of the embankment crest reaching 475 feet in height.

The Skunk Camp TSF is situated along a north-trending normal fault and is underlain by a tertiary age Gila Conglomerate that is partially covered by Quaternary deposits, including alluvium in the base of the major valleys (KCB 2018d). There is some potential for relatively shallow Gila Conglomerate thickness west of the normal fault and greater depths along the eastern edge (Montgomery 2019a). Alluvial channels located throughout the site are considered pathways for groundwater flow and are noted to be less than 150 feet thick. Recent measurement of depth to groundwater taken within the alluvium and Gila Conglomerate suggests that groundwater levels are approximately 70 feet below the ground surface in some locations (KCB 2018d). This TSF alternative is located within the Dripping Spring Wash basin, which flows 13 miles to the southeast and discharges into the Gila River. Several named and unnamed drainages report to Dripping Spring Wash. Stormwater diversion channels and dams are proposed on either side of the TSF, diverting surface runoff around the TSF and back into Dripping Spring Wash.

In response to public and agency comment on the discussion of this alternative in the DEIS, the USFS directed that additional geologic, geotechnical, and hydrological data be collected (KCB 2019b; M&A 2020a). The Skunk Camp site investigation resulted in further foundation characterization and hydrogeologic data gathering to supplement existing baseline information. The additional information collected support the design approach and philosophy of the original design in the DEIS (USFS 2020) and did not require any major design modifications (KCB 2020d) in the FEIS (USFS 2020).

The data collected also confirms that the anticipated geology, geologic units, and geotechnical conditions, including the hydrogeologic units and setting, are as described in the DEIS (USFS 2020). Additionally, the data collected was used to refine seepage control measures and confirm that the post-closure drainage reporting the Dripping Spring Wash (KCB 2020) will meet groundwater and surface water quality standards at the POCs (M&A 2020b).

The site's geology and hydrology coupled with the overall design of the TSF allow for a less complex and more reliable seepage collection system compared to the Near West 'Wet' and Near West 'Dry' TSF alternatives. The topography and geologic configuration of the site generally funnels seepage to one location, as compared to the topography and geologic configuration at Near West, which would allow seepage to move in multiple directions and thus require far more extensive engineering controls. This alternative would include one grout curtain of far less length and fewer alluvial pump-back wells between the embankment of the TSF and the grout curtain and seepage collection pond. For the Skunk Camp TSF, the seepage management plan in the DEIS (USFS 2019b) included levels of seepage controls with variations on the depth of the grout curtain and alluvial pump-back wells, rather than additional engineered controls (KCB 2018d, 2019). The seepage management plan developed for the FEIS (USFS 2020) is largely the same but has been refined (KCB 2020b) for this TSF as follows:

Level 0-1

- Operational Upstream Diversion Channels will divert non-contact water as much as practical to reduce water reporting to the TSF, thus this water would be unavailable for seepage into the foundation.
- Cycloned sand embankments will be well-drained such that a phreatic surface will not develop in the embankments long-term (reducing head on the foundation). To limit infiltration, the cycloned sand embankments will be progressively reclaimed, where possible, throughout operations.
- The cycloned sand embankments will include a finger drain network that will extend into Zone 2 – Near Dam Scavenger Beach to capture seepage from tailings deposition and embankment construction.
- Tailings deposited in the scavenger beach (scavenger total tailings and scavenger overflow) will be thickened to a 60 percent solids content slurry by mass to maximize water recovery and deposited in thin lifts over a large area to maximize evaporation losses and minimize water available to infiltrate through the tailings and into the foundation. The scavenger beach will also be managed as dry as possible (i.e., no to minimal ponded water), with runoff or bleed water that collects in the low points pumped to the active pyrite cell.
- A lined seepage collection pond downstream of the TSF for short-term management of seepage and construction water prior to returning to the active pyrite cell.
- Shallow alluvial pumpback wells downstream of the TSF to capture seepage that enters into the shallow foundation.

Level 2

- Pyrite tailings will be deposited in two segregated, low permeability cells to reduce seepage flows from the reclaim pond during operations and limit seepage from the pyrite tailings draindown during post-closure.
- A series of lined Contact Water Collection Ditches that convey captured seepage from the Main Embankment finger drains and convey to the seepage collection pond.
- A grout curtain and shallow pumpback well downstream of the seepage collection pond to capture stormwater flow in the alluvium or leakage from the seepage collection pond.

Seepage modeling studies prepared for and described in the DEIS (USFS 2019b) concluded that by using the described engineering seepage controls (KCB 2018d, 2019) this facility would be expected to comply with ADEQ groundwater quality standards at the POCs and the surface water quality standards (Aquatic and Wildlife warm) established for the Gila River. The modeling did not result in concentrations of any constituent above established water quality standards (Montgomery 2019a). In response to public and agency comments on the DEIS, the seepage controls were refined (KCB 2020b) and subject to additional analysis. The analysis also incorporated additional baseline data that was collected in response to public comments on the DEIS and CWA Section 404 Public Notice. The seepage controls and management approach described in KCB 2020 and the additional baseline data

were incorporated into a regional model (M&A 2020b). The regional model output confirmed analysis presented in the DEIS, demonstrating compliance with groundwater standards at the POCs. The model also confirms compliance with surface water standards for groundwater that would become surface flows within the downgradient Gila River for a duration of approximately 400 years.

5.2.4.2. Practicability

The Skunk Camp TSF Alternative is practicable. This alternative is available and both technically and logistically practicable. The ASLD has indicated that it is willing to sell this land to Resolution for the development of a TSF. The seepage collection system is simpler in design with a higher degree of effectiveness than the other TSF alternatives. The design of the TSF under this alternative has the capacity to meet the overall project purpose.

Table 3. TSF Alternative Practicability Analysis Results Summary

TSF Alternative	Tailings Placement Method	Key Geologic and Hydrogeologic Characteristics	Available	Logistically/Technologically Practicable	Practicability Determination
Near West 'Wet'	Conventional thickened; modified centerline embankment.	Distance to Queen Creek is ~0.25 miles.	No – Extensive seepage control system may require seepage controls within lands withdrawn from mineral entry by the BOR which is incompatible with the withdrawal and their intended future use.	No – Significantly exceeds uncollected seepage maximums even with Level 4 controls.	**Not Practicable (technology and logistics)**
Near West 'Dry'	High-density thickened/thin lift scavenger; modified centerline embankment for scavenger; physically separated pyrite cell using splitter berm.	Distance to Queen Creek is ~0.25 miles.	No – Extensive seepage control system necessitates seepage controls within lands withdrawn from mineral entry by the BOR which is incompatible with the withdrawal and their intended future use.	Yes – However, this TSF requires Level 4 seepage controls consistently operating at 99.5 percent efficiency. No known TSFs that use this degree of extensive seepage control technology to date.	**Not Practicable (not available)**
Silver King	Filtered scavenger and pyrite; structural outer shell	Mix of diverse and complex geology with higher potential for weathering and fracturing. Requires extensive surface water diversion tunnels, dams, and channels.	Yes	No – Technology for dry-stack methodology at the scale needed to meet the project purpose has not been demonstrated, is at an unprecedented height, and lacks ability to meet water quality standards and secure an APP.	**Not Practicable (technology and logistics)**
Skunk Camp	High-density thickened/thin lift scavenger; robust and resilient double embankment approach (full centerline for scavenger and downstream for pyrite).	Geology is composed of Gila Conglomerate with thin alluvial cover. Distance to Gila River ~13 miles.	Yes	Yes	**Practicable**

6. ENVIRONMENTAL EFFECTS OF THE SKUNK CAMP ALTERNATIVE

This section provides an analysis of the environmental impacts of the Skunk Camp alternative, which is the only alternative determined to be practicable. This analysis includes a discussion of impacts to the aquatic ecosystem and other anticipated adverse environmental consequences. Identification of these other adverse environmental consequences is based on information contained in the baseline resource reports and FEIS prepared for Resolution's proposed mine development. Analyses of these other adverse environmental consequences are necessary to ensure that the Corps may identify the LEDPA, as required by the Guidelines (40 CFR Part 230.10(a)).

The 404(b)(1) alternatives analysis is intended to ensure that no discharge 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" (40 CFR Part 230.10(a)). The aquatic ecosystem, in turn, is defined as waters of the U.S., including wetlands, that serve as habitat for interrelated and interacting communities and populations of plants and animals (40 C.F.R. Part 230.3(c)). In evaluating practicable alternatives, the Guidelines' preliminary focus is thus on assessing effects on waters of the U.S., but the analysis can extend to other adverse environmental consequences occurring outside of waters of the U.S.

The definition of "waters of the U.S." has been a source of considerable confusion for many years, particularly since the United States Supreme Court's 2006 decisions in *Rapanos v. United States and Carabell v. United States*. Following those decisions, the EPA and the Corps issued interpretive guidance, last modified in December 2008. In this 2008 CWA guidance document, entitled *Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States and Carabell v. United States* (the Guidebook), non-navigable tributaries that are not relatively permanent (which represent the majority of features present at all of the TSF alternatives) can be found jurisdictional only if they have a significant nexus with a Traditional Navigable Water (TNW). This represented a significant departure from the prior agency interpretation, which categorically regulated all tributaries, even ephemeral tributaries.

On June 22, 2020, the Navigable Waters Protection Rule (NWPR) promulgated by Corps and EPA went into effect, redefining the extent of federally regulated jurisdictional waters of the U.S. Multiple challenges to the NWPR have been filed in multiple courts, including one in Arizona. The fate of the NWPR remains unclear while this litigation is pending. Corps policy allows for issuance of a permit based on a PJD that predates the NWPR's effective date, as is the case for the Skunk Camp PJD. The environmental attributes of the surface water features within the Skunk Camp TSF footprint, however, are not dependent on their CWA jurisdictional status, and impacts to these features can still be considered under the Guidelines. The evaluation that follows focuses on the extent of surface water features exhibiting an OHWM in these ephemeral systems, as well as the location and extent of other aquatic features, such as seeps and springs.

In this analysis, identification of potential waters of the U.S. is based on the presence of an OHWM, as defined by the Corps' in its technical documentation including the August 2008 delineation manual *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* and the July 2010 update to the same. The identification of OHWM through a desktop review of high-quality, recent aerial photographs was supplemented with field verification through collection of geolocated ground photography. The identification of seeps and springs was completed via review of U.S. Geological Survey topographic maps and other publicly available data, supplemented by full field inventory of the Skunk Camp location (Montgomery & WestLand 2017). The Corps has concurred with this delineation and determined (Corps File No.SPL-2016-00547) that features in the Skunk Camp Alternative TSF footprint and portions of the North Pipeline Corridor are potentially jurisdictional waters of the U.S. pursuant to a PJD.

6.1. Impacts to the Aquatic Ecosystem/Surface Water Features

The estimated total impacts to potential waters of the U.S. associated with the Skunk Camp Alternative (TSF footprint, pipelines, and associated facilities) is 188.3 acres. These impacts are depicted in **Figures 12 and 13**. Of these impacts, 129.2 acres are anticipated to be direct permanent impacts resulting from construction of the TSF and its appurtenant features, excluding pipelines. Impacts from the pipeline include a maximum estimated 15.7 acres of largely temporary impacts from the buried pipeline and associated access road. As the final location of the pipeline within the analyzed corridor is still being refined, this estimate of 15.7 acres conservatively assumes that all the potential waters of the U.S. within the corridor are temporarily impacted. Finally, approximately 43.4 acres of indirect permanent impacts are anticipated from the 'dewatering' of ephemeral drainages downgradient of portions of the TSF and its appurtenant features, including the seepage controls and stormwater diversions.

Surface Water Resources

Potential waters of the U.S. identified within the site and pipeline corridor are dominated by both confined and braided ephemeral channels with functions and values typical of desert ephemeral systems. Non-ephemeral drainages within the North Pipeline Corridor, including Devil's Canyon and Mineral Creek, will not be impacted by the project. No special aquatic sites (e.g., wetlands) or seeps and springs are located within the footprint of this TSF or either potential pipeline corridor.

6.2. Other Adverse Environmental Consequences

As indicated in the introductory paragraph of **Section 6**, identification of the other adverse environmental consequences of the development of Skunk Camp TSF Alternative is based on information contained in the baseline resource reports and FEIS (USFS 2020) prepared for the proposed project. Adverse direct effects include the loss of those resources within the Skunk Camp alternative footprint as described in the FEIS. Construction of the TSF and associated infrastructure

(including pipelines) under this alternative will directly affect approximately 4,140 acres of previously undisturbed private and state lands.

Seepage

Implementing the engineered seepage control measures at Skunk Camp (KCB 2020b) would be relatively straightforward due to Skunk Camp's geological setting on Gila Conglomerate overlain with alluvial sediments and favorable topography, allowing for seepage collection to a single location downgradient of the TSF. Seepage control measures incorporated into the initial design and in groundwater modeling studies described in the DEIS (USFS 2019b) indicate that the seepage would be below the ADEQ groundwater standards at the POCs and the surface water standards set for the Gila River. The seepage controls were refined (KCB 2020b) after collection of additional baseline data in response to public comments on the DEIS and CWA Section 404 Public Notice. The seepage controls and management approach described in KCB 2020b and the additional baseline data were incorporated into a regional model (M&A 2020b). The regional model output analysis presented in the DEIS demonstrates compliance with groundwater standards at the POCs. The model also confirms compliance with surface water standards for groundwater that would become surface flows within the downgradient Gila River for a duration of approximately 400 years.

Tailings Safety (Risk and Consequences of Failure)

The Skunk Camp TSF will consist of two pyrite cells upstream of the scavenger beach contained by a cross-valley embankment (the Main Embankment). The pyrite cells and scavenger beach have the capacity to store more than the 72-hour Probable Maximum Flood (PMF) and are designed for the 1-in-10,000-year earthquake, assuming all potentially liquefiable tailings will liquefy. This design criteria and design approach (i.e., assuming all potentially liquefiable tailings will liquefy) are considered high standards in the industry resulting in a robust design.

The pyrite tailings will be deposited subaqueously in low permeability pyrite cells contained by independent, downstream, raised and compacted, cycloned sand embankments, which are then then buttressed by the scavenger beach. The Main Embankment will be constructed of compacted cyclone underflow, the coarser underflow scavenger tailings produced during cycloning, using a centerline embankment. Compacted cycloned sand tailings are a robust and resilient embankment construction method.

Cyclone overflow, the finer scavenger tailings produced during cycloning, and uncycloned scavenger tailings will be deposited upstream of the Main Embankment forming the tailings beach. Entrained water within the scavenger beach will be minimized by thickening prior to deposition in the TSF and adopting "thin-lift" deposition, allowing time for water to evaporate resulting in a relatively 'dry' tailings beach (KCB 2018). Water that may pool in low spots on the scavenger beach will be pumped to the pyrite cell, thus limiting the standing water within the scavenger beach.

A risk assessment workshop was completed between February 5th and 7th of 2020 to review the potential failure modes of the proposed Skunk Camp TSF for the DEIS. Failure Modes and Effects Analysis (FMEA) workshop participants used the results of the catastrophic failure event presented in the DEIS (USFS 2019b) as well as a more realistic slumping event based on the TSF design (KCB 2020c) to inform consequence classification of potential failure modes. During the workshop, 16 potential failure modes for the TSF were identified and developed, however, no unmitigable risks were identified. In general, the proposed Skunk Camp TSF design evaluated during the risk assessment is robust and addresses the potential failure modes through design, mitigation measures, planned operating procedures, and monitoring.

The DEIS (USFS 2019b) disclosed the potential effects of a catastrophic TSF failure event based on Rico et al. (2010), an approach informed by tailings failures associated mostly with upstream tailings embankments, which is not the design approach for the Skunk Camp TSF. Downstream communities potentially affected by the DEIS tailings dam failure extent estimate (USFS 2019b) consist of small rural communities with a total population of approximately 3,000 people. Four water supply systems serving these communities are present downstream of the proposed TSF and would potentially be affected by a dam failure. Larger downstream population centers include the towns of Winkelman, Hayden, and Kearney, which are over 20 miles away.

For some of the potential failure modes identified in the FMEA workshop in which the Skunk Camp TSF Main Embankment hypothetically fails, it was agreed that the released tailings from the 'dry' scavenger beach (i.e., no ponded water on the scavenger beach) would result in slumping failure that may not reach the Gila River. KCB (2020c) estimated the possible maximum extent of a hypothetical 'dry' slumping failure of the Skunk Camp TSF Main Embankment to be approximately 5.7 miles from the toe of the TSF down Dripping Spring Wash. Small residential areas and approximately 1.9 miles of Dripping Springs Road would become inaccessible. The post-failure slumping distance would not reach the Gila River (KCB 2020c).

Visual Resources

The Skunk Camp alternative is not highly visible from towns, cities, or densely populated areas.

Recreation

The Skunk Camp Alternative is in a relatively remote area and the TSF footprint would not include National Forest System lands or BOR lands. No official state or federal hiking trails (including the Arizona Trail) or recreational areas would need to be relocated due to the construction of this alternative.

6.3. CUMULATIVE IMPACTS TO THE AQUATIC ECOSYSTEM

Over the past 20 years, the Corps has authorized the fill of approximately 220 acres of waters of the U.S. in the Middle Gila River Watershed (HUC 15050100), resulting from issuance of about 396 general permits and 23 individual permits by the Corps. Because of changes to the Corps' database over the years, some inconsistencies resulting from the database conversions may cause impact calculations to be undercounted during the earlier part of this review period. Additionally, previous impacts to waters of the U.S. in urbanized areas and from mining projects in the HUC predate the period of Corps evaluation and permitting. This HUC includes a range of land uses including a portion of the highly urbanized Phoenix-Mesa Metropolitan area, a significant portion of the Gila River Indian Community (consisting primarily of farmland), and a portion of the Copper Triangle region. There is currently no data available that can be used to estimate the total area of waters of the U.S. present within this watershed. Changing rules regarding the Corps' geographic jurisdiction make such an estimate even more difficult.

The largest portion of previously permitted impacts to waters of the U.S. during the Corps' period of evaluation is from a large-scale tailings storage project associated with the Ray Mine in eastern Pinal County. This project included a CWA Section 404 individual permit for approximately 135 acres of permanent impacts. Approximately 173 acres of permanent acres of additional impacts to potential waters of the U.S. are proposed under the Skunk Camp TSF Alternative. No other pending or future CWA Section 404 permit applications within this watershed are known to exist at this time.

6.4. COMPLIANCE WITH THE GUIDELINES

The information on the range of alternatives analyzed, the availability and/or practicability of analyzed alternatives, the impacts to the aquatic system of the identified practicable alternative, and the other significant adverse environmental consequences of the identified practicable alternative described herein is intended to provide the Corps with the information necessary to make the determination of LEDPA under 40 CFR Part 230.10(a). This section is intended to demonstrate the compliance of the Skunk Camp TSF alternative with the other three independent requirements at 40 CFR Parts 230.10(b), (c), and (d) that must be met prior to the decision by the Corps to issue a permit.

The requirement at 40 CFR Part 230.10(b) prohibits discharges of dredged or fill material that will result in a violation of water quality standards or toxic effluent standards, will jeopardize a threatened or endangered species, or violate requirements imposed to protect a marine sanctuary. The Skunk Camp TSF alternative requires an APP from ADEQ to demonstrate that it will not cause or contribute to an exceedance of AWQS at the POC, or, if, AWQS for a pollutant has been exceeded in an aquifer at the time of permit issuance, that no additional degradation with respect to that pollutant will occur at the POC [A.R.S. § 49-243(B)(2)-(3); A.A.C. R18-9-A202(A)(8)(a)]. Seepage must also not contribute to the exceedance of any ADEQ surface water quality standards where

groundwater may emerge and contribute to surface flow [A.A.C. R18-11-405(b)]. The seepage control measures and control efficiencies required to meet this standard for the Skunk Camp TSF alternative are described in **Section 5.2.5**. It is anticipated that seepage control using recognized technologies will be well above what is required to meet the applicable surface and groundwater quality standards. Nor will construction of the TSF and its related facilities violate any toxic effluent standard or prohibition under § 307 of the CWA.

As described in the Biological Assessment (SWCA 2020) and FEIS (USFS 2020), the Skunk Camp TSF alternative and it's appurtenant features, including pipelines, are not anticipated to jeopardize the continued existence of species listed as threatened or endangered under the ESA or result in the destruction or adverse modification of such species' designated critical habitat. The Skunk Camp TSF alternative also will not violate any requirement designed to protect a marine sanctuary.

The requirement at 40 CFR Part 230.10(c) prohibits discharges of dredged or fill material that will cause or contribute to significant degradation of waters of the U.S. The discharge of fill for the construction of the TSF will result in the loss of the structure and aquatic function of the potential waters of the U.S., comprised entirely of ephemeral drainages, within the footprint of fill. Indirect and cumulative effects from the discharge on the aquatic environment are anticipated to be minimal and will not cause significant degradation. There are not anticipated to be significantly adverse effects on human health or welfare, on life stages of aquatic life and other wildlife dependent on aquatic ecosystems, or on aquatic ecosystem diversity, productivity and stability. There will be some indirect effects on recreational, aesthetic, and economic values of the lands surrounding the TSF as disclosed in the DEIS, but, for purposes of the Guidelines, the significant degradation analysis does not extend to these upland areas. The requirement at 40 CFR Part 230.10(c) requires analysis of whether significant degradation of the waters of the U.S. will occur.

The requirement at 40 CFR Part 230.10(d) prohibits discharges of dredged or fill material unless all appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem. The development of the Skunk Camp TSF design included a significant effort to avoid and minimize impacts to the ephemeral drainages and potential groundwater-dependent ecosystems in the TSF vicinity. Although the areas within the TSF and appurtenant infrastructure footprint will no longer contribute runoff from precipitation to downstream drainage reaches, the TSF design minimizes impacts to downstream waters of the U.S. by diverting upstream stormwater flows around the facility. The Skunk Camp TSF has been located relatively high in the Dripping Spring Wash watershed (**Figure 13**), minimizing the size of the upgradient watershed for which stormwater must be managed. Similarly, the stormwater controls, run-on diversions, and engineering controls have been designed to maintain downstream stormwater flows while minimizing the risk of contaminant discharge to downstream surface water features to the maximum extent practicable. The pipeline design has also been continually revised to avoid non-ephemeral features, important habitats, and permanent impacts to potential waters of the U.S.

7. SUMMARY AND CONCLUSIONS

The Skunk Camp TSF Alternative is the only alternative that satisfies the practicability criteria of the Guidelines. Selection of the Skunk Camp Alternative as the LEDPA for the Project is not precluded by the restrictions on discharge contained in 40 CFR Part 230.10. The Skunk Camp Alternative, therefore, represents the LEDPA for the Project.

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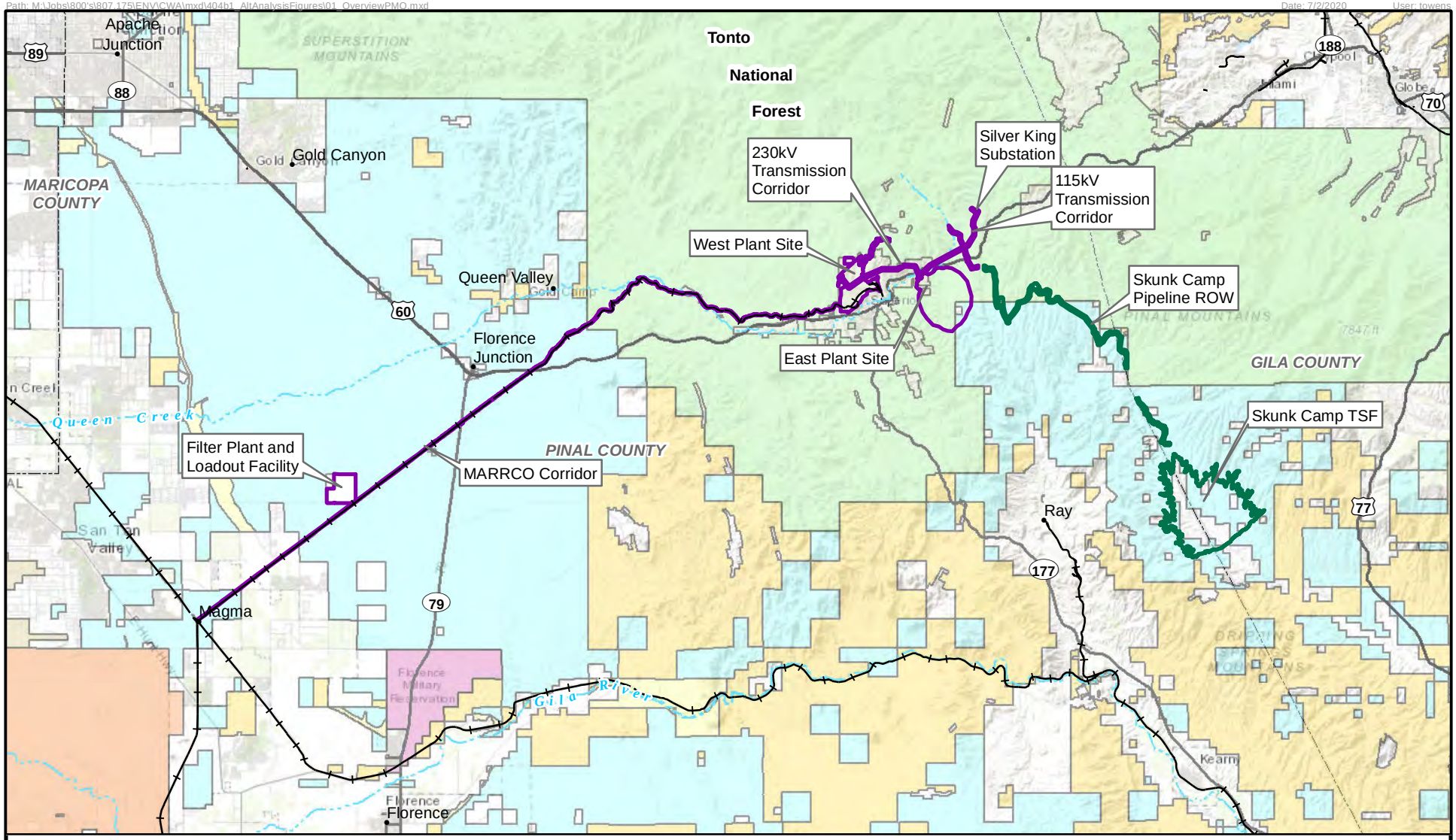
FIGURES



Pinal and Gila Counties, Arizona,
Data Source: BLM 2019, WRI Modified 2019, ALRIS, SWCA, and USFS
Image Source: ArcGIS Online, World Topo Map

Legend

- Skunk Camp TSF Alternative
- GPO Mine Element

Surface Management

- Bureau of Land Management (BLM)
- Bureau of Reclamation
- County
- Indian Lands
- Local or State Parks
- Military
- Other
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

WestLand Resources

N

0 2.5 5 Miles

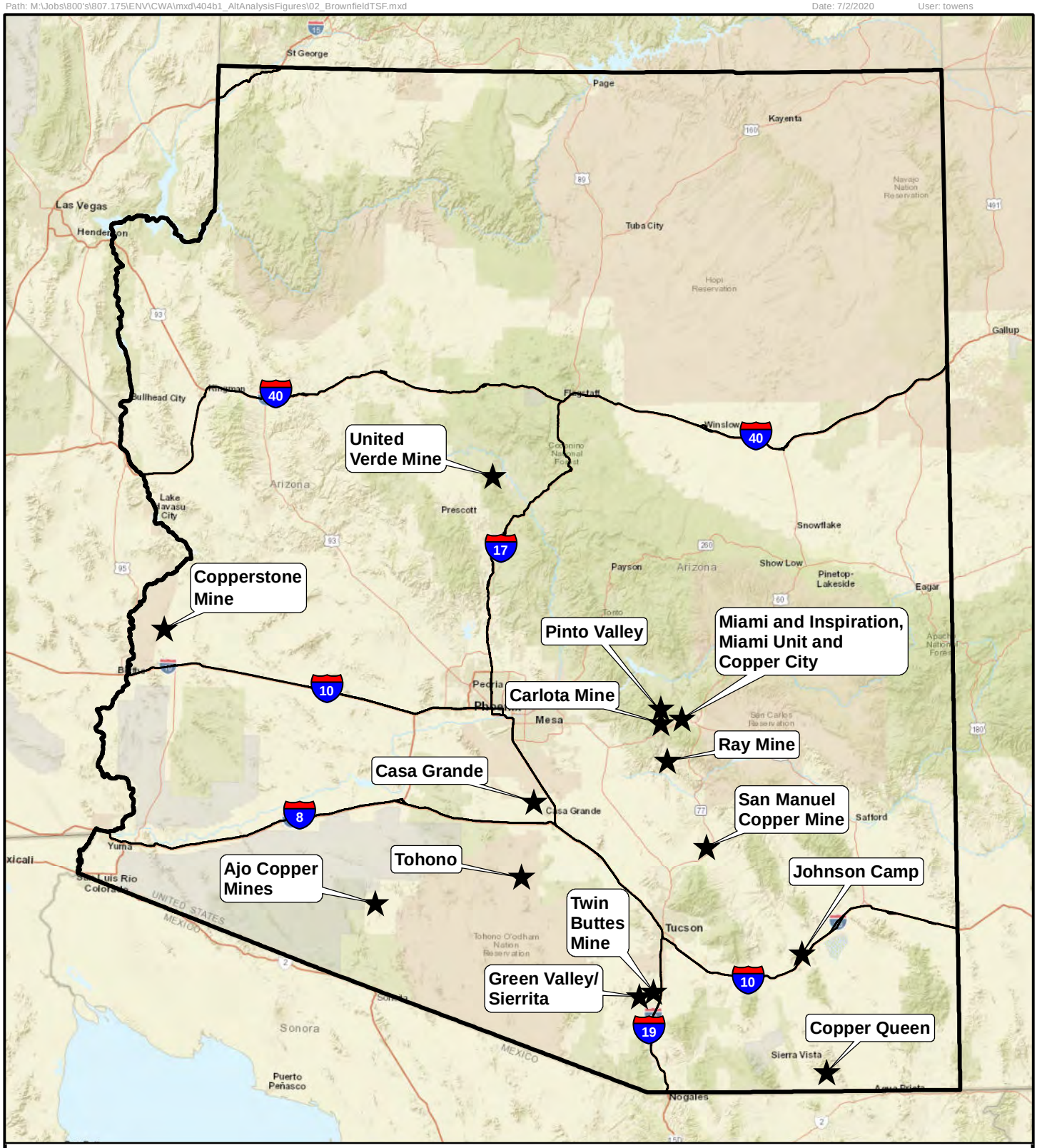
0 4 8 Kilometers

RESOLUTION COPPER

404(b)(1) Alternatives Analysis

OVERVIEW OF PROPOSED MINING OPERATION

Figure 1



Data Source: ARLIS, USDA, USFS 11-1-2017
Image Source: ArcGIS Online World Street Map

Legend

★ Brownfield Site

—— Interstates (ALRIS)

N

0 25 50 Miles

0 50 100 Kilometers

WestLand Resources

RESOLUTION COPPER

404(b)(1) Alternatives Analysis

BROWNFIELD TAILINGS STORAGE FACILITY LOCATIONS

Figure 2

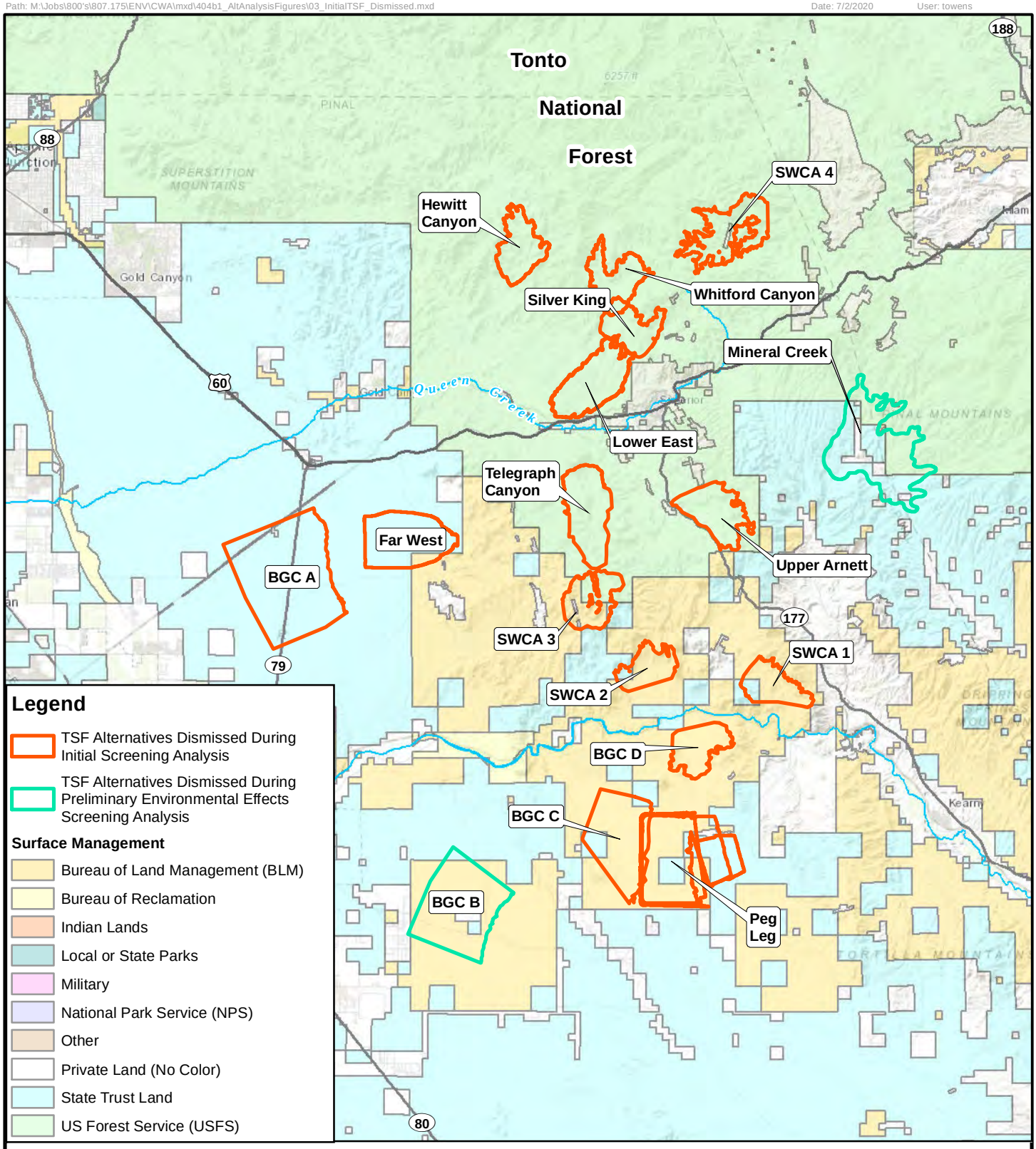


Image Source: ArcGIS Online World Topo Map

RESOLUTION COPPER

404(b)(1) Alternatives Analysis

TAILINGS STORAGE FACILITY ALTERNATIVES
DISMISSED FROM FURTHER CONSIDERATION

Figure 3

N

0 2.5 5 Miles

0 5 10 Kilometers

WestLand Resources

T2S, R9E, Portions of Sections 35, and 36,
T2S, R10E, Portions of Sections 25, 26, 28-33, 35, and 36,
T2S, R11E, Portions of Sections 29-32,
T3S, R9E, Portions of Sections 1, 2, 12, and 13,
T3S, R10E, Portions of Sections 1, 2, 4-10, and 15-21,
T3S, R11E, Portions of Sections 5, and 6,
Pinal County, Arizona
Data Source: http://www.superstition-vistas.org /resources/maps-handouts/ (Proposed SuperstitionVistas Area),
Surface Managment: BLM 2019, WRI Modified 2019
Image Source: ArcGIS Online USA Topo Map,
Mesa 1:100,000 USGS Quadrangle

Legend

- Superstition Vistas Study Area
- Tailings Alternatives Dismissed

Surface Managment (BLM)

- Bureau of Land Management (BLM)
- Bureau of Reclamation
- County
- Indian Lands
- Military
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

N

0 1 2 Miles

0 2 4 Kilometers

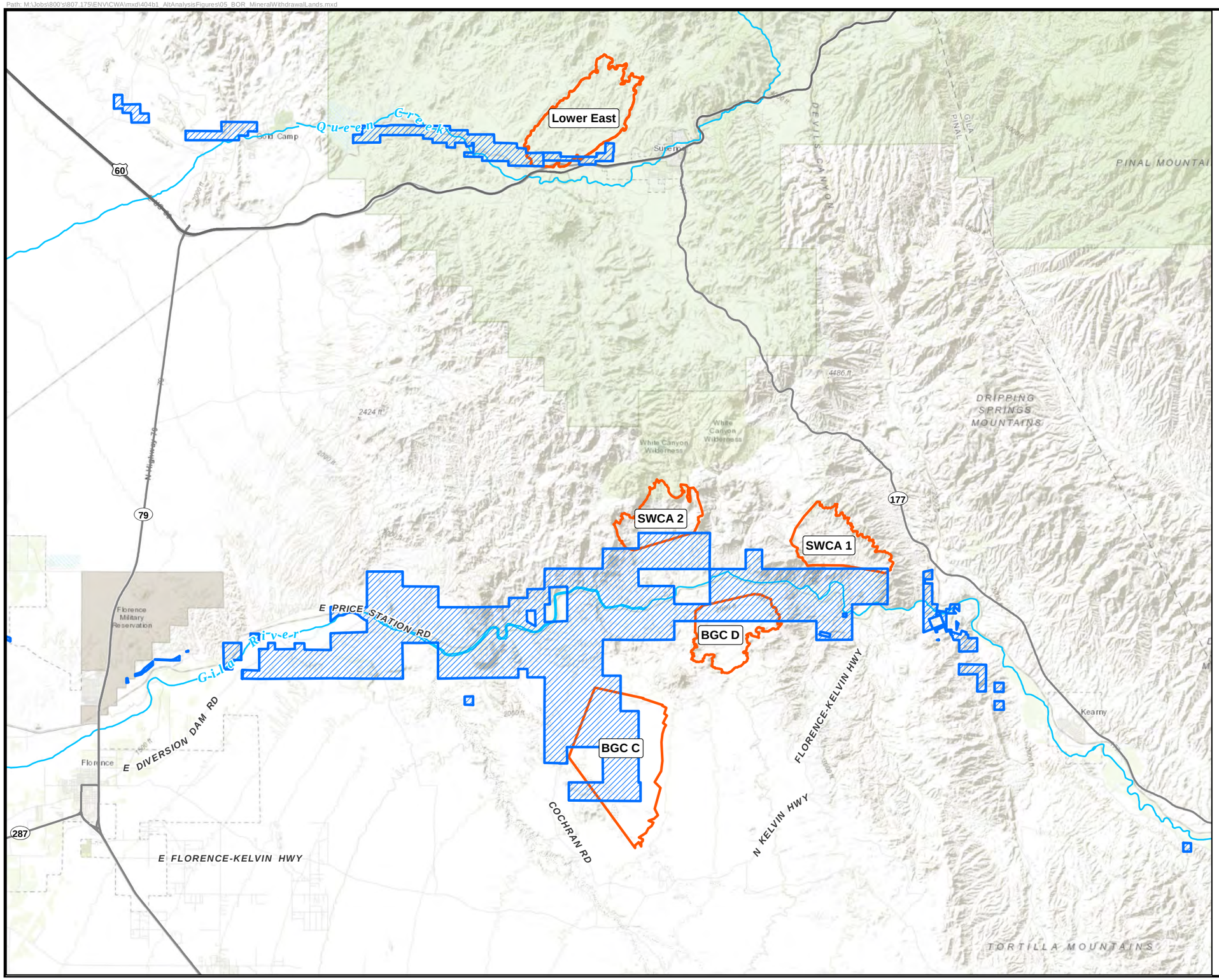
WestLand Resources

RESOLUTION COPPER

404(b)(1) Alternatives Analysis

SUPERSTITION VISTAS ASLD LANDS

Figure 4



Portion of T1S R12E, T2S R11 and 12E, T3S R12 and13E, T4S R11-13E, and T5S R11 and 12E,
Pinal County, Arizona
Image Source: ArcGIS Online World Topo Map

Legend

- Tailings Alternatives Dismissed
- Withdrawn Lands

N

0 1 2 Miles

0 2 4 Kilometers

WestLand Resources

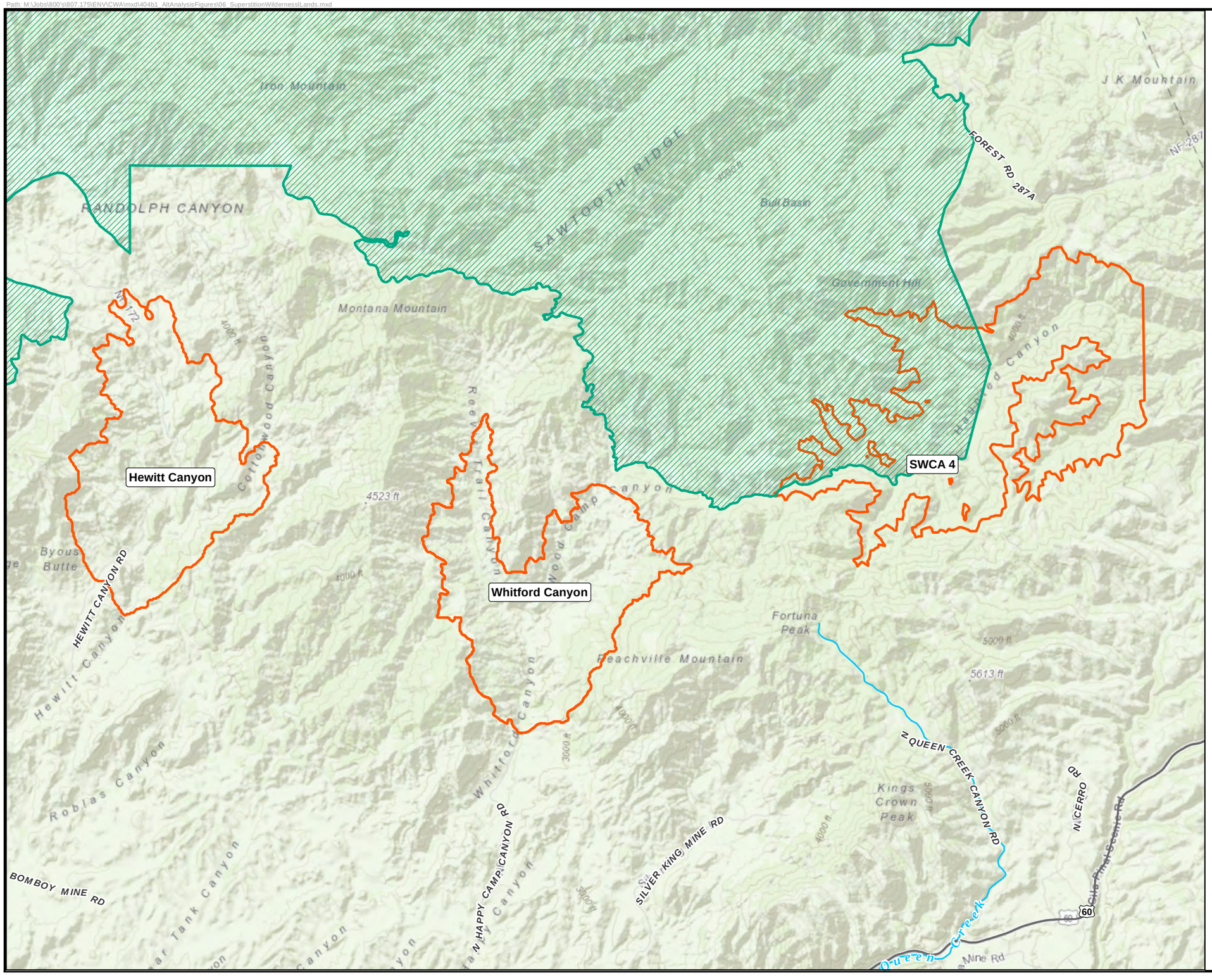
RESOLUTION COPPER

404(b)(1) Alternatives Analysis

BOR MINERAL WITHDRAWAL LANDS

Figure 5

Portion of T1N R11-13E and T1S R11-13E,
Pinal County, Arizona
Image Source: ArcGIS Online World Topo Map



Legend

- Superstition Wilderness
- Tailings Alternatives Dismissed

N

0 0.5 1 Miles

0 1 2 Kilometers

WestLand Resources

RESOLUTION COPPER

404(b)(1) Alternatives Analysis

SUPERSTITION WILDERNESS LANDS

Figure 6

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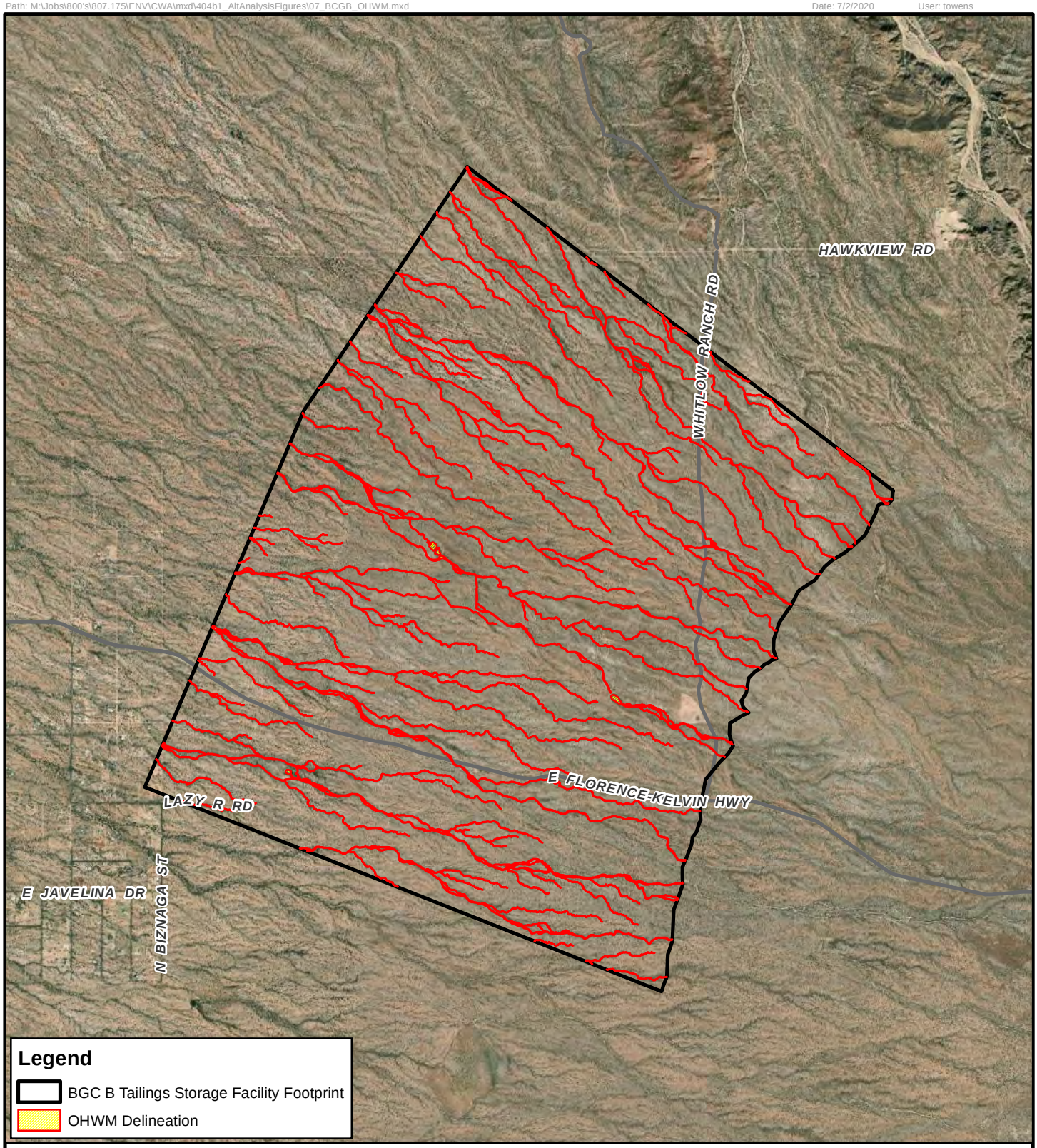


T4S, R11E, Portions of Sections 32 and 33,
T5S, R10E, Portion of Section 13,
T5S, R11E, Portions of Sections 3-11, 15-22, 27, and 28,
Pinal County, Arizona
Image Source: Maxar 2018

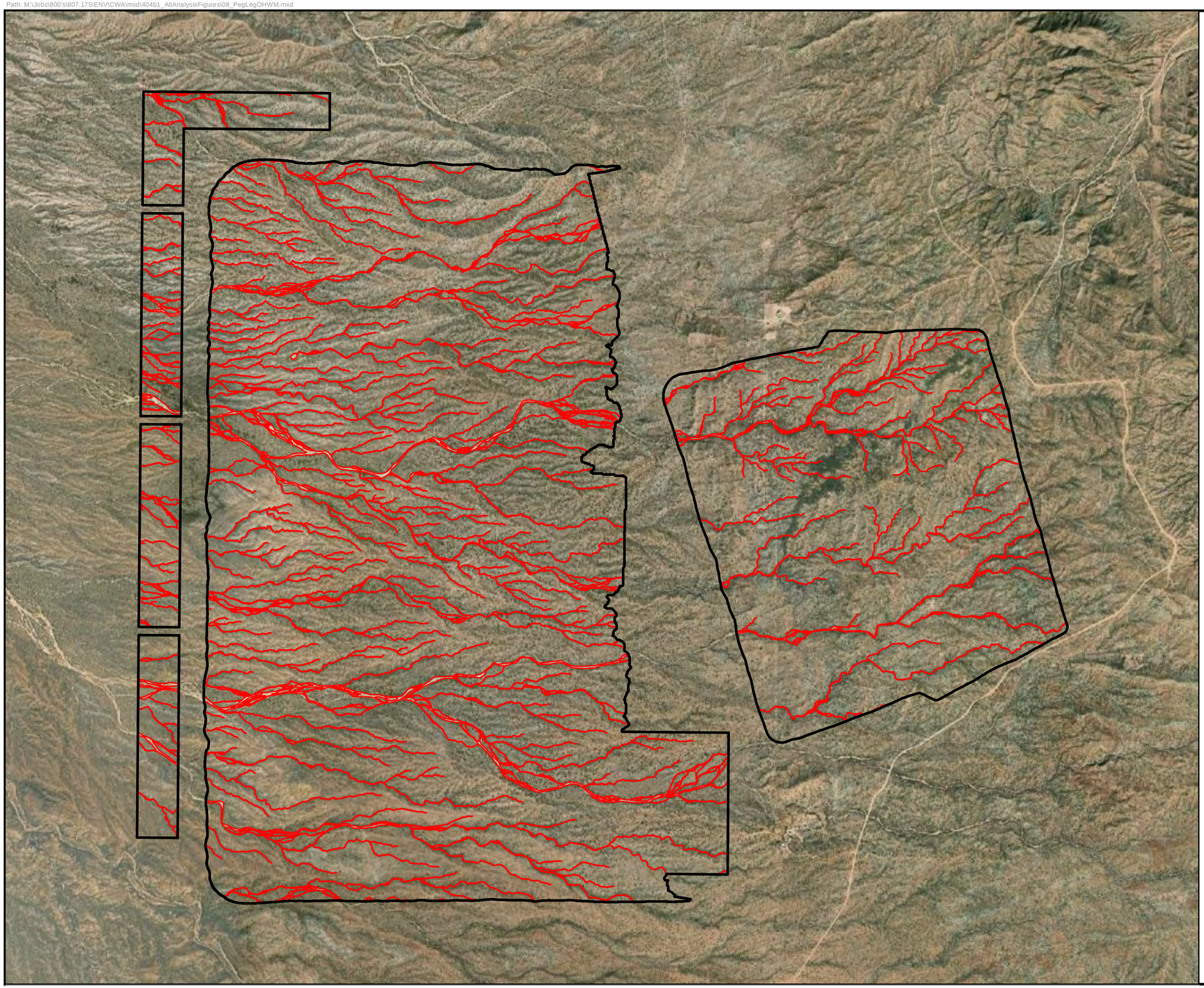
RESOLUTION COPPER
404(b)(1) Alternatives Analysis
BGC B OHWM DELINEATION
Figure 7

WestLand Resources

N

0 2,000 4,000 Feet

0 1,000 2,000 Meters



T4S, R12E, Portions of Sections 25-27 and 34-36,
T4S, R13E, Portions of Sections 31 and 32,
T5S, R12E, Portions of Sections 1-3 and 10-12,
T5S, R13E, Portions of Sections 5 and 6,
Pinal County, Arizona,
Data Source: SWCA DEIS for Peg Leg Tailings Features
Image Source: Maxar 2/6/2018

Legend

- OHWM Delineation
- Peg Leg TSF Features

N

0 1,200 2,400 Feet

0 600 1,200 Meters

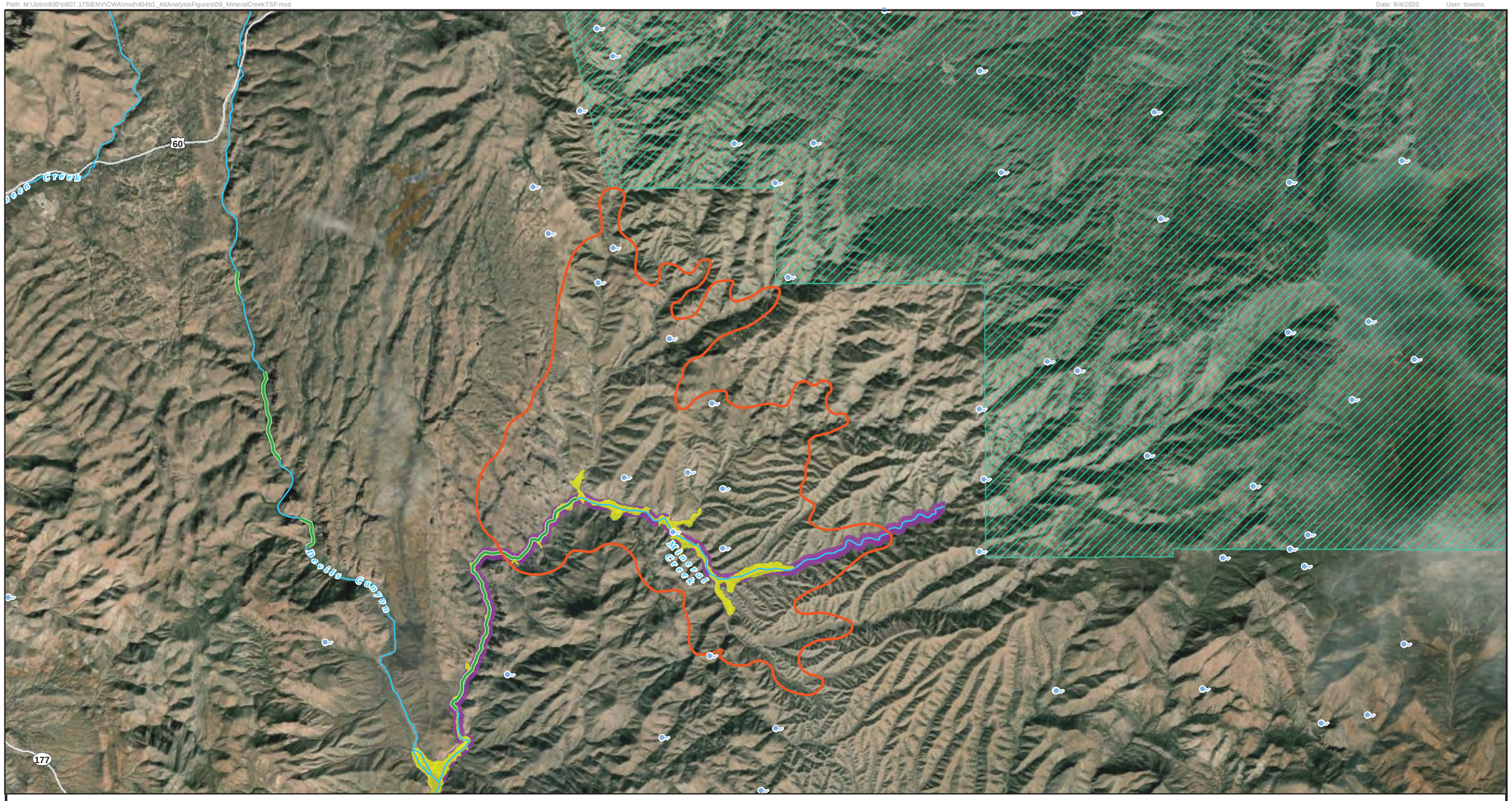
WestLand Resources

RESOLUTION COPPER

404(b)(1) Alternatives Analysis

OHWM DELINEATION OF
PEG LEG TSF ALTERNATIVE

Figure 8



T1S, R14E, Portions of Sections 31-33,
T2S, R13E, Portions of Sections 1, 11-14, 23, and 24,
T2S, R14E, Portions of Sections 5-9, 16-21, and 28-30,
Gila and Pinal County, Arizona
Image Source: Maxar, 2018

WestLand Resources

N

0 0.5 1 Miles

0 1 2 Kilometers

Legend

- Spring (ALRIS)
- Continuous Saturated Reach (Montgomery and Associates 3-16-2018)
- Streams (ALRIS)
- Mineral Creek TSF

USFWS Critical Habitat

- Gila chub, Designated Critical Habitat, 11-02-2005
- Mexican spotted owl, Designated Critical Habitat, 08-31-2004
- Yellow-billed Cuckoo, Proposed Critical Habitat, 08-15-2014

RESOLUTION COPPER

404(b)(1) Alternatives Analysis

MINERAL CREEK TSF

Figure 9

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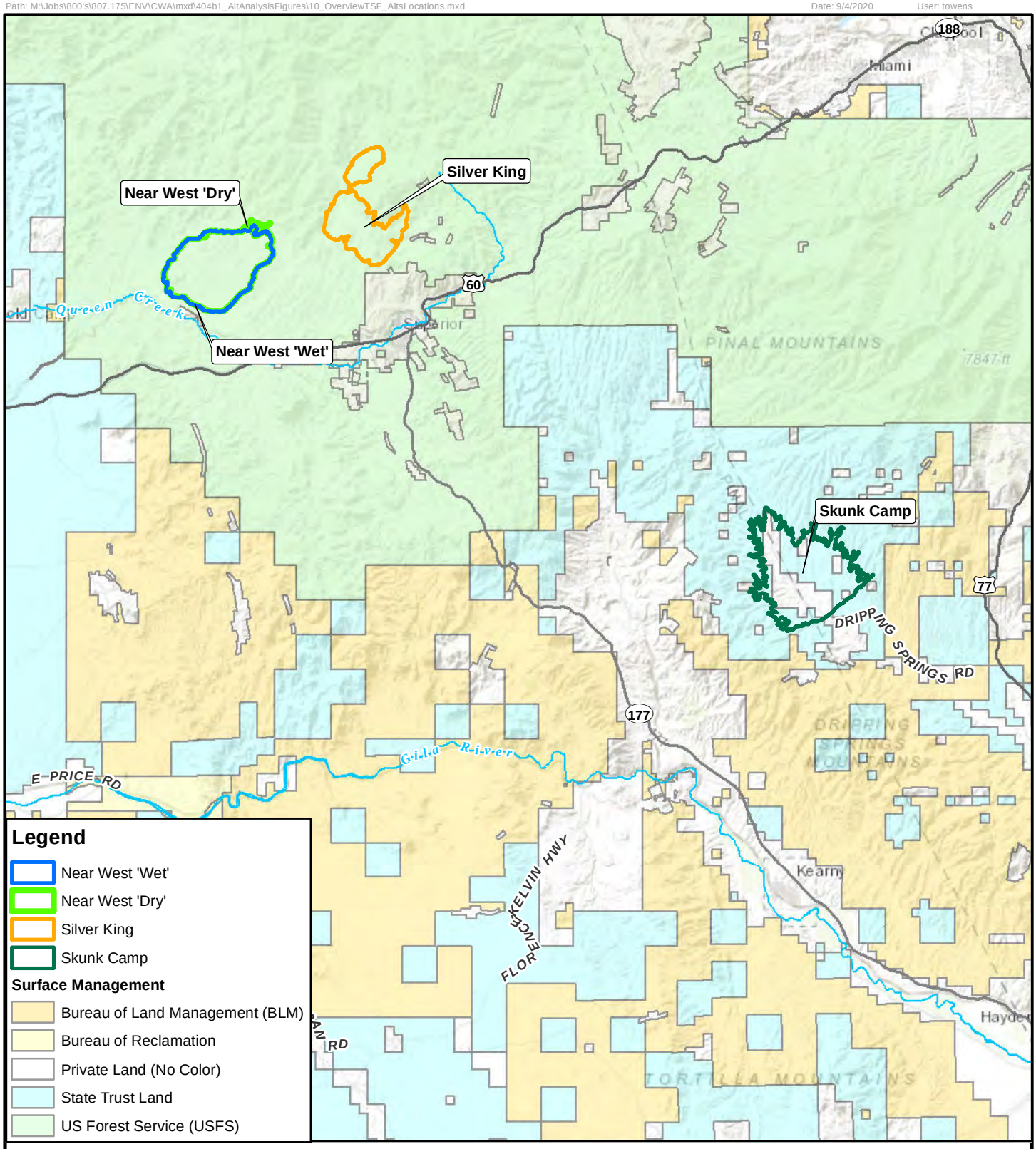


Portions of T1S R11 and 12E; T2S R14E; T3S R14E;
T4S R12 and 13E; and T5S R12 and 13E,
Pinal and Gila Counties, Arizona,
Image Source: ArcGIS Online, World Topo

RESOLUTION COPPER

404(b)(1) Alternatives Analysis

OVERVIEW OF TSF ALTERNATIVES
LOCATIONS CONSIDERED IN DETAIL

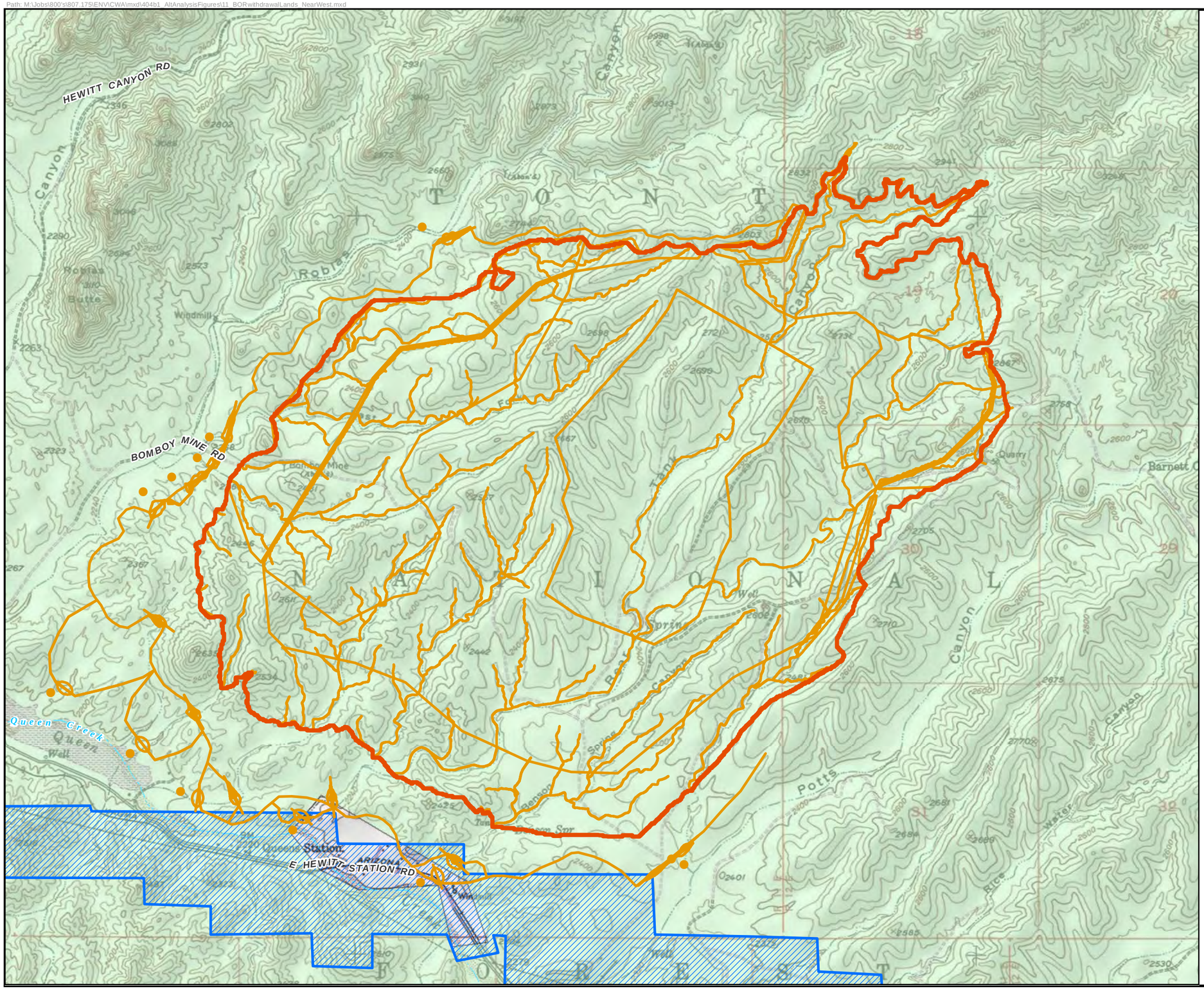
Figure 10

WestLand Resources

N

0 2 4 Miles

0 4 8 Kilometers



Near West 'Dry' TSF within:
T1S, R11E, Portions of Sections 23-27, 34-36,
T1S, R12E, Portions of Sections 18, 19, 30, and 31,
Pinal County, Arizona,
Picketpost Mountain USGS 7.5' Quadrangle
Data Source: SWCA and Golder
Surface Management: BLM 2018, WRI modified 2019

Legend

- Near West Seepage Collection
- Near West 'Dry' TSF
- Withdrawn Lands

Surface Management

- Private Land (No Color)
- US Forest Service (USFS)

N

0 1,000 2,000 Feet

0 500 1,000 Meters

WestLand Resources

RESOLUTION COPPER

404(b)(1) Alternatives Analysis

NEAR WEST TSF 'DRY'
ALTERNATIVE DETAIL

Figure 11

Path: M:\Jobs\800's\807.175\ENV\CWA\mxd\404b1_AltAnalysisFigures\12_SkunkCampPipelineImpacts.mxd

Date: 9/4/2020 User: towens

Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019,

Legend

- Ancillary Facilities
- Skunk Camp Direct OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

Note: Most OHWM impacts in the pipeline corridor are temporary and this analysis conservatively assumes all OHWM will be impacted.

N

0 2,000 4,000 Feet

0 1,000 2,000 Meters

WestLand Resources

RESOLUTION COPPER

404(b)(1) Alternatives Analysis

SKUNK CAMP PIPELINE ALTERNATIVE
IMPACTS TO AQUATIC ECOSYSTEMS

Figure 12

Path: M:\Jobs\800's\807.175\ENV\CWA\mxd\404b1_AltAnalysisFigures\13_SkunkCampTSFImpacts.mxd

Date: 9/4/2020 User: towens

Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019

Legend

- Ancillary Facilities
- Diversion Channel
- Diversion Dam Pipeline
- Diversion Dam
- Retention Pond
- Seepage Collection Dam
- Seepage Collection Pond
- Skunk Camp Direct OHWM Impact
- Skunk Camp Indirect OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land

N

0 1,500 3,000 Feet

0 750 1,500 Meters

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404(b)(1) Alternatives Analysis

SKUNK CAMP TSF ALTERNATIVE
IMPACTS TO AQUATIC ECOSYSTEMS

Figure 13

APPENDIX A

Resolution Copper Mining, LLC Mine Plan of Operations and Land Exchange USFS Alternatives Data Request #3-F, Information on Potential Tailings Alternatives

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August 30, 2017

Ms. Mary Rasmussen
US Forest Service
Supervisor's Office
2324 East McDowell Road
Phoenix, AZ 85006-2496

Subject: Resolution Copper Mining, LLC – Mine Plan of Operations and Land Exchange – USFS Alternatives Data Request #3-F, Information on Potential Tailings Alternatives

Dear Ms. Rasmussen,

In a letter Resolution Copper received from the USFS dated July 19, 2017 (Alternatives Data Request #3), the USFS requested Resolution Copper (RC) to provide information related to tailings storage facility concepts and locations. For your review and consideration, please find RC's response to item F of that request listed below.

USFS Item F*: The Forest may consider tailings alternatives that would involve filtered tailings, more commonly known as "dry-stack" tailings. The Forest requests that Resolution provide input on technical or logistical concerns of using filtered tailings. We request that these specific topics be considered:*

1. *What technical or logistical limitations does Resolution foresee regarding the ultimate height or footprint of a filtered tailings facility, or regarding the proposed disposal rate (tonnage per day)?*

2. *What technical or logistical limitations does Resolution foresee regarding the distance that filtered tailings could be reasonably conveyed? Alternatively if tailings were instead pumped via pipeline as a slurry to a tailings disposal facility and then filtered at that location prior to stacking, what is the potential acreage or infrastructure that would be needed for the filter equipment?*

3. *What potential concerns does Resolution foresee with respect to controlling acid rock drainage if scavenger and pyrite/cleaner tailings are disposed in a filtered tailings facility?*

Resolution Copper Response to F:

RC has studied filtered tailings as a tailings management strategy and found that filtered tailings are not a beneficial, reasonable or practicable tailings management strategy for the Resolution

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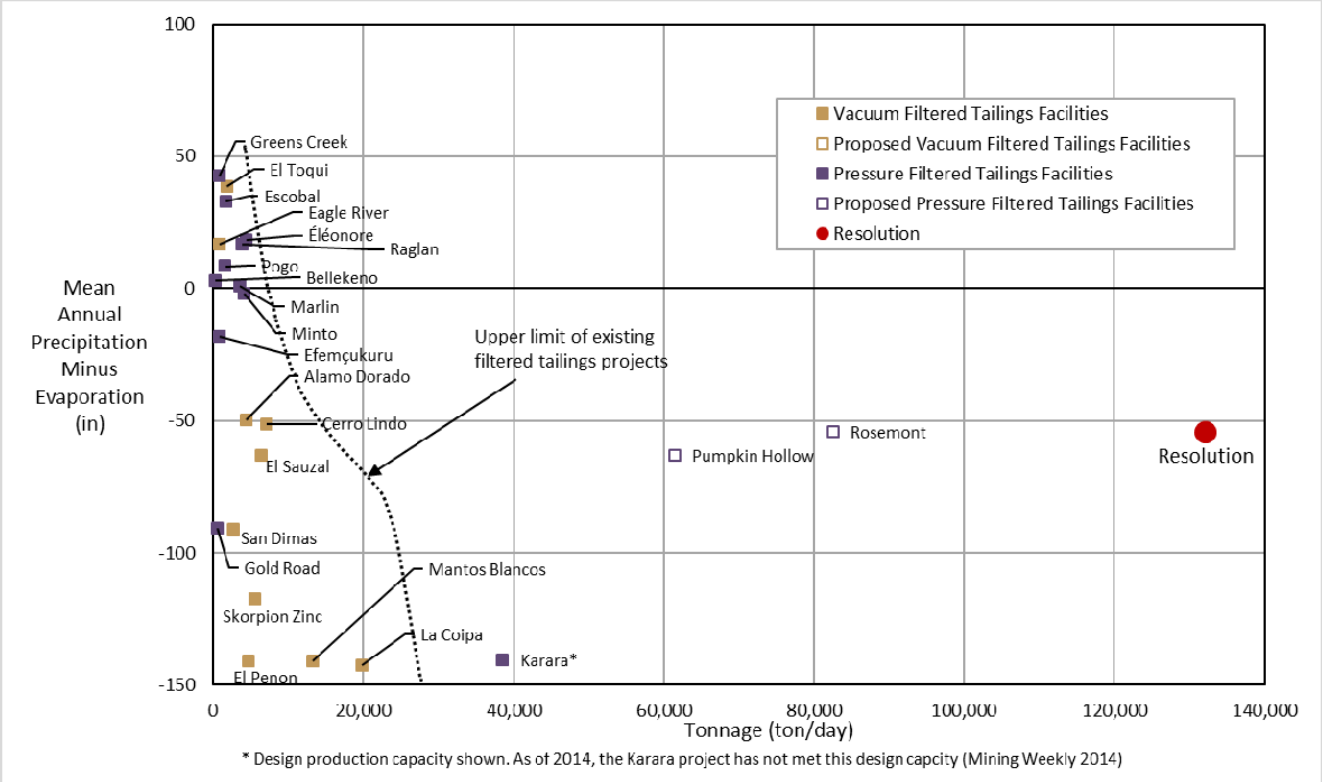
Project primarily because the scale is unprecedented and not demonstrated at an equivalent tonnage rate as well as other factors related to transportation, construction, water management and dust management challenges which are outlined herein.

RC has responded to each sub question of the Forest's item F separately below.

Resolution Copper Response to F-1: Technical and Logistical Limitations of Filtered Tailings for the Resolution Project

A key consideration when assessing the reasonableness, practicality and benefits of a tailings management strategy is precedents and lessons learned from case histories. A review of case histories was completed as part of the filtered tailings study, completed by RC's tailings engineer Klohn Crippen Berger, Ltd, whom have been involved with the Greens Creek filtered tailings facility for approximately 20 years and have been involved in several tailings technology reviews over recent years. An output from the review was a comparison of climate conditions to daily tailings production rate for operating mines and proposed projects, shown in Figure 1. The Resolution Project is also plotted on the figure for comparison.

Figure 1 Summary of Review Filtered Tailings Cases



Note: Net precipitation = mean annual precipitation minus mean annual evaporation. RC is in a semi-arid climate zone with low mean annual precipitation of 18 inches and high estimated mean annual potential evapotranspiration of 72 inches, for a mean annual precipitation minus evaporation of -54 inches per year.

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Based on the case history review of current and existing operations across the industry:

- Filtered tailings have never been applied at the production scale (130,000 ton per day) proposed for the Resolution Project or stored in a *dry-stack* pile of equivalent height.
    - Most filtered tailings are less than 10,000 tons per day. The La Coipa mine which is currently in care and maintenance did implement filtered tailings technology to a 20,000 tons per day operation. RC's estimated tailings production is 130,000 tons per day, 650% greater than La Copia.
    - Karara Mining Ltd. had proposed filtered tailings to manage a 40,000 ton per day operation, but returned to a conventional slurry facility after challenges with filtering and conveying limited production ramp-up.
    - To date, the maximum slope height of filtered embankments achieved is approximately 200 feet (La Coipa – from toe to crest, although maximum thickness of filtered tailings is approximately ~70 feet). A filtered tailings facility for the Resolution Project would be around 560 feet.

Given the vast differences between the tested and demonstrated limits of filtered tailings at the scale required for this project, RC will not consider this as a reasonable or practicable method for tailings management. In addition to precedents, additional key findings from RC's study of filtered tailings also are not in support of this tailings management strategy for this project, such as:

- Processing and Transportation
    - Most filtered tailings projects have reported challenges achieving target moisture contents and throughputs from filter plants on a reliable basis, especially at start-up. Conventional tailings facilities typically do not have this problem.
- Construction and Operations
    - Filtered tailings at the Near West site would be mechanically placed in rugged terrain which requires a significant construction fleet. The scale of the construction fleet for this operation would be much larger than a typical operation and be logistically challenging. See response to F-2 as well.
    - Due to potential upsets/unreliability of the filter plant and conveyor systems (i.e., mechanical break-downs, material produced at the filter plant that is too wet for transportation, flood events, wind events, etc.), multiple layers of back-up storage would be required (at the filter plant, at the filtered facility and potentially a separate back-up conventional tailings facility, like the Karara case history). At the Resolution Project's production rates, a back-up facility or stockpile would not be feasible within the current proposed disturbance footprints. Therefore, there would be significant additional disturbance on National Forest Service land.
- Water Management
    - Water management for filtered tailings for the Resolution Project would be complex. Runoff and seepage water would be managed in large external collection

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ponds rather than within the tailings impoundment as with conventional tailings facility. Therefore, there will be additional water retaining dams around the site, larger in size than those required for conventional slurry tailings options, and increased disturbance on National Forest Service land.

- Dust Management
    - Walking stacker conveyors for transporting and placement of filtered tailings would likely be required in a scenario for RC, a large active placement area is required, which cannot be progressively reclaimed. Therefore, there will be large areas requiring dust mitigation measures.
    - Unsaturated filtered tailings are prone to dusting and require active dust management if they can't be progressively reclaimed; requiring regular wetting, temporary covers, or some other measures to suppress dust (such as polymer suppressants).
    - Conventional slurry tailings facilities (as proposed in the mine plan of operations) would also have large exposed areas, but are more easily managed with multiple spigots to maintain a wet beach to reduce dust creation.
    - Due to the lower water content of the filtered tailings, more water (or other measures) would need to be used for dust mitigation than for conventional slurry. If water sprinklers are used as the dust management methodology, the make-up water benefits from using filtered tailings in comparison to conventional slurry tailings will be lessened significantly.

Resolution Copper Response to F-2: Transportation Logistics Considerations and Filter Plant Size

Due to the difficulty in transporting filtered tailings in comparison to slurry, it is not practical to have the filter plant at the WPS. The filter plant would be located at the tailings site, increasing the disturbance of National Forest Service lands. For this scale of operation, a filter plant would have a footprint of approximately 10 acres based on an estimate of the number of filter presses required. Once filtered, the tailings then require transportation to the tailings site and placement. Filter tailings can be transported via trucks or conveyors.

Many projects transport filtered tailings with trucks. The highest production mine reviewed that is using trucks as the primary method of filtered tailings transportation was Cerro Lindo at 7,100 tons per day. RC would need to place 130,000 tons per day. At 20 tons per load, RCM would require 6,500 dump truck loads per day to be moved from the filter plant to the tailings facility for placement. This method of placement would not be reasonable or practicable and therefore, walking stacker conveyors would be used for transportation, plus equipment to spread and compact the tailings. The rough terrain at the Near West site and at potential alternative locations would require the use of conveyors before valleys are filled, which is exceedingly difficult because walking stacker conveyors don't walk on rough rugged steep terrain and therefore re-handling of the tailings is likely required (additional earth-moving equipment). The substantial amount of

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heavy equipment would contribute significant amounts of noise and emissions above what is normal for conventional tailings facilities.

Resolution Copper Response to F-3: Acid Rock Drainage (ARD) Management

RC ore processing will generate two mineralogically and geochemically discrete tailings streams known as "scavenger" tailings and "cleaner" (or pyrite) tailings. Pyrite tailings are classified as Potentially Acid Generating (PAG). The management approach per the mine plan of operations for pyrite tailings involves subaqueous placement during operations (submerged beneath the reclaim pond) and then progressive covering with a thick sequence of scavenger tailings which would limit oxygen and thus minimize acid rock drainage.

If the pyrite tailings were filtered and stacked, they would be placed and kept in an unsaturated state. Thus, will oxidize under wetting and drying cycles from storm events, which would generate ARD and produce poorer water quality runoff compared to pyrite tailings stored in a saturated state (e.g. beneath a pond in a conventional facility). In a submittal to the USFS dated March 9, 2017 Resolution Copper provided a detailed technical report evaluating the chemistry of unsaturated pyrite tailings. The report is titled "*Geochemical Reactivity of Unsaturated Pyrite Tailings Technical Memorandum*" and included in Attachment 4 of this submittal.

As described in the response to F-1 above, external water management facilities are required to manage the water that can't be stored on the tailings surface. These can be large depending on topography, operational water balance, and storm storage requirements. In the case of the proposed location in the mine plan of operations, a filtered tailings scenario would require external water management facilities containing poor quality contact storm water to be located closer to Queen Creek.

Should you have any questions or require further information please contact me.

Sincerely,

Vicky Peacey,
Senior Manager, Permitting and Approvals; Resolution Copper Company, as Manager of Resolution Copper Mining, LLC

Cc: Ms. Mary Morissette, Senior Environmental Specialist; Resolution Copper Company
Mr. Andrew Luke, Metallurgical Engineer; Resolution Copper Company
Ms. Kate Patterson, P.Eng., M.Eng., PE, Associate, Tailings and Water Resources Engineer, Klohn Crippen Berger, Ltd

APPENDIX B

ASLD Letter Response to July 5, 2017 Letter Regarding "Potential to Locate a Resolution Copper Mine Tailings Storage Facility on Arizona State Trust Lands" (August 2, 2017)

Douglas A. Ducey
Governor

Lisa A. Atkins
Commissioner

Arizona State Land Department

1616 West Adams, Phoenix, Arizona 85007
(602) 542-4631

August 2, 2017

Mr. Neil Bosworth
Forest Supervisor
U. S. Forest Service
Tonto National Forest
2324 East McDowell Road
Phoenix, Arizona 85006

Re: Response to July 5, 2017 Letter Regarding *"Potential to Locate a Resolution Copper Mine Tailings Storage Facility on Arizona State Trust Lands"*

Dear Mr. Bosworth:

The Arizona State Land Department (Department) has received your above-referenced letter of July 5, 2017, regarding the alternative tailings facility locations to be considered in the Environmental Impact Statement (EIS) for the proposed Resolution Copper Mining (RCM) Project. Three of the alternative sites, identified as "Far West", "BGC-B" and "BGC-C" in your July 5th letter and its accompanying map, involve State Trust land (STL) managed by the Department to generate income on behalf of 13 beneficiaries, primarily supporting K-12 education in Arizona.

The Far West alternative site is mostly STL except for a small portion in the southeast. The Department has held numerous discussion with RCM regarding the Far West site since August 2010, and has consistently and repeatedly stated its refusal to authorize the use this site for such a purpose. The Far West site is on the east-central portion of what is referred to as the Superstition Vistas area which covers approximately 275 square miles of mostly STL and which the Department considers as THE prime area for future residential and commercial development in the Phoenix East Valley. Again, the Department will not consider the Far West site as a potential tailings facility.

Both alternatives BGC-B and BGC-C include what appears to be less than a section of STL each. All of the STL in both of these alternatives have grazing leases, and most also have some Rights-of-Way, including roads with Pinal County and an electric transmission line with Salt River Project. RCM would have to apply to purchase these parcels. As part of the process to take these parcels to auction, RCM would have to perform what the Department calls "condemnation work" which would mainly involve RCM doing sufficient geologic work and providing sufficient detail to demonstrate that there is no mineral value or potential on or under these parcels. Otherwise, the Department is statutorily unable to sell the land. RCM would also be required to compensate any

of the existing lessees and permittees. There are many other steps in the process, including but not limited to paying for a surface value appraisal and legal land survey, that RCM would have to complete before these parcels could be sold. And once the parcels are taken to auction, there is no guarantee that RCM would be the successful bidder.

Thank you for giving us the opportunity to comment of these alternatives, and we look forward to continuing to work with you as a Cooperating Agency on the EIS in the coming years.

Sincerely,

Lisa A. Atkins
Commissioner

cc: Fred Breedlove, Director, Natural Resources Division
Max Masel, Director, Real Estate Division
Joe Dixon, Minerals Section Manager
Mark Edelman, Planning & Engineering Section Manager

APPENDIX C

WestLand Resources, Inc. Resolution Copper Project Revised Alternatives Discussion (January 21, 2020)

RESOLUTION COPPER PROJECT REVISED ALTERNATIVES DISCUSSION

Prepared for: U.S. Army Corps of Engineers *on behalf of* Resolution Copper

Prepared by: WestLand Resources, Inc.

Date: January 21, 2020

Project No.: 0807.175 02 02

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TABLES

FIGURES

(*follow text*)

ATTACHMENTS

1. INTRODUCTION

The United States Forest Service (USFS) Tonto National Forest (TNF) has published a draft of an Environmental Impact Statement (EIS) for the purpose of reviewing the Resolution Copper Mining, LLC (Resolution) revised General Plan of Operations (GPO) under the National Environmental Policy Act (NEPA). As proposed, the tailings storage facility (TSF), associated pipelines, and appurtenant TSF infrastructure for the planned mine development require the discharge of fill to surface water features that the U.S. Army Corps of Engineers (Corps) is anticipated to determine to be potentially jurisdictional waters of the United States (waters of the U.S.) pursuant to a preliminary jurisdictional determination (PJD). Resolution therefore has made application for a Clean Water Act (CWA) Section 404 permit for these discharges. The Draft EIS (DEIS), published in August 2019, included as Appendix C a draft Practicability Analysis document (WestLand 2019) containing an analysis of alternatives as required to demonstrate compliance with guidelines established under CWA Section 404(b)(1) (40 CFR § Part 230; the Guidelines) for avoidance, minimization, and mitigation of impacts to waters of the U.S. The evaluation of alternatives closely followed the format of the NEPA evaluation of alternatives in the TNF DEIS.

After review, discussion, and workgroup meetings with the TNF, the Corps, and the Environmental Protection Agency (EPA), portions of the Practicability Analysis were revised to ensure the evaluation of alternatives undertaken therein conformed to the requirements of an analysis of alternatives under the CWA Section 404(b)(1) Guidelines. The revised alternatives discussion was reviewed with the agencies and Resolution at Workgroup Meeting #2 on August 21, 2109 and at Workgroup Meeting #4 on October 16, 2019. Additional information on some of the evaluated alternatives was provided by Resolution and the agencies to support the analysis. WestLand Resources, Inc. (WestLand) has developed this technical memorandum to capture the revised information before the final CWA Section 404(b)(1) Alternatives Analysis document is published with the Final EIS.

2. FORMULATION OF PROJECT ALTERNATIVES

The TNF utilized information gathered from public scoping, cooperating and consulting agencies, government-to-government consultation with Native American groups, and alternatives workshops to identify public values and develop screening criteria used to evaluate the alternative TSF locations and designs in the DEIS. Most of these alternatives, and the methodology for identifying them, were discussed in detail in the *Resolution Copper Project and Land Exchange Environmental Impact Statement DRAFT Alternatives Evaluation Report, November 2017* (SWCA 2017) and *Appendix F: Alternatives Considered but Dismissed from Detailed Analysis* of the DEIS (USFS 2019). The draft Practicability Analysis document (WestLand 2019) was designed to be consistent with, and relied on, the detailed analysis of TSF alternatives contained in these documents to support the selection of the alternatives analyzed in detail for compliance with the Guidelines.

The USFS systematically evaluated dozens of potential TSF locations and technologies for both the full volume and partial volumes (split volume storage) of tailings. The identification and evaluation of alternatives, in addition to varying the proposed location of the TSF, also included a process that prioritized alternatives through the following: the potential for use of previously disturbed, or 'brownfield', sites for TSF development; the use of multiple sites for the placement of tailings; and finally differing the types of tailings embankments and tailings processing/placement technologies, including filtered or 'dry stack' tailings, at proposed TSF locations. The next sections of this document maintain this process and structure in providing the revised alternatives information.

2.1. GEOGRAPHIC SCOPE FOR TSF ALTERNATIVES

As described in the draft Practicability Analysis (WestLand 2019), the USFS evaluated a broad landscape surrounding the Resolution mine to identify initial potential alternative locations for the TSF described in the GPO. Factors considered in this evaluation included locations within a reasonable proximity to the Resolution mine site, favorable topography, sufficient storage capacity, and the potential for use of previously disturbed, or 'brownfield', sites for TSF development. The potential use of multiple sites for the placement of tailings, or split volume storage, was also evaluated.

2.1.1. Brownfields

The USFS evaluation of brownfield sites included areas not under the ownership of Resolution and associated with other current and previous mining operations in locations up to 200 miles from the Resolution ore deposit. Fifteen brownfield sites, as well as the future subsidence zone anticipated from mining the Resolution ore deposit itself, were analyzed as potential areas for the storage of tailings that might be available and practicable as alternatives to the development of a new TSF in a previously undisturbed location (SWCA 2017; WestLand 2019). It was ultimately determined that none of the brownfield sites were available, provided capacity sufficient to meet Resolution's project purpose, or were otherwise feasible and reasonable alternatives for TSF locations and the use of these brownfield sites was dismissed from detailed analysis (SWCA 2017; WestLand 2019). Minor edits were made to **Table 1** as presented in the draft Practicability Analysis document to correctly reflect the capacity for tailings storage available at the currently operating Pinto Valley Mine and Ray Mine operations. Neither of these changes was material to the practicability of the brownfield sites as TSF locations for the project. The revised **Table 1** is included below.

Table 1. Brownfields Sites Investigated for Potential Tailings Storage (adapted from SWCA 2017 [revised])

Site Name	Ownership	Mining Activity Status	Approximate Distance (miles)[1]	Available[2]	Capacity for NPAG/PAG Tailings	Capacity for PAG Tailings Only	Other Factors	Alternative Dismissed
Ajo	Freeport-McMoRan	Copper mine, potential for future operation	120	No	No	No	N/A	Yes
Carlota	KGHM International Ltd.	Copper mine, current operation	10	No	No	No	N/A	Yes
Casa Grande	ASARCO LLC	Copper mine, closed operation	49	Yes	No	No	N/A	Yes
Copper Queen	Freeport-McMoRan	Copper mine, closed operation, tourism	145	No	No	No	N/A	Yes
Copperstone	Kerr Mines Incorporated	Gold mine, closed operation	190	Yes	No	No	N/A	Yes
Sierrita	Freeport-McMoRan	Copper mine, current operation	100	No	No	No	N/A	Yes
Johnson Camp	Excelsior Mining Corp.	Copper mine, potential for future operation	100	No	No	No	N/A	Yes
Miami and Inspiration	Freeport-McMoRan	Copper mine, closing	15	Yes	No	Yes	WQARF Site	Yes
Miami Unit and Copper Cities	BHP Copper Inc.	Copper mine, closing	15	Yes	No	Yes	WQARF Site	Yes
Pinto Valley Mine	Pinto Valley Mining Corp.	Copper mine, current operation	11	No	Yes	Yes	N/A	Yes
Ray Mine	ASARCO	Copper mine, current operation	11	No	Yes	Yes	N/A	Yes

1 Distances measured in aerial miles between Resolution ore body and brownfields facility. The total length to construct appropriate infrastructure (pipelines, etc.) would be considerably longer.

2 In this context, lack of availability generally refers to the fact that a given mine facility is currently in operation or is understood to be evaluating returning to operation and would therefore be unavailable for tailings disposal. The availability assessment reflected in Table 1 does not consider such other salient factors as whether the owner of the sites in question would be willing to sell the land to Resolution or otherwise allow the deposition of tailings to be generated by the planned Resolution operation, whether the deposition of the Resolution tailings (or a portion thereof) would be consistent with approved site closure/reclamation strategies, or the feasibility of transporting tailings to the sites.

Site Name	Ownership	Mining Activity Status	Approximate Distance (miles)[1]	Available[2]	Capacity for NPAG/PAG Tailings	Capacity for PAG Tailings Only	Other Factors	Alternative Dismissed
Resolution Copper Subsidence Zone	Resolution Copper	Copper mine, potential for future operation	3	Yes	No	Yes	Safety	Yes
San Manuel	BHP Copper Inc.	Copper mine, closed operation	45	Yes	No	Yes	Proximity to San Pedro River	Yes
Tohono Cyprus	Freeport-McMoRan	Copper mine, potential for future operation	70	No	No	No	N/A	Yes
Twin Buttes	Freeport-McMoRan	Copper mine, potential for future operation	95	No	No	No	N/A	Yes
United Verde	Phelps Dodge Corporation	Copper mine, closed operation	115	Yes	No	No	N/A	Yes

2.1.2. Multiple TSF Locations

The use of multiple TSFs was investigated by the USFS (SWCA 2017; USFS 2019) as part of the evaluation of brownfield TSF locations and was considered in the draft Practicability Analysis (WestLand 2019). In general, the use of multiple smaller sites for the storage of tailings is problematic from an operations, maintenance, and environmental perspective given the need to duplicate infrastructure at multiple smaller TSFs. Splitting the footprint of a TSF designed for a given capacity into multiple smaller TSFs designed to store that same capacity often results in a greater overall footprint, given the need to duplicate infrastructure at each site. No revisions were made to the discussion of multiple TSFs included in the draft Practicability Analysis (WestLand 2019).

2.2. SKUNK CAMP FILTERED TAILINGS ('DRY-STACK') DESIGN

After dismissal of the brownfield alternatives, 16 alternative TSF locations to that location proposed in the GPO were further evaluated (SWCA 2017, USFS 2019). Numerous aspects of TSF design and construction such as embankment type (e.g., upstream, centerline, modified centerline, and downstream embankments), foundation treatment and lining options, management of pyrite or potentially acid generating (PAG) tailings (e.g., methods for complete physical separation from NPAG), and deposition methods (e.g., conventional thickened, high-density thickened, and filtered, or 'dry-stack') were assessed for use at these locations. Although the dry-stack technology needed to meet the overall project purpose is unproven and not commercially available, this method was carried forward for further analysis as part of the Silver King TSF alternative in the DEIS (USFS 2019) and draft Practicability Analysis (WestLand 2019) for the sake of completeness.

In Workgroup Meeting #3, the EPA requested that the filtered, or 'dry-stack,' technology also be evaluated for the proposed TSF at the Skunk Camp location to assess whether the filtered tailings TSF could potentially reduce the footprint of the TSF as compared to a conventional slurry TSF. KCB Consultants Ltd. (KCB) prepared a conceptual Filtered Tailings Impoundment Layout and Staging memorandum (KCB 2020) to evaluate the likely footprint of a Skunk Camp filtered tailings TSF after conventional deposition for the first 10 years of operations. This memorandum assumed that the filtered tailings technology would be feasible and commercially available at the scale of the Resolution project in time for production, a fact that is not currently true. The KCB evaluation found that the filtered tailings TSF at Skunk Camp would instead have a larger footprint than the conventional slurry TSF and may, in fact, require additional back-up storage area (KCB 2020). The discussion of the filtered tailings analysis for Skunk Camp (KCB 2020) will be added to the final CWA Section 404(b)(1) Alternatives Analysis document published as part of the Final EIS.

3. ANALYSIS OF PROJECT ALTERNATIVES

As part of DEIS development, the 16 potential TSF locations (**Figure 1**), including the GPO location, were screened and assessed using criteria developed from the public and agency scoping processes (SWCA 2017; USFS 2019). These general screening criteria included locations that were within a more reasonable distance of the West Plant Site, sites that avoided landscape barriers such as mountains or rivers, sites outside rugged terrain too steep for TSF development, and sites potentially near existing or historic mining operations. One additional potential TSF site, Mineral Creek, was developed after the initial screening was completed and was carried through to a site-level practicability analysis.

Section 3.3 of the draft Practicability Analysis document (WestLand 2019) analyzed these 17 alternatives as required to demonstrate compliance with the CWA Section 404(b)(1) Guidelines. Based on discussion with the agencies at Workgroup Meeting #4 and additional information received by WestLand, edits were made to **Table 2** and Section 3 as presented in the draft Practicability Analysis document (WestLand 2019) to support the additional analysis. Sixteen (16) of the TSF alternatives were dismissed from further consideration and included in **Table 2**. The final TSF alternative, Mineral Creek, was carried to a site-level practicability analysis, but was then determined to have other serious environmental consequences that would prevent it from being selected as the Least Environmentally Damaging Practicable Alternative. The Mineral Creek TSF alternative is discussed in *Section 3.3*.

3.1. TSF LOCATIONS DISMISSED FROM CONSIDERATION DUE TO AVAILABILITY

Fourteen (14) of the 16 TSF alternatives in **Table 2** were dismissed from further detailed consideration based on availability issues. The factors related to these availability and/or practicability issues are listed in the revised **Table 2**. Discussion of the information used to revise **Table 2** is included in the sections below.

3.1.1. ASLD Lands Associated with the BCG A and Far West Alternatives

The BCG A and Far West TSF alternatives are located approximately 14 miles southwest of Superior Arizona, on Arizona State Trust Lands managed by the Arizona State Land Department (ASLD; **Figure 2**). The ASLD land underlying both alternatives has been proposed as the location for a future 175,000-acre residential and commercial development known as Superstition Vistas (Superstition Vistas 2013; **Figure 2**). Placing a TSF within this planned area development would decrease the amount of land available and reduce property values within the viewshed of the TSF. ASLD has stated that it will not sell this land to Resolution for the development of a TSF and both alternatives were dropped from further consideration.

Table 2. Initial Alternative TSF Locations Dismissed from Consideration (adapted from USFS 2019, Appendix F [revised])

Alternative Location	Available	Logistically Practicable	Technologically Practicable	Dismissed
BCG A	No – includes ASLD lands not available for purchase.	N/A	N/A	Yes – not available.
BCG B	No – paved alignment of Florence-Kelvin Highway runs through site.	No – paved alignment of Florence-Kelvin Highway runs through site.	N/A	Yes – not available or logistically practicable.
BCG C	No – includes lands withdrawn from mineral entry by BOR.	N/A	N/A	Yes – not available. A reconfiguration of BCG C became DEIS Alternative 5 (Peg Leg).
BCG D	No – includes lands withdrawn from mineral entry by BOR.	N/A	No – proximity to the Gila River creates impracticable technological challenges related to seepage control.	Yes – not available and not technologically practicable.
Dry-Stack at GPO	Yes	No – water management issues with very close proximity (<0.25 mi) to Queen Creek (fully unsaturated PAG would exceed WQ standards and result in long-term WQ issues).	No – dry-stack technology not proven at scale and not commercially available. Impoundment would be over 500 feet high an unprecedented height for a dry stack TSF worldwide.	Yes – neither logistically nor technologically practicable. Reconfigurations based on modified centerline embankment with thickened and high-density thickened tailings as well as physically isolating the PAG behind a splitter berm became DEIS Alternatives 2 and 3 (Near West 'Wet' and 'Dry').
Far West	No – includes ASLD lands not available for purchase.	N/A	N/A	Yes – not available.
Hewitt Canyon	No – location in proximity to Superstition Wilderness Class I airshed would prevent compliance with air quality regulations.	No – location in proximity to Superstition Wilderness Class I airshed would prevent compliance with air quality regulations.	N/A	Yes – not available or logistically practicable.

Alternative Location	Available	Logistically Practicable	Technologically Practicable	Dismissed
Lower East	No – includes lands withdrawn from mineral entry by BOR.	N/A	N/A	Yes – not available.
Silver King	No – conventional tailings deposition design at this location was not available because of historic cemetery and adverse mineral estate.	N/A	No – presence of historic mine workings and impoundment is ~1000 feet high, an unprecedented height for a conventional TSF.	Yes – not available or technologically practicable. Reconfiguration of methodology and footprint became DEIS Alternative 4 (Silver King Dry-Stack).
SWCA 1	No – appurtenant features (seepage collection, etc.) on lands withdrawn from mineral entry by BOR.	Yes	No – proximity to the Gila River and terrain also present challenges for seepage and stormwater management.	Yes – not available and not technologically practicable.
SWCA 2	No – includes lands withdrawn from mineral entry by BOR.	Yes	No – proximity to the Gila River and terrain present challenges for seepage and stormwater management.	Yes – not available and not technologically practicable.
SWCA 3	Yes	No – rugged topography makes it unlikely to have available capacity for all tailings volume and presents substantial difficulties for infrastructure, structures, and equipment.	No – location is on steep ridge crest and occupies portions of both the Queen Creek and Gila River watersheds, requiring substantial engineering controls to minimize seepage from multiple locations.	Yes – neither logistically nor technologically practicable.
SWCA 4	No – partially located on Superstition Wilderness and therefore not available.	N/A	N/A	Yes – not available.
Telegraph Canyon	No – creek reach listed as candidate for Scenic River Area designation under Wild and Scenic Rivers Act.	N/A	N/A	Yes – not available.

Alternative Location	Available	Logistically Practicable	Technologically Practicable	Dismissed
Upper Arnett	No – creek reach listed as candidate for Scenic River Area designation under Wild and Scenic Rivers Act.	N/A	N/A	Yes – not available.
Whitford Canyon	No – location in proximity to Superstition Wilderness Class I airshed would prevent compliance with air quality regulations.	No – location in proximity to Superstition Wilderness Class I airshed would prevent compliance with air quality regulations.	N/A	Yes – not available or logistically practicable.

3.1.2. Lands Associated with the Florence-Kelvin Highway and BCG B

The BCG B TSF alternative is located east of Florence in Pinal County (**Figure 3**). The paved alignment of the existing Florence-Kelvin highway runs through the center of the site proposed for the TSF footprint. The lands underlying this portion of the highway are not available for development of a TSF, as this alignment would need to be replaced and rerouted. This TSF alternative was dropped from further consideration.

3.1.3. Lands Associated with the BOR Mineral Withdrawal

The BCG C, BCG D, SWCA 1, and SWCA 2 TSF alternatives are located along the Gila River west of Kearny and east of Florence (**Figure 1**). The Lower East TSF alternative is located along Queen Creek west of Superior (**Figure 1**). Lands underlying portions of all five of these TSF alternatives have been withdrawn from mineral entry by the Bureau of Reclamation (BOR; **Figure 4**) and Resolution has no mining claims located at these sites that predate the withdrawal. The BOR withdrawal is related to use of these lands by the Salt River Project (SRP) and the San Carlos Irrigation Project (SCIP) for water storage and diversion and/or power generation, transmission, and distribution. Information provided to the USFS and Corps indicates that these withdrawals have no sunset date and remain in force as long as the purpose for the withdrawal still exists. BOR has provided information to the USFS and Resolution indicating these lands remain unavailable for TSF development. This information is provided as **Attachments 1**, **2**, and **3** of this document. These 5 TSF alternatives were dropped from further consideration.

3.1.4. Lands Associated with the Superstition Wilderness

The Hewitt Canyon and Whitford Canyon TSF alternatives are located in proximity to the Superstition Wilderness, and SWCA 4 is located within the wilderness boundary (**Figure 5**). Air Sciences Inc. (ASI) prepared a technical memorandum (ASI 2019) describing the regulatory constrains associated with the Class I airshed of the wilderness. The TNF determined that even if the TSFs were operated and controlled to industry standards, they are so close to the wilderness boundary as to be incompatible with the protection of the Class I airshed (ASI 2019). Further, no emissions offsets are available to mitigate potential air quality impacts (ASI 2019). These TSF alternatives were dropped from further consideration.

Related to the above, the location of the SWCA 4 TSF alternative partially within the Superstition Wilderness boundary precludes it availability for development of a TSF. This alternative was also dropped from further consideration.

3.1.5. Wild and Scenic River Candidate Reaches

The Telegraph Canyon and Upper Arnett TSF locations (**Figure 1**) were dismissed from further consideration because, in addition to other unique natural resource values, these two creeks are tributaries to reaches previously listed as candidates for designation as Scenic River Areas (USFS 1993) under the National Wild and Scenic Rivers Act (16 U.S.C. 1271 et seq.). This system allows for the preservation of certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment or present and future generations. Both Arnett and Telegraph creeks contain reaches which are free from impoundments with shorelines that are primitive and undeveloped. These TSF alternatives were dropped from further consideration.

3.2. TSF Locations Dismissed from Consideration Due to Practicability

The two remaining TSF alternatives in **Table 2**, Dry-Stack at GPO and SWCA 3 (**Figure 1**), were dismissed from further detailed consideration based on practicability issues. The Dry-Stack at GPO TSF was determined to be both logistically and technologically impracticable. Water management issues related to fully unsaturated PAG tailings in the Dry-Stack at GPO TSF would exceed water quality standards and result in long-term water quality issues. Additionally, the dry-stack technology proposed for use in this TSF is not proven or commercially available at the scale proposed for the Resolution project and the resulting impoundment is over 500 feet high, an unprecedented height for filtered tailings. This alternative was dropped from further consideration.

The SWCA 3 TSF was determined to be both logistically and technologically impracticable. The rugged topography of the location makes the proposed TSF unlikely to have available capacity for the proposed tailings volume and makes impossible the safe and effective construction and operation of the embankment and associated infrastructure (USFS 2019). The location of this TSF on a steep ridge crest requires substantial engineering controls to minimize seepage from multiple locations and occupies portions of both the Queen Creek and Gila River watersheds. This alternative was dropped from further consideration.

3.3. Site-Level Practicability Analysis for the Mineral Creek TSF Location

As described above, one additional potential TSF site, Mineral Creek (**Figure 6**), was developed after the initial TSF screening was completed and was carried through to a site-level practicability analysis. Discussion of this alternative has been included in a new section of the draft CWA Section 404(b)(1) Alternatives Analysis document preliminarily titled Section 3.4. Site-Level Practicability Analysis. The Mineral Creek TSF alternative location appears to be available and both logistically and technologically practicable for the development of a TSF. However, before detailed design and engineering documentation for a TSF at his location could be prepared, other significant adverse environmental consequences were identified that would be sufficient to keep this location from being selected as the Least Environmentally Damaging Practicable Alternative (LEDPA).

Mineral Creek, located within the HUC-10 Mineral Creek – Gila River watershed (**Figure 6**), is a northeast to southwest trending drainage originating in the foothills of the Pinal mountains, joining the Gila River just south of Kelvin, Arizona. The drainage is spatially intermittent with a very large portion considered continuously saturated (M&A and WestLand 2017). Vegetation composition along the continuously saturated reaches of Mineral Creek consists of mixed stands of Arizona sycamore (*Platanus wrightii*), velvet mesquite (*Prosopis velutina*), and gray thorn (*Ziziphus obtusifolia*), with a few Goodding's willow (*Salix gooddingii*). Intermittent patches of seepwillow (*Baccharis salicifolia*) and singlewhorl burrobrush (*Ambrosia monogyra*) occur along the terraces. Approximately nine (9) miles of Mineral Creek in this area has been designated by the U.S. Fish and Wildlife Service (USFWS) as critical habitat (**Figure 6**) for the native and endangered Gila chub (*Gila intermedia*). Of this 9-mile-long reach, approximately 5.16 miles would be permanently lost within the footprint of this TSF. Based on this impact, this alternative will not be subject to detailed consideration in the draft CWA Section 404(b)(1) Alternatives Analysis document.

4. CONCLUSION

The DEIS published in August 2019 by the USFS TNF included as Appendix C a draft Practicability Analysis document (WestLand 2019) containing an analysis of alternatives as required to demonstrate compliance with guidelines established under CWA Section 404(b)(1). This evaluation of alternatives closely followed the format of the NEPA evaluation of alternatives in the TNF DEIS. After review and discussion at Workgroup Meetings #2 and #4 on August 21, 2109 and October 16, 2019, respectively, portions of the Practicability Analysis were revised to ensure the evaluation of alternatives undertaken therein conformed to the requirements of an analysis of alternatives under the CWA Section 404(b)(1) Guidelines. WestLand has developed this technical memorandum to capture the revised alternatives discussion and additional information provided by Resolution and the agencies on some of the evaluated alternatives. The information presented in this memorandum will be included in the final CWA Section 404(b)(1) Alternatives Analysis document published with the Final EIS.

5. REFERENCES

Air Sciences Inc. (ASI). 2019. Air Quality Regulatory Constraints Associated with the Hewitt Canyon and Whitford Canyon Tailings Alternatives. September 2019.

KCB Consultants Ltd. (KCB). 2020. Conceptual Filtered Tailings Impoundment Layout and Staging. Doc. #CCC.03-81600-EX-LTR-00010. January 2020.

Montgomery & Associates and WestLand Resources, Inc. (M&A and WestLand). 2017. Spring and Seep Catalog Resolution Copper Project Area Upper Queen Creek and Devils Canyon Watersheds. Tucson, Arizona. October 3, 2017.

Superstition Vistas. 2013. Superstition Vistas Information. Avaialble at: https://www.evp-az.org/wp-content/uploads/2016/04/Superstition-Vistas.pdf. Accessed on January 17, 2020.

SWCA Environmental Consultants (SWCA). 2017. Resolution Copper Project and Land Exchange Environmental Impact Statement DRAFT Alternatives Evaluation Report. edited by Tonto National Forest U.S. Forest Service. Phoenix, Arizona: U.S. Department of Agriculture. November 2017.

U.S. Forest Service (USFS). 1993. Preliminary Analysis of Eligibility and Classification for Wild/Scenic/Recreational River Designation: National Forests of Arizona. Southwestern Region. January 1993.

_____. 2019. Resolution Copper Project DRAFT Environmental Impact Statement. U.S. Department of Agriculture.

WestLand Resources, Inc. (WestLand). 2019. DRAFT Practicability Analysis in Support of Clean Water Act 404(B)(1) Anlternatives Analysis: Resolution Copper. Prepared for the Untied States Army Corps of Engineers on behalf of Resolution Copper. June 21, 2019.

FIGURES

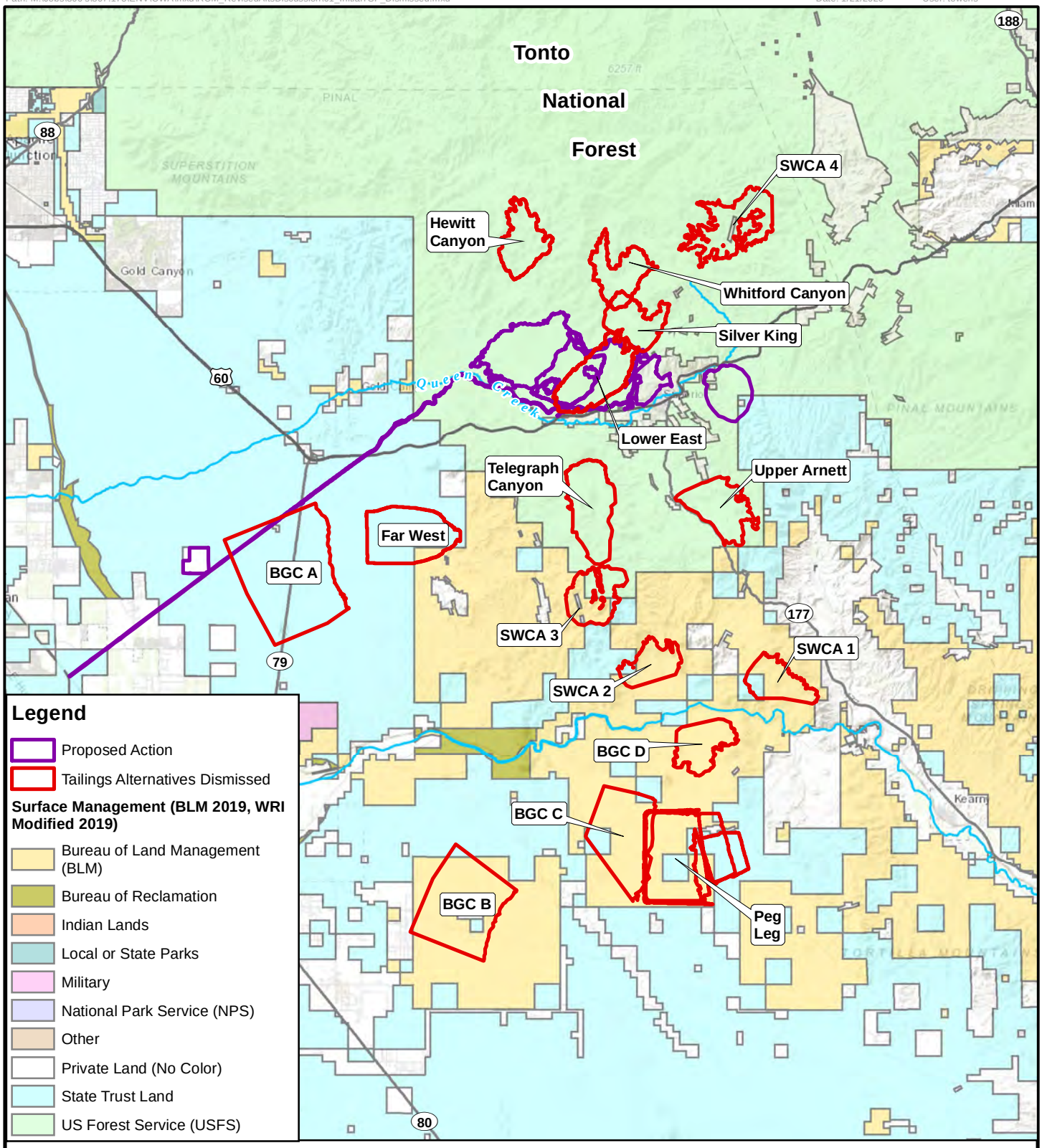


Image Source: ArcGIS Online World Topo Map

RESOLUTION COPPER

Revised Alternatives Discussion

INITIAL TAILINGS STORAGE FACILITY ALTERNATIVES
DISMISSED FROM FURTHER CONSIDERATION

Figure 1

N

0 2.5 5 Miles

0 5 10 Kilometers

WestLand Resources

Path: M:\Jobs\800's\807.175\ENV\CWA\mxd\RCM_RevisedAltsDiscussion\02_SupersitionVistaASLDlands.mxd

Date: 1/21/2020 User: towens

T2S, R9E, Portions of Sections 35, and 36,
T2S, R10E, Portions of Sections 25, 26, 28-33, 35, and 36,
T2S, R11E, Portions of Sections 29-32,
T3S, R9E, Portions of Sections 1, 2, 12, and 13,
T3S, R10E, Portions of Sections 1, 2, 4-10, and 15-21,
T3S, R11E, Portions of Sections 5, and 6,
Pinal County, Arizona
Data Source: http://www.superstition-vistas.org /resources/maps-handouts/ (Proposed SuperstitionVistas Area),
Surface Managment: BLM 2019, WRI Modified 2019
Image Source: ArcGIS Online USA Topo Map,
Mesa 1:100,000 USGS Quadrangle

Legend

- Proposed Superstition Vistas Area
- Tailings Alternatives Dismissed

Surface Management (BLM 2019, WRI Modified 2019)

- Bureau of Land Management (BLM)
- Bureau of Reclamation
- County
- Indian Lands
- Military
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

N

0 1 2 Miles

0 2 4 Kilometers

WestLand Resources

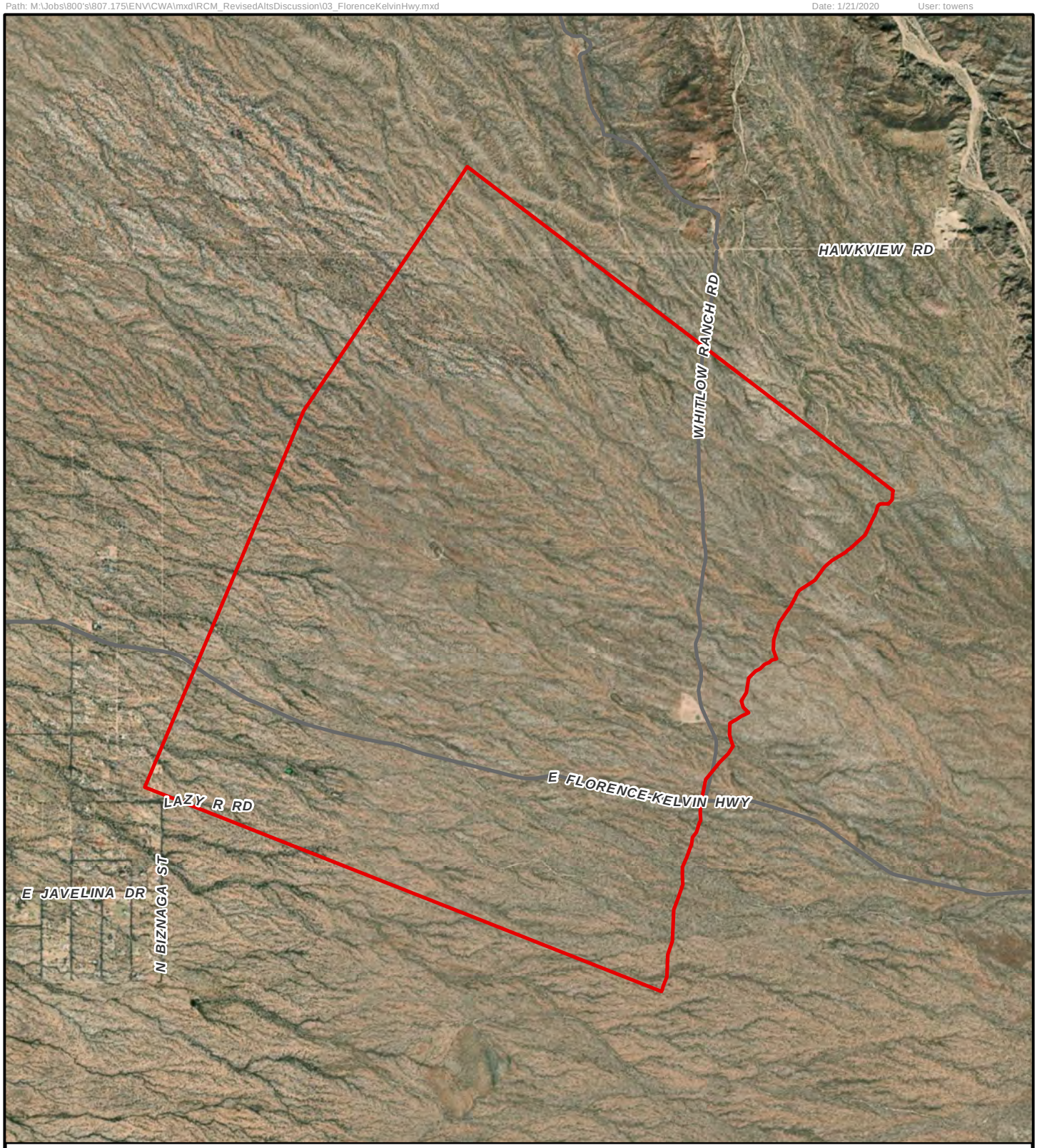
RESOLUTION COPPER

Revised Alternatives Discussion

SUPERSTITION VISTA ASLD LANDS

Figure 2

Path: M:\Jobs\800's\807.175\ENV\CWA\mxd\RCM_RevisedAltsDiscussion\03_FlorenceKelvinHwy.mxd Date: 1/21/2020 User: towens



T4S, R11E, Portions of Sections 32 and 33,
T5S, R10E, Portion of Section 13,
T5S, R11E, Portions of Sections 3-11, 15-22, 27, and 28,
Pinal County, Arizona
Image Source: DigitalGlobe 2018

Legend

BGC B

RESOLUTION COPPER

Revised Alternatives Discussion

BGC B TSF

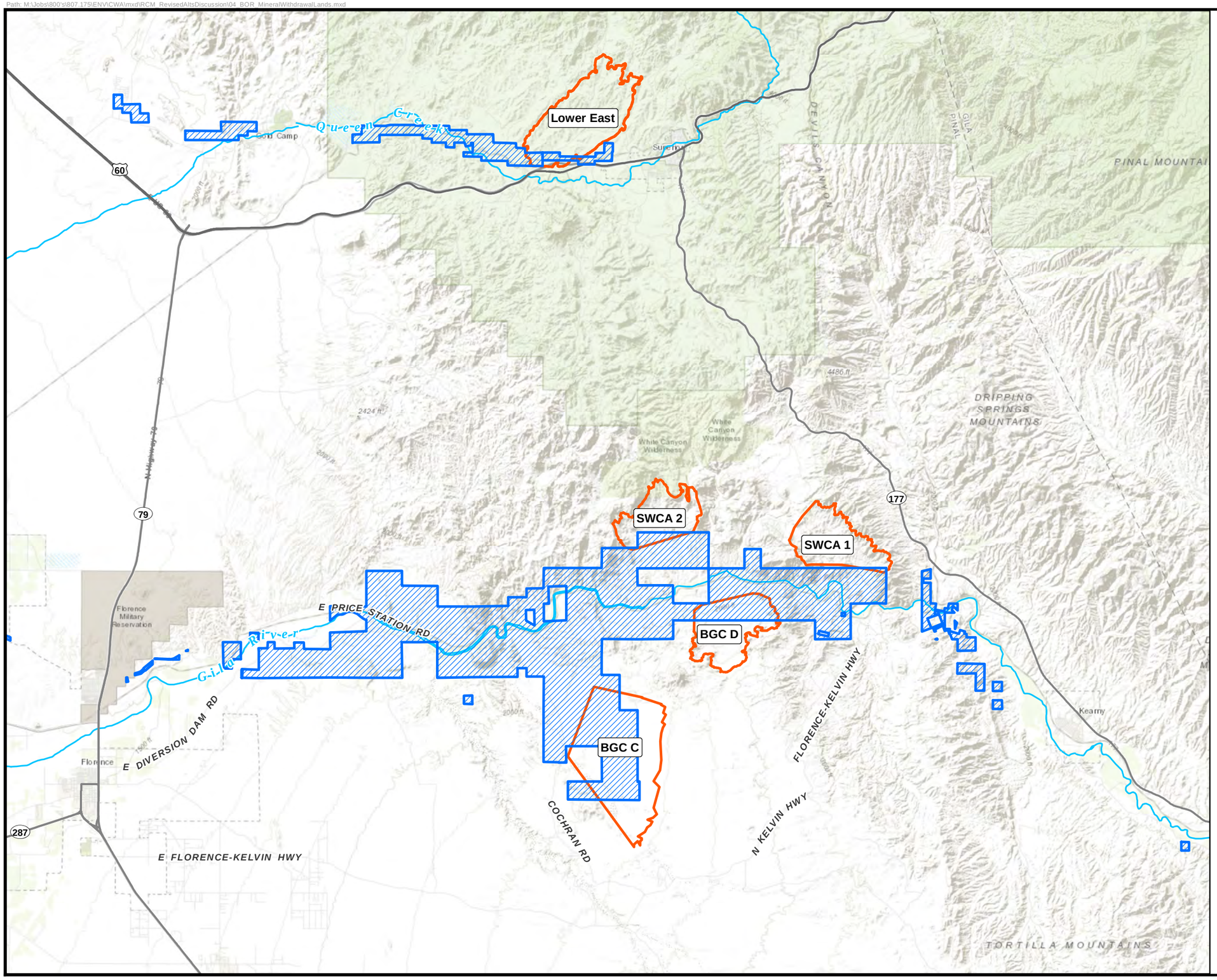
Figure 3

WestLand Resources

N

0 2,000 4,000 Feet

0 1,000 2,000 Meters



Portion of T1S R12E, T2S R11 and 12E, T3S R12 and13E, T4S R11-13E, and T5S R11 and 12E,
Pinal County, Arizona
Image Source: ArcGIS Online World Topo Map

Legend

- Tailings Alternatives Dismissed
- Withdrawn Lands

N

0 1 2 Miles

0 2 4 Kilometers

WestLand Resources

RESOLUTION COPPER

Revised Alternatives Discussion

BOR MINERAL WITHDRAWAL LANDS

Figure 4

Portion of T1N R11-13E and T1S R11-13E,
Pinal County, Arizona
Image Source: ArcGIS Online World Topo Map

Legend

- Superstition Wilderness
- Tailings Alternatives Dismissed

N

0 0.5 1 Miles

0 1 2 Kilometers

WestLand Resources

RESOLUTION COPPER

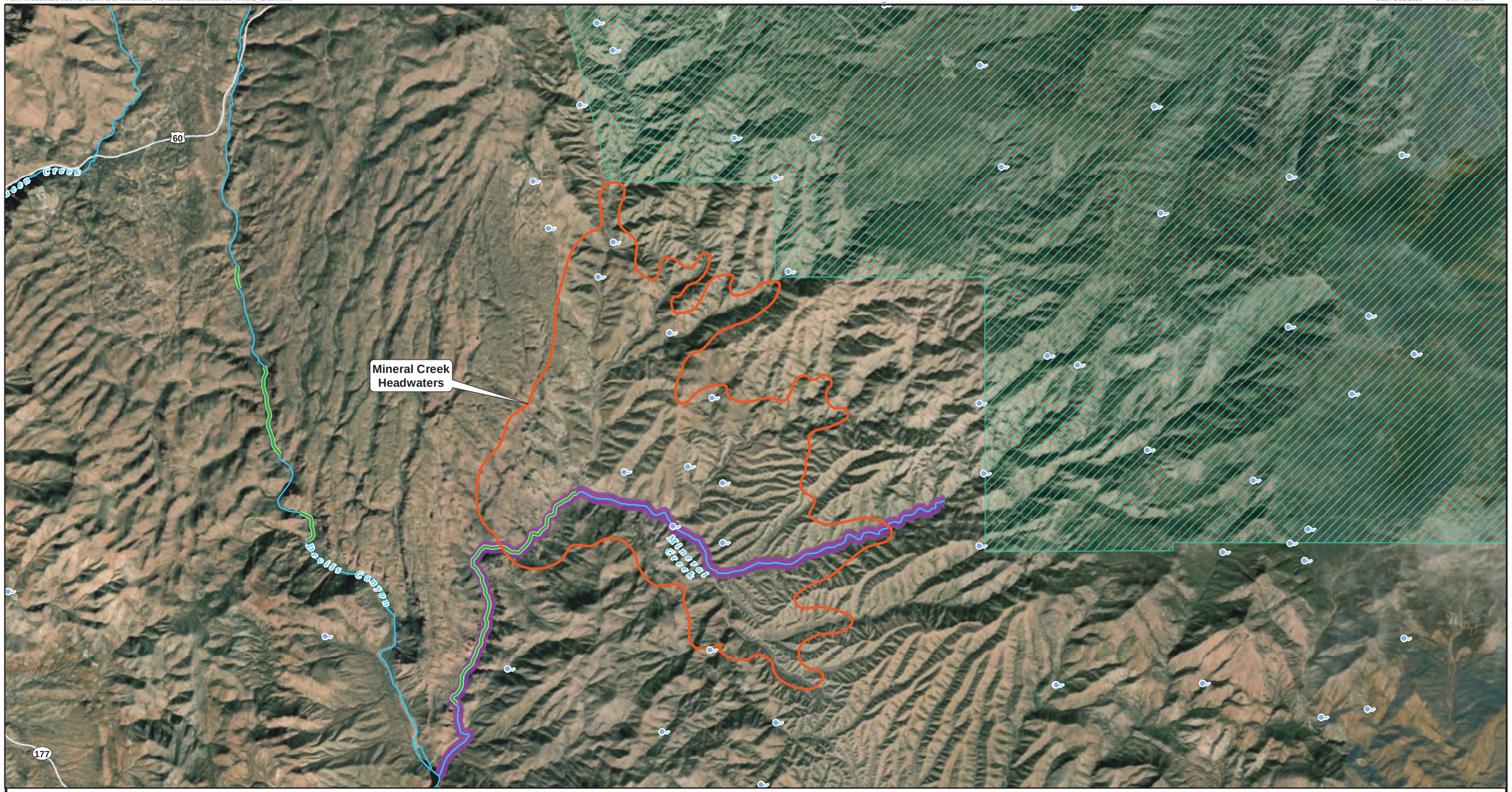
Revised Alternatives Discussion

SUPERSTITION WILDERNESS LANDS

Figure 5

Path: M:\Jobs\800's\807.175\ENV\CWA\mxd\RCM_RevisedAltsDiscussion\06_Mineral_Creek.mxd

Date: 1/21/2020 User: towens



T1S, R14E, Portions of Sections 31-33,
T2S, R13E, Portions of Sections 1, 11-14, 23, and 24,
T2S, R14E, Portions of Sections 5-9, 16-21, and 28-30,
Gila and Pinal County, Arizona
Image Source: DigitalGlobe, 2-6-2018

WestLand Resources

N

0 0.5 1 Miles

0 1 2 Kilometers

Legend

- Spring (ALRIS)
- Continuous Saturated Reach (Montgomery and Associates 3-16-2018)
- Streams (ALRIS)
- Mineral Creek Headwaters

USFWS Critical Habitat

- Gila chub, Designated Critical Habitat, 11-02-2005
- Mexican spotted owl, Designated Critical Habitat, 08-31-2004

RESOLUTION COPPER

Revised Alternatives Discussion

MINERAL CREEK TSF

Figure 6

ATTACHMENT
I
May 23, 1925
First Form
Withdrawal

FIRST FORM WITHDRAWAL

ADDRESS ALL COMMUNICATIONS TO COMMISSIONER

DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

WASHINGTON

OFFICE OF THE COMMISSIONER

May 23, 1935

The Secretary

of the Interior.

Sir:

It is recommended that the following described lands, excepting any tract the title to which has passed out of the United States, be withdrawn from public entry, under the first form of withdrawal, as provided in Sec. 3, Act of June 17, 1902 (32 Stat.,388).

Salt River Project, Arizona.

Gila and Salt River Base and Meridian

T. 1 N. R. 8 E., (unsurveyed), all Secs. 25 and 26; N½ and SE¼ Sec. 35; NW¼ and S½ Sec. 36.

T. 1 S. R. 10 E., SW¼SW¼ Sec. 30; N½NW¼, W½NE¼ and SE¼NE¼ Sec. 31; S½SW¼ and S½SE¼ Sec. 33; S½ Sec. 34; N½N½ Sec. 35.

T. 1 S. R. 11 E., (unsurveyed) S½SE¼ and NE¼SE¼ Sec. 32; S½ Sec. 33; S½ Sec. 34; S½ Sec. 35; SW¼ Sec. 36.

T. 2 S. R. 11 E., (unsurveyed) all Sec. 1; E½ Sec. 2; E½ Sec. 3.

T. 1 S. R. 12 E., (unsurveyed) S½ and NE¼ Sec. 34; E½ and SW¼ Sec. 35.

T. 2 S. R. 12 E., E½NW¼ Sec. 4; S½NE¼, SW¼ and NE¼NE¼ Sec. 5; S½NE¼ Sec. 8.

As portions of the above described lands are unsurveyed it is requested that notation be made on the records so as to

First Form Withdrawal- Salt River Project- Cont.

withdraw the lands after survey is made as well as prior thereto.

Respectfully,

Commissioner.

DEPARTMENT OF THE INTERIOR

MAY 23 1925

The lands described are hereby reserved as recommended and the Commissioner of the General Land Office will cause the records of his office and of the local land office to be noted accordingly.

(Sgd) E. C. FINNEY.

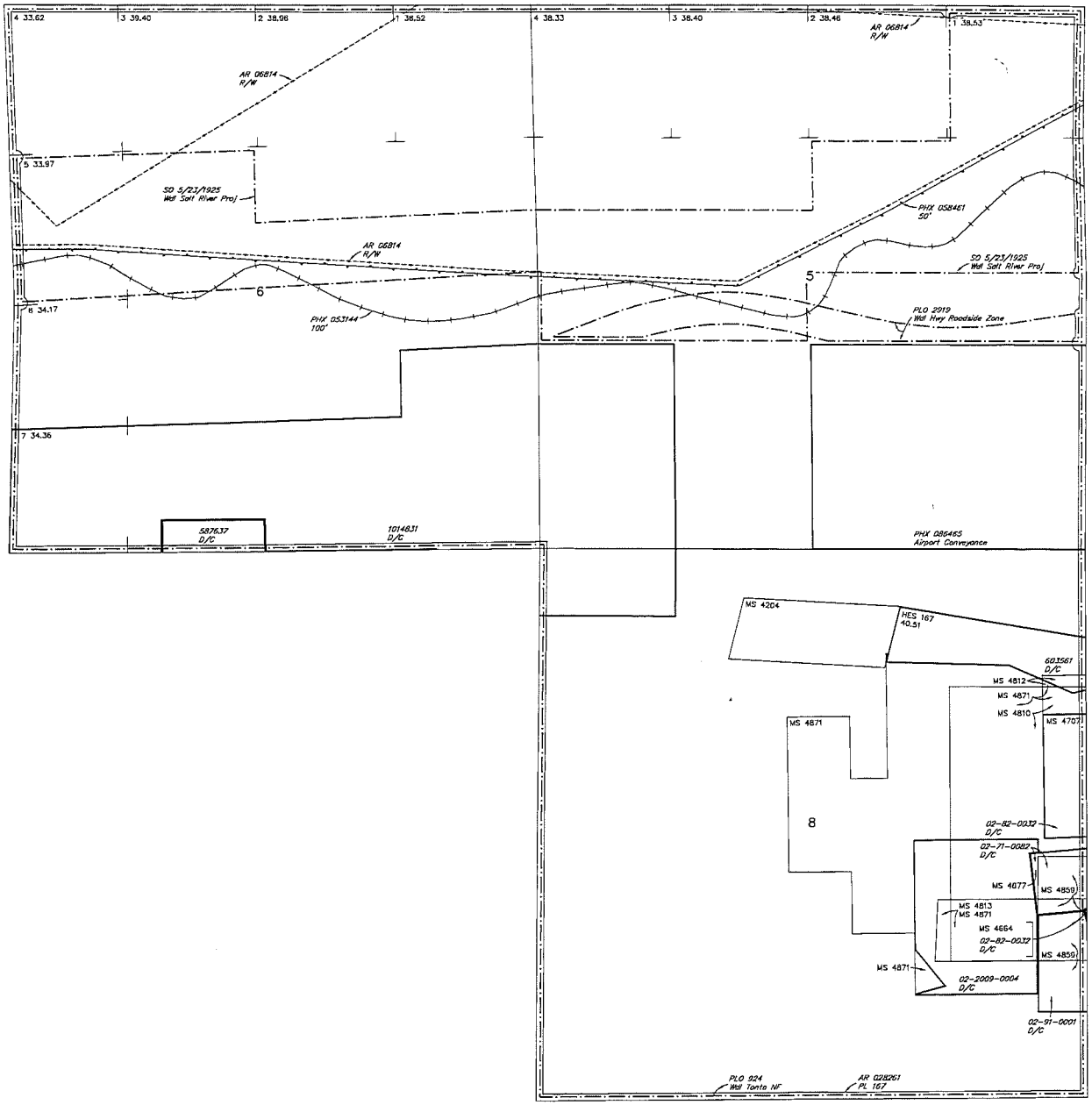
First Assistant Secretary.

Copy to U.S.C.S.

" " G.L.O.

TOWNSHIP 2 SOUTH RANGE 12 EAST OF THE GILA AND SALT RIVER MERIDIAN, ARIZONA

PINAL COUNTY
LOWER SONORAN FIELD OFFICE



SCALE in chains
5 0 5 10 20

WARNING STATEMENT
This plat is the Bureau's Record of Title, and should be used only as a graphic display of the township survey data. Records hereon do not reflect title changes which may have been effected by lateral movements of rivers or other bodies of water. Refer to the cadastral surveys for official survey information.

STATUS OF PUBLIC DOMAIN LAND AND MINERAL TITLES

MTP SUPPL SECS 5,6,8

INDEX TO SEGREGATED TRACTS				
RESURVEY	ORIGINAL SURVEY			
TRACT NO	T	R	SEC	SUBDIVISION

FOR ORDERS AFFECTING DISPOSAL OR USE OF UNIDENTIFIED LANDS WITHDRAWN FOR CLASSIFICATION, MINERALS, WATER AND/OR OTHER PUBLIC PURPOSES, REFER TO INDEX OF MISCELLANEOUS DOCUMENTS.

MDS 610 NW

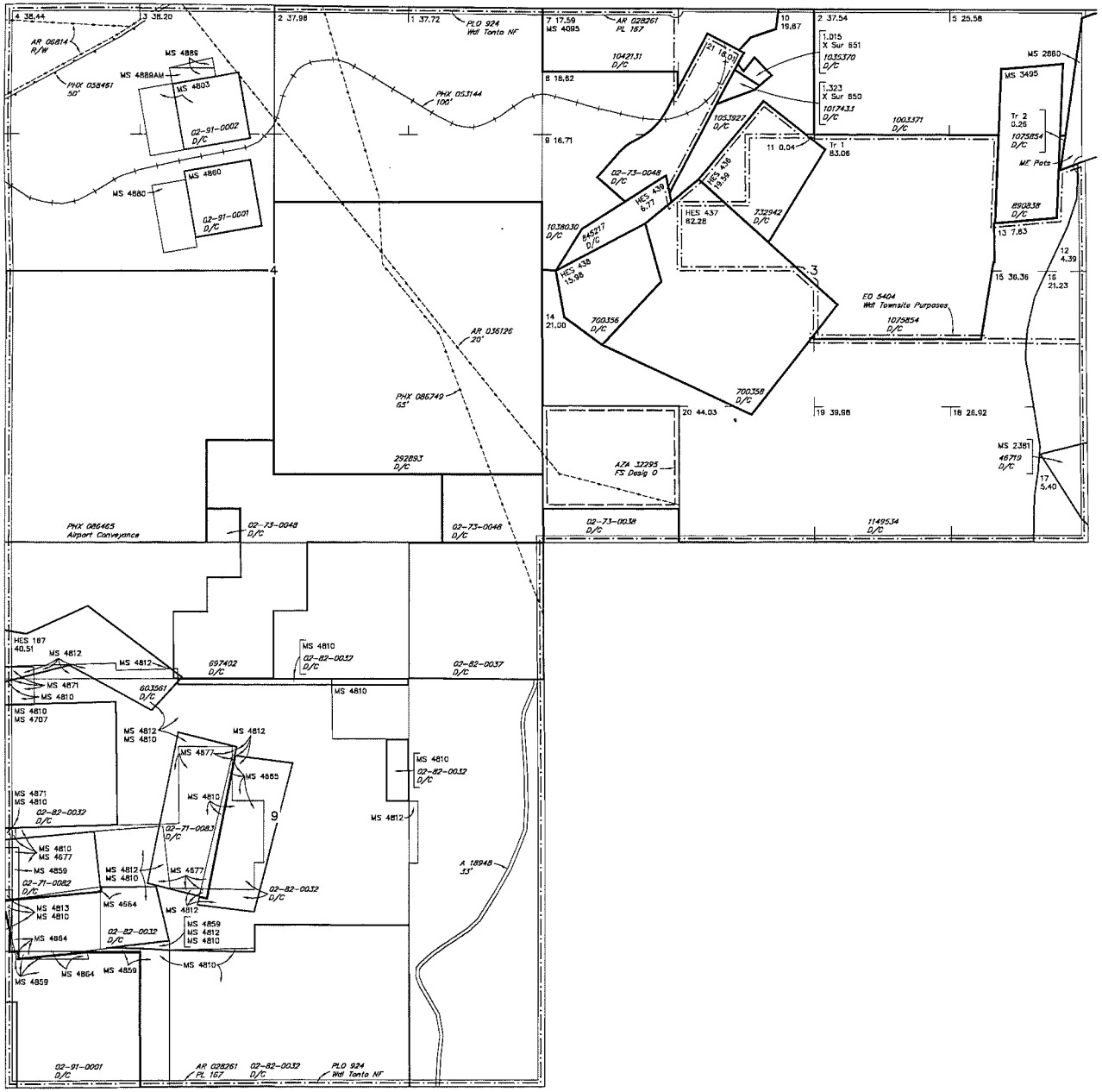
NO 2

CURRENT TO	NW
2-11-2016	ACAD

GSR Mer
T 2 S
R 12 E

TOWNSHIP 2 SOUTH RANGE 12 EAST OF THE GILA AND SALT RIVER MERIDIAN, ARIZONA

PINAL COUNTY
LOWER SONORAN FIELD OFFICE



SCALE in chains
5 0 5 10 20

WARNING STATEMENT
This plat is the Bureau's Record of Title, and should be used only as a graphic display of the township survey data. Records hereon do not reflect title changes which may have been effected by lateral movements of rivers or other bodies of water. Refer to the cadastral surveys for official survey information.

STATUS OF PUBLIC DOMAIN
LAND AND MINERAL TITLES

MTP
SUPPL SECS 3,4,9

INDEX TO SEGREGATED TRACTS				
RESURVEY	ORIGINAL SURVEY			
TRACT NO	T	R	SEC	SUBDIVISION

FOR ORDERS AFFECTING DISPOSAL OR USE OF UNIDENTIFIED LANDS WITHDRAWN FOR CLASSIFICATION, MINERALS, WATER AND/OR OTHER PUBLIC PURPOSES, REFER TO INDEX OF MISCELLANEOUS DOCUMENTS.

MDS 609 NE
610 NW

NO 1

CURRENT TO	NW
2-11-2016	ACAD

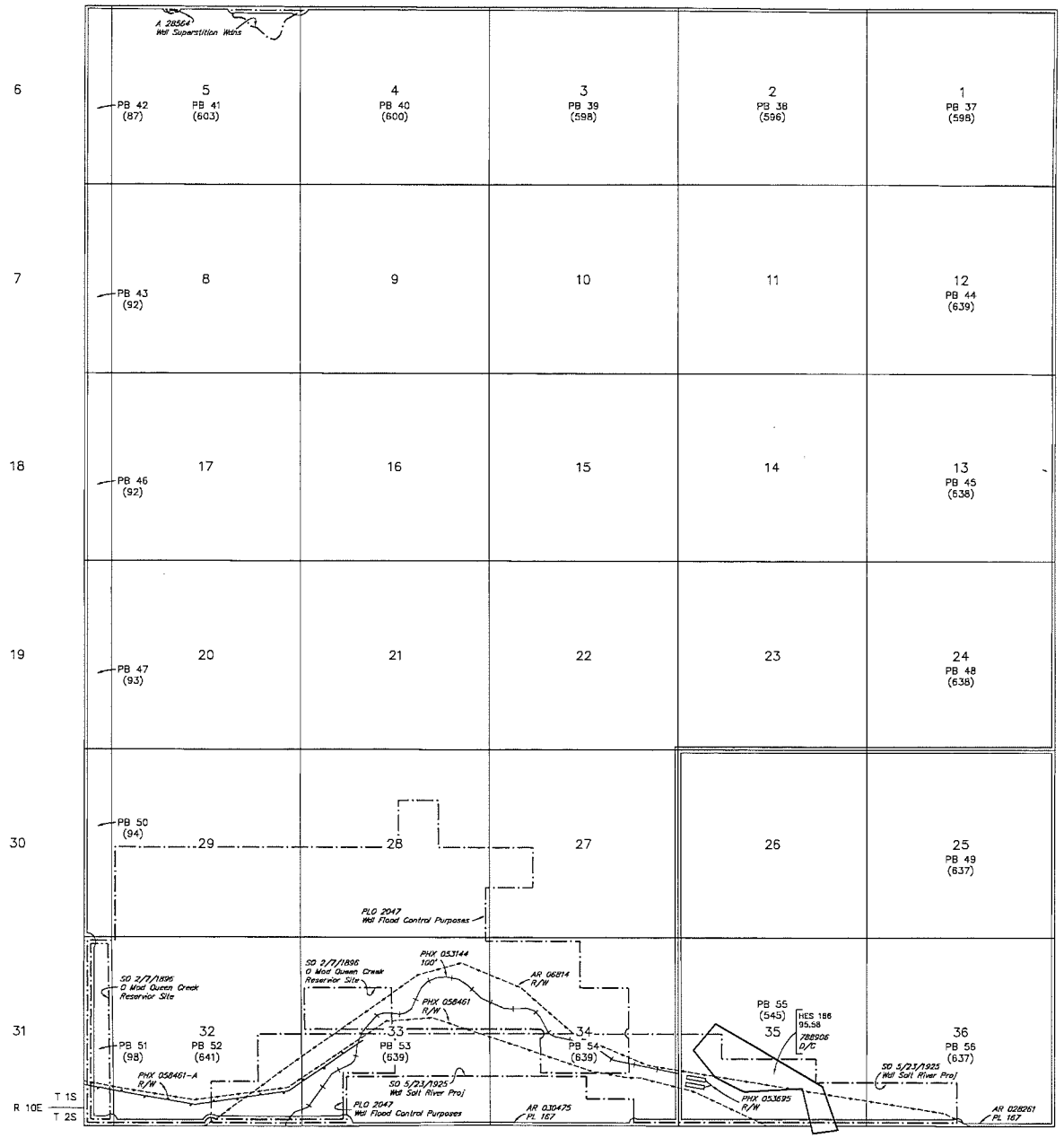
GSR Mer
T 2 S
R 12 E

UNSURVEYED TOWNSHIP 1 SOUTH RANGE 11 EAST OF THE GILA AND SALT RIVER MERIDIAN, ARIZONA

AMENDED PROTRACTION DIAGRAM OFFICIALLY FILED 06/18/2003

PINAL COUNTY

LOWER SONORAN FIELD OFFICE



Lat 32°17'23"N

Long 111°10'47"W

SCALE in chains

10 5 0 10 20 30 60

WARNING STATEMENT

This plat is the Bureau's Record of Title, and should be used only as a graphic display of the township survey data. Records hereon do not reflect title changes which may have been effected by lateral movements of rivers or other bodies of water. Refer to the cadastral surveys for official survey information.

STATUS OF PUBLIC DOMAIN LAND AND MINERAL TITLES

INDEX TO SEGREGATED TRACTS				
RESURVEY	ORIGINAL SURVEY			
TRACT NO	T	R	SEC	SUBDIVISION

FOR ORDERS AFFECTING DISPOSAL OR USE OF UNIDENTIFIED LANDS WITHDRAWN FOR CLASSIFICATION, MINERALS, WATER AND/OR OTHER PUBLIC PURPOSES, REFER TO INDEX OF MISCELLANEOUS DOCUMENTS.

All Tp included in Wdl Tonto NF PL 924 10/23/1953

Every smallest legal subdivision adjacent to Queen Creek which when surveyed will be within approximately Secs: 20, 21, 27, 28, 29, 30, 31, 32, 33, 34, & 35 included in Wdl Pwr Site CL 438 O 11/16/1956

CURRENT TO	NW
7-30-2014	ACAD

GSR Mer

T 1 S

R 11 E

ATTACHMENT 2
April 24, 1931 Executive Order No. 5611

Executive Order

Withdrawal of Public Lands for Use in Connection with San Carlos Indian Irrigation Project, Arizona

Under authority of the act of Congress approved June 25, 1910 (36 Stat. 847), as amended by the act of August 24, 1912 (37 Stat. 497), it is hereby ordered that the following described tracts of public lands in Arizona be, and they are hereby, withdrawn from settlement, location, sale, or entry, except as provided in said acts, for use in connection with the San Carlos Indian Irrigation Project, subject to any valid rights or claims initiated prior to March 24, 1931:

GILA AND SALT RIVER MERIDIAN

T. 4 S., R. 11 E., sec. 1, S. ½ SW. ¼ and SE. ¼;
sec. 2, S. ½ SE. ¼;
sec. 11, lots 1, 2, 3, 8, and 9 and NE. ¼ NE. ¼;
sec. 12, all;
sec. 13, N. ½ and N. ½ S. ½;
sec. 14, NE. ¼ and N. ½ SE. ¼;
T. 4 S., R. 12 E., sec. 1, all;
sec. 2, all;
sec. 3, S. ½;
sec. 4, S. ½;
sec. 5, all;
sec. 6, all;
sec. 7, all;
sec. 8, N. ½;
sec. 9, N. ½;
sec. 10, N. ½;
T. 4 S., R. 13 E., sec. 5, all;
sec. 6, all;
T. 5 S., R. 15 E., sec. 12, SE. ¼;
sec. 13, E. ½;
sec. 24, NE. ¼;
T. 4 S., R. 16 E., sec. 28, all (N. ½ unsurveyed);
T. 5 S., R. 16 E., sec. 7, all (partly unsurveyed).

This order shall continue in full force and effect unless and until revoked by the President or by act of Congress.

HERBERT HOOVER

THE WHITE HOUSE,
April 24, 1931.

[No. 5611]

U. S. GOVERNMENT PRINTING OFFICE, 1931

prices of another marketing agency without prior notice or hearing.[5]

On March 25, 1943, the agency filed a response to the motion of Consumers' Counsel in which it averred that the summary action requested by Consumers' Counsel was not authorized by the Rules of Practice and Procedure before the Division. Due notice and hearing, it is claimed, are indispensable prerequisites to any action by the Division, whether the motion be regarded as seeking to reopen for introduction of additional evidence or as alleging new matter in this continuing docket. The agency further maintains that the suspension of the agency's current price list would result merely in suspending a function of the agency and in confusing its members, and would not prevent any inflationary market prices.

Immediately prior to the establishment of Division minima, this agency's prices were, in different sizes, from 10 cents to 20 cents per ton lower than such minima, although considerably higher than the prices established by the agency when it began to function in January 1939. From October 1, 1940, to June 1941, agency prices were substantially the same as Division minima. Thereafter, a 20 cents per ton increase was put into effect. The agency price list current at the time of the hearing contained prices from 5 cents to 40 cents per ton above Division minima in different sizes and for shipment to different marketing areas. According to the allegations of the motion of Consumers' Counsel, the prices set forth in Price List No. 28 are substantially the same as OPA maxima, which are 15 cents to 80 cents (in one size group) per ton above the Division minima for most agency members for shipment to their home market area.[6] The record does not disclose the history of this agency's prices between the time of the hearing in September and October 1941 and the date of issuance of Price List No. 28, which was the very date on which OPA maximum price increases, governing the coals of agency members, became effective.[6]

The present motion assumes that under the provisions of section 12 of the Act, the Division may summarily suspend without hearing marketing agency price lists even when, as in this case, no specific reservation of this power has been made under the terms of the order granting provisional approval to the agency. The motion further assumes that such summary action is appropriate when it is shown only that the price list of the agency corresponds substantially to the applicable maximum prices established by OPA. The appropriateness of the suspension procedure has been vigorously mooted in this and other proceedings involving marketing agencies. Conflicting conclusions have been reached by the Examiners who have considered the problem. I do not believe it advisable to attempt to resolve this complex legal question in passing upon the present motion for interlocutory relief. It is not necessary to make any final resolution of the issue since I believe that no sufficient showing has been made to justify the suspension of the agency price list.

It may be, as Consumers' Counsel suggests, that there "is a substantial economic difference between prices when they are established as maximum or ceiling prices and the same prices when established as minimum or floor prices." But the difficulty of the present problem, however, is to translate what is alleged as a "substantial economic difference" into a workable basis for determining the fairness and reasonableness of the agency prices. The motion gives no help in this regard; indeed, Consumers' Counsel expressly indicates that the relief which is sought is "addressed specifically to those prices . . . which are the same as the maximum prices promulgated by the Office of Price Administration for the coals" and states that "no opinion is expressed regarding other prices contained in the Agency's Price List." Consumers' Counsel does not suggest any logical reason why prices which may be a few cents under the OPA maxima should properly be left unchanged while those identical with the OPA maxima should be suspended. Nor does the motion suggest prices which would more nearly effectuate what are contended to be the standards of Section 12.

On the basis of the general and inadequate allegations of the motion, I do not feel justified in holding that the agency's prices, which do not exceed the legal maxima established by OPA, are necessarily inimical to the public interest or prevent the public "from receiving coal at fair and reasonable prices." While it may be that the effect of concerted price-fixing action of the members of the agency has been to stabilize coal prices at or near applicable OPA maxima in the area, it does not appear that such action on the part of the agency members represented more than a response to general market conditions. There is certainly no basis in the record before me to justify an inference that the establishment of the price list in question was a substantial cause of inflationary coal prices or that the relief requested would substantially discourage sales at the present high market levels.

The problem or reconciling the interests of marketing agencies and the public calls for the highest degree of administrative statesmanship. Numerous proceedings involving marketing agencies in various parts of the country have been pending before the Division for some time. After full and extensive hearings, it has become evident that the regulatory problems involved are extremely complex, the factors to be considered, in many instances, extremely subtle, and confident conclusions difficult to obtain. Widely varying conceptions of the aims and objectives of section 12 have been suggested. The necessity for rigorous general regulations as well as supervision of particular activities of marketing agencies has been vigorously asserted and denied. Differences in the organization of various agencies have been disclosed which may or may not affect the type of regulation necessary or appropriate. After hearing oral arguments in a number of these cases and after careful preliminary study, it is clear to me that issues of this character may not properly be resolved on a preliminary motion of the type here presented. Without deciding whether it may be appropriate for the Division, pursuant to the authority granted in section 12 of the Act, to impose maximum price restrictions on the sale of coal through marketing agencies, I believe that under present marketing conditions and in view of the present maximum price restrictions promulgated by the Office of Price Administration, it cannot be assumed that the public interest is being seriously or substantially prejudiced so as to justify drastic temporary measures of the type sought in the present motion. Before such relief would be appropriate, a more substantial showing is required.

Accordingly, the motion of the Bituminous Coal Consumers' Counsel filed March 12, 1943 should be denied.

It is so ordered.

Dated: June 21, 1943.

[SEAL] DAN H. WHEELER,
Director.

[F. R. Doc. 43-10075; Filed, June 23, 1943; 10:41 a. m.]

---

[5] *Matter of Application of Belleville Fuels, Inc.*, Docket No. 821-FD.

[6] The average is a fraction over 44 cents per ton higher for all size groups covered.

[6] The price list filed by the agency with the Division indicates that, as of November 1942, the agency's prices generally were the same as the applicable maximum prices established by the Office of Price Administration, save that in Size Groups 16 to 25 the agency's prices were ten to twenty cents lower than the effective maxima.

General Land Office.

[Public Land Order 141]

ARIZONA

WITHDRAWAL OF PUBLIC LANDS FOR USE IN CONNECTION WITH SAN CARLOS INDIAN IRRIGATION PROJECT

By virtue of the authority vested in the President and pursuant to Executive Order No. 9337 of April 24, 1943: *It is ordered*, As follows:

Subject to valid existing rights, the following-described public lands are hereby withdrawn from all forms of appropriation under the public-land laws, including the mining and mineral-leasing laws, and reserved under the jurisdiction of the Secretary of the Interior for use in connection with the San Carlos Indian Irrigation Project:

GILA AND SALT RIVER MERIDIAN

T. 4 S., R. 11 E.,
Sec. 13, SW¼SW¼;
Sec. 14, S½SE¼.
T. 3 S., R. 12 E.,
Sec. 35, S½N½, S½.
T. 4 S., R. 12 E.,
Sec. 4, S½N½;
Sec. 18, lot 1.

T. 4 S., R. 13 E.,
Sec. 1, SW¼SW¼;
Sec. 3, S½S½;
Sec. 4, lots 1, 2, 3, 4, S½N½, NE¼SW¼, NE¼SE¼, S½S½;
Sec. 9, lots 1, 2, N½NE¼, NW¼;
Sec. 12, lot 2, NW¼NW¼.
The areas described aggregate 1,918.57 acres.

The Commissioner of the General Land Office shall continue to administer the lands for grazing purposes under section 15 of the Taylor Grazing Act (48 Stat. 1269).

This order shall take precedence over, but shall not rescind or revoke, the withdrawal for classification and other purposes made by Executive Order No. 6910 of November 26, 1934, as amended, so far as such order affects the above-described lands.

ABE FORTAS,
Acting Secretary of the Interior.

JUNE 16, 1943.

[F. R. Doc. 43-10029; Filed June 23, 1943; 9:24 a. m.]

NEW MEXICO

[Public Land Order 142]

WITHDRAWING PUBLIC LAND FOR USE IN CONNECTION WITH PROSECUTION OF WAR

Executive Order No. 6583 of February 3, 1934, revoked in part.

By virtue of the authority vested in the President and pursuant to Executive Order No. 9337 of April 24, 1943: *It is ordered*, As follows:

Subject to valid existing rights, the following-described public land is hereby withdrawn from all forms of appropriation under the public-land laws, including the mining and mineral-leasing laws, and reserved under the jurisdiction of the Department of the Interior for use in connection with the prosecution of the war:

NEW MEXICO PRINCIPAL MERIDIAN

T. 18 S., R. 13 W., sec. 12. NE¼NE¼.
The area described contains 40 acres.

Executive Order No. 6583 of February 3, 1934, withdrawing public lands for the purpose of aiding the State of New Mexico in making exchange selections under the act of June 15, 1926, c. 590, 44 Stat. 746, is hereby revoked so far as it affects the above-described land.

ABE FORTAS,
Acting Secretary of the Interior.

JUNE 16, 1943.

[F. R. Doc. 43-10030; Filed June 23, 1943; 9:24 a. m.]

DEPARTMENT OF AGRICULTURE.

Farm Security Administration.

ARKANSAS

DESIGNATION OF COUNTIES FOR LOANS

In accordance with the rules and regulations promulgated by the Secretary of Agriculture on July 1, 1941, as extended by Supplement 2 of Secretary's Memorandum No. 867 issued as of July 1, 1942, loans made in the county mentioned herein, under Title I of the Bankhead-Jones Farm Tenant Act, may be made within the localities herein described and designated. The value of the average farm unit of thirty acres and more in each of these localities has been determined in accordance with the provisions of the said rules and regulations. A description of the localities and the determination of value for each follow:

REGION VI

ARKANSAS

Prairie County

Locality I—Consisting of the townships of Belcher, Roc Roe, and Tyler	$9,110
Locality II—Consisting of the townships of Calhoun, Upper Surrounded Hill, and Lower Surrounded Hill	3,445
Locality III—Consisting of the townships of Bullard, Center, Des Arc, Hazen, Hickory Plain, Union, Watensaw, and White River	2,485

The purchase price limit previously established for the county above-mentioned is hereby cancelled.

Approved: June 22, 1943.

[SEAL] C. B. BALDWIN,
Administrator.

[F. R. Doc. 43-10081; Filed, June 23, 1943; 11:20 a. m.]

DEPARTMENT OF LABOR.

Wage and Hour Division.

LEARNER EMPLOYMENT CERTIFICATES

ISSUANCE TO VARIOUS INDUSTRIES

Notice of issuance of special certificates for the employment of learners under the Fair Labor Standards Act of 1938.

Notice is hereby given that special certificates authorizing the employment of learners at hourly wage rates lower than the minimum wage rate applicable under section 6 of the Act are issued under section 14 thereof, Part 522 of the regulations issued thereunder (August 16, 1940, 5 F.R. 2862, and as amended June 25, 1942, 7 F.R. 4725), and the determination and order or regulation listed below and published in the FEDERAL REGISTER as here stated.

Apparel Learner Regulations, September 7, 1940 (5 F.R. 3591), as amended by Administrative Order March 13, 1943 (8 F.R. 3079).

Single Pants, Shirts and Allied Garments, Women's Apparel, Sportswear, Rainwear, Robes and Leather and Sheep-Lined Garments, Divisions of the Apparel Industry, Learner Regulations, July 20, 1942 (7 F.R. 4724), as amended by Administrative Order March 13, 1943 (8 F.R. 3079).

Artificial Flowers and Feathers Learner Regulations, October 24, 1940 (5 F.R. 4203).

Glove Findings and Determination of February 20, 1940, as amended by Administrative Order September 20, 1940 (5 F.R. 3748) and as further amended by Administrative Order, March 13, 1943 (8 F.R. 3079).

Hosiery Learner Regulations, September 4, 1940 (5 F.R. 3530), as amended by Administrative Order March 13, 1943 (8 F.R. 3079).

Independent Telephone Learner Regulations, September 27, 1940 (5 F.R. 3829).

Knitted Wear Learner Regulations, October 10, 1940 (5 F.R. 3982), as amended by Administrative Order, March 13, 1943 (8 F.R. 3079).

Millinery Learner Regulations, Custom Made and Popular Priced, August 29, 1940 (5 F.R. 3392, 3393).

Textile Learner Regulations, May 16, 1941 (6 F.R. 2446) as amended by Administrative Order March 13, 1943 (8 F.R. 3079).

Woolen Learner Regulations, October 30, 1940 (5 F.R. 4302).

Notice of amended order for the employment of learners in the Cigar Manufacturing Industry, July 20, 1941 (6 F.R. 3753).

The employment of learners under these certificates is limited to the terms and conditions therein contained and to the provisions of the applicable determination and order or regulations cited above. The applicable determination and order or regulations, and the effective and expiration dates of the certificates issued to each employer is listed below. The certificates may be cancelled in the manner provided in the regulations and as indicated in the certificates. Any person aggrieved by the issuance of any of these certificates may seek a review or reconsideration thereof.

NAME AND ADDRESS OF FIRM, INDUSTRY, PRODUCT, NUMBER OF LEARNERS AND EFFECTIVE DATES

Single pants, shirts, and allied garments, women's apparel, sportswear, rainwear, robes, and leather and sheep-lined garments divisions of the apparel industry

Hamilton Carhartt Overall Company, Irvine, Kentucky; Work clothing; 5 learners (A. T.); effective June 21, 1943, expiring February 21, 1944.

Elder Manufacturing Company, 7025 Pennsylvania Avenue, St. Louis, Missouri; Men's dress shirts; Army shirts; 10 percent (T); effective June 21, 1943, expiring June 21, 1944.

Hollywood Maxwell Company, Main Street, Arkadelphia, Arkansas; Brassieres; 10 learners (T); effective June 21, 1943, expiring June 21, 1944. (This certificate replaces the certificate effective August 10, 1942 and expiring August 10, 1943.)

Jabour Manufacturing Company, 8463½ S. Vermont, Los Angeles, California; Children's cotton garments; 6 learners (T); effective June 21, 1943, expiring June 21, 1944.

W. Kotkes & Son, Lynchburg, Virginia; Cotton and Rayon uniforms; 10 percent (T); effective June 21, 1943, expiring June 21, 1944.

Super Togs Company, Cherry Street, Slatington, Pennsylvania; Ladies' sportswear; 20 learners (A. T.); effective June 23, 1943, expiring December 23, 1943.

Willards Shirt Company, Willards, Maryland; Cotton work shirts; 10 percent (T); effective June 22, 1943, expiring September 22, 1943.

Glove Industry

Berlin Glove Company, 615 Fox Alley, Berlin, Wisconsin; Leather dress gloves; 10 percent (A. T.); effective June 21, 1943, expiring December 21, 1943.

Hosiery Industry

Charles H. Bacon Company, Loudon, Tennessee; Seamless hosiery; 5 percent (A. T.); effective June 21, 1943, expiring October 26, 1943.

Drexel Knitting Mills Company, Inc., Drexel, North Carolina; Seamless ho-

Post Office Box 1449, Santa Fe, N. Mex., 87501.

HARRY R. ANDERSON,
Assistant Secretary of the Interior.

SEPTEMBER 27, 1965.

[F.R. Doc. 65-10479; Filed, Oct. 1, 1965; 8:45 a.m.]

[Public Land Order 3833]

[Nevada 051736]

NEVADA

Partial Revocation of Executive Order No. 7558

By virtue of the authority vested in the President by section 1 of the Act of June 25, 1910 (36 Stat. 847; 43 U.S.C. 141), and pursuant to Executive Order No. 10355 of May 26, 1952 (17 F.R. 4831), it is ordered as follows:

1. Executive Order No. 7558 of February 23, 1937, so far as it withdrew the following-described lands for use of the Soil Conservation Service for erosion control demonstrations, is hereby revoked:

MOUNT DIABLO MERIDIAN

CRYSTAL SPRINGS AREA

T. 4 S., R. 59 E.,
Sec. 35, E½;
Sec. 36, All.
T. 5 S., R. 59 E.,
Sec. 1, All;
Secs. 2 and 11, E½;
Secs. 12 and 13, All;
Sec. 14, E½;
Sec. 23, NE¼;
Sec. 24, NW¼.
T. 4 S., R. 60 E.,
Secs. 31 and 32, All;
Sec. 33, W½.
T. 5 S., R. 60 E.,
Sec. 4, W½;
Secs. 5, 6, 7, 8, All;
Sec. 9, W½;
Sec. 17, NW¼;
Sec. 18, N½, SW¼.

PANACA AREA

T. 1 S., R. 68 E.,
Sec. 36, All.
T. 2 S., R. 68 E.,
Secs. 1 and 12, All.
T. 1 S., R. 69 E.,
Sec. 31, All;
Sec. 32, S½.
T. 2 S., R. 69 E.,
Secs. 2 and 3, S½;
Secs. 4 through 12, inclusive.

Aggregating approximately 18,379.25 acres.

2. At 10 a.m. on November 2, 1965, the lands shall become subject to application, petition, location and selection generally, subject to valid existing rights, the provisions of existing withdrawals, and the requirements of applicable law. All valid applications received at or prior to 10 a.m. on November 2, 1965, shall be considered as simultaneously filed at that time. Those filed thereafter shall be considered in the order of filing.

3. The lands have been open to applications and offers under the mineral leasing laws and to location for metalliferous minerals. They will be open to location under the U.S. mining laws for non-metalliferous minerals after 10 a.m. on November 2, 1965.

Inquiries concerning the lands should be addressed to the Manager, Land Office, Bureau of Land Management, Reno, Nev.

HARRY R. ANDERSON,
Assistant Secretary of the Interior.

SEPTEMBER 27, 1965.

[F.R. Doc. 65-10480; Filed, Oct. 1, 1965; 8:45 a.m.]

[Public Land Order 3834]

[BLM 060857]

MICHIGAN

Adding Lands to Manistee and Hiawatha National Forests

By virtue of the authority vested in the President by section 24 of the Act of March 3, 1891 (26 Stat. 1103; 16 U.S.C. 471), and section 1 of the Act of June 4, 1897 (30 Stat. 34, 36; 16 U.S.C. 473), and pursuant to Executive Order No. 10355 of May 26, 1952 (17 F.R. 4831), it is ordered as follows:

Subject to valid existing rights, the following described public lands are hereby added to and reserved as parts of the national forest as indicated, and shall hereafter be subject to all laws and regulations applicable thereto:

MICHIGAN MERIDIAN

MANISTEE NATIONAL FOREST

T. 1 N., R. 10 W.,
Sec. 7, Islands 1, 2 and 3.
T. 39 N., R. 9 W.,
Sec. 2, lot 3.
T. 8 N., R. 5 E.,
Sec. 3, lot 7;
Sec. 10, lot 6;
Sec. 15, lots 15, 16, 17 and 18.
T. 26 N., R. 10 W.,
Sec. 2, lots 15 and 17.
T. 27 N., R. 11 W.,
Sec. 31, lot 12.
T. 7 N., R. 11 W.,
Sec. 5, lot 1.
T. 16 N., R. 18 W.,
Sec. 2, NE¼SE¼, NE¼NE¼.
T. 30 N., R. 4 W.,
Sec. 25, lot 9;
Sec. 36, lot 8.

HIAWATHA NATIONAL FOREST

T. 46 N., R. 27 W.,
Sec. 11, NE¼NE¼.

The areas described aggregate 170.98 acres.

HARRY R. ANDERSON,
Assistant Secretary of the Interior.

SEPTEMBER 27, 1965.

[F.R. Doc. 65-10481; Filed, Oct. 1, 1965; 8:45 a.m.]

[Public Land Order 3835]

[Arizona 017239]

ARIZONA

Withdrawal for Proposed Buttes Dam and Reservoir, Middle Gila River Project

By virtue of the authority contained in section 3 of the Act of June 17, 1902 (32 Stat. 338; 43 U.S.C. 416), as amended and supplemented, it is ordered as follows:

1. Subject to valid existing rights, the following described public lands which are under the jurisdiction of the Secretary of the Interior, are hereby withdrawn from all forms of appropriation under the public land laws, including the mining laws, but not from leasing under the mineral leasing laws, and reserved for the proposed Buttes Dam and Reservoir, Middle Gila River Project:

GILA AND SALT RIVER MERIDIAN

T. 4 S., R. 10 E.,
Sec. 10, SE¼SE¼;
Sec. 13, NW¼NW¼, S½N½, S½;
Sec. 14, S½NE¼, NE¼NW¼, S½NW¼, S½;
Sec. 15, NW¼, NW¼SW¼, S½SE¼.
T. 4 S., R. 11 E.,
Sec. 1, SE¼, S½SW¼;
Sec. 4, S½;
Sec. 5;
Sec. 7, lots 1, 3, 4, 7, SE¼SW¼, S½SE¼;
Secs. 8, 9, 10, 11 and 12;
Sec. 13, N½, N½S½, SW¼SW¼, S½SE¼;
Secs. 14, 15 and 17;
Sec. 22, NE¼SE¼.
T. 3 S., R. 12 E.,
Sec. 33, S½;
Secs. 34 and 35.
T. 4 S., R. 12 E.,
Sec. 1;
Sec. 3, S½;
Secs. 4 and 5;
Sec. 6, lots 1, 2, 3, 4, 5, 6, S½NE¼;
Sec. 7, lots 3, 4, SE¼;
Secs. 8, 9, and 10;
Sec. 11, N½;
Sec. 12, N½;
Sec. 17;
Sec. 18, lots 1, 2, 3, 4, E½;
Sec. 19, lots 1, 2, 3, 4, E½;
Sec. 20;
Sec. 21, W½;
Secs. 28 and 29;
Sec. 30, lots 1, 2, 3, 4, E½;
Sec. 31, lots 1, 2, NE¼;
Sec. 33.
T. 5 S., R. 12 E.,
Sec. 4, lots 1, 2, 3, 4, S½N½;
Sec. 5, lots 1, 2, 3, 4, S½N½.
T. 3 S., R. 13 E.,
Sec. 31, lots 3, 4, E½SW¼.
T. 4 S., R. 13 E.,
Sec. 1, lots 4, 5, W½SW¼;
Sec. 2, lots 1, 2;
Sec. 3;
Sec. 4, lots 1, 2, 3, 4, S½N½, NE¼SW¼, S½SW¼, NE¼SE¼, S½SE¼;
Secs. 5 and 6;
Sec. 7, lots 1 and 2, E½NW¼, NE¼;
Sec. 8, N½;
Sec. 9, lots 1, 2, 3, 4, N½N½, S½NW¼, N½S½, S½SE¼;
Sec. 12, lots 1, 2, 4, and part of lots 3, 5, 6, 7, 8, Part S½NW¼, that are Federal lands: NW¼NW¼.
T. 4 S., R. 14 E.,
Sec. 7, lot 6;
Sec. 8, E½SW¼, SW¼SW¼;
Sec. 18, lots 1, 2, 3, 4, 9, 10, 11;
Sec. 19, W½NE¼;
Sec. 20, SW¼NW¼, SW¼SW¼.
T. 5 S., R. 15 E.,
Sec. 7, SE¼SW¼;
Sec. 13, lot 4;
Sec. 24, lots 1 and 4, W½SE¼.
T. 5 S., R. 16 E.,
Sec. 5, lots 1 to 6, S½NE¼, N½SE¼, SW¼SE¼;
Sec. 6, lot 1, and unsurveyed portion of SE¼SE¼;
Sec. 7, lot 1, pt. lot 2, E½NE¼, N½SE¼, and unsurveyed portion of N½NW¼, NW¼NE¼;
Sec. 8, NW¼NW¼.

The areas described aggregate approximately 26,164.28 acres in Pinal County.

2. The use and administration of the lands will become subject to the provisions of the reclamation laws (Act of June 17, 1902, supra, as amended and supplemented), including the use of the lands under lease, license or permit, at such time as the Buttes Dam and Reservoir, Middle Gila River Project, is authorized by the Congress.

3. Pending authorization of the project, the withdrawal made by this order does not alter the applicability of the public land laws governing the use of the lands under lease, license, or permit, or the disposal of their mineral or vegetative resources, other than under the mining laws, subject to the condition that such use or disposition will not be inconsistent with the reclamation laws and the purposes for which the lands are withdrawn.

HARRY R. ANDERSON,
Assistant Secretary of the Interior.

SEPTEMBER 27, 1965.

[F.R. Doc. 65-10482; Filed, Oct. 1, 1965; 8:45 a.m.]

[Public Land Order 3836]

[BLM 048089]

ARKANSAS

Transferring Jurisdiction Over Oil and Gas Deposits Underlying Certain Acquired Lands at Fort Chaffee Military Reservation

Whereas, the hereinafter described lands to which title has been acquired by the United States, and which comprise a portion of the Fort Chaffee Military Reservation, are reported to be subject to drainage of their oil and gas deposits by wells on adjacent lands in private ownership; and

Whereas, it is necessary in the public interest that such protective action be taken as will prevent loss to the United States by reason of such drainage or threatened drainage; and

Whereas, in order to facilitate such action, it is considered advisable that jurisdiction over the oil and gas deposits in such acquired lands be transferred from the Department of the Army to the Department of the Interior, in which transfer the Secretary of the Army concurs,

Now, therefore, by virtue of the authority vested in the President, and pursuant to Executive Order No. 10355 of May 26, 1952 (17 F.R. 4831), it is ordered as follows:

1. The jurisdiction over the oil and gas deposits owned by the United States in the following-described lands is hereby transferred from the Department of the Army to the Department of the Interior:

FIFTH PRINCIPAL MERIDIAN

T. 6 N., R. 29 W.,
Secs. 1, 2, 7, 8 and 9;
Sec. 10, NE¼, S½NW¼ and S½;
Sec. 11;
Sec. 12, N½N½ and S½ those portions lying west of Rattlesnake Canyon Road;
Sec. 13, those portions lying west of Rattlesnake Canyon Road;
Secs. 14 and 15;
Sec. 16, N½, N½S½, SW¼SW¼ and SE¼SE¼;
Secs. 17 and 18;
Sec. 20, N½N½NE¼NW¼ and N½NW¼NW¼;
Sec. 21, N½NE¼NE¼ and N½S½NE¼NE¼.
T. 6 N., R. 30 W.,
Sec. 11, S½, less 8 acres in N½NW¼NW¼SW¼;
Secs. 12, 13 and 14;
Sec. 23, N½NE¼, SE¼NE¼ and NE¼NW¼;
Sec. 24, N½N½ and SW¼NW¼.
T. 8 N., R. 31 W.,
Secs. 22, 23, 26, 27, 34 and 35 (less approximately 40.95 acres of county-owned lands).

The areas described aggregate 13,294.45 acres of acquired lands.

2. The Secretary of the Interior shall take such action as may be necessary to protect the United States from loss on account of the drainage or threatened drainage of oil and gas from such lands.

3. The jurisdiction of the Department of the Interior over such deposits shall be limited only by the primary jurisdiction of the Department of the Army over the lands for military purposes.

4. The jurisdiction of the Department of the Interior over such deposits of oil and gas shall continue until revocation of this Public Land Order, and no action which may be taken by the Department of the Army to relinquish jurisdiction over the described lands for military purposes or to transfer such jurisdiction out of the Department of the Army shall affect in any way the jurisdiction of the Department of the Interior over the oil and gas deposits.

5. Public Land Order No. 2248 of December 28, 1960, so far as it withdrew the following-described public lands for use of the Department of the Army for military purposes in connection with the Fort Chaffee Military Reservation, is hereby modified to the extent necessary to permit leasing of the said lands for oil and gas under the Act of February 25, 1920 (41 Stat. 437), as amended and supplemented:

FIFTH PRINCIPAL MERIDIAN

T. 6 N., R. 29 W.,
Sec. 10, N½NW¼;
Sec. 12, S½N½.

Containing approximately 240 acres.

HARRY R. ANDERSON,
Assistant Secretary of the Interior.

SEPTEMBER 27, 1965.

[F.R. Doc. 65-10483; Filed, Oct. 1, 1965; 8:45 a.m.]

[Public Land Order 3837]

[Oregon 016416]

OREGON

Withdrawal for Materials Site (Sugarloaf Mountain)

By virtue of the authority vested in the President and pursuant to Executive Order No. 10355 of May 26, 1952 (17 F.R. 4831), it is ordered as follows:

Subject to valid existing rights, the following described lands which are under the jurisdiction of the Secretary of the Interior are hereby withdrawn from all forms of appropriation under the public land laws, including the mining laws (Ch. 2, Title 30 U.S.C.), but not from leasing under the mineral leasing laws, for a Department of the Interior Materials Site:

WILLAMETTE MERIDIAN

SUGARLOAF MOUNTAIN MATERIAL SITE

T. 29 S., R. 12 W.,
Sec. 23, E½ and E½SW¼;
Sec. 24, SW¼SW¼.

The areas described aggregate 440 acres of revested O&C Railroad grant lands and public domain.

HARRY R. ANDERSON,
Assistant Secretary of the Interior.

SEPTEMBER 27, 1965.

[F.R. Doc. 65-10484; Filed, Oct. 1, 1965; 8:45 a.m.]

Title 50—WILDLIFE AND FISHERIES

Chapter I—Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Department of the Interior

PART 32—HUNTING

Noxubee National Wildlife Refuge, Mississippi

The following special regulation is issued and is effective on date of publication in the FEDERAL REGISTER.

§ 32.22 Special regulations; upland game; for individual wildlife refuge areas.

MISSISSIPPI

NOXUBEE NATIONAL WILDLIFE REFUGE

Public hunting of squirrels and rabbits on the Noxubee National Wildlife Refuge, Miss., is permitted only on the area designated by signs as open to hunting. This open area, comprising 42,590 acres, is delineated on a map available at the refuge headquarters, Route 1, Brooksville, Miss., and from the Regional Director, Bureau of Sport Fisheries and Wildlife, 809 Peachtree-Seventh Building, Atlanta, Ga., 30323. Hunting shall be in accordance with all applicable State regulations covering the hunting of squirrels and rabbits subject to the following conditions:

(1) The open season extends from October 15 through October 30, 1965, excluding Sundays.

(2) The use of dogs is not permitted.

The provisions of this special regulation supplement the regulations which govern hunting on wildlife refuge areas generally which are set forth in Title 50, Code of Federal Regulations, Part 32, and are effective through October 30, 1965.

W. L. TOWNS,
Acting Regional Director, Bureau of Sport Fisheries and Wildlife.

[F.R. Doc. 65-10478; Filed, Oct. 1, 1965; 8:45 a.m.]

pursuant to the determination of the Federal Power Commission in DA-150-Arizona, it is ordered as follows:

1. The Executive order of November 22, 1924, creating Powersite Reserve No. 759, and the Departmental Order of February 1, 1917, creating Waterpower Designation No. 4, are hereby revoked as far as they affect the following described lands:

GILA AND SALT RIVER MERIDIAN

T. 5 S., R. 29 E.,
All land within 1 mile of the San Francisco River and Gila River in sections 16, 17, and 20.
T. 5 S., R. 30 E.,
Sec. 7, NE¼NW¼;
Sec. 33, S½SW¼, SW¼SE¼.
T. 6 S., R. 30 E.,
Sec. 3, lot 1.
T. 6 S., R. 31 E.,
Sec. 18, lot 7.

The areas described aggregate approximately 1,535 acres of public and nonpublic land in Greenlee County.

Of these lands, the following described lands are public lands:

T. 5 S., R. 29 E.,
Sec. 20.
T. 6 S., R. 30 E.,
Sec. 3, lot 1.
T. 6 S., R. 31 E.,
Sec. 18, lot 7.

The land described as lot 1, sec. 3, T. 6 S., R. 30 E., is included in a withdrawal application, Arizona 030451, filed by the Corps of Engineers, Department of the Army, to which the regulations in 43 CFR 2351.3(a) are applicable.

2. At 10 a.m. on January 11, 1973, the unappropriated public land shall be open to operation of the public land laws generally, subject to valid existing rights, the provisions of existing withdrawals, and the requirements of applicable law. All valid applications received at or prior to 10 a.m. on January 11, 1973, shall be considered as simultaneously filed at that time. Those received thereafter shall be considered in the order of filing.

The unappropriated public land has been and will continue to be open to the filing of applications and offers under the mineral leasing laws, and to location and entry under the U.S. mining laws.

Inquiries concerning the public lands should be addressed to the Chief, Division of Technical Services, Bureau of Land Management, 3022 Federal Building, Phoenix, Ariz. 85025.

HARRISON LOESCH,
Assistant Secretary of the Interior.

DECEMBER 6, 1972.

[FR Doc.72-21273 Filed 12-11-72;8:46 am]

[Public Land Order 5316]

[Arizona 3535]

ARIZONA

Withdrawal for Reclamation Project

By virtue of the authority contained in section 3 of the Act of June 17, 1902, as amended and supplemented, 43 U.S.C. § 416 (1970), it is ordered as follows:

Subject to valid existing rights, the following described public lands, which are under the jurisdiction of the Secretary of the Interior, are hereby withdrawn from all forms of appropriation under the public land laws, including the mining laws, 30 U.S.C., Ch. 2, but not from leasing under the mineral leasing laws, and reserved for the Buttes Dam and Reservoir Site of the Central Arizona Project:

GILA AND SALT RIVER MERIDIAN

T. 4 S., R. 11 E.,
Sec. 18, lots 1 to 4, incl., E½W½, E½.
T. 4 S., R. 13 E.,
Sec. 9, lot 1261-B except that portion included in Mineral Patent No. 29747.

The areas described aggregate 646.60 acres in Pinal County.

The land described in section 9, T. 4 S., R. 13 E., is also included in Powersite Classification No. 436 of November 16, 1956.

HARRISON LOESCH,
Assistant Secretary of the Interior.

DECEMBER 6, 1972.

[FR Doc.72-21230 Filed 12-11-72;8:46 am]

[Public Land Order 5317]

[Colorado 12469, 13142]

COLORADO

Correction of Public Land Order No. 5208

The description of the lands in Public Land Order 5208 of April 20, 1972, appearing in 37 F.R. 8383 of the issue of April 26, 1972, revoking certain reclamation withdrawals, is hereby corrected by changing the SW¼, sec. 20, T. 1 N., R. 86 W., to read the NW¼SW¼, sec. 20, in paragraph 1, and by changing the land described as T. 1 N., R. 37 W., to read T. 1 N., R. 37 W., in paragraph 2, of said order.

HARRISON LOESCH,
Assistant Secretary of the Interior.

DECEMBER 6, 1972.

[FR Doc.72-21281 Filed 12-11-72;8:46 am]

[Public Land Order 5318]

[Montana 20669]

MONTANA

Withdrawal for National Forest Recreation Area

By virtue of the authority vested in the President and pursuant to Executive Order No. 10355 of May 26, 1952 (17 F.R. 4831), it is ordered as follows:

1. Subject to valid existing rights, the following described national forest lands are hereby withdrawn from appropriation under the mining laws, 30 U.S.C. Ch. 2, but not from leasing under the mineral leasing laws, in aid of programs of the Department of Agriculture:

CUSTER NATIONAL FOREST

PRINCIPAL MERIDIAN

Macnab Pond Campground

T. 1 N., R. 59 E.,
Sec. 19, NE¼NE¼, E½NW¼NE¼, N½SE¼NE¼, NE¼SW¼NE¼.

Ekalaka Park Campground

T. 1 N., R. 58 E.,
Sec. 33, SW¼NE¼NE¼, SE¼NW¼NE¼, NE¼SW¼NE¼, N½SE¼SW¼NE¼, N½SW¼SE¼NE¼, NW¼SE¼NE¼.

The areas described aggregate 140 acres in Carter County.

2. The withdrawal made by this order does not alter the applicability of those public land laws governing the use of the national forest lands under lease, license, or permit or governing the disposal of their mineral or vegetative resources other than under the mining laws.

HARRISON LOESCH,
Assistant Secretary of the Interior.

DECEMBER 6, 1972.

[FR Doc.72-21282 Filed 12-11-72;8:46 am]

[Public Land Order 5319]

[Arizona 030111]

ARIZONA

Partial Revocation of Whipple Barracks Target Range Withdrawal

By virtue of the authority vested in the President and pursuant to Executive Order No. 10355 of May 26, 1952 (17 F.R. 4831), it is ordered as follows:

1. The Executive order of August 18, 1904, withdrawing lands for the use of the War Department as a target range for the troops at Whipple Barracks, Ariz., is hereby revoked so far as it affects the following described lands:

GILA AND SALT RIVER MERIDIAN

T. 14 N., R. 2 W.,
Sec. 2, S½SW¼;
Sec. 3, SE¼, E½SW¼;
Sec. 10, lots 1, 2, 3, NW¼NE¼, E½NW¼;
Sec. 11, N½NW¼.

The areas described aggregate 640 acres in Yavapai County.

Of the lands described, 576.53 acres have been patented under the Recreation and Public Purposes Act of June 14, 1926, 44 Stat. 471, as amended, 43 U.S.C. 869 et seq. (1964), or conveyed to the State of Arizona pursuant to sections 2275 and 2276, U.S. Revised Statutes, as amended, 43 U.S.C. 851-852 (1964).

2. The remaining lands, described as the SE¼SW¼ sec. 2, and lot 3 sec. 10, T. 14 N., R. 2 W., containing 63.47 acres, have been classified for disposal under the provisions of the Recreation and Public Purposes Act of June 14, 1926, supra, and section 7 of the Act of June 28, 1934, 48 Stat. 1272, as amended, 43 U.S.C. 315f (1964), pursuant to applications filed by the city of Prescott and Yavapai County, Ariz. These lands, therefore, will not be subject to other use or disposition under the public land laws in the absence of a modification or revocation of a modification or revocation of such classification (43 CFR 2440.4).

Inquiries concerning the lands should be addressed to the Manager, Land Office, Bureau of Land Management, 3022 Federal Building, Phoenix, Ariz. 85025.

HARRISON LOESCH,
Assistant Secretary of the Interior.

DECEMBER 6, 1972.

[FR Doc.72-21283 Filed 12-11-72;8:46 am]

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

60334

Gila River, Arizona

POWER SITE CLASSIFICATION NO. 438

Pursuant to authority vested in me by the act of March 3, 1879 (20 Stat. 394; 43 U.S.C. 31), and by Departmental Order No. 2333 of June 10, 1947 (43 C.F.R. 4.623; 12 F. R. 4025), the following described land is hereby classified as power sites insofar as title thereto remains in the United States and subject to valid existing rights; and this classification shall have full force and effect under the provisions of sec. 24 of the act of June 10, 1920, as amended by sec. 211 of the act of August 26, 1935 (16 U.S.C. 818):

Gila and Salt River Meridian

T. 12 N., R. 5 E. (Unsurveyed)
Every smallest legal subdivision which when surveyed will be adjacent to Verde River upstream from Sycamore Creek and under an altitude of 3,100 feet. Protraction of existing surveys indicates that the lands when surveyed will be within secs. 1, 2, 3, 11, and 12.

T. 13 N., R. 5 E.,
sec. 4, $S\frac{1}{2}SW\frac{1}{4}$;
sec. 5, lots 2, 6, and $SW\frac{1}{4}NE\frac{1}{4}$;
sec. 7, lots 8 and 11;
sec. 9, $NW\frac{1}{4}$ and $S\frac{1}{2}SE\frac{1}{4}$;
sec. 10, $SW\frac{1}{4}SW\frac{1}{4}$;
sec. 15, lot 2, $SW\frac{1}{4}$, and $NW\frac{1}{4}SE\frac{1}{4}$;
sec. 16, $N\frac{1}{2}NE\frac{1}{4}$, $SW\frac{1}{4}NE\frac{1}{4}$, $W\frac{1}{2}SE\frac{1}{4}$, and $SE\frac{1}{4}SE\frac{1}{4}$;
sec. 17, lots 2, 3, 5, 6, and 8;
sec. 18, $NE\frac{1}{4}NE\frac{1}{4}$;
sec. 20, $SE\frac{1}{4}NE\frac{1}{4}$ and $E\frac{1}{2}SE\frac{1}{4}$;
sec. 21, $N\frac{1}{2}$ and $W\frac{1}{2}SW\frac{1}{4}$;
sec. 22, $E\frac{1}{2}W\frac{1}{2}$ and $SW\frac{1}{4}SE\frac{1}{4}$;
sec. 25, $S\frac{1}{2}SW\frac{1}{4}$ and $SE\frac{1}{4}$;
sec. 26, $SW\frac{1}{4}$;
sec. 27, $NW\frac{1}{4}NE\frac{1}{4}$, $NE\frac{1}{4}NW\frac{1}{4}$, and $S\frac{1}{2}NW\frac{1}{4}$;
sec. 28, $NE\frac{1}{4}$ and $W\frac{1}{2}NW\frac{1}{4}$;
sec. 33, lots 1, 7, and 8;
sec. 34, lots 1, 2, 3, 4, 5, 6, 7, 8, 11, and 12;
sec. 35, $S\frac{1}{2}NE\frac{1}{4}$, $NW\frac{1}{4}$, and $S\frac{1}{2}$;
sec. 36, $NE\frac{1}{4}$, $W\frac{1}{2}$, and $W\frac{1}{2}SE\frac{1}{4}$.

T. 14 N., R. 5 E.,
sec. 19, $NE\frac{1}{4}SE\frac{1}{4}$;
sec. 20, lots 2 and 3;
sec. 29, lots 4, 7, and 8;
sec. 30, lot 2;
sec. 32, lots 2 and 8.

T. 13 N., R. 6 E.,
sec. 31, lots 4 and 5.

T. 1 S., R. 10 E.,
sec. 25, $SE\frac{1}{4}SE\frac{1}{4}$;
sec. 36, lots 1, 2, 3, 4, $NE\frac{1}{4}$, $SE\frac{1}{4}NW\frac{1}{4}$, and $N\frac{1}{2}S\frac{1}{2}$.

T. 1 S., R. 11 E. (Unsurveyed)
Every smallest legal subdivision any part of which when surveyed will be adjacent to Queen Creek under an altitude of 2,250 feet. Protraction of existing surveys indicates that the lands when surveyed will be within secs. 20, 21, 27, 28, 29, 30, 31, 32, 33, 34, and 35.

T. 2 S., R. 11 E.,
sec. 5, lots 3, 4, and $SW\frac{1}{4}NW\frac{1}{4}$;
sec. 6.

T. 4 S., R. 11 E.,
sec. 1, $SE\frac{1}{4}SW\frac{1}{4}$ and $SE\frac{1}{4}$;
sec. 2, $W\frac{1}{2}SE\frac{1}{4}$ and $SE\frac{1}{4}SE\frac{1}{4}$;
sec. 11;
sec. 12, lots 1, 3, 4, 5, 6, 7, and 8, $N\frac{1}{2}NW\frac{1}{4}$, $S\frac{1}{2}SW\frac{1}{4}$, and $SE\frac{1}{4}SE\frac{1}{4}$;
sec. 13, $N\frac{1}{2}$, $N\frac{1}{2}SW\frac{1}{4}$, $SW\frac{1}{4}SW\frac{1}{4}$, and $W\frac{1}{2}SE\frac{1}{4}$;
sec. 14, $NE\frac{1}{4}$.

T. 3 S., R. 12 E.,
sec. 34, $S\frac{1}{2}SE\frac{1}{4}$;
sec. 35, $E\frac{1}{2}NE\frac{1}{4}$ and $S\frac{1}{2}$;
sec. 36, $S\frac{1}{2}SW\frac{1}{4}$, $SW\frac{1}{4}SE\frac{1}{4}$, and $E\frac{1}{2}SE\frac{1}{4}$.

T. 4 S., R. 12 E.,
sec. 1, lots 1, 2, 3, 4, $S\frac{1}{2}N\frac{1}{2}$, and $N\frac{1}{2}S\frac{1}{2}$;
sec. 2;
sec. 3, $S\frac{1}{2}$;
sec. 4, $S\frac{1}{2}N\frac{1}{2}$ and $S\frac{1}{2}$;
sec. 5, lots 2, 3, 4, $S\frac{1}{2}N\frac{1}{2}$, and $S\frac{1}{2}$;
sec. 6, lots 1, 4, 5, 6, and $SE\frac{1}{4}NE\frac{1}{4}$;
sec. 7, lots 3, 4, and $SE\frac{1}{4}$;
sec. 8, $N\frac{1}{2}$ and $NW\frac{1}{4}SW\frac{1}{4}$;
sec. 9, $N\frac{1}{2}$, $NE\frac{1}{4}SW\frac{1}{4}$, and $N\frac{1}{2}SE\frac{1}{4}$;
sec. 10, $N\frac{1}{2}NE\frac{1}{4}$ and $NW\frac{1}{4}$;
sec. 18, lot 1.

T. 4 S., R. 13 E.,
sec. 1, lots 3, 7, 9, and $SW\frac{1}{4}SW\frac{1}{4}$;
sec. 3, $S\frac{1}{2}S\frac{1}{2}$;
sec. 4, $SW\frac{1}{4}NE\frac{1}{4}$, $S\frac{1}{2}NW\frac{1}{4}$, $NE\frac{1}{4}SW\frac{1}{4}$, $S\frac{1}{2}SW\frac{1}{4}$, and $SE\frac{1}{4}$;
sec. 5, $S\frac{1}{2}N\frac{1}{2}$, $NE\frac{1}{4}SW\frac{1}{4}$, and $SE\frac{1}{4}$;
sec. 6, lots 3, 4, 5, 6, $S\frac{1}{2}NE\frac{1}{4}$, and $SE\frac{1}{4}NW\frac{1}{4}$;
sec. 8, $NE\frac{1}{4}NE\frac{1}{4}$;
sec. 9, $NE\frac{1}{4}$ and $N\frac{1}{2}NW\frac{1}{4}$;
sec. 12, lots 1, 2, and $NW\frac{1}{4}NW\frac{1}{4}$.

T. 4 S., R. 14 E.,
sec. 7, lots 3, 4, 7, and $SW\frac{1}{4}SE\frac{1}{4}$;
sec. 17, $SE\frac{1}{4}SW\frac{1}{4}$.

T. 4 S., R. 15 E.,
sec. 1, $S\frac{1}{2}N\frac{1}{2}$;
sec. 2, $SE\frac{1}{4}NE\frac{1}{4}$ and $NE\frac{1}{4}SE\frac{1}{4}$;
sec. 12, $NE\frac{1}{4}NW\frac{1}{4}$.

T. 4 S., R. 16 E.,
sec. 4, $S\frac{1}{2}S\frac{1}{2}$ (Unsurveyed);
sec. 5, $S\frac{1}{2}N\frac{1}{2}$ (Unsurveyed);
sec. 13, $NW\frac{1}{4}NW\frac{1}{4}$ (Unsurveyed);
sec. 18, $NE\frac{1}{4}NE\frac{1}{4}$ (Unsurveyed).

T. 7 S., R. 16 E.,
sec. 1, $SW\frac{1}{4}$;
sec. 2;
sec. 3, lot 1;
sec. 4, lot 14;
sec. 10, lot 7 and $SE\frac{1}{4}SE\frac{1}{4}$;
sec. 11, $S\frac{1}{2}S\frac{1}{2}$;
sec. 12, $S\frac{1}{2}SW\frac{1}{4}$;
sec. 13, $W\frac{1}{2}W\frac{1}{2}$;
sec. 14;
sec. 15, lots 10, 12, and $NE\frac{1}{4}NE\frac{1}{4}$;
sec. 23, $E\frac{1}{2}$, $N\frac{1}{2}NW\frac{1}{4}$, and $SE\frac{1}{4}NW\frac{1}{4}$;
sec. 24, $NW\frac{1}{4}NW\frac{1}{4}$, $S\frac{1}{2}NW\frac{1}{4}$, $N\frac{1}{2}SW\frac{1}{4}$, and $SW\frac{1}{4}SW\frac{1}{4}$;
sec. 25, $W\frac{1}{2}$ and $SW\frac{1}{4}SE\frac{1}{4}$;
sec. 26, $N\frac{1}{2}NE\frac{1}{4}$, $SE\frac{1}{4}NE\frac{1}{4}$, and $NE\frac{1}{4}SE\frac{1}{4}$.

T. 8 S., R. 16 E.,
sec. 1, lot 1;
sec. 2, lot 1 and $SE\frac{1}{4}NE\frac{1}{4}$;
sec. 12, $E\frac{1}{2}NW\frac{1}{4}$.

T. 7 S., R. 17 E.,
sec. 6, $W\frac{1}{2}SE\frac{1}{4}$.

T. 8 S., R. 17 E.,
sec. 6, lot 6;
sec. 7, $E\frac{1}{2}NW\frac{1}{4}$.

T. 21 S., R. 21 E.,
sec. 9, E½NE¼;
sec. 10, N½ and SE¼;
sec. 12, lots 1, 2, S½NE¼, SE¼NW¼, and N½SE¼.

T. 21 S., R. 22 E.,
sec. 7, NE¼NE¼ and NE¼SW¼.

T. 2 S., R. 31 E.,
Every smallest legal subdivision in unsurveyed secs. 17, 18, 19, 20, and 30 adjacent to Blue River which when surveyed will be in whole or in part under an altitude of 4,000 feet.

The area described is estimated to aggregate 24,608 acres, 19,408 acres of which are surveyed.

/S/ Thomas B. Nolan
Director

Date
Nov 16 1956

Copy to: BLM, Wash., D. C.
BLM, Phoenix, Arizona

ATTACHMENT 3
April 27, 1979 Tri-Party Agreement

1979 "TRI-PARTY" AGREEMENT

- BETWEEN USFS, SRP, BOR (SRP DAMS ONLY)

- ALSO REFERRED TO AS A "PROJECT SUPPLEMENTAL AGREEMENT"

MANAGEMENT MEMORANDUM
AMONG THE SALT RIVER PROJECT AGRICULTURAL IMPROVEMENT AND POWER DISTRICT, UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE AND UNITED STATES BUREAU OF RECLAMATION

Purpose and Objective

It being agreed that a three-party memorandum should be utilized to give guidance to Salt River Project Agricultural Improvement and Power District (Salt River Project), United States Department of Agriculture Forest Service (Forest Service) and United States Bureau of Reclamation (Bureau) officials and personnel having responsibilities for managing lands withdrawn for Salt River Project Reclamation purposes within Forest Service boundaries, the purpose of this Management Memorandum is to coordinate the program activities of the three entities to the end that multiple uses, public recreation, aesthetic protection, enhancement of wildlife, planning, management, environmental compatibility, public access and use, and security of Reclamation works, will be undertaken and maintained consistent with the responsibilities of each of the parties, the protection of the environment and the proper enhancement of land values.

Authority

Through delegations of authority from the Secretary of the Interior, the Bureau investigates, designs, constructs, and is responsible for operation and maintenance of the multiple-purpose projects and facilities on and along the Salt and Verde Rivers in Arizona for water storage and diversion, utilization and regulation of water and land, and related

resources, including generation, transmission and distribution of electric power under the Federal Reclamation Act of 1902, and Acts amendatory thereof and supplementary thereto. Certain of these responsibilities, involving the care, operation and maintenance of Reclamation project works and the use of Reclamation withdrawn lands for Reclamation purposes within the Tonto National Forest, have been delegated to and assumed by the Salt River Project pursuant to a contract between the Salt River Valley Water Users' Association and the United States, dated September 6, 1917, as amended, and as assigned to the Salt River Project.

The Forest Service is responsible for protection and development of National Forest system lands pursuant to authorities under the Organic Act of June 4, 1897, and the Multiple Use Sustained Yield Act of June 12, 1960, as implemented by the Memorandum of Understanding dated January 26, 1948, between the Forest Service and the Bureau. (The Salt River Project was not a party to the 1948 Memorandum of Understanding.)

Stipulations

The area of Reclamation withdrawn lands within the Tonto National Forest is shown on United States Bureau of Land Management Land Status Maps. The Salt River Project, in carrying out its responsibilities for care, operation, maintenance and construction of water and power facilities

and delivery of water and electrical power and energy under the above-mentioned contract of 1917 and all other contracts, will be guided by this Management Memorandum as to the administration of the withdrawn lands shown on said Land Status Maps. The Forest Service and the Bureau, in carrying out their respective responsibilities, will also be guided by this Management Memorandum.

Premises

The following are the legal and factual premises upon which this management plan is based:

1. The Bureau is the Federal agency which has primary jurisdiction over the withdrawn lands when the lands are utilized for Reclamation purposes. Under the terms of the 1917 contract, the Salt River Project operates and maintains Reclamation works on the withdrawn lands.

2. The Forest Service is responsible for the administration of the withdrawn lands which are not being used for Reclamation purposes.

3. The Salt River Project is responsible for the administration of waters from the Salt and Verde Rivers and their tributaries pursuant to judicial decree and applicable laws. The Forest Service and the Bureau cannot grant any permits or approvals for use of waters from the Salt and Verde Rivers or their tributaries.

4. Except as set forth in paragraph 3 hereof, permits, licenses or other use-rights for non-Reclamation works may be granted by the Forest

Service to private parties, county, state or Federal entities within withdrawal lands shown on said Land Status Maps pursuant to authorizing statutes.

5. Consistent with applicable law, it is the Bureau's policy not to issue permits, licenses or other authorizations to third parties for non-Reclamation works within the withdrawn lands shown on said Land Status Maps.

6. The Bureau and the Salt River Project are entitled to engage in activities related to the care, operation, maintenance and construction of Reclamation works within the withdrawn lands shown on said Land Status Maps without the prior approval of the Forest Service. As used herein, the term "Reclamation works" shall include the following where used for Reclamation purposes:

(a) Dams and spillways, canals, headgates and pipelines, tunnels, reservoirs, and powerplants;

(b) Employee housing, including houses used for operation and maintenance crews, and accessory buildings and structures;

(c) Electrical transmission lines, substations, and switchyards; electric distribution lines which serve Reclamation works;

(d) Domestic water facilities, sewage treatment plants, refuse disposal areas, equipment and material storage facilities, and similar facilities;

(e) Safety and security facilities including barriers, fences, log booms, and other safety devices, boat and barge docks (nonpublic);

(f) Communication facilities, including microwave facilities and telephone lines;

(g) Gauging stations and facilities to determine hydrological conditions, river and creek flows; and

(h) Access and maintenance roads, fences, gates, bridges, and drainage facilities used in connection with Reclamation works and areas for obtaining and stockpiling road maintenance materials used for such works.

7. The Forest Service has responsibility for enforcement and compliance with applicable laws, and rules and regulations of governmental agencies for all activities other than those related to the care, operation, maintenance and construction of Reclamation works.

Management Agreement

In implementing the rights and obligations described above, the parties will observe the following:

A. Before acting upon applications for leasing, licensing, permitting or the like, Forest Service will furnish the Bureau a list of such applications with copy to the Salt River Project's authorized

designee. Applications for nonsignificant uses may, in individual cases, or in specified categories, be handled informally by telephone between the respective offices of the Forest Supervisor and the Projects Manager, Arizona Projects Office. The list will indicate the nature of the use for which the application is made. In addition, when in the opinion of the Forest Service such an application relates to a land use which may impact a present or prospective Reclamation use, Forest Service will furnish information sufficient for a tentative judgment as to such impact. If no comments with regard to a list of applications are received by Forest Service within twenty-one (21) days, it may be assumed that no interference with Reclamation use is involved; however, in those cases where further information is furnished the assumption of noninterference may be made if no response is made by the Bureau within thirty (30) days following receipt of the information.

If within the twenty-one-(21) or thirty-(30)-day periods referred to above, the Bureau desires to delay in the granting of the proposed application and/or a consultation with Forest Service concerning the same, it will notify Forest Service in writing. In any case where the Salt River Project notifies the Bureau that possible interference with a present or prospective Reclamation use is indicated, the Bureau will respond to Forest Service requesting a delay and/or consultation. The Forest Service will delay action in accordance with such a request.

The consulting representative of the Forest Service shall be the Supervisor, Tonto National Forest and/or his designated representatives. The consulting representative of the Bureau shall be the Projects Manager, Arizona Projects Office, and/or his designated representatives. Where the interest of the Salt River Project in the proposed application is indicated, the Salt River Project's authorized designee will be notified of the proposed consultation by the Bureau and representatives of the Salt River Project will be requested to participate. If agreement is not reached in consultation by representatives of the Supervisor, Tonto National Forest; representatives of the Projects Manager, Arizona Projects Office; and the Salt River Project's authorized designee, the matter will be referred to their principals, and failing an agreement among them, the matter will be referred to the Forest Service Regional Forester and the Bureau Regional Director.

B. Notwithstanding the provisions of paragraph 6 above relating to activities involving Reclamation works, the Bureau and the Salt River Project will consult with Forest Service before taking any major action which could materially affect or impact the activities of the Forest Service.

C. Joint consultation and cooperation with other Federal, state, and local authorities will be maintained by the parties on all phases

pertaining to the use of the withdrawn lands and water areas which concern such activities.

D. In recogizing the Forest Service's responsibilities for managing the resources of the National Forests in combinations that best meet the needs of the American people, the Bureau and the Salt River Project will consult with the Forest Service so that the establishment of Reclamation works, will so far as possible, be consistent with the management plans established for National Forests.

E. The Forest Service and the Bureau will cooperate in the management of off-road vehicle use of Reclamation withdrawn lands in accordance with regulations. The parties recognize the Salt River Project's need for vehicular access to certain areas in order to construct, operate, and maintain its water and power facilities.

F. Representatives of the Forest Service, the Bureau and the Salt River Project should meet at least annually to review matters of mutual interest or concern. Such representatives will also be available as required to meet at any level of administration to review problems of mutual interest or concern.

G. Channels of communication should be maintained for review of all actions by each party with regard to lands or water that could affect or impact the activities of the other parties of this Management Memorandum.

H. Any major action of a party which could materially affect or impact the activities of the other party or parties within the Reclamation withdrawn lands shown on said Land Status Maps should be reviewed with representatives of the other parties prior to taking such action. In the event a disagreement arises at the operating level, concerning the proposed action, such disagreement should be submitted for review at the next highest level of responsibility within the organization of the parties hereto.

It is agreed by the parties hereto that nothing contained in this Management Memorandum shall be used in any administrative or judicial proceeding to evidence legal rights or obligations of the United States or the Salt River Project or of any other party.

Notices in the behalf of the United States Bureau of Reclamation shall be given by or to the:

Projects Manager
Bureau of Reclamation
Arizona Projects Office
Suite 2200 Valley Center
201 North Central Avenue
Phoenix, Arizona 85073

Notices in the behalf of the United States Department of Agriculture Forest Service shall be given by or to the:

Forest Supervisor
Tonto National Forest
102 South 28th Street
P. O. Box 13705
Phoenix, Arizona 85002

Notices in the behalf of the Salt River Project Agricultural Improvement and Power District shall be given by or to the:

General Manager
Salt River Project
Agricultural Improvement and
Power District
1521 Project Drive
P. O. Box 1980
Phoenix, Arizona 85001

or his authorized designee.

The agreements and arrangements set forth above are not intended to limit areas of cooperation and communication among the parties. This Management Memorandum reflects the intention of the parties to achieve maximum cooperation and it is understood that changes in or additions to the Management Memorandum may be made in the future to reach that goal.

Executed this 27th day of April 1979

SALT RIVER PROJECT AGRICULTURAL
IMPROVEMENT AND POWER DISTRICT

By _____
General Manager

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

By _____
Regional Forester

UNITED STATES BUREAU OF RECLAMATION

By _____
Acting Regional Director

COPY

ADDENDUM NO. 1
TO
MANAGEMENT MEMORANDUM OF
APRIL 27, 1979

Purpose of Addendum

1. The 1948 Memorandum of Understanding between the Commissioner of Reclamation and the Chief of the Forest Service provides in Clause 5 that the Forest Service will be responsible for the administration of National Forest lands in a reclamation withdrawal which are not in actual use in connection with reclamation works, and

2. Clause 6 of that agreement also provides that the Bureau reserves the right to determine the area subject to its primary jurisdiction, and

3. Clause 9 contemplates local agreements for specific projects, and

4. The 1979 Management Memorandum is such a local agreement, but it did not clearly designate areas of primary jurisdiction, contemplating instead that it would be done by a later addition to the agreement.

5. This Addendum hereby accomplishes that purpose.

Designation of Areas of Primary Jurisdiction:

1. Areas of primary jurisdiction are as determined by the Bureau of Reclamation on the attached six maps dated July 1981 and titled: "Roosevelt Dam, Horse Mesa Dam, Mormon Flat Dam, Stewart Mountain Dam, Bartlett Dam, and Horseshoe Dam."

2. Any areas of primary jurisdiction which may have been previously established or inferred are hereby superseded.

3. All appropriate regulations and procedures of the United States Department of Interior will apply to these Bureau of Reclamation administered areas.

4. Any future changes in areas of primary jurisdiction will be determined by the Bureau of Reclamation by revisions to the appropriate map(s) and by procedures similar to this Addendum.

Executed this 2nd day of Aug., 1982.

SALT RIVER PROJECT AGRICULTURAL
IMPROVEMENT & POWER DISTRICT

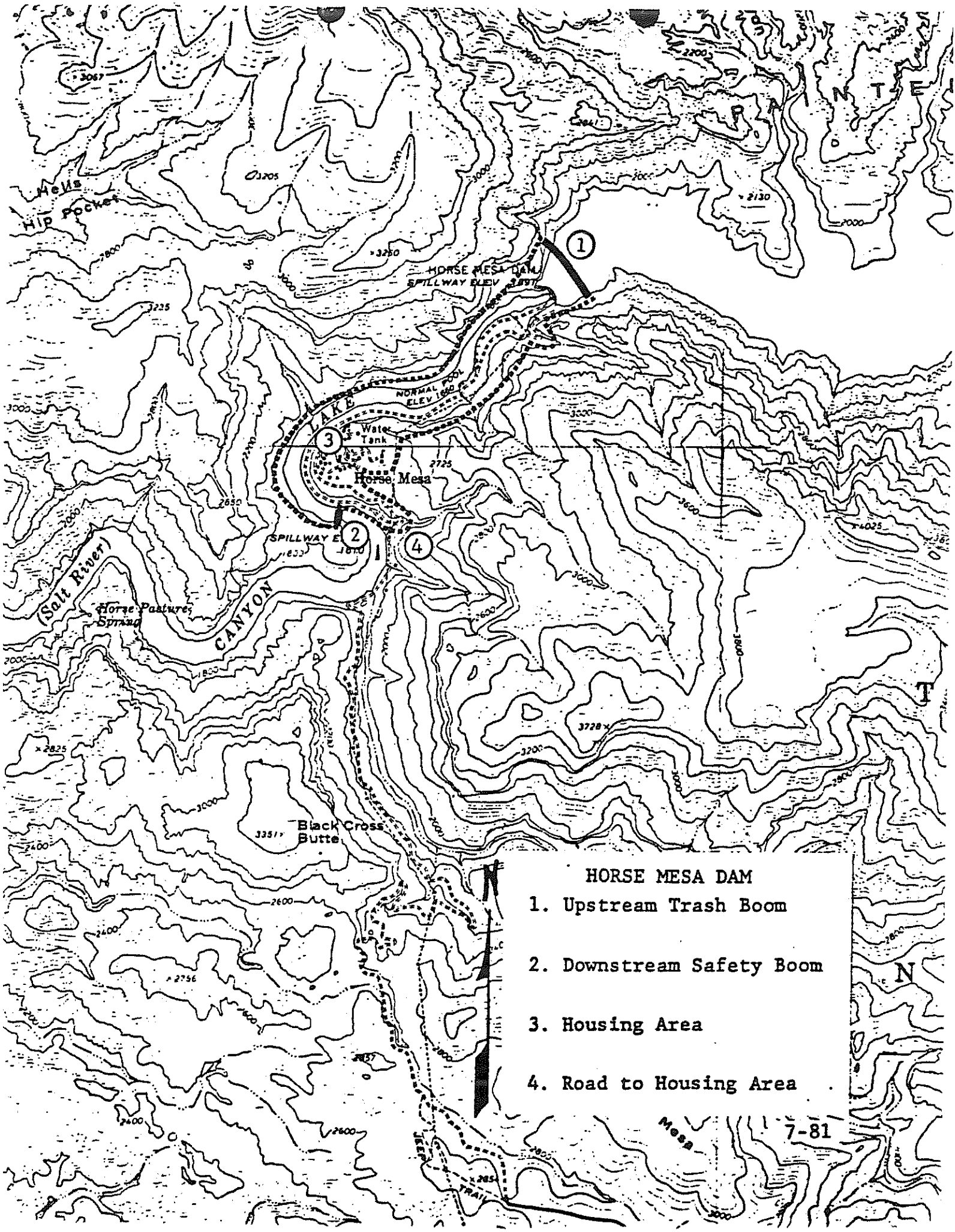
By _____
General Manager

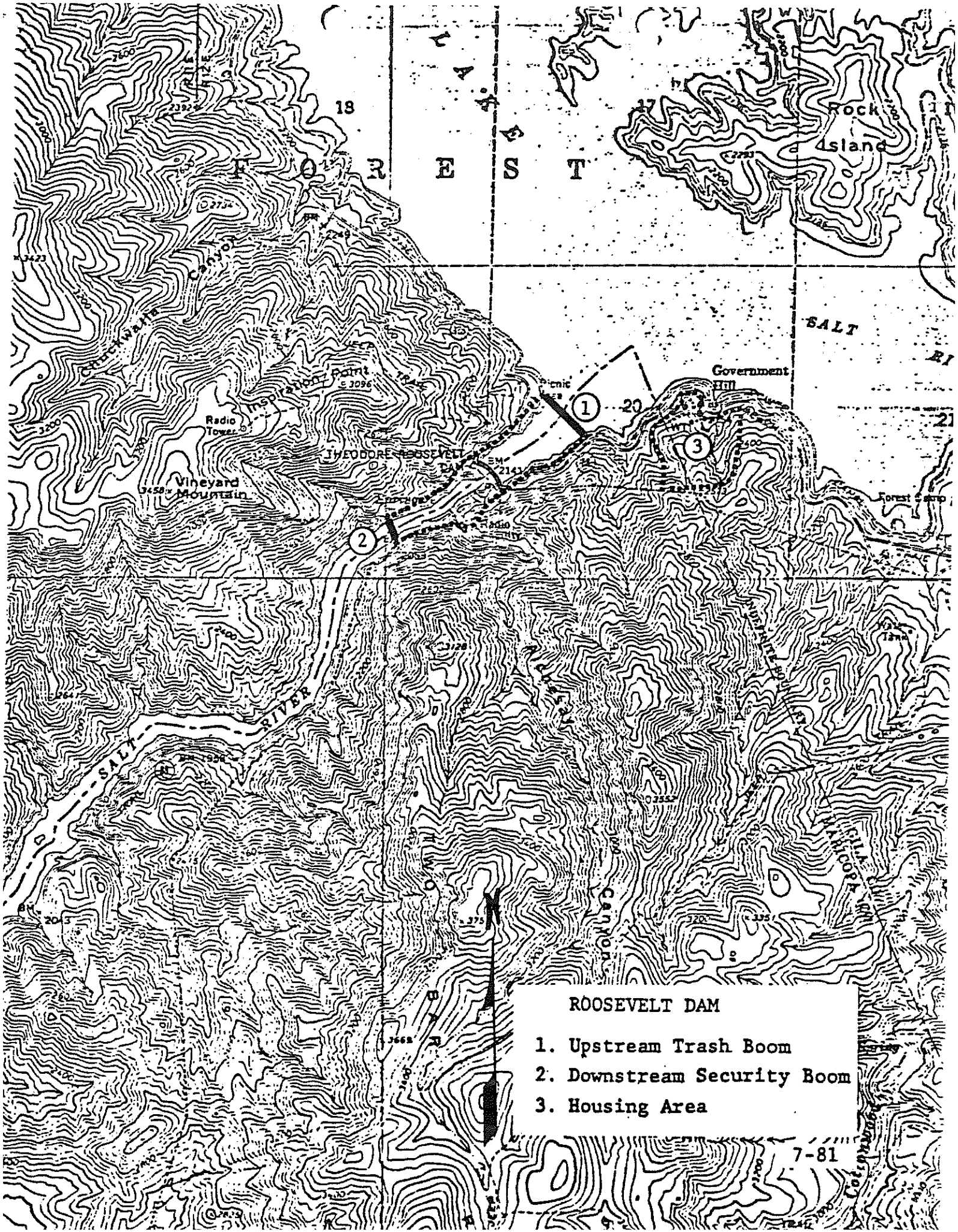
UNITED STATES DEPARTMENT OF
AGRICULTURE, FOREST SERVICE

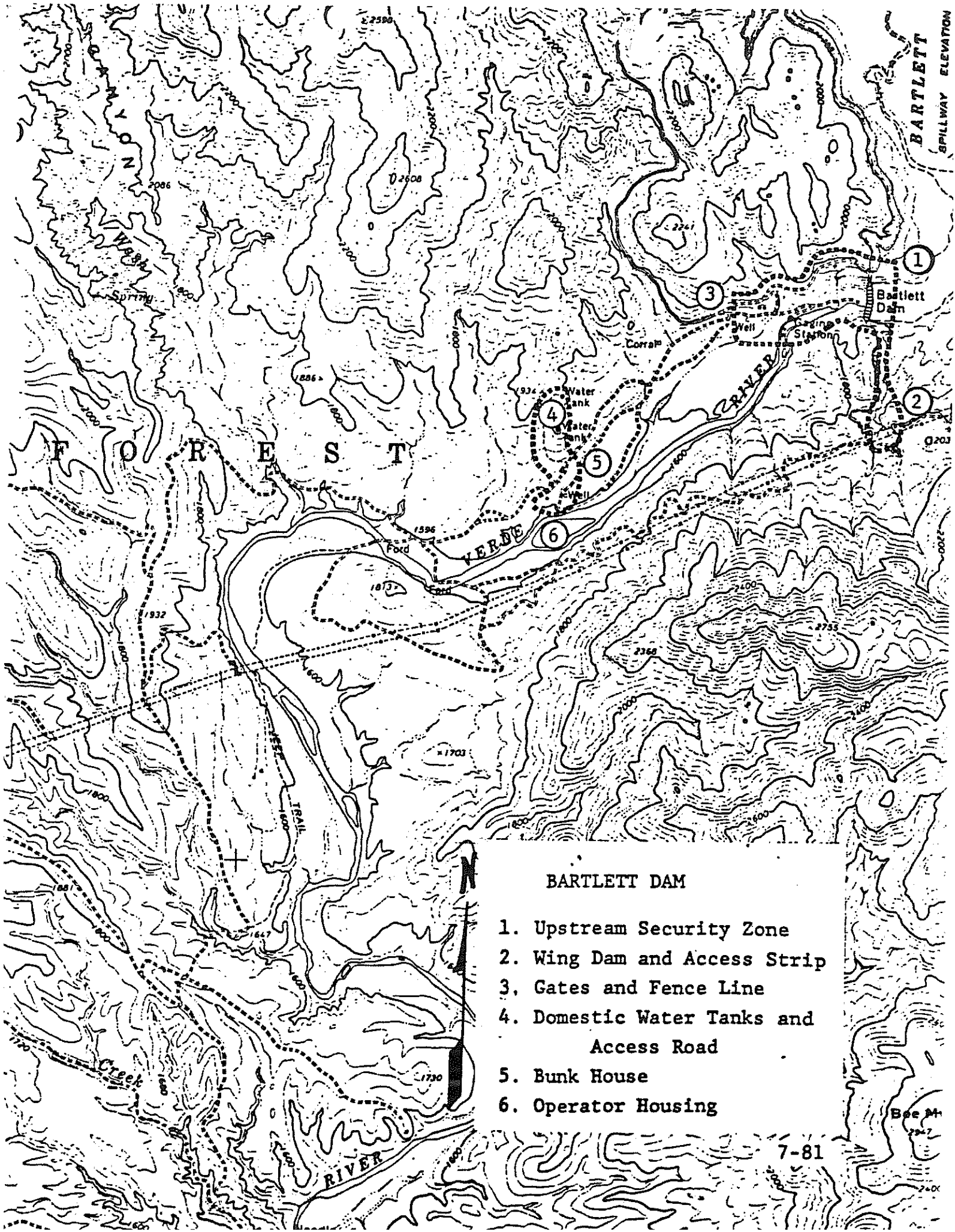
By _____
Regional Forester

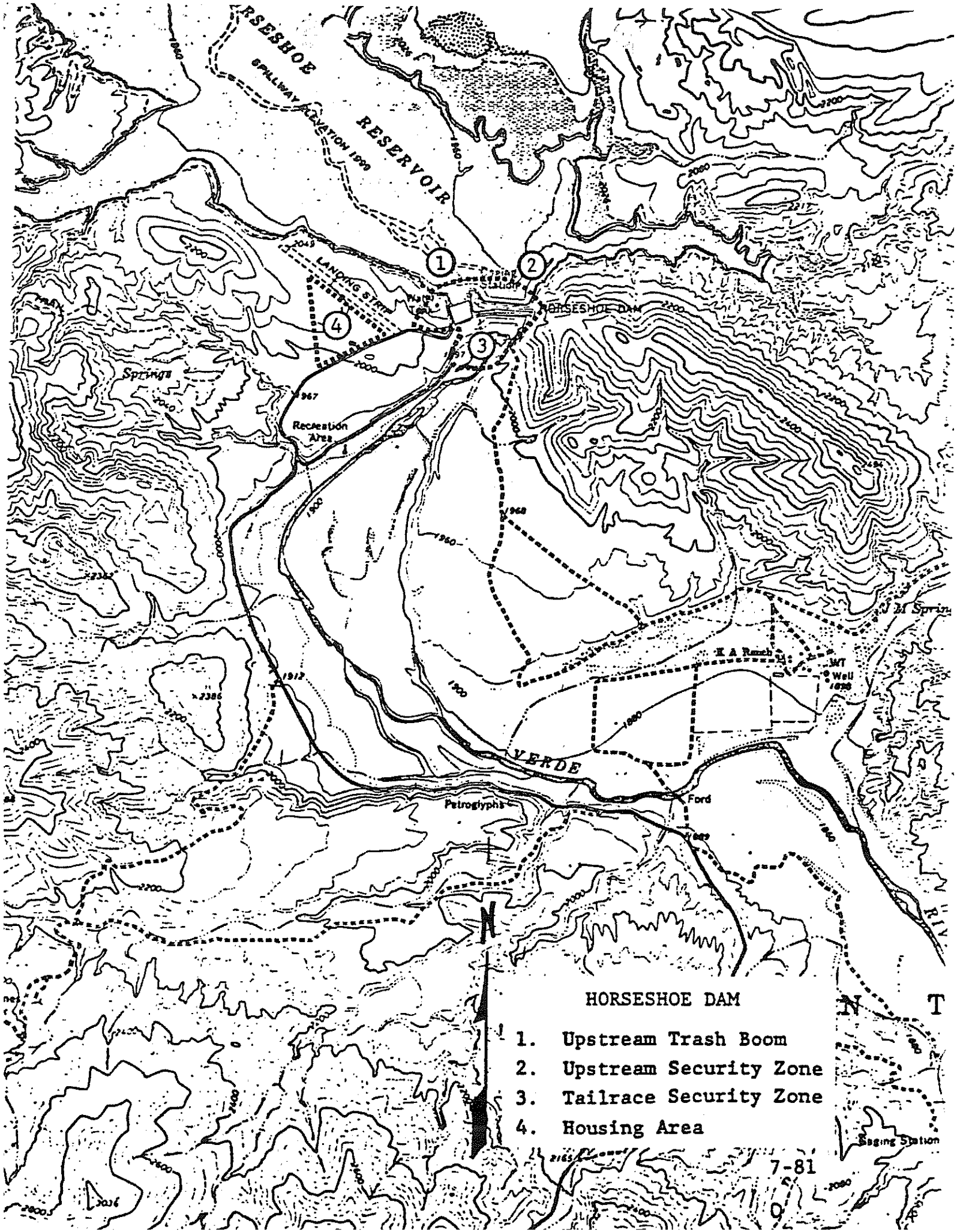
UNITED STATES BUREAU OF RECLAMATION

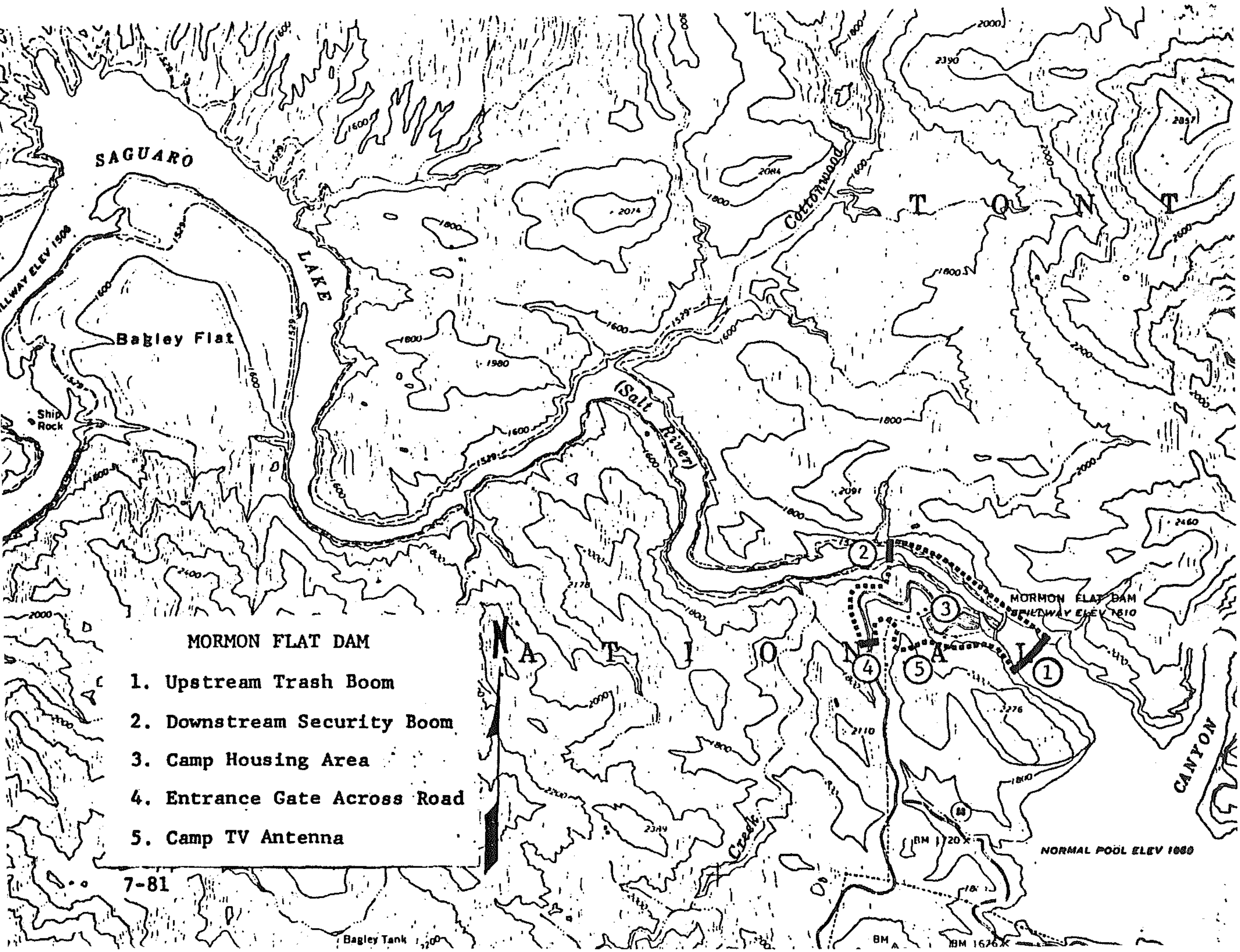
By _____
ACTING Regional Director

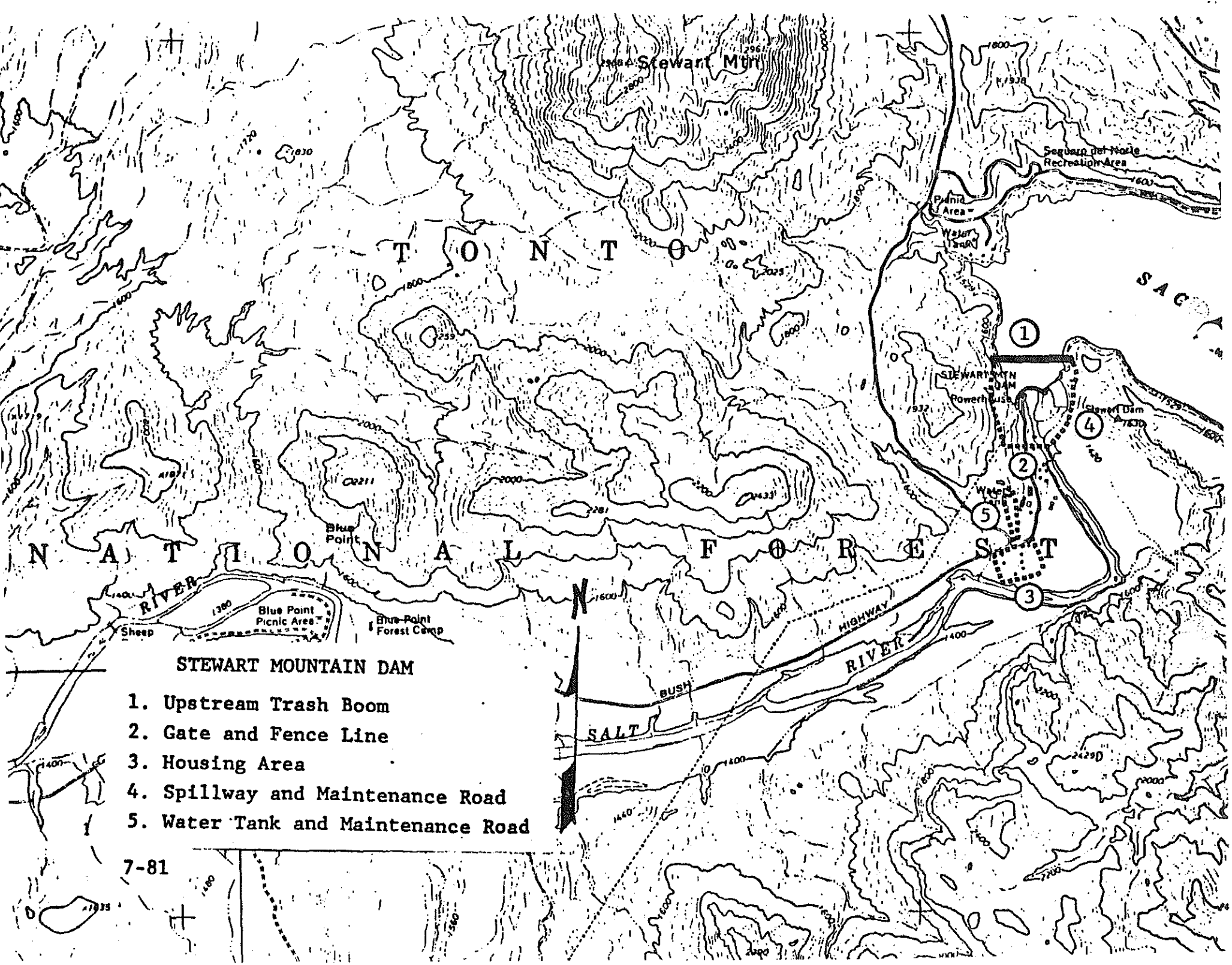

HORSE MESA DAM
1. Upstream Trash Boom
2. Downstream Safety Boom
3. Housing Area
4. Road to Housing Area
7-81
HORSE MESA DAM
SPILLWAY ELEV
LAKE
NORMAL POOL
ELEV 1660
Water Tank
Horse Mesa
SPILLWAY EL
(Salt River)
Horse Pastures Spring
CANYON
Black Cross Butte
Mesa
JEEP TRAIL
Wells Hip Pocket
N


FOREST
Rock Island
Government Hill
Radio Tower
Vineyard Mountain
SALT RIVER
ROOSEVELT DAM
1. Upstream Trash Boom
2. Downstream Security Boom
3. Housing Area
7-81


BARTLETT
SPILLWAY ELEVATION
Bartlett Dam
Gaging Station
Well
Corral
Water Tank
Water Tank
Well
RIVER
VERDE
Ford
Ford
F O R E S T
Spring
TRAIL
Creek
RIVER
N
BARTLETT DAM
1. Upstream Security Zone
2. Wing Dam and Access Strip
3. Gates and Fence Line
4. Domestic Water Tanks and Access Road
5. Bunk House
6. Operator Housing
7-81


RSESHOE
RESERVOIR
SPILLWAY ELEVATION 1999
LANDING STRIP
Pump Station
HORSESHOE DAM
Springs
Recreation Area
K A Ranch
WT Well
VERDE
Petroglyphs
Ford
Gaging Station
HORSESHOE DAM
1. Upstream Trash Boom
2. Upstream Security Zone
3. Tailrace Security Zone
4. Housing Area
N
7-81


SAGUARO
LAKE
Bagley Flat
Ship Rock
(Salt River)
Cottonwood
T O N T
N A T I O N A L
MORMON FLAT DAM
SPILLWAY ELEV 1810
NORMAL POOL ELEV 1660
CANYON
Creek
Bagley Tank
MORMON FLAT DAM
1. Upstream Trash Boom
2. Downstream Security Boom
3. Camp Housing Area
4. Entrance Gate Across Road
5. Camp TV Antenna
7-81


Stewart Mtn
T O N T O
N A T I O N A L F O R E S T
Sequoia del Norte Recreation Area
Picnic Area
Water Tank
SAGE
STEWART MTN DAM
Powerhouse
Spillway Dam
Water Tank
Blue Point
Blue Point Picnic Area
Blue Point Forest Camp
Sheep
RIVER
HIGHWAY
RIVER
BUSH
SALT
N
1
2
3
4
5
STEWART MOUNTAIN DAM
1. Upstream Trash Boom
2. Gate and Fence Line
3. Housing Area
4. Spillway and Maintenance Road
5. Water Tank and Maintenance Road
7-81

APPENDIX D

Air Sciences Inc. Air Quality Regulatory Constraints Associated with the Hewitt Canyon and Whitford Canyon Tailings Alternatives (September 13, 2019)

AIR SCIENCES INC.
DENVER • PORTLAND • LOS ANGELES

AIR QUALITY REGULATORY CONSTRAINTS ASSOCIATED WITH THE HEWITT CANYON AND WHITFORD CANYON TAILINGS ALTERNATIVES

PREPARED FOR: Kami Ballard & Vicky Peacey, Resolution Copper

PREPARED BY: Dave Randall

PROJECT NO.: 262-32

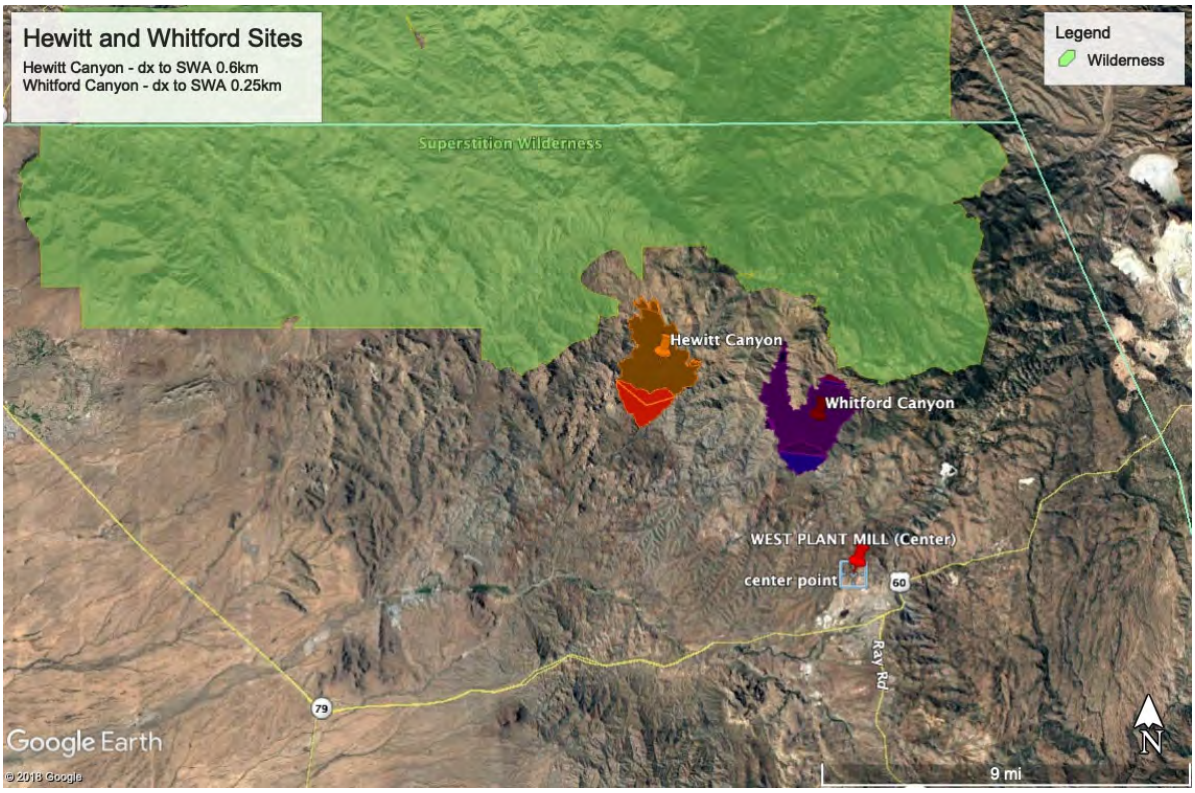
DATE: September 13, 2019

As part of the Section 404 of the Clean Water act practicability review , the U.S., Environmental Protection Agency (EPA) has asked for additional information pertaining to two tailings storage facility (TSF) alternatives called Hewitt Station (HC) and Whitford Canyon (WC) on Tonto National Forest adjacent to the Superstition Mountain Wilderness. This technical memorandum provides additional information on the air quality regulatory context associated with those two sites that would ultimately result in technology and/or logistical constraints rendering the facilities incapable of being built and impracticable. The following factors were key to the USDA – Forest Service, Tonto National Forest's (TNF) practicability determinations for these sites:

- The northern extent of the HC and WC footprints are essentially adjacent (less than 1 km) to the southern boundary of the Superstition Wilderness Area (SWA), a designated mandatory Class I airshed.
- The regulatory responsibilities of the TNF to preserve air quality in the SWA include stringent thresholds for pollutant impacts at the boundary of the SWA due to emissions from proposed projects.
- Due to the close proximity to a wilderness area boundary, there are no available TSF design options, construction methods, operational methods, or particulate matter control technologies available for the 1,300 million ton (approximately 4,000 acre) TSF to essentially eliminate the generation of dust due to construction, operation, and wind erosion.

Proximity of HC and WC to the SWA

Figure 1 shows the locations of the HC and WC sites at the boundary of the SWA. The northern extent of the footprints of these sites are well within 1 km of the southern boundary of the SWA.



Air Quality Protection in the SWA

The SWA is a designated mandatory Class I airshed that is managed by the TNF. The TNF's broad responsibilities under the National Environmental Policy Act (NEPA) to address air quality impacts from proposed projects are largely driven by the Clean Air Act (CAA) which:

1. Protects human health and welfare with National Ambient Air Quality Standards (NAAQS).
2. Sets a national visibility goal in mandatory Class I airsheds of no human-caused impairment which was further defined through the 1999 Regional Haze Rule.
3. Establishes the Prevention of Significant Deterioration (PSD) of Air Quality Related Values program for review of new pollution sources.

Over several decades, the USDA – FS, other federal land managers (FLMs), and EPA have developed policy and guidance to which TNF refers to fulfill its responsibilities under these air quality regulatory programs. The level of protection of air resources in the SWA that the above

mentioned regulatory programs require and pertinent policy and guidance were deciding factors in the TNF's rationale to not carry the HC and WC TSF alternatives forward for detailed analysis (USFS DEIS, August 2019) . Decisions on facility location, design, operating methods, emission controls, and best management practices have all been influenced by the project's proximity to the SWA. It remains a priority to design, develop, and operate the project so that the TNF can continue to fulfill its obligations to protect air quality in the SWA.

Practicability Assessment of HC and WC Sites

In the practicability assessment of many candidate sites for the TSF, TNF concluded that the proximity of the HC and WC sites to the SWA and the unique air quality protection standards applicable to the SWA made these sites logistically impracticable for further consideration as locations for the TSF. The conclusion of the holistic review given the context of the Clean Air Requirements was that no level of design, construction, technology, operational methods, or air pollution controls could essentially eliminate particulate matter emissions due to material handling and wind erosion at the HC or WC TSF. TNF found that these alternative sites, even if well operated and controlled to industry standard, were so close to the SWA boundary that approving the project and fulfilling its obligations to protect air resources in the SWA would be incompatible. The HC and WC alternative TSF sites therefore failed TNF's practicability assessment and were removed from further consideration.

Applicability of Using Emissions Offsets to Mitigate Air Quality Impacts to the SWA

EPA has requested written confirmation from Pinal County Air Quality Control that potential air quality impacts to the SWA could not be addressed using emission offsets. The bullet points below summarize the permitting rules for which emission offsets may be required. These permitting rules do not accommodate the use of emission offsets to address potential impacts to air quality in Class I airsheds. An email (August 22, 2019) from Michael Sundblom, Director Pinal County Air Quality Control, confirms this summary and is provided as an attachment to this memo.

- Emissions offsets are part of the New Source Review (NSR) permitting process. (In Pinal County's local SIP-approved NSR rules, offsets are addressed at 3-3-230.)
- The NSR emissions offsets provisions apply to new major sources or major modifications to existing sources where the area the source is located in is in nonattainment with the NAAQS.
- Offsets are emission reductions obtained from existing sources located in the vicinity of a proposed source (and within the allowable offset area, usually within the nonattainment area).

- The purpose for requiring offsetting emissions decreases is to allow an area to move toward attainment of the NAAQS while still allowing industrial growth.

In summary, unlike in non-attainment areas where proposed sources can be required to obtain pollutant offsets to mitigate permitted increases in emissions, there is no such regulatory context or authority allowing offsetting of emissions (or air quality impacts) within a Class I area.

From: Michael Sundblom [mailto:Michael.Sundblom@pinalcountyaz.gov]
Sent: Thursday, August 22, 2019 8:37 AM
To: Ballard, Kami (RC) <Kami.Ballard@riotinto.com>
Subject: RE: PM10 Offsets

Kami,

It is my understanding that the "Offset" regulatory approach applies to major source air quality permitting in areas that do not attain a NAAQS.

In our local SIP approved NSR rules, offsets are addressed at *3-3-230, "Offset and net air quality benefit standards"* and apply in areas that do not attain a criteria pollutant NAAQS. In practice offsets for the nonattainment pollutant (equal to or greater than the permitted emissions) would be required by a source attempting to permit a major source. As an example, in a moderate PM10 nonattainment area a source with emissions greater than 100tpy would be subject to the offset provisions and would be required to offset all the permitted emissions of PM10.

I'm not familiar with a similar regulatory approach for emissions impacting a Class I area.

Please let me know if you would like to discuss further.

Mike

From: Ballard, Kami (RC) [mailto:Kami.Ballard@riotinto.com]
Sent: Wednesday, August 21, 2019 2:48 PM
To: Michael Sundblom <Michael.Sundblom@pinalcountyaz.gov>
Subject: PM10 Offsets

Hi Mike,

Is it possible to use offsets to mitigate impacts to a Class I area or is the offset program specific to non-attainment areas under the NSR program of the Clean Air Act?

Thank you,

Kami Ballard
Environmental & Permitting Advisor – Resolution Copper

102 Magma Heights
Superior, AZ 85173, United States
T: +1 520.689.3418
Kami.ballard@riotinto.com www.resolutioncopper.com

APPENDIX E

WestLand Resources, Inc. Resolution Copper Project BGC B Tailings Storage Facility Revised Alternatives Discussion (April 13, 2020)

RESOLUTION COPPER PROJECT BGC B TAILINGS STORAGE FACILITY ALTERNATIVE DISCUSSION

Prepared for: U.S. Army Corps of Engineers *on behalf of* Resolution Copper

Prepared by: WestLand Resources, Inc.

Date: April 13, 2020

Project No.: 0807.175 02 02

TABLE OF CONTENTS

FIGURES

(follow text)

1. INTRODUCTION

The United States Forest Service (USFS) Tonto National Forest (TNF) has published a Draft Environmental Impact Statement (DEIS; USDA 2019) for the purpose of reviewing the Resolution Copper Mining, LLC (Resolution) revised General Plan of Operations (GPO) under the National Environmental Policy Act (NEPA). In the DEIS, the Skunk Camp tailings storage facility (TSF) was identified as the preferred TSF alternative. As proposed, the Skunk Camp TSF and its associated pipelines and appurtenant TSF infrastructure for the planned mine development requires the discharge of fill to approximately 124 acres of drainage features that the U.S. Army Corps of Engineers (Corps) is anticipated to determine to be potentially jurisdictional waters of the United States (waters of the U.S.) pursuant to a preliminary jurisdictional determination (PJD). Based on the presumption that potentially jurisdictional waters of the U.S. will be impacted by discharges of dredged or fill material resulting from these portions of Resolution's planned mine development, Resolution made an application for a Clean Water Act (CWA) Section 404 permit for these discharges. The DEIS included as Appendix C a draft Practicability Analysis document (WestLand 2019c) containing an analysis of alternative TSF sites as required to demonstrate compliance with guidelines established under CWA Section 404(b)(1) (40 CFR § Part 230; the Guidelines) for avoidance, minimization, and mitigation of impacts to waters of the U.S. Chief among the Guidelines process is the evaluation of "available and practical" alternatives, and the selection of the Least Environmentally Damaging Practicable Alternative (LEDPA). The evaluation of alternatives closely followed the format of the NEPA evaluation of alternatives in the TNF DEIS.

After review, discussion, and workgroup meetings with the TNF, the Corps, and the Environmental Protection Agency (EPA), portions of the Practicability Analysis were revised to ensure the evaluation of alternatives undertaken therein conformed to the requirements of an analysis of alternatives under the Guidelines. The revised alternatives discussion was reviewed with the agencies and Resolution at Workgroup Meeting #2 on August 21, 2019 and at Workgroup Meeting #4 on October 16, 2019. Additional information on some of the evaluated alternatives was provided by Resolution and the agencies to support the analysis, and WestLand Resources, Inc. (WestLand), captured this information in a technical memorandum (WestLand 2020). The purpose of this document is to expand upon the information provided in the previous technical memorandum regarding TSF Alternative BGC B and the decision and underlying rationale to dismiss this alternative from further analysis before the final CWA Section 404(b)(1) Alternatives Analysis document is published with the Final EIS.

2. BACKGROUND ON FORMULATION OF PROJECT ALTERNATIVES

The TNF and cooperating agencies (including the Corps)[1] utilized information gathered from public scoping, government-to-government consultation with Native American groups, and alternatives workshops to identify public values and develop screening criteria used to evaluate the alternative TSF locations and designs in the DEIS. Most of these alternatives, and the methodology for identifying them, were discussed in detail in the *Resolution Copper Project and Land Exchange Environmental Impact Statement DRAFT Alternatives Evaluation Report, November 2017* (SWCA 2017) and *Appendix F: Alternatives Considered but Dismissed from Detailed Analysis* of the DEIS (USDA 2019). The draft Practicability Analysis document (WestLand 2019c) was designed to be consistent with, and relied on, the detailed analysis of TSF alternatives contained in these documents to support the selection of the alternatives analyzed in detail for compliance with the Guidelines.

As described in the draft Practicability Analysis (WestLand 2019c), the USFS evaluated the landscape surrounding the Resolution mine to identify initial potential alternative locations for the TSF described in the GPO. Factors considered in this evaluation included locations within a reasonable proximity to the Resolution mine site, favorable topography, sufficient storage capacity, and the potential for use of previously disturbed, or 'brownfield', sites for TSF development. The potential use of multiple sites for the placement of tailings, or split volume storage, was also evaluated.

During this process, the USFS systematically evaluated dozens of potential TSF locations (**Figure 1**). The evaluation criteria included locations that were within a reasonable proximity to mine and the West Plant Site, sites that avoided landscape barriers such as mountains or rivers, sites outside rugged terrain too steep for TSF development, and sites potentially near existing or historic mining operations. Resolution Copper's feedback was informed by input from the Resolution Copper Independent Tailings Review Board (ITRB).

Section 3.3 of the draft Practicability Analysis document (WestLand 2019c) analyzed these alternatives as required to demonstrate compliance with the Guidelines. Based on discussion with the agencies at Workgroup Meeting #4 and additional information received by WestLand, edits were made to Table 2 and *Section 3* as presented in the draft Practicability Analysis document (WestLand 2019) to support the additional analysis. Sixteen (16) TSF alternatives were dismissed from further consideration and included in Table 2. Among the alternatives dismissed was TSF alternative BGC B.

[1] Henceforth in this document, references to the USFS in the context of development of the DEIS should be understood to include the agencies cooperating in the development of that document, including (but not limited to) the Corps.

3. TSF ALTERNATIVE BGC B

3.1. DESCRIPTION

TSF Alternative BGC B (BGC B) is located in Pinal County, Arizona, on lands administered by the Bureau of Land Management (BLM) and Arizona State Land Department (ASLD) (**Figure 1**). BGC B is situated approximately 20 miles southwest of the West Plant Site, which is described in the draft EIS as the location from which the tailings will ultimately be transferred to the TSF. Notable landscape features between the West Plant Site and BGC B include U.S. Highway 60 and the Gila River (**Figure 1**). Notable landscape features that occur within the BGC B footprint include portions of the paved E Florence-Kelvin Highway and the unpaved Whitlow Ranch Road (**Figure 2**). A rural residential community is present adjacent to BGC B, near the southwest corner of the site.

WestLand conducted a desktop evaluation of the BGC B site and identified approximately 124 acres of drainage features within the BGC B footprint (**Figure 2**). Based on the characteristics of these drainages and their proximity to the Gila River, it is likely that the drainages would qualify as waters of the U.S. subject to Corps' jurisdiction. Important to note is that the linework depicted in **Figure 2** reflects only the BGC B footprint and does not include associated pipelines and other appurtenant TSF infrastructure.

3.2. DISMISSAL FROM FURTHER ANALYSIS

As stated in **Section 1**, development of the Skunk Camp TSF would result in approximately 124 acres of impacts to potential waters of the U.S. The BGC B footprint alone contains approximately 124 acres of potential waters of the U.S. (**Figure 2**). The addition of pipelines and development of other appurtenant TSF infrastructure to BGC B would result in additional impacts, i.e. BGC B entails more impacts to potential waters of the U.S. than the Skunk Camp TSF. Additionally, the Florence-Kelvin Highway, which bisects the southern portion of the BGC B footprint (**Figure 2**) would require a substantial reroute which would add considerably more impacts.

The Skunk Camp TSF is located approximately 15 miles southeast of the West Plant Site, and a tailings pipeline between the two sites would not cross the Gila River. Conversely, BGC B is located 20 miles southwest of the West Plant site, and a tailings pipeline between BGC B and the West Plant site would necessarily cross the Gila River. Development of a tailings pipeline across the Gila River would likely require impacts to waters of the U.S. at that location and potentially impact species listed as threatened or endangered by the U.S. Fish and Wildlife Service under the Endangered Species Act, including southwestern willow flycatcher and yellow-billed cuckoo, which utilize the Gila River between Kearny and Florence for breeding and/or a migration travel corridor (WestLand 2016a, 2016b, 2019a, b).

The higher acreage of impacts to potential waters of the U.S. compared to Skunk Camp and the potential environmental consequences of constructing and operating a tailings pipeline across the Gila River preclude BGC B from consideration as the LEDPA. BGC B is therefore dropped from further consideration as a viable TSF site and will not be analyzed in detail in the Final Environmental Impact Statement.

4. REFERENCES

SWCA Environmental Consultants. 2017. Resolution Copper Project and Land Exchange Environmental Impact Statement DRAFT Alternatives Evaluation Report. Tonto National Forest U.S. Forest Service. Phoenix, Arizona: U.S. Department of Agriculture. November 2017.

U.S. Department of Agriculture. 2019. DRAFT Environmental Impact Statement Resolution Copper Project and Land Exchange. Tonto National Forest. Phoenix, Arizona: U.S. Forest Service. August 1, 2019.

WestLand Resources, Inc. 2016a. 2016 Southwestern Willow Flycatcher Survey: Middle Gila River from Upstream of the Kelvin Bridge to Downstream of Zelleweger Wash, Pinal County, Arizona. *Prepared for Asarco LLC - Ray Mine Operations*. Tucson, Arizona: WestLand Resources, Inc. October 25, 2016.

_____. 2016b. 2016 Yellow-Billed Cuckoo Survey Portions of the Middle Gila River, Pinal County, Arizona. *Prepared for Asarco LLC*. Tucson, Arizona: WestLand Resources, Inc.

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_____. 2019c. DRAFT Practicability Analysis in Support of Clean Water Act 404(b)(1) Alternatives Analysis. *Prepared for U.S. Army Corps of Engineers on behalf of Resolution Copper*. Tucson, Arizona: WestLand Resources, Inc. June 2019.

_____. 2020. Resolution Copper Project Revised Alternaives Discussion. *Prepared for the U.S. Army Corps of Engineers on behalf of Resolution Copper*. Tucson, Arizona: WestLand Resources, Inc. January 21, 2020.

FIGURES

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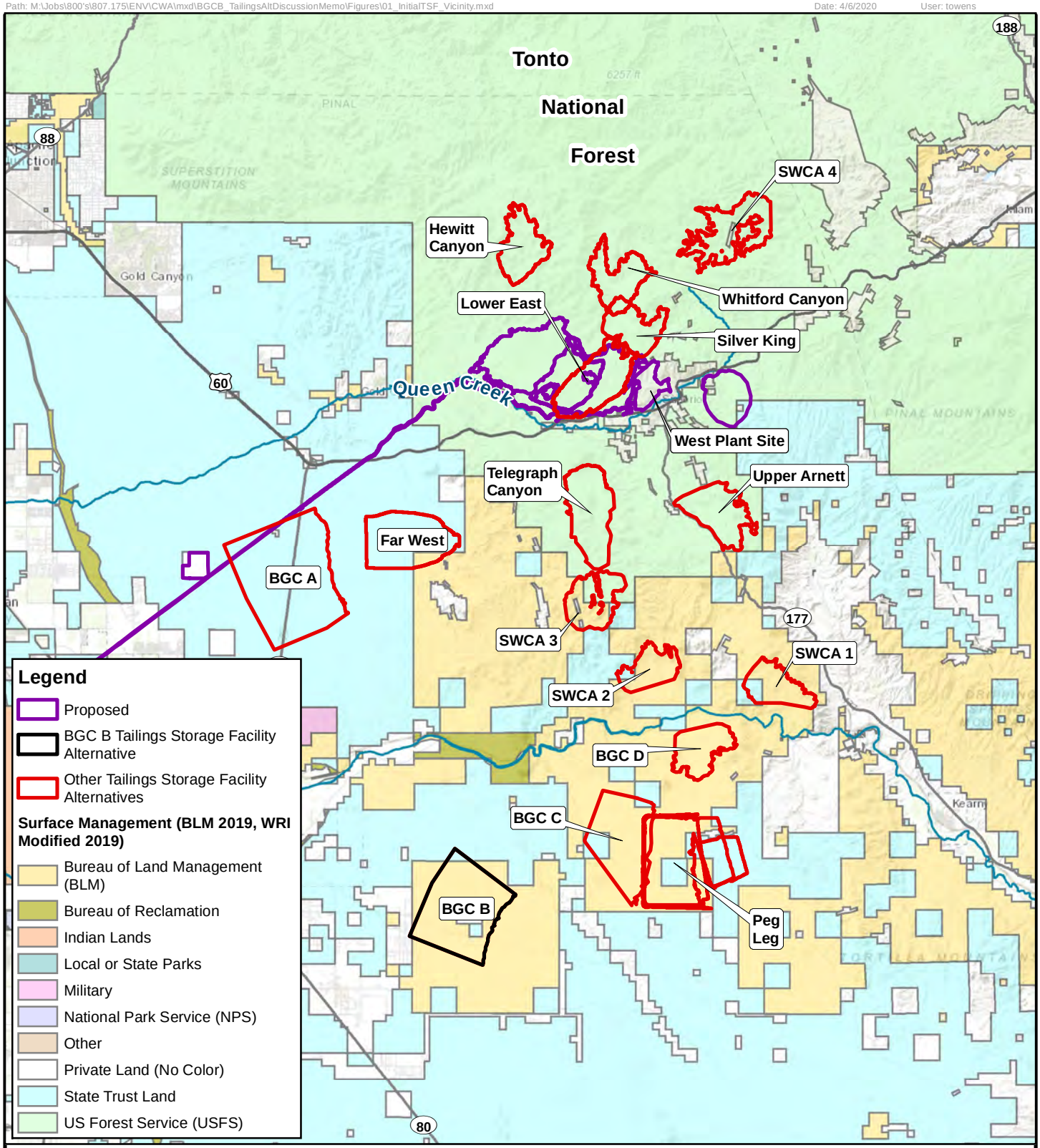

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RESOLUTION COPPER

BGC B Tailings Storage Facility Alternative Discussion

VICINITY MAP

Figure 1

WestLand Resources

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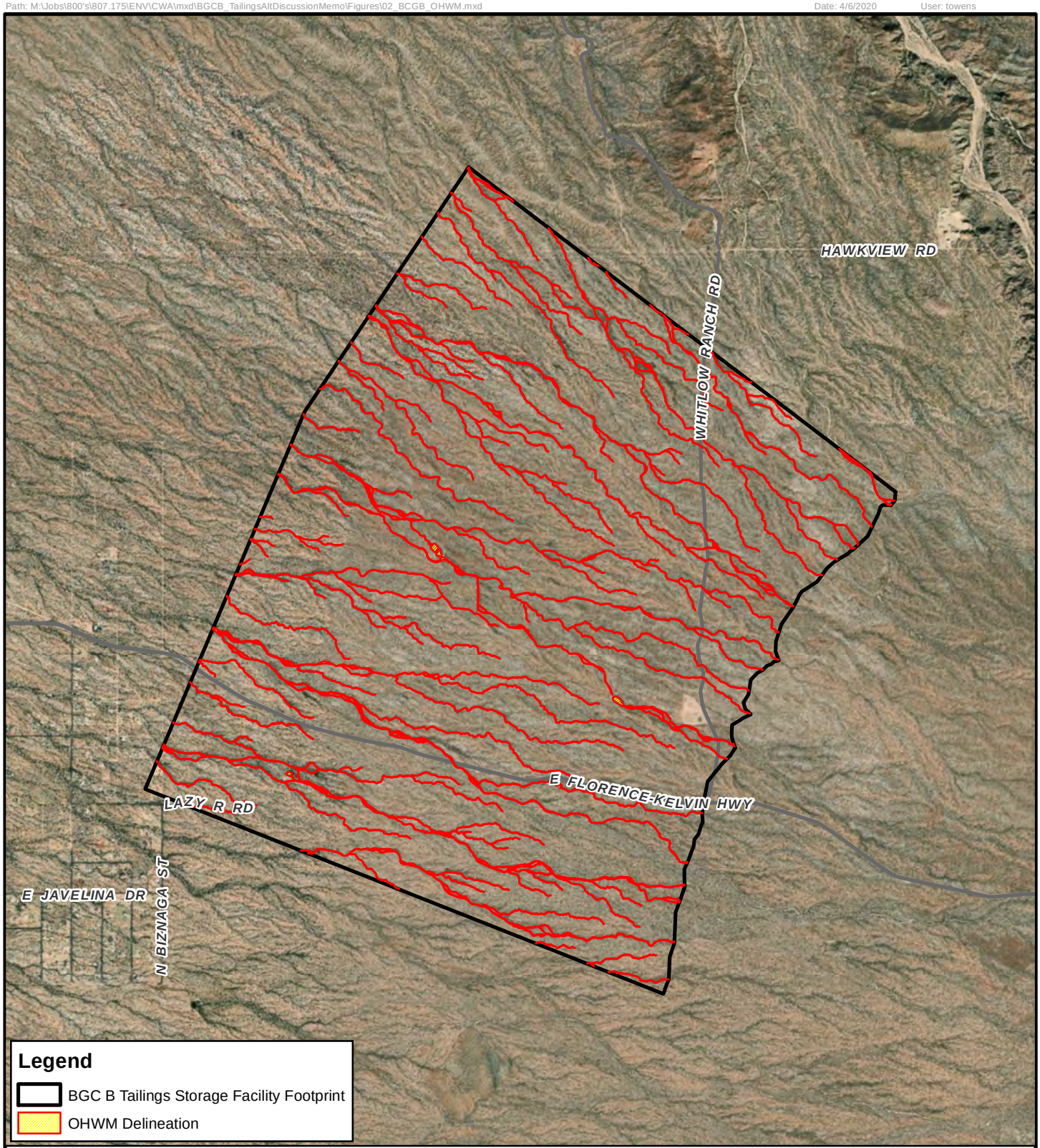

T4S, R11E, Portions of Sections 32 and 33,
T5S, R10E, Portion of Section 13,
T5S, R11E, Portions of Sections 3-11, 15-22, 27, and 28,
Pinal County, Arizona
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RESOLUTION COPPER

BGC B Tailings Storage Facility
Alternative Discussion

BGC B OHWM DELINEATION

Figure 2

WestLand Resources

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0 2,000 4,000 Feet

0 1,000 2,000 Meters

APPENDIX F

KCB Consultants Ltd. Resolution Copper Project Skunk Camp Tailings Storage Facility Filtered Tailings Analysis, Conceptual Filtered Tailings Impoundment Layout and Staging (January 17, 2020)

KCB Consultants Ltd.

January 17, 2020

Resolution Copper Mining LLC
P.O. Box 1944
Superior, Arizona
85273

Ms. Victoria Peacey
Senior Manager – Permitting and Approvals

Dear Ms. Peacey:

Resolution Copper Project
Skunk Camp Tailings Storage Facility Filtered Tailings Analysis
Conceptual Filtered Tailings Impoundment Layout and Staging
Doc. # CCC.03-81600-EX-LTR-00010 – Rev. 1

1 INTRODUCTION

KCB Consultants Ltd. (KCBCL) presented considerations for the application of filtered tailings for the Resolution Copper Project at the Skunk Camp site on September 3, 2019 to the Resolution 404 Workgroup during their Meeting #3. During this meeting, EPA representatives requested an action item for Resolution Copper Mining LLC (RCM) to review options to transition from a conventional slurry tailings storage facility (TSF) to a filtered tailings stack to assess whether filtered tailings disposal (if feasible) could reduce the footprint of the Skunk Camp TSF. The purpose of transitioning from a conventional facility to a filtered tailings facility is to allow adequate time for the possible successful development of this technology at the scale of the Resolution Copper Project.

A follow-up meeting was held on October 16, 2019 to review results of the assessment.

This technical letter presents two conceptual options for transitioning from conventional slurry deposition for Non-Potentially Acid Generating (NPAG) scavenger tailings (in early years) to filtered tailings (in later years) for the proposed Skunk Camp site, assuming that filtered tailings disposal has already demonstrated to be feasible at the scale of the Resolution Copper Project.

Key objectives of the conceptual options are to:

- manage the Potentially Acid Generating (PAG) pyrite tailings by depositing the tailings subaqueously in segregated lined cells and physical isolated behind a downstream embankment;
- manage the NPAG scavenger tailings by:
  - conventional slurry placement (cycloning and thickening), as included in the Draft Environmental Impact Statement (DEIS) (USFS 2019) for the first 10-15 years;

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2 North Central Avenue, 18th Floor • Phoenix Arizona 85004 • USA
t 602.283.1006 • www.kcbconsultants.com

- filtered tailings stacking for the years that follow to the end of operations; and

- provide required tailings and design storm storage volumes (72-hr PMF) to meet the project's design criteria.

2 CONSIDERATIONS FOR FILTERED TAILINGS FOR THE RESOLUTION PROJECT

- Processing, transport and placement:
  - Filter plant and transport (e.g. conveyors) for project would be precedent setting as there are currently no filtered tailings operations in the world at tonnage rates higher than 30,000 tons per day (tpd). Most filtered tailings operate at 1,000 tpd to 10,000 tpd in flatter areas and/or where adequate backup storage is available. The management approach has only been tried and proven at these lower production rates and has not been proven or commercially available at the scale of the Resolution Copper proposed mine (> 120,000 tpd).
  - There is only one example of a filtered tailings facility that has a production above 20,000 tpd, Karara as referenced from EPA. Karara Mining Limited in Western Australia is operating a filtered stack at 30,000 metric tonnes per day in a very arid environment in flat terrain (Amoah 2019). The project still requires back-up slurry storage as well as back-up transportation methods. Given the Resolution project is an order of magnitude larger in scale and located in mountainous terrain, following the same approach as Karara, additional contingency (e.g., filter presses, slurry storage, etc.) should be incorporated into the design along with back up slurry storage.
- Storm water management for filtered piles:
  - Surface of the filtered tailings would be sloped such that storm water would not pond on the pile to maintain as dry a surface as possible and not re-wet the tailings, directing surface runoff to designated collection areas, so it can be pumped into the pyrite cell.
- Seepage management:
  - Filtered tailings would produce less seepage into the foundation than the wet tailings options. However, seepage would still need to be managed.
- Dust management:
  - Filtered tailings would be deposited "dry" in windrows from a walking stalker conveyor, spread and compacted in place. The dry filtered tailings are susceptible to dusting prior to compaction (and potentially require temporary covers), so the tailings should be compacted with a smooth drum roller as soon as possible after deposition. Due to the production or pace at which the filtered tailings are placed, the risk of dust during wind events and not meeting air quality requirements would be high and likely more frequent than at a thickened tailings facility. This would result in increased requirements for protection of the tailings surface from dust generation.

- Transportation:
  - Filtered tailings would be transported from the Filter Plant to the TSF on conveyors. Conveyors need gradual slopes/terrain and simple deposition geometry for reliable operations and consistent deposition, as they need to move continuously and "walk" over the terrain while depositing. This is particularly important on the outer structural zone to ensure stability and prevent risk of tailings failure. The more complex the topography and deposition plan, the higher the risk of not meeting construction and operational requirements, requiring re-handling, back-up storage and/or alternate placement.

3 DEPOSITION STRATEGY AND STAGING

3.1 General

Assuming filtered technology can be successfully developed and is commercially available for the Resolution Copper scale and environment, for the first 10-15 years of operations, scavenger tailings and pyrite tailings would be managed with cycloning and thickening for the scavenger tailings, similar to the design presented in the DEIS. From Year 10 or 15 onwards, the pyrite tailings would continue to be managed behind a full downstream embankment and under a water cover to prevent and minimize oxidation and risk of acid rock drainage, but the scavenger tailings would be filtered and stacked. The following relevant key features are maintained from the DEIS design:

- Upstream non-contact water would be diverted as much as practical.
- The pyrite tailings would be stored in two pyrite cells within the ultimate impoundment; both cells would eventually be encapsulated by the scavenger tailings. The pyrite cells embankments would be constructed in the downstream-raised methodology using the scavenger tailings (either cyclone sand and/or filtered tailings). The pyrite cell would include an engineered low-permeability layer for vertical and lateral hydrologic containment.
- Ultimately, the scavenger tailings would be impounded by a cross-valley, centerline-constructed, structural shell (constructed of cycloned sand or filtered tailings - referred to as the main embankment in the DEIS).

3.2 Conceptual Options to Transition to Filtered Tailings

Operationally, raising filtered tailings stacks around or on top of existing conventional tailings storage facilities presents challenges related to trafficability and constructability. For this reason, two highly conceptual options for transitioning to filtered tailings were developed for this analysis.

Option 1 (see Figure 1)

For the first 15 years:

- Scavenger tailings would be cycloned to produce cyclone sand for embankment construction.

- Pyrite tailings would be subaqueously deposited in a low-permeability lined cell in the north of the site, contained by a downstream raised cycloned sand dam.
- Uncycloned scavenger tailings and cyclone overflow would be deposited in a cell on the east side of the site, contained by a centerline raised cycloned sand dam.

For the remainder of the life of mine:

- Scavenger tailings would be filtered and stacked in the south of the site. A portion of the tailings would be used for structural zones that contain the pyrite tailings or the ultimate downstream slope of the ultimate TSF.
- Pyrite tailings would continue to be subaqueously deposited in a low-permeability lined cell in the north of the site and then within the center of the impoundment, contained by a downstream raised filtered scavenger tailings structural zone.

Option 2 (see Figure 2)

For the first 10 years, the TSF would be constructed in the same configuration proposed in the DEIS:

- Scavenger tailings would be cycloned to produce cyclone sand for embankment construction.
- Pyrite tailings would be subaqueously deposited in a low-permeability lined cell in the Pyrite Cell 1 (from the DEIS design), contained by a downstream raised cycloned sand dam.
- Uncycloned scavenger tailings and cyclone overflow would be deposited in the south of site, contained by a centerline raised cycloned sand dam (which will form the base of the Main Embankment).

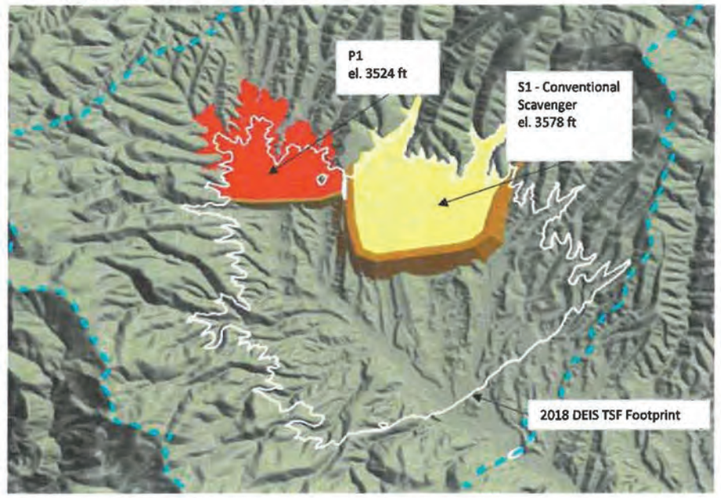
For the next 10 years (Year 10 to Year 20):

- Scavenger tailings would be filtered and stacked in the north and east of the site. The Year 0-10 scavenger tailings cell would need to be allowed to drain in order to be trafficable prior to stacking filtered tailings on top. A portion of the tailings would be used for structural zones that contain the pyrite tailings.
- Pyrite tailings would continue to be subaqueously deposited in DEIS Pyrite Cell 1, then the DEIS Pyrite Cell 2 (starting in Year 15), a low-permeability lined cell within the center of the impoundment, contained by downstream-raised dams (constructed from filtered scavenger tailings). Pyrite Cell 1 would be covered with scavenger tailings (either slurry or filtered tailings).

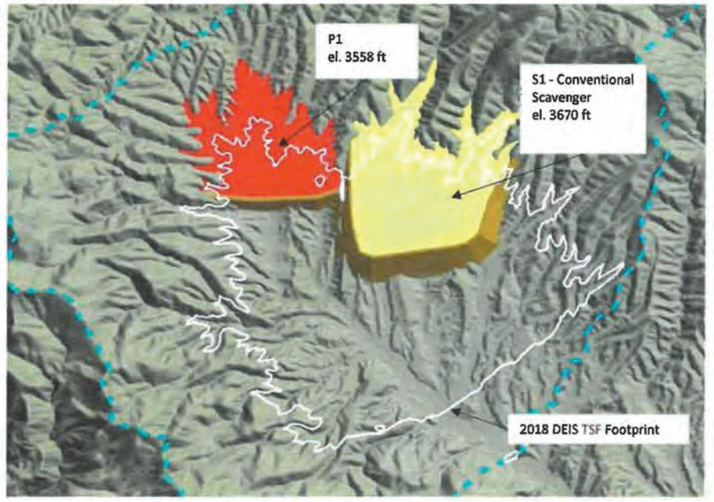
For the remainder of the life of mine:

- Scavenger tailings would be filtered and stacked in the south of the site (a top the conventional Year 0-10 scavenger tailings cell). A portion of the tailings would be used for structural zones that contain the pyrite tailings or the ultimate downstream slope.
- Pyrite tailings would continue to be subaqueously deposited in Pyrite Cell 2 within the center of the impoundment, contained by a downstream raised filtered scavenger tailings structural zone.

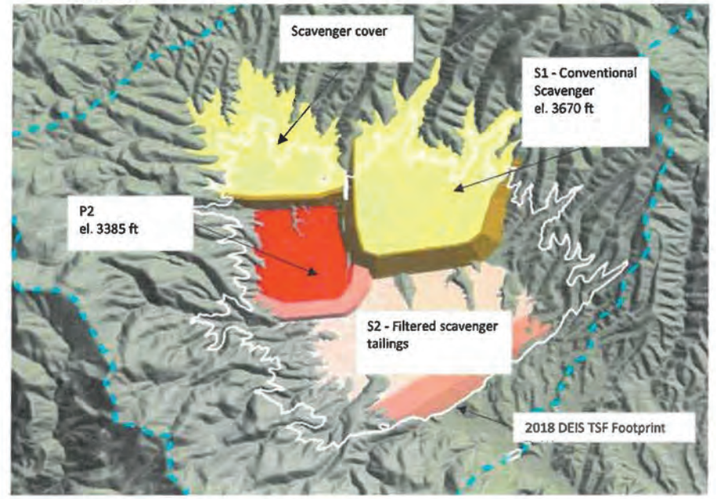
YEAR 10



YEAR 15



YEAR 20



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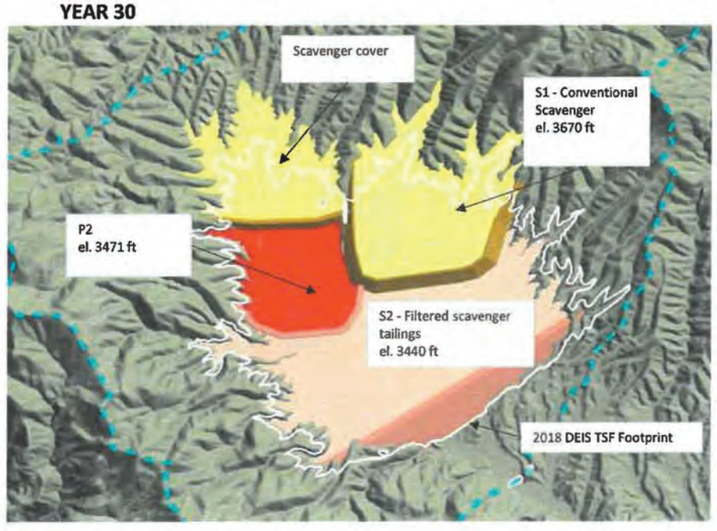
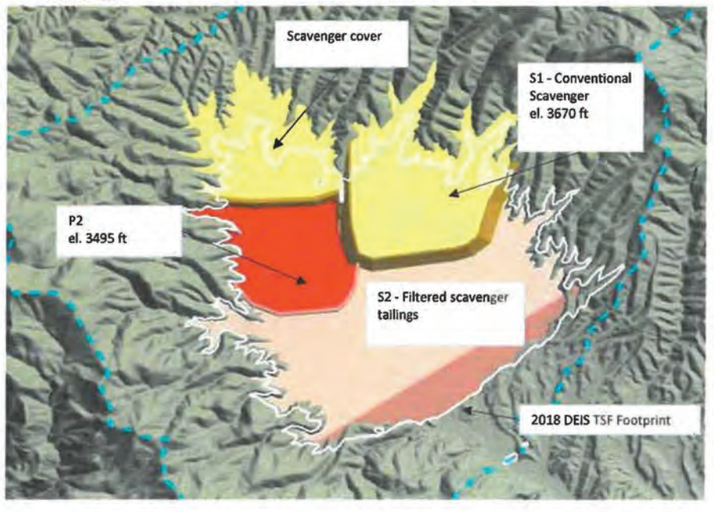


YEAR 41



LEGEND	
	SCAVENGER TAILINGS (CYCLONE OVERFLOW/TOTAL TAILINGS)
	PYRITE TAILINGS
	CYCLONED SAND EMBANKMENT
	FILTERED SCAVENGER TAILINGS (NON-STRUCTURAL)
	FILTERED SCAVENGER TAILINGS (STRUCTURAL)
	TOTAL TSF CATCHMENT AREA

NOT FOR CONSTRUCTION

TO BE READ WITH KCB CONSULTANTS LTD. REPORT DATED JANUARY 2020

CLIENT: RESOLUTION COPPER

KCB Consultants Ltd.

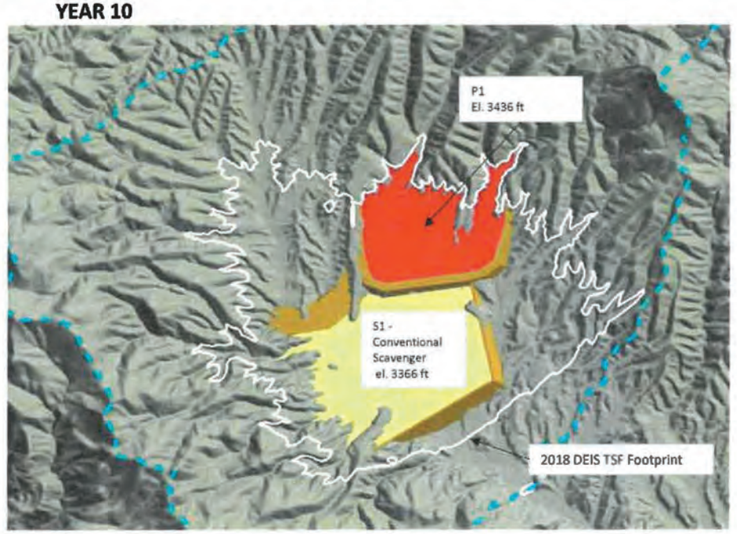
PROJECT: RESOLUTION COPPER PROJECT
404 WORKING GROUP ACTION ITEMS

TITLE: FILTERED TAILINGS OPTION 1: TAILINGS STAGING SUMMARY

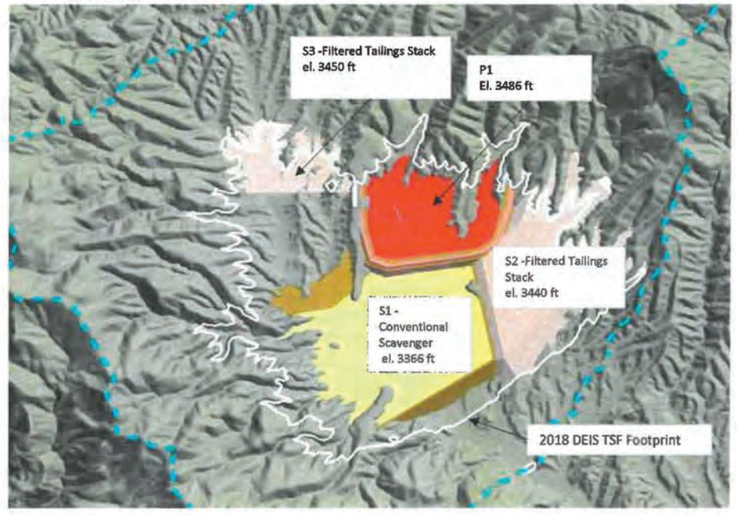
PROJECT No.: UM09441A22

FIG No.: 1

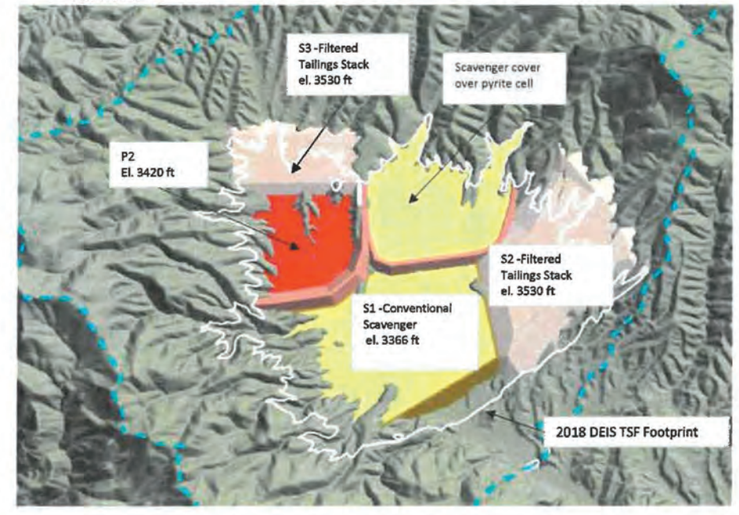
YEAR 10



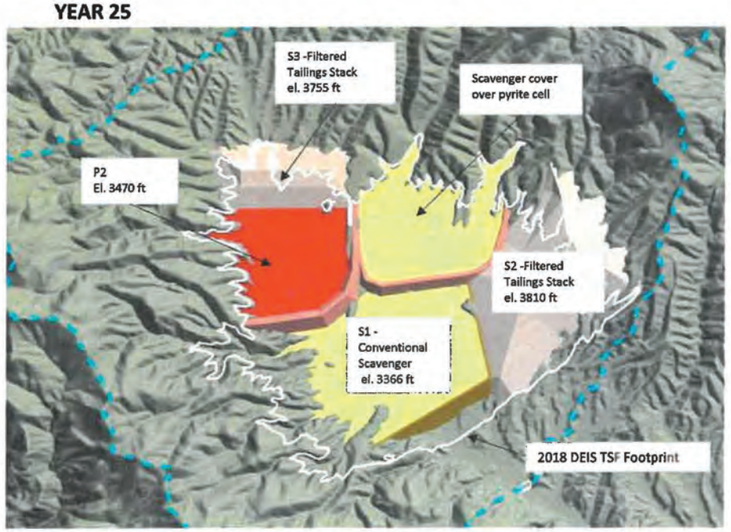
YEAR 15



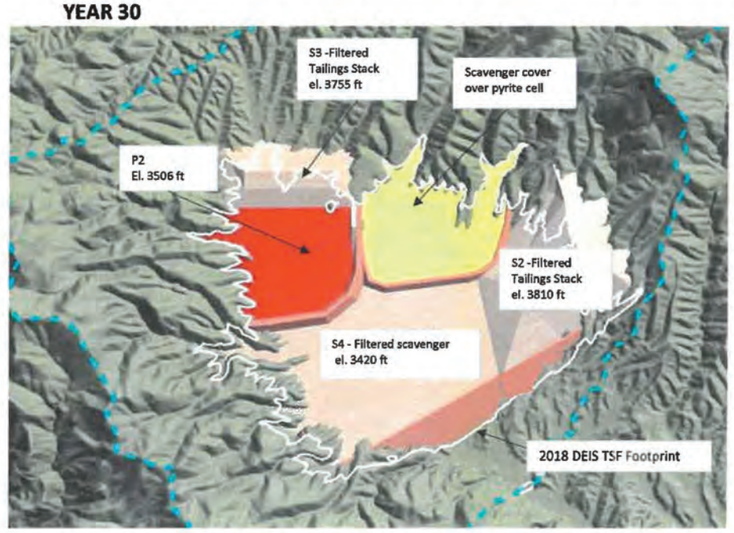
YEAR 20



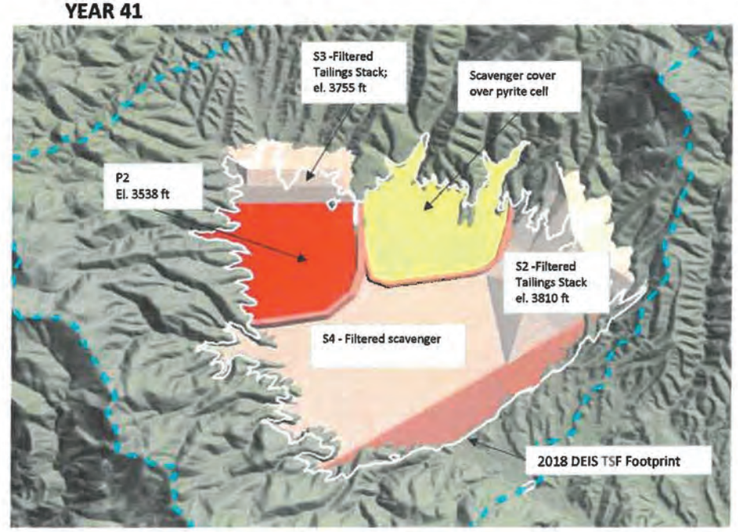
YEAR 25



YEAR 30



YEAR 41



LEGEND

- SCAVENGER TAILINGS (CYCLONE OVERFLOW/TOTAL TAILINGS)
- PYRITE TAILINGS
- CYCLONED SAND EMBANKMENT
- FILTERED SCAVENGER TAILINGS (NON-STRUCTURAL)
- FILTERED SCAVENGER TAILINGS (STRUCTURAL)
- TOTAL TSF CATCHMENT AREA

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PROJECT: RESOLUTION COPPER PROJECT
404 WORKING GROUP ACTION ITEMS

TITLE: FILTERED TAILINGS OPTION 2: TAILINGS STAGING SUMMARY

PROJECT No. UM09441A22

FIG No. 2

4 SUMMARY OF RESULTS AND CONCLUSIONS

Both options presented would have a larger footprint than the DEIS TSF and may need additional back-up storage than what has been considered at this stage. Placement of filtered tailings at this scale would need large flat areas for conveyor placement which could be challenging given the complex and rough terrain of the site, particularly for Option 2 (see Figure 2). Based on learnings and experience from existing operations that attempted to increase capacity at a much smaller production tonnage than Resolution Copper, ample back-up storage would be required to address the risk of problems during construction and operations.

A summary of the results for both the options are included from Table 4.1 to Table 4.5. A qualitative comparison on the ease of transitioning of the two options is provided in Table 4.7.

Table 4.1 Option Tonnage Comparison

Stage	Mine Years	Scavenger Tailings (MTons)				Pyrite Tailings (MTons)	
		Cyclone Sand2	Total Scavenger or Overflow	Filtered Tailings		Pyrite Cell 1	Pyrite Cell 2
				Structural	Non-structural		
OPTION 1 (i.e. separate NPAG cell for Year 0 to 15)							
I	0 - 15	135	291	-	-	80	-
II	16 - 41	-	-	157	570	-	136
% of Total		10%	21%	11%	42%	6%	10%
OPTION 2 (i.e. DEIS configuration for Year 0 to 10)							
I	0 - 10	73	162	-	-	43	-
II	11 - 25	-	-	165	417	37	77
III	26- 41	-	-	34	308	-	64
% of Total		5%	12%	14%	53%	6%	10%

Table 4.2 Staging Summary – Option 1 (i.e., separate NPAG cell for Year 0 to 15)

Stage I – Conventional Tailings Storage				
		Elevation (ft)	Height – toe to crest (ft)	Cumulative Volume Stored (Mcyd)
Year 15	Scavenger Embankment (S1)	3,670	448	355
	Pyrite Embankment (P1)	3,580	235	56
Stage II – Filtered Tailings Storage				
		Elevation (ft)	Height – toe to crest (ft)	Cumulative Volume Stored (Mcyd)
Year 20	Filtered Tailings Stack (S2)	3,291	207	139
	Pyrite Embankment (P2)	3,407	246	27
Year 30	Filtered Tailings Stack (S2)	3,440	356	418
	Pyrite Embankment (P2)	3,490	300	79
Year 41	Filtered Tailings Stack (S2)	3,484	400	523
	Pyrite Embankment (P2)	3,513	323	98

Table 4.3 Staging Summary – Option 2 (i.e., DEIS configuration for Year 0 to 10)

Stage I – Conventional Tailings Storage				
		Elevation(ft)	**Height – toe to crest (ft)**	**Volume Stored (Mcyd)**
Year 10	Scavenger Embankment (S1)	3,365	265	197
	Pyrite Embankment (P1)	3,480	223	30
Stage II – Filtered Tailings Storage				
		Elevation (ft)	**Height – toe to crest (ft)**	**Volume Stored (Mcyd)**
Year 20	Filtered Tailings Stack (S2)	3,540	290	115
	Filtered Tailings Stack (S3)	3,530	145	44
	Pyrite Embankment (P1)	3,519	262	56
	Pyrite Embankment (P2)	3,560	340	27
Stage III – Filtered Tailings Storage				
		Elevation (ft)	**Height – toe to crest (ft)**	**Volume Stored (Mcyd)**
Year 30	Filtered Tailings Stack (S2)	3,810	560	214
	Filtered Tailings Stack (S3)	3,755	370	84
	Pyrite Embankment (P2)	3,560	340	80
	Filtered Tailings Stack (S4)	3,420	337	140
Year 41	Filtered Tailings Stack (S2)	3,810	560	214
	Filtered Tailings Stack (S3)	3,755	370	84
	Filtered Tailings Stack (S4)	3,474	387	387
	Pyrite Embankment (P2)	3,560	340	98

Table 4.4 Comparison of Make-up Water Requirements

Life of Mine	**Filtered Tailings Option 1**	**Filtered Tailings Option 2**	**DEIS Layout**
Make-up water requirements(acre-ft)	262,000 (Note 2)	213,000 (Note 2)	545,000 (Note 1)

Notes: 1. Make-up requirements for the DEIS layout are taken from the Water Balance Tailings Alternatives report by Westland (2018).

2. Make-up requirements for filtered options are estimated by assuming the change in overall TSF water losses (relative to the DEIS layout) is attributed to the change in the amount of water entrained in the scavenger tailings (Equation 1 and 2). For this comparison, the filtered tailings solids content is assumed to be 88% whereas the assumed solids content in the DEIS is between 60 and 65%.

$$Water\ entrained\ (by\ mass) = (1 - solids\ content\ \%) * Tailings\ Tonnage(tons) - \textbf{Equation 1}$$

$$Total\ make-up\ req._{filt.} = Total\ make-up\ req._{DEIS} + (Water\ entrained_{filt.} - Water\ entrained_{DEIS}) - \textbf{Equation 2}$$

Table 4.5 Comparison of TSF impoundment footprints

	Filtered Tailings Option 1	**Filtered Tailings Option 2**	**DEIS Layout**
TSF Footprint – impoundment only (acre)	4,100	3,900	3,800

Table 4.6 Comparison of Peak Power Requirements

	Filtered Tailings Option 1 and 2	DEIS Layout	% Increase
Annual Peak Power Requirements (kW)	45,800	4,110	~1100%

Table 4.7 Considerations in Transition to Filtered Tailings Options

Consideration	Transition to Filtered Tailings Option 1 (i.e. separate NPAG cell for Year 0 to 15)	Transition to Filtered Tailings Option 2 (i.e. DEIS configuration for Year 0 to 10)
Ease of transitioning to filtered tailings	▪ Relatively easier to start placing filtered tailings compared to Option 2, because tailings can be conveyed and stacked within the southern, flatter portion of the site. ▪ However, this option would be harder to keep as a conventional facility if filtered tailings were not implemented.	▪ Option has flexibility to be maintained as a conventional facility. ▪ Transition to filtered tailings would be more challenging because the slurry scavenger tailings would need to be allowed to drain and consolidate to become trafficable before conveyors for filtered tailings would be used on the surface. Also, the areas initially used for filtered tailings is more rugged than the south of the site, potentially requiring double-handling of the filtered tailings in areas.
Storm water management	▪ Simpler geometry and easier compared to option 2.	▪ Multiple areas for filtered tailings and with more complex geometry will be more challenging for storm water management.

5 CLOSING

This letter is an instrument of service of KCB Consultants Ltd. (KCBCL). The letter has been prepared for the exclusive use of Resolution Copper Mining LLC (Client) for the specific application to the Resolution Copper Project, and it may not be relied upon by any other party without KCBCL's written consent. KCBCL has prepared this report in a manner consistent with the level of care, skill and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered. KCBCL makes no warranty, express or implied.

Yours truly,

KCB CONSULTANTS LTD.

Kate Patterson, P.E., P.Eng.
Project Manager

KP:dl

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APPENDIX G

Tables 3.1 – 3.7 Adapted from KCB Consultants Ltd. Summary of DEIS Tailings Alternatives Seepage Control Levels (February 22, 2019)

APPENDIX B. TABLES 3.1 – 3.7 ADAPTED FROM KLOHN CRIPPEN BERGER

SUMMARY OF DEIS TAILINGS ALTERNATIVES SEEPAGE CONTROL LEVELS

(Section 3, Pages 2 – 11, February 22, 2019)

Table 3.1 TSF Alternatives References

TSF Alternative	Seepage Control Design for Draft EIS	Uncaptured Seepage Estimate
2 Near West ("wet")	KCB (2018a)	M&A (2018b, 2019)
3 Near West ("dry")	KCB (2018b)	M&A (2018b, 2019)
4 Silver King	KCB (2018c)	KCB (2019b)
5 Peg Leg	Golder (2018a, 2018b)	Golder (2019)
6 Skunk Camp	KCB (2018d)	KCB (2019a)

Table 3.2 Summary of TSF Alternatives Seepage Control Levels

Seepage Control Measures	Alternative 2 Near West – "wet"				Alternative 3 Near West – "dry"				Alternative 4 Silver King Filtered		Alternative 5 Peg Leg		Alternative 6 Skunk Camp		
Seepage Control Level:	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**1**	**2**	**1**	**2**	**3**
Discharge control systems to achieve BADCT for base metal TSFs (ADEQ 2005)															
Storm water and shallow aquifer intercepts	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Natural geologic features functioning as liners	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓			
Localized liners of geosynthetics and/or clay	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Fine Sealing	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Sub-drainage beneath the impoundment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Leachate collection systems (finger or blanket drains)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lining beneath main underdrains													✓	✓	✓
Centerline embankment construction	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Drains and reclaim water pump-back systems	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Free draining rockfill zones in the embankment															
Runoff water collection via channels and dikes or berms from embankment surface	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Engineered hydraulic barriers – grout curtains with pump-back wells	✓	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓
Engineered hydraulic barriers – reclaim wells and trench drains with clay or geomembrane				✓				✓					✓	✓	✓
Other seepage control measures															
Tailings thickening	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
High-density thickening of tailings (and implementation of thin lift placement)					✓	✓	✓	✓				✓			
Dewatering (filtering)									✓	✓					
Downgradient pump-back wells			✓	✓			✓	✓		✓	✓	✓	✓	✓	✓
Extended engineered hydraulic barriers – grout curtains with pump-back wells		✓	✓	✓		✓	✓	✓						✓	✓
Additional downgradient pump-back wells				✓				✓						✓	✓

Table 3.3 Alternative 2 Near West Modified Proposed Action (Modified Centerline Embankment – "wet") Seepage Control Levels

Level of Seepage Control	Seepage Control Description (see KCB 2018a)	From M&A (2018b, 2019)				
		Average Seepage Capture Efficiency (%) (Note 1)	Average Scavenger (NPAG) Seepage (acre-ft/yr)	Average Pyrite (PAG) Seepage (acre-ft/yr)	Average Collection Pond Seepage (acre-ft/yr)	Average Uncaptured Seepage (acre-ft/yr)
0	Features required for stability and act as seepage control features include modified centerline-raised compacted cycloned sand embankments and an embankment underdrainage system.	*not explicitly modeled*				
Between 0 and 1 (Note 2)	Seepage control measures represented in the 2018 Alternative 2/3 steady-state model report[2] (M&A 2018) include: ▪ features for stability described above; ▪ embankment underdrains extend into the impoundment under the entire scavenger beach; and ▪ seepage collection ponds with cut-offs walls and pump-back wells.	91%	1,912	220	8	194
1	Seepage control measures as presented in the DEIS report (KCB 2018a) include: ▪ features for stability described above; ▪ embankment underdrains extend into the impoundment for 200 ft; ▪ foundation treatment or selective engineered low-permeability layers in areas that are not Gila Conglomerate; ▪ engineered low-permeability layers for the pyrite starter facility; ▪ encapsulation of pyrite tailings in the scavenger tailings fines; and ▪ seepage collection ponds with cut-offs, grout curtains and pump-back wells. Grout curtain would extend from the ground surface to 100 ft below ground.	*not explicitly modeled*				
2	To increase Level 1 seepage capture, Level 2 (as described in KCB 2018a) includes extending the grout curtain to target high-permeability zones and seepage pathways.	*not explicitly modeled*				
3	To increase Level 2 seepage capture, Level 3 (as described in KCB 2018a) includes adding additional seepage collection ponds/facilities downstream.	*not explicitly modeled*				

Level of Seepage Control	Seepage Control Description (see KCB 2018a)	From M&A (2018b, 2019)				
		Average Seepage Capture Efficiency (%) (Note 1)	Average Scavenger (NPAG) Seepage (acre-ft/yr)	Average Pyrite (PAG) Seepage (acre-ft/yr)	Average Collection Pond Seepage (acre-ft/yr)	Average Uncaptured Seepage (acre-ft/yr)
4	To increase Level 3 seepage capture, Level 4 (as described in KCB 2018a) includes additional pump-back wells and grout curtain/cut-off walls. Seepage control measures represented in modified steady-state model report[2] (M&A 2019), in addition to the simulation described in M&A (2018), include: ▪ low-permeability liners in areas that are not Gila Conglomerate; ▪ engineered low-permeability liner for the entire pyrite cell; ▪ downgradient grout curtain extending from the ground surface to 100 ft below ground; and ▪ additional pump-back wells (see Note 3).	99%	1,910	223	0.6	21

Notes:

1. Seepage capture efficiency is calculated from the tailings seepage that enters the foundation, it does not account for dewatering (thickening/filtering) or climate effects.
2. Seepage control modeled by M&A were based on the seepage control measures described in KCB (2018a).
3. Pump back wells were added in the model by M&A in locations to maximize seepage capture.

Table 3.4 Alternative 3 Near West Modified Proposed Action (High-density thickened NPAG Scavenger and Segregated PAG Pyrite Cell) - Seepage Control Levels

Level of Seepage Control	Seepage Control Description (see KCB 2018b)	From M&A (2018b, 2019)				
		Average Seepage Capture Efficiency (%) (Note 1)	Average Scavenger (NPAG) Seepage (acre-ft/yr)	Average Pyrite (PAG) Seepage (acre-ft/yr)	Average Collection Pond Seepage (acre-ft/yr)	Average Uncaptured Seepage (acre-ft/yr)
0	Features required for stability and act as seepage control features include modified centerline-raised compacted cycloned sand embankments and an embankment underdrainage system.	*not explicitly modeled*				
Between 0 and 1 (Note 2)	Seepage control measures represented in the steady-state model report[2] (M&A 2018) include: ▪ embankment underdrains extend into the impoundment under the entire scavenger beach; and ▪ seepage collection ponds with cut-offs walls and pump-back wells.	84%	508	220	5	116
1	Seepage control measures as presented in the DEIS report (KCB 2018a) include: ▪ features for stability described above; ▪ embankment underdrains extend into the impoundment under the entire scavenger beach; ▪ foundation treatment or selective engineered low-permeability layers in areas that are not Gila Conglomerate; ▪ engineered low-permeability layers for the entire pyrite cell; and ▪ seepage collection ponds with cut-offs, grout curtains and pump-back wells. Grout curtain would extend from the ground surface to 100 ft below ground.	*not explicitly modeled*				
2	To increase Level 1 seepage capture, Level 2 (as described in KCB 2018b) includes extending the grout curtain to target high-permeability zones and seepage pathways.	*not explicitly modeled*				
3	To increase Level 2 seepage capture, Level 3 (as described in KCB 2018b) includes adding additional seepage collection ponds/facilities downstream.	*not explicitly modeled*				

Level of Seepage Control	Seepage Control Description (see KCB 2018b)	From M&A (2018b, 2019)				
		Average Seepage Capture Efficiency (%) (Note 1)	Average Scavenger (NPAG) Seepage (acre-ft/yr)	Average Pyrite (PAG) Seepage (acre-ft/yr)	Average Collection Pond Seepage (acre-ft/yr)	Average Uncaptured Seepage (acre-ft/yr)
4	To increase Level 3 seepage capture, Level 4 (as described in KCB 2018b) includes additional pump-back wells and grout curtain/cut-off walls. Seepage control measures as represented in modified steady-state model report (M&A 2019), in addition to the simulation described in M&A (2018), include: ▪ selective engineered low-permeability liners in areas that are not Gila Conglomerate; ▪ engineered low-permeability liners for the entire pyrite cell; ▪ grout curtain would extend from the ground surface to 100 ft below ground, extending to target high-permeability zones and seepage pathways; and ▪ additional pump-back wells (see Note 3).	99.5%	630	130	15	3

Notes:

1. Seepage capture efficiency is calculated from the tailings seepage that enters the foundation, it does not account for dewatering (thickening/filtering) or climate effects.
2. Seepage control modeled by M&A were based on the seepage control measures described in KCB (2018b).
3. Pump back wells were added in the model by M&A in locations to maximize seepage capture.

Table 3.5 Alternative 4 Silver King Seepage Control Levels

Level of Seepage Control	Seepage Control Description (see KCB 2018c, 2019b)	Average Seepage Capture Efficiency (%) (Note 1)	Average Scavenger (NPAG) Seepage (acre-ft/yr)	Average Pyrite (PAG) Seepage (acre-ft/yr)	Average Collection Pond Seepage (acre-ft/yr)	Average Uncaptured Seepage (acre-ft/yr)
0	Features required for stability and act as seepage control features include dewatered tailings, compacted structural zone with an underdrainage system.	n/a	77.5	1.9	0.6	n/a
1	In addition to the features for stability, seepage collection, as presented in the DEIS report (KCB 2018c), includes lined collection ditches and collection ponds that cut-off the alluvium. There is potential that a portion of the seepage would not be collected with this approach. A preliminary estimate of up to 80% capture is assumed because seepage can be collected in the underdrains and the alluvial channels will be cut-off. There is a remaining risk that a large portion of the flow paths would bypass seepage collection.	less than 80%				greater than 17 acre-ft/yr
2	In addition to the features described for Level 1, additional seepage control measures would include targeted grouting of fractures (potential seepage pathways) in the foundation and pump-back wells for seepage return. A preliminary estimate of up to 90% capture is assumed because of the uncertainty in the foundation conditions. There is a remaining risk that a portion of the flow paths would bypass seepage collection.	up to 90%				greater than 9 acre-ft/yr

Notes:

1. Seepage capture efficiency is calculated from the tailings seepage that enters the foundation, it does not account for dewatering (thickening/filtering) or climate effects.

Table 3.6 Alternative 5 Peg Leg Seepage Control Levels

Level of Seepage Control	Seepage Control Description (see Golder 2018a, 2018b, 2019)	Average Seepage Capture Efficiency (%) (Note 1)	Average Scavenger (NPAG) Seepage (acre-ft/yr)	Average Pyrite (PAG) Seepage (acre-ft/yr)	Average Collection Pond Seepage (acre-ft/yr)	Average Uncaptured Seepage (acre-ft/yr)
0	Features required for stability and to act as seepage control features include modified centerline-raised compacted cycloned sand embankments and an embankment underdrainage system. Separate NPAG and PAG cells	n/a	2,660	1,270	<1	3,930
1	Seepage control measures as presented in the DEIS report (Golder 2019) include: ▪ features for stability described above; ▪ surface water diversions around the NPAG and PAG facilities to minimize run-on surface water; ▪ lined Seepage collection ponds and ditches; ▪ finger drains extending from the embankment underdrains below the impoundment beach and along the existing drainages; ▪ HDPE lining of reclaim pond area (300 acres) where reclaim pond is in contact with native materials; ▪ engineered low-permeability layers for the entire pyrite cell; and ▪ pump-back wells to form a continuous cone of depression (cut off) and collect surface seepage below the NPAG embankment.	65%	2,537	1,211	<1	1,317
2	Seepage control measures, as described above with the addition of: ▪ complete synthetic lining of PAG cells base and embankment; ▪ removal of alluvium and pervious sediments above bedrock below PAG cells; ▪ utilization of thin-lift deposition beginning in year 7 when sufficient operating area becomes available; and ▪ adjusting pump back wells to allow 261 acre-ft/yr to bypass system (requires less pumping than level 1).	84%	1,640	25	<1	261

Notes:

1. Seepage capture efficiency is calculated from the tailings seepage that enters the foundation, it does not account for dewatering (thickening/filtering) or climate effects.

Table 3.7 Alternative 6 Skunk Camp Seepage Control Levels

Level of Seepage Control	Seepage Control Description (see KCB 2018d, 2019a)	Average Seepage Capture Efficiency (%) (Note 1)	Average Scavenger (NPAG) Seepage (acre-ft/yr)	Average Pyrite (PAG) Seepage (acre-ft/yr)	Average Uncaptured Seepage (acre-ft/yr)
0	Features required for stability and also act as seepage control features include centerline-raised compacted cycloned sand embankments and an embankment underdrainage system.	n/a	1,820	50	n/a
1	Seepage control measures as presented in the DEIS report (KCB 2018d) include: ▪ features for stability described above; ▪ embankment underdrains extend into the impoundment for 100 ft to 200 ft; ▪ engineered low-permeability layers for the pyrite cells; ▪ seepage collection ponds with cut-offs, grout curtains and pump-back wells. Grout curtain would extend from the ground surface to 70 ft below ground and the seepage pump-back wells at 20 ft below ground level (estimated to be the base of the alluvium).	64%[1]	1,820	50	580-660
2	To increase Level 1 seepage capture, Level 2 (as described in KCB 2019) includes an extension of the grout curtain to 100 ft and the seepage pump-back wells installed at 70 ft below ground (estimated to be the base of the weathered Gila Conglomerate layer).	80%[1]	1,840	50	270-370
3	To increase Level 2 seepage capture, Level 3 (as described in KCB 2019) includes an installation of the seepage pump-back wells at 100 ft below ground, at the depth of the grout curtain.	90%[1]	1,840	50	70-180

Notes:

1. Seepage capture efficiency is calculated from the tailings seepage that enters the foundation, it does not account for dewatering (thickening/filtering) or climate effects.

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Appendix D. Clean Water Act Section 404 Conceptual Mitigation Plan – Resolution Copper Project

Disclaimer: The Section 508 amendment of the Rehabilitation Act of 1973 requires that the information in federal documents be accessible to individuals with disabilities. The U.S. Forest Service has made every effort to ensure that the information in the Final Environmental Impact Statement for Resolution Copper Project and Land Exchange is accessible. However, this appendix is not fully compliant with Section 508, and readers with disabilities are encouraged to contact John Scaggs by phone at 602-225-5292 or by email at john.scaggs@usda.gov if they would like access to the information.

CLEAN WATER ACT SECTION 404 CONCEPTUAL MITIGATION PLAN

Resolution Copper Project

Prepared for:

United States Army Corps of Engineers

On Behalf of:

RESOLUTION COPPER

102 Magma Heights – Superior, Arizona 85173

Project Number: 807.175 06 02

September 15, 2020

WestLand Resources

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1. INTRODUCTION

Resolution Copper Mining, LLC (Resolution, or the Applicant) has proposed the development and operation of an underground copper and molybdenum mine near Superior, Arizona (**Figure 1**). As proposed, the construction of the tailings storage facility (TSF), associated pipelines, and appurtenant infrastructure requires the discharge of fill to surface water features (**Figure 2**) that the U.S. Army Corps of Engineers (Corps) has determined (Corps File No. SPL-2016-00547) to be potentially jurisdictional waters of the United States (waters of the U.S.) pursuant to a preliminary jurisdictional determination (PJD). As these potentially jurisdictional waters of the U.S. will be impacted by discharges of dredged or fill material resulting from portions of Resolution's planned mine development, Resolution has made application for a Clean Water Act (CWA) Section 404 permit for these discharges.

In order to secure a CWA Section 404 permit, the Applicant is bound by the requirements of the Corps' and the U.S. Environmental Protection Agency's (EPA) "Final Rule for Compensatory Mitigation for Losses of Aquatic Resources" (33 C.F.R. Parts 325 and 332 and 40 C.F.R. Part 320; published in 73 Fed. Reg. 19594-19705) (Corps and EPA 2008), hereinafter referred to as the 2008 Mitigation Rule. The fundamental objective of the 2008 Mitigation Rule is to establish standardized compensatory mitigation criteria for all mitigation types to offset unavoidable impacts to waters of the U.S. authorized through the issuance of a CWA Section 404 permit. Compensatory mitigation is required for unavoidable impacts to waters of the U. S. after all appropriate and practicable avoidance and minimization has been achieved. The South Pacific Division of the Corps has developed a standard operating procedure in the form of a Mitigation Ratio-Setting Checklist (MRSC) for determining compensatory mitigation requirements.

As configured, only the development of the TSF, pipelines, and appurtenant infrastructure (collectively, the "Project" for purposes of this document) require a discharge of dredged or fill material into potential waters of the U.S. Resolution has coordinated with the Corps to identify potential mitigation opportunities for the Project. This Conceptual Mitigation Plan is presented in six sections: *Section 1* identifies the document's purpose and organization; *Section 2* introduces the Project and the overall project purpose; *Section 3* describes avoidance and minimization measures and summarizes Project impacts to potential waters of the U.S.; *Section 4* provides a description of the mitigation site selection process and outlines the specific conceptual plans for each proposed mitigation area and the expected outcome; *Section 5* summarizes the site assessment process for determining migration ratios and provides the results from application of the MRSC; and *Section 6* includes the references used in the preparation of this document. The application of mitigation credits in *Section 5* describes application of the MRSC-derived mitigation ratios to Project impacts and mitigation sites in a sequential fashion, as needed, until all of the functional impacts for each impact drainage class are mitigated. The application of mitigation to impacts in this Conceptual Mitigation Plan is intended only to demonstrate sufficient credit is available to mitigate for unavoidable impacts to waters of the U.S. from development of the Project. Actual application of the mitigation credits in the Final Mitigation

Plan may occur in a number of ways. Following review and approval (or modification, as appropriate) by the Corps of the concepts contained in this Conceptual Mitigation Plan, a final Mitigation Plan in compliance with the 2008 Mitigation Rule will be completed.

2. PROJECT DESCRIPTION AND PURPOSE

2.1. MINE DEVELOPMENT BACKGROUND

Resolution's planned mine development is located near Superior in Pinal County, Arizona (**Figure 1**) in an area commonly referred to as the Copper Triangle and specifically within the Pioneer Mining District. Mine exploration and operations have been conducted in the area since the early 1860's, when the discovery of silver led to the development of the Silver King Mine. Magma Copper Company (Magma) took over the Silver King Mine and operated it as the Magma Mine from 1912 until the operation was finally shut down in 1996. After Magma's shutdown, the Resolution ore deposit was discovered 1.2 miles south of the existing Magma Mine and 7,000 feet below the ground surface. Since 2004, Resolution has steadily worked to investigate and delineate the Resolution ore body, develop a mine design, prepare environmental and engineering studies to support the mine permitting and approvals effort, and conduct multiple community outreach efforts and public meetings to inform and involve the public as plans were developed.

Resolution proposes the development of the Resolution ore body using panel caving, a type of cave mining. The copper and molybdenum ore will be mined, undergo primary crushing underground, and then be sent to a concentrator facility to be constructed at the existing West Plant Site north of Superior. Concentrate produced at the West Plant Site will be transported offsite for additional processing, while the resulting tailings will be transported via a pipeline to the proposed Skunk Camp TSF location, approximately 3 miles east of the Asarco Ray open pit mine. Under the current proposed operating conditions and Life of Mine (LOM) planning parameters, the Resolution ore body is sufficient to support the concentrator operations for approximately 41 years. As currently configured, operations are anticipated to result in the mining of approximately 1.4 billion tons of copper and molybdenum ore and the production of approximately 1.37 billion tons of tailings. Because portions of Resolution's planned mine development occur on lands managed by the U.S. Forest Service (USFS) Tonto National Forest (TNF), the USFS is reviewing the General Plan of Operations (GPO) and associated land exchange under the National Environmental Policy Act (NEPA) and publishing an Environmental Impact Statement (EIS) for the planned mine development.

2.2. PROJECT DESCRIPTION

Although the planned locations of all mine facilities are described in the EIS, only the development of the TSF, pipelines, and auxiliary infrastructure requires a discharge of dredged or fill material into potential waters of the U.S. and associated CWA Section 404 permit. Discharge of fill for the development of these features, particularly the TSF, consists mostly of the leveling of existing topography through site grading (cut and fill) of the natural ground surface. Materials to be discharged

to potential waters of the U.S. during this process would consist primarily of native soil and rock taken from the footprint of the constructed features during the grading process. The Applicant's overall project purpose and need is to construct and operate a TSF and associated infrastructure capable of storing approximately 1.37 billion tons of tailings produced through milling copper and molybdenum ore from the Resolution ore body (plus approximately 12 million cubic yards of on-site borrow material used to construct the starter embankments), along with the pipelines and associated infrastructure needed to transport tailings to the TSF and recycled water from the TSF back to the concentrator facility. Capacity to deposit approximately 1.37 billion tons of tailings is required to allow for utilization of the Resolution ore body to the extent described in the EIS (mining of approximately 1.4 billion tons of ore).

2.3. PROJECT PURPOSE

The Applicant's overall project purpose and need is to construct and operate a TSF and associated infrastructure capable of storing approximately 1.37 billion tons of tailings produced through milling copper and molybdenum ore from the Resolution ore body (plus approximately 12 million cubic yards of on-site borrow material used to construct the starter embankments), along with the pipelines and associated infrastructure needed to transport tailings to the TSF and recycled water from the TSF back to the concentrator facility. Capacity to deposit approximately 1.37 billion tons of tailings is required to allow for utilization of the Resolution ore body to the extent described in the EIS (mining of approximately 1.4 billion tons of ore). The Applicant's basic project purpose is mine tailings storage, which is not water-dependent. However, the proposed discharge will not affect a special aquatic site, so the rebuttable presumption in 40 C.F.R. § 230.10(a)(3) is not triggered.

3. JURISDICTIONAL WATERS OF THE U.S.

3.1. AVOIDANCE AND MINIMIZATION

The development of alternatives for Resolution's proposed underground copper and molybdenum mine design included a significant effort to avoid and minimize impacts to potential waters of the U.S. to the extent practicable. Only the development of the TSF, pipelines, and auxiliary infrastructure requires a discharge of dredged or fill material into potential waters of the U.S. Numerous aspects of TSF design and construction, such as embankment type (e.g., upstream, centerline, modified centerline, and downstream embankments), management of tailings, and deposition methods (e.g., conventional thickened, high-density thickened, and filtered, or 'dry-stack'), were assessed for use at the proposed TSF locations (USFS 2019, 2020) to avoid and minimize impacts. A number of onsite mitigation measures (referred to as "applicant committed environmental protection measures") were incorporated into the Skunk Camp TSF designs to address impacts to the aquatic environment, including potential waters of the U.S., and water quality and quantity functions. The pipeline corridor from the West Plant to the TSF presented in the Draft EIS (USFS 2019) was also refined and updated based on agency and public comment. The pipeline corridor revision resulted in a reduction in overall disturbance from the pipeline of approximately 463 acres and a reduction in impacts to potentially

jurisdictional waters of the U.S. of approximately 15.3 acres. The revised pipeline alignment incorporates a span for Devils' Canyon and underground boring beneath Mill Creek and Mineral Creek, outside of the Ordinary High Water Mark of all three major drainages, and completely avoids designated critical habitat for the Gila chub (*Gila intermedia*) and proposed critical habitat for the Yellow-billed cuckoo (*Coccyzus americanus*).

Although the area beneath the footprint of the TSF and its appurtenant features will no longer contribute runoff from precipitation to downstream drainage reaches, the TSF design minimizes impacts to downstream waters of the U.S. by diverting upstream stormwater flows around the facility. Similarly, the stormwater controls, run-on diversions, and engineering controls have been designed to maintain downstream stormwater flows while minimizing the risk of contaminant discharge to downstream surface water features. The full range of alternatives analyzed in the development of the proposed design of the Project is described in the 404(b)(1) Alternatives Analysis (WestLand 2020a) and EIS (USFS 2019, 2020) prepared for the Project.

3.2. JURISDICTIONAL IMPACTS

Table 1 summarizes the unavoidable impacts to potential waters of the U.S. that would result from construction of the alternative identified as the Least Environmentally Damaging Practicable Alternative (LEDPA) in the alternatives analysis: the Skunk Camp TSF Alternative. This alternative is also analyzed as Alternative 6 in the EIS prepared by the USFS (USFS 2020). Under the Skunk Camp TSF Alternative (**Figure 2**), the total amount of permanently impacted, or 'lost,' potential waters of the U.S. from development of the Project was determined to be 172.62 acres (**Figure 3**). These impacts include 129.24 acres are anticipated to be direct permanent impacts resulting from construction of the TSF and 43.38 acres of indirect permanent impacts are anticipated from the 'dewatering' of ephemeral drainages downgradient of portions of the TSF and its appurtenant features, including the seepage controls and stormwater diversions (**Figure 4**). Impacts from the pipeline (**Figure 5**) include a maximum estimated 15.70 acres of largely temporary impacts from the buried pipeline and associated access road. The final location of the pipeline within the analyzed 500-foot corridor will be micro-sited prior to construction and will disturb an estimated 200 feet within the 500 foot corridor. The estimate of 15.70 acres conservatively assumes that all the potential waters of the U.S. within the 500-foot corridor are temporarily impacted. As these impacts from the development of the pipeline are temporary, no mitigation for these impacts are proposed in the Conceptual Mitigation Plan.

Table 1. Impacts to Potential Waters of the U.S. from the Project

Project Component	Type of Impact	Impacts to Potential Waters of the U.S. (Acres)
TSF	Direct Impacts - Permanent	129.24
TSF	Indirect Impacts - Permanent	43.38
Pipeline	Direct Impacts - Temporary	15.70

Impacts to potentially jurisdictional waters of the U.S. from development of the Project are not expected to occur until approximately 10 years after authorization of the Project. As a component of reducing the risk and uncertainty related to compensatory mitigation success, Resolution anticipates initiating compensatory mitigation actions several years in advance of the construction of the TSF and the associated impacts to potentially jurisdictional waters of the U.S. Initiating mitigation in advance of impacts to potential waters of the U.S. also removes any aspect of temporal loss of aquatic function associated with impacted surface water features. These factors are considered in the discussion of mitigation actions below and in the calculation of final mitigation ratios in the MRSC.

Potential waters of the U.S. identified within the TSF footprint and pipeline corridor are dominated by both confined and braided ephemeral channels with functions and values typical of desert ephemeral systems. Non-ephemeral drainages within the pipeline corridor, including Devil's Canyon and Mineral Creek, will not be impacted by the project. No jurisdictional special aquatic sites (e.g., wetlands) or seeps and springs are located within the footprint of this TSF or the pipeline corridor.

The area of the proposed Skunk Camp TSF is relatively undisturbed with ongoing local ranching activities. As stated above, potential waters of the U.S. identified within the TSF footprint are dominated by both confined and braided ephemeral channels. Some minor alteration of these ephemeral channels has occurred through the construction of corrals and stock tanks related to the ranching activity (**Figure 2**). As part of the development of the MRSC (**Attachment A**), the drainages within the Skunk Camp TSF site were grouped into three different classes based on physical parameters that affect their hydrologic, chemical, and biotic function as assessed in Step 2. These classes, Classes A, B, and C are described below and shown in **Figure 6**.

Impact Class A: Class A washes consist of low-gradient, braided (multi-thread) ephemeral drainages within broad, relatively unrestricted floodplains. Class A washes are located lower in the watershed, and in the area of the Skunk Camp TSF are located mainly at lower elevations in the central portion of the site (**Figure 6**). Class A washes in this area include the lower portions of Dripping Spring Wash, Stone Cabin Wash, and Skunk Camp Wash. Xeroriparian vegetation is common and widespread along the banks and floodplain terraces of Class A washes but is generally absent in the low-flow channels. Sediment in the active channels of Class A washes is typically soft and is characterized by a well-sorted mixture composed primarily of sand, silt, and gravel. The TSF and its appurtenant features impact approximately 86.94 acres of Class A drainages.

Impact Class B: Class B washes are located higher upgradient in the local watershed and consist of low- to moderate-gradient, typically single-thread, ephemeral drainages. The active channels of Class B washes are generally confined within well-defined, relatively narrow floodplains. Class B washes are located throughout the area of the Skunk Camp TSF, with most are directly tributary to the Class A washes (**Figure 6**). Vegetation along Class B washes typically includes narrow bands of xeroriparian vegetation along the banks. Vegetation may be present within the low-flow channel as well. Sediment in the active channels of Class B washes may be well-or poorly sorted, and typically includes sand,

gravel, and cobbles. The TSF and its appurtenant features impact approximately 39.98 acres of Class B drainages.

Impact Class C: Class C washes are located in the headwaters of the local watershed and consist of moderate- to high-gradient single-thread ephemeral drainages. The active channels of Class C washes are typically confined within well-defined, very narrow floodplains. Class C washes represent the upper-most headwater tributaries in the area of the Skunk Camp TSF (**Figure 6**). Vegetation along Class C washes typically includes narrow bands of xeroriparian vegetation along the bed and banks. Upland species may be present in the low-flow channel. The substrate in the active channels of Class C washes may be well-or poorly sorted, and typically includes gravel, cobbles, and boulders. Cut banks are common in these drainages and the channel bed may be scoured to bedrock in some areas. The TSF and its appurtenant features impact approximately 45.70 acres of Class C drainages.

The total amount of permanently impacted, or 'lost,' potential waters of the U.S. from development of the Project was determined to be 172.62 acres. These impacts include 129.2 acres which are anticipated to be direct permanent impacts resulting from construction of the TSF and 43.4 acres of indirect permanent impacts are anticipated from the 'dewatering' of ephemeral drainages downgradient of portions of the TSF and its appurtenant features, including the seepage controls and stormwater diversions (**Figure 4**). As the impacts from the development of the pipeline are temporary, no mitigation for these impacts are proposed in the Conceptual Mitigation Plan. These impacts, separated by drainage class, are shown in **Table 2**.

Table 2. Impacts from the Project by Drainage Class

Drainage Class	Type of Impact	Impacts to Potential Waters of the U.S. (Acres)
Class A	Direct Impacts	60.75
	Indirect Impacts	26.19
Class B	Direct Impacts	32.28
	Indirect Impacts	7.70
Class C	Direct Impacts	36.21
	Indirect Impacts	9.49

4. MITIGATION SITE SELECTION

4.1. SITE SELECTION OVERVIEW

The 2008 Mitigation Rule identifies general classes of compensatory mitigation, as well as clear preference among these classes, specifically noting that Mitigation Banking and then in-lieu-fee (ILF) Mitigation are preferred over applicant-sponsored on-site or off-site mitigation. As a general matter, in-kind mitigation is also preferred over out-of-kind mitigation. Resolution considered these general classes of compensatory mitigation from a watershed perspective in the selection of proposed mitigation sites and the development of the draft Conceptual Mitigation Plan.

The Project is located within the Middle Gila River subbasin, defined as Hydrologic Unit Code (HUC 8) 15050100. In accordance with the Corps' Final 2015 Regional Compensatory Mitigation and Monitoring Guidelines (2015), Resolution evaluated mitigation opportunities, based on the above hierarchy, within the Project watershed and adjacent watersheds. WestLand is not aware of any watershed planning efforts for the HUC 6 or HUC 8 watersheds within which the Project is located that identify specific restoration goals for aquatic resources. There are currently no Mitigation Banks established in Arizona and no approved ILF Mitigation projects in this watershed HUC 8 subbasin. Resolution had initially proposed the use of the Arizona Game and Fish Department (AGFD) Lower San Pedro River Wildlife Area (LSPRWA) ILF project within the adjacent Lower San Pedro HUC 8 watershed subbasin (HUC 15050203), which has been used as mitigation for other projects located in the Middle Gila River HUC 8 watershed (WestLand 2018). All advanced credits available for purchase through the LSPRWA ILF project have been sold or obligated for sale, however, and the Corps and EPA have requested that the additional 650 credits anticipated from five future phases of development of the ILF not be considered in the Conceptual Mitigation Plan for the Project at this time. Given the lengthy mine construction period described in *Section 3.2*, Resolution anticipates that additional credits would become available and may be considered and incorporated in the future.

Based on the above, Resolution has identified three permittee-responsible mitigation sites, all offsite mitigation opportunities. Given that the footprint of the practicable TSF alternative contains ephemeral drainage channels and will be operated as part of an active copper mine, little opportunity exists for the development of onsite mitigation for unavoidable impacts to waters of the U.S.

4.2. MITIGATION SITE DESCRIPTION

The three permittee-responsible mitigation sites identified are the MAR-5/ORRS Mitigation Site, the Queen Creek Mitigation Site, and the H&E Farm Mitigation Site (**Figure 7**). The relative ecological benefits of each mitigation opportunity are discussed in the Conceptual Mitigation Plan for the Project and summarized here. Discussion of the benefits of these sites is based on WestLand's recent experience working within the framework of the 2008 Mitigation Rule on similar mitigation projects (WestLand 2017, 2018), following Corps guidelines (Corps 2015), and field investigations and analysis. Fulfillment of mitigation at each site would provide regional conservation benefits, though none of the proposed mitigation measures will create xeroriparian habitat similar to the habitat that will be lost or impacted by the Project. Mitigation activities proposed at these sites include preservation, enhancement, and restoration of high-value mesoriparian and hydroriparian habitats, which, although out-of-kind, are rarer within the regional landscape and have higher productivity and wildlife values (Lowery, Stingelin, and Hofer 2016).

The Corps (2017a) defines *compensatory mitigation* as "the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved." *Restoration* is defined (Corps 2017a) as "the manipulation of the physical, chemical, or biological characteristics of a site

with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: reestablishment and rehabilitation." *Re-establishmen*t "results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions," while *Rehabilitation* "results in a gain in aquatic resource function but does not result in a gain in aquatic resource area." *Establishment* is "the manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site" and "results in a gain in aquatic resource area and functions." *Enhancement* is "the manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s)…may also lead to a decline in other aquatic resource function(s)…[and] does not result in a gain in aquatic resource area (Corps 2017a)."

4.2.1. MAR-5/ORRS Mitigation Site

The Gila River Indian Community (GRIC, the Community) MAR-5 Recharge Project is a 5-year pilot study designed to evaluate the effectiveness of recharging a portion of the GRIC allotment of Central Arizona Project (CAP) water into the Gila River, on the Community's lands (**Figure 7**). Over the 5-year pilot study, CAP water was discharged at a single turnout near the Olberg Road Bridge in GRIC District 3. Baseline data collection was conducted at the site in 2015 prior to the initiation of discharge of CAP water. The pre-discharge vegetation of the area was described (WestLand 2019) as a sparse collection of upland woody shrubs with desert forbs and Bermudagrass (*Cynodon dactylon*), along with the nonnative, invasive tamarisk (*Tamarix* spp.). Resolution first began discussions with the Corps about potential use of the site as CWA compensatory mitigation in 2014. The pre-impact mitigation was intended to reduce temporal losses of aquatic function from Project impacts to potential waters of the U.S. and minimize mitigation risk and uncertainty. In 2017, the Sacramento District of the Corps' South Pacific Division formalized guidance (Corps 2017b) on an Advance Permittee-Responsible Mitigation (APRM) process very similar to that undertaken at the MAR-5 Restoration Area. Resolution and the Corps have coordinated between 2014 and the present to evaluate and document the establishment of the riparian community at the MAR-5 Restoration Area and the associated functional lift in accordance with the 2008 Mitigation Rule.

The instream discharge, initiated in August 2015, established an approximately 123-acre wetted area at the GRIC MAR-5 site (**Figure 8**) and associated riparian vegetation community, and it is anticipated that continued discharges would provide additional sustained and significant ecological lift as riparian habitat in this area continues to develop. Data collected in 2017 (WestLand 2019) show a five-fold increase in total vegetation volume and a six-fold increase in total herbaceous cover, and at the end of the pilot study the site was populated with desirable riparian species including cattails (*Typha* spp.) and Goodding's willow (*Salix gooddingii*). Tamarisk density at the site also increased substantially and the GRIC Department of Environmental Quality has identified a large tamarisk thicket directly upstream, the 23-acre Olberg Road Restoration Site (ORRS), that is likely a major seed source contributing to the tamarisk colonization and proliferation at the GRIC MAR-5 site.

Given the proximity of MAR-5 and ORRS and the clear ecological linkage between the two locations, the areas are considered together as the MAR-5/ORRS Mitigation Site in the Conceptual Mitigation Plan. The conceptual mitigation strategy for the ORRS consists of exotic tree species (principally tamarisk) removal and control, combined with native plant species reseeding. Mitigation activities at MAR-5 consist of the continued discharge of CAP allotment into the river, as well as exotic tree species control combined with seeding of native plant species. Exotic tree species removal and control combined with seeding of native plant species at both MAR-5 and ORRS would allow for the restoration, enhancement, 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 Corps places a high value on restoration projects (33 CFR 332.3(a)(2)), and the MAR-5/ORRS Mitigation Site represents a significant restoration opportunity on one of Arizona's largest river systems and it is within the same Middle Gila HUC 8 subbasin as the Project. Additionally, the Community has indicated that the continued recharge at the site would restore a cultural resource (surface flows in the Gila River) that has significant traditional value to the Community. **Table 3** provides a brief summary of the proposed mitigation within the MAR-5/ORRS Mitigation Site. The specific types of compensatory mitigation provided by the MAR-5/ORRS Mitigation Site include establishment, rehabilitation, and enhancement (Corps 2017a).

Table 3. Mitigation Areas within the MAR-5/ORRS Mitigation Site

Mitigation Area	Acreage	Description of Area and Proposed Mitigation
MAR-5 Restoration Area	123.0	The MAR-5 Restoration Area is located within the active channel of the Gila River. Discharge of CAP water into the channel has established a riparian vegetation community along the 123-acre wetted area. Continued discharge of this allotment will continue establishment of this riparian community. Exotic species removal and control and seeding of native species will improve the functions of this restored riparian community.
ORRS Area	23.0	The ORRS Area is located within the Gila River channel immediately upgradient of the MAR-5 Restoration Area and is a major seed source for tamarisk growing within the MAR-5 Restoration Area. Exotic species removal and control and seeding of native species will rehabilitate the existing riparian community and enhance the functions of the MAR-5 Restoration Area.

4.2.2. Queen Creek Mitigation Site

The Queen Creek Mitigation Site is approximately 79 acres in size and includes a 1.8-mile-long reach of Queen Creek near Superior, Arizona (**Figure 7**). The 79-acre Queen Creek Mitigation Site includes lands owned by Resolution and BHP Mineral Resources, Inc. (BHP). This reach of Queen Creek is ephemeral with a large, well-defined, single to multi-threaded, low-gradient channel and a mainly xeroriparian vegetation community composed of mature, medium-stature catclaw acacia (*Acacia greggii*), velvet mesquite (*Prosopis velutina*) shrubs, and medium-stature creosote (*Larrea tridentata*). Immediately downgradient of the proposed mitigation site, Queen Creek receives treated effluent from the Superior Wastewater Treatment Plant (SWWTP) and the Imerys Perlite USA, Inc. mine, forming an effluent

dependent water with more mesoriparian vegetation. Anthropogenic disturbances are present throughout the site including debris piles, unauthorized trails, and roads.

Conceptual mitigation elements for the site consist of actions intended to enhance the ecological condition of this reach, including the removal of tamarisk to allow native riparian vegetation to return to its historic composition and structure and promote more natural stream functions (**Figure 9**). Additionally, a site protection instrument would be established to restrict future development of the site and provide protected riparian and wildlife habitat. The Corps has requested that, although the site protection instrument will cover the entire 79-acre site, mitigation credit for the Queen Creek Mitigation Site be limited to an approximately 33-acre area that includes the Queen Creek channel and the riparian corridor of the channel. Within this xeroriparian corridor, limited removal of sparsely populated tamarisk and other invasive species would occur, followed by planting and seeding of native plant species. Select man-made debris would be removed while avoiding disturbance to existing mature woody vegetation; seeding of native plant species would follow. The Queen Creek project would be accessible and highly visible from Superior (**Figure 9**), allowing a local community affected by the Project to be a major beneficiary of the mitigation. **Table 4** provides a brief summary of the proposed mitigation within the Queen Creek Mitigation Site. The specific type of compensatory mitigation provided by the Queen Creek Mitigation Site is enhancement (Corps 2017a).

Table 4. Mitigation Areas within the Queen Creek Mitigation Site

Mitigation Area	Acreage	Description of Area and Proposed Mitigation
Queen Creek Enhancement Area	33.0	The Queen Creek Enhancement Area includes the channel of an approximately 1.8-mile-long reach Queen Creek. Exotic species removal and control, seeding of native species, and removal of select anthropogenic disturbances without additional disturbance of mature vegetation will enhance the functions of the riparian community associated with this reach.

4.2.3. H&E Farm Mitigation Site

The H&E Farm Mitigation Site is an approximately 500-acre site located along the Lower San Pedro River, approximately 3.5 miles northwest of the town of Mammoth in Pinal County, Arizona (**Figure 7**). The property is comprised entirely of private lands managed by The Nature Conservancy (TNC) and includes an approximately 2-mile-long low-gradient, braided intermittent reach of the San Pedro River. The river floodplain and terrace to the east of the river is comprised of former agricultural fields currently used for cattle grazing and associated ranching activities. Existing vegetation within the historic agricultural fields is sparse and consists of small to medium-statured mesquite and graythorn (*Ziziphus obtusifolia*). Vegetation along the active channel at the H&E Farm Mitigation Site consists of narrow, dense stands of mesoriparian and xeroriparian trees and shrubs. Species include large-statured mesquite (*Prosopis* sp.) and tamarisk, with a few individual cottonwoods (*Populus* sp.) and interspersed patches of singlewhorl burrobush (*Ambrosia monogyra*).

The H&E Farm Mitigation Site contains two proposed mitigation areas, the 300-acre H&E Terrace Reestablishment Area and the 15-acre H&E Wetland Reestablishment Area (**Figure 10**). CWA mitigation activities proposed for the H&E Farm Mitigation Site include removal of agricultural ditch and berm systems in the historic fields, reestablishment of some ephemeral drainage channels on the eastern floodplain terrace, reestablishment of the natural alluvial fan and floodplain terrace structure, and restoration of their associated vegetation (**Figure 10**). This earthwork, reestablishment, and revegetation will reconnect uplands to the east of the river with the mainstem of the San Pedro River and return aquatic functions to this portion of the floodplain. Minimal earthwork and planting of native riparian trees and shrubs is proposed within the former agricultural fields to enhance the adjacent wetland features, reestablish former wetland areas, and restore a more native vegetation community. These efforts are intended to mirror the previous mitigation strategies implemented by TNC and Arizona Department of Water Resources (ADWR) in 2011, as well as ongoing CWA mitigation at the LSPRWA ILF, which is contiguous with the western and northern boundaries of the H&E Farm Mitigation Site (**Figure 10**). **Table 5** provides a brief summary of the proposed mitigation within the H&E Farm Mitigation Site. The specific types of compensatory mitigation provided by the H&E Farm Mitigation Site include reestablishment and enhancement (Corps 2017a).

Table 5. Mitigation Areas within the H&E Farm Mitigation Site

Mitigation Area	Acreage	Description of Area and Proposed Mitigation
H&E Terrace Reestablishment Area	300.0	The H&E Terrace Reestablishment Area consists of historic agricultural fields occupying the former floodplain, floodplain terrace, and alluvial fan of the San Pedro River within the eastern half of the mitigation site. Mitigation activities proposed within this area include removal of agricultural ditch and berm systems, reestablishment of some ephemeral drainage channels on the floodplain terrace, reestablishment of the natural alluvial fan and terrace structure, and restoration of these features associated vegetation. Minimal planting of native trees and shrubs is proposed within the river floodplain to enhance this vegetation community.
H&E Wetland Reestablishment Area	15.0	The H&E Wetland Reestablishment Area includes an area of historic agricultural fields immediately adjacent to existing wetlands in the San Pedro River channel. Minimal earthwork and planting of native riparian trees and shrubs is proposed adjacent to existing wetlands to enhance the wetland features present, reestablish former wetland areas, and restore a more native vegetation community.

5. SITE ASSESSMENT AND DETERMINATION OF MITIGATION RATIOS

The South Pacific Division of the Corps has developed the *Standard Operating Procedure for the Determination of Mitigation Ratios* (Corps 2017) for determining compensatory mitigation requirements for the processing of CWA Section 404 permits. The substantive component of this procedure is completion of Attachment 12501.1-SPD, the MRSC. The completed MRSC is intended to provide a ratio determining the amount of acreage necessary as compensatory mitigation to offset the acreage of authorized impacts, in compliance with the 2008 Mitigation Rule. Completion of the MRSC

comprises a 10-step process that includes a functional analysis of impacted waters of the U.S. and proposed mitigation parcels, establishes baseline mitigation ratios, and authorizes adjustment of those ratios based on specified criteria.

The 10 steps for the completion of the MRSC are:

Step 1. Identification and Classification of Aquatic Resources
Step 2. Qualitative Impact-Mitigation Comparison
Step 3. Quantitative Impact-Mitigation Comparison
Step 4. Mitigation Site Location
Step 5. Net Loss of Aquatic Resource Surface Area
Step 6. Type Conversion
Step 7. Risk and Uncertainty
Step 8. Temporal Loss
Step 9. Final Mitigation Ratio
Step 10. Final Compensatory Mitigation Summary

As Step 2 of this process, the functions of the aquatic features at both the impact and mitigation sites are compared to assess those aquatic functions and values lost if the Project is permitted compared to those aquatic functions and values gained through mitigation activities. Evaluation of these functions was based on available data, published literature, aerial photography, field observations, and field data collected from both the impact and proposed mitigation sites. This effort also included use of the *California Rapid Assessment Method (CRAM) Episodic Riverine Field Book, version 2.0* (CWMW 2018), which was specifically developed to assess the functionality of ephemeral drainages based on relationships between condition and function. CRAM is used in California to assess the function of ephemeral aquatic features in comparison to normally functioning reference features of the same class and similar flow regime. Although not designed or currently approved for use as a stand-alone qualitative impact-mitigation comparison method, metrics from CRAM were incorporated in the Step 2 qualitative functional assessment. Given the nature of the proposed mitigation sites, this assessment requires a functional comparison of services provided by relatively small ephemeral drainage systems to services provided by much larger intermittent or perennial systems (e.g., the Gila River) and associated riparian habitat. The assessment is not intended to make a value judgement between these systems; rather, the assessment fulfills the purposes of the MRSC to provide a comparative assessment of the functionality of the systems at the impact and mitigation sites and to develop a mitigation ratio that will ensure there is no net loss of aquatic functions and values.

Functional assessment of the Skunk Camp TSF impact site included field data collection and evaluation of a representative sample of the ephemeral drainages within the property, selected based on physical parameters, such as underlying geology, slope and landscape position, that can affect their hydrologic, chemical, and biotic functions. The functional losses assessed result from direct impacts to ephemeral channel areas within the Project footprint and indirect permanent impacts anticipated from the 'dewatering' of ephemeral drainages downgradient of portions of the TSF and its appurtenant features,

including the seepage controls and stormwater diversions. The three mitigation sites occupy highly valuable and rare areas adjacent to the major mainstem drainages of the Gila River, Queen Creek, and San Pedro River watersheds and the proposed mitigation actions will help restore, enhance, and maintain natural functions and associated riparian buffers along these larger waterbodies. The resources and functions present at the three mitigation sites were classified and evaluated by mitigation area, where such areas were defined by existing physical characteristics and by the specific primary mitigation actions proposed. Defined mitigation areas within the three mitigation sites include areas of establishment, establishment, rehabilitation, and enhancement activities. Functional scoring of each mitigation area consisted primarily of an evaluation of the functional gain that the area would provide upon achievement of mitigation success. The functional or ecological 'lift' provided by the mitigation activities is presented as the difference between the current baseline functions of the mitigation site and the functional value anticipated under post-mitigation conditions.

The MRSC document included as **Attachment A** describes the methods used for the application of these 10 steps to determine the final mitigation ratios and acreages in this analysis, and provides the results of applying the MRSC to the calculation of compensatory mitigation required for the proposed impacts to potential waters of the U.S. from development of the Project. The final ratios determine the amount of acreage credits that are generated by each mitigation area when compared to each impacted drainage class. Step 9 of the MRSC is the calculation of final mitigation scoring ratios from Steps 2-8 in the MRSC. The final mitigation ratios comparing each impact class to each mitigation area were compiled and are summarized in **Table 6**. The *Standard Operating Procedure for the Determination of Mitigation Ratios* (Corps 2017) instructions state that where a qualitative comparison is used for the functional assessment in Step 2, final mitigation ratios may not be less than 1:1. Therefore, ratios shown in **Table 6** as less than 1:1 are applied as a ratio of 1:1 in **Table 7**.

Table 6. Final Mitigation Ratios Per Impacted Drainage Class and Mitigation Area

Mitigation Site Areas	Skunk Camp TSF Impact Site		
	Impact Class A Ratio	Impact Class B Ratio	Impact Class C Ratio
MAR-5/ORRS Mitigation Site			
MAR-5 Restoration Area	1.25:1	0.88:1	0.50:1
ORRS Area	2.75:1	2.60:1	1:1
Queen Creek Mitigation Site			
Queen Creek Enhancement Area	4.70:1	4.20:1	4.20:1
H&E Farm Mitigation Site			
H&E Terrace Reestablishment Area	1.39:1	0.83:1	0.67:1
H&E Wetland Reestablishment Area	0.63:1	0.30:1	0.22:1

In Step 10, the total acres of impacted area by drainage class are applied to the number of mitigation credits provided by mitigation site, based on the final mitigation ratios. **Table 7** summarizes the application of the MRSC-derived mitigation ratios to the mitigation sites in a sequential fashion. The completed MRSC worksheets, showing the steps described above, are an appendix to the MRSC document provided as **Attachment A**. Mitigation credits were applied to the higher functionally scoring Class A impacts first, then to the lower scoring Class B and Class C. The application of mitigation credit areas began with the MAR-5/ORRS Mitigation Site areas and moved sequentially through the mitigation areas of the Queen Creek Mitigation Site and the H&E Farm Mitigation Site, as needed, until all of the functional impacts for each drainage class were mitigated. Application of the mitigation credits in this fashion was based solely on the order of discussion of the mitigation sites in this document. Actual application of the mitigation credits in the Final Mitigation Plan may occur in a number of ways. The application of mitigation to impacts in this Conceptual Mitigation Plan is intended to demonstrate sufficient credit is available to mitigate for unavoidable impacts to waters of the U.S. from development of the Project.

Table 7. Final Mitigation Credits Applied by Impact Drainage Class and Mitigation Site/Area

Impact Drainage Class	Impact Acres	Mitigation Site/Area	Mitigation Acres Available	Mitigation Ratio	Mitigation Acres Used	Mitigation Credits Provided	Remaining Impact Acres
Impact Class A	86.94	MAR-5 Restoration Area	123.00	1.25:1	108.68	86.94	0.00
		ORRS Area	23.00	2.75:1	0.00	0.00	0.00
		Queen Creek Enhancement Area	33.00	4.70:1	0.00	0.00	0.00
		H&E Terrace Reestablishment Area	300.00	1.39:1	0.00	0.00	0.00
		H&E Wetland Reestablishment Area	15.00	1:1	0.00	0.00	0.00
Impact Class B	39.98	MAR-5 Restoration Area	14.32	1:1	14.32	14.32	25.66
		ORRS Area	23.00	2.60:1	23.00	8.84	16.82
		Queen Creek Enhancement Area	33.00	4.20:1	33.00	7.85	8.97
		H&E Terrace Reestablishment Area	300.00	1:1	8.97	8.97	0.00
		H&E Wetland Reestablishment Area	15.00	1:1	0.00	0.00	0.00
Impact Class C	45.70	MAR-5 Restoration Area	0.00	1:1	0.00	0.00	0.00
		ORRS Area	0.00	1:1	0.00	0.00	0.00
		Queen Creek Enhancement Area	0.00	4.20:1	0.00	0.00	0.00
		H&E Terrace Reestablishment Area	300.00	1:1	45.70	45.70	0.00
		H&E Wetland Reestablishment Area	15.00	1:1	0.00	0.00	0.00

6. REFERENCES

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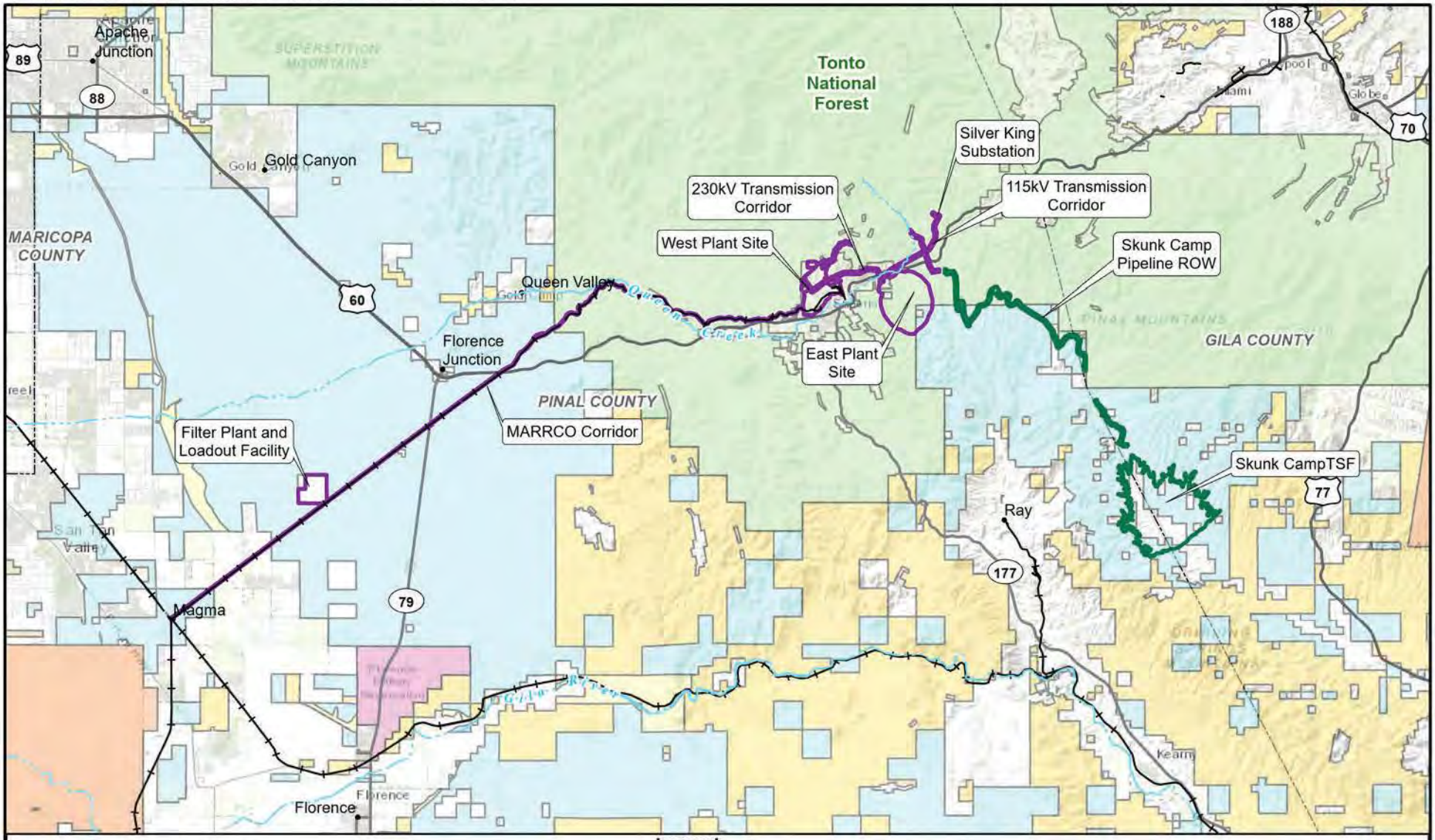
FIGURES



Legend

Pinal and Gila Counties, Arizona,
Data Source: BLM 2019, WRI Modified 2019, ALRIS, SWCA, and USFS
Image Source: ArcGIS Online, World Topo Map

N
0 2.5 5 Miles
0 4 8 Kilometers

WestLand Resources

- Skunk Camp TSF Alternative
- GPO Mine Element

Surface Management

- Bureau of Land Management (BLM)
- Bureau of Reclamation
- County
- Indian Lands
- Local or State Parks
- Military
- Other
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

OVERVIEW OF PROPOSED MINING OPERATION

Figure 1

Path: M:\Jobs\800's\807.175\ENV\Mitigation\ArcGISpro\RCM_Mitigation_807_175\RCM_Mitigation_807_175_CMP.aprx Date: 7/24/2020 User: towens

Legend

- Ancillary Facilities
- Diversion Channel
- Diversion Dam Pipeline
- Diversion Dam
- Retention Pond
- Seepage Collection Dam
- Seepage Collection Pond
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018

N

0 3,000 6,000 Feet

0 1,500 3,000 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

SKUNK CAMP TSF ALTERNATIVE
AERIAL OVERVIEW

Figure 2

Path: M:\Jobs\800's\807.175\ENV\Mitigation\ArcGISpro\RCM_Mitigation_807_175\RCM_Mitigation_807_175_CMP.aprx Date: 7/24/2020 User: towens

Legend

- Ancillary Facilities
- Diversion Channel
- Diversion Dam Pipeline
- Diversion Dam
- Retention Pond
- Seepage Collection Dam
- Seepage Collection Pond
- Skunk Camp Direct OHWM Impact
- Skunk Camp Indirect OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019

N

0 3,000 6,000 Feet

0 1,500 3,000 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

SKUNK CAMP TSF ALTERNATIVE
IMPACTS TO THE AQUATIC ECOSYSTEM

Figure 3

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Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019

Legend

- Ancillary Facilities
- Diversion Channel
- Diversion Dam Pipeline
- Diversion Dam
- Retention Pond
- Seepage Collection Dam
- Seepage Collection Pond
- Skunk Camp Direct OHWM Impact
- Skunk Camp Indirect OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land

N

0 1,500 3,000 Feet

0 750 1,500 Meters

WestLand Resources

USDA FSA, GeoEye, Maxar, CNES/Airbus DS

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

SKUNK CAMP TSF DIRECT AND INDIRECT IMPACTS

Figure 4

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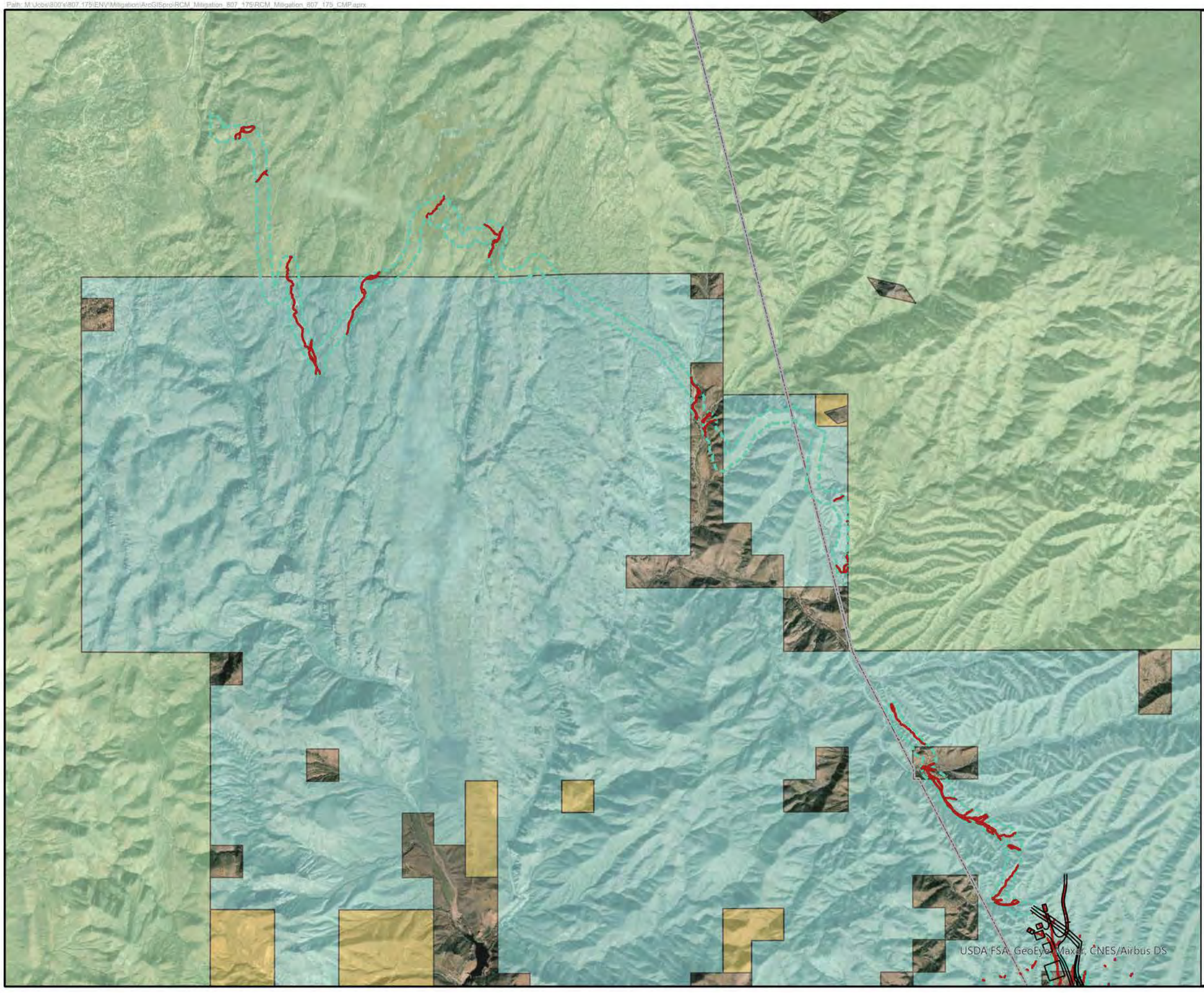


Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019

Legend

- Ancillary Facilities
- Skunk Camp Direct OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

Note: Most OHWM impacts in the pipeline corridor are temporary and this analysis conservatively assumes all OHWM will be impacted.

N

0 2,000 4,000 Feet

0 1,000 2,000 Meters

WestLand Resources

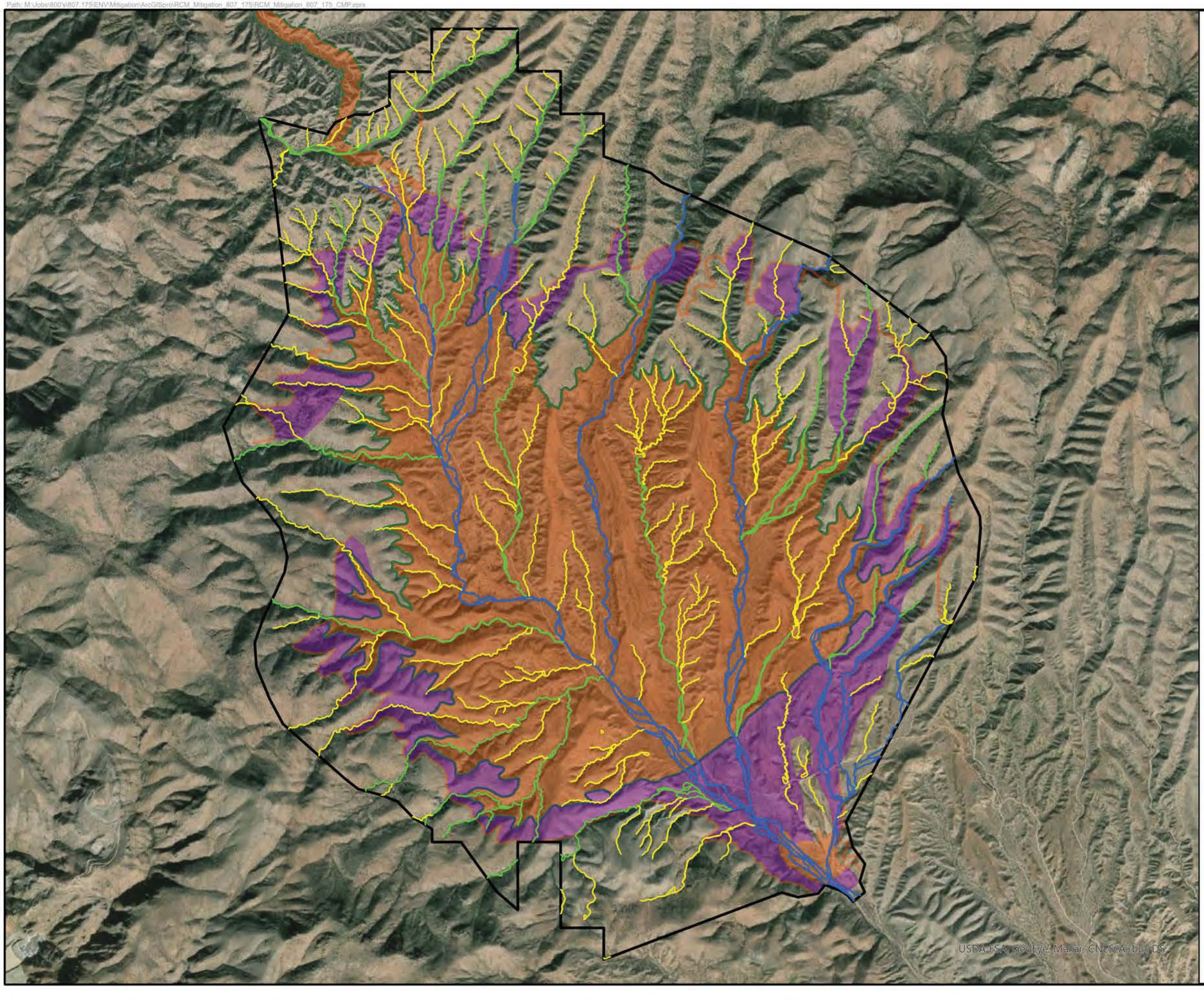
RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

SKUNK CAMP TSF PIPELINE DIRECT IMPACTS

Figure 5

Path: M:\Jobs\800's\807.175\ENV\Mitigation\ArcGISpro\RCM_Mitigation_807_175\RCM_Mitigation_807_175_CMP.aprx



Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018

Legend

- Skunk Camp Analysis Area
- Skunk Camp Direct Impact Area
- Skunk Camp Indirect Impact Area
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Skunk Camp OHWM Drainage Class

- Class A
- Class B
- Class C

N

0 1,500 3,000 Feet

0 750 1,500 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

SKUNK CAMP TSF IMPACT DRAINAGE CLASSES

Figure 6

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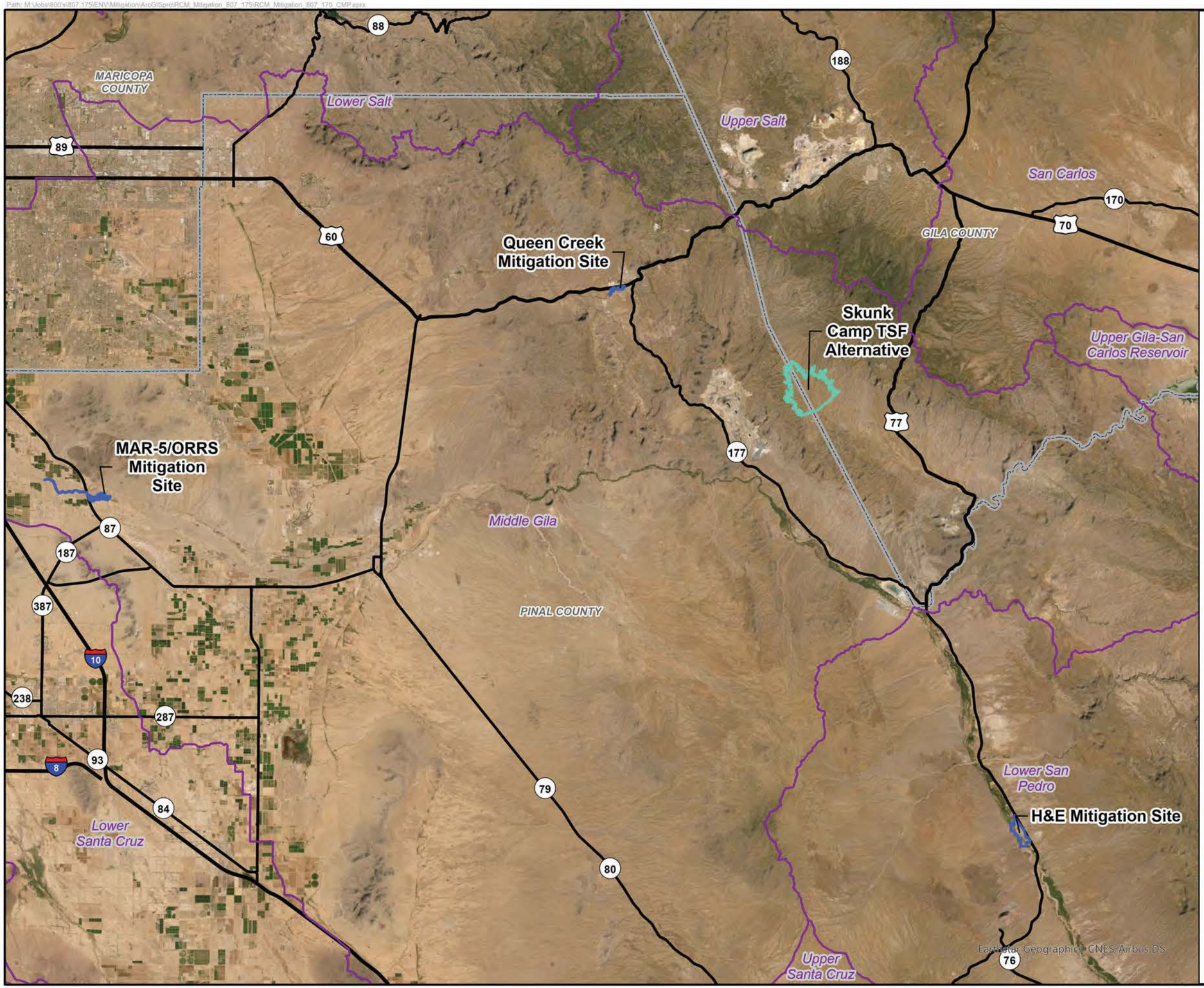


Portions of T2S R12-14E, T4S R6-7E, T6S R20E, T7S R16E, and T8S R16E,
Pinal, Graham, and Gila Counties, Arizona,
Image Source: Maxar 2018

Legend

- Mitigation Boundaries
- Skunk Camp TSF Alternative
- USGS HUC 8

N

0 4 8 Miles

0 8 16 Kilometers

WestLand Resources

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

MITIGATION SITES AERIAL OVERVIEW

Figure 7

Path: M:\Jobs\800's\807.175\ENV\Mitigation\ArcGIS\pro\RCM_Mitigation_807_175\RCM_Mitigation_807_175_CMP.aprx Date: 7/24/2020 User: towens

T4S, R6E, Portions of Sections 8-14,
Pinal County, Arizona,
Image Source: Maxar 6/19/2018

WestLand Resources

N

0 750 1,500 Feet

0 250 500 Meters

Legend

- MAR-5/ORRS Mitigation Site
- MAR-5 Restoration Area
- ORRS Area

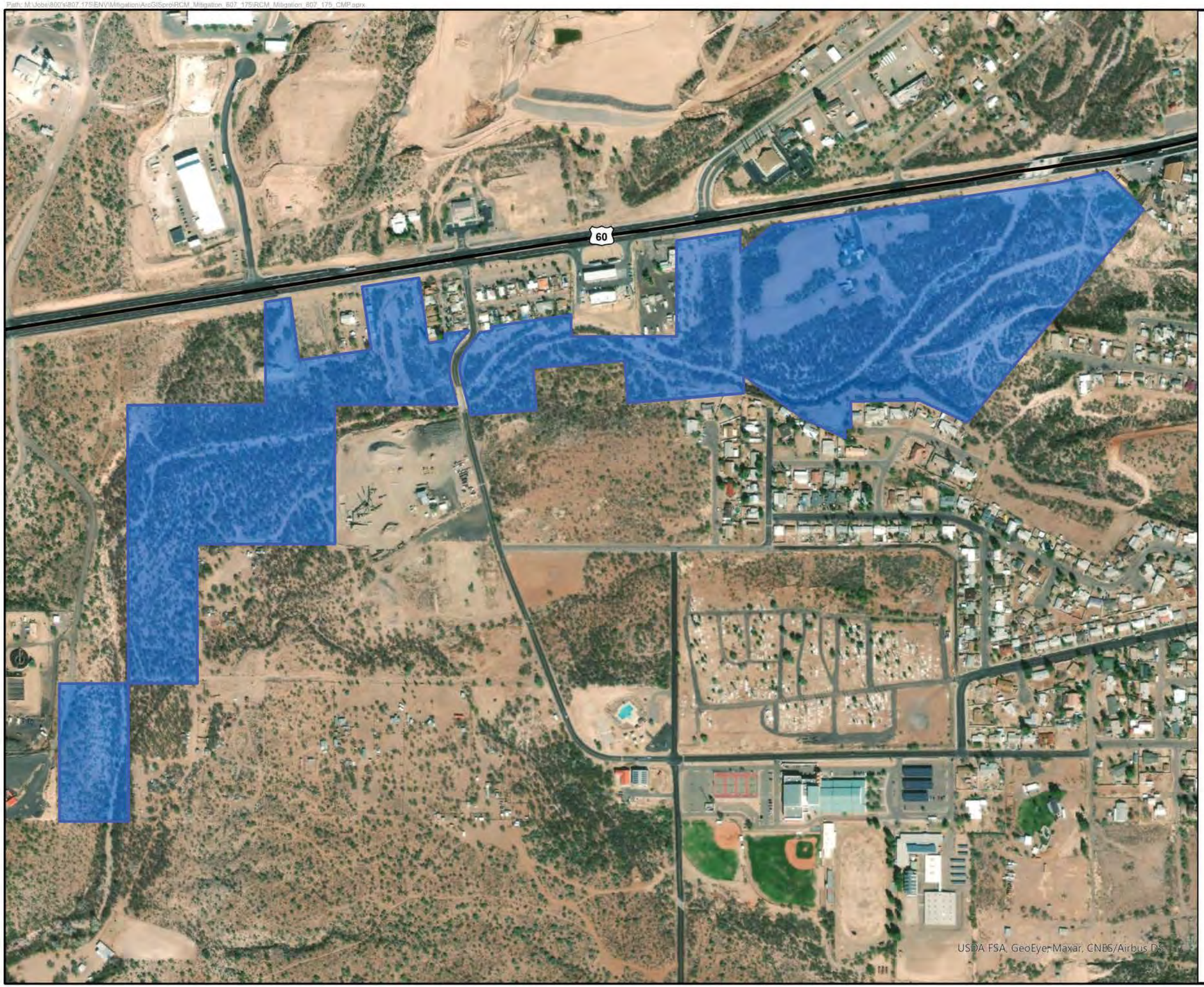
RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

MAR-5/ORRS MITIGATION SITE

Figure 8

Path: M:\Jobs\800's\807.175\ENV\Mitigation\ArcGISpro\RCM_Mitigation_807_175\RCM_Mitigation_807_175_CMP.aprx



T2S, R12E, Portions of Sections 3 and 4,
Pinal County, Arizona,
Image Source: Maxar 2/6/2018

Legend

- Queen Creek Enhancement Area
- Queen Creek Mitigation Site

N

0 250 500 Feet

0 100 200 Meters

WestLand Resources

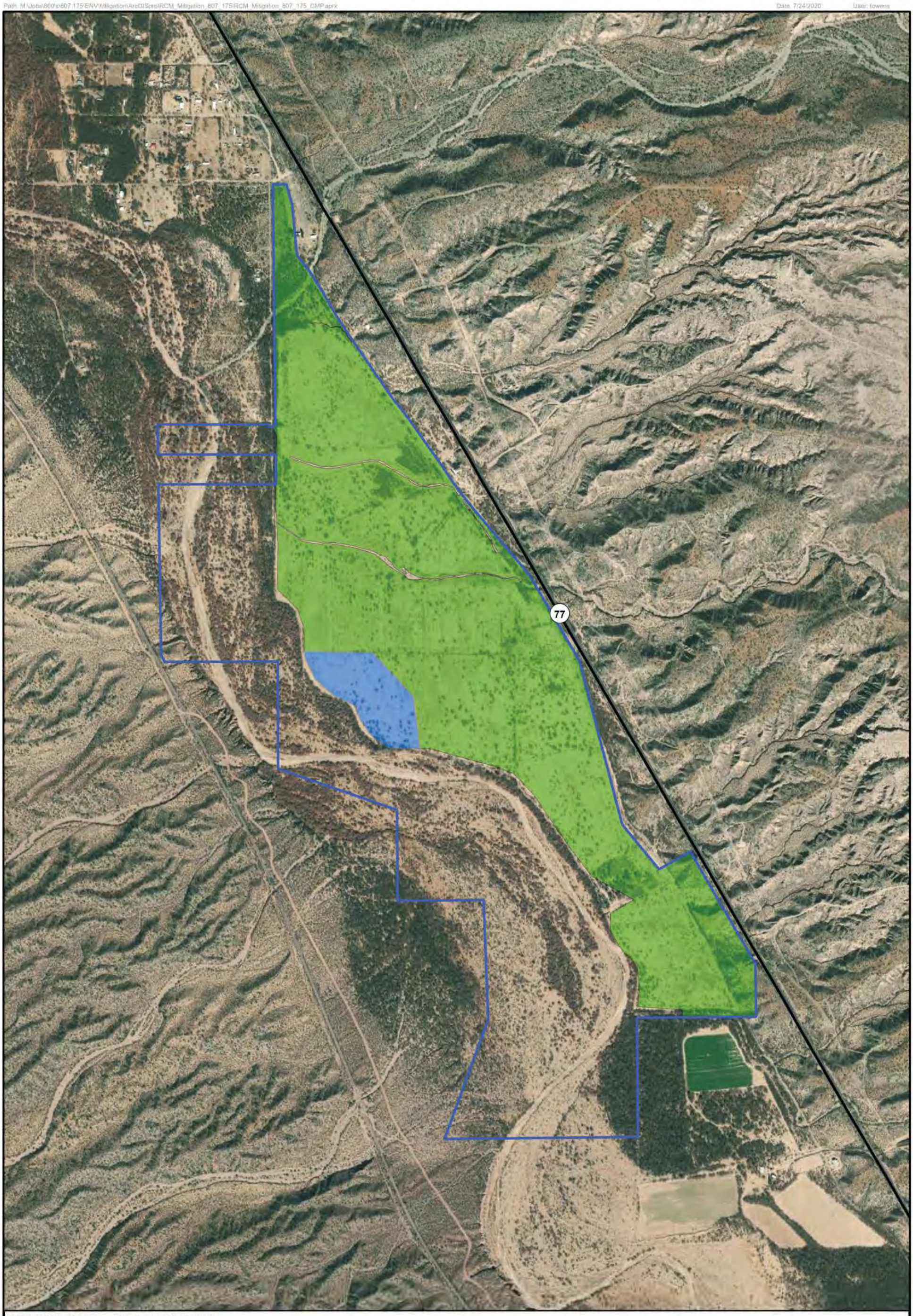
RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

QUEEN CREEK MITIGATION SITE

Figure 9

Path: M:\Jobs\800's\807_175\ENV\Mitigation\ArcGISpro\RCM_Mitigation_807_175\RCM_Mitigation_807_175_CMP.aprx Date: 7/24/2020 User: towens



T7S, R16E, Portions of Sections 35 and 36,
T8S, R16E, Portion of Section 1,
Pinal County, Arizona,
Image Source: Maxar 1/31/2018

Legend

- H&E Farm Mitigation Site
- H&E Terrace Reestablishment Area
- H&E Wetland Reestablishment Area

N

0 500 1,000 Feet

0 250 500 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

H&E FARM MITIGATION SITE

Figure 10

ATTACHMENT A

Resolution Copper Project Mitigation Ratio-Setting Checklist

RESOLUTION COPPER PROJECT
MITIGATION RATIO-SETTING CHECKLIST

Prepared for: U.S. Army Corps of Engineers *on behalf of* Resolution Copper

Prepared by: WestLand Resources, Inc.

Date: September 15, 2020

Project No.: 807.175 06 01

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1. DOCUMENT PURPOSE AND ORGANIZATION

Resolution Copper Mining, LLC (Resolution, or the Applicant) has proposed the development and operation of an underground copper and molybdenum mine near Superior, Arizona (**Figure 1**). As proposed, the construction of the tailings storage facility (TSF), associated pipelines, and appurtenant infrastructure requires the discharge of fill to surface water features (**Figure 2**) that the U.S. Army Corps of Engineers (Corps) has determined (Corps File No. SPL-2016-00547) to be potentially jurisdictional waters of the United States (waters of the U.S.) pursuant to a preliminary jurisdictional determination (PJD). As these potentially jurisdictional waters of the U.S. will be impacted by discharges of dredged or fill material resulting from portions of Resolution's planned mine development, Resolution has made application for a Clean Water Act (CWA) Section 404 permit for these discharges.

In order to secure a CWA Section 404 permit, the Applicant is bound by the requirements of the Corps' and the U.S. Environmental Protection Agency's (EPA) "Final Rule for Compensatory Mitigation for Losses of Aquatic Resources" (33 C.F.R. Parts 325 and 332 and 40 C.F.R. Part 320; published in 73 Fed. Reg. 19594-19705) (Corps and EPA 2008), hereinafter referred to as the 2008 Mitigation Rule. The fundamental objective of the 2008 Mitigation Rule is to establish standardized compensatory mitigation criteria for all mitigation types to offset unavoidable impacts to waters of the U.S. authorized through the issuance of a CWA Section 404 permit. Compensatory mitigation is required after all efforts to avoid and minimize impacts have been achieved and impacts to waters of the U.S. would still occur. The South Pacific Division of the Corps has developed a standard operating procedure in the form of a Mitigation Ratio-Setting Checklist (MRSC) for determining compensatory mitigation requirements.

As configured, only the development of the TSF, pipelines, and appurtenant infrastructure (collectively, the "Project" for purposes of this document) requires a discharge of dredged or fill material into potential waters of the U.S. Resolution has coordinated with the Corps to identify potential mitigation opportunities for the Project. This MRSC report has been prepared to support the Conceptual Mitigation Plan (WestLand 2020b) for the Project and is an attachment to that document. Detailed description of the Project and overall project purpose, impacts to potential waters of the U.S., and the mitigation site selection process are included in the Conceptual Mitigation Plan (WestLand 2020b). This MRSC report is presented in five sections: *Section 1* provides the document purpose and organization; *Section 2* summarizes Project impacts to potential waters of the U.S.; *Section 3* identifies the proposed mitigation sites; and *Section 4* describes the mitigation sites and actions, defines the methods used for determining final mitigation ratios and acreages in this analysis, and provides the results of applying the checklist. *Section 5* lists the references used in developing the report. Following review and approval (or modification, as appropriate) by the Corps of the concepts contained in the Conceptual Mitigation Plan, a final Mitigation Plan in compliance with the 2008 Mitigation Rule will be completed.

2. JURISDICTIONAL IMPACTS FROM THE PROJECT

The development of alternatives for Resolution's proposed underground copper and molybdenum mine design included a significant effort to avoid and minimize impacts to potential waters of the U.S. to the extent practicable. Only the development of the TSF, pipelines, and auxiliary infrastructure requires a discharge of dredged or fill material into potential waters of the U.S. A number of onsite mitigation measures (referred to as "applicant committed environmental protection measures") were incorporated into the TSF designs to address impacts to the aquatic environment, including potential waters of the U.S., and water quality and quantity functions (WestLand 2020b). The full range of alternatives analyzed in the development of the proposed design of the Project is described in the 404(b)(1) Alternatives Analysis (WestLand 2020a) prepared for the Project.

Table 1 summarizes the unavoidable impacts to the aquatic ecosystem that would result from construction of the alternative identified as the Least Environmentally Damaging Practicable Alternative (LEDPA) in that analysis: the Skunk Camp TSF Alternative. This alternative is also analyzed as Alternative 6 in the EIS prepared by the USFS (USFS 2020). Under the Skunk Camp TSF Alternative (**Figure 2**), the total amount of permanently impacted, or 'lost,' potential waters of the U.S. from development of the Project was determined to be 172.62 acres (**Figure 3**). These impacts include 129.24 acres are anticipated to be direct permanent impacts resulting from construction of the TSF and 43.38 acres of indirect permanent impacts are anticipated from the 'dewatering' of ephemeral drainages downgradient of portions of the TSF and its appurtenant features, including the seepage controls and stormwater diversions (**Figure 4**). Impacts from the pipeline (**Figure 5**) include a maximum estimated 15.7 acres of largely temporary impacts from the buried pipeline and associated access road. The final location of the pipeline within the analyzed corridor is still being refined and this estimate of 15.7 acres conservatively assumes that all the potential waters of the U.S. within the corridor are temporarily impacted. As these impacts from the development of the pipeline are temporary, no mitigation for these impacts are proposed in the Conceptual Mitigation Plan.

Potential waters of the U.S. identified within the TSF footprint and pipeline corridor are dominated by both confined and braided ephemeral channels with functions and values typical of desert ephemeral systems. Non-ephemeral drainages within the pipeline corridor, including Devil's Canyon and Mineral Creek, will not be impacted by the project. No jurisdictional special aquatic sites (e.g., wetlands) or seeps and springs are located within the footprint of this TSF or the pipeline corridor. None of the components of this Project alternative would adversely affect any special aquatic sites, including wetlands.

Table 1. Impacts to Potential Waters of the U.S. from the Project

Project Component	Type of Impact	Impacts to Potential Waters of the U.S. (Acres)
TSF	Direct Impacts - Permanent	129.24
TSF	Indirect Impacts - Permanent	43.38
Pipeline	Direct Impacts - Temporary	15.70

3. MITIGATION SITE SELECTION

The 2008 Mitigation Rule identifies general classes of compensatory mitigation, as well as clear preference among these classes, specifically noting that Mitigation Banking and then in-lieu-fee (ILF) Mitigation are preferred over applicant-sponsored on-site or off-site mitigation. As a general matter, in-kind mitigation is also preferred over out-of-kind mitigation. Resolution considered these general classes of compensatory mitigation from a watershed perspective in the selection of proposed mitigation sites and the development of the draft Conceptual Mitigation Plan.

The Project is located within the Middle Gila River subbasin, defined as Hydrologic Unit Code (HUC 8) 15050100. In accordance with the Corps' Final 2015 Regional Compensatory Mitigation and Monitoring Guidelines (2015), Resolution evaluated mitigation opportunities, based on the above hierarchy, within the Project watershed and adjacent watersheds. WestLand is not aware of any watershed planning efforts for the HUC 6 or HUC 8 watersheds within which the Project is located that identify specific restoration goals for aquatic resources. There are currently no Mitigation Banks established in Arizona and no approved ILF Mitigation projects in this watershed HUC 8 subbasin. Resolution had initially proposed the use of the Arizona Game and Fish Department (AGFD) Lower San Pedro River Wildlife Area (LSPRWA) ILF project within the adjacent Lower San Pedro HUC 8 watershed subbasin (HUC 15050203), which has been used as mitigation for other projects located in the Middle Gila River HUC 8 watershed (WestLand 2018). All advanced credits available for purchase through the LSPRWA ILF project have been sold or obligated for sale, however, and the Corps and EPA have requested that the additional 650 credits anticipated from five future phases of development of the ILF not be considered in the Conceptual Mitigation Plan for the Project at this time. Given the lengthy mine construction period, Resolution anticipates that additional credits would become available and may be considered and incorporated in the future.

As the footprint of the practicable TSF alternative contains ephemeral drainage channels and will be operated as part of an active copper mine, little opportunity exists for the development of onsite mitigation for unavoidable impacts to waters of the U.S. Therefore, Resolution has identified three permittee-responsible mitigation sites, all offsite mitigation opportunities: the MAR-5/ORRS Mitigation Site, the Queen Creek Mitigation Site, and the H&E Farm Mitigation Site (**Figure 6**). The relative ecological benefits of each mitigation opportunity are discussed in the Conceptual Mitigation Plan (WestLand 2020b) for the Project and summarized in *Section 4.1.2* of this MRSC document. Discussion of the benefits of these sites is based on WestLand's recent experience working within the framework of the 2008 Mitigation Rule on similar mitigation projects (WestLand 2017, 2018) and following Corps guidelines (Corps 2015). Fulfillment of mitigation at each site would provide regional conservation benefits, though none of the proposed mitigation measures will create xeroriparian habitat similar to the habitat that will be lost or impacted by the Project. Mitigation activities proposed at these sites include preservation, enhancement, and restoration of high-value mesoriparian and hydroriparian habitats, which, although out-of-kind, are rarer within the regional landscape and have higher productivity and wildlife values (Lowery, Stingelin, and Hofer 2016).

4. MRSC METHODS AND RESULTS

The South Pacific Division of the Corps has developed the *Standard Operating Procedure for the Determination of Mitigation Ratios* (Corps 2017) for determining compensatory mitigation requirements for the processing of CWA Section 404 permits. The substantive component of this procedure is completion of Attachment 12501.1-SPD, the MRSC. The completed MRSC is intended to provide a ratio determining the amount of acreage necessary as compensatory mitigation to offset the acreage of authorized impacts, in compliance with the 2008 Mitigation Rule. Completion of the MRSC comprises a 10-step process that includes a functional analysis of impacted waters of the U.S. and proposed mitigation parcels, establishes baseline mitigation ratios, and authorizes adjustment of those ratios based on specified criteria.

The 10 steps for the completion of the MRSC are:

Step 1. Identification and Classification of Aquatic Resources
Step 2. Qualitative Impact-Mitigation Comparison
Step 3. Quantitative Impact-Mitigation Comparison
Step 4. Mitigation Site Location
Step 5. Net Loss of Aquatic Resource Surface Area
Step 6. Type Conversion
Step 7. Risk and Uncertainty
Step 8. Temporal Loss
Step 9. Final Mitigation Ratio
Step 10. Final Compensatory Mitigation Summary

The following section of this document describes the methods used for the application of these steps to determine the final mitigation ratios and acreages in this analysis, and provides the results of applying the MRSC to the calculation of compensatory mitigation required for the proposed impacts to potential waters of the U.S. from development of the Project.

4.1. IDENTIFICATION AND CLASSIFICATION OF AQUATIC RESOURCES (STEP 1)

Step 1 within the MRSC is the identification and classification of the aquatic resources present at and functions provided by the impact site and the proposed mitigation site.

4.1.1. Skunk Camp TSF Alternative Drainage Impact Classes

The drainages within the Skunk Camp TSF site were grouped into three different classes based on physical parameters that affect their hydrologic, chemical, and biotic function as assessed in Step 2. These classes, Classes A, B, and C are described below and shown in **Figure 7**.

Impact Class A: Class A washes consist of low-gradient, braided (multi-thread) ephemeral drainages within broad, relatively unrestricted floodplains. Class A washes are located lower in the local watershed and include the lower portions of Dripping Spring Wash, Stone Cabin Wash, and Skunk Camp Wash. The TSF and its appurtenant features impact approximately 86.94 acres of Class A drainages.

Impact Class B: Class B washes are located higher upgradient in the local watershed and consist of low- to moderate-gradient, typically single-thread, ephemeral drainages. Class B washes are located throughout the area of the Skunk Camp TSF, with most directly tributary to the Class A washes (**Figure 7**). The TSF and its appurtenant features impact approximately 39.98 acres of Class B drainages.

Impact Class C: Class C washes are located in the headwaters of the local watershed and consist of moderate- to high-gradient single-thread ephemeral drainages. Class C washes represent the upper-most headwater tributaries in the area of the Skunk Camp TSF (**Figure 7**). The TSF and its appurtenant features impact approximately 45.70 acres of Class C drainages.

The total amount of permanently impacted, or 'lost,' potential waters of the U.S. from development of the Project was determined to be 172.62 acres. These impacts include 129.2 acres which are anticipated to be direct permanent impacts resulting from construction of the TSF and 43.4 acres of indirect permanent impacts are anticipated from the 'dewatering' of ephemeral drainages downgradient of portions of the TSF and its appurtenant features, including the seepage controls and stormwater diversions (**Figure 7**). As the impacts from the development of the pipeline are temporary, no mitigation for these impacts are proposed in the Conceptual Mitigation Plan. These impacts, separated by drainage class, are shown in **Table 2**.

Table 2. Impacts from the Project by Drainage Class

Drainage Class	Type of Impact	Impacts to Waters of the U.S. (Acres)
Class A	Direct Impacts	60.75
	Indirect Impacts	26.19
Class B	Direct Impacts	32.28
	Indirect Impacts	7.70
Class C	Direct Impacts	36.21
	Indirect Impacts	9.49

4.1.2. Mitigation Site Areas

The proposed mitigation areas at the three mitigation sites, the MAR-5/ORRS Mitigation Site, the Queen Creek Mitigation Site, and the H&E Farm Mitigation Site, are described below and shown in **Figures 8**, **9**, and **10**.

MAR-5/ORRS Mitigation Site: The MAR-5/ORRS Mitigation Site contains two proposed mitigation areas, the 123-acre MAR-5 Restoration Area and the 23-acre Olberg Road Restoration Site (ORRS) Area (**Figure 8**). Brief descriptions of the proposed mitigation areas are provided in **Table 3**. The specific types of compensatory mitigation provided by the MAR-5/ORRS Mitigation Site include establishment, rehabilitation, and enhancement (Corps 2017).

Table 3. Mitigation Areas within the MAR-5/ORRS Mitigation Site

Mitigation Area	Acreage	Description of Area and Proposed Mitigation
MAR-5 Restoration Area	123.0	The MAR-5 Restoration Area is located within the active channel of the Gila River. Discharge of Central Arizona Project water into the channel has established a riparian vegetation community along the 123-acre wetted area. Continued discharge of this allotment will continue establishment of this riparian community. Exotic species removal and control and seeding of native species will improve the functions of this restored riparian community.
ORRS Area	23.0	The ORRS Area is located within the Gila River channel immediately upgradient of the MAR-5 Restoration Area and is a major seed source for tamarisk growing within the MAR-5 Restoration Area. Exotic species removal and control and seeding of native species will rehabilitate the existing riparian community and enhance the functions of the MAR-5 Restoration Area.

Queen Creek Mitigation Site: The 79-acre Queen Creek Mitigation Site includes one proposed mitigation area: the Queen Creek Enhancement Area (**Figure 9**). The Corps has requested that, although the site protection instrument will cover the entire 79-acre Queen Creek Mitigation Site, mitigation credit for the site be limited to an approximately 33-acre area that includes the Queen Creek channel and the riparian corridor of the channel. A brief description of the proposed mitigation area is provided in **Table 4**. The specific type of compensatory mitigation provided by the Queen Creek Mitigation Site is enhancement (Corps 2017).

Table 4. Mitigation Areas within the Queen Creek Mitigation Site

Mitigation Area	Acreage	Description of Area and Proposed Mitigation
Queen Creek Enhancement Area	33.0	The Queen Creek Enhancement Area includes the channel of an approximately 1.2-mile-long reach Queen Creek. Exotic species removal and control, seeding of native species, and removal of select anthropogenic disturbances without additional disturbance of mature vegetation will enhance the functions of the riparian community associated with this reach.

H&E Farm Mitigation Site: The H&E Farm Mitigation Site contains two proposed mitigation areas, the 300-acre H&E Terrace Reestablishment Area and the 15-acre H&E Wetland Reestablishment Area (**Figure 10**). Brief descriptions of the proposed mitigation areas are provided in **Table 5**. The

specific types of compensatory mitigation provided by the H&E Farm Mitigation Site include reestablishment and enhancement (Corps 2017).

Table 5. Mitigation Areas within the H&E Farm Mitigation Site

Mitigation Area	Acreage	Description of Area and Proposed Mitigation
H&E Terrace Reestablishment Area	300.0	The H&E Terrace Reestablishment Area consists of historic agricultural fields occupying the former floodplain, floodplain terrace, and alluvial fan of the San Pedro River within the eastern half of the mitigation site. Mitigation activities proposed within this area include removal of agricultural ditch and berm systems, reestablishment of some ephemeral drainage channels on the floodplain terrace, reestablishment of the natural alluvial fan and terrace structure, and restoration of these features associated vegetation. Minimal planting of native trees and shrubs is proposed within the river floodplain to enhance this vegetation community.
H&E Wetland Reestablishment Area	15.0	The H&E Wetland Reestablishment Area includes an area of historic agricultural fields immediately adjacent to existing wetlands in the San Pedro River channel. Minimal earthwork and planting of native riparian trees and shrubs is proposed adjacent to existing wetlands to enhance the wetland features present, reestablish former wetland areas, and restore a more native vegetation community.

4.2. QUALITATIVE IMPACT-MITIGATION COMPARISON (STEP 2)

Step 2 of the MRSC is a qualitative comparison between the functions of potential waters of the U.S. that will be impacted by the proposed Project and the functional gain from the proposed mitigation actions. Eleven hydrologic, chemical, and biotic functions were developed for this purpose (**Table 6**).

Table 6. Functions Evaluated for TSF Impacted Drainages

Evaluated Functions
HYDROLOGIC FUNCTIONS
Hydrologic Connectivity
Subsurface Flow and Groundwater Recharge
Energy Dissipation
Sediment Transport/Regulation
CHEMICAL FUNCTIONS
Elements, Compounds, and Particulate Cycling
Organic Carbon Export/Sequestration
BIOTIC FUNCTIONS
Aquatic Invertebrate Fauna
Presence of Fish and Fish Habitat Structure
Riparian/Wetland Vegetation Structure
Age Class Distribution of Wooded Riparian or Wetland Vegetation
Native/Non-native Plant Species

These functions are consistent with those identified in the South Pacific Division's *Standard Operating Procedure for the Determination of Mitigation Ratios* (Corps 2017) based on WestLand's recent experience working within the framework of the 2008 Mitigation Rule on similar mitigation projects (WestLand 2017, 2018). Scoring for these 11 functions was conducted based on available data, published literature, field data collected on potential waters of the U.S., general field observations, and aerial photography. The functions of each resource were scored qualitatively on a six-category numeric scale, as follows: 0 = none, 1 = low, 2 = low-moderate, 3 = moderate, 4 = moderate-high, and 5 = high function.

The functions of the aquatic features at both the impact and mitigation sites are compared in Step 2 to assess those aquatic functions and values lost if the Project is permitted compared to those aquatic functions and values gained through mitigation activities. Given the nature of the proposed mitigation sites, this assessment requires a functional comparison of services provided by relatively small ephemeral drainage systems to services provided by much larger intermittent or perennial systems (e.g., the Gila River) and associated riparian habitat. The assessment is not intended to make a value judgement between these systems; rather, the assessment fulfills the purposes of the MRSC to provide a comparative assessment of the functionality of the systems at the impact and mitigation sites and to develop a mitigation ratio that will ensure there is no net loss of aquatic functions and values.

Functional assessment of the Skunk Camp TSF impact site included field data collection and evaluation of a representative sample of the ephemeral drainages within the property, selected based on physical parameters, such as underlying geology, slope and landscape position, that can affect their hydrologic, chemical, and biotic functions. The functional losses assessed result from direct impacts to ephemeral channel areas within the Project footprint and indirect permanent impacts anticipated from the 'dewatering' of ephemeral drainages downgradient of portions of the TSF and its appurtenant features, including the seepage controls and stormwater diversions. The three mitigation sites occupy highly valuable and rare areas adjacent to the major mainstem drainages of the Gila River, Queen Creek, and San Pedro River watersheds and the proposed mitigation actions will help restore, enhance, and maintain natural functions and associated riparian buffers along these larger waterbodies. The resources and functions present at the three mitigation sites were classified and evaluated by mitigation area, where such areas were defined by existing physical characteristics and by the specific primary mitigation actions proposed. Defined mitigation areas within the three mitigation sites include areas of establishment, reestablishment, rehabilitation, and enhancement activities (**Figures 8**, **9**, and **10**) as described in *Section 4.1*. Functional scoring of each mitigation area consisted primarily of an evaluation of the functional gain that the area would provide upon achievement of mitigation success. The functional or ecological 'lift' provided by the mitigation activities is presented as the difference between the current baseline functions of the mitigation site and the functional value anticipated under post-mitigation conditions.

4.2.1. Function Definition and Scoring Methods

Definitions of each function and explanation of the scoring methods are provided below:

4.2.1.1. Hydrologic Functions

Hydrologic Connectivity: Hydrologic connectivity scoring assesses the connectivity between surface waters to downstream receiving waters through both surface and shallow subsurface flow.

Scoring for this category was based on the ability of a defined drainage class or mitigation area to transmit either perennial or ephemeral flows from an upstream source to the downstream receiving water. Any impedance in a channel would slow the flow rate of water whether that impedance was artificial, such as a roadbed or railroad, or natural, such as a broad, flat channel with a deep sand and gravel bed. A "5" or "high" score would be given to a system that transmits virtually all water from its upstream source to the downstream receiving water. A "1" or "low" score would be given to a system that transmits comparatively little water from its upstream source to the downstream receiving water.

Subsurface Flow and Groundwater Recharge: Subsurface flow and groundwater recharge scoring assesses the potential for surface water to infiltrate into the channel bed and continue to move either vertically to recharge local or regional groundwater aquifers or laterally to support riparian vegetation and contribute to material cycling.

Scoring for this function was based on the permanence and volume of flow through the feature, coupled with the impedance of the channel. A "1" or "low" score would be given to a low-order ephemeral stream with compact bed soils; shallow bedrock, impenetrable horizons, or high clay content; and sparse xeroriparian buffer. A "5" or "high" score would be given to a large perennial stream with a silt or gravel bed substrate; meso-, hydroriparian, or wetland vegetation buffer; and, deep low-impedance soils promoting infiltration and hyporheic exchange through the streambed.

Energy Dissipation: Energy dissipation scoring assesses the ability of the watershed to dissipate the high energy of floodwaters leading to slower velocities, reduced potential for erosion, enhanced groundwater recharge, and support of riparian vegetation.

Scoring for this function was based on three parameters: the relative sinuosity of the channel, the roughness and gradient of the channel, and the ability of the adjacent floodplain to hold and attenuate flood flows. A "1" or "low" score would be given to a relatively straight, high-gradient stream with a sandy bottom or a constrained buffer and floodplain with minimal riparian vegetation. A "5" or "high" score would be given to a highly sinuous or braided low gradient channel with cobbles, woody vegetation, and/or debris within the channel; and an accessible floodplain with a well-developed riparian buffer.

Sediment Transport/Regulation: Sediment transport and regulation scoring assesses the ability of the features to regulate the transport of sediment downstream and the ability to minimize excessive sediment loss and gains.

Scoring for this function was based on a qualitative evaluation of the channel geometry, the ability of upstream and lateral features to provide sediment to the system, and the ability of the system to attenuate sediment loads. A "1" or "low" score would be given to feature with little ability to either provide sediment to the system and/or attenuate sediment loads, such as high-gradient, bedrock-dominated drainage systems. A "5" or "high" score would be given to a feature with strong abilities in these areas, such as features with deep alluvial beds or wide floodplains that provide sediment sources and storage.

4.2.1.2. Chemical Functions

Elements, Compounds, and Particulate Cycling: Elements, compounds, and particulate cycling scores assess the ability of a stream class to regulate the transport of elements, compounds, and particulates. This function includes the capacity to reduce harmful pulses of nitrogen and phosphorus to downstream waters. Riparian vegetation aids in the sequestration of nutrients that can be released during flood events and through subsurface movement. Riparian vegetation is also a critical component in the denitrification process, which can prevent excessive nitrogen levels that lead to eutrophication and hypoxia.

The cycling of elements, compounds, and particulates was evaluated using channel width, upland and riparian vegetation volume and composition, stream gradient, and bed characteristics. A lower score was given to a high-gradient, low-order headwater stream with reduced or degraded riparian buffer and/or excessive chemical input. A higher score would be given to a higher order stream with a healthy riparian buffer, active hyporheic zone, and features that have the ability to retard excessive nutrient pulses through capture and storage (such as roughness, sinuosity, or vegetation).

Organic Carbon Export/Sequestration: Organic carbon export and/or sequestration evaluate(s) the production, retention, and transport of organic nutrients through the riparian system. Riparian vegetation is capable of producing and exporting significantly higher amounts of organic carbon than typical desert upland vegetation.

Scoring for this function considers channel geometry, frequency of flow, stream connectivity, stream and riparian area substrates, and riparian buffer width, density, and species composition. A lower score would be given to a narrow ephemeral stream with little to no connectivity and a minimal riparian buffer. A higher score would be given to a wide perennial stream with a well-defined riparian buffer, dense vegetation, and healthy soils that could generate large amounts of organic material for sequestration or export.

4.2.1.3. Biotic Functions

Aquatic Invertebrate Fauna: Aquatic invertebrate fauna scoring assesses the presence of aquatic invertebrate fauna within the water features. This score is also an indication of the extent of prey base available to higher order species, including aquatic-feeding amphibians, reptiles, and fish.

Scoring for this metric is based on the number of aquatic invertebrate orders that are estimated to be present within impact areas and mitigation sites. If no invertebrates are present, a score of "0" or "none" was given to the site. Scoring was then determined by the estimated average number of taxonomic orders present within a site, with one order scoring "1" or "low" and five or more orders scoring "5" or "high."

Presence of Fish and Fish Habitat Structure: Scoring of this function assesses the presence and diversity of fish and the presence and quality of fish habitat based on methods outlined in Stacey et al. (2006).

A score of "none" was given for systems supporting no fish. A score of "1" or "low" was given for the presence of non-native fish only, while a score of "moderate" was given for the presence of both native and non-native species. A "5" or "high" score would be given for sites that have native species only.

Fish habitat structure is an aggregate of three factors, including the presence of riffles and pools, the amount of underbank cover, and the amount of woody debris within the channel. The presence of riffles and pools was scored based on estimated area containing pools with a score of "0" or "none" for a lack of pools up to a score of "5" or "high" for pools that are present along at least 50 percent of the feature. Underbank cover was scored in the same manner. Large woody debris was a qualitative evaluation of the amount of large woody debris within each drainage class. The three rankings were considered and a composite score between "0" and "5" was assigned based on the combination of conditions noted within each impacted drainage class or mitigation site.

Riparian/Wetland Vegetation Structure: Riparian/wetland vegetative structure scoring evaluates the volume, density, and structure of vegetation within the riparian areas. The extent and density of riparian vegetation directly affects the ability of the riparian area to perform many of the functions in this analysis. The volume, density, and structure of riparian vegetation is also important in determining the overall quality of the riparian ecosystem.

For this function, the qualitatively estimated volume, density, and structure of riparian vegetation, where present, were considered within the impact areas, both instream and within riparian and upland habitat. For the mitigation areas, the likely presence of riparian vegetation, as well as the volume, density, and structure of that vegetation, at the completion of successful mitigation was estimated based on similar riparian settings. The scoring categories were given numeric values corresponding to the estimated characteristics of riparian vegetation on a similar six-category numeric scale to that used in the qualitative assessment for the other 10 functions. A score of "1" or "low" would be given to areas generally lacking riparian vegetation, lacking vertical structural complexity of the riparian community, and lacking

horizontal interspersion. A "5" or "high" score would be given for sites with abundant wetland and riparian vegetation possessing a high degree of both vertical and horizontal structural complexity.

Age-Class Distribution of Woody Riparian or Wetland Vegetation: This function ranks the age-class distribution structure of woody vegetation. A robust age-class distribution provides diverse habitat niches and demonstrates the health and permanency of the riparian and/or wetland community present at the site.

Scoring for this function was based on the estimated age classes of shrubs and trees, and included seedling, sapling, mature, and senescent. If one class is present, the feature is scored "1" or "low"; if two classes are present, "2" or "low-moderate"; three classes, "3" or "moderate"; and all four classes, "4" or "moderate-high". A "5" or "high" score was given if all four classes were present along with wetland vegetation. For restoration activities, estimates were based on anticipated growth and recruitment levels in each area upon achievement of mitigation success.

Native/Non-native Woody Vegetation Species: Native/non-native woody vegetation species scoring provides a qualitative evaluation of the proportion of non-native woody species in the community. Non-native vegetation can have detrimental impacts on other plant and animal species, and it can alter soil and chemical functions and compositions.

A "5" or "high" score is given for classes or areas with an estimated cover of less than five percent non-native species, and a "1" or low score indicates greater than 50 percent estimated cover of non-native species. For the mitigation site, estimates were based on anticipated conditions in each area upon achievement of mitigation success.

4.2.2. Qualitative Comparison Functional Scores

The functional losses assessed entail impacts to ephemeral channel area within the footprint of the Project. The areas of each proposed mitigation activity within each of the three proposed mitigation sites were assessed for their ability to provide functional gain through the enhancement, reestablishment, restoration, and active management activities. **Table 7** provides the functional scoring of the three classes of potential waters of the U.S. that would be impacted by the Project and the functional scoring within the mitigation areas of the three proposed mitigation sites upon achievement of mitigation success. A full description of the scoring rationale for the three classes of ephemeral drainages and the mitigation areas of the three proposed mitigation sites is attached as **Appendix A**.

Table 7. Functional Assessment Scoring for Impacted Drainage Classes and Mitigation Areas*

Assessed Functions	Skunk Camp TSF Impact Site			MAR-5/ORRS Mitigation Site		Queen Creek Mitigation Site	H&E Farm Mitigation Site	
	Impact Class A	Impact Class B	Impact Class C	MAR-5 Restoration Area	ORRS Area	Queen Creek Enhancement Area	H&E Terrace Reestablishment Area	H&E Wetland Reestablishment Area
Hydrologic Functions								
Hydrologic Connectivity	5	4	2	4	4	5	4	5
Subsurface Flow/Groundwater Recharge	4	3	2	5	2	4	3	4
Energy Dissipation	5	3	2	4	4	5	3	3
Sediment Transport/Regulation	5	3	2	4	4	5	4	4
Chemical Functions								
Elements, Compounds, and Particulate Cycling	4	3	2	4	3	4	4	4
Organic Carbon Export/Sequestration	4	2	1	4	3	4	3	4
Biotic Functions								
Aquatic Invertebrate Fauna	1	1	1	3	4	2	2	4
Presence of Fish and Fish Habitat Structure	0	0	0	2	2	0	0	1
Riparian/Wetland Vegetation Structure	4	3	3	4	3	4	2	4
Age-Class Distribution of Woody Riparian or Wetland Vegetation	4	3	3	4	3	4	3	4
Native/Non-Native Vegetation Species	5	5	5	4	4	5	4	4

* Impact drainage classes shown on **Figure 7** and mitigation areas shown on **Figures 8**, **9**, and **10**.

The scores provided by the functional assessment are used to develop the mitigation baseline ratios for use in the MRSC worksheet included as Attachment 12501.6-SPD of the *Standard Operating Procedure for the Determination of Mitigation Ratios* (Corps 2017). Comparison of each impacted drainage class to each mitigation area of the three mitigation sites calculates the adjustment from the starting 1:1 mitigation to impact ratio, were a given mitigation area used to mitigate for a given impact. Mitigation provided for impacts can be higher or lower depending on the relative quality of the mitigation function compared to the quality of the impacted function. The ratios calculated from the complete list of comparisons are provided in **Table 8**.

Table 8. Comparative Mitigation Baseline Ratios for MRSC Step 2

Mitigation Site Areas	Skunk Camp TSF Impact Site		
	Impact Class A Ratio	Impact Class B Ratio	Impact Class C Ratio
MAR-5/ORRS Mitigation Site			
MAR-5 Restoration Area	2.50:1	1.75:1	1:1
ORRS Area	2.75:1	2.60:1	1:1
Queen Creek Mitigation Site			
Queen Creek Enhancement Area	4.50:1	4:1	4:1
H&E Farm Mitigation Site			
H&E Terrace Reestablishment Area	2.50:1	1.50:1	1.20:1
H&E Wetland Reestablishment Area	1.75:1	1:1.50	1:2.75

4.3. QUANTITATIVE IMPACT-MITIGATION COMPARISON (STEP 3)

Steps 2 and 3 of the MRSC are mutually exclusive and provide a comparison of the impact and mitigation sites based on a set of defined functional values. Step 2 is qualitative comparison (used in this analysis and described above) and Step 3 is a quantitative comparison. In order to proceed using Step 3, the MRSC requires an accepted method for conducting the assessment quantitatively. In most cases, this requires a published, peer-reviewed assessment manual that is appropriate for the region and the aquatic functions present within all considered sites. Currently, there is no Corps-approved assessment method accepted for use in Arizona. Therefore, this analysis uses the qualitative assessment in Step 2 and omits Step 3.

4.4. MITIGATION SITE LOCATION (STEP 4)

Step 4 of the MRSC is a ratio adjustment based on the location of a mitigation site with respect to the impact site. This is generally determined based on whether both sites are located within the same watershed as defined by the appropriate HUC. Although there is no defined standard HUC level for use in completing the MRSC, HUC 8 or HUC 10 designations are typically considered appropriate.

The Project is located within the Middle Gila River HUC 8 (15050100) subbasin. Both the MAR-5/ORRS Mitigation Site and the Queen Creek Mitigation Site are also located in the Middle Gila River HUC 8 (15050100) subbasin and no penalty for mitigation site location is applied for these sites. The H&E Farm Mitigation Site is located within the adjacent Lower San Pedro HUC 8 (15050203) subbasin and, although it is proximal to and has a direct hydrologic connection with the reach of the Gila River directly downgradient of the impact site (**Figure 6**), an adjustment of +1 for mitigation site location is applied for this site.

4.5. NET LOSS OF AQUATIC RESOURCE SURFACE AREA (STEP 5)

Per the MRSC instructions, credit can only be given for this step if establishment or reestablishment of aquatic features is to be completed by proposed mitigation actions. Net loss of aquatic resources is scored with a modification of +0 for establishment or reestablishment mitigation and +1 for all remaining mitigation types.

Aquatic resource reestablishment has already occurred as a result of water discharge within the MAR-5 Restoration Area and no penalty for net loss of aquatic resource surface area is applied for this site. No aquatic resource establishment is proposed within the ORRS Mitigation Site or the Queen Creek Mitigation Site. Therefore, an adjustment of +1 is added to the mitigation ratio for these mitigation areas. Aquatic resource reestablishment is proposed within both mitigation areas at the H&E Farm Mitigation Site. Therefore, no penalty for net loss of aquatic resource surface area is applied for this site.

4.6. TYPE CONVERSION (STEP 6)

Out-of-kind mitigation can result in an increase to the mitigation ratio if the mitigation site presents lower quality or less valuable habitat. However, if it is determined that the mitigation site has or will have a rare, unique, or valuable resource type for the determined watershed, a decrease of the mitigation ratio could be applied. Scoring for this category can range from +4 for out-of-kind habitat that is common to -4 for restoration or conversion of rare and valuable habitat. The scoring for this category compares the impact sites and the mitigation sites by assessing the rarity of the stream or habitat type and the overall functional benefit to the watershed.

Development of the Skunk Camp TSF Alternative is expected to result in the permanent impact to and loss of 172.62 acres of ephemeral drainages. This alternative would not adversely impact any special aquatic sites, including wetlands. The three defined classes of impacted drainages, Classes A, B, and C consist only of ephemeral desert washes with relatively sparse xeroriparian or upland vegetation and temporary flow regimes. While these features play an important role in desert ecology, they are more common and provide less functional value when compared to the riparian areas offered by the proposed mitigation sites.

The mitigation areas of the MAR-5/ORRS Mitigation Site provide opportunities for rehabilitation, enhancement, and long-term management along a stretch of the Gila River. Upon achievement of the mitigation success criteria, the MAR-5 Restoration Area and the ORRS Area would provide dense riparian habitat that is both rare and important within Arizona. The discharge of Central Arizona Project water into the Gila River channel has already established a riparian vegetation community along this reach. Due to the rare and regionally significant habitat rehabilitated and enhanced by these mitigation areas, a ratio adjustment of -3 is applied.

The Enhancement Area of the Queen Creek Mitigation Site provides opportunities for enhancement, preservation, and long-term management along Queen Creek. This reach of Queen Creek provides mature xeroriparian habitat. Exotic species removal and control, seeding of native species, and removal of select anthropogenic disturbances without additional disturbance of mature vegetation will enhance the functions of the riparian community associated with this reach. This community is most similar to that found along the largest drainages in the Skunk Camp Impact Area but is also more common that more mesic riparian areas. A ratio adjustment of -1.5 is applied for the Queen Creek Enhancement Area.

The mitigation areas of the H&E Farm Mitigation Site provide opportunities for reestablishment of some ephemeral drainage channels on the floodplain terrace, reestablishment of the natural alluvial fan and terrace structure, and restoration of associated vegetation. Upon achievement of the mitigation success criteria, the H&E Terrace Reestablishment Area would provide dense, mesquite-dominated, riparian habitat that is currently both rare and important within Arizona. Earthwork and planting of native riparian trees and shrubs in the H&E Wetland Reestablishment Area would reestablish former wetland areas, enhance the existing wetlands along the San Pedro River channel, and restore a more native vegetation community. The rarity of wetland features within Arizona, as well as their location in proximity to other river restoration projects like the LSPRWA ILF, makes this mitigation regionally significant. Due to these factors, a ratio adjustment of -2.5 is applied for the H&E Terrace Reestablishment Area and a ratio adjustment of -3.5 is applied for the H&E Wetland Reestablishment Area.

4.7. RISK AND UNCERTAINTY (STEP 7)

Risk and uncertainty are assessed so that the mitigation ratio reflects the uncertainty inherent in some mitigation activities. Factors that are considered include: 1) permittee-responsible mitigation; 2) mitigation site did not formerly support targeted aquatic resources; 3) difficult-to-replace resources (see 33 CFR 332.3(e)(3) and (f)(2)); 4) modified hydrology (e.g., high-flow bypass); 5) artificial hydrology (e.g., pumped water source); 6) structures requiring long-term maintenance (e.g., outfalls, drop structures, weirs, bank stabilization structures); 7) planned vegetation maintenance (e.g., mowing, land-clearing, fuel modification activities); 8) shallow, buried structures (e.g., riprap, clay liners), and 9) absence of long-term preservation mechanism. Each element of risk is scored from +0.1 to +0.3 based on the amount of uncertainty.

The mitigation actions at the MAR-5 Restoration Area include the establishment of riparian vegetation that has already occurred and, therefore, has proven successful. This suggests the management of exotic species and the establishment of native riparian vegetation through active management also has a high probability of success. The restoration does, however, presently require artificial hydrology, includes planned vegetation maintenance, and is permittee-responsible mitigation. The ratio adjustment for these factors of the MAR-5 Restoration Area is +1. The mitigation actions at the ORRS Area include planned vegetation maintenance and are permittee-responsible but lack the need for artificial hydrology. The ratio adjustment for these factors of the ORRS Area is +1. Until long-term site protection has been addressed, the Corps has requested that an additional +1 be added to the risk and uncertainty variable for this site. When long-term site protection has been addressed to the Corps' satisfaction, this additional +1 modifier for both sites will be removed.

The mitigation actions within the Enhancement Area of the Queen Creek Mitigation Site include planned vegetation maintenance and are permittee-responsible, but these actions are limited in area. Therefore, a ratio adjustment of +0.7 was applied to these actions.

The mitigation actions at both areas of the H&E Farm Mitigation Site involve planned vegetation management, utilize water control structures requiring long-term management, and are, at present, permittee-responsible mitigation. Vegetation reestablishment in the H&E Terrace Reestablishment Area may involve some artificial hydrology to ensure planting success. Given the existing site characteristics, vegetation and wetland reestablishment in the H&E Wetland Reestablishment Area would not require artificial hydrology but does involve wetlands, a difficult-to-replace resource. Based on these factors, a ratio adjustment of +0.7 is applied to both areas of the H&E Farm Mitigation Site.

4.8. TEMPORAL LOSS (STEP 8)

Temporal loss is associated with mitigation activities that begin after impacts are made and considers the amount of time it takes for a mitigation activity to reach a full, functional potential. Ratio adjustments are applied based on the amount of time required for the planting, establishment, and growth of vegetation. The temporal adjustment to the mitigation ratio is .05 per month and generally assumes a 20-month period (adjustment of +1) for herbaceous growth, a 40-month period (adjustment of +2) for woody shrubs, and a 60-month, or 5-year, period (adjustment of +3) for tree species.

The mitigation actions at both areas of the MAR-5/ORRS Mitigation Site include the establishment of tree species. The establishment of trees within the MAR-5 Restoration Area has, however, already occurred and therefore no ratio adjustment is applied in this step. Additionally, the impacts to potential waters of the U.S. from the development of the TSF will not occur for up to 10 years after issuance of the permit. As such, the proposed establishment of tree species within the ORRS Area of the MAR-5/ORRS Mitigation Site, the Queen Creek Mitigation Site, and the H&E Farm Mitigation Site will not involve a temporal loss of function between the initiation of the impact and the completion of the

mitigation establishment. Therefore, no ratio adjustment is applied to these mitigation areas for this step.

4.9. FINAL MITIGATION RATIO (STEP 9)

The final ratios determine the amount of acreage credits that are generated by each mitigation area when compared to each impacted drainage class. Step 9 of the MRSC is the calculation of final mitigation scoring ratios from Steps 2-8 in the MRSC. The final mitigation ratios comparing each impact class to each mitigation area were compiled and are summarized in **Table 9**. The *Standard Operating Procedure for the Determination of Mitigation Ratios* (Corps 2017) instructions state that where a qualitative comparison is used for the functional assessment in Step 2, final mitigation ratios may not be less than 1:1. Therefore, ratios shown in **Table 9** as less than 1:1 are applied as a ratio of 1:1 in **Table 10**.

Table 9. Final Mitigation Ratios Per Impacted Drainage Class and Mitigation Area

Mitigation Site Areas	Skunk Camp TSF Impact Site		
	Impact Class A Ratio	Impact Class B Ratio	Impact Class C Ratio
MAR-5/ORRS Mitigation Site			
MAR-5 Restoration Area	1.25:1	0.88:1	0.50:1
ORRS Area	2.75:1	2.60:1	1:1
Queen Creek Mitigation Site			
Queen Creek Enhancement Area	4.70:1	4.20:1	4.20:1
H&E Farm Mitigation Site			
H&E Terrace Reestablishment Area	1.39:1	0.83:1	0.67:1
H&E Wetland Reestablishment Area	0.63:1	0.30:1	0.22:1

4.10. FINAL COMPENSATORY MITIGATION SUMMARY (STEP 10)

In Step 10, the total acres of impacted area by drainage class are applied to the number of mitigation credits provided by mitigation site, based on the final mitigation ratios. **Table 10** summarizes the application of the MRSC-derived mitigation ratios to the mitigation sites in a sequential fashion. The completed MRSC worksheets, showing the steps described above, are provided as **Appendix B**. Mitigation credits were applied to the higher functionally scoring Class A impacts first, then to the lower scoring Class B and Class C. The application of mitigation credit areas began with the MAR-5/ORRS Mitigation Site areas and moved sequentially through the mitigation areas of the Queen Creek Mitigation Site and the H&E Farm Mitigation Site, as needed, until all of the functional impacts for each drainage class were mitigated. Application of the mitigation credits in this fashion was based solely on the order of discussion of the mitigation sites in this document. Actual application of the mitigation

credits in the Final Mitigation Plan may occur in a number of ways. The application of mitigation to impacts in this MRSC document is intended to demonstrate sufficient credit is available to mitigate for unavoidable impacts to waters of the U.S. from development of the Project.

Table 10. Final Mitigation Credits Applied by Impact Drainage Class and Mitigation Site/Area

Impact Drainage Class	Impact Acres	Mitigation Site/Area	Mitigation Acres Available	Mitigation Ratio	Mitigation Acres Used	Mitigation Credits Provided	Remaining Impact Acres
Impact Class A	86.94	MAR-5 Restoration Area	123.00	1.25:1	108.68	86.94	0.00
		ORRS Area	23.00	2.75:1	0.00	0.00	0.00
		Queen Creek Enhancement Area	33.00	4.70:1	0.00	0.00	0.00
		H&E Terrace Reestablishment Area	300.00	1.39:1	0.00	0.00	0.00
		H&E Wetland Reestablishment Area	15.00	1:1	0.00	0.00	0.00
Impact Class B	39.98	MAR-5 Restoration Area	14.32	1:1	14.32	14.32	25.66
		ORRS Area	23.00	2.60:1	23.00	8.84	16.82
		Queen Creek Enhancement Area	33.00	4.20:1	33.00	7.85	8.97
		H&E Terrace Reestablishment Area	300.00	1:1	8.97	8.97	0.00
		H&E Wetland Reestablishment Area	15.00	1:1	0.00	0.00	0.00
Impact Class C	45.70	MAR-5 Restoration Area	0.00	1:1	0.00	0.00	0.00
		ORRS Area	0.00	1:1	0.00	0.00	0.00
		Queen Creek Enhancement Area	0.00	4.20:1	0.00	0.00	0.00
		H&E Terrace Reestablishment Area	291.03	1:1	45.70	45.70	0.00
		H&E Wetland Reestablishment Area	15.00	1:1	0.00	0.00	0.00

5. REFERENCES

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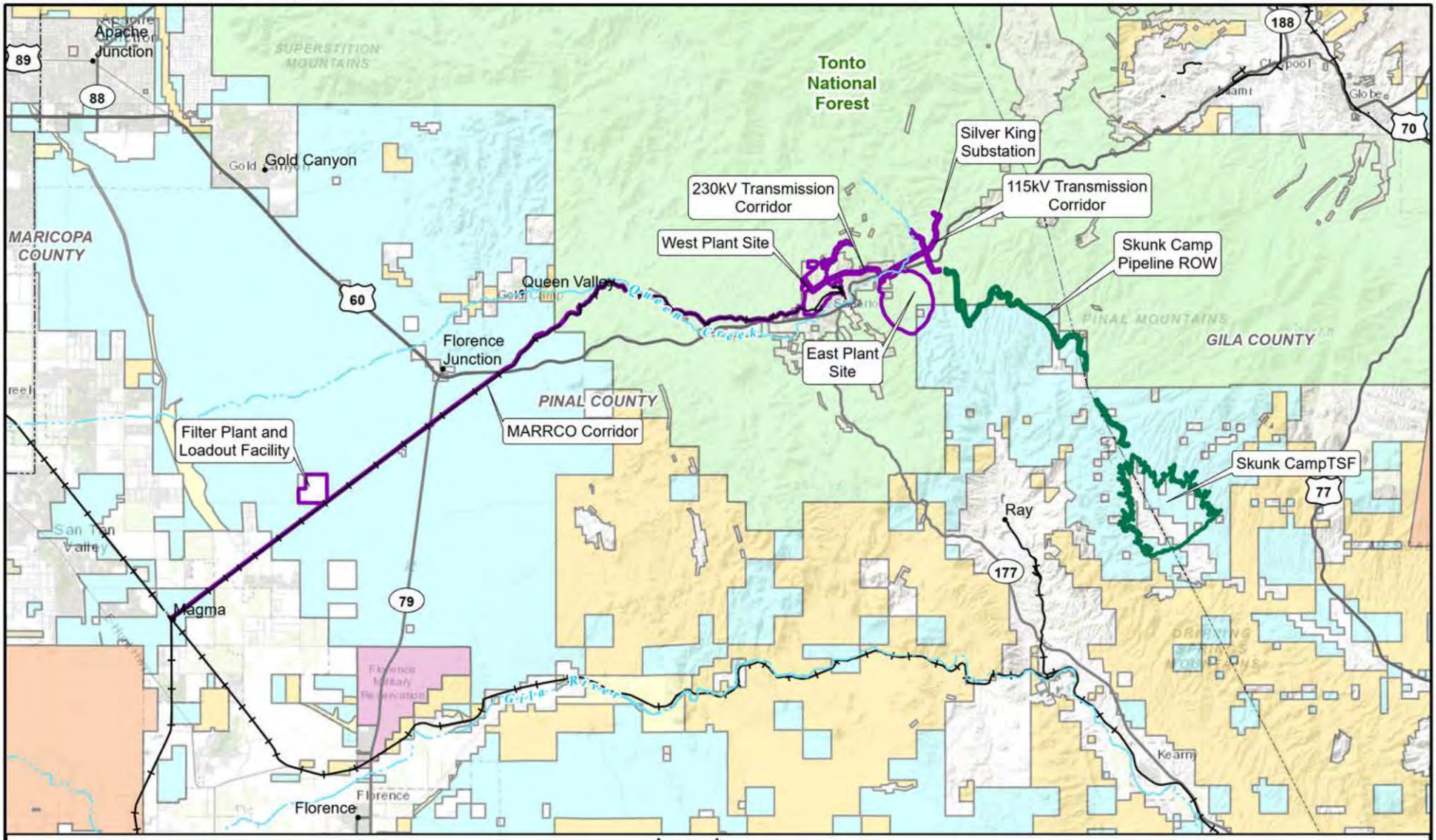
_____. 2020b. DRAFT Clean Water Act Section 404 Conceptual Mitigation Plan: Resolution Copper Project. *Prepared for U.S. Army Corps of Engineers on behalf of Resolution Copper*. Tucson, Arizona: WestLand Resources, Inc. July 2020.

FIGURES



Legend

Pinal and Gila Counties, Arizona,
Data Source: BLM 2019, WRI Modified 2019, ALRIS, SWCA, and USFS
Image Source: ArcGIS Online, World Topo Map

N
0 2.5 5 Miles
0 4 8 Kilometers

WestLand Resources

- Skunk Camp TSF Alternative
- GPO Mine Element

Surface Management

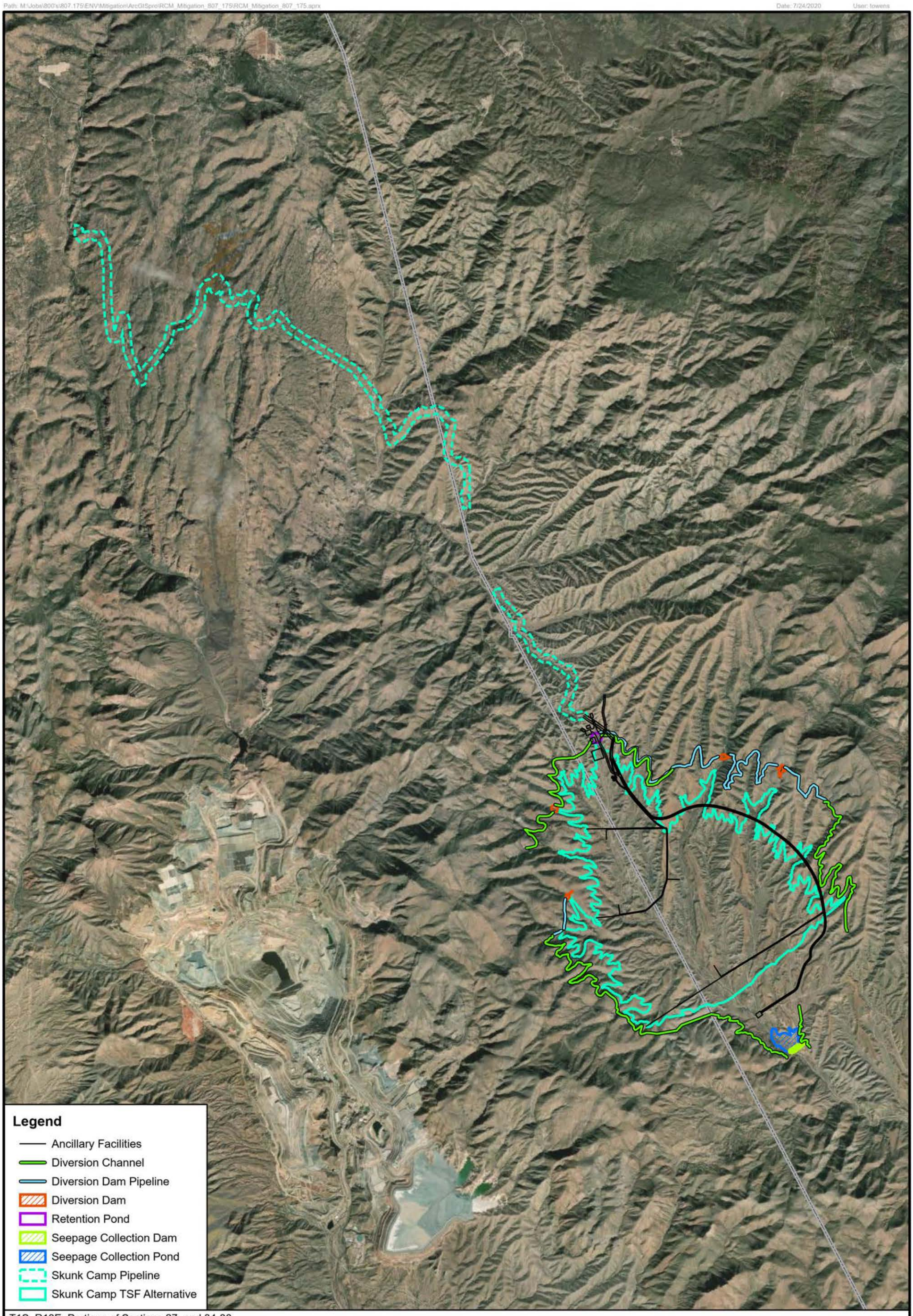
- Bureau of Land Management (BLM)
- Bureau of Reclamation
- County
- Indian Lands
- Local or State Parks
- Military
- Other
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

OVERVIEW OF PROPOSED MINING OPERATION

Figure 1



T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018

WestLand Resources

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

SKUNK CAMP TSF ALTERNATIVE
AERIAL OVERVIEW

Figure 2

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Legend

- Ancillary Facilities
- Diversion Channel
- Diversion Dam Pipeline
- Diversion Dam
- Retention Pond
- Seepage Collection Dam
- Seepage Collection Pond
- Skunk Camp Direct OHWM Impact
- Skunk Camp Indirect OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019

N

0 3,000 6,000 Feet

0 1,500 3,000 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

SKUNK CAMP TSF ALTERNATIVE
IMPACTS TO THE AQUATIC ECOSYSTEM

Figure 3

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Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019

Legend

- Ancillary Facilities
- Diversion Channel
- Diversion Dam Pipeline
- Diversion Dam
- Retention Pond
- Seepage Collection Dam
- Seepage Collection Pond
- Skunk Camp Direct OHWM Impact
- Skunk Camp Indirect OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land

N

0 1,500 3,000 Feet

0 750 1,500 Meters

WestLand Resources

USDA FSA, GeoEye, Maxar, CNES/Airbus DS

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

SKUNK CAMP TSF DIRECT AND INDIRECT IMPACTS

Figure 4

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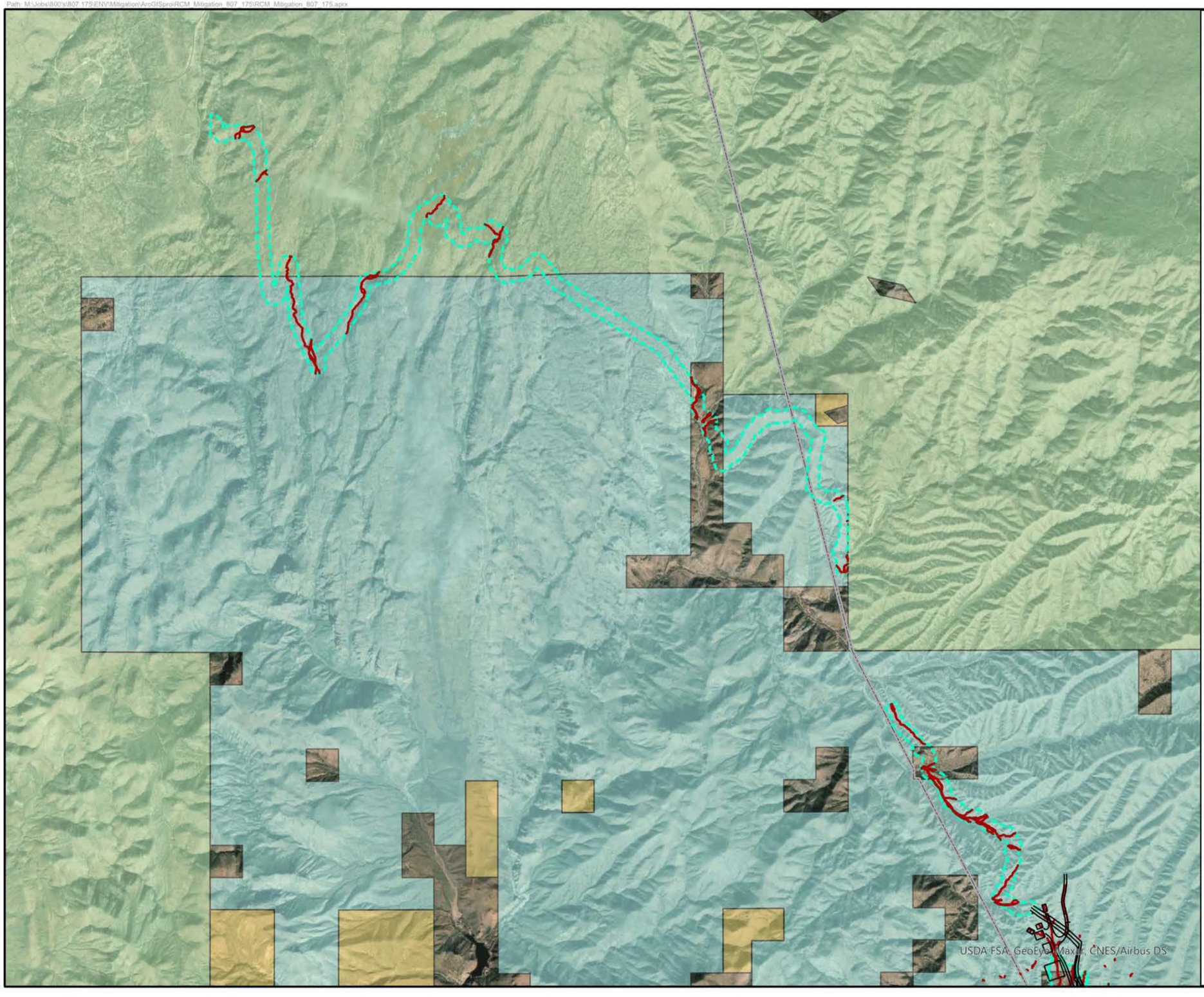

Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019

Legend

- Ancillary Facilities
- Skunk Camp Direct OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

Note: Most OHWM impacts in the pipeline corridor are temporary and this analysis conservatively assumes all OHWM will be impacted.

N

0 2,000 4,000 Feet

0 1,000 2,000 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

SKUNK CAMP TSF PIPELINE DIRECT IMPACTS

Figure 5

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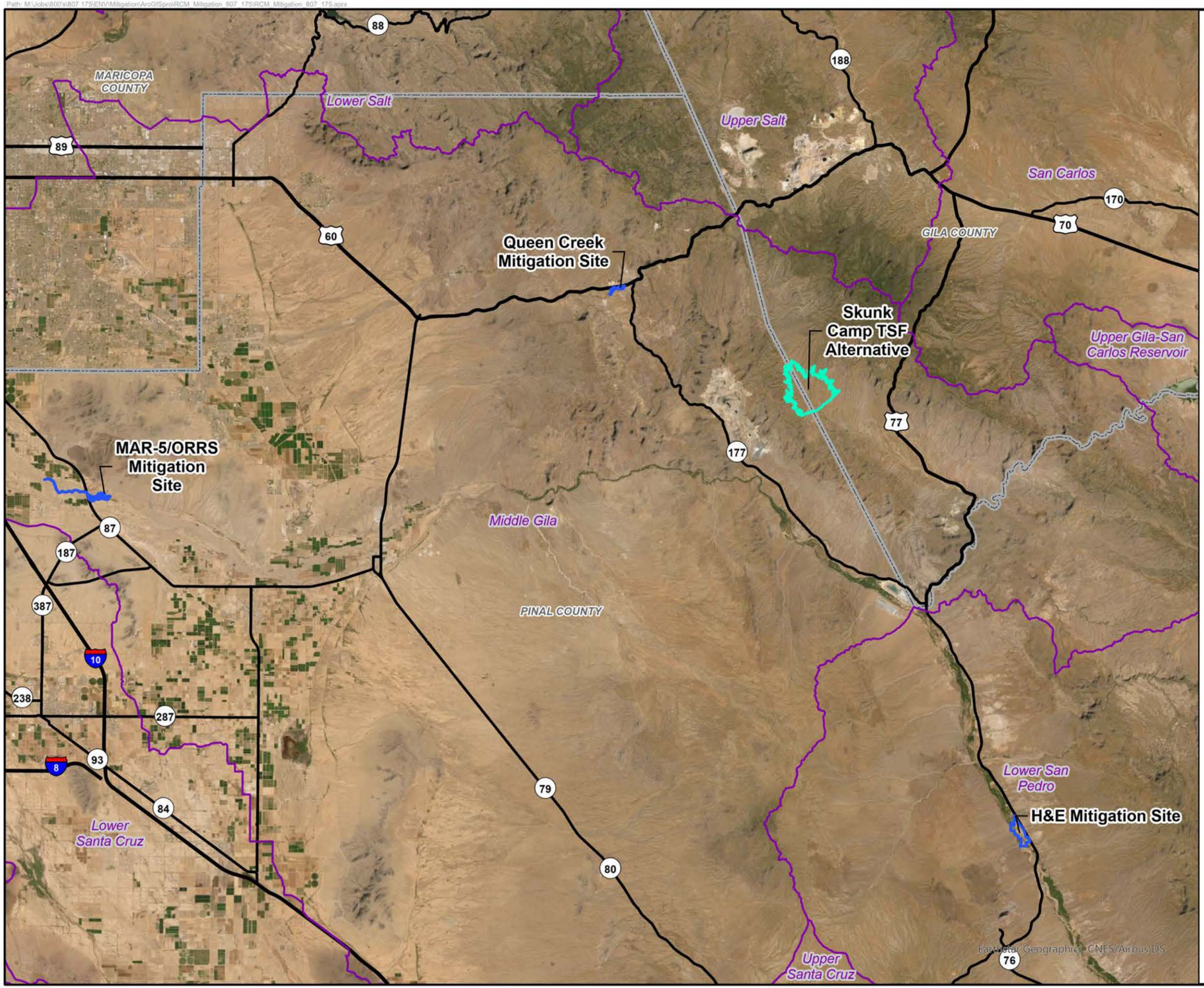

Portions of T2S R12-14E, T4S R6-7E, T6S R20E, T7S R16E, and T8S R16E,
Pinal, Graham, and Gila Counties, Arizona,
Image Source: Maxar 2018

Legend

- Mitigation Boundaries
- Skunk Camp TSF Alternative
- USGS HUC 8

N

0 4 8 Miles

0 8 16 Kilometers

WestLand Resources

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

MITIGATION SITES AERIAL OVERVIEW

Figure 6

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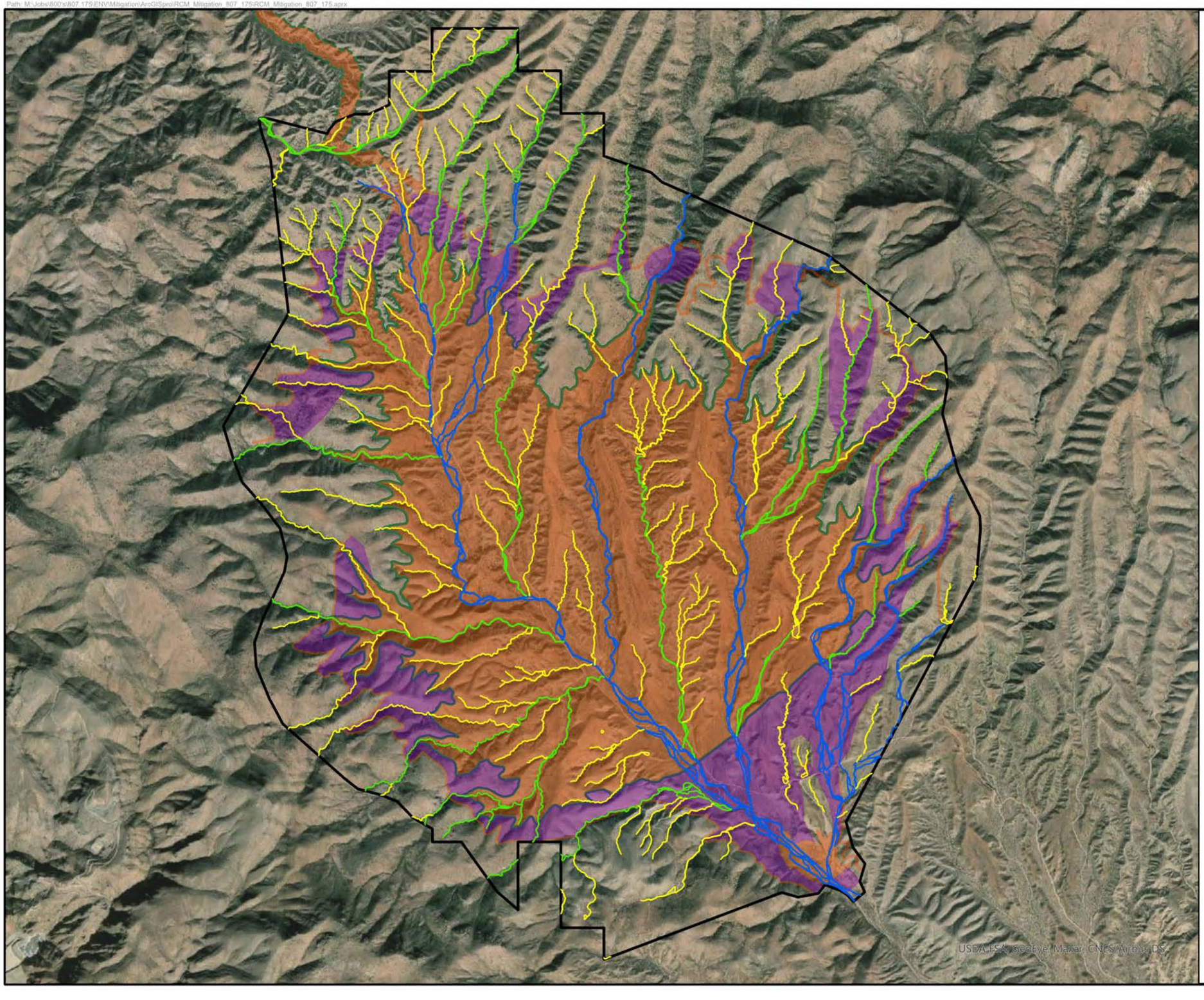

Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018

Legend

- Skunk Camp Analysis Area
- Skunk Camp Direct Impact Area
- Skunk Camp Indirect Impact Area
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Skunk Camp OHWM Drainage Class

- Class A
- Class B
- Class C

N

0 1,500 3,000 Feet

0 750 1,500 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

SKUNK CAMP TSF IMPACT DRAINAGE CLASSES

Figure 7

Path: M:\Jobs\800's\807 175\ENV\Mitigation\ArcGISpro\RCM_Mitigation_807_175\RCM_Mitigation_807_175.aprx

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T4S, R6E, Portions of Sections 8-14,
Pinal County, Arizona,
Image Source: Maxar 6/19/2018

WestLand Resources

N

0 750 1,500 Feet

0 250 500 Meters

Legend

- MAR-5/ORRS Mitigation Site
- MAR-5 Restoration Area
- ORRS Area

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

MAR-5/ORRS MITIGATION SITE

Figure 8

Path: M:\Jobs\800's\807.175\ENV\Mitigation\ArcGISproj\RCM_Mitigation_807_175\RCM_Mitigation_807_175.aprx

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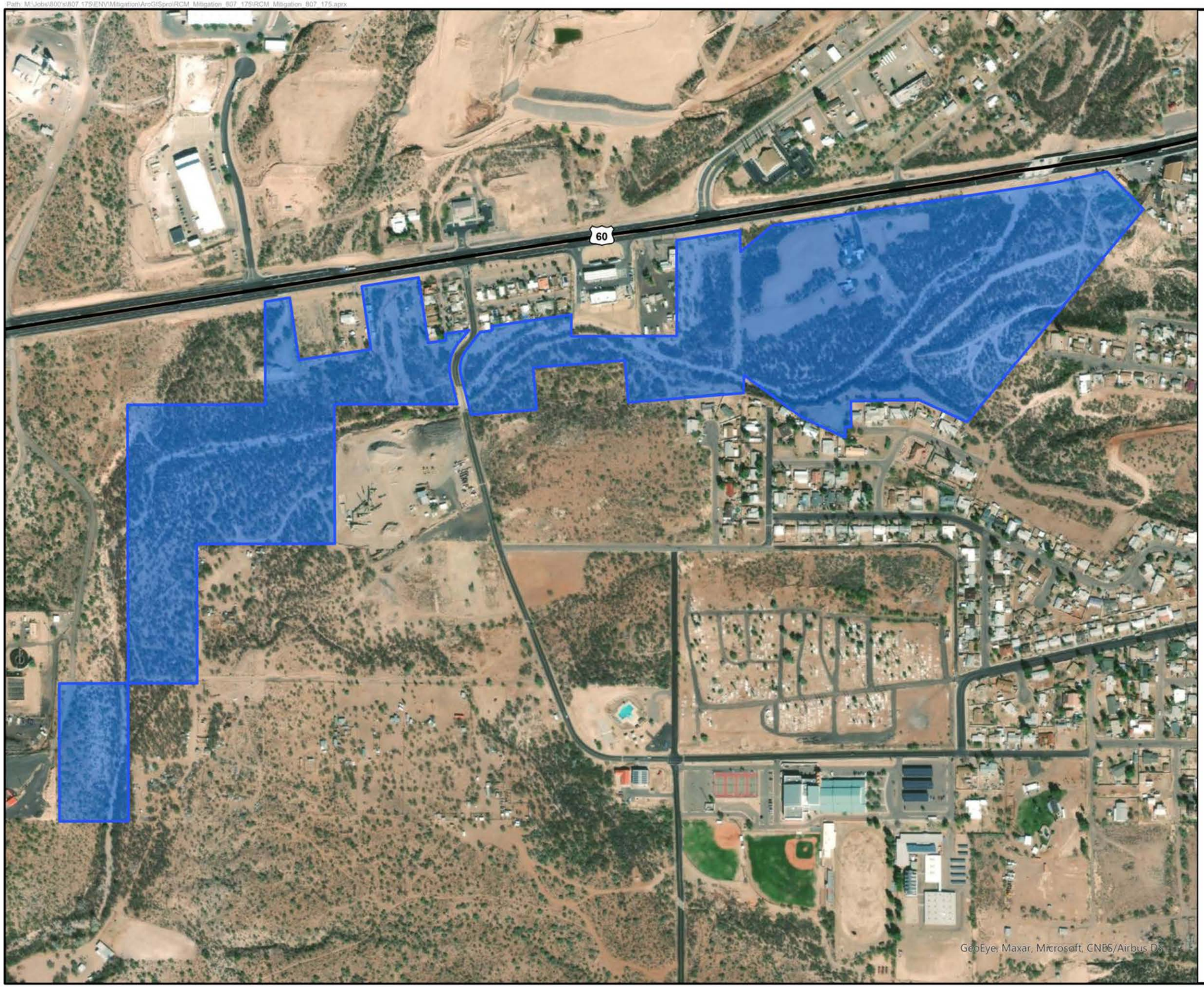


T2S, R12E, Portions of Sections 3 and 4,
Pinal County, Arizona,
Image Source: Maxar 2/6/2018

Legend

- Queen Creek Enhancement Area
- Queen Creek Mitigation Site

N

0 250 500 Feet

0 100 200 Meters

WestLand Resources

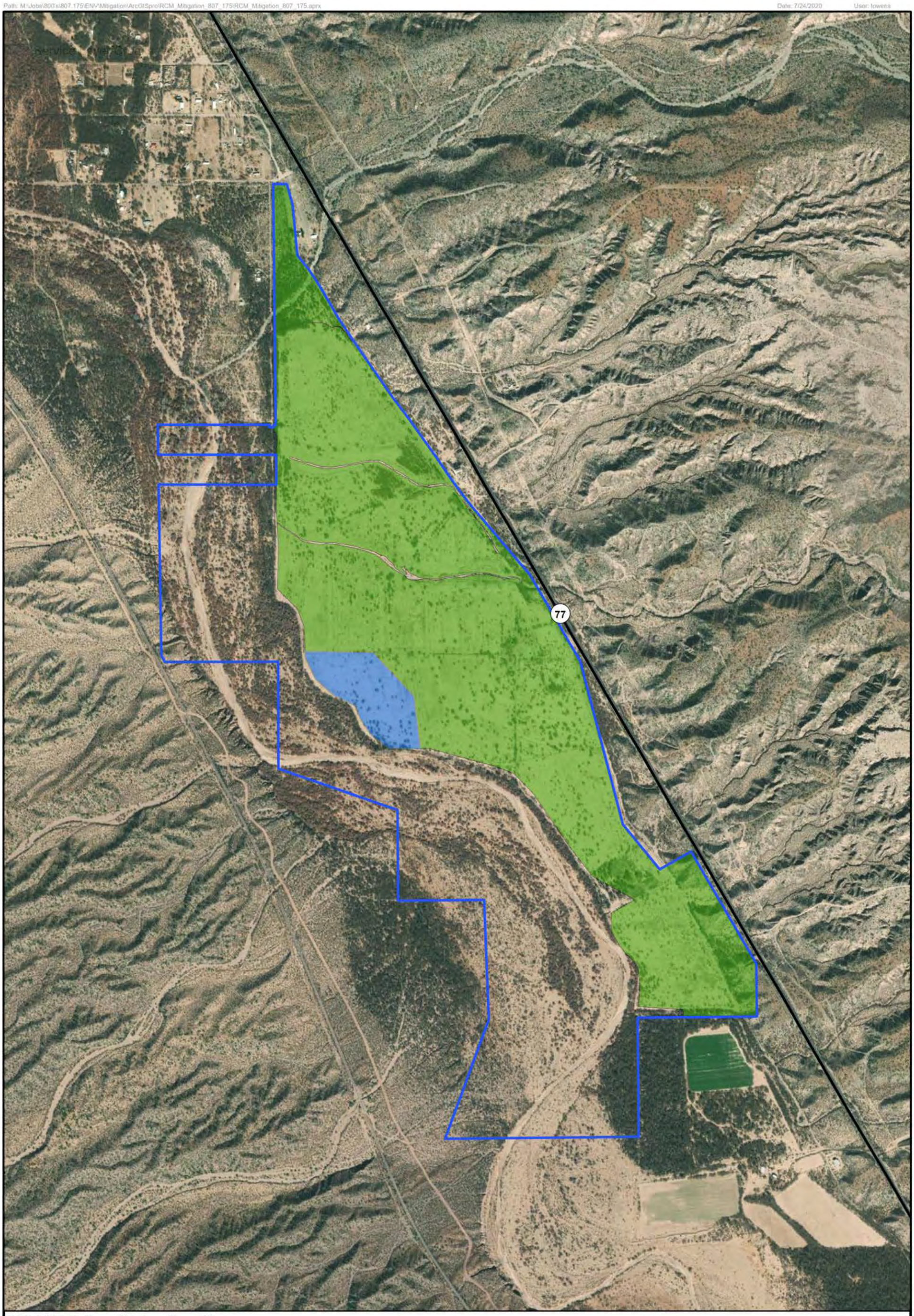
RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

QUEEN CREEK MITIGATION SITE

Figure 9

Path: M:\Jobs\800's\807.175\ENV\Mitigation\ArcGISpro\RCM_Mitigation_807_175\RCM_Mitigation_807_175.aprx Date: 7/24/2020 User: towens



T7S, R16E, Portions of Sections 35 and 36,
T8S, R16E, Portion of Section 1,
Pinal County, Arizona,
Image Source: Maxar 1/31/2018

WestLand Resources

N

0 500 1,000 Feet

0 250 500 Meters

Legend

- H&E Farm Mitigation Site
- H&E Terrace Reestablishment Area
- H&E Wetland Reestablishment Area

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

H&E FARM MITIGATION SITE

Figure 10

APPENDIX A

Functional Scoring Summaries

IMPACT CLASS A

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	5 High	Class A features consist of low-gradient, braided, lower-watershed ephemeral channels. The channels lack major impediments to flow and are capable of transporting moderate high volumes of water, though transport capacity is dependent on rainfall.
Subsurface Flow/Groundwater Recharge	4 Moderate-High	Water flow through the loose alluvial soils in Class A channels provides some subsurface flow and potential to replenish groundwater aquifers, with subsurface flows strongly dependent on precipitation events. Limited xeroriparian vegetation indicates that temporary lateral subsurface flow potential may exist.
Energy Dissipation	5 High	Class A features exhibit braided channels, channel sinuosity, low-gradient, a well-developed floodplain, and loose alluvium capable of reducing flow intensities through evaporation, channel infiltration, and natural physical control features.
Sediment Transport/Regulation	5 High	Class A features have braided channels with well-sorted bed material and primarily unrestricted floodplains and can retain and deposit large amounts of sediment during precipitation events. Lack of dense riparian habitat may limit the ability of these features to regulate excessive sediment loads.
Chemical Functions		
Elements, Compounds, and Particulate Cycling	4 Moderate-High	Class A features have broad channels with loose alluvium and have the potential to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. These systems are ephemeral and are generally vegetated only with xeroriparian and upland species, which may limit nutrient cycling ability.
Organic Carbon Export/Sequestration	4 Moderate-High	Class A features have the potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The features, along with upstream and downstream adjacent waters, are ephemeral, limiting both the amount and timing of carbon sequestration and export through the system. These features also lack a significant amount of in-channel vegetation and a dense riparian buffer, which limits the ability of the system to generate or export high amounts of organic carbon.
Biotic Functions		
Aquatic Invertebrate Fauna	1 Low	Class A features do not exhibit permanent or intermittent flows. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species.
Presence of Fish and Fish Habitat Structure	0 None	Class A features do not contain any permanent or intermittent waters. Flow events within these ephemeral systems will not result in the presence of fish species.

Function	Score	Explanation
Riparian/Wetland Vegetation Structure	4 Moderate-High	Class A features generally do not support riparian-obligate vegetation. Xeroriparian vegetation is common and widespread along the banks and floodplain terraces of these features. Vegetated area supports 2 or more plant layers, and these features have a "high" to "moderate" degree of horizontal vegetation interspersion.
Age Class Distribution of Woody Riparian or Wetland Vegetation	4 Moderate-High	In Class A features, wetland vegetation is generally absent. Xeroriparian and upland vegetation is common and widespread. Woody trees and shrubs from a range of age classes are present.
Native/Non-native Vegetation Species	5 High	The vegetation communities in Class A features are mostly native. Vegetation sampling indicates an average of less than 15% invasion by non-native species.

IMPACT CLASS B

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	4 Moderate-High	Class B features consist of ephemeral, typically moderate- to high-gradient single-thread upper watershed channels. The channels lack major impediments to flow and are capable of transporting moderate low to moderate volumes of water, though transport capacity is dependent on rainfall.
Subsurface Flow/Groundwater Recharge	3 Moderate	Water flow through the Class B channels provides limited amount of subsurface flow and potential to replenish groundwater aquifers, with subsurface flows strongly dependent on precipitation events. Infiltration limited by impervious layers at shallow depths. Limited xeroriparian vegetation indicates that temporary lateral subsurface flow potential may exist.
Energy Dissipation	3 Moderate	Class B features typically contain single-thread channels and are moderate to high gradient. Energy dissipation through infiltration limited by lack of in-channel sediments and impervious layers at shallow depths. Energy dissipation occurs through natural physical control features such as cut banks, channel sinuosity, boulder steps, and/or flood debris.
Sediment Transport/Regulation	3 Moderate	Class B features have well or poorly-sorted bed material and can retain and deposit a moderate amount of sediment during precipitation events. Confined floodplains may limit the extent of sediment regulation in these features.
Chemical Functions		
Elements, Compounds, and Particulate Cycling	3 Moderate	Class B features have a limited capacity to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. These systems are ephemeral and are generally vegetated with a narrow band of xeroriparian vegetation, which may limit nutrient cycling ability.
Organic Carbon Export/Sequestration	2 Low-Moderate	Class B features have limited potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The features, along with upstream and downstream adjacent waters, are ephemeral, limiting both the amount and timing of carbon sequestration and export through the system. These features lack a dense riparian buffer and may have shallow depths to bedrock, which limits the ability of these features to generate or export high amounts of organic carbon.
Biotic Functions		
Aquatic Invertebrate Fauna	1 Low	Class B features do not exhibit permanent or intermittent flows. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species.
Presence of Fish and Fish Habitat Structure	0 None	Class B features do not contain any permanent or intermittent waters. Flow events within these ephemeral systems will not result in the presence of fish species.

Function	Score	Explanation
Riparian/Wetland Vegetation Structure	3 Moderate	Class B features generally do not support riparian-obligate vegetation. Xeroriparian vegetation is present but limited along the banks of these features. Vegetated area supports 2 or more plant layers, and these features have a "high" to "moderate" degree of horizontal vegetation interspersion.
Age Class Distribution of Woody Riparian or Wetland Vegetation	3 Moderate	In Class B features, wetland vegetation is generally absent. Xeroriparian and upland vegetation is common but limited along the bed and banks. Woody trees and shrubs from a range of age classes are present.
Native/Non-native Vegetation Species	5 High	The vegetation communities in Class B features are mostly native. Vegetation sampling indicates an average of less than 15% invasion by non-native species.

IMPACT CLASS C

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	2 Low-Moderate	Class C features consist of ephemeral, moderate- to high-gradient single-thread headwater channels. The channels lack major impediments to flow and are capable of transporting moderate low volumes of water, and only in response to heavy precipitation events.
Subsurface Flow/Groundwater Recharge	2 Low-Moderate	Water flow through the Class C channels provides very small amount of subsurface flow, if any, with very limited potential to replenish groundwater aquifers. Infiltration limited by impervious layers at shallow depths and shallow depth to bedrock. Narrow bands of xeroriparian vegetation indicate that temporary lateral subsurface flow potential may exist.
Energy Dissipation	2 Low-Moderate	Class C features contain single-thread channels and are moderate to high gradient. Energy dissipation through infiltration limited by lack of in-channel sediments and impervious layers at shallow depths. Energy dissipation occurs through natural physical control features such as cut banks, channel sinuosity, boulder steps, and/or flood debris.
Sediment Transport/Regulation	2 Low-Moderate	Class C features have well or poorly-sorted bed material and deposit only small amounts of sediment during precipitation events. Confined floodplains typically limit the extent of sediment deposition and transport in these features.
Chemical Functions		
Elements, Compounds, and Particulate Cycling	2 Low-Moderate	Class C features have shallow depths to bedrock and thus have a very limited capacity to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. These systems are ephemeral and are generally vegetated with a narrow band of xeroriparian vegetation, which may further limit nutrient cycling ability.
Organic Carbon Export/Sequestration	1 Low	Class C features have limited potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The features, along with upstream and downstream adjacent waters, are ephemeral, limiting both the amount and timing of carbon sequestration and export through the system. These features have confined floodplains, shallow depths to bedrock, and narrow xeroriparian buffers, which limit the ability of these features to generate or export high amounts of organic carbon.
Biotic Functions		
Aquatic Invertebrate Fauna	1 Low	Class C features do not exhibit permanent or intermittent flows. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species.
Presence of Fish and Fish Habitat Structure	0 None	Class C features do not contain any permanent or intermittent waters. Flow events within these ephemeral systems will not result in the presence of fish species.

Function	Score	Explanation
Riparian/Wetland Vegetation Structure	3 Moderate	Class C features do not support riparian-obligate vegetation. Xeroriparian vegetation is present in but limited narrow bands along the banks of these features. Vegetated area supports 2 or more plant layers, and these features have a "high" to "moderate" degree of horizontal vegetation interspersion.
Age Class Distribution of Woody Riparian or Wetland Vegetation	3 Moderate	In Class C features, wetland vegetation is absent. Xeroriparian and upland vegetation is common but limited along the bed and banks. Woody trees and shrubs from a range of age classes are present.
Native/Non-native Vegetation Species	5 High	The vegetation communities in Class C features are mostly native. Vegetation sampling indicates an average of less than 15% invasion by non-native species.

MAR-5 RESTORATION AREA

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Hydrologic Functions			
Hydrologic Connectivity	4 Moderate-High	4 Moderate-High	This mitigation site includes the Gila River mainstem, a large, multi-threaded, low-gradient channel. The channel lacks major impediments to flow and is capable of transporting moderate to high volumes of water. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Subsurface Flow/Groundwater Recharge	2 Low-Moderate	5 High	The Gila River mainstem possess deep alluvial deposits, but depth to groundwater can also be considerable. Subsurface flow is present. Dense riparian vegetation indicates lateral flow high, but dependent on discharge. The intent of the pilot project and continued discharge of the CAP allotment is groundwater recharge and storage.
Energy Dissipation	2 Low-Moderate	4 Moderate-High	The Gila River mainstem channel has some sinuosity, is low-gradient, and possesses alluvium capable of reducing flow intensities through evaporation, channel infiltration, and natural physical control features. The river has a well-developed floodplain. Dense riparian vegetation provides increased overland roughness, but this vegetation is limited to the wetted area. Prior to the discharge of CAP water for mitigation, vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.
Sediment Transport/Regulation	2 Low-Moderate	4 Moderate-High	The Gila River mainstem has braided channels with well-sorted bed material and primarily unrestricted floodplains. It can retain and deposit large amounts of sediment during precipitation events. The dense riparian habitat enhances the ability of this area to regulate excessive sediment loads, but this vegetation is limited to the wetted area. Prior to the discharge of CAP water for mitigation, vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.
Chemical Functions			
Elements, Compounds, and Particulate Cycling	2 Low-Moderate	4 Moderate-High	The Gila River's broad alluvial channel has the potential to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. Dense riparian habitat enhances nutrient cycling ability. This site also possesses a hyporheic zone when saturated, but this zone is limited to the wetted area. Prior to the discharge of CAP water for mitigation, the site lacked both the dense riparian vegetation and the hyporheic zone.

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Organic Carbon Export/Sequestration	2 Low-Moderate	4 Moderate-High	The Gila River mainstem has the potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The upstream adjacent reaches are ephemeral limiting both the amount and timing of carbon sequestration and export through the system. The Gila River mainstem has a significant amount of in-channel vegetation and a dense riparian buffer, which increases the ability of the system to generate or export high amounts of organic carbon, but this vegetation is limited to the wetted area. Prior to the discharge of CAP water for mitigation, vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.
Biotic Functions			
Aquatic Invertebrate Fauna	1 Low	3 Moderate	The wetted area creates intermittent flows. Irruptive aquatic insects are present and provide a prey community for aquatic-feeding species. Adjacent riparian vegetation provides additional opportunities for enhancement of invertebrate fauna community. Prior to the discharge of CAP water for mitigation, intermittent flows were not present, and vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.
Presence of Fish and Fish Habitat Structure	0 None	2 Low-Moderate	The Gila River possesses some diversity of structure in terms of potential fish habitat. Fish may be present during flow events in this system. Prior to the discharge of CAP water for mitigation, intermittent flows were not present.
Riparian/Wetland Vegetation Structure	2 Low-Moderate	4 Moderate-High	This area supports riparian-obligate vegetation and dense riparian vegetation is common and widespread. The vegetated area supports 1 or more plant layers but is anticipated to develop additional layers from mitigation. Currently the vegetated areas have a "low" degree of horizontal vegetation interspersion but are anticipated to be "high" to "moderate" at completion of mitigation. Prior to the discharge of CAP water for mitigation, intermittent flows were not present, and vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.
Age Class Distribution of Woody Riparian or Wetland Vegetation	2 Low-Moderate	4 Moderate-High	Wetland vegetation is generally absent in this area. Dense riparian vegetation has become common and widespread. Woody trees and shrubs have developed from the discharge of water and all age classes will be present with continued mitigation. Prior to the discharge of CAP water for mitigation vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Native/Non-native Vegetation Species	1 Low	4 Moderate-High	The vegetation community in this area is a mix of native and non-native species. Exotic removal and control is anticipated to be successful, providing a higher proportion of native to non-native vegetation. Prior to the discharge of CAP water for mitigation, intermittent flows were not present, and vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.

ORRS AREA

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Hydrologic Functions			
Hydrologic Connectivity	4 Moderate-High	4 Moderate-High	This mitigation site includes the Gila River mainstem, a large, multi-threaded, low-gradient channel. The channel lacks major impediments to flow and is capable of transporting high volumes of water. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Subsurface Flow/Groundwater Recharge	2 Low-Moderate	2 Low-Moderate	The Gila River mainstem possess deep alluvial deposits, but depth to groundwater can also be considerable. Subsurface flow is present but may become perched under certain conditions. Dense riparian vegetation indicates lateral flow high, but dependent on discharge. The intent of the pilot project and continued discharge of the CAP allotment is groundwater recharge and storage.
Energy Dissipation	2 Low-Moderate	4 Moderate-High	The Gila River mainstem channel has some sinuosity, is low-gradient, and possesses alluvium capable of reducing flow intensities through evaporation, channel infiltration, and natural physical control features. The river has a well-developed floodplain. Dense riparian vegetation provides increased overland roughness throughout site. Groundwater recharge and storage at MAR-5 increase the function of this vegetation community and restoration of the native vegetation character will provide additional lift for this function.
Sediment Transport/Regulation	2 Low-Moderate	4 Moderate-High	The Gila River mainstem has braided channels with well-sorted bed material and primarily unrestricted floodplains. It can retain and deposit large amounts of sediment during precipitation events. The dense riparian habitat enhances the ability of this area to regulate excessive sediment loads. Groundwater recharge and storage at MAR-5 increase the function of this vegetation community and restoration of the native vegetation character will provide additional lift for this function.
Chemical Functions			
Elements, Compounds, and Particulate Cycling	2 Low-Moderate	3 Moderate	The Gila River's broad alluvial channel has the potential to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. Dense riparian habitat enhances nutrient cycling ability. Groundwater recharge and restoration of the native vegetation character will provide lift for this function.

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Organic Carbon Export/Sequestration	2 Low-Moderate	3 Moderate	The Gila River mainstem has the potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The upstream adjacent reaches are ephemeral limiting both the amount and timing of carbon sequestration and export through the system. The Gila River mainstem has a significant amount of in-channel vegetation and a dense riparian buffer, which increases the ability of the system to generate or export high amounts of organic carbon. Groundwater recharge and storage at MAR-5 increase the function of this vegetation community and restoration of the native vegetation character will provide additional lift for this function.
Biotic Functions			
Aquatic Invertebrate Fauna	1 Low	4 Moderate-High	Irruptive aquatic insects are present and provide a prey community for aquatic-feeding species. Adjacent riparian vegetation provides additional opportunities for enhancement of invertebrate fauna community. Prior to the discharge of CAP water for mitigation, intermittent flows were not present.
Presence of Fish and Fish Habitat Structure	0 None	2 Low-Moderate	The Gila River possesses some diversity of structure in terms of potential fish habitat. Fish may be present during flow events in this system. Prior to the discharge of CAP water for mitigation, intermittent flows were not present.
Riparian/Wetland Vegetation Structure	2 Low-Moderate	3 Moderate	This area supports riparian-obligate vegetation and dense riparian vegetation is common and widespread. The vegetated area supports 1 or more plant layers but is anticipated to develop additional layers from mitigation. Currently the vegetated areas have a "low" degree of horizontal vegetation interspersion but are anticipated to be "high" to "moderate" at completion of mitigation. Prior to the discharge of CAP water for mitigation, intermittent flows were not present, and vegetation was limited mainly to non-native tamarisk.
Age Class Distribution of Woody Riparian or Wetland Vegetation	2 Low-Moderate	3 Moderate	Wetland vegetation is generally absent in this area. Dense riparian vegetation has become common and widespread. Woody trees and shrubs have developed from the discharge of water and all age classes will be present with continued mitigation. Prior to the discharge of CAP water for mitigation, intermittent flows were not present, and vegetation was limited mainly to non-native tamarisk.
Native/Non-native Vegetation Species	1 Low	4 Moderate-High	The vegetation community includes an abundance of non-native species. Exotic removal and control is anticipated to be successful, providing a higher proportion of native to non-native vegetation. Prior to the discharge of CAP water for mitigation, intermittent flows were not present, and vegetation was limited mainly to non-native tamarisk.

QUEEN CREEK ENHANCEMENT AREA

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Hydrologic Functions			
Hydrologic Connectivity	5 High	5 High	This mitigation site includes the Queen Creek mainstem, a medium to large, well-defined, single to multi-threaded, low-gradient drainage channel. The channel lacks major impediments to flow and is capable of transporting high volumes of water. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Subsurface Flow/Groundwater Recharge	4 Moderate-High	4 Moderate-High	The Queen Creek mainstem has quaternary alluvial and colluvial deposits, as well as relatively shallow (20 to 75 ft bgs) depth to groundwater. There is potential for subsurface flow and potential to replenish groundwater aquifers. Dense vegetation indicates lateral flow exists, but dependent on discharge. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Energy Dissipation	5 High	5 High	The Queen Creek mainstem channel has sinuosity, is low-gradient, and possess alluvium/colluvium capable of reducing flow intensities through evaporation, channel infiltration, and natural physical control features. Dense riparian vegetation provides increased overland roughness. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Sediment Transport/Regulation	5 High	5 High	The Queen Creek mainstem has braided channels with well-sorted bed material and can retain and deposit of sediment during precipitation events. The dense riparian habitat enhances the ability of this area to regulate excessive sediment loads. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Chemical Functions			
Elements, Compounds, and Particulate Cycling	3 Moderate	4 Moderate-High	The Queen Creek mainstem has the potential to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. Dense riparian habitat enhances nutrient cycling ability. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Organic Carbon Export/Sequestration	4 Moderate-High	4 Moderate-High	The Queen Creek mainstem has the potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The upstream adjacent reaches are ephemeral limiting both the amount and timing of carbon sequestration and export through the system. The Queen Creek mainstem has a dense riparian buffer, which increases the ability of the system to generate or export high amounts of organic carbon, this is also constrained by the narrow floodplain. No lift from the current state for this function was anticipated as a result of the mitigation actions.

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Biotic Functions			
Aquatic Invertebrate Fauna	1 Low	2 Low-Moderate	The Queen Creek mainstem does not exhibit permanent flows. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species. A minor lift from the removal of anthropogenic disturbances is anticipated.
Presence of Fish and Fish Habitat Structure	0 None	0 None	The Queen Creek mainstem does not contain any permanent or intermittent waters. Flow events within this ephemeral system will not result in the presence of fish species. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Riparian/Wetland Vegetation Structure	3 Moderate	4 Moderate-High	Dense xeroriparian vegetation is common and widespread. The vegetated area supports 2 or more plant layers and is anticipated to develop additional layers from mitigation. Currently the vegetated areas have a "high" to "moderate" degree of horizontal vegetation interspersion. A minor lift in function from the removal of anthropogenic disturbances and development of additional vegetation structure is anticipated.
Age Class Distribution of Woody Riparian or Wetland Vegetation	4 Moderate-High	4 Moderate-High	Wetland vegetation is generally absent in this area. Dense xeroriparian vegetation is common and widespread. Woody trees and shrubs from a range of age classes are present. Mitigation actions will have limited effect on this distribution.
Native/Non-native Vegetation Species	4 Moderate-High	5 High	The vegetation community in this feature is mostly native with some limited exotics. Exotic removal and control is anticipated to be successful, providing a higher proportion of native to non-native vegetation.

H&E TERRACE REESTABLISHMENT AREA

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Hydrologic Functions			
Hydrologic Connectivity	1 Low	4 Moderate-High	This mitigation area is located between the uplands and the San Pedro River and proposes the reestablishment of low-gradient, single channel, lower-watershed ephemeral channels and alluvial fans. The area currently consists entirely of farm fields that have removed the natural connection between the uplands and the river. This mitigation will restore connectivity of the river floodplain between uplands and San Pedro River mainstem. This area will lack major impediments to flow. This area will be capable of transporting moderate to high volumes of water, though transport capacity is dependent on rainfall.
Subsurface Flow/Groundwater Recharge	1 Low	3 Moderate	The compacted soils of these agricultural fields prevent normal subsurface flow, as evidenced by sinkholes in field structure. Mitigation will help increase infiltration but not completely alleviate post-agriculture conditions. There is currently little lateral flow, but mitigation will slow flows and increase infiltration.
Energy Dissipation	1 Low	3 Moderate	The compacted soils of these agricultural fields impede normal energy dissipation for this landform. Mitigation will help increase energy dissipation but not completely alleviate post-agriculture conditions. New channels, alluvial fans, and riparian vegetation will provide increased overland roughness and energy dissipation.
Sediment Transport/Regulation	1 Low	4 Moderate-High	The compacted soils of these agricultural fields interfere with normal sediment transport/regulation for this landform. Mitigation will help increase this function over much of the area. New channels, alluvial fans, and riparian vegetation will provide increased sediment transport/regulation.
Chemical Functions			
Elements, Compounds, and Particulate Cycling	1 Low	4 Moderate-High	The compacted soils of these agricultural fields have a limited capacity to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. Mitigation will help increase this function over much of the area.
Organic Carbon Export/Sequestration	1 Low	3 Moderate	The compacted soils of these agricultural fields have a limited capacity to store organic matter in subsurface soils and provide downstream pulses during flow events. Mitigation will help increase this function, but not completely alleviate post-agriculture conditions. Development of a significant amount of dense riparian vegetation will increase the ability of the system to generate or export high amounts of organic carbon.

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Biotic Functions			
Aquatic Invertebrate Fauna	1 Low	2 Low-Moderate	This area does not exhibit permanent or intermittent flows. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species.
Presence of Fish and Fish Habitat Structure	0 None	0 None	This area does not contain any permanent or intermittent waters. Flow events within these ephemeral systems will not result in the presence of fish species. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Riparian/Wetland Vegetation Structure	1 Low	2 Low-Moderate	Vegetation in the former fields is sparse and uncommon. This area generally will not support riparian-obligate vegetation, but dense xeroriparian vegetation will become common and widespread with mitigation. Vegetated area generally supports 1 plant layer, where present, but will be anticipated to develop additional layers. Currently the vegetated areas have a "low" degree of horizontal vegetation interspersion but are anticipated to be "moderate" at completion of mitigation.
Age Class Distribution of Woody Riparian or Wetland Vegetation	1 Low	3 Moderate	Vegetation in the former fields is sparse and uncommon. Wetland vegetation is generally absent in this area. Riparian vegetation will become common and widespread. Woody trees and shrubs will develop from the mitigation actions and all age classes will be present with continued mitigation.
Native/Non-native Vegetation Species	1 Low	4 Moderate-High	Vegetation in the former fields is sparse and uncommon. The vegetation community in this area is anticipated to be mostly native, with limited opportunity for exotics. Exotic removal and control during mitigation implementation is anticipated to be very successful, providing a higher proportion of native to non-native vegetation.

H&E WETLAND REESTABLISHMENT AREA

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Hydrologic Functions			
Hydrologic Connectivity	1 Low	5 High	This mitigation site includes an area of historic agricultural fields immediately adjacent to existing wetlands in the San Pedro River channel, a large, well-defined, multi-threaded, low-gradient channel. The channel lacks major impediments to flow and is capable of transporting high volumes of water. The mitigation site currently consists entirely of farm fields that have removed the natural connection between the uplands and the river.
Subsurface Flow/Groundwater Recharge	1 Low	4 Moderate-High	The adjacent San Pedro River mainstem possesses quaternary alluvial and surficial deposits, has relatively shallow (20 to 50 ft bgs) depth to groundwater, and the existing wetland characteristics show subsurface flow and potential to replenish groundwater aquifers. Mitigation will increase area with these favorable conditions. The compacted soils of these agricultural fields prevent normal subsurface flow, as evidenced by sinkholes in field structure. Dense riparian vegetation indicates lateral flow is present.
Energy Dissipation	1 Low	3 Moderate	The San Pedro River mainstem channel has some sinuosity, is low-gradient, and possesses alluvium capable of reducing flow intensities through evaporation, channel infiltration, and natural physical control features. The river has a well-developed floodplain. Restoring this area to the floodplain would enhance these functions in the new area. The compacted soils of the agricultural fields impede normal energy dissipation for this landform. Riparian vegetation provides increased overland roughness.
Sediment Transport/Regulation	1 Low	4 Moderate-High	Braided channels with well-sorted bed material and primarily unrestricted floodplains can retain and deposit large amounts of sediment during precipitation events. Restoring this area to the floodplain would enhance these functions in the new area. The compacted soils of these agricultural fields interfere with normal sediment transport/regulation for this landform. The riparian habitat will enhance the ability of this area to regulate excessive sediment loads.
Chemical Functions			
Elements, Compounds, and Particulate Cycling	1 Low	4 Moderate-High	The compacted soils of these agricultural fields have a limited capacity to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. Broad alluvial channels have the potential to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. Riparian habitat enhances nutrient cycling ability. This site may possess a hyporheic zone when saturated.

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Organic Carbon Export/Sequestration	1 Low	4 Moderate-High	The San Pedro River mainstem has the potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The upstream adjacent reaches are ephemeral limiting both the amount and timing of carbon sequestration and export through the system. The compacted soils of the agricultural fields have a limited capacity to store organic matter in subsurface soils and provide downstream pulses during flow events. Restoring this area to the floodplain would enhance these functions in the new area. The San Pedro River mainstem has a significant amount of in-channel vegetation and some riparian buffer, which increases the ability of the system to generate or export high amounts of organic carbon, but this vegetation is limited to the wetted area.
Biotic Functions			
Aquatic Invertebrate Fauna	1 Low	4 Moderate-High	This area does not currently exhibit permanent or intermittent flows and was given over to agriculture. The adjacent wetland areas support irruptive aquatic insects and provides some prey community for aquatic-feeding species. Enhancement of riparian vegetation provides additional opportunities for enhancement of invertebrate fauna community.
Presence of Fish and Fish Habitat Structure	0 None	1 Low	This area does not currently exhibit permanent or intermittent flows and was given over to agriculture. The San Pedro River possesses diversity of structure in terms of potential fish habitat. Fish may be present during flow events in this system once mitigation is complete, but the wetland area will remain off-channel.
Riparian/Wetland Vegetation Structure	1 Low	4 Moderate-High	Vegetation in the former fields is sparse and uncommon. The adjacent wetlands area support wetland and riparian-obligate vegetation. Riparian vegetation is common and widespread and widespread but will only be dense along wetland margins. The vegetated area supports 2 or more plant layers but is anticipated to develop additional layers from mitigation. The vegetated areas are anticipated to have a "moderate" degree of horizontal vegetation interspersion at completion of mitigation.
Age Class Distribution of Woody Riparian or Wetland Vegetation	1 Low	4 Moderate-High	Vegetation in the former fields is sparse and uncommon. Wetland vegetation is present in the adjacent wetlands. generally absent in this area. Riparian vegetation is common and widespread but will only along wetland margins. Woody trees and shrubs from a range of age classes are present. Mitigation actions will increase the area exhibiting these conditions.
Native/Non-native Vegetation Species	1 Low	4 Moderate-High	Vegetation in the former fields is sparse and uncommon. The vegetation community in this area is a mix of native and non-native species. Exotic removal and control is anticipated to be successful, providing a higher proportion of native to non-native vegetation.

APPENDIX B

MRSC
Worksheets

Attachment 12501.6 - SPD Mitigation Ratio Setting Checklist (See 12501-SPD for Revisions Sheet)

1	9/15/2020	Corps File No.: SPL-2016-00547		Project Manager:MWL									
	Impact Site Name:	Class A	ORM Resource	River/Stream			Hydrology: Ephemeral						
	Impact Cowardin or HGM type:	Riverine	Impact area :	86.94			Impact distance:	linear feet					
		Mitigation Sites											
		Mitigation Site Name:	MAR-5	Mitigation Site Name:	ORRS		Mitigation Site Name:	Queen Creek		Mitigation Site Name:	H&E Terrace		Mitigation Site Name:	H&E Wetland
		Mitigation Type:	Restoration	Mitigation Type:	Restoration		Mitigation Type:	Enhancement		Mitigation Type:	Restoration		Mitigation Type:	Restoration
		ORM Resource Type:	River/Stream	ORM Resource Type:	River/Stream		ORM Resource Type:	River/Stream		ORM Resource Type:	River/Stream		ORM Resource Type:	River/Stream
		Cowardin/HGM type:		Cowardin/HGM type:			Cowardin/HGM type:			Cowardin/HGM type:			Cowardin/HGM type:	
		Hydrology:		Hydrology:			Hydrology:			Hydrology:			Hydrology:	
2	**Qualitative impact-mitigation comparison**:	Starting ratio:	**1.00 : 1.00**	Starting ratio:	**1.00 : 1.00**		Starting ratio:	**1.00 : 1.00**		Starting ratio:	**1.00 : 1.00**		Starting ratio:	**1.00 : 1.00**
		Ratio adjustment:	**1.50**	Ratio adjustment:	**1.75**		Ratio adjustment:	**3.50**		Ratio adjustment:	**1.50**		Ratio adjustment:	**0.75**
		Baseline ratio:	**2.50 : 1.00**	Baseline ratio:	**2.75 : 1.00**		Baseline ratio:	**4.50 : 1.00**		Baseline ratio:	**2.50 : 1.00**		Baseline ratio:	**1.75 : 1.00**
		PM justification: See qualitative sheet for adjustment		PM justification: See qualitative sheet for adjustment			PM justification: See qualitative sheet for adjustment			PM justification: See qualitative sheet for adjustment			PM justification: See qualitative sheet for adjustment	
3	**Quantitative impact-mitigation comparison**:	N/A	:	N/A	:		N/A	:		N/A			N/A	
4	**Mitigation site location**:	Ratio adjustment:	**0**	Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**1**		Ratio adjustment:	**1**
		PM justification: Impact site and mitigation site are within the same HUC 8.		PM justification: Impact site and mitigation site are within the same HUC 8.			PM justification: Impact site and mitigation site are within the same HUC 8.			PM justification: Located in adjacent HUC 8 with direct hydrologic connection to Gila River near impact site.			PM justification: Located in adjacent HUC 8 with direct hydrologic connection to Gila River near impact site.	
5	**Net loss of aquatic resource surface area**:	Ratio adjustment:	**0**	Ratio adjustment:	**1**		Ratio adjustment:	**1**		Ratio adjustment:	**0**		Ratio adjustment:	**0**
		PM justification: Aquatic resource establishment has occurred.		PM justification: No aquatic resource establishment is proposed.			PM justification: No aquatic resource establishment is proposed.			PM justification: Aquatic resource establishment proposed as part of mitigation.			PM justification: Aquatic resource establishment proposed as part of mitigation.	
6	**Type conversion:**	Ratio adjustment:	**-3**	Ratio adjustment:	**-3**		Ratio adjustment:	**-1.5**		Ratio adjustment:	**-2.5**		Ratio adjustment:	**-3.5**
		PM justification: Riparian habitat adjacent to Gila River is a rare and valuable resource in Arizona.		PM justification: Riparian habitat adjacent to Gila River is a rare and valuable resource in Arizona.			PM justification: Riparian habitat adjacent to Queen Creek is a rare and valuable resource in Arizona.			PM justification: Riparian habitat adjacent to the San Pedro River is a rare and valuable resource in Arizona.			PM justification: Wetland habitat adjacent to the San Pedro River is a rare and valuable resource in Arizona.	
7	**Risk and uncertainty**:	Ratio adjustment:	**2**	Ratio adjustment:	**2**		Ratio adjustment:	**0.7**		Ratio adjustment:	**0.7**		Ratio adjustment:	**0.7**
		PM justification: Permittee-responsible mitigation, vegetation maintenance, artifical hydrology (during establisment).		PM justification: Permittee-responsible mitigation, vegetation maintenance.			PM justification: Permittee-responsible mitigation, vegetation maintenance			PM justification: Permittee-responsible mitigation, vegetation maintenance, structures, artificial hydrology (establishment)			PM justification: Permittee-responsible mitigation, vegetation maintenance, difficult-to-replace resource	
8	**Temporal loss**:	Ratio adjustment:	**0**	Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**0**
		PM justification: Tree species already present.		PM justification: Mitigation completed before impact incurred.			PM justification: Mitigation completed before impact incurred.			PM justification: Mitigation completed before impact incurred.			PM justification: Mitigation completed before impact incurred.	
9	**Final mitigation ratio(s):**	Baseline ratio from 2 or 3:	2.50 : 1.00	Baseline ratio from 2 or 3:	2.75 : 1.00		Baseline ratio from 2 or 3:	4.50 : 1.00		Baseline ratio from 2 or 3:	2.50 : 1.00		Baseline ratio from 2 or 3:	1.75 : 1.00
		Total adjustments (4-8):	-1	Total adjustments (4-8):	0		Total adjustments (4-8):	0.2		Total adjustments (4-8):	-0.8		Total adjustments (4-8):	-1.8
		Final ratio:	**2.50 : 2.00**	Final ratio:	**2.75 : 1.00**		Final ratio:	**4.70 : 1.00**		Final ratio:	**2.50 : 1.80**		Final ratio:	**1.75 : 2.80**
			1.25 : 1		2.75 : 1			4.70 : 1			1.39 : 1			0.63 : 1
		to Resource type:	River/Stream	to Resource type:	River/Stream		to Resource type:	River/Stream		to Resource type:	River/Stream		to Resource type:	River/Stream
		Cowardin or HGM:	Riverine	Cowardin or HGM:	Riverine		Cowardin or HGM:	Riverine		Cowardin or HGM:	Riverine		Cowardin or HGM:	Riverine
		Hydrology:		Hydrology:			Hydrology:			Hydrology:			Hydrology:	
		Total Acreage at Site	123.00 acres / feet	Total Acreage at Site	23.00 acres / feet		Total Acreage at Site	33.00 acres / linear feet		Total Acreage at Site	300.00 acres / linear feet		Total Acreage at Site	15.00 acres / linear feet
		of Resource type:	River/Stream	of Resource type:	River/Stream		of Resource type:	River/Stream		of Resource type:	River/Stream		of Resource type:	River/Stream
		Cowardin or HGM:	Riverine	Cowardin or HGM:	0		Cowardin or HGM:	0		Cowardin or HGM:	0		Cowardin or HGM:	0
		Hydrology:	0	Hydrology:	0		Hydrology:	0		Hydrology:	0		Hydrology:	0
		Mitigation Credits:	acres / feet	Mitigation Credits:	acres / feet		Mitigation Credits:	acres / linear feet		Mitigation Credits:	acres / linear feet		Mitigation Credits:	acres / linear feet
10	**Final compensatory mitigation requirements:**	Starting impact:	acres	Starting impact:	acres		Starting impact:	acres		Starting impact:	acres		Starting impact:	acres
		Remaining Impact:	acres	Remaining Impact:	acres		Remaining Impact:	acres		Remaining Impact:	acres		Remaining Impact:	acres
		Additional PM comments:		Additional PM comments:			Additional PM comments:			Additional PM comments:			Additional PM comments:	

Impact Class A

	Function	Score
Physical	Hydrologic Connectivity	5
	Subsurface Flow\Groundwater Recharge	4
	Energy Dissipation	5
	Sediment Transport/Regulation	5
Chemical	Elements, Compounds, and Particulate Cycling	4
	Organic Carbon Export/Sequestration	4
Biotic	Aquatic Invertebrate Fauna	1
	Presence of Fish\Fish Habitat Structure	0
	Riparian/Wetland Habitat Structure	4
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4
	Native/Non-native Vegetation Species	5

MAR-5 Restoration Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	5	4	4	0		
	Subsurface Flow\Groundwater Recharge	4	2	5	3		
	Energy Dissipation	5	2	4	2		
	Sediment Transport/Regulation	5	2	4	2		
Chemical	Elements, Compounds, and Particulate Cycling	4	2	4	2		
	Organic Carbon Export/Sequestration	4	2	4	2		
Biotic	Aquatic Invertebrate Fauna	1	1	3	2		
	Presence of Fish\Fish Habitat Structure	0	0	2	2		
	Riparian/Wetland Habitat Structure	4	2	4	2		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	2	4	2		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	41	20	42	22		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	1.50
PM Justification:	

ORRS Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	5	4	4	0		
	Subsurface Flow\Groundwater Recharge	4	2	2	0		
	Energy Dissipation	5	2	4	2		
	Sediment Transport/Regulation	5	2	4	2		
Chemical	Elements, Compounds, and Particulate Cycling	4	2	3	1		
	Organic Carbon Export/Sequestration	4	2	3	1		
Biotic	Aquatic Invertebrate Fauna	1	1	4	3		
	Presence of Fish\Fish Habitat Structure	0	0	2	2		
	Riparian/Wetland Habitat Structure	4	2	3	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	2	3	1		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	41	20	36	16		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	1.75
PM Justification:	

Queen Creek Enhancement Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	5	5	5	0		
	Subsurface Flow\Groundwater Recharge	4	4	4	0		
	Energy Dissipation	5	5	5	0		
	Sediment Transport/Regulation	5	5	5	0		
Chemical	Elements, Compounds, and Particulate Cycling	4	3	4	1		
	Organic Carbon Export/Sequestration	4	4	4	0		
Biotic	Aquatic Invertebrate Fauna	1	1	2	1		
	Presence of Fish\Fish Habitat Structure	0	0	0	0		
	Riparian/Wetland Habitat Structure	4	3	4	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	4	4	0		
	Native/Non-native Vegetation Species	5	4	5	1		
	Total	41	38	42	4		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	3.50
PM Justification:	

H&E Terrace Reestablishment Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	5	1	4	3		
	Subsurface Flow\Groundwater Recharge	4	1	3	2		
	Energy Dissipation	5	1	3	2		
	Sediment Transport/Regulation	5	1	4	3		
Chemical	Elements, Compounds, and Particulate Cycling	4	1	4	3		
	Organic Carbon Export/Sequestration	4	1	3	2		
Biotic	Aquatic Invertebrate Fauna	1	1	2	1		
	Presence of Fish\Fish Habitat Structure	0	0	0	0		
	Riparian/Wetland Habitat Structure	4	1	2	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	1	3	2		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	41	10	32	22		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	1.50
PM Justification:	

H&E Wetland Reestablishment Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	5	1	5	4		
	Subsurface Flow\Groundwater Recharge	4	1	4	3		
	Energy Dissipation	5	1	3	2		
	Sediment Transport/Regulation	5	1	4	3		
Chemical	Elements, Compounds, and Particulate Cycling	4	1	4	3		
	Organic Carbon Export/Sequestration	4	1	4	3		
Biotic	Aquatic Invertebrate Fauna	1	1	4	3		
	Presence of Fish\Fish Habitat Structure	0	0	1	1		
	Riparian/Wetland Habitat Structure	4	1	4	3		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	1	4	3		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	41	10	41	31		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	0.75
PM Justification:	

Attachment 12501.6 - SPD Mitigation Ratio Setting Checklist (See 12501-SPD for Revisions Sheet)

1	9/15/2020	Corps File No.: SPL-2016-00547		Project Manager:MWL									
	Impact Site Name:	Class B	ORM Resource	River/Stream			Hydrology: Ephemeral						
	Impact Cowardin or HGM type:	Riverine	Impact area :	39.98			Impact distance:	linear feet					
		Mitigation Sites											
		Mitigation Site Name:	MAR-5	Mitigation Site Name:	ORRS		Mitigation Site Name:	Queen Creek		Mitigation Site Name:	H&E Terrace		Mitigation Site Name:	H&E Wetland
		Mitigation Type:	Restoration	Mitigation Type:	Restoration		Mitigation Type:	Enhancement		Mitigation Type:	Restoration		Mitigation Type:	Restoration
		ORM Resource Type:	River/Stream	ORM Resource Type:	River/Stream		ORM Resource Type:	River/Stream		ORM Resource Type:	River/Stream		ORM Resource Type:	River/Stream
		Cowardin/HGM type:		Cowardin/HGM type:			Cowardin/HGM type:			Cowardin/HGM type:			Cowardin/HGM type:	
		Hydrology:		Hydrology:			Hydrology:			Hydrology:			Hydrology:	
2	**Qualitative impact-mitigation comparison**:	Starting ratio:	**1.00 : 1.00**	Starting ratio:	**1.00 : 1.00**		Starting ratio:	**1.00 : 1.00**		Starting ratio:	**1.00 : 1.00**		Starting ratio:	**1.00 : 1.00**
		Ratio adjustment:	**0.75**	Ratio adjustment:	**1.60**		Ratio adjustment:	**3.00**		Ratio adjustment:	**0.50**		Ratio adjustment:	**-0.50**
		Baseline ratio:	**1.75 : 1.00**	Baseline ratio:	**2.60 : 1.00**		Baseline ratio:	**4.00 : 1.00**		Baseline ratio:	**1.50 : 1.00**		Baseline ratio:	**1.00 : 1.50**
		PM justification: See qualitative sheet for adjustment		PM justification: See qualitative sheet for adjustment			PM justification: See qualitative sheet for adjustment			PM justification: See qualitative sheet for adjustment			PM justification: See qualitative sheet for adjustment	
3	**Quantitative impact-mitigation comparison**:	N/A	**:**	N/A	**:**		N/A	**:**		N/A			N/A	
4	**Mitigation site location**:	Ratio adjustment:	**0**	Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**1**		Ratio adjustment:	**1**
		PM justification: Impact site and mitigation site are within the same HUC 8.		PM justification: Impact site and mitigation site are within the same HUC 8.			PM justification: Impact site and mitigation site are within the same HUC 8.			PM justification: Located in adjacent HUC 8 with direct hydrologic connection to Gila River near impact site.			PM justification: Located in adjacent HUC 8 with direct hydrologic connection to Gila River near impact site.	
5	**Net loss of aquatic resource surface area**:	Ratio adjustment:	**0**	Ratio adjustment:	**1**		Ratio adjustment:	**1**		Ratio adjustment:	**0**		Ratio adjustment:	**0**
		PM justification: Aquatic resource establishment has occurred.		PM justification: No aquatic resource establishment is proposed.			PM justification: No aquatic resource establishment is proposed.			PM justification: Aquatic resource establishment proposed as part of mitigation.			PM justification: Aquatic resource establishment proposed as part of mitigation.	
6	**Type conversion:**	Ratio adjustment:	**-3**	Ratio adjustment:	**-3**		Ratio adjustment:	**-1.5**		Ratio adjustment:	**-2.5**		Ratio adjustment:	**-3.5**
		PM justification: Riparian habitat adjacent to Gila River is a rare and valuable resource in Arizona.		PM justification: Riparian habitat adjacent to Gila River is a rare and valuable resource in Arizona.			PM justification: Riparian habitat adjacent to Queen Creek is a rare and valuable resource in Arizona.			PM justification: Riparian habitat adjacent to the San Pedro River is a rare and valuable resource in Arizona.			PM justification: Wetland habitat adjacent to the San Pedro River is a rare and valuable resource in Arizona.	
7	**Risk and uncertainty**:	Ratio adjustment:	**2**	Ratio adjustment:	**2**		Ratio adjustment:	**0.7**		Ratio adjustment:	**0.7**		Ratio adjustment:	**0.7**
		PM justification: Permittee-responsible mitigation, vegetation maintenance, artifical hydrology (during establisment).		PM justification: Permittee-responsible mitigation, vegetation maintenance.			PM justification: Permittee-responsible mitigation, vegetation maintenance			PM justification: Permittee-responsible mitigation, vegetation maintenance, structures, artificial hydrology (establishment)			PM justification: Permittee-responsible mitigation, vegetation maintenance, difficult-to-replace resource	
8	**Temporal loss**:	Ratio adjustment:	**0**	Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**0**
		PM justification: Tree species already present.		PM justification: Mitigation completed before impact incurred.			PM justification: Mitigation completed before impact incurred.			PM justification: Mitigation completed before impact incurred.			PM justification: Mitigation completed before impact incurred.	
9	**Final mitigation ratio(s):**	Baseline ratio from 2 or 3:	1.75 : 1.00	Baseline ratio from 2 or 3:	2.60 : 1.00		Baseline ratio from 2 or 3:	4.00 : 1.00		Baseline ratio from 2 or 3:	1.50 : 1.00		Baseline ratio from 2 or 3:	1.00 : 1.50
		Total adjustments (4-8):	-1	Total adjustments (4-8):	0		Total adjustments (4-8):	0.2		Total adjustments (4-8):	-0.8		Total adjustments (4-8):	-1.8
		Final ratio:	**1.75 : 2.00**	Final ratio:	**2.60 : 1.00**		Final ratio:	**4.20 : 1.00**		Final ratio:	**1.50 : 1.80**		Final ratio:	**1.00 : 3.30**
			0.88 : 1		2.60 : 1			4.20 : 1			0.83 : 1			0.30 : 1
		to Resource type:	River/Stream	to Resource type:	River/Stream		to Resource type:	River/Stream		to Resource type:	River/Stream		to Resource type:	River/Stream
		Cowardin or HGM:	Riverine	Cowardin or HGM:	Riverine		Cowardin or HGM:	Riverine		Cowardin or HGM:	Riverine		Cowardin or HGM:	Riverine
		Hydrology:		Hydrology:			Hydrology:			Hydrology:			Hydrology:	
		Total Acreage at Site	123.00 acres / feet	Total Acreage at Site	23.00 acres / feet		Total Acreage at Site	33.00 acres / linear feet		Total Acreage at Site	300.00 acres / linear feet		Total Acreage at Site	15.00 acres / linear feet
		of Resource type:	River/Stream	of Resource type:	River/Stream		of Resource type:	River/Stream		of Resource type:	River/Stream		of Resource type:	River/Stream
		Cowardin or HGM:	Riverine	Cowardin or HGM:	0		Cowardin or HGM:	0		Cowardin or HGM:	0		Cowardin or HGM:	0
		Hydrology:	0	Hydrology:	0		Hydrology:	0		Hydrology:	0		Hydrology:	0
		Mitigation Credits:	acres / feet	Mitigation Credits:	acres / feet		Mitigation Credits:	acres / linear feet		Mitigation Credits:	acres / linear feet		Mitigation Credits:	acres / linear feet
10	**Final compensatory mitigation requirements:**	Starting impact:	acres	Starting impact:	acres		Starting impact:	acres		Starting impact:	acres		Starting impact:	acres
		Remaining Impact:	acres	Remaining Impact:	acres		Remaining Impact:	acres		Remaining Impact:	acres		Remaining Impact:	acres
		Additional PM comments:		Additional PM comments:			Additional PM comments:			Additional PM comments:			Additional PM comments:	

Impact Class B

	Function	Score
Physical	Hydrologic Connectivity	4
	Subsurface Flow\Groundwater Recharge	3
	Energy Dissipation	3
	Sediment Transport/Regulation	3
Chemical	Elements, Compounds, and Particulate Cycling	3
	Organic Carbon Export/Sequestration	2
Biotic	Aquatic Invertebrate Fauna	1
	Presence of Fish\Fish Habitat Structure	0
	Riparian/Wetland Habitat Structure	3
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3
	Native/Non-native Vegetation Species	5

MAR-5 Restoration Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	4	4	4	0		
	Subsurface Flow\Groundwater Recharge	3	2	5	3		
	Energy Dissipation	3	2	4	2		
	Sediment Transport/Regulation	3	2	4	2		
Chemical	Elements, Compounds, and Particulate Cycling	3	2	4	2		
	Organic Carbon Export/Sequestration	2	2	4	2		
Biotic	Aquatic Invertebrate Fauna	1	1	3	2		
	Presence of Fish\Fish Habitat Structure	0	0	2	2		
	Riparian/Wetland Habitat Structure	3	2	4	2		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	2	4	2		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	30	20	42	22		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	0.75
PM Justification:	

ORRS Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	4	4	4	0		
	Subsurface Flow\Groundwater Recharge	3	2	2	0		
	Energy Dissipation	3	2	4	2		
	Sediment Transport/Regulation	3	2	4	2		
Chemical	Elements, Compounds, and Particulate Cycling	3	2	3	1		
	Organic Carbon Export/Sequestration	2	2	3	1		
Biotic	Aquatic Invertebrate Fauna	1	1	4	3		
	Presence of Fish\Fish Habitat Structure	0	0	2	2		
	Riparian/Wetland Habitat Structure	3	2	3	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	2	3	1		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	30	20	36	16		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	1.60
PM Justification:	

Queen Creek Enhancement Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	4	5	5	0		
	Subsurface Flow\Groundwater Recharge	3	4	4	0		
	Energy Dissipation	3	5	5	0		
	Sediment Transport/Regulation	3	5	5	0		
Chemical	Elements, Compounds, and Particulate Cycling	3	3	4	1		
	Organic Carbon Export/Sequestration	2	4	4	0		
Biotic	Aquatic Invertebrate Fauna	1	1	2	1		
	Presence of Fish\Fish Habitat Structure	0	0	0	0		
	Riparian/Wetland Habitat Structure	3	3	4	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	4	4	0		
	Native/Non-native Vegetation Species	5	4	5	1		
	Total	30	38	42	4		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	3.00
PM Justification:	

H&E Terrace Reestablishment Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	4	1	4	3		
	Subsurface Flow\Groundwater Recharge	3	1	3	2		
	Energy Dissipation	3	1	3	2		
	Sediment Transport/Regulation	3	1	4	3		
Chemical	Elements, Compounds, and Particulate Cycling	3	1	4	3		
	Organic Carbon Export/Sequestration	2	1	3	2		
Biotic	Aquatic Invertebrate Fauna	1	1	2	1		
	Presence of Fish\Fish Habitat Structure	0	0	0	0		
	Riparian/Wetland Habitat Structure	3	1	2	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	1	3	2		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	30	10	32	22		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	0.50
PM Justification:	

H&E Wetland Reestablishment Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	4	1	5	4		
	Subsurface Flow\Groundwater Recharge	3	1	4	3		
	Energy Dissipation	3	1	3	2		
	Sediment Transport/Regulation	3	1	4	3		
Chemical	Elements, Compounds, and Particulate Cycling	3	1	4	3		
	Organic Carbon Export/Sequestration	2	1	4	3		
Biotic	Aquatic Invertebrate Fauna	1	1	4	3		
	Presence of Fish\Fish Habitat Structure	0	0	1	1		
	Riparian/Wetland Habitat Structure	3	1	4	3		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	1	4	3		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	30	10	41	31		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	-0.50
PM Justification:	

Attachment 12501.6 - SPD Mitigation Ratio Setting Checklist (See 12501-SPD for Revisions Sheet)

1	9/15/2020	Corps File No.: SPL-2016-00547		Project Manager:MWL									
	Impact Site Name:	Class C	ORM Resource	River/Stream			Hydrology: Ephemeral						
	Impact Cowardin or HGM type:	Riverine	Impact area :	45.7			Impact distance:	linear feet					
		Mitigation Sites											
		Mitigation Site Name:	MAR-5	Mitigation Site Name:	ORRS	Mitigation Site Name:	Queen Creek	Mitigation Site Name:	H&E Terrace	Mitigation Site Name:	H&E Wetland
		Mitigation Type:	Restoration	Mitigation Type:	Restoration	Mitigation Type:	Enhancement	Mitigation Type:	Restoration	Mitigation Type:	Restoration
		ORM Resource Type:	River/Stream	ORM Resource Type:	River/Stream	ORM Resource Type:	River/Stream	ORM Resource Type:	River/Stream	ORM Resource Type:	River/Stream
		Cowardin/HGM type:		Cowardin/HGM type:		Cowardin/HGM type:		Cowardin/HGM type:		Cowardin/HGM type:	
		Hydrology:		Hydrology:		Hydrology:		Hydrology:		Hydrology:	
2	**Qualitative impact-mitigation comparison**:	Starting ratio:	**1.00 : 1.00**	Starting ratio:	**1.00 : 1.00**	Starting ratio:	**1.00 : 1.00**	Starting ratio:	**1.00 : 1.00**	Starting ratio:	**1.00 : 1.00**
		Ratio adjustment:	**0.00**	Ratio adjustment:	**0.10**	Ratio adjustment:	**3.00**	Ratio adjustment:	**0.20**	Ratio adjustment:	**-1.75**
		Baseline ratio:	**1.00 : 1.00**	Baseline ratio:	**1.10 : 1.00**	Baseline ratio:	**4.00 : 1.00**	Baseline ratio:	**1.20 : 1.00**	Baseline ratio:	**1.00 : 2.75**
		PM justification: See qualitative sheet for adjustment		PM justification: See qualitative sheet for adjustment		PM justification: See qualitative sheet for adjustment		PM justification: See qualitative sheet for adjustment		PM justification: See qualitative sheet for adjustment	
3	**Quantitative impact-mitigation comparison**:	N/A	**:**	N/A	**:**	N/A	**:**	N/A		N/A	
4	**Mitigation site location**:	Ratio adjustment:	**0**	Ratio adjustment:	**0**	Ratio adjustment:	**0**	Ratio adjustment:	**1**	Ratio adjustment:	**1**
		PM justification: Impact site and mitigation site are within the same HUC 8.		PM justification: Impact site and mitigation site are within the same HUC 8.		PM justification: Impact site and mitigation site are within the same HUC 8.		PM justification: Located in adjacent HUC 8 with direct hydrologic connection to Gila River near impact site.		PM justification: Located in adjacent HUC 8 with direct hydrologic connection to Gila River near impact site.	
5	**Net loss of aquatic resource surface area**:	Ratio adjustment:	**0**	Ratio adjustment:	**1**	Ratio adjustment:	**1**	Ratio adjustment:	**0**	Ratio adjustment:	**0**
		PM justification: Aquatic resource establishment has occurred.		PM justification: No aquatic resource establishment is proposed.		PM justification: No aquatic resource establishment is proposed.		PM justification: Aquatic resource establishment proposed as part of mitigation.		PM justification: Aquatic resource establishment proposed as part of mitigation.	
6	**Type conversion:**	Ratio adjustment:	**-3**	Ratio adjustment:	**-3**	Ratio adjustment:	**-1.5**	Ratio adjustment:	**-2.5**	Ratio adjustment:	**-3.5**
		PM justification: Riparian habitat adjacent to Gila River is a rare and valuable resource in Arizona.		PM justification: Riparian habitat adjacent to Gila River is a rare and valuable resource in Arizona.		PM justification: Riparian habitat adjacent to Queen Creek is a rare and valuable resource in Arizona.		PM justification: Riparian habitat adjacent to the San Pedro River is a rare and valuable resource in Arizona.		PM justification: Wetland habitat adjacent to the San Pedro River is a rare and valuable resource in Arizona.	
7	**Risk and uncertainty**:	Ratio adjustment:	**2**	Ratio adjustment:	**2**	Ratio adjustment:	**0.7**	Ratio adjustment:	**0.7**	Ratio adjustment:	**0.7**
		PM justification: Permittee-responsible mitigation, vegetation maintenance, artifical hydrology (during establisment).		PM justification: Permittee-responsible mitigation, vegetation maintenance.		PM justification: Permittee-responsible mitigation, vegetation maintenance		PM justification: Permittee-responsible mitigation, vegetation maintenance, structures, artificial hydrology (establishment)		PM justification: Permittee-responsible mitigation, vegetation maintenance, difficult-to-replace resource	
8	**Temporal loss**:	Ratio adjustment:	**0**	Ratio adjustment:	**0**	Ratio adjustment:	**0**	Ratio adjustment:	**0**	Ratio adjustment:	**0**
		PM justification: Tree species already present.		PM justification: Mitigation completed before impact incurred.		PM justification: Mitigation completed before impact incurred.		PM justification: Mitigation completed before impact incurred.		PM justification: Mitigation completed before impact incurred.	
9	**Final mitigation ratio(s):**	Baseline ratio from 2 or 3:	1.00 : 1.00	Baseline ratio from 2 or 3:	1.10 : 1.00	Baseline ratio from 2 or 3:	4.00 : 1.00	Baseline ratio from 2 or 3:	1.20 : 1.00	Baseline ratio from 2 or 3:	1.00 : 2.75
		Total adjustments (4-8):	-1	Total adjustments (4-8):	0	Total adjustments (4-8):	0.2	Total adjustments (4-8):	-0.8	Total adjustments (4-8):	-1.8
		Final ratio:	**1.00 : 2.00**	Final ratio:	**1.00 : 1.00**	Final ratio:	**4.20 : 1.00**	Final ratio:	**1.20 : 1.80**	Final ratio:	**1.00 : 4.55**
			0.50 : 1		1.00 : 1		4.20 : 1		0.67 : 1		0.22 : 1
		to Resource type:	River/Stream	to Resource type:	River/Stream	to Resource type:	River/Stream	to Resource type:	River/Stream	to Resource type:	River/Stream
		Cowardin or HGM:	Riverine	Cowardin or HGM:	Riverine	Cowardin or HGM:	Riverine	Cowardin or HGM:	Riverine	Cowardin or HGM:	Riverine
		Hydrology:		Hydrology:		Hydrology:		Hydrology:		Hydrology:	
		Total Acreage at Site	123.00 acres / feet	Total Acreage at Site	23.00 acres / feet	Total Acreage at Site	79.00 acres / linear feet	Total Acreage at Site	300.00 acres / linear feet	Total Acreage at Site	15.00 acres / linear feet
		of Resource type:	River/Stream	of Resource type:	River/Stream	of Resource type:	River/Stream	of Resource type:	River/Stream	of Resource type:	River/Stream
		Cowardin or HGM:	Riverine	Cowardin or HGM:	0	Cowardin or HGM:	0	Cowardin or HGM:	0	Cowardin or HGM:	0
		Hydrology:	0	Hydrology:	0	Hydrology:	0	Hydrology:	0	Hydrology:	0
		Mitigation Credits:	acres / feet	Mitigation Credits:	acres / feet	Mitigation Credits:	acres / linear feet	Mitigation Credits:	acres / linear feet	Mitigation Credits:	acres / linear feet
10	**Final compensatory mitigation requirements:**	Starting impact:	acres	Starting impact:	acres	Starting impact:	acres	Starting impact:	acres	Starting impact:	acres
		Remaining Impact:	acres	Remaining Impact:	acres	Remaining Impact:	acres	Remaining Impact:	acres	Remaining Impact:	acres
		Additional PM comments:		Additional PM comments:		Additional PM comments:		Additional PM comments:		Additional PM comments:	

Impact Class C

	Function	Score
Physical	Hydrologic Connectivity	2
	Subsurface Flow\Groundwater Recharge	2
	Energy Dissipation	2
	Sediment Transport/Regulation	2
Chemical	Elements, Compounds, and Particulate Cycling	2
	Organic Carbon Export/Sequestration	1
Biotic	Aquatic Invertebrate Fauna	1
	Presence of Fish\Fish Habitat Structure	0
	Riparian/Wetland Habitat Structure	3
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3
	Native/Non-native Vegetation Species	5

MAR-5 Restoration Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	2	4	4	0		
	Subsurface Flow\Groundwater Recharge	2	2	5	3		
	Energy Dissipation	2	2	4	2		
	Sediment Transport/Regulation	2	2	4	2		
Chemical	Elements, Compounds, and Particulate Cycling	2	2	4	2		
	Organic Carbon Export/Sequestration	1	2	4	2		
Biotic	Aquatic Invertebrate Fauna	1	1	3	2		
	Presence of Fish\Fish Habitat Structure	0	0	2	2		
	Riparian/Wetland Habitat Structure	3	2	4	2		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	2	4	2		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	23	20	42	22		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	0.00
PM Justification:	

ORRS Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	2	4	4	0		
	Subsurface Flow\Groundwater Recharge	2	2	2	0		
	Energy Dissipation	2	2	4	2		
	Sediment Transport/Regulation	2	2	4	2		
Chemical	Elements, Compounds, and Particulate Cycling	2	2	3	1		
	Organic Carbon Export/Sequestration	1	2	3	1		
Biotic	Aquatic Invertebrate Fauna	1	1	4	3		
	Presence of Fish\Fish Habitat Structure	0	0	2	2		
	Riparian/Wetland Habitat Structure	3	2	3	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	2	3	1		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	23	20	36	16		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	0.10
PM Justification:	

Queen Creek Enhancement Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	2	5	5	0		
	Subsurface Flow\Groundwater Recharge	2	4	4	0		
	Energy Dissipation	2	5	5	0		
	Sediment Transport/Regulation	2	5	5	0		
Chemical	Elements, Compounds, and Particulate Cycling	2	3	4	1		
	Organic Carbon Export/Sequestration	1	4	4	0		
Biotic	Aquatic Invertebrate Fauna	1	1	2	1		
	Presence of Fish\Fish Habitat Structure	0	0	0	0		
	Riparian/Wetland Habitat Structure	3	3	4	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	4	4	0		
	Native/Non-native Vegetation Species	5	4	5	1		
	Total	23	38	42	4		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	3.00
PM Justification:	

H&E Terrace Reestablishment Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	2	1	4	3		
	Subsurface Flow\Groundwater Recharge	2	1	3	2		
	Energy Dissipation	2	1	3	2		
	Sediment Transport/Regulation	2	1	4	3		
Chemical	Elements, Compounds, and Particulate Cycling	2	1	4	3		
	Organic Carbon Export/Sequestration	1	1	3	2		
Biotic	Aquatic Invertebrate Fauna	1	1	2	1		
	Presence of Fish\Fish Habitat Structure	0	0	0	0		
	Riparian/Wetland Habitat Structure	3	1	2	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	1	3	2		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	23	10	32	22		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	0.20
PM Justification:	

H&E Wetland Reestablishment Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	2	1	5	4		
	Subsurface Flow\Groundwater Recharge	2	1	4	3		
	Energy Dissipation	2	1	3	2		
	Sediment Transport/Regulation	2	1	4	3		
Chemical	Elements, Compounds, and Particulate Cycling	2	1	4	3		
	Organic Carbon Export/Sequestration	1	1	4	3		
Biotic	Aquatic Invertebrate Fauna	1	1	4	3		
	Presence of Fish\Fish Habitat Structure	0	0	1	1		
	Riparian/Wetland Habitat Structure	3	1	4	3		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	1	4	3		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	23	10	41	31		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	-1.75
PM Justification:	

Appendix E. Alternatives Impact Summary

Summary of Impacts

One of the core processes of any environmental impact statement (EIS)-level National Environmental Policy Act (NEPA) analysis is public outreach early in the project, which serves to inform the public, stakeholders, Tribes, and other Federal, State, and municipal agencies of the nature of the proposed action and provides an opportunity for interested persons to ask questions of the lead Federal agency and to express thoughts or concerns they may have regarding the action. This process is referred to as "scoping" (40 Code of Federal Regulations (CFR) 1501.7).

The scoping process also serves as a means for the lead agency to gather initial ideas for alternative actions to the project that may accomplish the same overall purpose but possibly be less damaging to the environment. And, lastly, the public scoping process is essential to initially identifying potential effects on resources and other issues that will be analyzed in detail in the EIS.

The scoping process for this EIS is detailed in the "Resolution Copper Project and Land Exchange Environmental Impact Statement Scoping Report" (Scoping Report) available here: https://www.resolutionmineeis.us/documents/usfs-tonto-scoping-report.

The information gathered during the scoping process was subsequently analyzed by members of the project team and distilled into 14 major issues for consideration in the EIS. Nearly all of these major issues include sub-issues to further focus the analysis, and all included specific "factors for analysis" as a means to gauge and compare effects. Details of how comments gathered during scoping were distilled into primary issues and sub-issues are documented in the "Resolution Copper Project and Land Exchange Environmental Impact Statement: Final Summary of Issues Identified Through Scoping" (Issues Report), available at https://www.resolutionmineeis.us/documents/usfs-tonto-issues-report-201711.

Table E-1 below provides a complete listing of primary issues and sub-issues that guided the effects analysis and a summary of impacts by project alternative. Please note that this table is organized by major issue as derived from the scoping process and the issues analysis, rather than by the section of the final EIS (FEIS) in which that resource is addressed; the information in the leftmost column points the reader to where in the FEIS the corresponding analysis may be found.

A high-level look at impacts and differences between alternatives is displayed at the end of chapter 2. Whereas appendix E also summarizes impacts, it is specifically intended to provide a crosswalk between the original issues/sub-issues and the actual results of the analysis, and to provide a more detailed yet succinct comparison between alternatives.

As documented in the footnotes to table E-1, during course of the impacts analysis, certain sub-issues were modified or dismissed altogether for the specific reasons cited in each footnote.

Table E-1. Alternatives impact summary

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 1A: Tribal Values and Concerns – Disturbance to Tribal Values and Practices from Combined Resource Disturbance						
3.14.4.2 and 3.14.4.7	1A-1. Qualitative assessment of how cumulative resource disturbance impacts tribal values and spiritual practices	Although under this alternative the Resolution Mine would not be developed, other ongoing or reasonably foreseeable transportation, utility, and other projects, and particularly large-scale mining operations such as the Pinto Valley Mine, the ASARCO Ripsey Wash tailings impoundment, and potential mine development in the Copper Butte area, would continue to be likely to adversely affect places and natural resources valued by Native Americans.	Development of the Resolution Mine under this or any other action alternative would directly and permanently damage the NRHP-listed *Chí'chil Biłdagoteel* Historic District TCP at the East Plant Site. In addition, as noted for the no action alternative, other large-scale mine development along with smaller transportation, utility, and private land development projects in the Superior region may adversely affect certain places and resources of value to Native Americans, including historic resource collection sites and culturally valued landforms and features.	Same as noted under Alternatives 1 and 2	Same as noted under Alternatives 1 and 2	Same as noted under Alternatives 1 and 2	Same as noted under Alternatives 1 and 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 1B: Tribal Values and Concerns – Impacts to Tribal Valued Resources at Oak Flat and Apache Leap						
3.7.1.5 and 3.14.4.2	1B-1. Quantitative assessment of number of sacred springs or other discrete sacred sites impacted	Under the no action alternative most sacred sites would remain unaltered. However, Resolution Copper would continue dewatering activities at the East Plant Site. As described in FEIS section 3.7.1, it is possible under the no action alternative that as many as six sacred springs could be adversely affected by drawdown due to continued mine dewatering.	In addition to impacts as under the no action alternative, water table drawdown caused by block caving is anticipated to impact two additional springs in the Superior area. Three additional springs would be buried beneath the tailings impoundment, and six additional springs or ponds would be within the subsidence area. A total of 14 sacred springs is anticipated to be lost under Alternative 2.	Same as Alternative 2	In addition to the springs in and around the town of Superior that would be adversely impacted by dewatering and block caving activities at the East Plant Site, under the Silver King Alternative one additional spring would be buried beneath the tailings impoundment. A total of 12 sacred springs is anticipated to be lost under Alternative 4.	Under this alternative, although springs in and around the town of Superior would be adversely impacted by dewatering and block caving activities at the East Plant Site, analysis shows no additional springs at the tailings location would be impacted. A total of 11 sacred springs is anticipated to be lost under Alternative 5.	Under this alternative, although springs in and around the town of Superior would be adversely impacted by dewatering and block caving activities at the East Plant Site, analysis shows no additional springs at the tailings location would be impacted. A total of 11 sacred springs is anticipated to be lost under Alternative 6.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.12.4 and 3.14.4.2	1B-2. Qualitative assessment of the impacts on Native Americans from the destruction and desecration of land, springs, burials, and sacred sites	Same as above with respect to springs. Other effects on lands, burials, and other features and places of value to Native Americans would not occur under the no action alternative.	Development of the Resolution Mine under this or any other action alternative would directly and permanently damage the NRHP-listed *Chí'chil Biłdagoteel* Historic District TCP (Oak Flat) at the East Plant site which would be devastating to the Western Apache, Yavapai, Hopi, and Zuni peoples who consider Oak Flat to be a sacred place. Twenty-three special interest areas, 138 archaeological sites, 14 springs and 3 ponds, and 67 plant species would be impacted by the mine facilities. Indirect impacts may occur to portions of the *Chí'chil Biłdagoteel* Historic District that are outside the project area, as well as to 10 places of traditional and cultural importance within the indirect analysis area. Under Alternative 2, the tailings storage facility would be fully in view from Picketpost Mountain, a mountain sacred to Western Apache bands, and the presence of the nearly 500-foot-high tailings would constitute an adverse visual effect on the landscape.	Same as Alternative 2	Same as Alternative 2, with the exception that 33 special interest areas, 147 archaeological sites, 12 springs and 3 ponds, and 70 plant species would be impacted by the mine facilities.	Same as Alternative 2, with the exception that 133 special interest areas, 157 archaeological sites, 11 springs and 3 ponds, and 56 plant species would be impacted by the mine facilities.	Same as Alternative 2, with the exception that 383 special interest areas, 380 archaeological sites, 11 springs and 3 ponds, and 62 plant species would be impacted by the mine facilities.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.7.1.5; 3.12.4.2; and 3.14.4.2	1B-3. [REVISED][1] Qualitative assessment of traditional resource collection areas impacted	No adverse effects to any traditional resource collection areas are foreseen. However, as noted in FEIS section 3.7.1, under the no action alternative six springs are anticipated to be impacted by continued dewatering, which may also adversely affect plant availability.	Under all action alternatives, one or more Emory oak groves at Oak Flat, used by tribal members for acorn collecting, will likely be lost. Other unspecified mineral and/or plant collecting locations are also likely to 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.	Same as Alternative 2	Impacts at the East Plant Site/Oak Flat would be the same as under Alternative 2. Other impacts to tribal values and concerns would be similar in context and intensity to those under Alternative 2; however, because the tailings storage facility would be in a different location, the specific impacts to potentially meaningful sites, resources, routes, and viewsheds would vary. See FEIS sections 3.11.4 (scenery), 3.12.4 (cultural resources), and 3.14.4 (tribal values) for detailed impact analyses specific Alternative 4.	Impacts at the East Plant Site/Oak Flat would be the same as under Alternative 2. Other impacts to tribal values and concerns would be similar in context and intensity to those under Alternative 2; however, because the tailings storage facility would be in a different location, the specific impacts to potentially meaningful sites, resources, routes, and viewsheds would vary. See FEIS sections 3.11.4 (scenery), 3.12.4 (cultural resources), and 3.14.4 (tribal values) for detailed impact analyses specific to Alternative 5.	Impacts at the East Plant Site/Oak Flat would be the same as under Alternative 2. Other impacts to tribal values and concerns would be similar in context and intensity to those under Alternative 2; however, because the tailings storage facility would be in a different location, the specific impacts to potentially meaningful sites, resources, routes, and viewsheds would vary. See FEIS sections 3.11.4 (scenery), 3.12.4 (cultural resources), and 3.14.4 (tribal values) for detailed impact analyses specific to Alternative 6.

[1] The original issue factor expected to be analyzed was: "Quantitative assessment of acres of traditional resource collection areas impacted." As locations for many traditional resource collection areas identified are sensitive, this was changed to a qualitative assessment rather than relying on acreage calculations.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 2A: Socioeconomics – Impacts to Municipal Infrastructure						
3.13.4.2	2A-1. Quantitative assessment of change in employment, labor earnings and economic output over time, including direct and indirect effects	No impacts anticipated.	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 $1.2 billion.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
3.13.4.2	2A-2. Quantitative assessment of change in tax revenues per year over time, including changes to payments in lieu of taxes (PILT)	No impacts anticipated.	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.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.13.4.2	2A-3. Quantitative assessment of change in demand and cost for local road maintenance over time	No impacts anticipated.	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. However, these impacts are difficult to predict as no precise figures have been available that break out road maintenance costs vs. total municipal expenditures. Based on projected changes in the effective population served by Pinal County, the proposed mine could increase the total costs of county service provisions (of which maintenance of County roads is one expenditure) by approximately $540,000 per year.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.13.4.2	2A-4. Qualitative assessment of change in demand and cost for emergency services over time	No impacts anticipated.	The Town of Superior anticipates that its costs of providing services related to public safety (police and fire protection) would increase. Resolution Copper has entered into an agreement with the Town of Superior to provide $1.65 million to support emergency response services by the Town over the period from 2016 to 2021, as well as agreements to offset other direct costs to the Town of Superior.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.13.4.2	2A-5. Quantitative assessment of change in tourism and recreation revenue over time	No impacts anticipated.	The effects of the proposed mine at the East Plant Site would reduce the number of hunting days per year by approximately 188, and result in a direct reduction of $10,510 annual wildlife-related recreation spending in the local economy, which would equal a nominal value of $630,480 over the 60-year life of the proposed mine. The Near West tailings alternative site would reduce the number of hunting days per year on the site by approximately 1,200, amounting to a reduction in direct wildlife-related recreation expenditures of $66,920 per year or $4.0 million over a 60-year mine life.	Same as Alternative 2	Effects from East Plant Site are the same as Alternative 2. The Silver King alternative site would reduce the number of hunting days per year by approximately 1,078, and reduce the amount of direct wildlife-related recreation expenditures by about $60,368 per year or $3.6 million over a 60-year mine life.	Effects from East Plant Site are the same as Alternative 2. The Peg Leg alternative site would reduce the number of hunting days per year by approximately 219, and reduce the amount of direct wildlife-related recreation expenditures by about $12,254 per year or $735,269 over a 60-year mine life.	Effects from East Plant Site are the same as Alternative 2. The Skunk Camp alternative site would reduce the number of hunting days per year by approximately 1,269, and reduce the amount of direct wildlife-related recreation expenditures by about $70,554 per year or $4.2 million over a 60-year mine life.
	Issue 2B: Socioeconomics – Impacts to Property Values						
3.13.4.2	2B-1. Quantitative assessment of change in property values over time	No impacts anticipated.	Properties values within a 5-mile radius of the tailings storage facility would be reduced by approximately $3.1 million, a reduction of 4.1%.	Same as Alternative 2	Property values within a 5-mile radius of the tailings storage facility would be reduced by approximately $5.5 million, a reduction of 10.6%.	Property values within a 5-mile radius of the tailings storage facility would be reduced by approximately $69,000, a reduction of 6.3%.	Property values within a 5-mile radius of the tailings storage facility would be reduced by $58,000, a reduction of 4.0%.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 2C: Socioeconomics – Impacts to Groundwater Availability/Usability						
3.7.1.5	2C-1. Qualitative assessment of effect of reduced groundwater availability on property values	No impacts anticipated.	While drawdown caused by mine dewatering and block caving could impact wells at Top-of-the-World and Superior, Resolution Copper has committed to mitigation (replacement of water sources) that would result in no net loss of water supplies.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
3.7.2.4; Appendix M	2C-2. Qualitative assessment of effect of reduced groundwater quality on property values	No impacts anticipated.	While concentrations of metals and other constituents (sulfate, total dissolved solids) are expected to increase above background concentrations due to seepage from the tailings storage facility, no concentrations above Arizona Aquifer Water Quality Standards are anticipated that would render downgradient water supplies unusable.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 2D: Socioeconomics – Impacts to Local and Regional Living Standards						
3.13.4.3	2D-1. Qualitative assessment of the ability to meet rural landscape expectations as expressed by Federal, State, and local plans	No impacts anticipated.	Large-scale mining projects such as the Resolution Mine may also adversely affect what are considered desirable but less tangible qualities of a rural setting and lifestyle. Applicant-committed environmental protection measures would be effective at expanding the economic base of the local community and improving resident quality of life, and could partially offset the expected impacts.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
	2D-2. [DROPPED][2]						

[2] The original issue factor expected to be analyzed was: "Quantitative assessment of economic effects on amenity-based relocation." Based on the BBC Research and Consulting report titled "Socioeconomic Effects Technical Report: Resolution Copper Mine Environmental Impact Statement" (BBC Research and Consulting 2018), amenity-based relocation in Pinal and Gila Counties was already low, compared, for example, with Maricopa County. Development of the Resolution Copper Mine is not expected to substantially alter existing conditions with respect to amenity-based resident populations or future relocations in these two counties.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.13.4.2	2D-3. Quantitative assessment of economic effects from change in visitor uses of Tonto National Forest and other public lands	No impacts anticipated.	The affected areas are used for a variety of activities, including OHV use, camping, and hunting, by visitors from outside Pinal County. AGFD estimates the East Plant Site and subsidence area would affect about 6 miles of public access motorized routes and eliminate 421 acres of dispersed camping. AGFD estimates that the Near West Tailings alternative would affect about 23 miles of public access motorized routes and eliminate 1,737 acres of dispersed camping.	Same as Alternative 2	Effects of the East Plant Site and subsidence area are the same as under Alternative 2. AGFD estimates that the Silver King tailings alternative would affect about 20 miles of public access motorized routes and eliminate 1,434 acres of dispersed camping.	Effects of the East Plant Site and subsidence area are the same as under Alternative 2. AGFD estimates that the Peg Leg tailings alternative would affect about 45 miles of public access motorized routes and eliminate 1,009 acres of dispersed camping (excluding pipeline corridors).	Effects of the East Plant Site and subsidence area are the same as under Alternative 2. AGFD estimates that the Skunk Camp tailings alternative would affect about 32 miles of public access motorized routes and eliminate 861 acres of dispersed camping (excluding pipeline corridors).
	Issue 3: Environmental Justice						
3.15.4.2	3-1. Quantitative assessment of economic effects on environmental justice communities and qualitative assessment of whether these effects are disproportionate	Beneficial or adverse economic impacts to environmental justice populations would not occur, as the mine would not be developed and current land use would remain unchanged.	Overall, while both adverse and beneficial economic effects would impact environmental justice communities, they would not be disproportionately high or adverse (see FEIS table 3.15.4-1).	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.15.4.2 (*Continued*)	3-1. Quantitative assessment of economic effects on environmental justice communities and qualitative assessment of whether these effects are disproportionate (*Continued*)		All environmental justice communities would experience socioeconomic benefits such as an increase in tax revenues and direct and indirect employment opportunities. There would also be negative socioeconomic effects. The expected influx of new workers may lead to shortages of housing and/or pressures on municipal infrastructure such as roads, schools, and medical facilities, and may be accompanied by price increases. Property values may be affected by the proximity of the tailings storage facility. Adverse or beneficial economic effects from the mine would be most apparent in the environmental justice community of the town of Superior. A number of applicant-committed measures would increase quality of life and opportunities within the town of Superior, offsetting some negative effects.				

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.15.4.2	3-2. Qualitative assessment of disproportionate effects of adverse resource impacts to environmental justice communities	Disproportionate effects on environmental justice populations would not occur, as the mine would not be developed and current land use would remain unchanged.	The proposed East Plant Site, West Plant Site, area of subsidence, and auxiliary facilities would have disproportionately high and adverse impacts on the environmental justice community of the town of Superior for scenic resources and dark skies, as well as transportation (see FEIS table 3.15.4-1). In addition, impacts on cultural resources and tribal concerns and values would have a disproportionally adverse impact on Native American communities. Other environmental justice communities (with the exception of Native American communities) would not experience adverse impacts as a result of the proposed project because they would be located outside the geographic area of influence for most resources, or impacts are not disproportionately high or adverse on the community. For Alternative 2, the same impacts are true of the tailings storage facility.	Same as Alternative 2	Same as Alternative 2. For the Alternative 4 tailings storage facility, the scenic impacts from the Silver King alternative tailings storage would be felt most strongly in the town of Superior, due to the proximity and location of the facility.	Same as Alternative 2, but the Alternative 5 tailings storage facility would not impact any environmental justice communities.	Same as Alternative 2, but the Alternative 6 tailings storage facility would not impact any environmental justice communities.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 4: Impacts to Cultural Resources						
	4-1. [DROPPED][3]						
	4-2. [DROPPED][4]						
3.12.4	4-3. Quantitative assessment of number of NRHP-eligible historic properties, sacred sites, and other landscape-scale properties, to be buried, destroyed, or damaged	If, under this alternative, the GPO is not approved but the land exchange occurs, 31 NRHP-eligible sites and one TCP would be adversely affected. If the GPO is not approved and the land exchange does not occur, there would be no effect.	120 NRHP-eligible and 18 sites of currently undetermined eligibility would be adversely affected. One TCP at the East Plant Site would also be adversely affected. About 95% of this area has been fully pedestrian surveyed for cultural resources.[5]	Same as Alternative 2	Impacts would be similar to Alternative 2; 145 NRHP-eligible sites and two currently undetermined sites would be directly and adversely impacted. About 69% of this area has been fully pedestrian surveyed for cultural resources.	Impacts would be similar to Alternative 2; 154 NRHP-eligible sites and three currently undetermined sites would be directly and adversely impacted. Approximately 80% of the area has been fully pedestrian surveyed for cultural resources.	Impacts would be similar to Alternative 2; 377 NRHP-eligible sites and three currently undetermined sites would be directly and adversely impacted. About 86% of the area has been fully pedestrian surveyed for cultural resources.

[3] The original issue factor expected to be analyzed was: "Qualitative assessment of the impacts to places of traditional and cultural significance to Native Americans including natural resources." This is largely duplicated by issue factors 1B-1, 1B-2, and 1B-3.

[4] The original issue factor expected to be analyzed was: "Qualitative assessment of the impacts on other non-tribal communities in the region in terms of impacts on resources, such as historical townsites, cemeteries, mines, ranches, and homesteads." Any historical sites are already incorporated into the analysis described by issue factor 4-3.

[5] Note that any remaining acreage slated for ground disturbance or land sale will be inventoried in accordance with the Programmatic Agreement, and cultural sites identified and addressed in accordance with the Programmatic Agreement.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.12.4	4-4. Quantitative assessment of number of NRHP-eligible historic properties expected to be visually impacted	If, under this alternative, the GPO is not approved but the land exchange occurs, 31 NRHP-eligible sites and one TCP would be adversely affected. If the GPO is not approved and the land exchange does not occur, there would be no effect.	In addition to direct impacts, historic properties within the indirect analysis area and atmospheric analysis area could be impacted visually. This includes 62 historic properties within the indirect analysis area (2 NRHP-listed, 41 NRHP-eligible, and 19 unevaluated), 53 sites within the atmospheric analysis area within 2 miles of the East Plant Site, the West Plant Site, the subsidence area, and the transmission line, and 54 sites within the atmospheric analysis area within 6 miles of the tailings storage facility.	Same as Alternative 2	In addition to direct impacts, historic properties within the indirect analysis area and atmospheric analysis area could be impacted visually. This includes 58 historic properties within the indirect analysis area (2 NRHP-listed, 44 NRHP-eligible, and 12 unevaluated), 53 sites within the atmospheric analysis area within 2 miles of the East Plant Site, the West Plant Site, the subsidence area, and the transmission line, and 55 sites within the atmospheric analysis area within 6 miles of the tailings storage facility.	In addition to direct impacts, historic properties within the indirect analysis area and atmospheric analysis area could be impacted visually. This includes 77 historic properties within the indirect analysis area (2 NRHP-listed, 56 NRHP-eligible, and 19 unevaluated), 53 sites within the atmospheric analysis area within 2 miles of the East Plant Site, the West Plant Site, the subsidence area, and the transmission line, and 5 sites within the atmospheric analysis area within 6 miles of the tailings storage facility.	In addition to direct impacts, historic properties within the indirect analysis area and atmospheric analysis area could be impacted visually. This includes 58 historic properties within the indirect analysis area (2 NRHP-listed, 45 NRHP-eligible, and 11 unevaluated), 53 sites within the atmospheric analysis area within 2 miles of the East Plant Site, the West Plant Site, the subsidence area, and the transmission line, and 12 sites within the atmospheric analysis area within 6 miles of the tailings storage facility.
3.4.4	4-5. Qualitative assessment of potential for vibrations to damage cultural resources within and adjacent to the project areas	If the GPO is not approved and the land exchange does not occur, there would be no effect.	The vibration analysis indicates that within given levels of explosive loading, neither blasting nor non-blasting vibrations exceed selected thresholds based on structural damage.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	4-6. [DROPPED][6]						
3.14.4	4-7. [REVISED][7] Qualitative assessment of number of impacted sites known/likely to have human remains	If the GPO is not approved and the land exchange does not occur, there would be no effect.	At this time, no sites have been determined to contain human remains; this would be determined during data recovery activities, and a burial plan would be in place to properly handle any human remains identified.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
	4-8. [DROPPED][8]						
	Issue 5A: Public Health and Safety – Health Impacts						
	5A-1. [DROPPED][9]						
3.2.4	5A-2. [REVISED][10] Qualitative assessment of the public health risk from geologic hazards, including seismic activity	If the GPO is not approved and the land exchange does not occur, there would be no effect.	Induced mine seismicity has been observed at other mines and is possible, but unlikely to be of sufficient magnitude to cause structural damage.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

[6] The original issue factor expected to be analyzed was: "Qualitative assessment of impacts to historic properties, including visual impacts." Any historical sites are already incorporated into the analysis described by issue factor 4-3.

[7] The original issue factor expected to be analyzed was: "Quantitative assessment of number of impacted prehistoric sites known/likely to have human remains." The issue factor was modified to incorporate issue factor 4-8, and changed from a quantitative to a qualitative assessment.

[8] The original issue factor expected to be analyzed was: "Quantitative assessment of number of historic sites likely to have human remains." The issue factor was incorporated into issue factor 4-7.

[9] The original issue factor expected to be analyzed was: "Qualitative assessment of the public health risk from mine operations and facilities, including the potential for exposure to historically contaminated soil." The issue factor was generic and duplicative of more specific risks to human health analyzed by issue factors 5A-2, 5A-3, 5A-4, 5B-1, 5B-2, 5C-1, 5C-2, 5C-3, and 5C-4.

[10] This issue factor largely overlapped with issue factor 9A-3: "Qualitative assessment of the impact of the project to seismic activity." Issue factor 5A-2 has been modified to incorporate this aspect, and issue factor 9A-3 has been dropped.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.4.4	5A-3. Qualitative assessment of the public health risk from noise and vibrations	If the GPO is not approved and the land exchange does not occur, there would be no effect.	Noise and vibration levels from mine construction and operation are expected to occasionally be perceptible to residents of the town of Superior and visitors to the immediate area of the East Plant Site, West Plant Site, filter plant and loadout facility, and this or other tailings storage facility locations, particularly during construction phases, and from haul trucks during active operations, but mine-related noises and vibrations are not expected to represent either short- or long-term threats to public health and safety.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.6.4	5A-4. Quantitative assessment of the ability to meet air quality standards for human health	No mine activities other than ongoing dewatering would occur; it is expected that current air quality standards would be met.	Air quality impacts from construction and operation of the Resolution Mine are not expected at any time to exceed NAAQS criteria pollutant thresholds, including those for particulates, and are therefore not anticipated to represent a threat to public health. A supplemental health impact analysis was conducted to assess the potential for both cancer risk and non-carcinogenic chronic health effects from exposure to airborne NPAG tailings. The analysis determined that Alternative 2 does not exceed selected thresholds for health risk.	Same as Alternative 2	Same as Alternative 2. The health impact analysis for Alternative 4 considered exposure to both NPAG and PAG airborne tailings. The analysis determined that Alternative 4 does not exceed selected thresholds for health risk.	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 5B: Public Health and Safety – Safety Concerns Related to Tailings Impoundment						
3.10.1	5B-1. [REVISED][11] Qualitative assessment of the risk of failure of tailings dam or concentrate/ tailings pipelines and potential impacts downstream in the event of a failure	No risk of failure, as no tailings facility or pipelines would be built.	Risk of failure is minimized by required adherence to National Dam Safety Program and APP standards, and applicant-committed environmental protection measures. Alternative 2 embankment is less resilient than Alternatives 5 and 6 due to: modified-centerline construction, long embankment (10 miles), freestanding structure	Alternative 3 embankment is less resilient than Alternatives 5 and 6 due to: modified-centerline construction, long embankment (10 miles), freestanding structure. Alternative 3 is more resilient than Alternative 2 due to ultrathickening.	Alternative 4 represents the least risk of all alternatives. Failure of filtered tailings would result in localized slump or landslide, not a long downstream runout.	Alternative 5 embankment is more resilient than Alternatives 2 and 3 due to: centerline construction, shorter embankment (7 miles). Double embankment for PAG using a downstream dam, and use of multiple PAG cells, reduces risk of PAG release.	Alternative 6 embankment is more resilient than Alternatives 2, 3, and 5 due to: centerline construction, shortest embankment (3 miles), cross-valley construction with tie-in to solid rock on each side. Double embankment for PAG using a downstream embankment, and use of multiple PAG cells, reduces risk of PAG release.
3.10.1	5B-2. Quantitative assessment of the seismic stability of the tailings impoundment	No tailings facility would be built.	The design earthquake meets the most stringent of all standards (Maximum Credible Earthquake), and static factor of safety (1.5) and seismic factor of safety (1.2) meet the most stringent of all standards.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

[11] The original issue factor only referenced the tailings storage facility, and has been modified to include both concentrate and tailings pipelines.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 5C: Public Health and Safety – Transportation-Related and General Safety Risks						
3.5.4.8	5C-1. Quantitative assessment of the potential change in traffic accidents	No change from current traffic volumes and patterns.	Under Alternative 2 increased traffic associated with mine worker commuting and truck traffic to and from the mine is expected to result in increased traffic congestion and increased risk of traffic accidents.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
	5C-2. [DROPPED][12]						

[12] The original issue factor expected to be analyzed was: "Quantitative assessment of the trip count per day for all hazardous materials and qualitative assessment of potential effects." The issue factor was combined with issue factor 5C-3.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.10.3.4	5C-3. Qualitative assessment of the risks to public health from potential accidents or spills during the transport of hazardous materials	No impacts anticipated.	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. In general, there would be direct impacts on plants and wildlife in the immediate vicinity, direct impacts on soil in the immediate vicinity, and possible migration into surface water either directly or via stormwater runoff from contaminated areas. Queen Creek and tributary washes (like Silver King Wash) are the locations most likely to be affected in the event of a transportation release.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.5.4.8, 3.10.3.4, and 3.13.4.2	5C-4. Qualitative assessment of the impacts to local emergency response to accidents or spills on public roadways	No change from current conditions.	Under Alternative 2, increased traffic associated with mine worker commuting and truck traffic to and from the mine is expected to result in increased risk of traffic accidents. There may also be an increased risk of hazardous materials simply due to an increased presence of hazardous materials at mine facilities and the regular transport of these materials to and from these facilities. The Town of Superior anticipates that its costs of providing services related to public safety would increase; Resolution Copper has entered into an agreement with the Town of Superior to provide $1.65 million to support emergency response services by the Town over the period from 2016 to 2021, as well as agreements to offset other direct costs to the Town of Superior.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
	Issue 5D: Public Health and Safety – Risks Related to Subsidence						
	5D-1. [DROPPED][13]						

[13] The original issue factor expected to be analyzed was: "Qualitative assessment of the public health risk from geological hazards." This duplicates issue factor 5A-2.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.10.2	5D-2. Qualitative assessment of increased fire risk due to mine operations and subsidence	No change from current conditions.	While increased risks of fire ignition from mine activities (i.e., blasting, construction, increased traffic) cannot be entirely prevented, risks are expected to be substantially mitigated through adherence to a fire plan that requires mine employees to be trained for initial fire suppression and to have fire tools and water readily available.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
	Issue 6A: Water Resources – Groundwater Availability						
3.7.1.5	6A-1. Direction and magnitude of change in aquifer water level, compared with background conditions	Drawdown from mine dewatering anticipated under the no action alternative up to >50 feet at six springs. No effects anticipated to perennial streams.	Additional drawdown caused by block caving anticipated at two additional springs; one spring (DC-6.6W) feeds perennial flow in Devil's Canyon, contributing up to 5% of flow.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
3.7.1.5	6A-2. Geographic extent in which water resources may be impacted	Geographic area impacted by groundwater drawdown under the no action alternative shown in FEIS figure 3.7.1-8.	Geographic area impacted by groundwater drawdown caused by mine dewatering shown in FEIS figure 3.7.1-3; geographic area impacted by groundwater drawdown caused by the Desert Wellfield shown in FEIS figure 3.7.1-2.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.7.1.5	6A-3. Duration of the effect (in years)	Takes ~150–200 years to see maximum drawdown from mine dewatering; recovery of water levels would continue longer. No drawdown would occur at Desert Wellfield.	Takes ~500–900 years to see maximum drawdown from mine dewatering at some GDE locations; recovery of water levels would continue longer. Drawdown at Desert Wellfield recovers within ~130 years after closure.	Same as Alternative 2	Same as Alternative 2 for mine dewatering Drawdown at Desert Wellfield recovers within ~20 years after closure	Same as Alternative 2	Same as Alternative 2
3.7.1.5	6A-4. Comparison of mine water needs and water balance with overall basin water balance, both total volume (acre-feet) and annual rate (acre-feet per year)	No water would be pumped from Desert Wellfield. Mine dewatering pumping would continue indefinitely.	Desert Wellfield pumping over life of mine = 590,000 acre-feet 87,000 acre-feet pumped over life of mine for dewatering	Desert Wellfield pumping over life of mine = 490,000 acre-feet 87,000 acre-feet pumped over life of mine for dewatering	Desert Wellfield pumping over life of mine = 180,000 acre-feet 87,000 acre-feet pumped over life of mine for dewatering	Desert Wellfield pumping over life of mine = 540,000 acre-feet 87,000 acre-feet pumped over life of mine for dewatering	Desert Wellfield pumping over life of mine = 540,000 acre-feet 87,000 acre-feet pumped over life of mine for dewatering
3.7.1.5	6A-5. REVISED[14] Assessment of impact to general groundwater supply areas (feet of water-level decrease)	No impacts anticipated.	For wells connected to regional aquifers, drawdown from mine dewatering up to 30 feet anticipated in Top-of-the-World and Superior. Wells in shallow alluvium or fractures are unlikely to be impacted. Maximum drawdown impacts from Desert Wellfield anticipated to be 40–50 feet at NMIDD, 110–140 feet near wellfield.	Same as Alternative 2	Same as Alternative 2 for mine dewatering Maximum drawdown impacts from Desert Wellfield anticipated to be less than 20 feet at NMIDD, 30–35 feet near wellfield	Same as Alternative 2	Same as Alternative 2

[14] The original issue factor expected to be analyzed was: "Number of known private and public water supply wells within the geographic extent of the water-level impact and assessment of impact to these water supplies (feet of water-level decrease)." The Forest Service determined that analyzing impacts to individual wells was not feasible (see section 3.7.1). Impacts on representative wells were assessed instead.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.7.1.5	6A-6. Potential for subsidence to occur as a result of groundwater withdrawal	No impacts anticipated.	Drawdown associated with the Desert Wellfield would contribute to lowering of groundwater levels in the East Salt River valley basin, including near two known areas of known ground subsidence. There is the potential for Desert Wellfield pumping to contribute to regional subsidence.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
	Issue 6B: Water Resources – Groundwater Quality						
3.7.2.4, Risk of Seepage Impacting Groundwater or Surface Water Quality (sections for each alternative)	6B-1. [REVISED][15] Quantitative assessment of anticipated groundwater quality changes, compared for context to Arizona water quality standards	No tailings seepage would occur; no changes in groundwater quality beyond existing conditions would be anticipated.	Concentrations are not anticipated to be above standards in aquifers downgradient of tailings facility. Selenium concentrations are anticipated to be above surface water standards at Whitlow Ranch Dam. Most concentrations are anticipated to increase from baseline conditions; sulfate concentrations are anticipated to be above secondary standards.	Concentrations are not anticipated to be above standards in aquifers or surface waters downgradient of tailings facility. Selenium and cadmium concentrations are anticipated to increase from baseline conditions.	Concentrations are not anticipated to be above standards in aquifers downgradient of tailings facility. Selenium concentrations are anticipated to be above surface water standards at Whitlow Ranch Dam. Most concentrations are anticipated to increase from baseline conditions; sulfate concentrations are anticipated to be above secondary standards.	Concentrations are not anticipated to be above standards in aquifers or surface waters downgradient of tailings facility. Most concentrations are anticipated to increase from baseline conditions; sulfate concentrations are anticipated to be substantially above secondary standards.	Concentrations are not anticipated to be above standards in aquifers or surface waters downgradient of tailings facility. Most concentrations are anticipated to increase from baseline conditions; sulfate concentrations are anticipated to be above secondary standards.

[15] The original issue factor expected to be analyzed was: "Quantitative assessment of the ability to meet Arizona Aquifer Water Quality Standards at points of compliance designated in the aquifer protection permit." The authority to determine the ability to meet water quality standards lies with the State of Arizona. The Forest Service disclosure focuses on anticipated impacts to groundwater and surface water quality; comparison with water quality standards is presented for context, but is not a regulatory determination.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.7.2.4, Risk of Seepage Impacting Groundwater or Surface Water Quality (sections for each alternative)	6B-2. [REVISED][16] Qualitative assessment of seepage control techniques	No seepage control needed.	Modeled seepage control efficiency of 99%. Risk of not meeting desired efficiency is high.	Modeled seepage control efficiency of 99.5%. Risk of not meeting desired efficiency is high.	Estimated seepage control efficiency of 90%. Risk of not meeting desired efficiency is moderate.	Modeled seepage control efficiency of 84%. Risk of not meeting desired efficiency is moderate.	Modeled seepage control efficiency of 90%. Risk of not meeting desired efficiency is moderate. Refined modeling suggests seepage control is adequate to control water quality impacts.
3.7.2.4, Risk of Seepage Impacting Groundwater or Surface Water Quality (sections for each alternative)	6B-3. Quantitative assessment of the estimated changes in groundwater quality in situ in the area of block caving, including the estimated fate and transport	No block caving would occur; no changes in groundwater quality beyond existing conditions would be anticipated.	Saturated column tests suggest that initial poor water quality in the block-cave zone could meet standards as reflooding continues. Substantial uncertainty exists with effects of oxidation over time.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
	6B-4. [DROPPED][17]						

[16] The original issue factor expected to be analyzed was: "Qualitative assessment of the ability to demonstrate best available demonstrated control technology." Assessment of the ability to meet best available demonstrated control technology is under the authority of the State of Arizona. The Forest Service has instead assessed the expected seepage control techniques and the ability of the project to control seepage to the point that water quality standards are likely to be met.

[17] The original issue factor expected to be analyzed was: "Quantitative assessment of the estimated changes in groundwater quality as a result of seepage from tailings area, including the estimated fate and transport." This duplicates issue factor 6B-1.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.10.3.4	6B-5. Qualitative assessment of the potential for spills or inadvertent release of contaminants to groundwater	No impacts anticipated.	The process water temporary storage ponds are double-lined with leak detection. Infiltration is unlikely to occur under normal operating conditions, and leak detection is incorporated into the process water portion of the pond. If an unplanned spill were to occur, releases underground or at the East Plant Site would be unlikely to migrate due to the hydraulic sink created by dewatering; releases at the tailings storage facility would be likely captured by seepage controls. The primary concern would be spills within the West Plant Site that could likely migrate toward Queen Creek and eventually downstream. Emergency response and material handling plans minimize the risk of release and provide for rapid emergency cleanup.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 6C: Water Resources – Surface Water Availability						
3.7.1.5	6C-1/6C-2. [REVISED][18] Qualitative assessment of the potential lowering of the water table or reduced groundwater flow to Queen Creek, Devil's Canyon, Arnett Creek, Mineral Creek, or other perennial waters that results in permanent changes in flow patterns and that may affect current designated uses	No impacts anticipated.	No direct impacts to perennial flow in Queen Creek, Devil's Canyon, Arnett Creek, or Mineral Creek are anticipated from groundwater drawdown. However, additional drawdown is anticipated to impact spring DC-6.6W which feeds perennial flow in Devil's Canyon, contributing up to 5% of flow.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
3.16.4	6C-3. [REVISED][19] Quantitative assessment of the number of water sources that would be lost to direct disturbance or dewatering	No impacts anticipated.	21 livestock water sources anticipated to be impacted	Same as Alternative 2	20 livestock water sources anticipated to be impacted	10 livestock water sources anticipated to be impacted	14 livestock water sources anticipated to be impacted

[18] Originally two issue factors were expected to be analyzed: "6C-1. Quantitative assessment of the number of stream miles changed from intermittent/perennial flow status to ephemeral flow status as a result of the project;" and "6C-2. Quantitative assessment of the potential lowering of the water table or reduced groundwater flow to Queen Creek, Devil's Canyon, Arnett Creek, Mineral Creek, or other perennial waters that results in permanent changes in flow patterns and that may affect current designated uses." Given the limitations of the groundwater model to predict surface water impacts, these factors were combined and modified.

[19] The original issue factor expected to be analyzed was: "Quantitative assessment of the number of stock watering tanks that would be lost to direct disturbance or reductions in surface flow." Most changes to water sources for both stock and wildlife are from loss of springs, not stock tanks. This issue factor was changed to reflect all water sources lost due to direct or indirect disturbance.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.7.3.4	6C-4. Quantitative assessment of the change in volume, frequency, and magnitude of runoff from the project area	No impacts anticipated.	Reduction in annual average runoff of 3.5% at mouth of Devil's Canyon due to subsidence crater. Reduction in annual average runoff of 6.5% in Queen Creek at Whitlow Ranch Dam.	Same as Alternative 2	Reduction in annual average runoff of 3.5% at mouth of Devil's Canyon due to subsidence crater. Reduction in annual average runoff of 19.9% in Queen Creek at Boyce Thompson Arboretum, and 8.9% at Whitlow Ranch Dam.	Reduction in annual average runoff of 3.5% at mouth of Devil's Canyon due to subsidence crater. Reduction in annual average runoff of 21.3% at mouth of Donnelly Wash, and 0.2% in Gila River.	Reduction in annual average runoff of 3.5% at mouth of Devil's Canyon due to subsidence crater. Reduction in annual average runoff of 12.9% at mouth of Dripping Spring Wash, and 0.5% in Gila River.
	Issue 6D: Water Resources – Surface Water Quality						
3.7.2.4, Potential Surface Water Quality Impacts from Stormwater Runoff	6D-1. [REVISED][20] Quantitative assessment of anticipated surface water quality changes from runoff, compared for context to Arizona water quality standards	No impacts anticipated.	No impacts anticipated under normal conditions due to operational stormwater controls and post-closure reclamation cover; runoff is not allowed to be released after operations until appropriate water quality standards are met. 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.	Same as Alternative 2	Same as Alternative 2. Some potential for Alternative 4 to require treatment of collected PAG runoff prior to recycling.	Same as Alternative 2	Same as Alternative 2

[20] The original issue factor expected to be analyzed was: "Quantitative assessment of the ability to meet Arizona Surface Water Quality Standards for the appropriate designated uses." The authority to determine the ability to meet water quality standards lies with the State of Arizona. The Forest Service disclosure focuses on anticipated impacts to groundwater and surface water quality; comparison to water quality standards is presented for context, but is not a regulatory determination. Note that surface water quality impacts potentially caused by tailings seepage are assessed under issue factor 6B-1.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.7.3.4	6D-2. Qualitative assessment of the change in geomorphology and characteristics of downstream channels	No impacts anticipated.	No impacts anticipated.	No impacts anticipated.	No impacts anticipated.	No impacts anticipated.	No impacts anticipated, but assessment conducted suggests stormwater controls could induce scour downstream.
	6D-3. [DROPPED][21]						
3.7.3.4	6D-4. Quantitative assessment of the acres of potentially jurisdictional waters of the U.S. impacted	No impacts anticipated.	No jurisdictional waters are located above Whitlow Ranch Dam (as determined by U.S. Army Corps of Engineers)	No jurisdictional waters are located above Whitlow Ranch Dam (as determined by U.S. Army Corps of Engineers)	No jurisdictional waters are located above Whitlow Ranch Dam (as determined by U.S. Army Corps of Engineers)	182.5 acres of permanent direct impacts	129.2 acres of permanent direct impacts; 15.7 acres of temporary direct impacts; 43.4 acres of permanent indirect impacts
	Issue 6E: Water Resources – Seeps, Springs, Riparian Areas, and Groundwater-Dependent Ecosystems						
3.3.4	6E-1. Acres of riparian areas disturbed, by vegetation classification	No impacts anticipated.	Riparian = 97 acres Xeroriparian = 102 acres	Same as Alternative 2	Riparian = 85 acres Xeroriparian = 156 acres	Riparian = 83 acres Xeroriparian = 162 acres	Riparian = 44 acres Xeroriparian = 724 acres

[21] The original issue factor expected to be analyzed was: "Quantitative assessment of the acres and locations that may be affected by surface water quality impacts and the duration (in years) of those impacts." This duplicates issue factor 6D-1.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.7.1.5	6E-2. [REVISED][22] Number of GDEs degraded or lost	Under the no action alternative Resolution Copper would continue dewatering activities at the East Plant Site. It is anticipated under the no action alternative that as many as six sacred springs could be adversely affected by drawdown due to continued mine dewatering.	Two additional springs would be impacted by dewatering once block caving begins. Three additional springs would be buried beneath the tailings impoundment, and six additional springs or ponds would be within the subsidence area. In addition, two GDEs associated with Queen Creek and one GDE associated with Devil's Canyon would experience some reduction in surface flow due to runoff captured by the subsidence area or tailings facility. A total of 20 GDEs would be impacted under Alternative 2.	Same as Alternative 2	Same as Alternative 2 for mine dewatering, subsidence, and changes to surface flow (17 GDEs). Two additional springs would be buried beneath the tailings impoundment, but one of these would already be impacted by drawdown. A total of 18 GDEs would be impacted under Alternative 4.	Same as Alternative 2 for mine dewatering, subsidence, and changes to surface flow (17 GDEs). No GDEs have been identified that would be lost due to tailings facility, but one additional GDE (the Gila River) would be impacted by reductions in surface flow due to the tailings facility. A total of 18 GDEs would be impacted under Alternative 5.	Same as Alternative 2 for mine dewatering, subsidence, and subsidence changes to surface flow (17 GDEs). No GDEs have been identified that would be lost due to tailings facility, but one additional GDE (the Gila River) would be impacted by reductions in surface flow due to the tailings facility. A total of 18 GDEs would be impacted under Alternative 6.

[22] The original issue factor expected to be analyzed was: "Number of seeps and springs degraded or lost." Many springs on the landscape are not perennial sources or water or support riparian vegetation. While the impacts to livestock/grazing focused on any named springs of water sources, regardless of their connection to groundwater (see factor 6C-3), the focus of the groundwater analysis was on specific areas with perennial flow and riparian vegetation that were determined to be groundwater-dependent ecosystems. This factor was changed to reflect only groundwater-dependent ecosystems.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.7.1.5 and 3.7.3.4	6E-3. Change in the function of riparian areas	Riparian function of six springs is anticipated to be lost due to mine dewatering; mitigation measures would not be in place to replace flow to these springs.	A total of 17 springs or ponds is anticipated to be impacted due to mine dewatering, subsidence, and direct disturbance. Mitigation measures would be effective at replacing water such that there would be no net loss of riparian ecosystems or aquatic habitat on the landscape, although ecosystems would change to adapt to new water sources. Devil's Canyon would receive less runoff and less inflow from one spring anticipated to be impacted (DC-6.6W), anticipated at 5% to 10%. Queen Creek would receive less runoff, ranging from 13% to 19% above Boyce Thompson Arboretum. Losses could contribute to a reduction in the extent and health of riparian vegetation. Complete drying of the downstream habitat, loss of dominant riparian vegetation, or loss of standing pools would be unlikely. There are no anticipated impacts to riparian areas along Telegraph Canyon, Arnett Creek, or Mineral Creek.	Same as Alternative 2	Same as Alternative 2, except 15 springs or ponds are anticipated to be impacted. Greater flow losses are seen in Queen Creek, which could result in larger impacts than Alternative 2, but similar in nature.	Same as Alternative 2, except 14 springs or ponds are anticipated to be impacted. Gila River would receive less runoff, but watershed losses (as a percentage change in perennial flow) are relatively low for Alternative 5 (0.2% at Donnelly Wash), largely due to the large watershed and flow of the Gila River.	Same as Alternative 2, except 14 springs or ponds are anticipated to impacted. Gila River would receive less runoff, but watershed losses (as a percentage change in perennial flow) are relatively low for Alternative 6 (0.3% at Donnelly Wash), largely due to the large watershed and flow of the Gila River.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	6E-4. [DROPPED][23]						
	Issue 6F: Water Resources – Floodplains						
3.7.3.4	6F-1. Quantitative assessment of the acreage of 100-year floodplains impacted (acreage)	No impacts anticipated.	8.5 acres (based on available floodplain maps)	Same as Alternative 2	Same as Alternative 2	179 acres of floodplain (based on available floodplain maps)	786 acres (based on available floodplain maps)
	6F-2. [DROPPED][24]						
	Water Resources – Additional Issue Factors Analyzed						
3.7.3.4	Acres of wetland impacted, based on National Wetlands Inventory	No impacts anticipated.	151.7 acres associated with ephemeral washes 5.4 acres associated with stock tanks 5.6 acres of wetlands largely along Queen Creek	Same as Alternative 2	164.5 acres associated with ephemeral washes 5.3 acres associated with stock tanks 5.6 acres of wetlands largely along Queen Creek	266.8 acres associated with ephemeral washes 11.2 acres associated with stock tanks 6.3 acres of wetlands largely along Queen Creek 6.7 acres of wetlands largely along the Gila River	234 acres associated with ephemeral washes 11.3 acres associated with stock tanks 5.6 acres of wetlands largely along Queen Creek

[23] The original issue factor expected to be analyzed was: "Ability to meet legal and regulatory requirements for riparian areas." This was originally considered in the event that some riparian areas had special designations under Arizona regulation, such as designated Outstanding Arizona Waters. No riparian areas were identified with special designations.

[24] The original issue factor expected to be analyzed was: "Qualitative assessment of the impact of floodplain changes to upstream or downstream users or residents." Ultimately, the mapping coverage for floodplains is inconsistent and impacts to downstream users would require more specific designs for how washes would be filled. For instance, while pipelines might cross mapped floodplains, if they are buried, there would be no anticipated impacts to downstream users or residents.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 7A: Biological Resources – Adverse Effects of Dewatering at the East Plant Site or Pumping at the West Plant Site						
3.7.1.5 and 3.8.4	7A-1. Qualitative assessment of effects on riparian habitat and species due to changes in flow to Queen Creek, Devil's Canyon, Arnett Creek, Mineral Creek, or other perennial or intermittent waters. [This assessment will be based on the results of the Issue 6 Analysis Factors]	Riparian function of six springs anticipated to be lost due to mine dewatering; mitigation measures would not be in place to replace flow to these springs.	Impacts on fish species include mortality from loss or modification of habitat due to changes in surface water levels or flows, including changes due to changes in groundwater elevation and contribution to surface flows. Would occur for all action alternatives and would have the greatest potential to impact fish species along areas of Devil's Canyon and Queen Creek that currently have surface flows. Impacts are to non-native fish populations (no native fish known to occur) in these locations. No impacts are anticipated in Mineral Creek to longfin dace or Gila chub. Riparian changes impacting amphibious or invertebrate species could occur along areas of Devil's Canyon and Queen Creek that currently have perennial surface flows that would be reduced by changes in runoff.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.7.1.5 and 3.8.4 (*Continued*)	7A-1. Qualitative assessment of effects on riparian habitat and species due to changes in flow to Queen Creek, Devil's Canyon, Arnett Creek, Mineral Creek, or other perennial or intermittent waters. [This assessment will be based on the results of the Issue 6 Analysis Factors] (*Continued*)		Most water sources potentially impacted by the project would be replaced.				
	Issue 7B: Biological Resources – Loss or Harassment of Individual Plants and Animals						
3.8.4	7B-1. Quantitative assessment of acres of suitable habitat disturbed for each special status species, including impacts to designated and proposed critical habitat	No changes from current conditions are anticipated.	Please see FEIS table 3.8.4-2; this acreage information is too extensive to be summarized here.	Please see FEIS table 3.8.4-2; this acreage information is too extensive to be summarized here.	Please see FEIS table 3.8.4-2; this acreage information is too extensive to be summarized here.	Please see FEIS table 3.8.4-2; this acreage information is too extensive to be summarized here.	Please see FEIS table 3.8.4-2; this acreage information is too extensive to be summarized here.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.8.4	7B-2. Qualitative assessment of the potential to affect the population viability of any species and qualitative assessment of mortality of various animal species resulting from the increased volume of traffic related to mine operations	No changes from current conditions are anticipated.	Under this or any action alternative there would be 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 species could see impacts on local populations in the action area, but no regional population-level impacts are likely.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
3.8.4	7B-3. Qualitative assessment of the potential for disturbance to create conditions conducive for invasive species	No changes from current conditions are anticipated.	Ground disturbance, particularly during project construction, would be likely to increase the potential for the introduction and colonization of disturbed areas by noxious and invasive plant species. These potential vegetation changes may decrease suitability of disturbed areas to support breeding, rearing, foraging, and dispersal activities of wildlife and special status species, and may also lead to a shift over time to more wildfire-adapted vegetation that favors noxious or invasive exotic species over native species.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.8.4	7B-4. Qualitative assessment of effects on wildlife behavior from noise, vibrations, and light	No changes from current conditions are anticipated.	Noise, vibrations, and light from mine construction and operations may change habitat use patterns for some species. 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. Some species could see impacts on local populations in the action area, but no regional population-level impacts are likely.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 7C: Biological Resources – Habitat Fragmentation and Loss						
3.8.4	7C-1. Qualitative assessment of the change in movement corridors and connectivity between wildlife habitats	No changes from current conditions are anticipated.	Potential impacts to wildlife movement corridors from all action alternatives would include the loss and fragmentation of movement and dispersal habitats from the subsidence area and from the tailings storage facility. Ground-clearing and consequent fragmentation of habitat blocks for other mine-related facilities would also inhibit wildlife movement. Obstacles to wildlife movement would also be created by pipeline corridors and other linear facilities, though restrictions to movement across linear features may be eased through mitigation.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
3.8.4	7C-2. [REVISED][25] Quantitative assessment of acres by type of terrestrial habitat lost, altered, or indirectly impacted	No changes from current conditions are anticipated.	Projected losses of habitat acres under each action alternative are itemized in FEIS table 3.8.4-3; this information is too extensive to be summarized here.	Projected losses of habitat acres under each action alternative are itemized in FEIS table 3.8.4-3; this information is too extensive to be summarized here.	Projected losses of habitat acres under each action alternative are itemized in FEIS table 3.8.4-3; this information is too extensive to be summarized here.	Projected losses of habitat acres under each action alternative are itemized in FEIS table 3.8.4-3; this information is too extensive to be summarized here.	Projected losses of habitat acres under each action alternative are itemized in FEIS table 3.8.4-3; this information is too extensive to be summarized here.

[25] The original issue factor expected to be analyzed was: "Quantitative assessment of acres by type of terrestrial and aquatic habitat lost, altered, or indirectly impacted." Aquatic habitat was removed from this issue factor because it is duplicated by issue factor 7A-1.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.7.1.5; 3.8.3.2; and 3.8.4.4	7C-3. [REVISED][26] Qualitative assessment of impacts to surface water that support wildlife and plants such as stock tanks, seeps, and springs	Six springs (not designated as wildlife waters) are anticipated to be lost due to mine dewatering; mitigation measures would not be in place to replace flow to these springs.	Of the 15 wildlife waters (waters built or improved such as stock tanks and wildlife guzzlers) within 5 miles of the project footprint, three would occur within the project facility area under this or other action alternatives. Benson Spring would be permanently lost beneath the tailings storage facility for Alternative 2. Mitigation would maintain or replace access to wildlife waters. An additional 17 springs or ponds not designated as wildlife waters are anticipated to be lost due to mine dewatering; mitigation would replace these waters as well.	Same as Alternative 2	Wildlife water Silver King Spring would be within the footprint of the tailings storage facility for Alternative 4 and would be permanently buried. Mitigation would maintain or replace access to wildlife waters. An additional 15 springs or ponds not designated as wildlife waters are anticipated to be lost due to mine dewatering; mitigation would replace these waters as well.	An additional 14 springs or ponds not designated as wildlife waters are anticipated to be lost due to mine dewatering; mitigation would replace these waters as well.	No wildlife waters would be impacted under Alternative 6. Fourteen springs or ponds not designated as wildlife waters are anticipated to be lost due to mine dewatering; mitigation would replace these waters.
	7C-4. [DROPPED][27]						

[26] The original issue factor expected to be analyzed was: “Qualitative assessment of impacts to aquatic habitats and surface water that support wildlife and plants such as stock tanks, seeps, and springs.” Aquatic habitat was removed from this issue factor because it is duplicated by issue factor 7A-1. This issue factor focuses instead on wildlife waters identified by the Arizona Game and Fish Department and springs.

[27] The original issue factor expected to be analyzed was: “Qualitative assessment of how changes in the function of riparian areas could impact wildlife habitat.” This duplicates issue factor 7A-1.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 8: Impacts to Air Quality						
3.6.2.2; 3.6.4.2	8-1. Quantitative estimate of particulate emissions (particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$) and particulate matter less than or equal to 10 microns in diameter (PM_{10})), compared with background (pounds per hour [for 24-hour impacts] and tons per year [tons/year]) and expected seasonal dust patterns and impact area	No impacts anticipated.	The PM_{10} emissions are estimated as 328.9 tons per year. Maximum emission concentration is modeled as 26 µg/m^3 (24-hour) and 7 µg/m^3 (annual), compared with background concentrations of 71 µg/m^3 and 17 µg/m^3, respectively. The $PM_{2.5}$ emissions are estimated as 77.8 tons per year. Maximum emission concentration is modeled as 11 µg/m^3 (24-hour) and 2 µg/m^3 (annual), compared with background concentrations of 6 µg/m^3 and 4 µg/m^3, respectively. Impact area does not extend beyond fence line.	Same as Alternative 2	Similar to Alternative 2	Similar to Alternative 2	Similar to Alternative 2
3.6.2.2	8-2. Volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions and emission rates (tons/year)	No impacts anticipated.	The estimated potential HAP emissions from the project (0.17 tons per year) are less than the major source thresholds (10 tons per year of any one HAP or 25 tons per year of all HAPs) The estimated VOC emissions from the project are 102.7 tons per year.	Same as Alternative 2	Similar to Alternative 2	Similar to Alternative 2	Similar to Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.6.2.2; 3.6.4.2	8-3. Quantitative assessment of total mine emissions (lb/hour and tons/year), compared with the current total regional emissions (tons/year), including criteria and other pollutants (carbon monoxide, lead, sulfur dioxide, nitrogen dioxide, particulate matter, and carbon dioxide). Include tabulation of greenhouse gas emissions of CO_2, CH_4, and N_2O. Depict location of sources for considered alternatives.	No impacts anticipated.	CO: 616 tons/year; 4,531 µg/m^3 project (1-hour), 8,081 µg/m^3 combined with background. NO_2: 118 tons/year; 138 µg/m^3 project (1-hour), 146 µg/m^3 combined with background. PM_{10}: 329 tons/year; 26 µg/m^3 project (24-hour), 97 µg/m^3 combined with background. $PM_{2.5}$: 78 tons/year; 11 µg/m^3 project (24-hour), 18 µg/m^3 combined with background. SO_2: 18 tons/year; 92 µg/m^3 project (1-hour), 117 µg/m^3 combined with background. Lead: 0.023 tons/year, below analysis threshold of 0.6 tons/year. CO_2 and greenhouse gas: 173,000 equivalent tons/year (direct emissions.	Same as Alternative 2	Similar to Alternative 2	Similar to Alternative 2	Similar to Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.6.4.2	8-4. Quantitative assessment of the ability to meet air quality standards, include impacts based on representative background air quality levels and analyze cumulative emissions and impacts	No impacts anticipated.	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 are 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 acceptability.	Same as Alternative 2	Similar to Alternative 2	Similar to Alternative 2	Similar to Alternative 2
3.6.2.2	8-5. Quantitative assessment of the off-site impacts of hazardous or toxic air pollutants compared to health-based levels	No impacts anticipated.	The ability to meet air quality standards is considered protective of public health. In addition, levels of metals deposition associated with particulate emissions were estimated and compared with Regional Screening Levels for which the EPA has derived carcinogenic and/or non-carcinogenic chronic health effects. For all alternatives, the estimated human health risk associated with the maximum air concentrations of inorganic metals is less than established thresholds.	Same as Alternative 2	Similar to Alternative 2	Similar to Alternative 2	Similar to Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.6.4.2	8-6. Quantitative assessment of the ability to meet NAAQS for criteria pollutants (carbon monoxide, lead, sulfur dioxide, nitrogen dioxide, ozone, and particulate matter), as modeled at the perimeter fence line of the mine facility, taking into account all mobile and stationary emission sources. Include spatial depictions of impacts for the area around the mine and alternative sites	Existing and ongoing impacts to 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.	None of the predicted results are anticipated to exceed the NAAQS at the ambient air boundary/fence line.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.6.4.2	8-7. Quantitative assessment of the impacts at Class I airsheds, specifically, changes to air quality–related values (AQRVs) of visibility, ozone, and deposition of sulfur dioxide and nitrogen oxides, as modeled at perimeter of Class I airsheds, and compared with current deposition rates and critical loads[28]	No impacts anticipated.	All impacts are projected to be less than the PSD increments at the Class I areas and, except for the Superstition Wilderness Area, would have an insignificant[29] impact at those areas. The highest 24-hour impacts of PM_{10} and $PM_{2.5}$ emissions on air quality at the Superstition Wilderness Area consume up to 50% of the Class I PSD increments. Sulfur and nitrogen deposition impacts are lower than thresholds established by guidance.	Same as Alternative 2	Similar to Alternative 2	Similar to Alternative 2	Similar to Alternative 2

[28] See Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report—Revised (2010) Natural Resource Report NPS/NRPC/NRR—2010/232.

[29] Comparisons to 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.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.6.4.2	8-8. Assessment using best available science of long-term trends in precipitation and temperature that may affect resources	Increases in global surface air temperatures in the Southwest have caused markedly increased average annual temperatures and reduced water storage due to early spring snowpack runoff. The trends in temperature and effects of snowmelt runoff, with declining river flow, are predicted to continue into the foreseeable future.	The proposed action would lead to emissions of greenhouse gases based largely on fuel use by mobile sources with a minor contribution from process combustion sources. The total direct greenhouse gas emissions would amount to about 173,000 tons/year, based on year 14 with the highest emission rates. Project emissions would contribute to ongoing climate trends. Additional indirect emissions would occur from energy production and transportation of concentrate.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 9A: Long-term Land Stability – Subsidence						
3.2.4	9A-1. Quantitative assessment of the extent, amount, and timing of land subsidence, with estimates of uncertainty	No changes from current conditions are anticipated.	Subsidence crater is estimated to first become evident at the surface at Oak Flat in mine year 6 or 7. At mine closure, subsidence crater is expected to be approximately 800–1,100 feet deep and approximately 1.8 miles in diameter. Modeling indicates there would be no damage to Apache Leap, Devil's Canyon, or U.S. 60. Monitoring would take place and Resolution Copper has stated it would modify mining plans if it appears any of these areas would be impacted.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
3.2.4	9A-2. [REVISED][30] Qualitative assessment of the potential to impact caves or karst resources, and paleontological resources	No changes from current conditions are anticipated.	A small area of Martin limestone with potential paleontological resources is within the footprint of Alternative 2; otherwise, no impacts to cave/karst resources or paleontological resources are anticipated.	Same as Alternative 2	No impacts to cave/karst resources or paleontological resources are anticipated.	No impacts to cave/karst resources or paleontological resources are anticipated.	No impacts to cave/karst resources or paleontological resources are anticipated.

[30] This issue factor originally focused solely on caves and karst resources. It has been expanded to include paleontological resources. These two resources are similar in that assessment of the potential to occur is largely based on types of geological units present.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	9A-3. [DROPPED][31]						
	Issue 9B: Long-Term Land Stability – Impact to Existing Landscape Productivity, Stability, and Function						
	9B-1. [DROPPED][32]						
3.3.4.2	9B-2. Quantitative level of disturbance leading to lost soil productivity (acres)	No loss of soil productivity expected.	The level of impact, soil, productivity responses, and revegetation success potential is described in section 3.3.4 (see FEIS tables 3.3.4-1 and 3.3.4-2). Total facility disturbance and impacts to productivity is 9,938 acres.	Same as Alternative 2	Total facility disturbance and impacts to productivity is 10,586 acres.	Total facility disturbance and impacts to productivity is 16,972 acres.	Total facility disturbance and impacts to productivity is 15,160 acres.

[31] The original issue factor expected to be analyzed was: "Qualitative assessment of the impact of the project to seismic activity." This issue factor largely overlapped with issue factor 5A-2 that deals with geological hazards. Issue factor 5A-2 has been modified to incorporate seismic activity specifically, and issue factor 9A-3 has been dropped.

[32] The original issue factor expected to be analyzed was: "Qualitative assessment of long-term stability of tailings and other mine facilities, including expected results of reclamation." This is duplicated by issue factors 5B-1 and 5B-2 (for tailings stability), and issue factor 9B-3 (for expected results of reclamation).

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.3.4.2	9B-3. Qualitative and quantitative assessment of the potential for revegetation of tailings and other mine facilities, using data (where available and if equivalent) from other mine site revegetation efforts conducted in central and southern Arizona	Under this alternative there would be no tailings or other significant changes to existing mine facilities.	Temporary impacts during construction and operation phases include the complete loss of soil productivity, vegetation, and functioning ecosystems within project disturbance areas. After completion of site reclamation and revegetation efforts, a minimum of 8% vegetation cover (including both native and non-native species) can likely be attained within the disturbed areas. Eventual site recovery is expected after reclamation, though not likely to the level of desired conditions or only after extremely long time frames.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
	9B-4. [DROPPED][33]						
3.7.3.4	9B-5. [REVISED][34] Qualitative assessment of the changes in sediment delivery to downstream streams and washes	No impacts to sediment yield would occur.	Changes in magnitude of peak flow and amount of flow would reduce sediment transport and bedload transport. Effects are not expected to be substantial in a sediment-transport limited system.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2; analysis conducted at this location suggests stormwater controls could induce downstream scour.

[33] The original issue factor expected to be analyzed was: "Qualitative evaluation of alteration of soil productivity and soil development." This is duplicated by issue factor 9B-2.

[34] The original issue factor expected to be analyzed was: "Quantitative assessment of the changes in sediment delivery to Queen Creek, Arnett Creek, or other key streams and washes (tons/year), compared with background sediment loading." This factor was changed to a qualitative assessment of sediment yields, due to lack of background data on sediment concentrations or current sediment loss.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 10: Recreation Resources						
3.9.4.2	10-1. Quantitative assessment of acres that would no longer meet current forest plan Recreation Opportunity Spectrum designations	No impacts anticipated.	Under Alternative 2, based on the Recreation Opportunity Spectrum (ROS) designation of user experiences, direct removal of 4,407 acres of the semi-primitive motorized setting, and 1,266 acres within the roaded natural setting.	Same as Alternative 2	Alternative 4 would remove 18 acres of the semi-primitive non-motorized setting, 5,088 acres of the semi-primitive motorized setting and 608 acres within the roaded natural setting.	Alternative 5 would remove 95 acres of the semi-primitive motorized setting and 1,044 acres of the roaded natural setting.	Alternative 6 would remove 146 acres of the semi-primitive non-motorized setting, 246 acres of the semi-primitive motorized setting, and 253 acres of the roaded natural setting.
3.9.4.2	10-2. Quantitative assessment of acres of the Tonto National Forest that would be unavailable for recreational use, for various phases of mine life and reclamation	No impacts anticipated.	All public access would be eliminated on 7,270 acres within the tailings storage facility fence line during construction, operations, and until reclamation is completed, which likely would be decades after closure. The entirety of the Oak Flat Federal Parcel would no longer be public land, though some access could remain during operations.	Same as Alternative 2	All public access would be eliminated on 8,023 acres within the tailings storage facility fence line during construction, operations, and until reclamation is completed, which likely would be decades after closure.	All public access would be eliminated on 13,028 acres within the tailings storage facility fence line during construction, operations, and until reclamation is completed, which likely would be decades after closure.	All public access would be eliminated on 6,513 acres within the tailings storage facility fence line during construction, operations, and until reclamation is completed, which likely would be decades after closure. However, these lands are currently private and Arizona State Trust lands, and would remain private lands after closure of the mine with no expectation of public access.
	10-3. [DROPPED][35]						

[35] The original issue factor expected to be analyzed was: "Quantitative assessment of change in visitor uses." This is largely the same information considered by issue factor 2A-5, which looked at socioeconomic effects of changes in tourism and recreation.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.5.4	10-4. Quantitative assessment of miles of NFS roads lost, for various phases of mine life and reclamation	No impacts anticipated	A total of 8.0 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.	Same as Alternative 2	Under Alternative 4, a total of 17.7 miles of NFS roads would be lost to the tailings storage facility.	Alternative 5 would not have loss to 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.
3.4.4	10-5. Qualitative assessment of potential for noise to reach recreation areas (i.e., audio "footprint")	No impacts anticipated.	Under most conditions, predicted noise during construction and operation as sensitive receptors representing recreation users are below thresholds of concern.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Noise levels along Dripping Springs Road exceed thresholds of concern. No residual impacts after mitigation applied (paving the road, imposing 15 mph speed limit, daytime deliveries only).
3.9.4; 3.11.4	10-6. Qualitative assessment of impacts on solitude in designated wilderness and other backcountry areas	No impacts anticipated.	Visitors to the Superstition Wilderness, Picketpost Mountain, and Apache Leap would have foreground and background views of the Alternative 2 facilities from trails and overlooks, and the recreation setting from certain site-specific views would change if the tailings storage facility were visible.	Same as Alternative 2	Same as Alternative 2	Visitors to the White Canyon Wilderness would have background views of the tailings storage facility pipeline corridor from some trails and overlooks, and the recreation setting from certain site-specific views would change if the tailings storage facility pipeline corridor were visible.	The tailings storage facility would not be visible from any designated wilderness areas, but the tailings pipeline corridor would be visible from the Superstition Wilderness.
	10-7. [DROPPED][36]						

[36] The original issue factor expected to be analyzed was: "Quantitative assessment of hunter days lost." This is largely the same information considered by issue factor 2A-5, which looked at socioeconomic effects of changes in tourism and recreation.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.9.4	10-8. Quantitative assessment of miles of Arizona National Scenic Trail, NFS trails, or other known trails requiring relocation, and qualitative assessment of user trail experience	No impacts anticipated.	0.07 mile of the tailings pipeline corridor would intersect the Arizona Trail. NFS Road 982 would also be intersected by the tailings pipeline corridor. Resolution Copper will construct an "overpass" for the tailings corridors that would span the Arizona Trail.	Same as Alternative 2	Would require 3.05 miles of the Arizona Trail to be closed and relocated to an area that would be safe for public use. The new construction would require a different trailway approach and exit in addition to the 3.05-mile direct loss of Arizona Trail.	The Arizona Trail would be intersected by 0.18 mile of the proposed tailings storage facility pipeline in the Passage 16 segment. Resolution Copper would construct an "overpass" for the tailings corridors that would span the Arizona Trail.	Impacts are similar to Alternative 2.
3.9.4.9	10-9. Qualitative 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	No impacts anticipated.	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 similar to those displaced by the project elsewhere in the Globe Ranger District, as well as on other Federal, State, and County lands. A total of 8,109 acres of Federal land base for recreation would be lost to public access.	Same as Alternative 2	Same as Alternative 2. A total of 8,700 acres of Federal land base for recreation would be lost to public access.	Same as Alternative 2. A total of 15,449 acres of Federal land base for recreation would be lost to public access.	Same as Alternative 2. A total of 8,935 acres of Federal land base for recreation would be lost to public access.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	Issue 11: Impacts to Scenic Resources						
3.11.4	11-1. [REVISED][37] Acres of Tonto National Forest land that would no longer meet current forest plan Visual Quality Objective designations	No impacts anticipated.	Analysis finds that within the project footprint the following acreage totals have designations that would not allow for the proposed project activities: 230 acres of Retention and 3,985 acres of Partial Retention.	Same as Alternative 2	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: 208 acres of Retention and 3,374 acres of Partial Retention.	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: 528 acres of Retention, and 706 acres of Partial Retention. Alternative 5 would also exceed the characteristics of Class III VRM on 7,086 acres.	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: 255 acres of Retention and 449 acres of Partial Retention.
3.11.4	11-2. [REVISED][38] Anticipated changes in landscape character from key analysis viewpoints, for various phases of mine life and reclamation	No impacts anticipated.	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 FEIS tables 3.11.4-1, 3.11.4-3, 3.11.4-4, and 3.11.4-5.	Same as Alternative 2	Analysis of anticipated changes in landscape character for Alternative 4 is presented in FEIS tables 3.11.4-1, 3.11.4-8 and 3.11.4-9.	Analysis of anticipated changes in landscape character for Alternative 5 is presented in FEIS tables 3.11.4-1, 3.11.4-10 and 3.11.4-11.	Analysis of anticipated changes in landscape character for Alternative 6 is presented in FEIS tables 3.11.4-1, and 3.11.4-12.

[37] The original issue factor expected to be analyzed was: "Quantitative assessment of acres that would no longer meet current forest plan Scenic Integrity Objective designations." This was changed to align with terminology currently in use on the Tonto National Forest.

[38] The original issue factor expected to be analyzed was: "Qualitative assessment/degree of change in landscape character from key analysis viewpoints, for various phases of mine life and reclamation." This factor was updated to better reflect the analysis presented.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.11.4	11-3. [REVISED][39] Miles of project area visibility along major thoroughfares in the area (i.e., U.S. 60, State Route [SR] 79 and SR 177)	No impacts anticipated.	The Alternative 2 facilities would be visible along 21.2 miles of U.S. 60 and 2.5 miles of SR 177.	Same as Alternative 2	Alternative 4 facilities would be visible along 18.3 miles of U.S. 60 and 3.6 miles of SR 177.	Alternative 5 facilities would be visible along 1.5 miles of U.S. 60 and 1.4 miles of SR 177.	The Alternative 6 tailings facilities would not be visible from either U.S. 60 or SR 177.
	11-4. [DROPPED][40]						
3.11.4	11-5. [REVISED][41] Potential for increase in sky brightness resulting from the mine facility and mine-related vehicle lighting	No impacts anticipated.	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 Trail, and the surrounding national forest landscape.	Same as Alternative 2	Same as Alternative 2	The visibility of lighting at the East Plant Site and West Plant Site would be unchanged from Alternative 2. Lighting at the Alternative 5 tailings location may be visible to nighttime recreationists in the area, Arizona Trail users, and persons traveling on the Florence-Kelvin Highway.	The visibility of lighting at the East Plant Site and West Plant Site would be unchanged from Alternative 2. However, there would be fewer observers of the night sky in the area of the tailings because of the remote location of the facility.
	Issue 12: Impacts to Transportation/ Access						

[39] The original issue factor expected to be analyzed was: "Quantitative assessment of miles of U.S. 60, State Route (SR) 79 or SR 177 with direct line-of-sight views of the project area." The factor was revised for added clarity.

[40] The original issue factor expected to be analyzed was: "Quantitative assessment of miles of project area visibility along concern level 1 and 2 roads and trails." This factor was eliminated because the Tonto National Forest does not use the term "concern level" roads or trails in its planning and Forest management efforts.

[41] The original issue factor expected to be analyzed was: "Qualitative assessment of increase in sky brightness resulting from mine facility and vehicle lighting." The factor was revised for added clarity.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.5.4	12-1. Quantitative assessment of change in type and pattern of traffic by road and vehicle type	Traffic volumes will continue to increase at an average 2% annual growth rate over the next 10 to 20 years, resulting in increased traffic levels on all roads in the area.	64 trips expected during the peak hour in peak construction and 46 trips expected during the peak hour at normal operations.	Same as Alternative 2	88 trips expected during the peak hour in peak construction and 58 trips expected during the peak hour at normal operations.	66 trips expected during the peak hour in peak construction and 46 trips expected during the peak hour at normal operations.	Same as Alternative 2
3.5.4	12-2. Quantitative assessment of the change in level of service on potential highway routes and local roads	With increasing traffic, due to normal background growth and development of the area, the intersections in the project area are generally expected to operate within an acceptable LOS in years 2022 and 2027. The Combs Road/Schnepf Road intersection is expected to operate with a side street LOS E/F by year 2022 through 2027.	Project-related traffic would contribute to decreased LOS at many intersections; unacceptable LOS (E/F) caused by project-related traffic occurs at Main Street/U.S. 60 (construction and operations), SR 177/U.S. 60 (construction), and Magma Mine Road/U.S. 60 (operations).	Same as Alternative 2	Similar to Alternative 2. In addition, unacceptable LOS (E/F) occurs at Silver King Mine Road/U.S. 60 (construction and operations),	Similar to Alternative 2	Similar to Alternative 2
	12-3. [DROPPED][42]						
	Issue 13: Impacts Caused by Mine-Related Noise and Vibration						
	13-1. [DROPPED][43]						

[42] The original issue factor expected to be analyzed was: “Quantitative assessment of roads decommissioned by the mine and roads lost to motorized access.” This is duplicated by issue factor 10-4.

[43] The original issue factor expected to be analyzed was: “Qualitative assessment of the potential for noise to reach recreation areas.” This is duplicated by issue factor 10-5.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.4.4	13-2. Qualitative assessment of the ability of alternatives to meet rural landscape expectations	No impacts anticipated.	Under most conditions, predicted noise and vibration during construction and operation at sensitive receptors are below thresholds of concern; rural character would not change due to noise.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Noise levels along Dripping Springs Road exceed thresholds of concern. No residual impacts after mitigations applied (paving the road, imposing 15 mph speed limit, daytime deliveries only); therefore, rural character would not change due to noise.
3.4.4	13-3. Quantitative 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	No impacts anticipated.	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 operation, for both blasting and non-blasting activities, at sensitive receptors are below thresholds of concern.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Noise levels along Dripping Springs Road exceed thresholds of concern. No residual impacts after mitigation applied (paving the road, imposing 15 mph speed limit, daytime deliveries only).
	13-4. [DROPPED][44]						

[44] The original issue factor expected to be analyzed was: "Quantitative assessment of acres of habitat impacted from noise, vibrations, and light, at frequencies pertinent to species of concern." This was duplicated by issue factor 7B-4.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
3.4.4.8	13-5. Qualitative assessment of effects of vibrations from blasting and mine operations at nearby residences and sensitive receptors	No impacts anticipated.	The vibration analysis indicates that within given levels of explosive loading, neither blasting nor non-blasting vibrations exceed selected thresholds based on structural damage.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
	Issue 14: Impacts to Land Ownership and Boundary Management						
	14-1. [DROPPED][45]						
1.4.2; Appendix B	14-2. Quantitative assessment of lands that will be conveyed to public ownership through the land exchange (i.e., approximately 5,460 acres in all parcel groups)	No exchange of lands would occur.	1,224 acres of land will be conveyed to the Forest Service and 4,236 acres of land will be conveyed to the BLM.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
3.16.4	14-3. Quantitative assessment of changes to acreage of grazing allotments, loss of animal unit months (AUMs), and qualitative assessment of impact from loss of grazing-related facilities (waters, stock tanks, roads, fences)	No impacts anticipated.	Under Alternative 2, affected grazing allotments would experience a reduction of 8,573 acres and 664 AUMs over six allotments and 21 grazing-related facilities (water sources) would also be lost.	Same as Alternative 2	Under Alternative 4 there would be a reduction in 9,178 acres and 703 AUMs over six allotments, and 20 grazing-related facilities (water sources) would be lost.	Under 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, as well as infrastructure at the Teacup headquarters.	Under Alternative 6 there would be a reduction of 13,781 acres and 2,797 AUMs over nine allotments, and 14 grazing-related facilities (water sources) would be lost, as well as infrastructure at the Slash S headquarters.

[45] The original issue factor expected to be analyzed was "Quantitative assessment of acres of public lands no longer accessible, for various phases of the mine life and reclamation." This is duplicated by issue factor 10-2.

FEIS Section	Issue Category	Alternative 1 – No Action	Alternative 2 – Near West Proposed Action	Alternative 3 – Near West – Ultrathickened	Alternative 4 – Silver King	Alternative 5 – Peg Leg	Alternative 6 – Skunk Camp
	14-4. Qualitative assessment of changes in fencing, boundary markers, and survey markers	No impacts anticipated.	It is anticipated that implementation of any action alternative would damage, destroy, or obliterate corner monuments and landownership boundaries (e.g., through ground-clearing activities or burial beneath tailings).	It is anticipated that implementation of any action alternative would damage, destroy, or obliterate corner monuments and landownership boundaries (e.g., through ground-clearing activities or burial beneath tailings).	It is anticipated that implementation of any action alternative would damage, destroy, or obliterate corner monuments and landownership boundaries (e.g., through ground-clearing activities or burial beneath tailings).	It is anticipated that implementation of any action alternative would damage, destroy, or obliterate corner monuments and landownership boundaries (e.g., through ground-clearing activities or burial beneath tailings).	It is anticipated that implementation of any action alternative would damage, destroy, or obliterate corner monuments and landownership boundaries (e.g., through ground-clearing activities or burial beneath tailings).
	14-5. [DROPPED][46]						
3.2.4	14-6. Qualitative assessment of impact to mining claims	Non–Resolution Copper unpatented lode or placer mining claims are located under the tailings storage facility and pipeline corridor.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

[46] The original issue factor expected to be analyzed was: "Qualitative assessment of impacts to regional land conservation efforts." This factor cannot be assessed until a full mitigation package is available that includes additional lands that may be brought forth in response to Clean Water Act Section 404 permitting of Endangered Species Act Section 7 consultation. At this time, regional conservation land efforts do not appear to be impacted in any specific way.

Appendix F. Alternatives Considered but Dismissed from Detailed Analysis

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required under the National Environmental Policy Act (NEPA) to rigorously explore and objectively evaluate all reasonable alternatives which were eliminated from detailed study, and to briefly discuss the reasons for their having been eliminated (40 Code of Federal Regulations (CFR) 1502.14). All comments received from the public, cooperating agencies, tribes, and the project team during the scoping period in response to the proposed action that provided suggestions for alternative methods for achieving the purpose and need were considered for analysis (SWCA Environmental Consultants 2017b). Some of these alternatives were determined to be outside the scope of the project, duplicative of the alternatives already being considered in detail, unable to fulfill the purpose and need, technically or economically infeasible, or involved components or actions that would cause unnecessary environmental harm, and therefore, were not considered for detailed analysis. A number of alternatives were initially considered and analyzed but later dismissed from further detailed analysis in the draft and final environmental impact statement (EIS) for reasons summarized in the following text.

The alternatives development process is tracked in several project records and documents, including the following:

- November 2017. "Resolution Copper Project and Land Exchange Environmental Impact Statement Final Alternatives Evaluation Report"(SWCA Environmental Consultants 2017a). This document summarizes the primary alternatives development process as it occurred through November 2017.
- November 2017. "Technical Memorandum for Alternative Mining Methods, Resolution Copper Mining, LLC, Superior, AZ" (Kliche 2017). This document, for the Tonto National Forest by Dr. Charles Kliche, was included as an appendix of the November 2017 Alternatives Evaluation Report and contains the detailed exploration of the applicability and reasonableness of alternative mining techniques other than block caving.
- February 2018. "Process Memorandum to File – Mines in Arizona "Unavailable" for Consideration as Viable Alternatives for Tailings Disposal" (Rausch 2018). This document summarizes the exploration of using various brownfield mine sites for tailings disposal; this information was also included in the November 2017 Alternatives Evaluation Report.
- March–April 2018. Correspondence between the U.S. Department of Agriculture Forest Service (Forest Service) and Resolution Copper Mining, LLC (Resolution Copper) in March and April of 2018, modifying the tailings storage design at the Near West tailings location to no longer use an upstream embankment (Resolution Copper 2018b; U.S. Forest Service 2018a).
- October 2018. "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). This document summarizes additional alternatives development that occurred in early 2018, after discussions with the Bureau of Land Management. Specifically, this document explores the development of Alternative 6 – Skunk Camp, which was not included in the November 2017 Alternatives Evaluation Report. This document also explores the evolution of naming conventions and how tailings techniques, technologies, and embankment designs evolved for the various alternatives.
- March 2019. "Memorandum regarding spreadsheet analysis of mining economics: "Dave Chambers, CSP2, 2/14/05 – updated with 2018 copper prices" (Kliche 2019). This document was authored by Dr. Kliche and reviews additional material submitted to the Tonto National Forest in December 2018, purporting to demonstrate the viability of mining techniques other than block caving.

- March 2019. "Process Memorandum to File – Review of Stakeholder Analysis of Alternative Mining Techniques" (Garrett 2019a). This document summarizes the review of additional material submitted to the Tonto National Forest in December 2018, purporting to demonstrate the viability of mining techniques other than block caving. This document looks at the technical aspects explored by Dr. Kliche as well as other considerations based on regulatory guidance.
- July 2019. "Process Memorandum to File – Summary of Process Steps taken during Review of Alternative Mining Techniques" (Garrett 2018f). This document lists the process steps that occurred during the project up through July 2019 related to the evaluation of alternative mining techniques.
- January 2020. "Response to "Comments on the Resolution Copper Draft Environmental Impact Statement," dated October 28, 2019 by Dr. David M. Chambers" (Kliche 2020). This document, authored by Dr. Kliche, reviews the public comments on the draft EIS (DEIS) analysis. Many of these comments were submitted by Dr. David Chambers, as an attachment of the Arizona Mining Reform Coalition comment letter.
- September 2020. "Process Memorandum to File – Post-DEIS Review of Alternative Mining Techniques" (Garrett 2020i). This document summarizes the process steps taken after receipt of public comments to revisit the potential for using alternative mining techniques, including Dr. Kliche's further review as well as investigations by the Geology and Subsidence Workgroup into alternative mining techniques.

Alternative Mining Techniques

Substantial public comments were received concerning Resolution Copper's proposed panel caving mining technique (panel caving is a form of block caving), in particular requesting that alternative mining techniques be considered or required. Public comments asked for alternatives considering the following items:

- use of traditional mining methods, including less-mechanized forms of mining,
- investigation of alternatives that would result in minimal surface disturbance, and
- use of alternative mining methods to reduce the volume of tailings produced.

The proposed panel caving mining method is seen as having two major drawbacks. First, panel caving results in the creation of a subsidence area at the surface, which impacts a variety of resources. Second, because panel caving does not leave any opening or cavity belowground, there is no opportunity to backfill tailings as a potential disposal alternative. The Forest Service agreed that if an alternative mining method were found to be reasonable, it could reduce certain resource impacts, and the agency undertook an investigation into the technical and economic feasibility of using alternative mining techniques.

OPEN-PIT MINING

Open-pit mining was considered but eliminated from detailed analysis because it would result in surface disturbances greater than those in the proposed action (panel caving), causing unnecessary environmental harm. Specifically:

- The footprint of the open pit would need to be approximately 10,000 acres, which is eight times larger than the projected maximum disturbance from subsidence (approximately 1,200 acres).
- The resulting pit would involve the total removal of Oak Flat, all of Apache Leap, approximately 4 miles of U.S. Route 60, approximately 3 miles of Queen Creek, and approximately 3 miles of Devil's Canyon.

- The pit would have a stripping ratio (waste rock to ore) of 35:1 and would result in approximately 205 billion tons of waste rock. This represents more than 100 times more volume than the projected volume of tailings under the General Plan of Operations (GPO). The waste rock generated from mining would need to be disposed of at some surface location, and a tailings impoundment would still be required.

ALTERNATIVE UNDERGROUND MINING TECHNIQUES

The term "stope" used in mining simply indicates an underground excavation or room, and the term "stoping" refers to any underground mining technique that removes ore from these areas. A spectrum of underground mining techniques was assessed, including naturally supported stoping methods (open stoping, open stoping with pillars), artificially supported stoping methods (shrinkage stoping, overhand and underhand cut-and-fill), other caved stoping methods aside from panel caving (sub-level caving), and other stoping methods like vertical crater retreat. These alternative underground mining techniques are described in detail in the "Resolution Copper Project and Land Exchange Environmental Impact Statement Final Alternatives Evaluation Report" (SWCA Environmental Consultants 2017a). Each of these stoping methods is suited to certain characteristics of an ore body, including ore and host rock strength, the depth and type of overburden or cap rock, and the size and shape of the ore body. As shown in table F-1, very few of these underground stoping methods have characteristics that are well suited to the Resolution copper deposit, even though technically these methods could be used.

Table F-1. Summary of underground stoping methods and their applicability to the Resolution Copper Mine ore deposit

Underground Stoping Method	Ideal Ore Body Characteristics	Ideal Ore Strength	Ideal Host Rock Strength	Backfill with Tailings Materials
Resolution Copper Mine Deposit	*Low grade, massive, thick*	*Weak–Moderate*	*Weak–Moderate*	*No*
Cut-and-fill	High grade, irregular, narrow to wide	Strong	Weak*	Yes
Open stoping	Small	Strong	Strong	Possible
Open stoping with pillar support	Low grade, horizontal or flat dipping	Strong	Strong	Possible
Shrinkage stoping	Fairly high grade, narrow to wide (4 to 100 feet) thick	Strong	Moderate*	Possible
Vertical crater retreat stoping	>40 feet thick	Strong	Strong	Possible

***** Indicates a match with the characteristics of the Resolution Copper Mine ore deposit

While there are other underground stoping techniques that could physically be applied to the Resolution copper deposit, each of the alternative underground mining methods assessed was found to have higher operational costs than panel caving. Higher operations costs would result in a shift in the "cutoff grade" of ore that could be profitably mined. The cutoff grade (given as a percentage) is the lowest grade of copper for a ton of ore that equals the cost of stripping, drilling, blasting, mining, hauling, crushing, and processing the ore (as well as administrative costs, taxes, and other overhead costs), given the current price and mill recovery.

The current cutoff grade as proposed by Resolution Copper is a greater-than-1-percent copper shell, which would result in the greatest potential volume of ore from within the deposit that can be profitably mined. The alternative underground techniques considered would shift the cutoff grade much higher and substantially reduce the amount of ore that could be profitably mined. As shown in table F-2, at a

2 percent cutoff grade, it is estimated that less than 20 percent of the deposit identified by Resolution Copper could be mined. At a 3 percent cutoff grade, it is estimated that less than 1 percent of the deposit could be mined. For comparison, the average grade of ore removed from the historic Magma Mine has been reported to be 5 percent. This higher grade of ore was able to support a cut-and-fill mining technique.

Table F-2. Estimated volume of Resolution Copper Mine deposit at various cutoff grades

Cutoff Grade	Estimated Volume (tons)	Percentage of Volume Proposed to Be Mined in GPO (%)	Source	Average Grade of Ore above the Cutoff Grade
1%	1,969,000,000	100	Resolution Copper	1.54%
2%	386,437,500	19.6	Independent estimate from Resolution Copper data	Unknown
3%	7,545,919	0.4	Extrapolation from first two data points	Unknown
4%	1,478,469	0.08	Extrapolation from first two data points	Unknown
5%	289,676	0.02	Extrapolation from first two data points	Unknown

Post-DEIS Analysis of Alternative Mining Techniques

Additional investigation was undertaken after receipt of public comments on the DEIS to evaluate whether the analysis of alternative mining techniques was reasonable and appropriate. Many comments received on alternative mining techniques were generic in nature, either expressing that the Tonto National Forest did not evaluate other techniques (which is not correct, as demonstrated in this appendix) or prioritized profitability over environmental protection (which is also not correct, as discussed below).

Substantive technical comments on alternative mining techniques focused on the following:

- That Resolution Copper did not make data available to the NEPA team, and that the data were insufficient for the NEPA team to evaluate alternative mining techniques.
- That inappropriate or outdated references were used in the assessment.
- That incorrect ore grade terminology was used in the assessment.

Dr. Kliche clarified a number of aspects of his analysis (Kliche 2020). Dr. Kliche clarified that adequate information was available to him to conduct the required review. Dr. Kliche also evaluated the results if updated per-ton mining costs were used in the analysis, and found no substantial change. Dr. Kliche and the Geology and Subsidence Workgroup also both provided updated industry-standard references for selection of mining techniques. When applied to the site-specific characteristics of the Resolution Copper project, all of the mining method techniques arrived at similar conclusions, with block caving identified as the preferred mining method. Additional investigation was also conducted as to the appropriateness of in-situ mining methods (M3 Engineering and Technology Corporation 2020).

Reasonableness of Alternative Mining Techniques

The Forest Service recognizes and acknowledges scoping comments that suggest the use of mining techniques other than panel caving could substantially reduce impacts on surface resources, both by reducing or eliminating subsidence and by allowing the potential of backfilling tailings underground. For this reason, the potential for using alternative mining techniques was investigated explicitly during the alternatives development process.

In the end, alternative mining techniques as applied specifically to the Resolution Copper Mine deposit were not found to be reasonable, with the following rationale:

1. Panel caving is a standard mining method used in the industry and is commonly used for deposits with the grade, size, depth, and geological characteristics of the Resolution Copper Mine deposit. All industry-standard guidance reviewed arrived at similar conclusions that block caving is an appropriate method to be applied.
2. While several underground stoping techniques could physically and technically be applied to the deposit, the ore and host rock characteristics typically favorable for these techniques differ from the characteristics of the Resolution Copper Mine deposit. While physically feasible, it is unlikely that any of these techniques would be chosen as a reasonable technique for a similar deposit.
3. Use of any of these alternative underground stoping 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 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. Accepting this level of reduction to accommodate an alternative mining technique is not economically feasible and would not be reasonable.

This threshold of reasonableness is consistent with guidance contained in the Forest Service minerals and geology manual (Forest Service Manual [FSM] 2800) (U.S. Forest Service 2006):

> The claimant has the right to see or otherwise dispose of *all locatable minerals*, including uncommon varieties of mineral materials, on which the claimant has a valid claim. (FSM 2813.12, emphasis added)
>
> In managing the use of the surface and surface resources, the Forest Service should attempt to minimize or prevent, mitigate, and repair adverse environmental impacts on National Forest System surface and cultural resources as a result of lawful prospecting, exploration, mining, and mineral processing operations, as well as activities reasonably incident to such uses. This should be accomplished by imposition of reasonable conditions *which do not materially interfere with such operations*. (FSM 2817.02, emphasis added)

The Forest Service found the substantial decreases in ore development that would result by requiring an alternative mining technique would not meet the definition of reasonable, would not allow Resolution Copper to dispose of all locatable minerals on which it has valid claims, and would materially interfere with its operations. For the above reasons, alternative mining techniques were considered but eliminated from detailed analysis.

Many public comments stated a concern that the Forest Service decision to eliminate alternative mining techniques from detailed analysis in the EIS prioritized profitability over environmental protection. This is not the case. The Forest Service did not calculate the profitability of Resolution Copper's mining plan and did not factor profitability into the analysis. The analysis focuses on appropriateness and reasonableness. The analysis is underpinned by the basic assumption that using a technique with higher per-ton mining costs requires a higher ore grade; it is this basic tradeoff that results in the potential loss of 80 percent of the ore deposit if an alternative mining technique were to be employed.

Brownfield Tailings Disposal

During scoping, public comments requested that the Forest Service identify a "brownfield" location (a site that is largely disturbed by previous activity) to store the tailings waste generated in the mining process. A list of potential brownfield sites was developed by reviewing possible mining brownfield sites in Arizona that could potentially hold all or a portion of the tailings anticipated to be produced through mining operations described in the GPO.

Fourteen existing pits or brownfield mine sites were originally considered for tailings disposal and are described in the following text.

AJO

The expected pumping distance to the Ajo pit is estimated to be over 120 miles and would cross numerous public and private jurisdictions. The environmental harm associated with long-distance transport corridors would be substantial, and this location offers only a partial disposal option and does not prevent the placement of a large tailings facility on Federal land. For these reasons, use of the Ajo pit was considered to be unreasonable and was dismissed.

CARLOTA

The Carlota site is over an existing heap leach pad and has minimal to no pit capacity for containing all of the potentially acid generating (PAG) material; tailings storage would require an embankment and expansion of this heap leach area. The site is located on a complex geological area that results in high geological and hydrogeological constraints, and tailings located here have the potential to impair water quality in Pinto Creek and would require creek diversions. Location of the tailings storage facility in this location would not address the water quality issues, and the alternative was therefore dismissed.

CASA GRANDE

Initial estimates showed that the Casa Grande pit potentially had the capacity to hold the PAG tailings material. Upon further investigation, it was determined that it does not have adequate capacity to store the PAG tailings material and is therefore not a suitable option for future tailings storage. This and other pits were also considered further as possible components of an alternative that would dispose of all tailings in multiple brownfield locations, but there was insufficient capacity to store all tailings, even with multiple locations.

COPPER QUEEN (BISBEE, ARIZONA)

Copper Queen Mine is a popular tourist attraction in Bisbee, Arizona. The mine hosts tours, includes a museum, and is visited by many tourists every year. The environmental harm associated with hundreds of miles of pipeline corridor disturbance across Federal, tribal, and other lands would be substantial. For these reasons, it was removed from further consideration for tailings storage.

COPPERSTONE

The Copperstone site does not have the capacity to store all or even the PAG-only portion of the Resolution Copper Mine tailings; this location was therefore removed from consideration for tailings storage.

GREEN VALLEY / SIERRITA

The Green Valley/Sierrita Mine has an ongoing mining operations; for that reason, it was dismissed from further investigation.

JOHNSON CAMP

The Johnson Camp mine has the potential for future mining operations and does not have the capacity to store all or the PAG portion of the tailings. For these reasons, the site was removed from further consideration for tailings storage.

MIAMI AND INSPIRATION / MIAMI UNIT AND COPPER CITY

The Miami and Inspiration / Miami Unit and Copper City mines are located within the Pinal Creek Water Quality Assurance Revolving Fund (WQARF), which is the State of Arizona's equivalent to Superfund. While not absolute, the legal concept of "joint and several liability" that drives Superfund means that use or ownership of these sites would potentially reflect liability on Resolution Copper Mining, LLC. Consideration of these sites was not considered reasonable and therefore they were dismissed.

PINTO VALLEY MINE

The anticipated Pinto Valley Mine operation and closure was considered; however, it was determined that the mine could still be operational at the time when tailings storage is required for the Resolution Copper Project. Because current mine life is projected through 2039, the project team dismissed this location from further investigation. Tailings storage would require an additional embankment and expansion of this area.

RAY MINE

The Ray Mine has an expected reserve life of between 2044 (ASARCO Grupo Mexico 2019) and 2066 (U.S. Army Corps of Engineers 2016) and is in the process of further expansion of a new tailings facility at Ripsey Wash as well as a land exchange with the U.S. Department of the Interior Bureau of Land Management (BLM). The Ray Mine was removed from further consideration because it is in operation and not available for tailings storage in the necessary project time frame.

RESOLUTION COPPER EAST PLANT SITE SUBSIDENCE AREA (POTENTIAL FUTURE BROWNFIELD SITE)

In addition to reviewing existing brownfields, scoping commenters recommended that the tailings be stored in the proposed Resolution Copper Project East Plant Site subsidence area. The feasibility of placement of tailings in the subsidence area, either as slurry or filtered tailings, was considered during alternatives development. In this scenario, the tailings would be placed initially on undisturbed land above the mining panels in the area that would gradually become a subsidence pit. The subsidence area would then be filled with tailings as it expanded over time. This option was dismissed for safety concerns, both aboveground and belowground. In panel caving, it is paramount to control the rate of panel caving and prevent air gaps from developing above the caved zone, which can lead to potentially catastrophic air blasts. Loading of tailings above the panel cave operation could change the rock dynamics in unexpected and unknown ways. If it involves slurry, the added aspect of drainage from above further complicates mining operations. Safety hazards exist for personnel placing tailings aboveground as well, given the active subsidence and earth movement. Overall, it was determined that this option represented unreasonable safety hazards and did not conform to industry norms.

SAN MANUEL

The expected pumping distance to the San Manuel pit is estimated to be approximately 50 miles (straight-line distance). A review of the site's geology shows a high-angle fault in the area. Hydrogeological conditions are unknown at this time but could present additional concerns. San Manuel was originally considered to represent a reasonable option; however, Resolution Copper raised concerns about its ability to control water quality after placement of PAG tailings in the existing pit, given the proximity to the San Pedro River. These concerns were further investigated by the project team, including review of Arizona Department of Environmental Quality (ADEQ) documents related to the closure of San Manuel. The best available information at this time suggests that use of the San Manuel pit would not successfully address the single driving issue of water quality. Specifically, the disposal methodology would not prevent oxidation of PAG material and current gradients would deliver acid drainage directly to the aquifer. Further, movement of seepage into groundwater and movement of groundwater away from the pit would not be controlled, as the current hydraulic sink would be expected to disappear without a pit lake present. The groundwater gradient would potentially deliver poor-quality groundwater directly to the San Pedro River. For these reasons, the San Manuel pit was eliminated from detailed analysis in the EIS.

TOHONO CYPRUS

The Tohono Cyprus site does not have the capacity to store all or the PAG portion of the tailings and was therefore eliminated from further consideration.

TWIN BUTTES

Twin Buttes has ongoing operations and future operation plans that make it infeasible for future tailings storage. The location would also require tailings to be pumped almost 100 miles (straight-line distance).

Other Alternative Tailings Disposal Locations

In response to public scoping comments, the Forest Service investigated several alternative tailings disposal locations (figure F-1). During the alternative evaluation process, the Forest Service reviewed the regional landscape to identify alternative locations that could potentially solve resource issues. These locations were then combined with the alternative locations previously identified by Resolution Copper (see section 3.3.10.1 of the GPO) and evaluated to determine which locations should be dismissed and which locations should be carried forward for inclusion in the EIS. Table F-3 presents the dismissal rationale for the tailings facility alternative locations not carried forward in the EIS. These locations were dismissed because they do not improve upon significant issues of concern over the proposed GPO location.

The initial development of alternative tailings disposal locations largely did not take into account the land ownership or jurisdiction. With respect to the NEPA process, Council on Environmental Quality (CEQ) guidance states, "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" (U.S. Fish and Wildlife Service 2020c). As a result, alternatives were developed encompassing Forest Service, BLM, Arizona State Land Department (ASLD), and private lands.

Jurisdiction does not drive initial alternatives development, but it does factor into the further refinement of alternatives to minimize these conflicts, and it also may factor into which alternative is preferred by the responsible official.

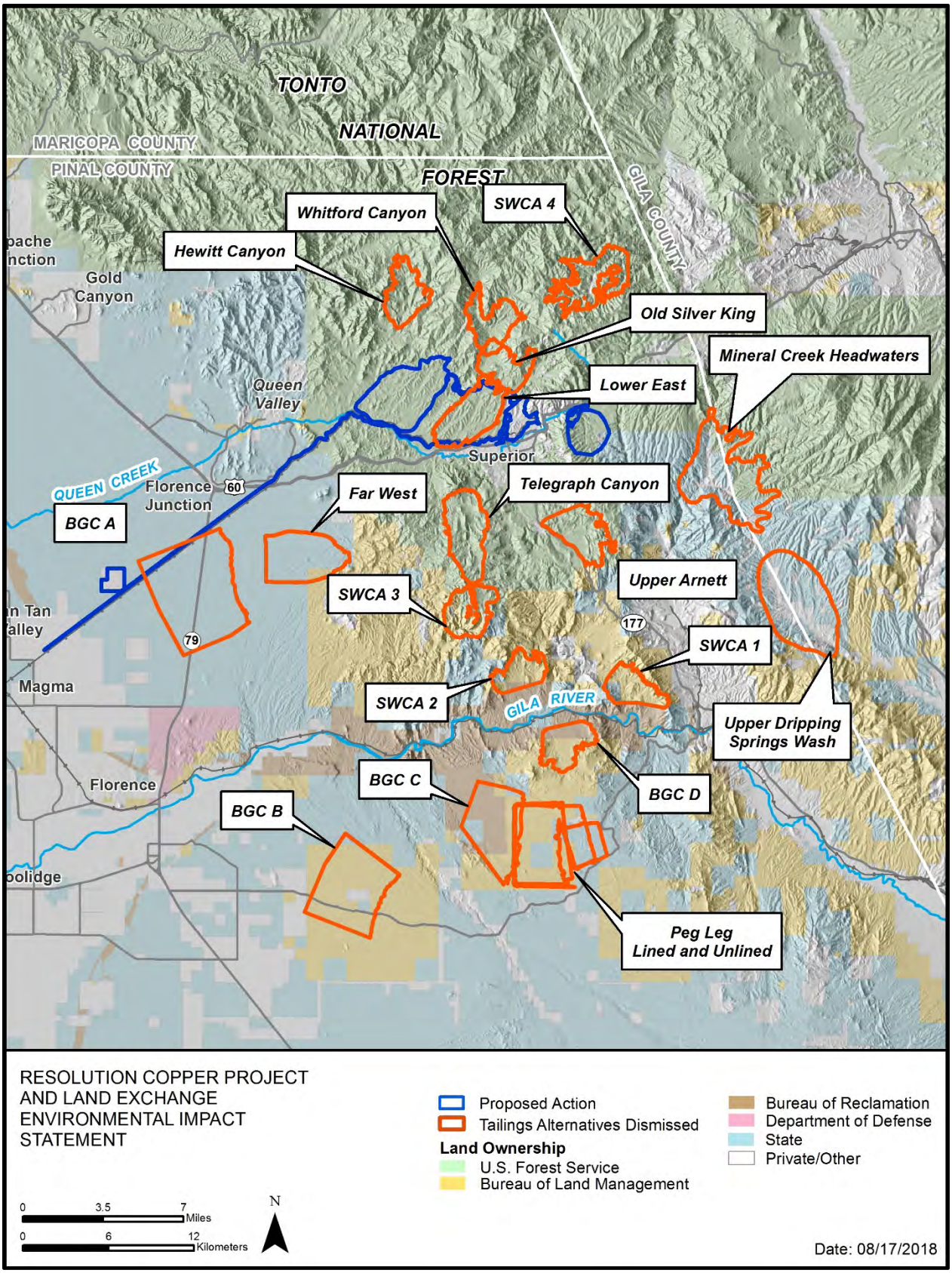


Figure F-1. Tailings facility alternative locations considered but dismissed from detailed study

Agency-Identified Alternative Tailings Disposal Locations and Techniques Considered but Ultimately Dismissed from Detailed Analysis

As noted in table F-3, the alternative of using filtered (or "dry stack") tailings rather than slurry tailings was eventually brought forward for detailed analysis at the Silver King location, very near the West Plant Site, rather than at the GPO location. This is now Alternative 4 (described in section 2.2.6) in the final EIS (FEIS).

Additionally, as a result of extensive meetings and consultations during the latter part of 2017 and early 2018, between the Tonto National Forest, the BLM, and Resolution Copper, together with information provided by the ASLD, BLM, and other cooperating agencies, four additional alternative tailings locations and/or alternative construction techniques came under serious consideration. The first two of these were proposed near, but not in the exact same location as, the previously considered "BGC C" alternative location shown in figure F-1 and described in table F-3.

This general location south of the Gila River came to be known as the "Peg Leg" site, after the name of a nearby wash. The major advantages it presented as an alternative tailings storage site included (a) relative remoteness from population centers and other infrastructure; (b) relative proximity to other ongoing and historic mining activities; (c) generally level topography on a base primarily consisting of alluvial soils, rather than the more upland, rocky, steeper terrain characteristic of the GPO and Silver King locations; and (d) lower recreational use and perceived scenic value than the GPO and Silver King areas.

The two "Peg Leg" alternatives that ultimately emerged were proposed to occupy approximately the same footprint south of the Gila River and west of State Route 177, but each would employ different construction techniques.

Table F-3. Alternative tailings facility locations considered but dismissed from detailed analysis

Alternative Location	Rationale for Dismissal
Whitford Canyon	The location does not provide an overall improvement upon the GPO location for key resource issues: • Water resource impacts: higher tributary area relative to other alternative locations. • Very close to Superstition Wilderness designated Class II airshed; too close for permitting. • Recreation impacts: directly covers the Arizona National Scenic Trail and disrupts popular off-highway vehicle loop route connections. • Biological impacts on a larger variety of biotic communities than most of other alternatives, including on areas deemed sensitive vegetation communities.
Hewitt Canyon	The location does not provide an overall improvement upon the GPO location for key resource issues: • Water resource impacts: higher tributary area relative to other alternative locations. • Very close to Superstition Wilderness designated Class II airshed; too close for permitting. • Recreation impacts on trails and disrupts popular off-highway vehicle loop route connections. • Biological impacts on a larger variety of biotic communities than most of other alternatives, including on areas deemed sensitive vegetation communities. • Longer tailings pipeline/transfer corridor relative to other alternative locations in the Queen Creek watershed.

Alternative Location	Rationale for Dismissal
Telegraph Canyon	The location does not provide an overall improvement upon the GPO location for key resource issues (water resources, biological resources, recreation resources): • Water resource impacts; hydrology drainage impacts; biological impacts on Important Bird Areas and riparian areas. • Recreation impacts on roads and trails; would cover large portion of the Arizona National Scenic Trail.
Lower East	The location does not provide an overall improvement upon the GPO location for key resource issues: • Water resource impacts. • Closer to the receptor Boyce Thompson Arboretum. • Closer to U.S. Route 60 and town of Superior.
Far West	The Forest Service sent an inquiry to the ASLD, the landowner, regarding the potential availability at this location for a tailings facility. ASLD responded that the agency has plans for future residential development for the area and therefore it is not available at this time, or in the future, for locating a tailings facility. For this reason, the location was dismissed from further investigation.
BGC A	The location does not provide an overall improvement upon the GPO location for key resource issues: • Water resource impacts, higher number of wells nearby. • Closer to receptors (residential areas). • Potentially encroaches on area infrastructure (roads).
BGC B	The location does not provide an overall improvement upon the GPO location for key resource issues: • Water resource impact, proximity to Gila River (potentially already degraded water quality). • Closer to receptors (residential areas). • Visual resource impacts, proximity to Florence area and nearby residential areas.
BGC D	The location does not provide an overall improvement upon the GPO location for key resource issues: • Water resource impacts: stormwater management more difficult due to local terrain and proximity to the Gila River. • Recreation impacts, including proximity to the Arizona National Scenic Trail.
SWCA 1	The location does not provide an overall improvement upon the GPO location for key resource issues: • Water resource impacts: stormwater management more difficult due to local terrain and proximity to the Gila River. • Recreation impacts, including proximity to the Arizona National Scenic Trail.
SWCA 2	The location does not provide an overall improvement upon the GPO location for key resource issues: • Water resource impacts: stormwater management more difficult due to local terrain and proximity to the Gila River.
SWCA 3	The location does not provide an overall improvement upon the GPO location for key resource issues: • Landscape constraints (very steep terrain, occupy two watersheds, high probability of faults for landslides). • Recreation impacts, proximity to the Arizona National Scenic Trail.
SWCA 4	This location was removed from consideration for key resource issues: • Water resource impacts, drainage into Roosevelt Lake. • Encroaches on Superstition Wilderness, a Class I airshed.
Upper Arnett	This location was removed from consideration for key resource issues: • Water resource impacts, impacts Arnett Creek, higher upstream in the watershed. • Biological resources, contains more unfragmented wildlife habitat, compared with other alternatives. • Proximity to area infrastructure, State Route 177. • Design confined by highway and landscape features provides less design flexibility. • Longer tailings pipeline/transfer corridor relative to other alternative locations.

Alternative Location	Rationale for Dismissal
Filtered Tailings at the GPO Tailings Facility Location	In response to public scoping comments, the Forest Service considered a tailings alternative of filtered tailings (also commonly known as dry stack tailings) at the proposed GPO tailings facility location. Ultimately, the Forest Service determined that due to the logistical concerns associated with water management and the tailings pipeline/transfer corridor, the evaluation of this alternative tailings technique would occur at the Alternative 4 (Silver King) location.
Silver King	The original location as considered by Resolution Community Working Group was moved to avoid a historic cemetery, underground mine workings of Silver King, mineral estate, and private land. The Silver King location was eliminated as a suitable location for slurry impoundment for water resource concerns but is being moved forward for detailed analysis as a filtered tailings location.
BGC C	This alternative location represented the first iteration of what eventually became Alternative 5 – Peg Leg. This specific location was relocated to move off of Bureau of Reclamation withdrawn lands; once moved, it evolved into the Peg Leg – Lined and Peg Leg – Unlined alternatives (see below).
Peg Leg – Lined	See more detail in the following text.
Peg Leg – Unlined	See more detail in the following text.
Mineral Creek Headwaters	See more detail in the following text.
Upper Dripping Spring Wash	See more detail in the following text.

Peg Leg – Lined

The first, known as "Peg Leg – Lined," would be located primarily on BLM- and ASLD-administered lands (figure F-2) and would be constructed behind a downstream-type embankment, rather than an upstream-type embankment as proposed at the GPO location, and would be fully lined.

Though not as efficient with space or materials necessary to construct as an upstream embankment, the downstream embankment configuration is considered robust and least prone to failure of all tailings embankment types. However, the great disadvantage of the downstream-type embankment is that it requires enormous amounts of non-tailings material (i.e., earthfill) to construct, and it must occupy in perpetuity a substantially greater surface area adjacent to the tailings impoundment itself. The issue with constructing a downstream embankment with borrow materials is that storage requirements would be increased by about one-third because the cyclone sand materials that are used to construct the other embankment options would need to be stored behind the borrow embankment.

Under the "Peg Leg – Lined" alternative, the PAG and non-potentially acid generating (NPAG) cells would be kept separate, rather than merging later during tailings facility development as under the GPO plan, and both cells would be fully lined with an engineered low-permeability liner or equivalent containment system that would continue to be enlarged vertically as the two cells grew in height over time. The PAG cell would be kept continuously saturated to reduce the chances for oxidation/metal leaching, and tailings would be deposited in both cells subaqueously. Any seepage from the PAG and NPAG cells would be collected via the tailings liners and recycled back into the process water, and if necessary treated prior to recycling.

All other major mine plan components such as the East Plant Site infrastructure, block-cave mining, West Plant Site processing, slurry concentrate delivery to the filter plant and loadout facility, and other utility corridors would remain unchanged from those proposed in the GPO, with the exception of a pipeline corridor needed to bring slurry tailings to the Peg Leg site.

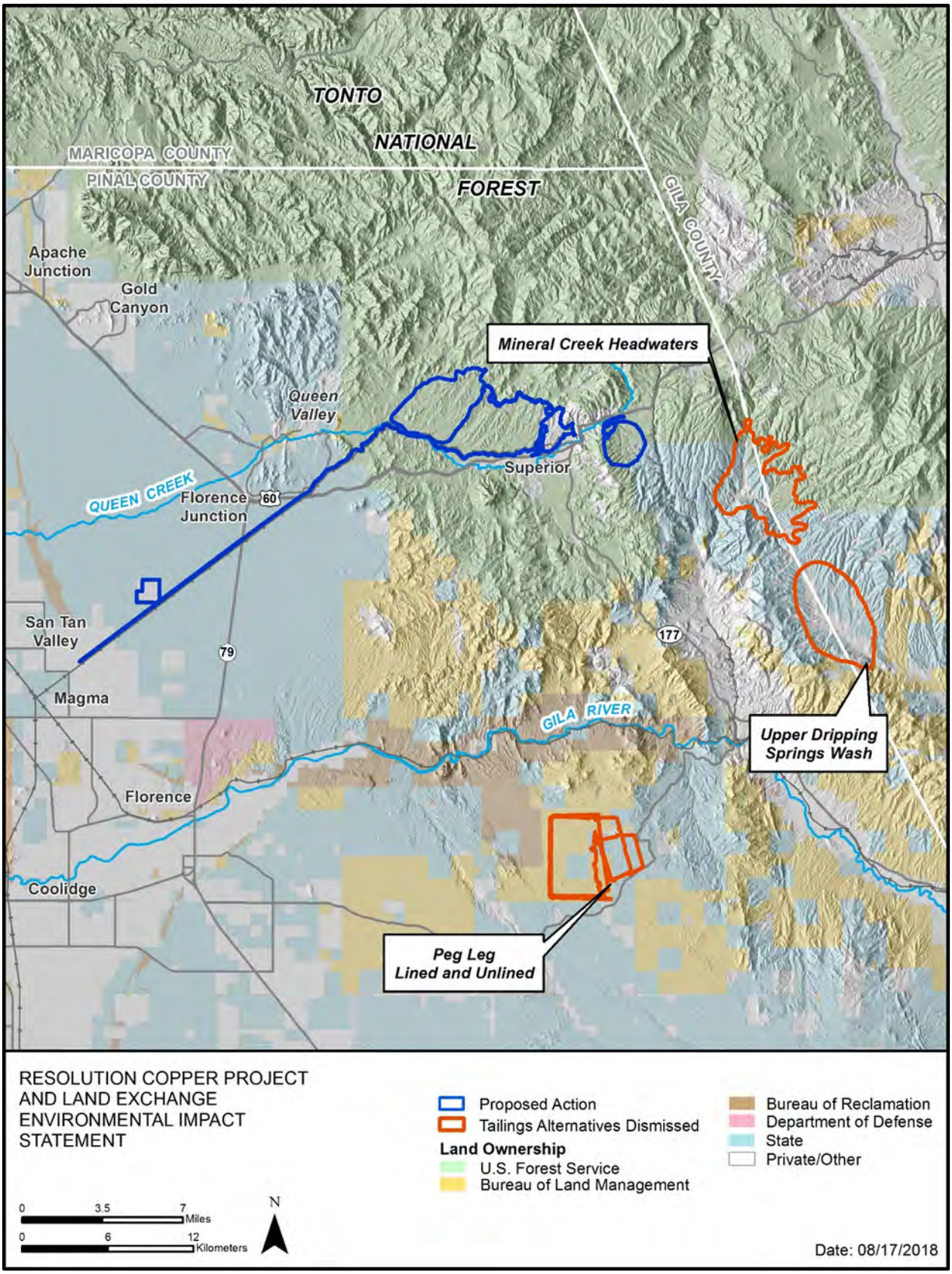


Figure F-2. Alternative tailings facility locations on BLM and ASLD lands

Peg Leg – Unlined

Conscious of both the advantages and limitations presented by the downstream embankment type, the Tonto National Forest decided to conduct preliminary analysis of another embankment type and seepage control methodology at the Peg Leg site.

Rather than a downstream embankment configuration, the "Peg Leg – Unlined" alternative proposed a centerline-type embankment, in which subsequent "raises" or "lifts" to the embankment over time would be built atop earlier levels of compacted cycloned tailings and earthfill.

The decision to proceed with this alternative as an unlined facility was deliberate in that it would allow direct comparison of the environmental effects of an unlined facility at this location—i.e., on a primarily alluvial soil base—versus a fully lined facility at the same Peg Leg location, and also provide an opportunity to evaluate the effects of an unlined facility on alluvium versus an unlined facility at the GPO location, as described in the original GPO Alternative 2 – Proposed Action (since abandoned in favor of detailed analysis of the two GPO Modified Proposed Actions presented in the FEIS in sections 2.2.4 and 2.2.5).

Under the "Peg Leg – Unlined" alternative, seepage would be controlled through a series of downstream collection embankments and ponds, monitoring wells, and pumpback systems.

RATIONALE FOR DISMISSAL FROM DETAILED ANALYSIS OF THE "PEG LEG – LINED" AND "PEG LEG – UNLINED" ALTERNATIVES

After several months of preliminary analysis by Forest Service resource specialists and Resolution Copper technical staff, it was determined that neither the Peg Leg – Lined nor the Peg Leg – Unlined alternatives warranted detailed analysis in the EIS.

Resolution Copper's engineering consultants estimated that generating the huge volumes of earthfill from within the Peg Leg tailings site's footprint in order to construct a downstream embankment would require excavating 0.9 billion tons of soil to a depth up to 160 feet from throughout the roughly 7,000-acre facility—essentially creating a major open-pit aggregate mining operation in addition to the underground mining proposed at the Oak Flat/East Plant Site. Further calculations estimated the effort would require full-time use of more than 140 earthmoving vehicles (dozers, backhoes, haul trucks, etc.), an increase over the amount of equipment needed for other slurry tailings alternatives. The direct carbon dioxide equivalent (CO_2e) emissions are 80 to 132 percent higher than the emissions expected at any other alternative embankment types under consideration. The project would have emissions of carbon monoxide (CO), sulfur dioxide (SO_2), nitric oxide (NO), volatile organic compounds (VOCs), and particulate matter (PM_{10} and $PM_{2.5}$). The Tonto National Forest therefore decided to eliminate this alternative because the adverse environmental effects of implementing it were determined to be substantially greater than either the GPO Proposed Action or the other tailings site alternatives already under consideration.

Similarly, the Peg Leg – Unlined alternative was eliminated from further consideration because preliminary analysis had shown the subsurface seepage resulting from having an unlined facility atop an alluvial soil base would be so great as to not be controllable, which would in turn require substantial additional pumping of fresh water to make up the lost seepage.

However, after several months of study, Resolution Copper approached officials at the Tonto National Forest with a proposal for yet a third alternative tailings facility design at the Peg Leg site that combined best practice tailings management aspects from both the Peg Leg lined and unlined alternatives. Their recommended design would shift the entire facility slightly to the east so that the PAG cells could be

constructed as a physically separate facility atop a broad outcropping of predominately consolidated rock, retained behind a downstream embankment, while the much greater volume of NPAG tailings would remain on the alluvial base immediately to the west, retained behind a centerline-type embankment. The entire PAG facility would be lined with an engineered low-permeability barrier, while the NPAG facility would be partially lined with an engineered low-permeability liner along the interior, upstream side of the embankment. This design preserves an alternative at the Peg Leg location and incorporates key components of the downstream embankment, centerline embankment, and lining.

This new alternative Peg Leg design was carried forward for detailed analysis in the EIS as Alternative 5 – Peg Leg (see FEIS section 2.2.7).

In late 2017 and early 2018, meetings between Tonto National Forest managers and BLM managers and resource specialists resulted in two additional tailings storage facility locations being put forth for consideration—neither of which either the Tonto National Forest or Resolution Copper had previously evaluated. These two alternative locations, which were initially referred to as the Mineral Creek Headwaters and Upper Dripping Spring alternatives, are described in greater detail in the following text.

Mineral Creek Headwaters

The BLM identified two general locations in watersheds approximately 7 and 11 miles, respectively, to the southeast of the town of Superior and approximately 3 miles northeast and directly east of the ASARCO Ray Mine as potential tailings sites that the agency believed warranted at least preliminary investigation (see figure F-2).

The first of these, which BLM referred to for planning purposes as the Mineral Creek Headwaters site, is a 6,077-acre area comprising 2.3 acres of BLM-administered public lands, 662 acres of Arizona State Trust surface with Federal mineral estate, 4,304 acres of Arizona State Trust lands with no Federal mineral estate, 80 acres of private surface with Federal mineral estate, and 1,029 acres of private lands with no Federal mineral estate. BLM stated that mining company ASARCO presently holds 21 mining claims within the area. The topography is a steep canyon with smaller side canyons.

Resource specialists and planners at the Tonto National Forest conducted a first-stage screening of the suitability of the Mineral Creek Headwaters area as a site for a future tailings storage facility. Although presumably of sufficient size to store the requisite volume of tailings, the site lies directly atop a perennial reach of Mineral Creek and abundant riparian vegetation. It would also occupy designated critical habitat for Gila chub. For these reasons, the Mineral Creek Headwaters site was eliminated from further consideration as a viable alternative for detailed analysis in the EIS.

Upper Dripping Spring Wash

The second potential site identified by the BLM is known as Upper Dripping Spring Wash, a 7,058-acre area directly east of the ASARCO Ray Mine. The site consists of a broad ephemeral wash bounded on the west by the Dripping Spring Mountains and on the east by the Mescal Mountains and the Pinal Mountains, approximately 13 miles north of the confluence of Dripping Spring Wash and the Gila River.

In terms of jurisdiction, the area identified by the BLM comprises 69 acres of BLM-administered public lands, 800 acres of Arizona State Trust surface with Federal mineral estate, 3,762 acres of Arizona State Trust lands with no Federal mineral estate, and 2,427 acres of private lands with no Federal mineral estate. The BLM identified 13 existing mining claims located within the proposed general boundaries of the site. Resolution Copper considered their initial hydrologic and geological assessments of the area highly promising and they engaged their engineering staff and contractors to develop a preliminary design

for a tailings facility near this location. The Upper Dripping Spring Wash alternative was eliminated from further consideration as an alternative for detailed analysis in the EIS, as it evolved into a different but similar alternative. Based on a design for a 3,995-acre tailings impoundment (exclusive of roads, pipeline corridors, and other auxiliary facilities) on only private and Arizona State Trust lands, the Tonto National Forest approved detailed analysis in the EIS for Alternative 6 and named it "Skunk Camp" for the nearby Skunk Camp Wash. Please see chapter 2 of the FEIS, section 2.2.8.

Application of Filtered Tailings to other alternatives

Filtered tailings were applied to Alternative 4 – Silver King as part of the range of alternatives. Public comments expressed a desire to see filtered tailings applied to other alternatives, particularly Alternative 6 – Skunk Camp (the preferred alternative). Under mining regulations (36 CFR 220.4(c)), the Forest Service responsible official can make a decision in the Record of Decision (ROD) that modifies an alternative so long as the modifications are "encompassed within the range of alternatives analyzed" in the EIS. Thus, the decision documented in the ROD can pick and choose between actions, activities, and facilities presented in the action alternatives in forming a Selected Action. If the responsible official chose to apply filtered tailings to another alternative tailings location, the EIS analysis and supporting documentation would suffice to disclose the impacts from the Selected Action.

The responsible official may not have jurisdiction to apply filtered tailings to Alternative 6 – Skunk Camp. If Alternative 6 – Skunk Camp is ultimately chosen as the Selected Action, only those actions, activities, and facilities located on National Forest System (NFS) lands will be authorized by the ROD. The tailings facilities and plant site locations are on State and/or private lands.

Power-Related Alternatives

Public comments expressed a desire to see alternative power generation used by the mine. Power for the proposed project is to be supplied by the SRP. The Resolution Copper project falls within the electric service area of the SRP. Under Arizona law, electric service within a service area is provided by a single entity. Other service providers cannot readily enter into that area (Arizona Revised Statutes 9-516A). For this reason, changes to power supply were considered to be beyond the scope of reasonable alternatives. Instead, alternative power generation is being considered as a mitigation measure (see appendix J).

Mining Other Locations

Some public comments indicate that the Forest Service should have examined reopening the San Manuel mine, instead of mining the Resolution ore deposit as proposed. Alternatives developed must respond to the "underlying purpose and need to which the agency is responding" (40 CFR 1502.13). Chapter 1 of the FEIS discloses the purpose and need: "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." The Forest Service is responding to a proposed mine plan for mining the Resolution ore deposit. Mining a different deposit, in a different location, owned by a different entity, does not meet the purpose of and need for the project.

Appendix G. Further Details of East Plant Site, West Plant Site, MARRCO Corridor, and Filter Plant and Loadout Facility Infrastructure

East Plant Site

Existing East Plant Site Facilities

Several of the existing mine facilities were constructed as part of the Magma Mine, which ceased operations in the mid-1990s, and are either being used by Resolution Copper Mining, LLC (Resolution Copper), to support mineral exploration or are unused legacy facilities. The unused legacy facilities include buildings, cooling towers, a descalant tank, and a wastewater treatment plant. Many of the existing East Plant Site facilities would continue to be used for mining operations and would need to be expanded. Table G-1 identifies the existing East Plant Site facilities and their proposed operations function.

Table G-1. Existing East Plant Site facilities

Facility	Current Function	Proposed Function and/or Changes During Operations
Magma Mine Road	Access to East Plant Site from U.S. Route 60	Access to East Plant Site from U.S. Route 60 (would be realigned at approximately year 8 of operations [mine year 14])
Mine Shaft 9	Supports ongoing installation of Shaft 10	Upcast exhaust shaft
Mine Shaft 10	Under construction, provides development rock for geochemical testing	Upcast exhaust shaft
Decline portal	Provides access to Shaft 10 and ventilation and refrigeration	No functional change
Batch plant	Produces concrete and shotcrete	No functional change; may be expanded, if needed
Electrical and mechanical building	Houses drill core processing and maintenance facilities	No functional change
Compressor building	Houses air compressors and water chillers	No functional change; additional compressor buildings would be constructed near new mine shafts
Water chilling plant	Chills water for Shaft 10	Would be eliminated and replaced by new refrigeration system for downcast Shafts 11, 12, and 13
115-kV Salt River Project (SRP) transmission line	Provides electricity to East Plant Site facilities	Would provide back-up redundancy to the 230-kV SRP transmission lines
115-kV Oak Flat electrical substation	Provides electricity to East Plant Site facilities	Would provide backup power for the underground mining area
Dry facilities	Provides showers, lavatories, and locker facilities for employees and contractors	No functional change; supplemental dry facility would be constructed
General administration building	Offices for mine management, operations, engineering, safety, and environmental personnel	No functional change; would be relocated and expanded
Storage and maintenance facilities	Materials and equipment storage and workshops for equipment maintenance	No functional change; additional storage and equipment maintenance workshops would be constructed
Explosives storage	Storage for explosives in accordance with ATF standards	No functional change; a storage area for surface explosives magazines would be constructed away from the main East Plant Site footprint
Contractor yards	Laydown yards for contractor deliveries	No functional change; laydown yard would be expanded
Chemical storage and containment areas	Containment area for the storage of chemicals	No functional change; chemical storage and containment areas would be located at several of the East Plant Site facilities

Facility	Current Function	Proposed Function and/or Changes During Operations
Water tanks	Two potable water tanks supplying East Plant Site with water delivered by the Never Sweat Tunnel	No functional change; a new mine service water tank would be constructed
Fuel tanks	Storage of fuel	No functional change; additional aboveground and underground fuel tanks would be constructed
Laydown areas	Areas for equipment sorting and stockpiling and materials delivery	No functional change; laydown area locations would change throughout mining phases
Stormwater management	Retention basins for stormwater runoff from impervious areas	No functional change; additional stormwater management facilities would be constructed for expanded East Plant Site footprint
Parking lot	Parking area for employees, contractors, and visitors for approximately 100 vehicles	No functional change; would be relocated and expanded to accommodate approximately 320 vehicles
Security trailer	Controls access to the East Plant Site from Magma Mine Road	No functional change
Public viewing terrace	Terrace overlooking the subsidence area with mine information	Closed to public, mine roads at East Plant Site would be closed to the public
Helicopter pad	Helicopter pad for transporting individuals to advanced medical facilities	No functional change; would be relocated
National Forest System (NFS) Roads	NFS Roads 2432, 2433, 2434, 315, and 469	Segments of these roads that are within the disturbance area and subsidence area would be closed to public access and/or decommissioned.

The Never Sweat Tunnel, an additional existing facility, connects the East Plant Site to the West Plant Site. The Never Sweat Tunnel currently serves two primary functions: (1) the tunnel transports development rock.[1] via railcar to the West Plant Site from the underground exploratory development activities at the East Plant Site, and (2) the tunnel transports water to and from the West Plant Site and the East Plant Site. The Never Sweat Tunnel would continue with these functions during mine construction and operations phases.

New East Plant Site Facilities

The primary proposed new mine facilities at the East Plant Site include four additional mine shafts and associated hoisting facilities, the realignment of Magma Mine Road, a wastewater treatment plant, a new Oak Flat substation, the Resolution Copper North substation, and various other facilities (see figure 2.2.2-7). Two new 230-kilovolt (kV) power lines, both operated by the Salt River Project (SRP), would be built to support the power demands and to increase the safety and reliability of underground operations.

MINE SHAFTS

Four new mine shafts and associated facilities (hoist houses and a winder house) would be constructed for ore production, hoisting employees in and out of the mine, refrigeration and ventilation purposes, and the construction of mine levels during mine development. Three of the new shafts (Shafts 11, 13, and 14) would be constructed on Resolution Copper–owned land, and one shaft would be constructed on lands currently managed by the Tonto National Forest (Shaft 12) but would be private after the execution of the land exchange.

[1] "Development rock" is rock removed during construction of tunnels and shafts. It may or may not have economic levels of copper. For the most part, development rock is stockpiled and then used during startup of the processing plant.

Table G-2 provides an overview of the six mine shafts that would be used during operations.

Table G-2. Mine shaft overview

Mine Shaft	Surface Ownership	New or Existing	Full Production Phase Function
9	Resolution Copper	Existing (currently being deepened and rehabilitated)	Upcast exhaust shaft
10	Resolution Copper	Existing	Upcast exhaust shaft
11	Resolution Copper	New	Production/downcast fresh air intake
12	Forest Service	New	Production/downcast fresh air intake
13	Resolution Copper	New	Service (employees and equipment)/downcast fresh air intake
14	Resolution Copper	New	Upcast exhaust shaft

MAGMA MINE ROAD REALIGNMENT AND EAST PLANT SITE ROADS

The existing Magma Mine Road is a two-lane paved road that provides access to the East Plant Site from U.S. Route 60. A segment of the existing Magma Mine Road would be located within the anticipated mining subsidence area. At approximately year 8 of mine operations (mine year 14), the segment of the Magma Mine Road within the subsidence area would be relocated outside the subsidence area to the north. The realigned roadway would be a two-lane paved road and would be used by mine employees, contractors, deliveries, and visitors to the mine. The proposed realignment of the Magma Mine Road is depicted in figure 2.2.2-5.

New paved and dirt roads would be constructed within the 189-acre East Plant Site that would connect the various facilities within the site. The roads would not be open for public access and would be used by mine employees and contractors only.

REFRIGERATION PLANT

A primary refrigeration system would be constructed to produce cool air and water for the underground mining operation. This system would consist of a bulk air cooler supplying each downcast shaft, a central refrigeration plant with a service water refrigeration system to provide chilled water, and thermal storage via a chilled water tank. All cooling systems would be equipped by multiple-cell condenser cooling towers for heat rejection.

WASTEWATER TREATMENT PLANT

Sewage from aboveground and underground facilities would be treated at a newly constructed wastewater treatment plant. Sewage from underground mine facilities would be transported to the plant on the surface via a system of pumps. The plant would be an extended aeration biological plant that uses a biological process for treating wastewater and separating the solids from liquid portion of the waste. Designed by the manufacturer, the “packaged plant” would provide treatment to secondary standards as defined by the Arizona Department of Environmental Quality (ADEQ).

ELECTRICAL SUBSTATIONS AND POWER LINES

Two new substations would be constructed at the East Plant Site: the Oak Flat substation and the Resolution Copper North substation and backup. The primary substation for the East Plant Site would be the 230-kV Oak Flat substation, which would be constructed north of the new production shafts to

provide power for aboveground and belowground activities. The substation would be powered by a new 230-kV transmission line originating from the SRP Silver King Substation north of U.S. Route 60.

The North substation and backup would be an alternate power substation and emergency generators would be located next to the production power to provide a backup electricity system. The emergency generators would be capable of backfeeding the main distribution system and would be able to operate the service auxiliary hoist in Shaft 13, partial mine cooling/ventilation system, and other essential services. The emergency generator system would have sufficient capacity to supply the total essential mine load with one of the generators out of service for maintenance.

Two new 230-kV power lines would be built by SRP within a 160-foot corridor with tower heights not typically exceeding 140 feet. Two lines are needed to increase safety and reliability of underground operations. The Silver King to Oak Flat 230-kV transmission main would provide power from the existing Silver King substation north of U.S. Route 60 to the new Oak Flat substation at the East Plant Site. The Superior to Oak Flat 230-kV power line main would provide redundant power from the East Plant Site to the new Superior substation at the West Plant Site.

OTHER NEW EAST PLANT SITE FACILITIES

Other new facilities that would be constructed at the expanded East Plant Site include a wash bay, a standalone first aid building, and a training building. The wash bay would use high-pressure water hoses and oil-water separators to clean vehicles and equipment. Wastewater from the wash bay would be sent to the Never Sweat Tunnel, where it would be combined with East Plant Site contact water and delivered to the West Plant Site process water system. Table G-3 identifies the major consumables, materials, and supplies that would be used at the East Plant Site, their delivered form, and their storage method.

Table G-3. Consumables, materials, and supplies used at East Plant Site

Material/Supply	Delivered Form	Considered Hazardous*	Storage Method
Diesel fuel	Liquid	Yes	Tanks
Propane	Gas	Yes	Tanks
Oils/Lubricants	Liquid	Yes	Sealed drums/totes
Antifreeze	Liquid	Yes	Individual containers
Solvents	Liquid	Yes	Individual containers
Explosives (emulsion product)	Solid	Yes	Locked magazines
Explosives (blasting detonators)	Solid	Yes	Locked magazines
Welding cylinders (argon gas, acetylene, etc.)	Gas	Yes	Cylinder storage corral
Hardware	Solid	No	General stores shelving
Carpentry supplies	Solid	No	General stores shelving

* Potential for physical, chemical, and/or environmental hazard

West Plant Site

Existing West Plant Site Facilities

Currently, the West Plant Site receives development rock from construction of tunnels, shafts, and underground infrastructure at the East Plant Site via the Never Sweat Tunnel. The development rock is sorted at the West Plant Site, tested for mineral composition, and stored at stockpiles. Development rock

is later processed as part of the startup of the concentrator complex. Similar to the East Plant Site, the West Plant Site consists of existing mine facilities constructed during historic mining operations that are either being used by Resolution Copper to support mineral exploration or are unused legacy facilities. The unused legacy facilities include tailings ponds, houses and offices in the upper basin, and the smelter complex. Of these legacy facilities, several have been reclaimed, including the 500-yard waste rock facility, smelter pond, depot pond, Settling Pond 2, and Tailings Pond 5. Several additional legacy facilities at the West Plant Site are currently in the process of being reclaimed, including the smelter facility and Tailings Ponds 6 and 7.

Table G-4 identifies the existing West Plant Site facilities that are currently used for mineral exploration and would continue to be used during mining operations and the facility's proposed function.

Table G-4. Existing West Plant Site facilities

Facility	Current Function	Proposed Function and/or Changes during Operations
Development rock stockpile	Storage of inert NPAG development rock from the East Plant Site for use in construction and reclamation	No functional change; stockpile would expand to a maximum capacity of 10.3 million cubic yards
Intermediate rock stockpiles	Storage of mineralized development rock delivered from the East Plant Site; maximum capacity of up to 774,000 tons or 498,000 cubic yards	No change
Staging areas	Temporary storage of development rock	No functional change; additional staging areas would be constructed near new mine entrance and other facilities
Borrow areas	Aggregate material supply for ongoing closure, redevelopment, and erosion control	No functional change or change in location
General administration building	Offices for mine management, operations, engineering, safety, and environmental personnel	No functional change; a larger additional administration building would be constructed near the new main entrance
Chemical storage facility	Chemicals used in mining activities are stored in Building 203	No functional change; chemical storage and containment areas would be located at several of the West Plant Site facilities
High-density sludge treatment system	Treatment of dewatering water to reduce total dissolved solids, metals, and pH	Dewatering water would be used in the processing cycle
Apex tunnel	Stormwater diversion	No change
Parking lots	Employee, contractor, and visitor parking	New parking areas would be constructed throughout the expanded West Plant Site; new main entrance at Lone Tree/Smeltertown Road; parking for 650 vehicles
Security buildings and gates at access points	Controls access at Main Gate and Lone Tree access points	No functional change; two new security buildings and gates would be constructed: (1) at the relocated main entrance at Main Street and Magma Heights Road, and (2) NFS Road 229 to control access during construction of new substation
Arizona Water Company CAP water tank	500,000-gallon potable water and fire flow supply for West Plant Site and East Plant Site; receives water from a 36-inch water pipeline	No change
Water supply pipelines	Distributes water throughout the West Plant Site and to the mine supply water tank for delivery to East Plant Site via a 16-inch pipeline in the Never Sweat Tunnel	Additional water supply pipelines would be constructed for new and expanded facilities
SRP 115-kV Trask substation	Distribute electricity throughout West Plant Site	Power supplied from the substation would be replaced with a 34.5-kV overhead transmission line to a new 34.5-/4.16-kV transformer

Facility	Current Function	Proposed Function and/or Changes during Operations
115-kV SRP transmission line	Electrical supply for West Plant Site	Rerouted to new Superior substation
Stormwater management	Controls and contains stormwater drainage from West Plant Site	Stormwater management system would be expanded to accommodate new and expanded facilities
Laydown yards	Temporary storage for construction deliveries	New laydown yards would be constructed for new and expanded facilities
Private roads	Roads within West Plant Site connecting facilities	New roads would be constructed to connect new and expanded facilities
NFS Road 229 (Silver King Mine Road) and NFS Road 1010	Provides secondary road access to the West Plant Site	NFS Road 229 would be reconstructed between U.S. Route 60 and the West Plant Site to allow for use by construction and mine equipment
Never Sweat Tunnel substation	Provides electricity to Never Sweat Tunnel	No change
Never Sweat Tunnel ventilation	Provides cooling for the Never Sweat Tunnel	No change

New West Plant Site Facilities

The proposed action would expand the West Plant Site from 422 acres to 940 acres to accommodate new facilities. The proposed new mine facilities at the West Plant Site include a new concentrator complex, reconstructed NFS Road 229, new administrative facilities, a water treatment plant, retention and contact water ponds, and electrical substations (see figure 2.2.2-9).

CONCENTRATOR COMPLEX

The concentrator complex at the West Plant Site would employ a traditional sulfide ore processing technique to process up between 132,000 to 165,000 tons of ore per day. The primary structural components of the concentrator complex would be the water process pond, the ore stockpile facility, the grinding circuit, the flotation circuit, and the molybdenum plant.

Process Water Pond and Storage Tank

The process water pond would hold up to 50 million gallons of water for use at the concentrator complex. The pond would be located west of the concentrator complex buildings and be used to pump process water to a 1-million-gallon storage tank at elevation above the concentrator. The tank provides the required head pressure needed at the concentrator. The pond would receive water from a variety of water sources, including Central Arizona Project (CAP) water, return water from the underground mine, and recovered water from the filter plant. The pond would be equipped with emergency overflow and a diversion ditch would be provided to route any potential overflows to a contact water pond south of the concentrator complex. The pond would be constructed so that it is double lined with leak detection and collection in accordance with the ADEQ best available demonstrated control technology requirements. Personnel and wildlife would be protected from entering the pond site with a chain-link fence surrounding the designated area. An emergency overflow containment downstream of the pond located on Resolution Copper property would be required.

Fresh Water Storage Tank

Fresh water would be supplied to the mine from the CAP water canal and wells along the Magma Arizona Railroad Company (MARRCO) corridor. Water is pumped to the West Plant Site along the MARRCO rail line to a 2-million-gallon CAP water distribution tank. This tank would be located above the concentrator.

Ore Stockpile

Crushed ore from the East Plant Site would be delivered to the West Plant Site via a conveyor system. The conveyor would unload the crushed ore at a covered ore stockpile adjacent to the concentrator complex. The ore stockpile would have a living capacity of 132,000 tons of ore and a total capacity of 441,000 tons. The ore stockpile is a surge facility for the mining operation to allow for short-term shutdowns of either the active mining operations at the East Plant Site or the concentrator operations while the other facility is still in operation.

Grinding Circuit

Ore from the East Plant Site and the ore stockpile would be delivered to the grinding circuit, where the crushed ore would be further ground with water into a slurry before being sent to the flotation circuit. Final grinding circuit design would be determined closer to operations, but according to the General Plan of Operations (GPO) (2016c), the grinding circuit is currently expected to consist of either two semi-autogenous grinding mills and four ball mills or three semi-autogenous mills and six ball mills. Once ore is processed at the semi-autogenous mills and ball mills, the slurry would be distributed to hydrocyclone classifiers (cyclones). Cyclone overflow, the final grinding circuit product, would then be delivered to the flotation circuit for further concentrate processing.

Flotation Circuit

After leaving the grinding circuit, copper and molybdenum would be concentrated in the bulk copper-molybdenum flotation circuit. The flotation circuit would consist of flotation tank cells, a regrind mill, cleaner cells, and copper and molybdenum thickening tanks. Chemical reagents would be used at the thickening tanks to further concentrate the copper and molybdenum and cause it to float to the surface of the slurry where it can be recovered. Chemical reagents would be stored and handled at a separate enclosed reagent building adjacent to the concentrator complex. Recovered molybdenum would be sent to the molybdenum plant at the concentrator complex for further processing. Recovered copper would be sent to the filter plant via the MAARCO corridor for further processing. Tailings—the processed non-economic waste material that results from copper ore processing—would be sent to the tailings storage facility approximately 3 miles west of the West Plant Site via two pipelines. The GPO (2016c) indicates that tailings slurry would be thickened to solids content of approximately 55 to 65 percent. Tailings low in sulfide or pyrite are considered non-potentially acid generating (NPAG). Tailings high in sulfide or pyrite are considered potentially acid generating (PAG). For a list of reagents that would be used in the concentrator complex's flotation circuit, see GPO table 3.9-3.

Molybdenum Plant

Molybdenum concentrate recovered in the flotation circuit would be further concentrated at the molybdenum plant, where it would be turned into molybdenum filter cake and packaged into sacks or containers. These sacks or containers would be ready for shipment to customers from the molybdenum plant. Approximately four shipments of molybdenum concentrate would be shipped by truck every day from the West Plant Site.

RECONSTRUCTED NFS ROAD 229 (SILVER KING MINE ROAD)

Approximately 1.3 miles of Silver King Mine Road (NFS Road 229) would be reconstructed between U.S. Route 60 and the West Plant Site to provide construction access to the new 230-kV substation. The road would also serve as a secondary access to the West Plant Site that would be designed for use by large construction and mining vehicles and equipment, and would be the main access for large deliveries to and from the West Plant Site.

ADMINISTRATIVE FACILITIES

The existing administrative building would be retained for continued use, and a larger additional administrative building would be constructed near the new main entrance to the West Plant Site. The new administrative building would provide office space for reception, mine management, document control, operations, engineering, safety, and environmental personnel. Space would also be available for conference and safety training rooms, a metallurgical laboratory, a first aid clinic, and dry change house facility.

WATER TREATMENT PLANT

An existing water treatment system is located at the West Plant Site for the treatment water from mine dewatering water at the East Plant Site. Treatment reduces total dissolved solids, metals, and pH prior to delivery to the new Magma Irrigation and Drainage District. During mine operations, water from mine dewatering would be incorporated into the tailings thickener process; however, the water treatment system would remain in place for use as needed.

RETENTION AND CONTACT WATER PONDS

Three new retention and contact water ponds would be constructed to collect and control stormwater flowing from the concentrator and stockpile facilities. The ponds would be located at the foot of the development rock pile and would be designed to collect stormwater for 100-year, 24-hour storm events.

ELECTRICAL SUBSTATIONS AND POWER LINES

A new 230-kV Superior substation would be constructed to provide electricity to West Plant Site facilities. The proposed realignment of Silver King Mine Road would provide access to the new substation during construction. Electricity would be delivered to the new 230-kV substation via a transmission line connection to the existing 230-kV transmission lines west of the West Plant Site. A redundant electricity supply from the existing Silver King Substation, via the new Oak Flat substation at the East Plant Site, would connect to the new 230-kV substation at the West Plant Site. As needed, several smaller substations would be constructed and connected to the new 230-kV substation to provide electricity to facilities in the West Plant Site.

The existing 115-kV transmission line would be rerouted within the existing West Plant Site boundary to avoid new facilities. A 34.5- to 115-kV transmission line would provide power from the West Plant Site along the tailings conveyance corridor to the tailings storage facility, depending on alternative. This would power the new facilities at the tailings storage facility.

CONSUMABLES, MATERIALS, AND SUPPLIES USED AT THE WEST PLANT SITE

Table G-5 identifies the major consumables, materials, and supplies that would be used at the West Plant Site, their delivered form, and their storage method. Table G-6 identifies the reagents that would be delivered to, stored, and used at the concentrator complex.

Table G-5. Consumables, materials, and supplies used at the West Plant Site

Material/Supply	Delivered Form	Considered Hazardous*	Storage Method
Diesel fuel	Liquid	Yes	Tanks
Oils/lubricants	Liquid	Yes	Sealed drums/totes
Antifreeze	Liquid	Yes	Individual containers

Material/Supply	Delivered Form	Considered Hazardous*	Storage Method
Solvents	Liquid	Yes	Individual containers
Office supplies	Solid	No	Individual containers
Propane	Gas	Yes	Tanks
Grinding balls	Solid	Yes	Locked magazines
Lab chemicals	Solid	Yes	Locked magazines
Welding cylinders (argon gas, acetylene, etc.)	Gas	Yes	Cylinder storage corral
Hardware	Solid	No	General stores shelving
Carpentry supplies	Solid	No	General stores shelving

* Potential for physical, chemical, and/or environmental hazard

Table G-6. Concentrator complex reagents

Material/Supply	Delivered Form	Considered Hazardous*	Storage Method
Dithiophosphate/monothiosulfate (Cytec 8989; collector) or equivalent copper collector	Bulk truck (liquid)	Yes	Storage tank
Sodium isopropyl xanthate (SIPX; collector)	Drums (dry)	Yes	Drums on pallets
Methyl isobutyl carbinol (MIBC; frother)	Bulk truck (liquid)	Yes	Storage tank
MCO (non-polar flotation oil; molybdenum collector) or #2 Diesel Fuel	Bulk truck (liquid)	Yes	Storage tank
Sodium hydrosulfide (NaHS; copper mineral depressant)	Bulk truck (liquid 30% concentration)	Yes	Storage tank
Flocculant (settling agent)	Bags or super sacks (dry)	Yes	Bags or sacks on pallet
Lime (90% CaO; pH modifier)	Bulk truck (dry)	Yes	Dry storage silos
Antiscalant (water treatment)	Drums (dry) or liquid (totes)	Yes	Drums or totes on pallets
Nitrogen (molybdenum sparge gas)	Vendor or Resolution Copper–owned nitrogen plant	Yes	Nitrogen tank

* Potential for physical, chemical, and/or environmental hazard

MARRCO CORRIDOR

Existing MARRCO Corridor Facilities

The MARRCO corridor is a historic mining railroad corridor that was originally built in the 1920s and ceased operations in the mid-1990s after the closure of the Magma Mine. Several utilities are currently collocated within the MARRCO corridor, including a buried fiber-optic line, an overhead transmission line and telephone line, and buried natural gas pipelines. In addition, the Arizona Water Company maintains a water pipeline and associated facilities within the corridor that supplies the town of Superior with CAP water. More recently, Resolution Copper installed an 18-inch dewatering line within the corridor that delivers treated water from the water treatment plant at the West Plant Site to the new Magma Irrigation and Drainage District. The proposed action would not require these utilities to be relocated or significantly modified.

New MARRCO Corridor Facilities

The proposed action would install several new facilities within or adjacent to the MARRCO corridor. Table G-7 identifies the proposed new facilities in the MARRCO corridor and their function.

Table G-7. New MARRCO corridor facilities

New Facility	Function	Upgrade Needed
CAP water pipeline and associated pump stations and recovery wells	Transport CAP water from CAP canal and recovered filter plant water to West Plant Site through new aboveground 36-inch steel pipeline.	New pump stations would be constructed along corridor to pump CAP water and pressurize pipeline for upgradient delivery to West Plant Site. Locations within the MARRCO corridor between the Queen Creek pump station and West Plant Site would need to be improved by grading and slope stabilization.
Concentrator pipelines	Transport copper concentrate from the West Plant Site to the filter plant and loadout facility through two new 8-inch HDPE-lined steel pipelines.	Grading and slope stabilization would be required at various locations. Depending on site conditions, pipelines would be built belowground where possible. The aboveground segments would be located within a containment ditch.
Containment basins	Allow for the emergency storage of concentrate if the pipeline needs to be emptied.	Various locations within the corridor would be excavated and lined with concrete to accommodate upstream volume of concentrate should the pipeline need to be emptied.
Access roads	Provide access to the facilities within the corridor and to the filter plant and loadout facility.	Access roads are described in detail in the "Transportation and Access" section in chapter 3.
Upgraded rail line and connection to Union Pacific Railroad	Transport copper concentrate from filter plant and loadout facility to the Union Pacific Railroad connection at Magma.	Segment of the rail line between the filter plant and loadout facility and Magma would be upgraded to handle the increase load weight, including an associated upgrade of the rail connection to the Union Pacific Railroad rail line.
Electric lines	Provide electricity to the recovery wells, pump stations, and the filter plant and loadout facility.	Double-circuit 69-kV power lines would be constructed adjacent to the MARRCO corridor to power lines within a new utility easement. The power lines would originate from the Abel substation near the MARRCO corridor's intersection with the CAP canal to the filter plant and loadout facility. A 12-kV power line on the same poles would provide power for the recovery wells within the MARRCO corridor.

FILTER PLANT AND LOADOUT FACILITIES

New Filter Plant and Loadout Facilities

The filter plant (see figure 2.2.2-14) would include a control room, three concentrate stock tanks, up to six concentrate filters, a filtrate clarifier, and compressors. The concentrate would be pumped to the stock tanks and then to the filters. The filtered concentrate would feed via conveyor to the adjacent loadout facility. The filtrate (water) would be separated in the filters and sent to the filtrate clarifier for thickening. Recovered filter water would be sent to a 3-million-gallon water storage tank, where it would mix with CAP water or groundwater before returning to the process water pond at the West Plant Site via a new water supply pipeline within the MARRCO corridor.

The loadout facility (see figure 2.2.2-14) would have a covered stockpile with a capacity of 110,000 tons of concentrate from the filter plant. Concentrate would be loaded into railcars through four hoppers. From the loadout facility, the concentrate would be shipped southwest into Magma Junction, where it would be loaded onto container cars for delivery via the Union Pacific Railroad to an off-site smelter.

As a precautionary measure, a concrete containment basin would also be constructed at the filter plant and loadout facility. The containment basin would allow for the emergency storage of concentrate if the concentrate pipeline in the MARRCO corridor needs to be emptied. The basin would be designed to contain the full volume of both concentrate pipelines.

The filter plant and loadout facility would be accessible from the west by East Skyline Road, east of San Tan Valley, and from the east by State Route 79 and the existing road in the MARRCO corridor. Auxiliary facilities to the filter plant and loadout facility would include a new electrical substation receiving electricity from a transmission line that runs within the MARRCO corridor, a security building, an employee and visitor parking lot, internal roadways, and potable water and wastewater treatment facilities.

CONSUMABLES, MATERIALS, AND SUPPLIES USED AT THE FILTER PLANT AND LOADOUT FACILITY

Table G-8 identifies the major consumables, materials, and supplies that would be used at the filter plant and loadout facility, their delivered form, and their storage method.

Table G-8. Consumables, materials, and supplies used at filter plant and loadout facility

Material/Supply	Delivered Form	Considered Hazardous*	Storage Method
Hardware	Solid	No	General stores shelving
Carpentry supplies	Solid	No	General stores shelving
Office supplies	Solid	No	General stores shelving
Flocculant	Bags or super sacks (dry)	Yes	Bags or sacks on pallets

* Potential for physical, chemical, and/or environmental hazard

Mine Site Lighting Plan

Further information was provided after the GPO regarding the lighting plan for the mine site, with a focus on whether lighting plans would align with Pinal County Code. Based on lighting source, fixture type, mounting type, and illumination level, the Pinal County Code identifies three lighting zones for commercial and industrial installations. The Resolution Copper project is designed to meet the most restrictive of these zones, namely Lighting Zone 3. The maximum lumen density or amount of light within a Lighting Zone 3 area is 19 lumens per square foot from all light sources, with other restrictions on use of mercury vapor light sources. The Town of Superior Outdoor Lighting Provisions prohibit not only mercury vapor, but also quartz halogen lighting sources.

Resolution Copper contends that the mine is exempt from the Pinal County Outdoor Lighting Code. Regardless, they plan to operate within the intent of the Pinal County Outdoor Lighting Code as long as mine safety and operations are not compromised and there are no conflicts with Mine Safety and Health Administration (MSHA) regulations or site-specific standards. The mine lighting plan includes detailed drawings of lighting source locations and anticipated lumens (M3 Engineering and Technology Corporation 2018).

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Appendix H. Further Details of Mine Water Balance and Use

Data Sources

The General Plan of Operations (GPO) describes an initial water budget for the mine, organized by three periods: construction (mine years 1–7), operations (mine years 8–36), and operations rampdown to closure (mine years 37–45) (Resolution Copper 2016c) (GPO figures 3.6-1a–c).

The initial water budget was later reproduced separately for each alternative (WestLand Resources Inc. 2018b). The tables included in this appendix reflect the later alternative water budgets. In some cases, minor differences in amount (within 5 percent) have been ignored for the purposes of simplicity. The water balance for each major mine component (East Plant Site, West Plant Site, filter plant and loadout facility, tailings storage facility, and the makeup water supply from the Desert Wellfield) is described separately.

For the purposes of the final environmental impact statement (FEIS), a consistent terminology was selected for describing mine phases (Rigg 2018). The alternatives differ from the GPO in that active mining is estimated to only last 40 years, instead of 45 years as described in the GPO. Table H-1 shows the correlation between the various phases from different sources.

Table H-1. Comparison of mine life phases from different water balance data sources

GPO Water Use Phase	GPO Duration	GPO, Translated into EIS Terminology ("Mine Years")	WestLand 2018 Duration	WestLand 2018 Translated into EIS Terminology ("Mine Years")
Construction	9 years	Mine years 1–9		
Mine development/rampup	7 years	Mine years 6–12	7 years	Mine years 6–12
Peak mining	29 years	Mine years 13–41	24 years	Mine years 13–36
Mine rampdown	9 years	Mine years 42–50	10 years	Mine years 37–46

Sources: Resolution Copper (2016c), see table 1.8-1 and figures 3.6-1a–c; WestLand Resources Inc. (2018b), see page 1 and figures 1–15

East Plant Site Water Use

Water input at the East Plant Site would come from two major sources: (1) groundwater inflow, and (2) mine service water. All groundwater inflow into the East Plant Site would be pumped in order to dewater the underground mine infrastructure, and sent through a pipeline to be used in the West Plant Site through the Never Sweat Tunnel. The mine service water could consist of fresh water from the Central Arizona Project (CAP) and recovery wells, combined with filtrate return from the filter plant and loadout facility. Mine service water would be delivered from the West Plant Site through a pipeline in the Never Sweat Tunnel.

Water would leave the East Plant Site in four ways: (1) mine dewatering sent to the West Plant Site, (2) as ore moisture, (3) as water lost through the shaft and vent, and (4) as water lost through refrigerant evaporation. Table H-2 identifies the acre-feet per year (AF/year) of water inflow and outflow for the East Plant Site during the construction, operations, and operations rampdown to closure phases.

Table H-2. East Plant Site water inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Groundwater inflow	2,118	1,772	1,298
Mine service water	5,874	6,944	4,081
Total AF/Year	**7,992**	**8,716**	**5,379**
Total AF/Phase	**55,944**	**209,184**	**53,790**
Outflow Sources			
Mine dewatering	4,967	3,992	2,979
Ore moisture	652	1,476	489
Evaporation from shaft, vent, and refrigeration	2,374	3,247	1,911
Total AF/year	**7,993**	**8,715**	**5,379**
Total AF/Phase	**55,951**	**209,160**	**53,790**

West Plant Site Water Use

The water balances for the West Plant Site and the tailings storage facility are closely related, and both change substantially based on the alternative and changes in tailings deposition and location. Water inputs at the West Plant Site that do not vary by alternative include the following: (1) dewatering from East Plant Site, (2) ore moisture, and (3) treated effluent. Water inputs at the West Plant Site that vary based on the tailings facility include the following: (1) process makeup water and (2) reclaimed water from tailings. Process makeup water would be delivered to the West Plant Site from the CAP recovery wells and recycled from the filter plant through a water pipeline in the Magma Arizona Railroad Company (MARRCO) corridor.

Similarly, some components of water leaving the West Plant Site do not vary by alternative and include the following: (1) evaporation and molybdenum plant losses, and (2) concentrate slurry to the filter plant. Water leaving as (3) tailings slurry (non-potentially acid generating [NPAG] and potentially acid generating [PAG] tailings) varies by alternative. Note that for Alternative 4 (filtered tailings), rather than requiring process water for the West Plant Site, an excess of process water is delivered back to the system.

Table H-3 identifies the AF/year of water inflow and outflow for the West Plant Site during the construction, operations, and operations rampdown to closure phases.

Table H-3. West Plant Site water inflow and outflow by source per mine phase

		Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources				
East Plant Site dewatering	All alternatives	4,967	3,992	2,979
Ore moisture	All alternatives	652	1,476	489
Treated effluent	All alternatives	36	36	36
Process makeup water	Alternative 2	3,400	13,757	752
Process makeup water	Alternative 3	1,646	10,076	1,592

		Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Process makeup water	Alternative 5	1,884	11,074	4,077
Process makeup water	Alternative 6	46	11,779	3,682
Tailings recycled water	Alternative 2	434	2,989	2,365
Tailings recycled water	Alternative 3	2,181	6,670	1,525
Tailings recycled water/collection pond	Alternative 4	7,365	17,017	4,923
Tailings recycled water	Alternative 5	3,850	9,315	1,724
Tailings recycled water	Alternative 6	5,378	8,598	464
Total AF In/Year	Alternative 2	**9,489**	**22,250**	**6,621**
Total AF Inflow/Phase	Alternative 2	**66,423**	**534,000**	**66,210**
Total AF In/Year	Alternative 3	**9,482**	**22,250**	**6,621**
Total AF Inflow/Phase	Alternative 3	**66,374**	**534,000**	**66,210**
Total AF In/Year	Alternative 4	**13,020**	**22,521**	**8,427**
Total AF Inflow/Phase	Alternative 4	**91,140**	**540,504**	**84,270**
Total AF In/Year	Alternative 5	**11,389**	**25,893**	**9,305**
Total AF Inflow/Phase	Alternative 5	**79,723**	**621,432**	**93,050**
Total AF In/Year	Alternative 6	**11,079**	**25,881**	**7,650**
Total AF Inflow/Phase	Alternative 6	**77,553**	**621,144**	**76,500**
Outflow Sources				
Concentrate slurry	All alternatives	416	942	312
Evaporation and molybdenum plant	All alternatives	490	497	488
Tailings slurry (PAG and NPAG)	Alternative 2	8,582	20,810	5,820
Tailings slurry (PAG and NPAG)	Alternative 3	8,575	20,810	5,820
Tailings slurry (PAG and NPAG)	Alternative 4	8,765	20,830	5,650
Tailings slurry (PAG and NPAG) plus makeup water	Alternative 5	10,481	24,454	8,503
Tailings slurry (PAG and NPAG)	Alternative 6	10,172	24,441	6,849
Process water back to system	Alternative 4 only	3,348	251	1,976
Total AF Out/Year	Alternative 2	**9,488**	**22,249**	**6,620**
Total AF Outflow/Phase	Alternative 2	**66,416**	**533,976**	**66,200**
Total AF Out/Year	Alternative 3	**9,481**	**22,249**	**6,620**
Total AF Outflow/Phase	Alternative 3	**66,367**	**533,976**	**66,200**
Total AF Out/Year	Alternative 4	**13,019**	**22,520**	**8,426**
Total AF Outflow/Phase	Alternative 4	**91,133**	**540,480**	**84,260**

		Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Total AF Out/Year	Alternative 5	**11,387**	**25,893**	**9,303**
Total AF Outflow/Phase	Alternative 5	**79,709**	**621,432**	**93,030**
Total AF Out/Year	Alternative 6	**11,078**	**25,880**	**7,649**
Total AF Outflow/Phase	Alternative 6	**77,546**	**621,120**	**76,490**

Tailings Storage Facility Water Use

Water input at the tailings storage facility would come from two sources: (1) delivered with tailings (NPAG and PAG) from the West Plant Site, or (2) as captured precipitation and stormwater runoff from the facility or collection ponds.

Water would leave the tailings storage facility in four ways: (1) water reclaimed and sent back to the West Plant Site, (2) water lost through evaporation, (3) water that is entrained with the tailings, and (4) seepage lost to the aquifer. One additional component—change in storage—reflects the fact that the tailings storage facility water balance is dynamic, and during the first two phases more water is coming into the facility than leaving, while during the last phase more water is leaving than coming in.

The inflows for Alternative 4 exceed the outflows by about 8,700 acre-feet during peak operations. This reflects the fact that more water is recovered than can be used. This water may require additional collection, treatment, and disposal.

Tables H-4 through H-8 identify the AF/year of water inflow and outflow for each tailings storage facility alternative during the construction, operations, and operations rampdown to closure phases.

Table H-4. Alternative 2 tailings storage facility water inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Tailings from West Plant Site	8,582	20,810	5,820
Precipitation and stormwater runoff	1,110	1,865	1,625
Change in storage	0	0	543
Total AF In/Year	**9,692**	**22,675**	**7,988**
Total AF Inflow/Phase	**67,844**	**544,200**	**79,980**
Outflow Sources			
Reclaim to West Plant Site	434	2,989	2,365
Evaporation	3,779	9,705	4,853
Entrainment	4,723	9,692	617
Lost seepage	77	153	153
Change in storage	679	136	0
Total AF Out/Year	**9,692**	**22,675**	**7,988**
Total AF Outflow/Phase	**67,844**	**544,200**	**79,880**

Table H-5. Alternative 3 tailings storage facility water inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Tailings from West Plant Site	8,575	20,810	5,820
Precipitation and stormwater runoff	1,007	1,573	1,573
Change in storage	0	0	256
Total AF In/Year	**9,582**	**22,383**	**7,649**
Total AF Inflow/Phase	**67,074**	**537,192**	**76,490**
Outflow Sources			
Reclaim to West Plant Site	2,181	6,670	1,525
Evaporation	2,296	5,270	3,219
Entrainment*	4,421	10,259	2,828
Lost seepage	39	77	77
Change in storage	645	107	0
Total AF Out/Year	**9,582**	**22,383**	**7,649**
Total AF Outflow/Phase	**67,074**	**537,192**	**76,490**

* Note that entrainment for Alternative 3 is based on an assumption of 100% saturation used in the global water balance and is known to be overestimated, compared with more detailed seepage modeling conducted for each alternative. See Garrett (2020d) for further details.

Table H-6. Alternative 4 tailings storage facility water inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Tailings from West Plant Site	8,765	20,830	5,650
Precipitation and stormwater runoff	1,298	2,747	3,584
Total AF In/Year	**10,063**	**23,577**	**9,234**
Total AF Inflow/Phase	**70,441**	**565,848**	**92,340**
Outflow Sources			
Reclaim to West Plant Site, including collection ponds	7,562	17,197	5,370
Evaporation	1,414	3,911	3,134
Entrainment	1,021	2,390	651
Lost seepage	66	79	79
Total AF Out/Year	**10,063**	**23,577**	**9,234**
Total AF Outflow/Phase	**70,441**	**565,848**	**92,340**

Table H-7. Alternative 5 tailings storage facility water inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Tailings from West Plant Site (plus makeup water)	10,481	24,454	8,503
Precipitation and stormwater runoff	2,819	6,769	9,645
Change in storage	0	0	15
Total AF In/Year	**13,300**	**31,223**	**18,163**
Total AF Inflow/Phase	**93,100**	**749,352**	**181,630**
Outflow Sources			
Reclaim to West Plant Site	3,850	9,315	1,724
Evaporation	3,028	9,929	12,521
Entrainment	4,822	10,335	2,661
Lost seepage	1,218	1,337	1,257
Change in storage	383	308	0
Total AF Out/Year	**13,301**	**31,224**	**18,163**
Total AF Outflow/Phase	**93,107**	**749,376**	**181,630**

Table H-8. Alternative 6 tailings storage facility water inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Tailings from West Plant Site	10,172	24,441	6,849
Precipitation and stormwater runoff	2,589	5,111	6,451
Change in storage	0	0	306
Total AF In/Year	**12,761**	**29,552**	**13,606**
Total AF Inflow/Phase	**89,327**	**709,248**	**136,060**
Outflow Sources			
Reclaim to West Plant Site	5,378	8,598	464
Evaporation	3,221	11,110	9,524
Entrainment	3,600	9,275	2,991
Lost seepage	114	453	627
Change in storage	448	116	0
Total AF Out/Year	**12,761**	**29,552**	**13,606**
Total AF Outflow/Phase	**89,327**	**709,248**	**136,060**

Filter Plant and Loadout Facility Water Use

Water input at the filter plant and loadout facility would come from a single source: as copper thickener underflow delivered from the West Plant Site through the MARRCO corridor.

Water would leave the filter plant and loadout facility in two ways: (1) as filter return water sent back to the West Plant Site and East Plant Site, and (2) as water lost within concentrate.

Table H-9 identifies the AF/year of water inflow and outflow for the filter plant and loadout facility during the construction, operations, and operations rampdown to closure phases.

Table H-9. Filter plant and loadout facility inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Copper thickener underflow	416	942	312
Total AF per Phase	**2,912**	**22,608**	**3,120**
Outflow Sources			
Filter return to West Plant Site and East Plant Site	342	774	257
Concentrate	74	168	56
Total AF/year	**416**	**942**	**313**
Total AF per Phase	**2,912**	**22,608**	**3,130**

Makeup Water Supply from Desert Wellfield

The overall water balances are complex, with the need to account for multiple reclaim/recycle loops and water sources. However, ultimately the mine water supply for each alternative can be reduced to the need for fresh groundwater to be pumped or recovered from the Desert Wellfield, as shown in table H-10. In the event Resolution Copper Mining, LLC, is successful in obtaining a Non-Indian Agriculture Central Arizona Project contract, this could offset groundwater pumping through direct delivery of water; however, this contract has not been approved or completed and therefore CAP water use is not considered in this appendix.

Table H-10. Fresh groundwater supply requirements per mine phase

		Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)	Total Water Use All Phases
Desert Wellfield pumping (AF/year)	Alternative 2	8,932	19,926	4,576	
Total AF per Phase	**Alternative 2**	**62,524**	**478,224**	**45,760**	**586,508**
Desert Wellfield pumping (AF/year)	Alternative 3	7,178	16,245	5,416	
Total AF per Phase	**Alternative 3**	**50,246**	**389,880**	**54,160**	**494,286**
Desert Wellfield pumping (AF/year)	Alternative 4	2,184	5,918	1,848	
Total AF per Phase	**Alternative 4**	**15,288**	**142,032**	**18,480**	**175,800**

		Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)	Total Water Use All Phases
Desert Wellfield pumping (AF/year)	Alternative 5	7,416	17,244	7,901	
Total AF per Phase	**Alternative 5**	**51,912**	**413,856**	**79,010**	**544,778**
Desert Wellfield pumping (AF/year)	Alternative 6	5,578	17,948	7,506	
Total AF per Phase	**Alternative 6**	**39,046**	**430,752**	**75,060**	**544,858**

Appendix I. Summary of Effects of the Land Exchange

Purpose of this Appendix

As noted in chapter 1, the EIS must consider a situation in which the mine is built but the land exchange is not executed. This situation is a possibility because the land exchange is a discretionary action on the part of Resolution Copper Mining, LLC. Under this scenario, the development of a mine on National Forest System lands would proceed under Title 36 Code of Federal Regulations (CFR) Part 228 surface management regulations (commonly known as Forest Service mining regulations).

The physical impacts to resources from the ore extraction, including subsidence and dewatering, are identical whether the mine is built on private land or public land. These are the impacts considered in chapter 3 of the EIS. With respect to the mine itself, the primary difference made by the land exchange is the regulatory framework under which the mine is regulated. The purpose of this appendix is to compare the regulatory framework applicable to private land (if a land exchange occurs) to the regulatory framework applicable to National Forest System lands (if no land exchange occurs).

Comparison of36 CFR 228 Regulations with Other Related State (Arizona) and Federal Environmental Regulations

In virtually all cases, some level of regulatory requirements apply to mining operations, regardless of whether they are taking place on private lands or National Forest System lands (see table I-1). U.S. Department of Agriculture Forest Service (herein called Forest Service) 36 CFR 228 surface management regulations (columns 1 and 2 in the table) apply only to Federal lands administered by the Forest Service. Other applicable laws, regulations, and rules (column 3) apply to both Federal and private lands, except for State mined land reclamation rules, which apply only to private lands.

Unless otherwise indicated in the table, surface resource management regulations are taken from 36 CFR 228. Aquifer Protection Permit (APP) laws and regulations are taken from Arizona Revised Statutes (ARS) 49-241 through 49-252 and Arizona Administrative Code (AAC) R18-9-101 through R18-9-403. Arizona State Mine Inspector laws and regulations are taken from Arizona State reclamation statutes at ARS 27-901, et seq., and rules at R11-2-201, et seq. Other regulations and rules are indicated in table I-1.

See table 1.5.6-1 in chapter 1 of the FEIS for descriptions of the applicable laws, statutes, regulations and rules listed in table I-1. This includes aquifer protection permits administered by the Arizona Department of Environmental Quality, mined land reclamation overseen by the Arizona State Mine Inspector, Clean Water Act permits administered by both the Arizona Department of Environmental Quality and the U.S. Army Corps of Engineers, and Clean Air Act permits administered by both Arizona Department of Environmental Quality and the Pinal County Air Quality Control District,

Table I-1. Comparison of 36 CFR 228 with Other Applicable Laws, Statutes, Regulations, and Rules

Forest Service Regulations 36 CFR 228 Subpart A – Locatable Minerals	Description	Other Applicable Laws, Statutes, Regulations, and Rules that are comparable to 36 CFR 228 Subpart A – Locatable Minerals
36 CFR 228.4	*Description of Operations.* In a notice of intent submitted to the appropriate District Ranger, sufficient description of the proposed area of activity, route(s) of access, equipment, devices, or practices proposed for use during operations, including, where applicable—	None

Forest Service Regulations 36 CFR 228 Subpart A – Locatable Minerals	Description	Other Applicable Laws, Statutes, Regulations, and Rules that are comparable to 36 CFR 228 Subpart A – Locatable Minerals
36 CFR 228.4(c)(2) 36 CFR 228.4(c)(3)	• A map or sketch showing information sufficient to locate the proposed area of operations on the ground, existing and/or proposed roads or access routes to be used in connection with the operations as set forth in §228.12, and the approximate location and size of areas where surface resources will be disturbed. • Information sufficient to describe or identify the type of operations proposed and how they would be conducted, the type and standard of existing and proposed roads or access routes, the means of transportation used or to be used as set forth in §228.12, the period during which the proposed activity will take place, and measures to be taken to meet the requirements for environmental protection in §228.8.	APP R18-9-A.202.A. Technical Requirements Mined Land Reclamation R11-2-501. Mining unit reclamation plan content. Clean Water Act 33 CFR 320 through 332 40 CFR 122
36 CFR 228.8(a)	*Air quality.* Operator shall comply with applicable Federal and State air quality standards, including the requirements of the Clean Air Act, as amended (42 USC 1857 et seq.).	Clean Air Act: Certification by ADEQ; ARS 49-401 et seq.; R18-2-101 et seq.
36 CFR 228.8(b)	*Water quality.* Operator shall comply with applicable Federal and State water quality standards, including regulations issued pursuant to the Federal Water Pollution Control Act, as amended (33 U.S.C. 1151 et seq.).	APP R18-9-A.202.A Technical Requirements Clean Water Act 33 CFR 320 through 332 40 CFR 122 AZPDES (Arizona delegated program); R18-9-B901 et seq.
36 CFR 228.8(c)	*Solid wastes*. Operator shall comply with applicable Federal and State standards for the disposal and treatment of solid wastes. All garbage, refuse, or waste, shall either be removed from National Forest System lands or disposed of or treated so as to minimize, so far as is practicable, its impact on the environment and the forest surface resources. All tailings, dumpage, deleterious materials, or substances and other waste produced by operations shall be deployed, arranged, disposed of, or treated so as to minimize adverse impact upon the environment and forest surface resources.	APP R18-9-A.202.A Technical Requirements Clean Water Act 33 CFR 320 through 332 40 CFR 122 AZPDES (Arizona delegated program); R18-9-B901 et seq.
36 CFR 228.8(d)	*Scenic values.* Operator shall, to the extent practicable, harmonize operations with scenic values through such measures as the design and location of operating facilities, including roads and other means of access, vegetative screening of operations, and construction of structures and improvements that blend with the landscape.	None [On most public lands there are no State or other Federal requirements for the protection of scenic values that are comparable to 36 CFR 228.8(d). However, lands having special management designations, such as Wilderness, National Monument, Wild and Scenic River, State Park, and the like are usually bound by particular restrictions on human development and other activities that would tend to alter natural scenic values.]

Forest Service Regulations 36 CFR 228 Subpart A – Locatable Minerals	Description	Other Applicable Laws, Statutes, Regulations, and Rules that are comparable to 36 CFR 228 Subpart A – Locatable Minerals
36 CFR 228.8(e)	*Fisheries and wildlife habitat.* In addition to compliance with water quality and solid waste disposal standards required by this section, operator shall take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations.	Mined Land Reclamation ARS 27-971. Submission and contents of reclamation plan.
36 CFR 228.8(f)	*Roads.* Operator shall construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values. Unless otherwise approved by the authorized officer, roads no longer needed for operations: (1) Shall be closed to normal vehicular traffic, (2) Bridges and culverts shall be removed, (3) Cross drains, dips, or water bars shall be constructed, and (4) The road surface shall be shaped to as near a natural contour as practicable and be stabilized.	Mined Land Reclamation R11-2-603. Mining unit reclamation plan content.
36 CFR 228.8(g)	*Reclamation.* Upon exhaustion of the mineral deposit or at the earliest practicable time during operations, or within 1 year of the conclusion of operations, unless a longer time is allowed by the authorized officer, operator shall, where practicable, reclaim the surface disturbed in operations by taking such measures as will prevent or control on-site and off-site damage to the environment and forest surface resources, including: (1) Control of erosion and landslides; (2) Control of water runoff; (3) Isolation, removal or control of toxic materials; (4) Reshaping and revegetation of disturbed areas, where reasonably practicable; and (5) Rehabilitation of fisheries and wildlife habitat.	Mined Land Reclamation R11-2-201 through R11-2-207 General regulatory provisions for plan documents. R11-2-602. Erosion control and topographic contouring.
36 CFR 228.9	*Maintenance during operations, public safety.* During all operations, operator shall maintain his or her structures, equipment, and other facilities in a safe, neat, and workmanlike manner. Hazardous sites or conditions resulting from operations shall be marked by signs, fenced, or otherwise identified to protect the public in accordance with Federal and State laws and regulations.	Mined Land Reclamation R11-2-601. Public safety standards. ARS 27-318. State requirements to cover, fence, fill, or otherwise secure areas around active or inactive/abandoned mining operations and to post warning signs.

Forest Service Regulations 36 CFR 228 Subpart A – Locatable Minerals	Description	Other Applicable Laws, Statutes, Regulations, and Rules that are comparable to 36 CFR 228 Subpart A – Locatable Minerals
36 CFR 228.10	*Cessation of operations, removal of structures and equipment.* Unless otherwise agreed to by the authorized officer, operator shall remove within a reasonable time following cessation of operations all structures, equipment, and other facilities and clean up the site of operations. Other than seasonally, where operations have ceased temporarily, an operator shall file a statement with the District Ranger which includes: (a) Verification of intent to maintain the structures, equipment and other facilities, (b) The expected reopening date, and (c) An estimate of extended duration of operations. A statement shall be filed every year in the event operations are not reactivated. Operator shall maintain the operating site, structures, equipment, and other facilities in a neat and safe condition during nonoperating periods.	Mined Land Reclamation ARS 27-971. Submission and contents of reclamation plan. R11-2-501. Mining unit reclamation plan content.
36 CFR 228.11	*Prevention and control of fire.* Operator shall comply with all applicable Federal and State fire laws and regulations and shall take all reasonable measures to prevent and suppress fires on the area of operations and shall require his or her employees, contractors, and subcontractors to do likewise.	Mined Land Reclamation ARS 27-311. Fire prevention and protection.
36 CFR 228.12	*Access.* An operator is entitled to access in connection with operations, but no road, trail, bridge, landing area for aircraft, or the like, shall be constructed or improved, nor shall any other means of access, including but not limited to off-road vehicles, be used until the operator has received approval of an operating plan in writing from the authorized officer when required by §228.4(a). Proposals for construction, improvement, or use of such access as part of a plan of operations shall include a description of the type and standard of the proposed means of access, a map showing the proposed route of access, and a description of the means of transportation to be used. Approval of the means of such access as part of a plan of operations shall specify the location of the access route, design standards, means of transportation, and other conditions reasonably necessary to protect the environment and forest surface resources, including measures to protect scenic values and to ensure against erosion and water or air pollution.	Mined Land Reclamation R11-2-501. Mining unit reclamation plan content. R11-2-603. Roads.

Forest Service Regulations 36 CFR 228 Subpart A – Locatable Minerals	Description	Other Applicable Laws, Statutes, Regulations, and Rules that are comparable to 36 CFR 228 Subpart A – Locatable Minerals
36 CFR 228.13	*Bonds.* (a) 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. In lieu of a bond, the operator may deposit into a Federal depository, as directed by the Forest Service, and maintain therein, cash in an amount equal to the required dollar amount of the bond or negotiable securities of the United States having market value at the time of deposit of not less than the required dollar amount of the bond. A blanket bond covering nationwide or statewide operations may be furnished if the terms and conditions thereof are sufficient to comply with the regulations in this part. (b) In determining the amount of the bond, consideration will be given to the estimated cost of stabilizing, rehabilitating, and reclaiming the area of operations. (c) In the event that an approved plan of operations is modified in accordance with §228.4 (d) and (e), the authorized officer will review the initial bond for adequacy and, if necessary, will adjust the bond to conform to the operations plan as modified. (d) When reclamation has been completed in accordance with §228.8(g), the authorized officer will notify the operator that performance under the bond has been completed, provided, however, that when the Forest Service has accepted as completed any portion of the reclamation, the authorized officer shall notify the operator of such acceptance and reduce proportionally the amount of bond thereafter to be required with respect to the remaining reclamation.	Mined Land Reclamation ARS 27-991 through 27-997. Financial assurance. R11-2-801 through R11-2-822. Financial assurance.
36 CFR 228.14	*Appeals.* Any operator aggrieved by a decision of the authorized officer in connection with the regulations in this part (i.e., 36 CFR part 228) may file an appeal under the provisions of 36 CFR part 251, subpart C.	Mined Land Reclamation ARS 27-933. Denials; appeals.

Notes: ADEQ = Arizona Department of Environmental Quality, APP = Aquifer Protection Permit, ARS = Arizona Revised Statutes, AZPDES = Arizona Pollutant Discharge Elimination System, CFR = Code of Federal Regulations, R = Arizona Administrative Code Rule.

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Appendix J. Mitigation and Monitoring Strategy

Introduction

This mitigation and monitoring strategy was developed by the Tonto National Forest using information from a number of sources in support of the draft environmental impact statement (DEIS) published in August 2019, and has been revised based on considerable input from public and agency comments for inclusion in the final environmental impact statement (FEIS). As stated in section 2.3 of the FEIS, the Council on Environmental Quality states that agencies should not commit to mitigation measures absent the authority or expectation of necessary resources to ensure the mitigation is performed (Council on Environmental Quality 2011). This mitigation and monitoring strategy is designed to clearly disclose which mitigation and monitoring items are within the authority of the U.S. Department of Agriculture Forest Service (Forest Service) or other regulatory permitting agency (e.g., U.S. Army Corps of Engineers, Bureau of Land Management (BLM), Arizona Department of Environmental Quality (ADEQ), or Arizona Department of Water Resources).

This appendix discusses the following items:

- Design Features and Applicant-Committed Environmental Protection Measures
- Mitigation and Monitoring Measures Considered in Chapter 3 Impacts Analysis, including measures required by the Forest Service, and voluntary measures by Resolution Copper Mining, LLC (Resolution Copper)
- Other Mitigation and Monitoring Measures Not Considered in Chapter 3 Impacts Analysis (aka Potential Future Measures)

Design Features and Applicant-Committed Environmental Protection Measures

The environmental analysis considered for this FEIS includes the implementation of Applicant-Committed Environmental Protection Measures. These measures are listed in each resource section of chapter 3 in a section titled “Summary of 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.

Many of these features are either specified in the General Plan of Operations (GPO) or were developed as part of the action alternatives. Resolution Copper has created the following plans to detail the protection measures it will employ under the action alternatives:

- 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, the Forest Service also developed additional stipulations that would be required as part of the subsidence monitoring. These additional stipulations are described in the mitigation section below.
- 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). A number of specific mitigation measures were developed to respond to impacts disclosed during the National Environmental

Policy Act (NEPA) process. These new mitigation measures were incorporated into the revised plan; those new requirements of the plan are discussed in the mitigation section below.

- 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 stormwater pollution prevention plan (SWPPP) (appendix to GPO)
- Wildlife management plan. This plan originally was included as an appendix to the GPO. After collaborative discussions with Arizona Game and Fish Department (AGFD), Resolution Copper submitted a revised wildlife management plan (Resolution Copper 2020j). A number of specific mitigation measures were developed in consultation with the AGFD, in order to respond to impacts disclosed during the NEPA process. These new mitigation measures were incorporated into the revised plan; these new requirements of the plan are discussed in the mitigation section below.
- Noxious weed and invasive species plan (created May 2019 in response to EIS analysis (Resolution Copper 2019))
- Tailings Pipeline Management Plan (AMEC Foster Wheeler Americas Limited 2019)
- Concentrate Pipeline Management Plan (M3 Engineering and Technology Corporation 2019)

The implementation and effectiveness of Applicant-Committed Environmental Protection Measures are considered integral to the analysis considered in this FEIS. These design features would be a requirement of the final record of decision (ROD) and final mining plan of operations.

Only those measures that were developed directly in response to impacts disclosed during the NEPA process are included in this appendix. These include the additional stipulations on the subsidence monitoring plan, new mitigations in the road use plan, and new mitigations in the wildlife management plan.

Mitigation and Monitoring Measures Considered in Chapter 3 Impacts Analysis

Mitigation and Monitoring Required by Forest Service

The role of the Tonto National Forest under its primary authorities in the Organic Administration Act, Locatable Regulations (36 Code of Federal Regulations (CFR) 228 Subpart A), and Multiple-Use Mining Act is to ensure that mining activities minimize adverse environmental effects on National Forest System (NFS) surface resources. The Forest Service authority related to mitigation is limited to protection of surface resources of NFS lands (see 30 United States Code (U.S.C.) 612, 5 U.S.C. 551, and 36 CFR 228.1). 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.

For the Forest Service to require implementation of mitigation, the mitigation must have a direct connection to avoiding, mitigating, or minimizing effects on NFS surface resources. The Forest Service has no authority, obligation, or expertise to determine or enforce compliance with other agencies' laws or regulations. However, it is the operator's responsibility to ensure that its actions comply with applicable laws. The Forest Service will only approve a final plan of operations once all other necessary permits are approved.

Mitigation and monitoring items under this heading are within the authority of the Forest Service, the U.S. Fish and Wildlife Service (FWS) through the Biological Opinion resulting from consultation under Section 7 of the Endangered Species Act, or the Arizona State Historic Preservation Office (SHPO) through the current Programmatic Agreement (PA) and associated historic properties treatment plans (HPTPs). These measures would be specified as a requirement of the final ROD and incorporated into the final mining plan of operations. The Forest Service is responsible for determining whether the implementation of mitigation and the results of monitoring in this category are in compliance with the decision that will be documented in the final ROD and final mining plan of operations, and it has a legal obligation to ensure that the requirements of the biological opinion and PA/HPTP are implemented. Resolution Copper would submit reports to the Tonto National Forest for review of work done in the previous year and be subject to routine inspections to verify mitigation and monitoring effectiveness.

Mitigation and Monitoring Agreed to by Resolution Copper Mining, LLC

Resolution Copper has publicly agreed to implement the mitigation and monitoring items under this heading. 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 the measures included in this category. They are presented here to facilitate disclosure of currently known mitigation and monitoring and their consideration in impacts analyses.

These measures differ from the Applicant-Committed Environmental Protection Measures in that they were not proposed as part of the project or alternatives and in many cases were developed directly in response to the EIS analysis or public comments in order to reduce resource impacts. Since the Forest Service and regulatory permitting agencies cannot require implementation of the mitigation and monitoring measures in this category, their implementation is not assured. The effectiveness of these mitigation measures is included in chapter 3 of the FEIS. As part of the NEPA process, it is recognized that these are measures that may occur, as opposed to measures that would occur. However, once these measures are included in the signed final ROD and final mining plan of operations, they would be legally binding on Resolution Copper.

Reporting and Evaluation

Monitoring would be evaluated annually after reports are reviewed by the appropriate land-managing agency to determine whether the level of monitoring and/or reporting is appropriate for the current conditions. This review may result in a change in the monitoring requirements. Please refer to section 2.3 of the FEIS for a discussion of mitigation-related monitoring and evaluation.

Detail of Mitigation and Monitoring Measures Analyzed in Chapter 3 Impacts Analysis

Mitigation and monitoring measures are detailed below, and include the following descriptors:

- Unique identification number
- Title of mitigation/monitoring measure
- A list of other identifiers for the measure, to assist with cross-referencing between DEIS and project record materials
- Description/overview of measure
- Source of measure
- Resource affected/impacts being mitigated
- Alternatives to which the measure is applicable
- Authority under which the measure is being required
- Funding sources
- Any additional ground disturbance that would be required to implement the measure

Naming Convention

Internal documentation makes use of several naming conventions to track mitigation, including those used in appendix J of the DEIS, and those used to evaluate mitigations between the DEIS and FEIS (Garrett 2020g).

For clarity, a single naming convention is used in appendix J of the FEIS, using the format "XX-YY-##." For example, measure "FS-GS-01: New stipulations on subsidence monitoring plan." Previous identifiers for each measure may be included as notes. This naming convention conveys three specific pieces of information:

- The first two letters ("***FS***-GS-01") convey the authority under which this measure would take place.
    - Those measures designated "FS" are under the authority of the Forest Service to require, either due to impacts on Forest Service surface resources, inclusion in the Biological Opinion, inclusion in the Programmatic Agreement, or inclusion in the Clean Water Act Section 404 permitting process.
    - Those measures designated "RC" are voluntary measures brought forward and undertaken by Resolution Copper that are outside of the authority of the Forest Service to require. Resolution Copper has publicly committed to these measures, which may ultimately be included as stipulations or requirements in regulatory permits; however, until that occurs, there is no guarantee these measures would be implemented. It should be noted that many of the "FS" required measures were originally brought forward voluntarily by Resolution Copper and then selected for inclusion by the Forest Service.
    - Those measures designated "PF" are potential future mitigation measures that are neither required by the Forest Service nor voluntarily committed to, but that were identified and developed during the NEPA analysis process to offset potential impacts. These measures may

be implemented later if anticipated impacts are confirmed; however, there is no guarantee these measures would be implemented.

- The second two letters ("FS-***GS***-01") convey the resource being addressed by the mitigation measure: geology, minerals, and subsidence (GS); soils, vegetation, and reclamation (SV); noise and vibration (NV), transportation and access (TA), air quality (AQ); water resources (WR); wildlife (WI); recreation (RC); public health and safety (PH); scenic resources (SR); cultural resources or tribal concerns (CR); socioeconomics (SO); and livestock and grazing (LG).
- The third number ("FS-GS-***01***") provides a unique identifier for each measure.

The order the measures appear below is not alphabetical, but rather organized in the same order that the resources appear in chapter 3 of the FEIS. Several mitigation measures were included in appendix J of the DEIS that were intended to be conducted between the DEIS and FEIS. These have been completed and are listed below but no longer appear as measures. Some measures included in appendix J of the DEIS have been superseded or are no longer applicable; these also remain below, clearly noted that they are no longer being considered.

Summary List of Mitigation Measures Included

The following required mitigation measures are included in appendix J of the FEIS:

- FS-GS-01: New stipulations on subsidence monitoring plan
- FS-SV-01: Resource salvage
- FS-SV-02: JI Ranch
- FS-SV-03: Revised reclamation and closure plans
- FS-TA-01: New mitigation aspects of revised road use plan
- FS-WR-01: Groundwater-dependent ecosystems (GDEs) and water well mitigation
- FS-WR-02: 404 Compensatory Mitigation Plan
- FS-WR-04: Replacement of water in Queen Creek
- FS-WI-01: New mitigation aspects of Revised Wildlife Management Plan
- FS-WI-02: Reptile and Sonoran Desert Tortoise (ESA-CCA) Plan
- FS-WI-03: Mitigation of loss of abandoned mine or cave habitat for bats
- FS-WI-04: Maintain or replace access to stock tanks and AGFD wildlife waters
- FS-RC-01: Relocation of Arizona National Scenic Trail
- FS-RC-02: Access to Oak Flat Campground
- FS-RC-03: Mitigation for adverse impacts to recreational trails (Tonto National Forest multi-use trail plan)
- FS-RC-04: Establish an alternative campground site (Castleberry) to mitigate the loss of Oak Flat Campground
- FS-PH-01: Satellite monitoring of tailings storage facility
- FS-PH-02: Adherence to National Dam Safety Program Standards
- FS-PH-03: Skunk Camp Pipeline Protection and Integrity Plan

- FS-SR-01: Minimize visual impacts from transmission lines
- FS-CR-01: Implementation of Oak Flat HPTP
- FS-CR-02: GPO Research Design
- FS-CR-03: Visual, Atmospheric, Auditory, Socioeconomic, and Cumulative Effects Mitigation Plan
- FS-CR-05: Emory Oak Collaborative Tribal Restoration Initiative
- FS-CR-06: Tribal Cultural Heritage Fund
- FS-CR-07: Archaeological database funds
- FS-CR-08: Tribal Education Fund
- FS-SO-01: Community Development Fund
- FS-SO-02: Establish foundations for long-term funding, including the Tribal Monitor Program

The following Resolution Copper voluntary mitigation measures are included in appendix J of the FEIS:

- RC-SV-04: Interim management of 7B Ranch
- RC-NV-01: Dripping Springs Road mitigations
- RC-AQ-01: Salt River Project solar participation agreement
- RC-WR-03: Skunk Camp Water Quality Monitoring Plan
- RC-RC-05: Mitigation for impacts on climbing resources
- RC-RC-06: Mitigation for public access to JI Ranch through AGFD cooperative agreement
- RC-CR-04: Increase size of Apache Leap Special Management Area
- RC-PH-04: Maintain the existing hotline for community complaints
- RC-PH-05: Adhere to Global Tailings Standard
- RC-SO-03: Establish a regional economic development entity for Copper Triangle communities
- RC-SO-04: Resolution Copper social investment program
- RC-SO-05: Continue funding Community Working Group
- RC-SO-06: Agreement with Town of Superior to cover direct costs
- RC-LG-01: Mitigation for impacts to ranching and grazing leases

The following potential future measures have been included in appendix J of the FEIS:

- PF-TA-01: Replace access if Forest Road 2438 is closed due to subsidence
- PF-TA-02: Mitigation for adverse impacts on existing transportation facilities
- PF-WR-01: Create and maintain public information repository
- PF-WR-02: Divert existing flows across the subsidence area to preserve downstream flows
- PF-WR-03: Mitigation of effects of water level declines
- PF-WI-01: Voluntary achievement of “no net loss” of habitat
- PF-RC-01: Purchase lands in the “Preserve”

- PF-RC-02: Develop Magma Arizona Railroad Company (MARRCO) corridor for tourism; reactivate rail
- PF-RC-03: Fund extension of the Legends of Superior Trails Queen Creek segment
- PF-SO-01: Mitigation for reduction in property values
- PF-SO-02: Commitment to continue and possibly expand existing apprenticeship program

The following measures were required in the DEIS and have been completed:

- Conduct soil surveys within the area to be disturbed by the preferred alternative tailings storage facility footprint (DEIS measure FS-223; KCB Consultants Ltd. (2020c))
- Conduct appropriate testing of soil materials within the preferred alternative tailings storage facility footprint (DEIS measure FS-224; KCB Consultants Ltd. (2020c))
- Conduct vegetation surveys within the preferred alternative tailings storage facility footprint (DEIS measure FS-225; WestLand Resources Inc. (2020l))
- Preparation of detailed reclamation plans for the preferred alternative (DEIS measure FS-226; KCB Consultants Ltd. (2020c))
- Conduct Refined Failure Modes and Effects Analysis (FMEA) before Final EIS for the preferred alternative (DEIS measure FS-227; Gannett Fleming (2020))

The following measures were included in the DEIS but have been replaced, have been consolidated into other measures, or are no longer applicable:

- Alternate road access to Skunk Camp tailings storage facility (DEIS measure RC-218) [superseded by RC-NV-01]
- Follow AGFD and FWS guidance for mitigation of impacts on wildlife (DEIS measure GP-125) [consolidated into FEIS measure FS-WI-01]
- Implement a wildlife management plan for stormwater ponds, including wildlife exclusion fencing (DEIS measure GP-131) [consolidated into FEIS measure FS-WI-01]
- Use of best management practices during pipeline construction and operations (DEIS measure CA-176) [consolidated into FEIS measures FS-WI-01 and FS-PH-04]
- Reduce impacts on golden eagles (DEIS measure CA-185) [consolidated into FEIS measure FS-WI-01]
- Reduce impacts on peregrine falcon (DEIS measure CA-186) [consolidated into FEIS measure FS-WI-01]
- Reduce impacts on migratory and breeding birds (DEIS measure CA-187) [consolidated into FEIS measure FS-WI-01]
- Implement impact avoidance and minimization measures for special status species (DEIS measure GP-122) [consolidated into FEIS measure FS-WI-01]
- Mitigate loss of bouldering at Oak Flat by establishing access to “Inconceivables” (DEIS measure RC-213) [superseded by FEIS measure FS-RC-02]
- Implement Recreation User Group and Superior Trail Network Plan (DEIS measure RC-214) [superseded by FEIS measure FS-RC-03]

- Provide replacement campground (DEIS measure RC-215) [consolidated into FEIS measure FS-RC-04]
- Develop access to Oak Flat Campground (DEIS measure RC-216) [consolidated into FEIS measure FS-RC-05]
- Improve resiliency of tailings storage facility (DEIS measure GP-26) [already incorporated into overall project design and alternatives development]
- Development of an emergency action plan for the tailings storage facility for the preferred alternative (DEIS measure FS-229) [consolidated into FEIS measure FS-PH-02]
- Establish procedures for reporting noise complaints (DEIS measure GP-133) [consolidated into FEIS measure RC-PH-03]
- Develop noise limits and a monetary fine structure for noise violations (DEIS measure GP-134) [already incorporated into overall project operations]
- Maintain equipment regularly to reduce noise from heavy machinery operations (DEIS measure GP-132) [already incorporated into overall project operations]
- Reevaluate GPO dust abatement strategy (DEIS measure GP-110) [already incorporated into overall project operations, and will be governed by air permit]
- Identify monitoring thresholds for fugitive dust pollution (DEIS measure GP-111) [already incorporated into overall project operations, and will be governed by air permit]
- Implement enforcement strategies for air quality mitigation (DEIS measure GP-112) [already incorporated into overall project operations, and will be governed by air permit]
- Test stormwater runoff through running washes (DEIS measure GP-76) [will be governed by Arizona Pollutant Discharge Elimination System (AZPDES) permit]
- Disclose results of water monitoring (DEIS measure GP-79) [consolidated into FEIS measure PF-WR-01]
- Detail methodology for monitoring and mitigation of discharge water (DEIS measure GP-92) [already incorporated into overall project operations, and will be governed by Aquifer Protection Permit (APP)]
- Streams and riparian ecosystem mitigation of impacts (DEIS measure CA-168) [consolidated into FEIS measure FS-WR-02]
- Surveys of riparian and aquatic species (DEIS measure CA-189) [consolidated into FEIS measure FS-WI-01]
- Special species surveys prior to construction and site-specific plans (DEIS measure CA-177) [consolidated into FEIS measure FS-WI-01]
- Arizona National Scenic Trail construction considerations (DEIS measure GP-230) [consolidated into FEIS measure FS-TA-01]
- Provide personal protective equipment (PPE) to employees (DEIS measure GP-113) [already incorporated into overall project operations, and governed by Mine Safety and Health Administration regulations]
- Install additional deep monitoring wells (DEIS measure GP-37) [consolidated into FEIS measure RC-WR-03]

- Wells up- and down-gradient of site (DEIS measure CA-206) [consolidated into FEIS measure RC-WR-03]
- Implement a long-term monitoring and mitigation plan for releases (DEIS measure FS-151) [consolidated into FEIS measure RC-WR-03]
- Clarify “interim shutdown” (DEIS measure GP-91) [consolidated into FEIS measure FS-SV-04]
- Require adequate bond amount (DEIS measure GP-102) [consolidated into FEIS measure FS-SV-04]
- BLM offered lands preservation/improvement (DEIS measure CA-166) [consolidated into FEIS measure RC-SV-03]

Required and Voluntary Measures for Geology, Minerals, Subsidence (1 measure)

FS-GS-01: New Stipulations on Subsidence Monitoring Plan

Other names: FS-222 (DEIS appendix J); M-PH11

Description/overview:

Resolution Copper proposed the subsidence monitoring plan as part of the original mine plan of operations, and therefore it has been included in the FEIS as an Applicant-Committed Environmental Protection Measure. However, the Forest Service has identified additional requirements related to the subsidence monitoring plan which are included here.

Source of measure:

The revised subsidence monitoring plan (2020) is the source of this measure. This version of the plan was collaboratively developed after receipt of comments on the DEIS, as part of the Geology and Subsidence Workgroup.

In addition, the Forest Service has identified two actions that were not included in the revised subsidence monitoring plan. The Forest Service views these additional requirements as necessary components to ensure that monitoring is implemented appropriately and with proper oversight.
The Forest Service will require these additional actions as part of the subsidence monitoring plan:

1. Given the highly technical nature of the monitoring, the Forest Service foresees the need for independent outside experts to assist in the review of monitoring results, through the duration of the operations phase. Annual and quarterly monitoring reports, as well as any updated modeling reports, shall be submitted to the Forest Service and reviewed by an independent third-party subsidence expert that will work on behalf of the Forest Service. The third-party subsidence expert shall be selected by the Forest Service and funded by Resolution Copper.
2. The Forest Service shall require notification within 24 hours of Resolution Copper completing internal data validation whenever project conditions reach Trigger Level 2 or 3. Upon notification that Trigger Level 2 or 3 have been encountered, the Forest Service will initiate a technical workgroup meeting to discuss these results. Participants in the technical workgroup meeting would include: 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.

Resource affected/impacts being mitigated:

This measure seeks to mitigate impacts of subsidence on Forest Service surface resources, including the Apache Leap Special Management Area.

Applicable alternatives:

All

Authority to require:

As subsidence would impact Forest Service surface resources, notably the Apache Leap Special Management Area, authority exists under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection).

Funded by:

Resolution Copper

Additional ground disturbance:

No additional ground disturbance anticipated.

Required and Voluntary Measures for Soils, Vegetation, and Reclamation (4 measures)

FS-SV-01: Resource salvage within the tailings storage facility footprint, tailings pipeline/power line corridor, and Oak Flat Federal Parcel
Other names: RC-208 (DEIS appendix J); PA Measure #B4
Description/overview: Resolution Copper would allow natural resource salvage within the Oak Flat Federal Parcel, the tailings storage facility footprint, and the tailings pipeline/power line corridor. This measure would facilitate the salvage of resources (e.g., culturally important plants and mineral resources) to address the loss of access to traditional collection areas and a loss of access to the *Chi'chil Bildagoteel* Historic District within the Oak Flat Federal Parcel (selected lands). To the extent practicable and in collaboration and partnership with Tribes, an inventory will be conducted to identify the natural resources within the Oak Flat Federal Parcel area, pipeline corridor, and tailings storage facility footprint. When the inventory is complete, the resources will be "salvaged" (collected) and the material gathered will be distributed amongst the Tribes for traditional and cultural use.
Source of measure: Resolution Copper; Programmatic Agreement
Resource affected/impacts being mitigated: This measure seeks to mitigate impacts on vegetation by directly salvaging individual plants, but also through improving reclamation success and recovery of habitat after closure. This measure also seeks to mitigate impacts on Tribes by providing for resource salvage prior to loss of access.
Applicable alternatives: All
Authority to require: As this measure is included in the Programmatic Agreement of which Resolution Copper is a signatory, implementation is required to take place.
Funded by: Resolution Copper
Additional ground disturbance: While resource salvage would require ground disturbance, it would be within the existing area of analysis of the project fence line, in areas that eventually would be fully disturbed by project activities.

FS-SV-02: Conservation of Arizona Hedgehog Cactus at JI Ranch
Other names: None
Description/overview: Resolution Copper will record a conservation easement on portions of the JI Ranch, or a comparable location with suitable Arizona hedgehog cactus habitat, after the publication of a Record of Decision (by both U.S. Forest Service and the U.S. Army Corps of Engineers (USACE)) and receipt of all requisite permits and approvals from the USACE (under Clean Water Act Section 404) and Forest Service; and before construction of pipeline and power line infrastructure for the final selected alternative (WestLand Resources Inc. 2020j). The conservation easement's purpose shall be for the protection of the Arizona hedgehog cactus and will be at least 100 acres, comprising one or multiple parcels, excluding roads and trails for the life of the project.
Source of measure: Resolution Copper; Biological Opinion
Resource affected/impacts being mitigated: Arizona hedgehog cactus lost habitat due to project activities
Applicable alternatives: All
Authority to require: As this measure is included as a conservation measure in the Biological Opinion, implementation is required to take place.
Funded by: Resolution Copper
Additional ground disturbance: None anticipated.

FS-SV-03: Revised Reclamation and Closure Plans
Other names: GP-91 (DEIS appendix J); GP-102 (DEIS appendix J); M-PH10; M-V3
Description/overview: The reclamation and closure plan assessed in the DEIS was largely conceptual in nature. Resolution Copper has completed revised reclamation and closure plans, both for the preferred alternative tailings storage facility (KCB Consultants Ltd. 2020c), and as part of the overall mine plan of operations (Tetra Tech Inc. 2020). Aspects of these reclamation and closure plans speak to several specific mitigation suggestions raised in public comments: • Public comments suggested that the subsidence area boundary should be fenced off to prevent cattle from entering the area if there is a safety hazard to the mine or the livestock. Access prevention measures to limit public access (including cattle) have been incorporated into the closure and reclamation plan, including a combination of fencing, locked gates, cattle guards, security patrols, and steep topography.

- Public comments suggested that comprehensive revegetation plans should be required for the subsidence area, the tailings slurry pipeline corridor, and the tailings facility as part of scenic resources mitigation. Comprehensive reclamation actions have been developed and incorporated into the revised reclamation and closure plans. The reclamation plans cover all mine plan components, including the mine area, subsidence area, tailings corridor, and the tailings storage facility. The reclamation plans include detailed revegetation plans for construction (reclaim and revegetate temporary construction footprints), operations (progressive reclamation of the tailings storage facility) and end of mine (closure) revegetation for all disturbance footprints. The revegetation plans incorporate the use of native seed mixes and site preparation, vegetation, monitoring, erosion monitoring, and vegetation reestablishment metrics of success. It is not practical to revegetate the eventual subsidence area because reclamation equipment and personnel to perform the work will not be able to safely access the area.
- Clarifies activities to be undertaken and conditions for interim shutdown of operations.
- Clarifies procedures to be undertaken to calculate financial assurance requirements.

Source of measure:

Public comments; Resolution Copper

Resource affected/impacts being mitigated:

Loss of habitat; surface water quantity and quality

Applicable alternatives:

All

Authority to require:

For those portions of the project area that would impact Forest Service surface resources, authority exists under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection). Other authorities exist with ADEQ under the Aquifer Protection Permit program and the AZPDES program, with the Arizona State Land Department for rights-of-way across State Trust land, and with the Arizona State Mine Inspector.

Funded by:

Resolution Copper

Additional ground disturbance:

Revegetated and reclaimed areas are already disturbed, as analyzed in the EIS

RC-SV-04: Voluntary cooperative management of 7B Ranch until BLM management plan is implemented

Other names: CA-166 (DEIS appendix J); M-L7; M-L9; M-L11; M-L15

Description/overview:

As a voluntary measure, Resolution Copper will work with the current caretaker of 7B Ranch, The Nature Conservancy, for management of the 7B Ranch to cover a transition period until BLM has developed and implemented a management plan consistent with the Section 3003 of Public Law (PL) 113-291, which specifically requires that not later than 2 years after the date on which the land is acquired, the Secretary of the Interior shall update the management plan for the San Pedro National Conservation Area to reflect the management requirements of the acquired land. Resolution Copper would fund the transition period, and fence repair/replacement and protection measures for cultural

resources may be implemented in collaboration with The Nature Conservancy and BLM under the transition arrangement. This includes undertaking limited bosque restoration activities as well. All other aspects of parcel cleanup or structure removal have already been implemented, after consultation with BLM.
Source of measure: Public comments; Resolution Copper
Resource affected/impacts being mitigated: Loss of riparian and upland habitat
Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Funded by: Resolution Copper
Additional ground disturbance: Negligible, associated with bosque restoration and fence repair/replacement

Required and Voluntary Measures for Noise and Vibration (1 measure)

RC-NV-01: Mitigate noise and vibration impacts along Dripping Springs Road
Other names: M-N2; M-N4; M-T3
Description/overview: Applicant-committed measures to address noise and vibration near the tailings facility specific to the presence of residential areas in Section 29, Township 3 South, Range 15 East, include the following prior to ground-disturbing activities: paving Dripping Springs Road, setting the speed limit to 15 mph, and requiring the deliveries of equipment and materials to occur during the daytime. Resolution Copper has already purchased properties in the footprint and vicinity of the tailings storage facility. Resolution Copper has an established hotline for community complaints (including noise and vibration) via email (community-complaint@resolutioncopper.com) and telephone ([520] 689-3955). These are described on the Resolution Copper website (www.resolutioncopper.com).
Source of measure: Resolution Copper; public comments
Resource affected/impacts being mitigated: Noise and vibration experienced along Dripping Springs Road
Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.

Funded by: Resolution Copper
Additional ground disturbance: None anticipated.

Required and Voluntary Measures for Transportation and Access (1 measure)

FS-TA-01: New Mitigation Aspects of Revised Road Use Plan
Other names: GP-230 (DEIS appendix J)
Description/overview: Resolution Copper included a road use plan as an appendix to their original mine plan of operations. After publication of the DEIS, Resolution Copper revised the road use plan in consultation with the Forest Service in response to comments submitted on the DEIS. Several revised aspects of the Road Use Plan (Resolution Copper 2020b) respond directly to issues raised during comments. Specific new measures in the revised road use plan include: • updates to incorporate the preferred alternative; • additional details of road and pipeline crossings; • additional details of the access east of Oak Flat, which was a specific issue raised in public comments; • additional details of management of construction with respect to the Arizona National Scenic Trail; • specific details about how access would be maintained to the extent possible for recreational activities, including hiking, camping, and hunting; and • a change in the location of employee access to the West Plant Site, to reduce impacts within the Town of Superior surface streets.
Source of measure: Resolution Copper; public comments
Resource affected/impacts being mitigated: Recreation and access
Applicable alternatives: All
Authority to require: Since the road use plan is an integral part of the mine plan of operations as submitted to the Forest Service, these measures are considered to be non-discretionary for implementation. This measure is listed here as a mitigation measure because aspects of the revised road use plan were developed directly in response to the impacts disclosed in the EIS analysis. Additionally, the routes impacted are Forest Service surface resources for Alternatives 2, 3, and 4, and authority exists under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection). For Alternative 5, 43 CFR 3809.2 provides similar authority to BLM to regulate mining to prevent unnecessary or undue degradation.

For Alternative 6, the Forest Service would not have jurisdiction over the tailings storage facility, but would have authority over the pipeline corridor crossing NFS lands.
Funded by: Resolution Copper
Additional ground disturbance: None.

Required and Voluntary Measures for Air Quality (1 measure)

RC-AQ-01: SRP Solar Participation Agreement
Other names: M-AQ1
Description/overview: Rio Tinto has plans to invest significantly over the next 5 years to support delivery of its climate change targets. In line with this objective, in November 2019, Resolution Copper entered into a Solar Participation Agreement with the Salt River Project Agricultural Improvement and Power District to obtain solar power from a 100-megawatt 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% of the generating facility's solar power. Accordingly, by entering into the agreement, Resolution Copper has sourced renewable energy credits constituting approximately 25% of Resolution Copper's estimated baseload in 2022. Resolution Copper will continue to explore other opportunities to obtain renewable energy credits as the project moves forward.
Source of measure: Resolution Copper; public comment
Resource affected/impacts being mitigated: Air quality and increased greenhouse gas emissions.
Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Funded by: Resolution Copper
Additional ground disturbance: None.

Required and Voluntary Measures for Water Resources (4 measures)

FS-WR-01: Monitoring and Mitigation Plan for Groundwater Dependent Ecosystems and Water Wells

Other names: RC-211 (DEIS appendix J); M-W28

Description/overview:

In April 2019, Resolution Copper provided the Forest Service with a document titled "Monitoring and Mitigation Plan for Groundwater Dependent Ecosystems and Water Wells" (Montgomery and Associates Inc. 2019b). This plan was revised and finalized in September 2020 (Montgomery and Associates Inc. 2020b). This document outlines a monitoring plan to assess potential impacts on each groundwater-dependent ecosystem (GDE), identifies triggers and associated actions to be taken by Resolution Copper to ensure that GDEs are preserved, and suggests mitigation measures for each GDE if it is shown to be impacted by future mine dewatering. Note that this plan includes actions both for GDEs and water supply wells.

The plan focuses on the same GDEs described in section 3.7.1 of the FEIS, as these are the GDEs that are believed to rely on regional groundwater that could be impacted by the mine. The stated goal of the plan is "to ensure that groundwater supported flow that is lost due to mining activity is replaced and continues to be available to the ecosystem." The plan specifically notes that it is not intended to address water sources associated with perched shallow groundwater in alluvium or fractures.

The specific GDEs addressed by this plan include the following:

- Bitter, Bored, Hidden, Iberri, Kane, McGinnel, McGinnel Mine, No Name, Rock Horizontal, and Walker Springs;
- Queen Creek below Superior (reach km 17.39 to 15.55) and at Whitlow Ranch Dam;
- Arnett Creek in two locations;
- Telegraph Canyon in two locations;
- Devil's Canyon springs (DC4.1E, DC6.1E, DC6.6W, and DC8.2W);
- Devil's Canyon surface water in two locations (reach km 9.1 to 7.5, and reach km 6.1 to 5.4);
- Mineral Creek springs (Government Springs, MC3.4W); and
- Mineral Creek surface water in two locations (MC8.4C, and reach km 6.9 to 1.6).

Monitoring frequency and parameters are discussed in the plan, and include such things as groundwater level or pressure, surface water level, presence of water or flow, extent of saturated reach, and phreatophyte area. In general, groundwater level or pressure and surface water level would be monitored daily (using automated equipment), while other methods would be monitored quarterly or annually.

Water supplies to be monitored are Superior (using well DHRES-16_743 as a proxy), Boyce Thompson Arboretum (using the Gallery Well as a proxy), and Top-of-the-World (using HRES-06 as a proxy).

A variety of potential actions are identified that could be used to replace water sources if monitoring reaches a specified trigger. Specific details (likely sources and pipeline corridor routes) are shown in the plan. These include the following:

- Drilling new wells, applicable to both water supplies and GDEs. The intent of installing a well for a GDE is to pump supplemental groundwater that can be used to augment flow. The exact location and construction of the well would vary; it is assumed in many cases groundwater would be transported to GDEs via an overland pipeline to minimize ground disturbance. Wells require maintenance in perpetuity, and likely would be equipped with storage tanks and solar panels, depending on specific site needs.

- Installing spring boxes. These are structures installed into a slope at the discharge point of an existing spring, designed to capture natural flow. The natural flow is stored in a box and discharged through a pipe. Spring boxes can be deepened to maintain access to water if the water level decreases. Spring boxes require little ongoing maintenance to operate.
- Installing guzzlers. Guzzlers are systems for harvesting rainwater for wildlife consumption. Guzzlers use an impermeable apron, typically installed on a slope, to collect rainwater which is then piped to a storage tank. A drinker allows wildlife and/or livestock to access water without trampling or further degrading the spring or water feature. Guzzlers require little ongoing maintenance to operate.
- Installing surface water capture systems such as check dams, alluvial capture, recharge wells, or surface water diversions. All of these can be used to supplement diminished groundwater flow at GDEs by retaining precipitation in the form of runoff or snowmelt, making it available for ecosystem requirements.
- Providing alternative water supplies from a non-local source. This would be considered only if no other water supply is available, with the Arizona Water Company or the Desert Wellfield being likely sources of water.

The September 2020 plan (Montgomery and Associates Inc. 2020b) is silent on the duration of this monitoring and mitigation measure. The Forest Service will require the following as part of the monitoring and mitigation plan for GDEs and water wells, due to the expectation that pumping effects could take many years or decades to be observed:

1) Monitoring and mitigation will be required to continue through operations, during the period of active dewatering.
2) Monitoring and mitigation will be required to continue during the closure phase as well, for at least 10 years after cessation of active dewatering.
3) At the end of this period, Resolution Copper may request from the Forest Service that individual GDEs and water wells be dropped from further monitoring and mitigation efforts, based on analysis of the observations made during the operations and closure phases.

Source of measure:

Resolution Copper

Resource affected/impacts being mitigated:

Water resources, riparian habitat, water supplies

Applicable alternatives:

All

Authority to require:

As this measure is included as a conservation measure in the Biological Opinion, implementation is required to take place. As some GDEs impacted are considered Forest Service surface resources, authority exists under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection).

Funded by:

Resolution Copper

Additional ground disturbance:

Yes, quantified in the plan in the event replacement water is needed

FS-WR-02: Clean Water Act Section 404 Compensatory Mitigation Plan

Other names: RC-217 (DEIS appendix J); CA-168 (DEIS appendix J); M-L1; M-L4; M-L12; M-R18; M-W2

Description/overview:

Resolution Copper has proposed a package of compensatory mitigation as part of the Clean Water Act Section 404 permitting process; this package is included in appendix D of the FEIS and has been approved by the USACE. The three compensatory mitigation parcels approved under the Section 404 permitting process are:

1. 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 Central Arizona Project 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 Mar-5/Olberg Road area encompasses 146 acres of lands; only the 23-acre Olberg Road mitigation parcel is part of the compensatory mitigation package.
2. 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.
3. 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.

Source of measure:

Clean Water Act Section 404 Permit

Resource affected/impacts being mitigated:
Mitigations impacts to waters of the U.S. and associated riparian habitat
Applicable alternatives:
Compensatory mitigation plans are specific to Alternative 6 only; Alternative 5 would also require permitting, although this has not been pursued to date. Alternatives 2, 3, and 4 would not require Section 404 permitting or any associated compensatory mitigation.
Authority to require:
Authority exists to require this under Section 404 of the Clean Water Act, administered by the USACE.
Funded by:
Resolution Copper
Additional ground disturbance:
As described in the FEIS Appendix D, Clean Water Act Section 4040 Compensatory Mitigation Plan

FS-WR-04: Replacement of water in Queen Creek
Other names: M-W16
Description/overview:
Resolution Copper will replace stormwater flow to Queen Creek that has been diverted as a direct result of subsidence. Resolution Copper plans to do so by placing water into Queen Creek above the Magma Bridge and potentially other locations. Queen Creek is a surface resource on portions of the Mesa and Globe Ranger Districts. Precise timing of actual subsidence impacts will depend on timing and sequencing of underground mining. Mitigations for stormwater flow loss to Queen Creek resulting from future subsidence impacts will be incrementally implemented in advance of and concurrent with future subsidence impacts in collaboration with the Town of Superior and other downstream stakeholders with a presence along Queen Creek, in order to offset the actual impacts of future activities. Thus, this mitigation will be supported by a process of baseline data collection to measure impacts. All mitigations involving discharge of replacement water are contingent on successful permitting, including the receipt of an AZPDES permit from ADEQ.
Source of measure:
Resolution Copper
Resource affected/impacts being mitigated:
Adverse impacts to surface water quantity
Applicable alternatives:
All
Authority to require:
For those project activities that would impact Forest Service surface resources, authority exists under 36 CFR 251.56 (terms and conditions on special use permits) or 36 CFR 228.8 (mine plan requirements for environmental protection).

Funded by:

Resolution Copper

Additional ground disturbance:

No additional ground disturbance is anticipated; most wells are existing or within the footprint of the facility.

RC-WR-03: Skunk Camp Water Quality Monitoring Plan

Other names: GP-37 (DEIS appendix J); CA-206 (DEIS appendix J); FS-151 (DEIS appendix J); M-W10

Description/overview:

Dripping Spring Wash is ephemeral between the proposed Skunk Camp tailings storage facility and the Gila River. Resolution Copper will need an AZPDES permit issued by the ADEQ, which will require monitoring of any discharges from the tailings storage facility, if any such discharges occur, which will identify the quality of any such discharges.

Resolution Copper will also need an Aquifer Protection Permit (APP) issued by ADEQ. APP permits include groundwater monitoring at specified point of compliance (POC) wells located near the facility. Monitoring at these wells is required to demonstrate that discharges from the facility will not cause exceedance of aquifer water quality standards (set equal to Federal primary drinking water maximum contaminant levels) at the POC(s), or cause further degradation of water quality if an aquifer water quality standard (AWQS) is already exceeded at the POC(s) at the time of permit issuance. APPs also typically include alert levels, generally set lower than corresponding aquifer quality limits and monitored at the POCs. APPs include specific contingency measures to be followed if specified conditions occur, including (but not limited to) exceedance of alert levels or aquifer quality limits. Finally, APPs require reporting of all monitoring results to ADEQ, as well as prompt reporting of permit violations or alert level exceedances.

Resolution Copper has provided a robust water quality monitoring program around the proposed tailings storage facility (Skunk Camp Water Quality Monitoring Plan, Montgomery and Associates Inc. (2020f)) which exceeds the likely monitoring requirements to be implemented under the APP or AZPDES permits. The Skunk Camp Water Quality Monitoring Plan includes monitoring of numerous wells and springs along or adjacent to Dripping Spring Wash, and in the Gila River just downstream of its confluence of Dripping Spring Wash.

Source of measure:

Resolution Copper

Resource affected/impacts being mitigated:

Adverse impacts to groundwater and surface water quality

Applicable alternatives:

Alternative 6

Authority to require:

Authority for these measures will ultimately reside with ADEQ under the APP and AZPDES programs; however, it is anticipated that much of the sampling detailed in the plan will remain voluntary by Resolution Copper.

Funded by:

Resolution Copper

Additional ground disturbance:

No additional ground disturbance anticipated; most wells are existing or within the footprint of the facility.

Required and Voluntary Measures for Wildlife (4 measures)

FS-WI-01: Revised Wildlife Management Plan

Other names: GP-125 (DEIS appendix J); GP-131 (DEIS appendix J); CA-176 (DEIS appendix J); CA-177 (DEIS appendix J); CA-185 (DEIS appendix J); CA-186 (DEIS appendix J); CA-187 (DEIS appendix J); CA-189 (DEIS appendix J); GP-122 (DEIS appendix J); M-WL1; M-WL3; M-WL4; M-WL11; M-WL14; M-WL23; M-WL25; M-WL28; M-WL32; M-WL36; M-WL42; M-WL45; M-WL49

Description/overview:

Resolution Copper included a wildlife management plan as an appendix to their original mine plan of operations. After publication of the DEIS, Resolution Copper consulted with the AGFD to revise the wildlife management plan in response to comments submitted by AGFD on the DEIS. Several revised aspects of the wildlife management plan (Resolution Copper 2020j) respond directly to issues raised in the comments, or supersede more generic measures contained in the DEIS.

Specific measures that this measure consolidates and supersedes are:

- Follow AGFD and FWS guidance for mitigation of impacts on wildlife (DEIS measure GP-125). Resolution Copper will be following appropriate guidance from the AGFD and FWS, relying on the Revised Wildlife Management Plan completed in response to AGFD comments, and the Biological Opinion issued by the FWS.
- Implement a wildlife management plan for stormwater ponds, including wildlife exclusion fencing (DEIS measure GP-131). These aspects are explicitly incorporated into the Revised Wildlife Management Plan.
- Use best management practices during pipeline construction and operations (DEIS measure CA-176). These aspects are explicitly incorporated into the Revised Wildlife Management Plan.
- Reduce impacts on golden eagles (DEIS measure CA-185). These aspects are explicitly incorporated into the Revised Wildlife Management Plan.
- Reduce impacts on peregrine falcon (DEIS measure CA-186). These aspects are explicitly incorporated into the Revised Wildlife Management Plan.
- Reduce impacts on migratory and breeding birds (DEIS measure CA-187). These aspects are explicitly incorporated into the Revised Wildlife Management Plan.
- Implement impact avoidance and minimization measures for special status species (GP-122). Resolution Copper will be following appropriate guidance for special status species, relying on the Revised Wildlife Management Plan completed in response to AGFD comments, and the Biological Opinion issued by the FWS.

Specific new measures in the Revised Wildlife Management Plan include the following:

- The project lighting plan would reduce impacts to wildlife from lights.
- May–September seasonal restrictions that were detailed in the Biological Assessment with respect to avian species would be implemented in riparian habitat (SWCA Environmental Consultants 2020a).

- Hazing, non-lethal deterrents, exclusion fencing, and other measures to minimize wildlife conflicts would be implemented.
- Flight diverters would be used on power lines over riparian habitat in Devil's Canyon, Queen Creek, and Mineral Creek.
- Preconstruction surveys and nest location for golden eagles, peregrine falcon, and migratory or breeding birds, with mitigation if occurrences are found.
- Mitigations for kit fox.

Source of measure:

Resolution Copper; public comments

Resource affected/impacts being mitigated:

Adverse effects on wildlife

Applicable alternatives:

All

Authority to require:

Since the wildlife management plan is an integral part of the mine plan of operations as submitted to the Forest Service, these measures are considered to be non-discretionary for implementation. This measure is listed here as a mitigation measure because aspects of the Revised Wildlife Management Plan were developed directly in response to the impacts disclosed in the EIS analysis.

Additionally, the habitats impacted are Forest Service surface resources for Alternatives 2, 3, and 4, and authority exists under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection). For Alternative 5, 43 CFR 3809.2 provides similar authority to BLM to regulate mining to prevent unnecessary or undue degradation. For Alternative 6, the Forest Service would not have jurisdiction over the tailings storage facility, but would have authority over the pipeline corridors crossing NFS lands.

Funded by:

Resolution Copper

Additional ground disturbance:

No additional ground disturbance anticipated.

FS-WI-02: Reptile and Sonoran Desert Tortoise (ESA-CCA) Plan

Other names: CA-191 (DEIS appendix J); M-WL34

Description/overview: Implement conservation actions detailed in the Candidate Conservation Agreement (CCA). The CCA would be a formal agreement between the FWS and Resolution Copper to address the conservation needs of proposed or candidate species, or species likely to become candidates for listing, before they become listed as endangered or threatened. Resolution Copper would voluntarily commit to conservation actions that would help stabilize or restore the species with the goal that listing would become unnecessary.

This measure was included in the DEIS and has since been incorporated into the Revised Wildlife Management Plan (FEIS measure FS-WI-1). Resolution Copper has committed to this measure.

Source of measure:

Arizona Game and Fish Department

Resource affected/impacts being mitigated:

Wildlife

Applicable alternatives:

All

Authority to require:

Because of its inclusion in the Revised Wildlife Management Plan, this measure is considered to be non-discretionary for implementation.

Additionally, the habitats impacted are Forest Service surface resources for Alternatives 2, 3, and 4, and authority exists under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection). For Alternative 5, 43 CFR 3809.2 provides similar authority to BLM to regulate mining to prevent unnecessary or undue degradation.
For Alternative 6, the Forest Service would not have jurisdiction over the tailings storage facility, but would have authority over the pipeline corridors crossing NFS lands.

Funded by:

Resolution Copper

Additional ground disturbance:

No additional ground disturbance anticipated.

FS-WI-03: Mitigation of loss of abandoned mine or cave habitat for bats

Other names: CA-172 (DEIS appendix J)

Description/overview:

Mitigate impacts on bat habitat by conducting pre-closure surveys over multiple years and multiple visits per year, to document species presence/absence and develop appropriate closure methods in coordination with AGFD, Bat Conservation International, and Forest Service biologists; implement wildlife exclusion measures pre-closure to minimize wildlife entrapment and mortality during closure; consider seasonal timing of closure on any sites with suitable maternity roosts; and identify mines, adits, and/or shafts with known bat roosting areas. If activities are adjacent to bat roosting/maternity sites, develop best management practices to reduce human encroachment.

This measure was included in the DEIS and has since been incorporated into the Revised Wildlife Management Plan (FEIS measure FS-WI-1). Resolution Copper has committed to this measure.

Source of measure:

Arizona Game and Fish Department

Resource affected/impacts being mitigated:

These actions seek to mitigate potential adverse effects on wildlife habitat.

Applicable alternatives:

All

Authority to require:

Because of inclusion in the Revised Wildlife Management Plan, this measure is considered to be non-discretionary for implementation.

Additionally, the habitats impacted are Forest Service surface resources for Alternatives 2, 3, and 4, and authority exists under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection). For Alternative 5, 43 CFR 3809.2 provides similar authority to BLM to regulate mining to prevent unnecessary or undue degradation.
For Alternative 6, the Forest Service would not have jurisdiction over the tailings storage facility, but would have authority over the pipeline corridors crossing NFS lands.

Funded by:

Resolution Copper

Additional ground disturbance:

No additional ground disturbance anticipated.

FS-WI-04: Maintain or replace access to stock tanks and Arizona Game and Fish Department wildlife waters

Other names: CA-175 (DEIS appendix J)

Description/overview: Resolution Copper would maintain or replace access to stock tanks and AGFD wildlife waters impacted by the project. Stock tanks are used to provide drinking water for livestock. AGFD constructs wildlife water developments to support a variety of wildlife, including game species. Benefits of AGFD wildlife water developments include a long lifespan; year-round, acceptable water quality for wildlife use; require no supplemental water hauling, except in rare or exceptional circumstances; minimal visual impacts and blend in with the surrounding landscape; are accessible to and used by target species and exclude undesirable/feral species to the greatest extent possible; and minimized risk of animal entrapment and mortality.

This measure was included in the DEIS and maintaining access in general has since been incorporated into the Revised Road Use Plan (FEIS measure FS-TA-1) and committed to by Resolution Copper.

Source of measure:

Arizona Game and Fish Department

Resource affected/impacts being mitigated:

These actions seek to mitigate potential adverse effects on livestock grazing, recreation, and wildlife habitat.

Applicable alternatives:

All

Authority to require:

Because of inclusion in the Revised Road Use Plan, this measure is considered to be non-discretionary for implementation.

Additionally, the areas impacted are Forest Service surface resources for Alternatives 2, 3, and 4, and authority exists under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection). For Alternative 5, 43 CFR 3809.2 provides similar authority to BLM to regulate mining to prevent unnecessary or undue degradation.

For Alternative 6, the Forest Service would not have jurisdiction over the tailings storage facility, but would have authority over the pipeline corridors crossing NFS lands.
Funded by: Resolution Copper
Additional ground disturbance: No additional ground disturbance anticipated.

Required and Voluntary Measures for Recreation (6 measures)

FS-RC-01: Relocation of Arizona National Scenic Trail
Other names: RC-212 (DEIS appendix J)
Description/overview: Resolution Copper has proposed to fund the relocation of a segment of the Arizona National Scenic Trail as well as the construction of new trailheads. Approximately 9 miles of new trail would need to be built between U.S. Route 60 and NFS Road 650 near Whitford Canyon. This measure was proposed by Resolution Copper and seeks to mitigate impacts on recreational opportunities on the trail. This measure is only applicable to Alternatives 2, 3, and 4. Relocating the trail and constructing new trailheads would require additional ground disturbance but the exact area of new disturbance has yet to be determined. It is assumed the new trail would be about 2 to 3 feet in width and approximately 3 acres of total surface area.
Source of measure: Resolution Copper
Resource affected/impacts being mitigated: These actions seek to mitigate potential adverse effects on recreation.
Applicable alternatives: Alternative 2, 3, and 4
Authority to require: The segments of the trail impacted are Forest Service surface resources for Alternatives 2, 3, and 4, and authority exists under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection).
Funded by: Resolution Copper
Additional ground disturbance: Yes, to be determined, but roughly estimated that a new trail bed would be 2 to 3 feet in width, and would account for approximately 3 acres of additional ground disturbance.

FS-RC-02: Access to Oak Flat Campground
Other names: RC-216 (DEIS appendix J); PA Measure #B5:
Description/overview: Resolution Copper will ensure access to the Oak Flat campground to members of the public and Tribes as long as safety allows. Resolution Copper will develop an Oak Flat Campground Management Plan prior to completion of the land exchange. The management approach is consistent with the current Forest Service management of the campground, but would also incorporate additional measures requested by Tribes, including closure of the campground to the public periodically or upon request by Indian Tribes for traditional and ceremonial purposes.
Source of measure: Programmatic Agreement
Resource affected/impacts being mitigated: These actions seek to mitigate potential adverse effects on recreation and tribal values.
Applicable alternatives: All
Authority to require: As this measure is included in the Programmatic Agreement of which Resolution Copper is a signatory, implementation is required to take place.
Funded by: Resolution Copper
Additional ground disturbance: No additional ground disturbance anticipated.

FS-RC-03: Mitigation for adverse impacts to recreational trails (Forest multi-use trail plan)
Other names: RC-214 (DEIS appendix J); M-R14; M-R17; M-R19; M-R20; M-R23; M-R35
Description/overview: In the DEIS, Resolution Copper had agreed to support the Recreation User Group (RUG) and the Superior Trail Network Plan to offset loss of public roads at Oak Flat. The RUG had proposed a conceptual plan for a trail system on the Tonto National Forest, located southwest of the town of Superior, that would meet the needs and interests of different stakeholders (WestLand Resources Inc. 2019). In 2020, land managers and resource specialists from the Tonto National Forest evaluated the proposed measures intended to mitigate recreation impacts on the Tonto National Forest resulting from actions associated with the proposed project. This review resulted in a set of measures found to be legitimate, practicable, and effective, and inclusion in the FEIS was recommended (Rausch and Rasmussen 2020). The recommendations include 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. Resolution Copper has committed to funding the construction and maintenance of the new multi-use trail network on the Tonto National Forest, with the further intent that investment funding can be supported by additional grants and funds from recreational groups and other organizations to further expand recreational opportunities.

Source of measure:

Tonto National Forest

Resource affected/impacts being mitigated:

These actions seek to mitigate potential adverse effects on recreation.

Applicable alternatives:

All

Authority to require:

As project impacts would impact Forest Service surface resources, including recreation opportunities involving motorized and non-motorized routes, authority exists under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection).

Funded by:

Resolution Copper

Additional ground disturbance:

Implementation of the full plan would involve 42 acres, which has been incorporated into the FEIS analysis.

FS-RC-04: Establish an alternative campground site (Castleberry) to mitigate the loss of Oak Flat Campground

Other names: RC-215 (DEIS appendix J); M-R1; M-R2; M-R14; PA Measure #C7

Description/overview:

Resolution Copper will establish an alternative campground site, known as Castleberry, within 18 months of the issuance of the final ROD, to mitigate the loss of Oak Flat Campground, which is a historic property (Graham 2020).

The new Castleberry Campground will be located on private property owned by Resolution Copper near the town of Superior that contains numerous prehistoric and historic-era historic properties. All efforts will be made to avoid effects on these properties when developing the campground facilities.
If construction of the Castleberry Campground cannot avoid effects on any of the identified historic properties, an HPTP will be developed pursuant the stipulations in the Programmatic Agreement to address the effects and implemented prior to the campground being constructed. Also, a plan will be developed in consultation with the Tribes to install interpretive signs at a few historic properties located near the Castleberry Campground.

Source of measure:

Resolution Copper

Resource affected/impacts being mitigated:

These actions seek to mitigate potential adverse effects on recreation.

Applicable alternatives:

All

Authority to require:

As this measure is included in the Programmatic Agreement of which Resolution Copper is a signatory, implementation is required to take place.

Funded by:

Resolution Copper

Additional ground disturbance:

Additional disturbance on the Castleberry property and access to property could include up to 50 acres, which has been incorporated into the FEIS analysis.

RC-RC-05: Mitigation for impacts on climbing resources

Other names: RC-213 (DEIS appendix J); M-R8; M-R9; M-R23; M-R33; M-R34; M-R37

Description/overview:

As described in the Queen Creek Climbing and Mitigation Access Plan (Oliver 2020), impacts to climbing resources near Oak Flat and Euro Dog Valley could be offset by new access to bouldering and climbing resources known as "The Inconceivables and Chill Hill Boulders." These climbing resources are roughly accessed from Arizona State Route 177, located approximately 5 miles south of Superior, in Pinal County, Arizona, in portions of Sections 26, 27, 34, and 35, Township 2 South, Range 12 East.

Initial engineering designs for improved road access and parking on NFS lands have been drafted and Resolution Copper has agreed to fund the improvements. Details are provided in the Inconceivables Road Access Plan (WestLand Resources Inc. 2020a).

Additionally, Resolution Copper has agreed to mitigation efforts in the combined "Queen Creek Climbing Area," which includes nine discrete climbing areas: The Pond, Atlantis, Oak Flat, Euro Dog Valley, The Mine Area, Apache Leap, Northern Devil's Canyon, Upper Devil's Canyon, and Lower Devil's Canyon, Hackberry Creek/The Refuge. Some of these areas will be impacted, and Resolution Copper has proposed the following mitigation:

- Oak Creek and Euro Dog Valley: May eventually be impacted by subsidence. Funds for a new access road (crossing NFS lands) to the Inconceivables and Chill Hill boulders.
- The Mine Area: Mining impacts will likely include closure of the current access route via Magma Mine Road and closure of some of the climbing area. Resolution Copper will work with local climbing groups and climbers to evaluate the feasibility of an alternate access route (trail) on private lands.
- Apache Leap: Access via Magma Mine Road and NFS Road 315 will be closed due to mining impacts. Resolution Copper will work with local climbing groups and climbers to evaluate the feasibility of an alternate access route (trail) across private lands. Although access from NFS Road 2440 via the Cross Canyon Road would not be impacted by mining activities, there may be possible restrictions for climbing as a result of the climbing management plan for Apache Leap Special Management Area.
- Upper Devil's Canyon: Access from NFS Road 2438 and/or 2439 via NFS Road 469 (Magma Mine Road) will most likely remain. However, in the event that parts of NFS Road 2438 are closed due to subsidence, Resolution Copper will work with local climbing groups and climbers to evaluate the feasibility of an alternate access route.
- Lower Devil's Canyon, Hackberry Creek/The Refuge: Access will remain from the south from NFS Road 315 via State Route 177, but access from Magma Mine Road will be closed.

Resolution Copper has also agreed to fund an endowment to support the continuing use of the Queen Creek Mining Area for climbing and bouldering. The Queen Creek Climbing Coalition has agreed to support the use of the fund for the development of climbing access and areas outside of the area impacted by the mine.
Source of measure: Resolution Copper
Resource affected/impacts being mitigated: These actions seek to mitigate potential adverse effects on recreation.
Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Funded by: Resolution Copper
Additional ground disturbance: Total new ground disturbance for the Inconceivables Access Road has been incorporated into the FEIS analysis. Other ground disturbance from recreation use would be negligible, and consistent with current uses.

RC-RC-06: Mitigation for public access to JI Ranch through AGFD cooperative agreement
Other names: M-S20
Description/overview: Resolution Copper will open Signal Mountain Road on the JI Ranch for public access to the Tonto National Forest for wildlife-related recreation through an agreement with AGFD.
Source of measure: Public comment
Resource affected/impacts being mitigated: Recreation and public access
Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Funded by: Resolution Copper
Additional ground disturbance: None.

Required and Voluntary Measures for Public Health and Safety (5 measures)

FS-PH-01: Satellite Monitoring of Tailings Storage Facility
Other names: FS-01 (DEIS appendix J)
Description/overview: High-resolution satellite imagery would be collected and processed at regular intervals. Processed output provided to the Forest Service or BLM would include beach width, tailings surface slope contours, and constructed site topography. This output could be provided for land manager verification of adherence to design criteria, as well as long-term monitoring of facility performance over time.
Source of measure: Tonto National Forest Interdisciplinary Team
Resource affected/impacts being mitigated: Public health and safety
Applicable alternatives: Alternatives 2, 3, 4, and 5
Authority to require: Alternatives 2, 3, and 4: authority exists under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection). Alternative 5: 43 CFR 3809.2 (BLM authority to regulate mining to prevent unnecessary or undue degradation). Alternative 6: As facility would ultimately be located on private land, the Forest Service would not have authority to require long-term monitoring of the tailings storage facility.
Funded by: Resolution Copper
Additional ground disturbance: No additional ground disturbance anticipated.

FS-PH-02: Adherence to National Dam Safety Program Standards
Other names: FS-228 (DEIS appendix J); FS-229 (DEIS appendix J)
Description/overview: For a tailings storage facility built on Federal land, the Forest Service is requiring that Resolution Copper adhere, at a minimum, to the requirements of the National Dam Safety Program discussed in "Relevant Laws, Regulations, Policies, and Plans" in section 3.10.1.3. This measure also incorporates the development of an emergency action plan for the tailings storage facility. The failure modes and effects analysis (FMEA) that was conducted provides key information to this process, including the breach analysis performed as a result (KCB Consultants Ltd. 2020b). Emergency action planning would include evaluation of emergency potential, inundation mapping and

classification of downstream inundated areas, response times, notification plans, evacuation plans, and plans for actions upon discovery of a potentially unsafe condition. This measure originally was anticipated to be conducted between the DEIS and FEIS (DEIS measure FS-229), and several fundamental steps were conducted (risk assessment and preparing the breach analysis). However, full emergency planning is premature, given that those efforts are specific to the downstream residents and community, and the facility would not begin operation—at best—for at least a decade. This remains a requirement for any facility built on Federal land, and while this would not include Alternative 6, emergency planning also is a specific requirement of the recently adopted Global Industry Standard on Tailings Management and would be conducted under that framework, regardless of site ownership (International Council on Mining and Metals et al. 2020).
Source of measure: Tonto National Forest Interdisciplinary Team
Resource affected/impacts being mitigated: Public health and safety
Applicable alternatives: Alternatives 2, 3, 4, and 5
Authority to require: Alternatives 2, 3, and 4: authority exists under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection). Alternative 5: 43 CFR 3809.2 (BLM authority to regulate mining to prevent unnecessary or undue degradation). Alternative 6: As facility would ultimately be located on private land, the Forest Service would not have authority to require these specific design standards.
Funded by: Resolution Copper
Additional ground disturbance: No additional ground disturbance anticipated.

FS-PH-03: Skunk Camp Pipeline Protection and Integrity Plan
Other names: CA-176 (DEIS appendix J); M-PH6; M-W30
Description/overview: Resolution Copper has prepared a plan for assuring the protection of resources and integrity of the Skunk Camp tailings pipelines during both construction and operations (Golder Associates Inc. 2020). This plan includes additional details of the crossings of drainages such as Devil's Canyon and Mineral Creek. The plan includes details of the materials and techniques to be used in construction, including appropriate industry codes and guidance, an assessment of potential failure modes for the pipeline and design remedies to ensure integrity, operational controls, and spill response plans.
Source of measure: Resolution Copper, public comments

Resource affected/impacts being mitigated: Public health and safety; surface and groundwater quality
Applicable alternatives: Alternative 6
Authority to require: As much of the pipeline route occurs across NFS lands, authority exists under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection).
Funded by: Resolution Copper
Additional ground disturbance: None.

RC-PH-04: Maintain the existing hotline for community complaints
Other names: GP-133 (DEIS appendix J); M-G2
Description/overview: Resolution Copper will maintain the existing hotline set up for community complaints via email and telephone, described on the Resolution Copper website (www.resolutioncopper.com). Email: community-complaint@resolutioncopper.com. Telephone: (520) 689-3955.
Source of measure: Public comment
Resource affected/impacts being mitigated: General public use, health and safety, or other public nuisance issues that could occur as a result of project activities.
Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Funded by: Resolution Copper
Additional ground disturbance: None.

RC-PH-05: Adhere to Global Tailings Standard

Other names: M-PH7

Description/overview:

Prior to the publication of the DEIS, in March 2019, the International Council on Mining and Metals announced it would co-convene an independent review of global tailings standards along with the United Nations Environment Programme (UNEP) and the Principles for Responsible Investment (PRI).

In August 2020, the Global Industry Standard on Tailings Management was launched (International Council on Mining and Metals et al. 2020). The preamble to the new Standard states: "The Global Industry Standard on Tailings Management (herein 'the Standard') strives to achieve the ultimate goal of zero harm to people and the environment with zero tolerance for human fatality. It requires Operators to take responsibility and prioritise the safety of tailings facilities, through all phases of a facility's lifecycle, including closure and post-closure. It also requires the disclosure of relevant information to support public accountability."

International Council on Mining and Metals (ICMM) member companies would implement the Standard as a commitment of membership. Both Rio Tinto and BHP, partners in Resolution Copper, are members of ICMM.

Key aspects of the new Standard include the following:

- Maintaining a comprehensive knowledge base, and requirements for periodic updates to facility management and design at least every 5 years, focusing on material changes in social, environmental, or local economic conditions.
- Identification of accountable parties, notably the Engineer of Record and the Accountable Executive.
- Use of an independent tailings review board (ITRB) and internal auditing.
- A focus on the mine lifecycle: operations, closure, and post-closure, extending until the facility is in a state of "safe closure." This means a closed tailings facility that does not pose ongoing material risks to people or the environment, which has been confirmed by an ITRB or senior independent technical reviewer and signed off by the Accountable Executive.
- Hazard classification based on downstream consequences, which in turn guides the selection of the seismic design standard and flood design standard. For example, for a hazard classification of "extreme," the flood design would be an annual exceedance probability of 1 in 10,000, or the Probable Maximum Flood (International Council on Mining and Metals et al. (2020:Annex 2, Table 2), and the seismic design criteria would be an annual exceedance probability of 1 in 10,000, or the Maximum Credible Earthquake (International Council on Mining and Metals et al. (2020:Annex 2, Table 3).
- Requirements for assessing credible failure modes, developing a breach analysis, and conducting emergency planning.
- Document "as-built" construction methods and conditions.
- Use of operational surveillance with specific and measurable performance objectives, indicators, criteria, and performance parameters, and development of clear trigger action response plans.
- Commitment to public disclosure of and access to information, and transparency.

Source of measure:

Resolution Copper, public comments

Resource affected/impacts being mitigated:

Public health and safety

Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Funded by: Resolution Copper
Additional ground disturbance: None.

Required and Voluntary Measures for Scenic Resources (1 measure)

FS-SR-01: Minimize visual impacts from transmission lines
Other names: FS-03 (DEIS appendix J)
Description/overview: Best management practices or other guidelines (on NFS lands) that would minimize visual impacts from transmissions lines could include the following: • non-specular transmission lines, transformers, and towers; • avoid use of monopole transmission structures; • avoid "skylining" of transmission/communication towers and other structures. Consider topography when siting transmission structures to avoid "skylining" of structures on high ridges in the landscape; and • use air transport capability to mobilize equipment and materials for clearing, grading, and erecting transmission towers in areas of the highest visual sensitivity with difficult access.
Source of measure: Internal NEPA Team scoping
Resource affected/impacts being mitigated: These measures seek to reduce and minimize the scenery impacts and project contrast of mining operations in the surrounding landscape and impacts upon sensitive viewers. All recommendations would be effective in reducing the form, line, and color contrasts presented by the project elements.
Applicable alternatives: All
Authority to require: Power line corridors occur mainly on Tonto National Forest-managed lands and mitigation can be required, regardless of alternative, under 36 CFR 251.56 (terms and conditions on special use permits) and 36 CFR 228.8 (mine plan requirements for environmental protection).
Funded by: Resolution Copper
Additional ground disturbance: No additional ground disturbance anticipated.

Required and Voluntary Measures for Cultural/Historical Resources and Tribal Values (7 measures)

FS-CR-01: Implementation of Oak Flat HPTP
Other names: RC-209 (DEIS appendix J); PA Measure #B1
Description/overview: The "Resolution Copper Oak Flat Land Exchange Treatment Plan" (Oak Flat HPTP) (Deaver and O'Mack 2019) sets out a plan for treatments to resolve the adverse effects on 42 historic properties that have been identified within the Oak Flat Federal Parcel. In accordance with the plan, Resolution Copper would conduct archaeological data recovery on sites eligible under Criterion D that would be adversely affected. Project materials and archaeological collections would be curated in accordance with 36 CFR 79 (Curation of Federally-Owned and Administered Archaeological Collections). All materials recovered from State Trust and private lands and the associated reports will be curated at the Arizona State Museum, Huhugam Heritage Center, or other approved repository.
Source of measure: Programmatic Agreement
Resource affected/impacts being mitigated: Adverse impacts to historic properties, tribal values and cultural heritage
Applicable alternatives: All
Authority to require: As this measure is included in the Programmatic Agreement of which Resolution Copper is a signatory, implementation is required to take place.
Funded by: Resolution Copper
Additional ground disturbance: Yes, but data recovery activities would take place within the area already assumed to be disturbed in the FEIS.

FS-CR-02: GPO Research Design
Other names: RC-210 (DEIS appendix J); PA Measure #B2
Description/overview: The GPO Research Design and data recovery plans detail treatments to resolve adverse effects on historic properties within the GPO project area, with the exception of those in the Oak Flat Federal Parcel. Data recovery would be conducted on archaeological sites eligible for the National Register of Historic Places under Criterion D within the GPO project area. Project materials and archaeological collections would be curated in accordance with 36 CFR 79 (Curation of Federally-Owned and Administered Archaeological Collections). All materials recovered from State Trust and private lands and the associated reports will be curated at the Arizona State Museum, Huhugam Heritage Center, or other approved repository.

Source of measure: Programmatic Agreement
Resource affected/impacts being mitigated: Adverse impacts to historic properties, tribal values and cultural heritage
Applicable alternatives: All
Authority to require: As this measure is included in the Programmatic Agreement of which Resolution Copper is a signatory, implementation is required to take place.
Funded by: Resolution Copper
Additional ground disturbance: Yes, but data recovery activities would take place within the area already assumed to be disturbed in the FEIS.

FS-CR-03: Visual, Atmospheric, Auditory, Socioeconomic, and Cumulative Effects Mitigation Plan
Other names: PA Measure #B3
Description/overview: The Forest Service will ensure that additional mitigation plan(s) are prepared after the publication of the FEIS that describe mitigation measures to address visual, atmospheric, auditory, and cumulative effects on historic properties. The plan or plans will be implemented upon concurrence of all of the signatories to the Programmatic Agreement.
Source of measure: Programmatic Agreement
Resource affected/impacts being mitigated: Adverse impacts to tribal values and cultural heritage
Applicable alternatives: All
Authority to require: As this measure is included in the Programmatic Agreement of which Resolution Copper is a signatory, implementation is required to take place.
Funded by: Resolution Copper

Additional ground disturbance:

Yes, but data recovery activities would take place within the area already assumed to be disturbed in the FEIS.

FS-CR-05: Emory Oak Collaborative Tribal Restoration Initiative

Other names: M-C5; PA Measure #C1

Description/overview:

In partnership with the Tonto National Forest, Resolution Copper will fund the Emory Oak Collaborative Tribal Restoration Initiative, a multi-year restorative fieldwork program for Emory oak groves located in the Tonto National Forest and the Coconino National Forest. The Tonto National Forest will direct the identification and restoration work of the Emory oak groves and fieldwork in consultation with tribal elders from Yavapai-Apache Nation, White Mountain Apache Tribe, San Carlos Apache Tribe, and Tonto Apache Tribe, and Northern Arizona University. Program treatments under consideration for Emory oak groves include installation of select fencing to exclude cattle and large herbivores, invasive species control, shrub canopy thinning, prescribed burns, hand-thinning, mastication, and reseeding through seed transplantation to increase recruitment of juvenile oaks. The program is designed to restore and protect Emory oak groves that are accessed by Apache communities for traditional subsistence gathering and ensure their sustainability for future generations.

Source of measure:

Programmatic Agreement

Resource affected/impacts being mitigated:

Emory oak groves, particularly those that will be lost at Oak Flat; adverse impacts to tribal values and cultural heritage

Applicable alternatives:

All

Authority to require:

As this measure is included in the Programmatic Agreement of which Resolution Copper is a signatory, implementation is required to take place.

Funded by:

Resolution Copper

Additional ground disturbance:

Treatments under consideration for Emory oak groves include installation of select fencing to exclude cattle and large herbivores, invasive species control, shrub canopy thinning, prescribed burns, mastication, and reseeding through seed transplantation to increase recruitment of juvenile oaks. Total ground disturbance is to be determined.

FS-CR-06: Tribal Cultural Heritage Fund
Other names: PA Measure #C3
Description/overview: Resolution Copper shall establish a cultural fund, through an endowment managed by an organization recognized as exempt under Internal Revenue Code section 501(c)(3), to partially address the physical and visual effects on the *Chi'chil Biłdagoteel* Historic District and other historic properties significant to Tribes. The concept of this fund was developed through government-to-government consultation and its purpose is to provide a fund from which Tribes could request financial support for activities that do not fit under the other tribal-related funding programs. Examples of tribal requests include but are not limited to direct funding to assist with new and existing tribal projects and programs. Monies from the cultural fund will be available to the following Tribes for completion of cultural preservation projects: the 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.
Source of measure: Programmatic Agreement
Resource affected/impacts being mitigated: Adverse impacts to tribal values and cultural heritage
Applicable alternatives: All
Authority to require: As this measure is included in the Programmatic Agreement of which Resolution Copper is a signatory, implementation is required to take place.
Funded by: Resolution Copper
Additional ground disturbance: No additional ground disturbance would take place.

FS-CR-07: Archaeological Database Funds
Other names: PA Measure #C6
Description/overview: In recognition of the substantial loss of cultural resources and historic properties on State Trust lands occurring through development of the preferred alternative, Resolution Copper shall fund the creation and/or enhancement of existing electronic archaeological databases to assist the State of Arizona with management of these assets. The funding shall be deposited into a restricted fund for the State's use in two installments. The first installment shall be deposited within 6 months of either (i) issuance of the final ROD, or (ii) State funding of the electronic database project, whichever is later, so long as the first installment has been funded the second installment shall be funded within 60 days of Notice to Proceed. If the first installment has not been made at the time of Notice to Proceed, both first and second installments shall be made when the State funds the electronic database project.

Source of measure: Programmatic Agreement
Resource affected/impacts being mitigated: Adverse impacts to historic properties, tribal values, and cultural heritage
Applicable alternatives: All
Authority to require: As this measure is included in the Programmatic Agreement of which Resolution Copper is a signatory, implementation is required to take place.
Funded by: Resolution Copper
Additional ground disturbance: No additional ground disturbance would take place.

FS-CR-08: Tribal Education Fund
Other names: PA Measure #C4
Description/overview: To partially address effects on the *Chí'chil Bildagoteel* Historic District and other historic properties significant to Tribes, Resolution Copper shall establish a fund, through an endowment to be managed by an organization recognized as exempt under Internal Revenue Code section 501(c)(3), dedicated to funding scholarships for tribal members pursuing post-high school education, at a college, university, vocational school, or accredited two-year program. Scholarships will be awarded based upon a committee's review of applicants.
Source of measure: Programmatic Agreement
Resource affected/impacts being mitigated: Adverse impacts to historic properties, tribal values and cultural heritage
Applicable alternatives: All
Authority to require: As this measure is included in the Programmatic Agreement of which Resolution Copper is a signatory, implementation is required to take place.
Funded by: Resolution Copper
Additional ground disturbance: No additional ground disturbance would take place.

RC-CR-04: Increase size of Apache Leap Special Management Area
Other names: None
Description/overview: Resolution Copper will donate 32 acres of privately owned land within the Apache Leap South End Parcel, in addition to 807 acres of land required by Section 3003 of PL 113-291. With this additional land, the Apache Leap Special Management Area (SMA), a sacred landscape for the Apache and Yavapai, will be 839 acres. The Apache Leap SMA is named after its signature feature, an escarpment of sheer cliff faces and hoodoos, and preserves the natural character of Apache Leap, allows for traditional uses of the area by Native Americans, and protects and conserves the cultural and archaeological resources of the area. Upon completion of the land exchange outlined in Section 3003 of PL 113-291, the additional 32 acres will be transferred into Federal ownership and the entire Apache Leap SMA will include only Federal lands. This measure would mitigate impacts on cultural and tribal values and would require no additional ground disturbance.
Source of measure: Resolution Copper
Resource affected/impacts being mitigated: Adverse impacts to tribal values and cultural heritage
Applicable alternatives: All
Authority to require: As this measure is included in the Programmatic Agreement of which Resolution Copper is a signatory, implementation is required to take place.
Funded by: Resolution Copper
Additional ground disturbance: No additional ground disturbance would take place.

Required and Voluntary Measures for Socioeconomics/Environmental Justice (6 measures)

FS-SO-01: Community Development Fund

Other names: M-C1; PA Measure #C5

Description/overview:

Resolution Copper shall establish a fund, through an endowment to be held by an organization recognized as exempt under Internal Revenue Code section 501(c)(3), to be focused on the built environment located within the visual/atmospheric/socioeconomic and cumulative effects APE.
The primary purpose of the fund is to address effects from the project on historic properties and other community infrastructure within the communities of Superior, Miami, Globe, Kearny, Hayden, and Winkelman. The monies in the fund will financially support a revolving loan program that will be administered by an organization that has experience in managing, investing, distributing, and reporting funds held for 501(c)(3) purposes and will be overseen by an appropriate governance structure that will be developed, and will permit the implementation of the funding described in this stipulation.
Applications for use of monies from the Community Development Fund shall be reviewed by a committee consisting of representatives from SHPO, the applicable administrating organization, and the affected communities. All funded projects must comply with the Secretary of the Interior's Standards for the Treatment of Historic Properties and compliance with these Standards will be determined by SHPO.
The endowment will be funded within 60 days of Notice to Proceed. Specific parameters for the Community Development Fund shall be defined through consultation between Resolution Copper, applicable administering organization, and SHPO, and must include:

- availability to municipalities, counties, non-profits, private citizens, and private organizations;
- preference for projects participating in other historic preservation incentive programs;
- preference for projects agreeing to repay funds within 5 years of award, with extensions possible.

Purchase or rehabilitation of the Harding building in Superior (a specific suggestion made in public comments) is a project that may be covered by this fund.

Source of measure:

Programmatic Agreement

Resource affected/impacts being mitigated:

Adverse impacts to historic properties

Applicable alternatives:

All

Authority to require:

As this measure is included in the Programmatic Agreement of which Resolution Copper is a signatory, implementation is required to take place.

Funded by:

Resolution Copper

Additional ground disturbance:

None.

FS-SO-02: Establish foundations for long-term funding, including the Tribal Monitor Program
Other names: M-C4; PA Measure #C2
Description/overview: Resolution Copper worked with the Forest Service to fund training and facilitate the employment of tribal members from the consulting Tribes to work on the project. More than 50 tribal members have been trained and 30 tribal members from seven Native American tribes are employed as tribal monitors, all funded by Resolution Copper. The program has been in place for over 2 years with approximately $1.8 million paid to tribal members in wages and benefits in 2018 and 2019. Tribal monitors will be employed for the implementation of the Oak Flat Historic Properties Treatment Plan (HPTP) and the GPO HPTPs. Resolution Copper will establish a foundation or foundations for funding the continuation of the Tribal Monitor Program, long-term maintenance and monitoring of the Emory Oak Collaborative Tribal Restoration Initiative, and development of a Tribal Youth Program in partnership with the Forest Service and consulting Tribes. All three programs will be available to the following Tribes: the 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.
Source of measure: Programmatic Agreement. With respect to the Tribal Monitor Program, during formal consultation between the Forest Service and Native American Tribes, Tribes requested the opportunity to have members of their own communities survey the land and prepare reports in their own words to have tribal “eyes and ears” on the project.
Resource affected/impacts being mitigated: Adverse impacts to tribal heritage and values
Applicable alternatives: All
Authority to require: As this measure is included in the Programmatic Agreement of which Resolution Copper is a signatory, implementation is required to take place.
Funded by: Resolution Copper
Additional ground disturbance: None.

RC-SO-03: Establish a regional economic development entity for Copper Triangle communities
Other names: M-S1; M-S13; M-S22; M-S27
Description/overview: Through investment of an initial endowment, Resolution Copper will develop a sustainable regional economic development entity (or entities) to provide programming and investment in the Copper Triangle communities (Superior, Hayden, Winkelman, and Kearney). This new community-based entity will partner with external organizations, local municipalities, and stakeholders. Specifically, partnerships will be sought with organizations having certain expertise and tools to support and enhance the quality of life in the region, such as strategic planning for economic reinvestment and workforce development.
Source of measure: Resolution Copper; public comments
Resource affected/impacts being mitigated: Adverse socioeconomic impacts within the Copper Triangle
Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Funded by: Resolution Copper
Additional ground disturbance: None.

RC-SO-04: Resolution Copper social investment program
Other names: M-R14
Description/overview: The Resolution Copper social investment program and corporate giving program have been established to support economic development and enhance quality of life. This includes programs that help create a diverse local business community and programs that help build a healthier and safer community, including parks/pool facilities and schools. Through these programs Resolution Copper has worked with cities, towns, governments, and school districts to fund existing projects, including pool repair and upgrades as well as school programs. These requests are defined and based on the needs of those local municipalities and school districts.
Source of measure: Resolution Copper; public comments
Resource affected/impacts being mitigated: Adverse socioeconomic impacts within the Copper Triangle

Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Funded by: Resolution Copper
Additional ground disturbance: None.

RC-SO-05: Continue funding Community Working Group
Other names: M-S17; M-W7
Description/overview: Based on regular project budgeting, Resolution Copper plans to continue funding the Community Working Group. Working with the Community Working Group, and combined with Rio Tinto corporate requirements for health, safety, and environmental protection, Resolution Copper will ensure all possible measures are taken to identify and mitigate public health, safety, and environmental issues before they occur, with transparency with local communities. Additionally, Resolution Copper will comply with the Rio Tinto Community and Social Performance Standard, which requires comprehensive engagement throughout the life of the project. The standard specifically requires effective engagements with communities on social, environmental, and other issues, disclosure of project-related information, and consultation with communities on matters that directly affect them, throughout the life of the project. This involvement includes continuing the Community Monitoring Program.
Source of measure: Resolution Copper; public comments
Resource affected/impacts being mitigated: Public safety and community engagement
Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Funded by: Resolution Copper
Additional ground disturbance: None.

RC-SO-06: Agreement with Town of Superior to cover direct costs
Other names: M-S11
Description/overview: Projected tax increases are a factor of Resolution Copper's business impacts on the Town of Superior, driven mainly through increased sales taxes from Resolution Copper employees and contractors within the town, and to a lesser extent property and sales tax increases benefiting the Town through Pinal County and State apportionments. Resolution Copper has historically paid the Town for more public safety coverage than a standard level of service requires at a mine site. Resolution Copper is committed to public safety and will continue to work with the Town to agree annually on projected net direct costs that will be Resolution Copper's responsibility.
Source of measure: Resolution Copper; Town of Superior; public comments
Resource affected/impacts being mitigated: Public safety and infrastructure
Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Funded by: Resolution Copper
Additional ground disturbance: None.

Required and Voluntary Measures for Livestock and Grazing (1 measure)

RC-LG-01: Mitigation for impacts to ranching and grazing leases
Other names: M-S28
Description/overview: Resolution Copper has and will continue to work collaboratively with ranchers who hold private property and/or grazing leases/rights within the vicinity of the proposed project footprint. To minimize ranching impacts, the corridor pipeline/power line has been designed consistent with feedback from ranchers to have minimal impact on ranching land uses and day-to-day activities. In the event that other ranching and range improvements may be impacted in the future, Resolution Copper would replace those improvements as a result of the construction of the pipeline corridor. Range fencing will be opened during pipeline construction with temporary fencing installed at the end of each workday to prevent livestock migration. Permanent repairs will be made to the fencing, including a gate to permit right-of-way access for inspection and maintenance activities along the pipeline corridor.
Source of measure: Resolution Copper; public comments

Resource affected/impacts being mitigated: Livestock grazing and socioeconomics
Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Funded by: Resolution Copper
Additional ground disturbance: None.

Other Mitigation and Monitoring Measures Not Considered in Chapter 3 Impacts Analysis (Potential Future Measures)

While not analyzed for effectiveness in the FEIS, other mitigation and monitoring measures were suggested during the scoping process, during alternatives development, during public comments on the DEIS, or would be likely under a permit or authorization required for the mine. As stated above, the Forest Service has the authority to require mitigation to limit impacts on Forest Service surface resources, but no delegated authority over those mitigation actions imposed by another regulating authority or on private land outside of regulating authorities.

The Forest Service would not have authority to require the items listed below, but they could be implemented in the future to limit impacts. These measures were not considered within the analysis of the FEIS.

Mitigation and Monitoring that could be Required by Other Regulatory and Permitting Agencies

Potential mitigation and monitoring measures associated with the permits listed below are within the authority of other regulatory permitting agencies and could be required, including the Arizona Department of Environmental Quality and Arizona Department of Water Resources. The Forest Service has no authority, obligation, or expertise to determine or enforce compliance for the measures associated with the permits listed in this section, as they have not yet been required by other agencies nor agreed to by Resolution Copper. The mitigation and monitoring measures in this section include permit requirements and stipulations from legally binding permits and authorizations such as the air quality permit, Aquifer Protection Permit, and groundwater withdrawal permit.

Many of these permits are not yet issued but are anticipated to be issued prior to approval of the final mining plan of operations or special use permit. Those permits received prior to the issuance of the final ROD may need to be modified to reflect the alternative selected by the deciding official. These regulatory and permitting agencies would share monitoring results and any instances of noncompliance with the Forest Service. 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 final ROD and compliance with the final mining plan of operations or special use permit. Some of the other permits, licenses, and authorizations (see FEIS table 1.5.4-1 in chapter 1) that are anticipated to be required for the mine to be operational (and may involve additional mitigations beyond those noted here) include:

- Aquifer Protection Permit (APP)
- Arizona Pollutant Discharge Elimination System (AZPDES) Permit
- Clean Water Act Section 401 Certification[1]
- Special Use Permits
- Project-Specific Section 404 Clean Water Act Permit
- Air Quality Control Permit

[1] The 401 water quality certification was issued by the Arizona Department of Environmental Quality on December 22, 2020.

Potential Future Measures for Transportation and Access (2 measures)

PF-TA-01: Replace access if NFS Road 2438 is closed due to subsidence
Other names: M-R23; M-R37
Description/overview: For areas east and south of the mine/Oak Flat (Devil's Canyon): NFS Road 315 from State Route 177 will remain open to allow public access to the areas south and east of the mine site for Lower Devil's Canyon. The existing Forest Service Road Maintenance Level is "Level 2 – High Clearance Vehicles." For access to upper Devil's Canyon, NFS Road 2438 and/or 2439 via NFS Road 469 (Magma Mine Road) will most likely remain. However, in the event that parts of NFS Road 2438 are closed due to subsidence, Resolution Copper will work with local climbing groups and climbers to evaluate the feasibility of an alternate access route. Access to Northern Devil's Canyon will remain open from U.S. 60 to NFS Road 342 (North Cerro Road). Rationale for including as a potential future measure: Resolution Copper provided this potential mitigation in response to the Forest Service on mitigation suggestions raised in public comments.
Source of measure: Resolution Copper; public comments
Resource affected/impacts being mitigated: Transportation and access; recreation
Applicable alternatives: All
Possible authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Additional ground disturbance: No additional ground disturbance anticipated.

PF-TA-02: Mitigation for adverse impacts on existing transportation facilities
Other names: None
Description/overview: 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 Level of Service (LOS) and potential safety impacts caused by mine traffic: • Install new stop signs at minor approaches to intersections as needed and subject to appropriate approval by Arizona Department of Transportation (ADOT). • Use flaggers or a temporary traffic signal as necessary to assist with turning movements at project intersections during peak construction, subject to appropriate approval by ADOT. Include advance warning signage such as CONSTRUCTION TRAFFIC or similar signs to alert drivers to any construction-related changes in roadway conditions.

- Stripe a new eastbound left-turn lane for the intersection of Main Street/Lonetree Road (Smeltertown Road), subject to appropriate approval by the Town of Superior.
- Construct and stripe a new westbound right-turn lane for the intersection of U.S. 60/Main Street, subject to appropriate approval by ADOT.

In all cases, Resolution Copper has indicated that the impacts to be addressed are temporary only, and that the proposed mitigations may be more harmful than helpful.

If any of these mitigations were to be implemented, it would likely be after monitoring of actual traffic impacts and safety conditions during construction and operations.

Source of measure:

Tonto National Forest

Resource affected/impacts being mitigated:

Transportation, public health and safety

Applicable alternatives:

All

Possible authority to require:

Local traffic authorities

Additional ground disturbance:

No measurable new ground disturbances are anticipated.

Potential Future Measures for Water Resources (3 measures)

PF-WR-01: Create and maintain public information repository

Other names: GP-79 (DEIS appendix J); M-G1; M-W6

Description/overview:

Create and maintain a public information repository, such as a community website, where all information on project monitoring and related matters is readily available in a timely manner, including water quality monitoring data.

Rationale for including as a potential future measure: There is merit in having a central clearinghouse of project-specific information for the public to access, restricted primarily to information submitted to government agencies as required under permits, but no single agency (including the Forest Service) is in a position to undertake that responsibility.

Source of measure:

Public comments

Resource affected/impacts being mitigated:

Water resources

Applicable alternatives:

All

Possible authority to require:

None known at this time

Additional ground disturbance:

No additional ground disturbance anticipated.

PF-WR-02: Divert existing flows across the subsidence area to preserve downstream flows

Other names: M-W26

Description/overview:

Public comments suggested that existing flows (surface runoff during storm events) be diverted across the subsidence area in order to preserve downstream flows, if possible. This concept was also raised by Forest Service specialists during the Groundwater Modeling Workgroup prior to publication of the DEIS.

Rationale for including as a potential future measure: Resolution Copper indicated in their responses to the Forest Service on mitigation suggestions raised in public comments, that to the extent practicable and before subsidence starts, Resolution Copper will evaluate the practicability of implementing diversion around the subsidence area. The majority of upgradient surface runoff that would flow towards the subsidence area would have to pass over the Resolution Copper East Plant Site infrastructure complex which sits between the source and the subsidence area. Minimizing that flow across infrastructure would be accomplished by diverting water around the facility and into Queen Creek and Devil's Canyon. This would also minimize the amount of flow lost to the subsidence area.

Source of measure:

Resolution Copper; public comments

Resource affected/impacts being mitigated:

Socioeconomic resources; water quality and water supply

Applicable alternatives:

All

Authority to require:

As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.

Additional ground disturbance:

None.

PF-WR-03: Mitigation of effects of water level declines

Other names: M-W32

Description/overview:

Arizona Water Company submitted comments on the DEIS requesting that appropriate funding or bonding be in place to ensure the project will not cause any significant water level declines or water quality impacts. While such mitigation is in place for water level declines caused by dewatering near the mine site (see measure FS-WR-01), no such protections are in place for the area near the Desert Wellfield in the East Salt River valley.

Rationale for including as a potential future measure: The EIS analysis discloses that water quality impacts and significant water level declines are not anticipated in any areas associated with Arizona Water Company water supply systems. However, Resolution Copper notes: "If there are unique situations where water users will be impacted because of well siting requirements, for example, Resolution will work with these impacted stakeholders to mitigate effects of a water level decline caused by the project." This mitigation measure is being included in the event remedies in the future could be warranted.
Source of measure: Resolution Copper; public comments
Resource affected/impacts being mitigated: Socioeconomic resources; water quality and water supply
Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Additional ground disturbance: None.

Potential Future Measures for Wildlife (1 measure)

PF-WI-01: Voluntary achievement of "no net loss" of habitat
Other names: M-WL47
Description/overview: Continue collaboration on a voluntary compensatory plan, beyond what is legally mandated, to achieve no net loss of habitat. Rationale for including as a potential future measure: Many aspects of the project design and mitigation will already replace habitat impacted by the mine or will prevent impacts from occurring. This includes preventing riparian and aquatic impacts associated with springs and perennial streams through water replacement if needed, reestablishment of habitat through reclamation, new riparian habitat brought forward as part of the compensatory mitigation under the Section 404 permit, as well as the offered lands coming into Federal ownership that contain desirable habitat. Although there is no legal mandate or regulatory requirement, the goal expressed in the mitigation measure—no net loss of habitat—is an aspirational goal that would have long-term benefits to wildlife in the region. Future mitigations could be considered to bring the project closer to this goal.
Source of measure: Public comments
Resource affected/impacts being mitigated: Wildlife habitat
Applicable alternatives: All

Possible authority to require:
None known at this time
Additional ground disturbance:
No additional ground disturbance anticipated.

Potential Future Measures for Recreation (3 measures)

PF-RC-01: Purchase lands in the "Preserve"
Other names: M-L2
Description/overview:
Purchase and transfer to Federal ownership a considerable portion of the lands suggested as "Preserve" in the Superstition Area Land Plan, an inclusive, 105-square mile study conducted by Superstition Area Land Trust in the early 2000s, with particular emphasis on adding land that would serve as a buffer between the south border of the Superstition Wilderness Area and Phoenix.
Rationale for including as a potential future measure: Congressional intent was that the land exchange was to take place, and mitigation for any impacts caused by the exchange of land is not required; regardless, the Forest Service is already requiring a robust mitigation package that will offset recreational impacts associated with the loss of Federal land base upon which recreation can occur. While not necessary to offset the impacts from the Resolution Copper Project, this potential mitigation expresses a long-term vision for maintaining regional open space and an enhanced recreational land base.
Source of measure:
Public comments
Resource affected/impacts being mitigated:
Recreation
Applicable alternatives:
All
Possible authority to require:
None known at this time
Additional ground disturbance:
No additional ground disturbance anticipated.

PF-RC-02: Develop MARRCO corridor for tourism; reactivate rail
Other names: M-S6
Description/overview:
Reactivating the existing rail line along the MARRCO corridor for tourism is not planned as part of the project. However, approval and construction of the proposed action does not foreclose potential other uses of the corridor in the future after sufficient discussion and analysis to address safety issues.

Rationale for including as a potential future measure: Resolution Copper dismissed reactivation of the rail system measure for operational and safety concerns. However, they also noted, "Approval and construction of the proposed action does not foreclose potential other uses of the corridor in the future after sufficient discussion and analysis to address safety issues. Resolution Copper would work with the Town of Superior and other stakeholders if such uses were proposed in the future."

Source of measure:

Resolution Copper; public comments

Resource affected/impacts being mitigated:

Socioeconomic resources

Applicable alternatives:

All

Authority to require:

As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.

Additional ground disturbance:

None.

PF-RC-03: Fund extension of the Legends of Superior Trails (LOST) Queen Creek segment

Other names: M-R27

Description/overview:

Public comments suggested that Resolution Copper fund the extension of the Legends of Superior Trails (LOST) Queen Creek segment south across the base of Apache Leap.

Rationale for including as a potential future measure: The Forest Service is already requiring a robust mitigation package to offset recreational impacts (motorized trails, non-motorized trails, and camping). The proposed trail is not identified in the management plan for the Apache Leap Special Management Area and would require additional specific proposals and appropriate NEPA clearance to implement. However, this potential mitigation could be compatible with the long-term regional trail system, including the Forest Service recreational mitigation package (FS-RC-03).

Source of measure:

Public comments

Resource affected/impacts being mitigated:

Recreation

Applicable alternatives:

All

Authority to require:

None known at this time

Additional ground disturbance:

None.

Potential Future Measures for Socioeconomic/Environmental Justice (2 measures)

PF-SO-01: Mitigation for reduction in property values
Other names: M-S26
Description/overview: The EIS analysis discloses that property values could be reduced due to proximity to the tailings storage facility, or other impacts such as changes in water quality. Public comments suggest that Resolution Copper compensate for any property value reductions. Rationale for including as a potential future measure: Impacts assigned to the tailings storage facility in public comments are not necessarily borne out by the EIS analysis. For instance, noise and traffic impacts associated with the tailings storage facility do not exceed any designated thresholds. However, the one situation in which nearby landowners may experience substantial impact is the potential for tailings seepage to impact downstream private wells. While the EIS predictions indicate that in most cases the numeric Arizona aquifer water quality standards would be met—and State permitting requirements would ensure this is the case—increases in other constituents such as sulfate and total dissolved solids could still degrade water quality and impact downstream property owners. Resolution Copper dismissed this mitigation measure but also noted that "Resolution Copper has already purchased properties in the footprint and vicinity of the Tailings Storage Facility to address this concern." This mitigation measure is being included as similar remedies in the future may be warranted.
Source of measure: Resolution Copper; public comments
Resource affected/impacts being mitigated: Socioeconomic resources; water quality and water supply
Applicable alternatives: All
Authority to require: None known at this time
Additional ground disturbance: None.

PF-SO-02: Commitment to continue and possibly expand existing apprenticeship program
Other names: M-S21
Description/overview: Resolution Copper established its Apprenticeship Program when it identified specific workforce needs to manage additional maintenance activities associated with the operation of the new Shaft 9 infrastructure and equipment. The Apprenticeship Program filled those workforce needs through the hiring and training of local individuals. The Apprenticeship Program includes free tuition, books, equipment, exam costs, lab fees, practical application training under a Resolution Copper Journeyman, and full-time employment at Resolution Copper. This program has been ongoing since 2018, and 12 individuals are scheduled to complete the program in December 2020.

Rationale for including as a potential future measure: In response to the Tonto National Forest on mitigation suggestions raised in public comments, Resolution Copper notes that the current program may be used to form the basis of a future program that can be expanded as Resolution Copper identifies specific skills needed for construction and operations.
Source of measure: Public comment
Resource affected/impacts being mitigated: Socioeconomics
Applicable alternatives: All
Authority to require: As an applicant-proposed mitigation measure, implementation is not assured; however, if included as a stipulation or requirement in a permit it may become required.
Additional ground disturbance: None.

Appendix K. Summary of Content of Resource Analysis Process Memoranda

Analysis Process Memoranda

Overview of Process

Under the National Environmental Policy Act of 1969, as amended (NEPA), the U.S. Department of Agriculture Forest Service (Forest Service) is responsible for taking a "hard look" at potential impacts from the Resolution Copper Project and Land Exchange (project) using the best available information and science. The project involves multiple facilities, multiple phases, a large and diverse geographic area, and several exceptionally complex analyses, including subsidence modeling, groundwater modeling, and geochemical modeling. A substantial amount of detailed documentation is necessary to describe the analysis approaches, assumptions, and results.

At the same time, the Forest Service has strived to make the environmental impact statement (EIS) accessible and understandable, as is made clear in the Council on Environmental Quality (CEQ) regulations that were in effect for this final EIS (FEIS; emphasis added):

> 40 Code of Federal Regulations (CFR) 1502.2 – Implementation
>
> To achieve the purposes set forth in §1502.1 agencies shall prepare environmental impact statements in the following manner:
>
> (a) Environmental impact statements shall be *analytic rather than encyclopedic*.
>
> (b) Impacts shall be discussed in proportion to their significance. There shall be *only brief discussion of other than significant issues*. As in a finding of no significant impact, there should be only enough discussion to show why more study is not warranted.
>
> (c) Environmental impact statements shall be *kept concise and shall be no longer than absolutely necessary* to comply with NEPA and with these regulations. Length should vary first with potential environmental problems and then with project size.
>
> 40 CFR 1502.8 – Writing
>
> Environmental impact statements shall be *written in plain language and may use appropriate graphics* so that decisionmakers and the public can readily understand them. Agencies should employ writers of clear prose or editors to write, review, or edit statements, which will be based upon the analysis and supporting data from the natural and social sciences and the environmental design arts.

To accomplish this balance, some details of the complex analysis have been left out of the EIS itself. These details are still available to the public in a series of memoranda, one for each resource in chapter 3. This is consistent with CEQ regulations:

> 40 CFR 1502.21 – Incorporation by reference
>
> Agencies shall incorporate material into an environmental impact statement by reference when the effect will be to cut down on bulk without impeding agency and public review of the action. The incorporated material shall be cited in the statement and its content briefly described. No material may be incorporated by reference unless it is reasonably available for inspection by potentially interested persons within the time allowed for

comment. Material based on proprietary data which is itself not available for review and comment shall not be incorporated by reference.

The purpose of this appendix is to summarize the available memoranda and the contents in each. Table K-1 shows a summary of the available process memoranda. Each subsection briefly summarizes the topics included in the individual process memoranda.

Table K-1. Summary of analysis process memoranda

Resource	Reference
Geology, Minerals, and Subsidence	Newell and Garrett (2018a)
Soils, Vegetation, and Reclamation	Newell (2018g)
Noise and Vibration	Newell (2018d)
Transportation and Access	Newell (2018h)
Air Quality	Newell et al. (2018)
Water Resources	Newell and Garrett (2018d)
Wildlife	Newell (2018j)
Recreation	Newell (2018e)
Public Health and Safety	Newell and Garrett (2018b)
Scenic Resources	Newell and Grams (2018)
Cultural Resources	Newell (2018a)
Socioeconomics	Newell (2018f)
Tribal Values and Concerns	Newell (2018i)
Environmental Justice	Newell (2018b)
Livestock and Grazing	Newell (2018c)

Geology, Minerals, and Subsidence

The content of the process memorandum that supports the "Geology, Minerals, and Subsidence" section of chapter 3 includes the following:

- Detailed Information Supporting EIS Analysis
  - Resource Analysis Area
  - Analysis Methodology
    - Approach – Baseline Data
    - Approach – Subsidence Modeling
    - Approach – Vetting of Geologic and Subsidence Modeling
    - Status of Geology and Subsidence Workgroup

  - Detailed Information on Geologic Framework and Geologic Units
    - Regional Geology
    - Regional Geologic Units
    - Structural Geology and Faults
    - Local Geology of Mine Area and Associated Infrastructure
      - Mineral Deposit
      - Tailings Storage Facility Area – Alternatives 2 and 3
      - Tailings Storage Facility Area – Alternative 4
      - Tailings Storage Facility Area – Alternative 5
      - Tailings Storage Facility Area – Alternative 6
      - East Plant Site
      - West Plant Site
      - Tunnels between East and West Plant Sites
      - Magma Arizona Railroad Company (MARRCO) Corridor
      - Filter/Loadout Facility
      - Pipeline Corridors
- Regulations, Laws, and Guidance
- Key Documents and References Cited for Geology, Minerals, and Subsidence

Soils, Vegetation, and Reclamation

The content of the process memorandum that supports the "Soils, Vegetation, and Reclamation" section of chapter 3 includes the following:

- Detailed Information Supporting EIS Analysis
  - Resource Analysis Area
  - Analysis Methodology and Selected Outcomes
    - Soils
    - Revegetation
    - Vegetation Communities, Noxious Weeds, and Special Status Plant Species
    - Concern for Impacts to Stability from Revegetation
    - Previous and Existing Disturbance
    - Assessment of Need to Collect Additional Information
- Regulation, Laws, and Guidance
- Key Documents and References Cited for Soils, Vegetation, and Reclamation
- Appendix 1: Additional Information for Vegetation Communities Affected Environment
  - Table A1-1. Vegetation Communities Acreage
  - Table A1-2. Special Status Plant Species Analyzed for Alternatives 2 and 3
  - Table A1-3. Special Status Plant Species Analyzed for Alternative 4
  - Table A1-4. Special Status Plant Species Analyzed for Alternative 5
  - Table A1-5. Special Status Plant Species Analyzed for Alternative 6

  - Table A1-6. Noxious and Invasive Weed Species Analyzed for Alternatives 2 and 3
  - Table A1-7. Noxious and Invasive Weed Species Analyzed for Alternative 4
  - Table A1-8. Noxious and Invasive Weed Species Analyzed for Alternative 5
  - Table A1-9. Noxious and Invasive Weed Species Analyzed for Alternative 6
- Appendix 2: Detailed Soil Analysis Results
  - Table A2-1. Acreage and susceptibility to wind/water erosion – Alternative 2
  - Table A2-2. Acreage and susceptibility to wind/water erosion – Alternative 3
  - Table A2-3. Acreage and susceptibility to wind/water erosion – Alternative 4
  - Table A2-4. Acreage and susceptibility to wind/water erosion – Alternative 5
  - Table A2-5. Acreage and susceptibility to wind/water erosion – Alternative 6

Noise and Vibration

The content of the process memorandum that supports the "Noise and Vibration" section of chapter 3 includes the following:

- Detailed Information Supporting EIS Analysis
  - Resource Analysis Area
  - Analysis Methodology
    - Noise Modeling
    - Non-Blasting Noise Modeling
    - Blasting Noise Modeling
    - Blasting Vibration Modeling
    - Non-Blasting Vibration Modeling
    - Noise and Vibration Metrics
- Regulation, Laws, and Guidance
- Key Documents and References for Noise and Vibration

Transportation and Access

The content of the process memorandum that supports the "Transportation and Access" section of chapter 3 includes the following:

- Detailed Information Supporting EIS Analysis
  - Resource Analysis Area
  - Analysis Methodology
- Regulation, Laws, and Guidance
- Key Documents and References Cited for Transportation and Access

Air Quality

The content of the process memorandum that supports the "Air Quality" section of chapter 3 includes the following:

- Detailed Information Supporting EIS Analysis
  - Resource Analysis Area
  - Analysis Methodology
    - Ambient Air Quality Monitoring
    - Conformity Analysis for Alternatives 5 and 6 for PM_{10} Non-Attainment Area
    - Emissions of Hazardous Air Pollutants
    - Lead Emissions and Impacts
    - Secondary $PM_{2.5}$ and Ozone Formation
    - Estimate of Indirect Emissions
    - Health Based Risk Assessment Screening
- Regulation, Laws, and Guidance
- Key Documents and References Cited for Air Quality

Water Resources

The content of the process memorandum that supports the "Water Resources" section of chapter 3, which has three subsections, includes the following:

GROUNDWATER QUANTITY AND GROUNDWATER-DEPENDENT ECOSYSTEMS

- Detailed Information Supporting EIS Analysis – Groundwater Quantity and Groundwater-Dependent Ecosystems
  - Resource Analysis Area
  - Analysis Methodology
    - Status of Groundwater Modeling Workgroup
    - Detailed Modeling Results for GDEs Summarized in DEIS
    - Assumption of Hydrologic Connection
    - Assessment of Need to Collect Additional Information
    - Rationale for Use of East Salt River Valley Model for Desert Wellfield
    - Subsidence Related to Groundwater Withdrawal – Desert Wellfield
    - Subsidence Related to Groundwater Withdrawal – East Plant Site
    - Inability to Analyze Individual Wells
    - Available Groundwater in East Salt River Valley
    - Full Detail for Tailings Water Balances
    - Percent Contribution of Spring DC6.6W to Devil's Canyon
- Regulation, Laws, and Guidance – Groundwater Quantity
- Key Documents and References – Groundwater Quantity and Groundwater Modeling

GROUNDWATER AND SURFACE WATER QUALITY

- Detailed Information Supporting EIS Analysis – Groundwater and Surface Water Quality
  - Resource Analysis Area
  - Analysis Methodology

        - Details of Geochemistry Workgroup
        - Assimilative Capacity Calculations
        - Reduced Assimilative Capacity from Reductions in Runoff
        - Existing Groundwater Quality – Frequency of Samples with Concentrations above Standards
        - Evolution of the Fully-Lined Alternative
        - Estimate of Seepage from a Fully Lined Facility
        - Evaluation of Filtered Tailings at Other Tailings Locations
        - Consideration of Consolidation of Tailings in Seepage Analysis
        - Comparison of Alternative 5 and 6 Surface Water Samples to Additional Gila River Water Quality Samples
        - Reasonableness of Peg Leg Values used in Seepage Modeling
        - Reasonableness of Skunk Camp Values used in Seepage Modeling
        - Assessment of Need to Collect Additional Information
        - Calculations of Pollutant Loading for Constituents of Concern from Each Alternative
        - Analysis for Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM)
        - Details of Mixing Model Construction
        - Mounding Analysis
- Regulation, Laws, and Guidance – Groundwater and Surface Water Quality
- Key Documents and References – Groundwater and Surface Water Quality

SURFACE WATER QUANTITY

- Detailed Information Supporting EIS Analysis – Surface Water Quantity
    - Resource Analysis Area
    - Analysis Methodology
        - Surface Water Effects – Modeling Approaches
        - Floodplains and Lack of Available Data
        - Detailed Floodplain Impacts
        - Detailed Wetland Impacts
        - Acreage Differences
        - Differences in Stormwater and Erosion Control between Alternatives
            - General Sediment and Erosion Control Measures
            - East Plant Site Facility Stormwater Controls
            - West Plant Site Facility Stormwater Controls
            - Filter Plant and Loadout Facility Stormwater Controls
            - Alternatives 2 and 3 Tailings Storage Facility Stormwater Controls
            - Alternative 4 Tailings Storage Facility Stormwater Controls
            - Alternative 5 Tailings Storage Facility Stormwater Controls

        - Alternative 6 Tailings Storage Facility Stormwater Controls
    - Full Details of Streamflow Discharge-Duration-Frequency Analysis
- Regulation, Laws, and Guidance – Surface Water Quantity
- Key Documents and References – Surface Water Quantity

Wildlife

The content of the process memorandum that supports the "Wildlife" section of chapter 3 includes the following:

- Detailed Information Supporting EIS Analysis
    - Resource Analysis Area
    - Analysis Methodology
        - Wildlife Connectivity (Table 1. Wildlife connectivity elements that overlap the analysis area)
        - Special Status Species (Table 2. Special Status Species Potentially Occurring within the Proposed Action Mining Component and its Associated 5-Mile Analysis Area)
        - Management Indicator Species (Table 3. Tonto National Forest MIS Habitat Acreages and Trends in the Project Area)
- Regulation, Laws, and Guidance
- Key Documents and References Cited for Wildlife
- Appendix 1: Wildlife Screening Tables
    - Table A1. Special Status Wildlife Species Analyzed for Alternatives 2 and 3
    - Table A2. Special Status Wildlife Species Analyzed for Alternative 4
    - Table A3. Special Status Wildlife Species Analyzed for Alternative 5
    - Table A4. Special Status Wildlife Species Analyzed for Alternative 6
- Appendix 2: Literature Review of Artificial Light Effects on Wildlife Species

Recreation

The content of the process memorandum that supports the "Recreation" section of chapter 3 includes the following:

- Detailed Information Supporting EIS Analysis
    - Resource Analysis Area
    - Analysis Methodology
- Regulation, Laws, and Guidance
- Key Documents and References Cited for Recreation

Public Health and Safety

The content of the process memorandum that supports the "Public Health and Safety" section of chapter 3, which has three subsections, includes the following:

TAILINGS AND PIPELINE SAFETY

- Detailed Information Supporting EIS Analysis – Tailings and Pipeline Safety
  - Resource Analysis Area
  - Analysis Methodology
    - Available Options for Breach Analysis
      - Empirical Method
      - Rheological and Energy Balance Methods
      - Advanced Modeling
    - Forest Service Chosen Methodology
    - Assessment of Need to Collect Additional Information
- Regulation, Laws, and Guidance – Tailings and Pipeline Safety
- Key Documents and References Cited for Tailings and Pipeline Safety

FUELS AND FIRE MANAGEMENT

- Detailed Information Supporting EIS Analysis – Fuels and Fire Management
  - Resource Analysis Area
  - Analysis Methodology
- Regulation, Laws, and Guidance – Fuels and Fire Management
- Key Documents and References Cited for Fuels and Fire Management

HAZARDOUS MATERIALS

- Detailed Information Supporting EIS Analysis – Hazardous Materials
  - Resource Analysis Area
  - Analysis Methodology
- Regulation, Laws, and Guidance – Hazardous Materials
- Key Documents and References Cited for Hazardous Materials

Scenic Resources

The content of the process memorandum that supports the "Scenic Resources" section of chapter 3 includes the following:

- Detailed Information Supporting EIS Analysis
  - Resource Analysis Area
  - Analysis Methodology
    - Viewshed Analysis
    - Key Observation Points and Contrast Rating Analysis
    - Visual Simulation
    - Additional Detail for Scenery Resources in the Analysis Area
- Regulation, Laws, and Guidance

- Key Documents and References Cited for Scenic Resources
- Appendix A: Viewshed Analyses for each Alternative
- Appendix B: Contrast Rating Worksheets for Each Key Observation Point
- Appendix C: Visual Simulations

Cultural Resources

The content of the process memorandum that supports the "Cultural Resources" section of chapter 3 includes the following:

- Detailed Information Supporting EIS Analysis
  - Resource Analysis Area
  - Analysis Methodology
- Regulation, Laws, and Guidance
- Key Documents and References Cited for Cultural Resources

Socioeconomics

The content of the process memorandum that supports the "Socioeconomics" section of chapter 3 includes the following:

- Detailed Information Supporting EIS Analysis
  - Resource Analysis Area
  - Analysis Methodology
- Regulation, Laws, and Guidance
- Key Documents and References Cited for Socioeconomics

In addition, a key technical report was prepared by BBC Research and Consulting to document the details of the economic modeling and analysis, titled "Socioeconomic Effects Technical Report: Resolution Copper Mine Environmental Impact Statement," and dated November 12, 2018 (BBC Research and Consulting 2018). This report was updated for the FEIS (BBC Research and Consulting 2020).

Tribal Values and Concerns

The content of the process memorandum that supports the "Tribal Values and Concerns" section of chapter 3 includes the following:

- Detailed Information Supporting EIS Analysis
  - Resource Analysis Area
  - Analysis Methodology
- Regulation, Laws, and Guidance
- Key Documents and References Cited for Tribal Values and Concerns

Environmental Justice

The content of the process memorandum that supports the "Environmental Justice" section of chapter 3 includes the following:

- Detailed Information Supporting EIS Analysis
  - Resource Analysis Area
  - Analysis Methodology
- Regulation, Laws, and Guidance
- Key Documents and References Cited for Environmental Justice

Livestock and Grazing

The content of the process memorandum that supports the "Livestock and Grazing" section of chapter 3 includes the following:

- Detailed Information Supporting EIS Analysis
  - Analysis Area
  - Analysis Methodology
    - Reduction in AUMs
- Regulation, Laws, and Guidance
- Key Documents and References Cited for Livestock and Grazing