Arizona Mining Reform Coalition ♦ Access Fund ♦ Center for Biological Diversity ♦ Concerned Citizens and Retired Miners Coalition ♦ Concerned Climbers of Arizona ♦ Earthworks ♦ Maricopa Audubon Society ♦ Patagonia Area Resource Alliance ♦ Save the Scenic Santa Ritas ♦ Save Tonto National Forest ♦ Sierra Club – Grand Canyon Chapter ♦ Sky Island Alliance ♦ Tucson Audubon Society ♦ Valley Unitarian Universalist Congregation – Green Sanctuary ♦ WildEarth Guardians

Alida Q. Montiel and Cyndi Tuell as individuals

July 18, 2016

Neil Bosworth,
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Sent by email to:
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RE: Scoping Comments for the Resolution Copper Mine DEIS

Dear Supervisor Bosworth:

Per the U.S. Forest Service's ("USFS") March 18, 2016 Forest User public scoping notice letter, this letter (and attachments), following are our comments to be considered for scoping of the Draft Environmental Impact Statement ("DEIS") covering the Resolution Copper Mining ("RCM") General Plan of Operations ("GPO"), Initial Submittal: November 15, 2013, Revised: September 23, 2014, Revised: 01/12/2016, and the related Land Exchange.

These comments are submitted on behalf of Arizona Mining Reform Coalition ("AMRC"), Access Fund, Center for Biological Diversity, Concerned Citizens and Retired Miners Coalition, Concerned Climbers of Arizona, Earthworks, Maricopa Audubon Society, Patagonia Area Resource Alliance, Save Tonto National Forest, Save the Scenic Santa Ritas, Sierra Club – Grand Canyon Chapter, Sky Island Alliance, Tucson Audubon Society, Valley Unitarian Universalist Congregation – Green Sanctuary, WildEarth Guardians, and Alida Montiel and Cyndi Tuell as individuals. Any or all of these organizations may also submit additional comments apart from these comments that are also incorporated into these comments.

Organizations

Arizona Mining Reform Coalition works in Arizona to improve state and federal laws, rules, and regulations governing hard rock mining to protect communities and the environment. AMRC works to hold mining operations to the highest environmental and social standards to provide for the long term environmental, cultural, and economic health of Arizona. Members of the

Coalition include: Apache – Stronghold, Center for Biological Diversity, Concerned Citizens and Retired Miners Coalition, Concerned Climbers of Arizona, Dragoon Conservation Alliance, EARTHWORKS, Empire Fagan Coalition, Environment Arizona, Groundwater Awareness League, Maricopa Audubon Society, Save the Scenic Santa Ritas, Grand Canyon Chapter of the Sierra Club, Sky Island Alliance, Spirit of the Mountain Runners, Tucson Audubon Society, and the Valley Unitarian Universalist Congregation.

The **Access Fund** is the national advocacy organization that keeps U.S. climbing areas open and conserves the climbing environment. Founded in 1990, the Access Fund works with nearly 100 local climbing organizations in supporting and representing some 2.3 million climbers nationwide in all forms of climbing: rock, ice, mountaineering, and bouldering.

The **Center for Biological Diversity** is a non-profit public interest organization with headquarters located in Tucson, Arizona, representing more than 1 million members and supporters nationwide dedicated to the conservation and recovery of threatened and endangered species and their habitats. The Center has long-standing interest in projects of ecological significance undertaken in the National Forests of the Southwest, including mining projects.

The **Concerned Citizens and Retired Miners Coalition** is a group of citizens who: 1) reside in Superior, Arizona, or do not reside in Superior, Arizona, but are affiliated with relatives who are residents; 2) are retired hard-rock miners who previously worked in the now non-operational mine in Superior, Arizona, and were displaced due to mine closure or personal disability; or 3) are individuals who are concerned that important U.S. public recreational land will be conveyed to a foreign mining company for private use.

The **Concerned Climbers of Arizona** was organized in 2010 for the purpose of preserving climbing access and the climbing environment. The group advocates for continued recreational access to climbing areas that are threatened by development or other forms of encroachment. Based in Phoenix, Arizona, the Concerned Climbers of Arizona is the primary group representing the interests of rock climbers in central Arizona.

Earthworks is a nonprofit organization dedicated to protecting communities and the environment from the adverse impacts of mineral and energy development while promoting sustainable solutions. Earthworks stands for clean air, water and land, healthy communities, and corporate accountability. We work for solutions that protect both the Earth's resources and our communities.

The **Maricopa Audubon Society's** Mission is to protect the natural world through public education and advocacy for the wiser use and preservation of our land, water, air and other irreplaceable resources. Maricopa Audubon Society members have led the Superior Christmas Bird Count in and around Oak Flat and Tonto National Forest for years. Our members bird, hike, camp and enjoy other activities in the natural areas which this project proposes to convert to a mine and tailings pile.

Patagonia Area Resource Alliance is a non-profit community watchdog organization that monitors the activities of mining companies, as well as ensures government agencies' due

diligence, to make sure their actions have long-term, sustainable benefits to public lands and water resources in Patagonia and the State of Arizona.

Save the Scenic Santa Ritas is a non-profit organization that is working to protect the Santa Rita and Patagonia Mountains from environmental degradation caused by mining and mineral exploration activities.

Save Tonto National Forest works to protect our National Forest and promote safe and responsible use by all groups of outdoor enthusiasts. We are based in Queen Valley, Arizona and have around 260 members concerned about the direction the Tonto National Forest is going.

Sierra Club is one of the nation's oldest and most influential grassroots organizations whose mission is "to explore, enjoy, and protect the wild places of the earth; to practice and promote the responsible use of the earth's ecosystems and resources; and to educate and enlist humanity to protect and restore the quality of the natural and human environments." Sierra Club has more than 2.4 million members and supporters with 40,000 in Arizona as part of the Grand Canyon (Arizona) Chapter. Our members have long been committed to protecting and enjoying the Tonto National Forest and have a significant interest in the proposed Resolution Copper Mine and related activities.

Sky Island Alliance works to protect and restore the biodiversity and natural heritage of the Sky Islands in the Sky Island region of the southwestern United States and northwestern Mexico. We work with volunteers, scientists, landowners, and government agencies to establish protected areas, restore healthy landscapes, and promote public appreciation of the region's unique biological diversity.

Tucson Audubon Society was established in 1949. The Tucson Audubon Society (Tucson Audubon) is a 501(c)(3) non-profit conservation organization, and is the third largest local Audubon chapter in the nation. Tucson Audubon inspires people to enjoy and protect birds through recreation, education, conservation and restoration of the environment upon which we all depend. Tucson Audubon advocates statewide for the sustainability, resilience, preservation, restoration and connectivity of habitats utilized by birds and other wildlife.

Valley Unitarian Universalist Congregation – Green Sanctuary of Chandler Arizona is an environmental advocacy group, accredited by the national Unitarian Universalist Association. The Work of our team focuses on projects that (1) worship and celebrate nature and the Earth; (2) sustain and conserve our natural resources; (3) promote environmental justice; and (4) educate members of the community on environmental issues.

WildEarth Guardians is a nonprofit conservation organization with offices in seven states. they have more than 160,000 members and activists across the United States and the world. WildEarth Guardians protects and restores wildlife, wild places, wild rivers, and the health of the American West. Toward this end, Guardians and its members work to protect the natural and cultural features of landscapes within national forests and other public lands, including their wildlife.

Alida Q. Montiel is Yolloincuauhtli and a teacher of indigenous traditional dance. She has a strong concern for the preservation of Oak Flat, a sacred and special place of the Apache people.

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Project Background

The proposal upon which we are commenting includes both a land exchange (which is currently mandated to be consummated within 60 days of the publishing of a Final Environmental Impact Statement by US law), and a large underground block cave mine and supporting facilities. The proposed mine would take place on a mix of federal public land, Arizona state trust land, and private land. The mine proposal includes a mine site at Oak Flat (East Plant Site), a processing facility (West Plant Site), a tailings dump site, a railroad/utility/pipeline corridor (MARRCO), and loading/filter plants site, and an unidentified final processing/smelter site(s) and associated travel routes. The identified portion of the project footprint encompasses approximately 10,000 acres and stretches more than 30 miles from East to West.

The land exchange includes 5,000 acres of land now purportedly under control of Rio Tinto and now private land.

The project is proposed by Resolution Copper, a wholly owned subsidiary of Rio Tinto, and BHP-Billiton, two huge foreign mining companies. The project is managed by Rio Tinto. In this document we refer equally to Resolution Copper and Rio Tinto.

General Observations

- These comments are a group effort and contain comments from many contributors. These are scoping comments and include a large body of actions that must be considered and fulfilled as required by federal laws and regulations. Our comments include a variety of questions, recommendations, and observations that taken as a whole will fulfill the full requirements of federal laws and regulations.

- Rio Tinto's proposal, as outlined in the General Plan of Operation ("GPO"), is untenable and would lead to the irreparable and permanent destruction of precious federal lands. Therefore, we oppose the permitting of the proposed actions. Our comments document how and why this proposal would violate a host of federal and state laws and as such, cannot be permitted by federal law.

- If these comments and recommendations are implemented, it is possible that a path forward for a proposed action could be found, but as stands, the project, as described, must not be permitted.

- We are strongly opposed to this mine and the impacts to our public lands and natural resources. We urge the Forest Service to select the No Action Alternative in the Environmental Impact Statement ("EIS"). If the EIS process is conducted fairly and objectively, this will be the only viable alternative.

- We further remind the Forest Service that federal permits cannot be granted unless Rio Tinto can show that its plan will not violate any federal, state, or international, laws or regulations.

- Because the project proposal is already well developed, many of the comments will be made in reference to sections of the General Plan of Operations ("GPO"). The GPO does not do well on developing alternatives, so appears to be depending on the EIS team to develop these alternatives. There are also some notable technical gaps; for example; lack of waste rock characterization and/or adequate explanation of how this material will be disposed so that there is no potential for acid rock drainage; and, no explanation as to how the amounts for the financial sureties were reached.

- The TNF has the authority and responsibility to regulate the use of Forest Service lands and where mining activities disturb these lands, the TNF may regulate the mining activities and activities incidental to mining to, among other things, prohibit unreasonable destruction of surface features and resources, including by limiting the permissible methods of mining in order to reduce environmental damage, even if this will result in increased operating costs for the mine. *See Clouser v. Espy*, 42 F.3d 1522, 1528-29 (9th Cir. 1994) ("there can be no doubt that the Department of Agriculture possesses statutory authority to regulate activities related to mining – even in non-wilderness areas – in order to preserve the national forests."); *see also Public Lands for the People, Inc. v. U.S. Dep't of Agriculture*, 697 F.3d 1192, 1197-98 (2013 (9th Cir. 2012), cert. denied, 133 S. Ct. 1464 (The 1872 Mining Law does not strip the U.S. Forest Service of its authority to limit methods of mining or activities incidental to mining. Forest Service may prohibit the use of motor vehicles to access mining claims due to impacts on quiet recreation opportunities, wildlife, water quality, air quality and other Forest Service resources); *Kuruk Tribe of Cal. v U.S. Forest Service*, 681 F.3d 1006, 1023 (9th Cir. 2012 (observing that while the 1872 Mining Law gives miners a statutory right to mine on Forest Service lands, the federal government "retains substantial regulatory power" over these mining activities).

- In a broader context, there must be discussion of how some technical/political choices are to be made: for example; how should the maximum design earthquake be chosen; and, should the recommendations of the Mt. Polley Expert Panel for tailings impoundments be followed?

- The tailings storage facility and all other proposed features (roads, pipelines, powerlines, etc.) on or across federal public land and not bound by the National Defense Authorization Act ("NDAA"), are not subject to the 1872 Mining Law and can only be reviewed and considered under the USFS Special Use permitting regime.
    - The USFS must require the company to submit right-of-way or other special use permit authorizations and require that all mandates of Title V of the Federal Land Policy Management Act ("FLPMA") and its implementing regulations are adhered to (e.g., no permit can be issued unless it can be shown that the issuance of the permit is in the best interests of the public, includes payment of fair market value, etc.).
    - This is required because the approval of roads is not a right covered by the 1872 Mining Law (especially when the roads are not proposed to access mineral deposits) – even if the company could show that its mining claims were valid, which it has not done. Further, even if the USFS could ignore its duties under its multiple use and other mandates and assume that the company had a right under the

Mining Law (which as noted herein is wrong), such rights do not attach to the rights-of-way and other FLPMA approvals needed for the roads.
    - Roads, even those across public land related to a mining operation, are not covered by statutory rights under the Mining Law.
    - Operations not conducted on "valid and perfected claims" must comply with all of FLPMA's requirements.

- The Forest Service must ask the Department of Interior to conduct a claims validity test for all mining claims not associated with the ore body itself, (all claims not included in the NDAA).
    - There is no evidence that the claims to be crossed by the roads, pipelines, or other planned mining facilities are valid under the Mining Law. It is almost certain the Project's activities (other than mining operations planned on lands covered by the NDAA), are on lands far from the mineralized zone and do not contain the requisite valuable mineral deposit. Indeed, it is likely that these lands contain common varieties of rock that are not even considered locatable minerals under federal mining law.

- The Forest Service required that the MARRCO corridor obtain a special use permit for activities across public land managed by the Forest Service to date. The EIS must analyze whether a permit will need to be granted, or updated, under this proposed plan or whether the Forest Service now feels that the railroad corridor is exempt from a special use permit and now will be permitted under 1872 Mining Law rules.

- A portion of the East Plant Site ("EPS") is on Arizona state trust lands and not effected by the NDAA. How will this affect the permitting process and what additional permits/scrutiny would be required for mining operations on Arizona state trust land?

- Under the NDAA language, would permits for activities on Arizona state trust land need to be analyzed under the "single EIS" required by the NDAA?

- For most of the duration of the NEPA process, federal lands at Oak Flat on the EPS that are managed by the Forest Service will remain in federal ownership. However, before the completion of the NEPA process, most federal land at the EPS would be transferred to private ownership by Rio Tinto. How will this affect the NEPA process?

- Rules regarding mining at Oak Flat now under federal ownership would change to rules governing mining on private lands should the NDAA be consummated. How will this affect the NEPA process?

- The EIS must fully analyze and quantify all baseline conditions for all potentially affected resources prior to analyzing or approving the project.

- The draft EIS must include an adequate mitigation plan, including a detailed

review of the impacts from and effectiveness of any mitigation measures.

- The EIS must fully review a full range of reasonable alternatives.

- The Forest Service must minimize all adverse impacts from the project and ensure compliance with all environmental and public land laws.

- USFS must fully analyze the project's impacts to threatened and endangered species.

- USFS must fully comply with the National Historic Preservation Act ("NHPA") and other requirements for the protection of historical, cultural, and/or religious sites/resources.

- The EIS should include a Social Impact Statement that analyzes the impact of the proposed project on affected Native American tribes and on the small communities surrounding the project area. This should include, but not be limited to, the San Carlos Apache Tribe, the Fort McDowell Yavapai Tribe, and other affected tribes, and the communities of Superior and Queen Valley.

- This scoping comment period was initiated prematurely.
    - There are a number of reasons why scoping should not yet have begun and therefore this deadline for the close of scoping comments is improper. Nonetheless, we are submitting the following comments in a timely manner for your July 18, 2016 deadline. However, we reserve the right to augment and/or replace these comments if and when the scoping process is reinitiated in a more proper manner.
    - In general, the scoping process is premature and/or not properly facilitated for the following reasons:
        - The General Plan of Operations ("GPO") is not complete and it is not possible to provide substantive comments when so much information about Rio Tinto's mining plans are incomplete or unknown.
        - It is not possible to make substantive comments on the tailings location when there has been no testing of the tailings dump location included in the MPO.
        - The Forest Service acknowledges that the passage of the Oak Flat land exchange law substantively changes the NEPA process required for federal permitting of the proposed project. However, the Forest Service has not fully disclosed how it plans to conduct the permitting process in light of changes necessary to comply with the land exchange law. Scoping should not have commenced until the process is fully determined and explained to the public.

Summary of Alternatives to be Considered

The EIS must consider a robust suite of alternatives to the plan proposed by Rio Tinto. The following alternatives that should be studied (note that this is by no means an exhaustive list and that additional alternatives are discussed below).:

- No mine (the no action alternative). This is our preferred alternative and only reasonable alternative!
- A mine design which does not include a land exchange
  - Following repeal of the Oak Flat land exchange or an option in which Rio Tinto does not ask for consummation of the land exchange.
- Alternative mining sites
  - Reopening of the San Manuel mine.
  - Purchase and mining out of the Pinto Valley mine then using the Pinto Valley open pit for backfilling.
  - Reopening of other closed mines (if done in a way that does not pollute).
- Higher production from existing working mines to ensure additional metals for domestic use.
- Requiring that the metals that may be mined from Oak Flat be used domestically.
- Mining methods other than the proposed block cave / panel cave design.
- Require backfilling of mine.
  - Cut and fill.
    - Would eliminate subsidence
    - Would drastically cut down on tailings
    - Would use less water
  - Modified forms of block caving
    - Mine a panel, backfill, mine another panel
    - Other methods of backfilling while using block caving
  - Other forms of underground mining including hybrid designs
- Dump tailings in existing open pits.
- Site tailings dump on private or state trust land.
- Find alternative site on public land.
  - Examine closely alternative tailings site locations rejected by Rio Tinto.
  - Find a tailings location on a brownfield site.
- Line the tailings site.
- Use downstream tailings dam construction rather than upstream.
- Construct tailings dams out of concrete, or at least rock, rather than tailings.
- Cover tailings with a synthetic cover.

GPO Deficiencies

Accuracy of Data in the GPO

Numerical data presented in the GPO need to be carefully reviewed before using them in the EIS. For Example, Section 7.2 of Appendix E of the GPO states that Queen Creek Canyon and Ga'an Canyon are each 3,940 ft. from "the proposed underground mine". GPO Exhibit 3.2-2 of Volume 1 and Figure 1 of Appendix E show that the proposed caving panels and the ore body are both significantly closer to Queen Creek Canyon than to Ga'an Canyon.

Incomplete Plan

After examining the documents included on the resolutionmineeis.us website (which the Forest Service says is the complete and current version of the plan submitted by Rio Tinto), it is clear that more questions are raised than are answered by Rio Tinto's plan.

Rio Tinto, in submitting what is essentially an outline of what they wish to do, is placing the burden of the final design of its proposed operation on the US Forest Service and the public. It is as if Rio Tinto is asking for agency and public help in finalizing the plan that would allow the company to destroy precious public assets for the monetary gain of Rio Tinto and its shareholders. We are uncomfortable being placed in the role of essentially negotiating the terms of the destruction of lands we hold precious, dear, and sacred.

In this document and by other actions, we will take part in this process that is laid out by laws and regulations, however, we do so under protest and with the clear knowledge that we are doing the job that Rio Tinto, the project proponent, should be doing.

Impact Analysis Criteria (Analysis of Past, Present, and Foreseeable Actions)

The USFS must fully review the impacts from all "past, present, and reasonably foreseeable future actions." These are the "cumulative effect/impacts" under NEPA. To comply with NEPA, the USFS must consider all direct, indirect, and cumulative environmental impacts of the proposed action. 40 CFR §§ 1502.16, 1508.8, 1508.25(c). Direct effects are caused by the action and occur at the same time and place as the proposed project. 40 CFR § 1508.8(a). Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. 40 CFR § 1508.8(b). Both types of impacts include "effects on natural resources and on the components, structures, and functioning of affected ecosystems," as well as "aesthetic, historic, cultural, economic, social or health [effects]." Id. Cumulative effects are defined as:

> [T]he impacts on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

40 CFR § 1508.7. In a cumulative impact analysis, an agency must take a "hard look" at all actions.

> An EA's analysis of cumulative impacts must give a sufficiently detailed catalogue of past, present, and future projects, and provide adequate analysis about how these projects, and differences between the projects, are thought to have impacted the environment. … Without such information, neither the courts nor the public ... can be assured that the [agency] provided the hard look that it is required to provide.

Te-Moak Tribe of Western Shoshone v. U.S. Dept. of Interior, 608 F.3d 592, 603 (9th Cir. 2010) (rejecting EA for mineral exploration that had failed to include detailed analysis of impacts from nearby proposed mining operations).

A cumulative impact analysis must provide a "useful analysis" that includes a detailed and quantified evaluation of cumulative impacts to allow for informed decision-making and public disclosure. Kern v. U.S. Bureau of Land Management, 284 F.3d 1062, 1066 (9th Cir. 2002); Ocean Advocates v. U.S. Army Corps of Engineers, 361 F.3d 1108 1118 (9th Cir. 2004). The NEPA requirement to analyze cumulative impacts prevents agencies from undertaking a piecemeal review of environmental impacts. Earth Island Institute v. U.S. Forest Service, 351 F.3d 1291, 1306-07 (9th Cir. 2003).

The NEPA obligation to consider cumulative impacts extends to all "past," "present," and "reasonably foreseeable" future projects. Blue Mountains, 161 F.3d at 1214-15; Kern, 284 F.3d at 1076; Hall v. Norton, 266 F.3d 969, 978 (9th Cir. 2001) (finding cumulative analysis on land exchange for one development failed to consider impacts from other developments potentially subject to land exchanges); Great Basin Mine Watch v. Hankins, 456 F.3d 955, 971-974 (9th Cir. 2006)(requiring "mine-specific … cumulative data," a "quantified assessment of their [other projects] combined environmental impacts," and "objective quantification of the impacts" from other existing and proposed mining operations in the region).

As the Ninth Circuit has further held:

> Our cases firmly establish that a cumulative effects analysis "must be more than perfunctory; it must provide a useful analysis of the cumulative impacts of past, present, and future projects." Klamath–Siskiyou, 387 F.3d at 994 (emphasis added) (quoting Ocean Advocates v. U.S. Army Corps of Eng'rs, 361 F.3d 1108, 1128 (9th Cir.2004)). To this end, we have recently noted two critical features of a cumulative effects analysis. First, it must not only describe related projects but also enumerate the environmental effects of those projects. See Lands Council v. Powell, 395 F.3d 1019, 1028 (9th Cir.2005) (holding a cumulative effects analysis violated NEPA because it failed to provide "adequate data of the time, place, and scale" and did not explain in detail "how different project plans and harvest methods affected the environment"). Second, it must consider the interaction of multiple activities and cannot focus exclusively on the environmental impacts of an individual project. See Klamath–Siskiyou, 387 F.3d at 996 (finding a cumulative effects analysis inadequate when "it only considers the effects of the very project at issue" and does not "take into account the combined effects that can be expected as a result of undertaking" multiple projects).

Oregon Natural Resources Council Fund v. Brong, 492 F.3d 1120, 1133 (9th Cir. 2007). Note that the requirement for a full cumulative impacts analysis is required in an EA, as well as in an EIS. See Te-Moak Tribe of Western Shoshone, 608 F.3d 592, 603 (9th Cir. 2010) (rejecting EA for mineral exploration that had failed to include detailed analysis of impacts from nearby proposed mining operations).

NEPA regulations also require that the agency obtain the missing "quantitative assessment" information:

> When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking.
> (a) If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement.
> (b) If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the environmental impact statement:
> (1) A statement that such information is incomplete or unavailable; (2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and (4) the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, "reasonably foreseeable" includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.

40 CFR § 1502.22. "If there is 'essential' information at the plan- or site-specific development and production stage, [the agency] will be required to perform the analysis under § 1502.22(b)." Native Village of Point Hope v. Jewell, 740 F.3d 489, 499 (9th Cir. 2014). Here, the adverse impacts from the Project when added to other past, present or reasonably foreseeable future actions is clearly essential to the USFS' determination (and duty to ensure) that the Project complies with all legal requirements and minimizes all adverse environmental impacts.

"[W]hen the nature of the effect is reasonably foreseeable but its extent is not, we think that the agency may not simply ignore the effect. The CEQ has devised a specific procedure for 'evaluating reasonably foreseeable significant adverse effects on the human environment' when 'there is incomplete or unavailable information.' 40 C.F.R. § 1502.22." Mid States Coalition for Progress v. Surface Transportation Board, 345 F.3d 520, 549-550 (8th Cir. 2003) (emphasis in original).

Thus, in this case, the USFS must fully consider the cumulative impacts from all past, present, and reasonably foreseeable future projects in the region on, at a minimum, water and air quality including ground and surface water quantity and quality, recreation, cultural/religious, wildlife, transportation/traffic, scenic and visual resources, etc. At a minimum, this requires the agency to

fully review, and subject such review to public comment in a draft EIS, the cumulative impacts from all other mining, grazing, recreation, energy development, roads, etc., in the region.

Equal Value and Appraisal Comments

I. Introduction

Section 3003 of the National Defense Authorization Act (hereinafter, the "Oak Flat rider") states that "[t]he value of the Federal land and non-Federal land to be exchanged under this section shall be equal or shall be equalized..."[1] and if the final appraised value of the Federal land "exceeds the value of the non-Federal land, Resolution Copper shall (I) convey additional non-Federal land in the State to the Secretary...; (II) make a cash payment to the United States; or (III) use a combination of the methods described in subclauses (I) and (II), as agreed to by Resolution Copper, the Secretary, and the Secretary of Interior.[2] In order to determine equal value, the Secretary and Resolution Copper "shall select an appraiser to conduct appraisals of the Federal and non-Federal land in compliance with the requirements of section 254.9 of title 36, Code of Federal Regulations"[3] (Forest Service land exchange regulations) and "in accordance with the nationally recognized appraisal standards..."[4]

II. FLPMA and NEPA

Under the Federal Land Policy and Management Act ("FLPMA")[5] of 1976, the Forest Service has broad discretionary authority to conduct land exchanges with nonfederal parties. When the agency initiates a land exchange, it is governed by regulations intended to protect the public interest. Sometimes, however, Congress can enact specific legislation that requires the agency to proceed with or provide authority to engage in a particular land exchange. For example, in some land exchanges, Congress mandates that the exchange take place, waiving laws such as FLPMA or NEPA. In such cases, the agency has no discretion and must act in accordance with the specific legislation. In other cases, Congress will give the agency significant discretion by simply creating authority for the Forest Service to pursue a land exchange if it wishes to do so. *In those situations, to the extent the provisions do not conflict with FLPMA or its regulations, the agency processes the land exchange as if it initiated a discretionary land exchange under FLPMA*.[6] In the Oak Flat land exchange, Congress took somewhat of a hybrid approach. While it does

[1] National Defense Authorization Act, 128 Stat. 3736, §3003(c)(5)(A).
[2] *Id.* at §3003(c)(5)(B)(i).
[3] *Id.* at §3003(c)(4)(A).
[4] *Id.* at §3003(c)(4)(B).
[5] 43 U.S.C. §§ 1701 et seq.
[6] *See* Forest Service Handbook, *Land Acquisition Handbook*, FSH 5409.13, Ch. 30 at 14 (2004) ("Legislated land exchanges often include provisions that conflict with standard land exchange authorities or with Forest Service land exchange regulations at Title 36, Code of Federal Regulations, part 254, subpart A...When a legislative exchange contains direction that conflicts with current regulation or policy, the legislation overrides the requirements of regulation and policy"); *see also* U.S. GAO, *Federal Land Management: BLM and the Forest Service Have Improved Oversight of the Land Exchange Process, but Additional Actions are Needed*, Report to the Subcommittee on Interior, Environment, and Related Agencies, Committee on Appropriations, House of Representatives, 5 (June 2009) (hereinafter "GAO Report") ("...where guidance is not specified in the legislation, transactions are to be handled in conformance with nationally recognized appraisal standards and the regulations...") *available at*: http://www.gao.gov/new.items/d09611.pdf

mandate some form of land exchange, it also explicitly mandates NEPA, and it does not waive FLPMA, leaving the Forest Service a great deal of legal discretion and authority when it comes to conducting the appraisal and determining equal value in this exchange.

III. The Meaning of Equal Value

When the Forest Service and a private party enter into an "Agreement to Initiate" a land exchange, the parties have up to 90 days to arrange for an appraisal.[7] FLPMA mandates that all land exchanges must yield equal value to both sides in the transaction before the exchange can be completed. Section 1716(b) states that:

> "the values of the lands exchanged...either shall be equal, or if they are not equal, the values shall be equalized by the payment of money to the grantor or to the Secretary concerned as the circumstances require so long as payment does not exceed 25 per centum of the total value of the lands or interests transferred out of Federal ownership."[8]

In addition to the equal value requirement, all land exchanges must also serve the public interest[9] and undergo an environmental impact analysis.[10] A land exchange cannot be completed until all three requirements are satisfied. When considering the public interest, the Forest Service has to consider a number of factors, including but not limited to: better management of Federal lands and resources; needs of State and local residents; protection of fish and wildlife habitats, cultural resources, watersheds, and wilderness and aesthetic values; and enhancement of recreation opportunities and public access.[11] To determine that an exchange serves the public interest, the agency must find that (1) the resource values and public objectives of Federal land, if retained, will not be more than the resource values and public objectives of the non-Federal land if acquired; and (2) the intended use of the Federal land conveyed will not substantially conflict with management objectives on adjacent Federal lands, including Indian Trust lands.[12] The decision and rationale are then made a part of the administrative record.

Thus, the Forest Service must produce a valid environmental impact analysis as required by NEPA.[13] In this case, the appraisal should be part of the NEPA public review process. The appraisal report informs the agency as to whether FLPMA's and USFS requirements that the "exchange must be of equal value" directive has been satisfied. As stated above, once the parties enter into an Agreement to Initiate, they have up to 90 days to arrange for an appraisal. Exactly

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[7] 43 U.S.C. § 1716(d)(1).
[8] 43 U.S.C. § 1716(b).
[9] 43 U.S.C. § 1716(a) ("A tract of public land or interests therein may be disposed of by exchange...where the Secretary concerned determines that the public interest will be well served by making that exchange..."); 36 C.F.R. § 254.3(b) ("The authorized officer may complete an exchange only after a determination is made that the public interest will be well served.").
[10] 36 C.F.R. § 254.3(g) ("After an agreement to initiate an exchange is signed, the authorized officer shall undertake an environmental analysis in accordance with the [NEPA], the Council on Environmental Quality regulations, and the Forest Service environmental policies and procedures...").
[11] 36 C.F.R. § 254.3(b)(1).
[12] *Id*. at § 254.3(b)(2).
[13] *Id.* at §§ 254.3(g), 254.9

how long the appraisal process will take is up to the parties to negotiate and write into the Agreement. The Oak Flat rider states that "[a]s soon as practicable after the date of enactment of this Act, the Secretary and Resolution Copper shall select an appraiser to conduct appraisals of the Federal land and non-Federal land in compliance with the requirements of section 254.9 of title 36, Code of Federal Regulations."[14]

To determine the value of the Federal and non-Federal land, a qualified appraiser (who must be approved by the agency), "shall provide to the [Forest Service] appraisals estimating the market value of the Federal and non-Federal properties involved..."[15] In estimating market value, the appraiser must:

> "(i) Determine the highest and best use of the property to be appraised;
> (ii) Estimate the value of the lands and interests as if in private ownership and available for sale in the open market;
> (iii) Include historic, wildlife, recreation, wilderness, scenic, cultural, or other resource values or amenities as reflected in prices paid for similar properties in the competitive market;
> (iv) Consider the contributory value of any interest in land such as water rights, minerals, or timber, to the extent they are consistent with the highest and best use of the property;..."[16]

The Forest Service, not the non-Federal party, makes the final approval and ultimate determination whether the Federal and non-Federal lands are approximately equal in value, and must document how the determination was made.[17] Under the Oak Flat legislation, the Forest Service must make the appraisals of the exchanged lands (or a summary thereof) available for public review.[18] It is our position that the Forest Service, under the Administrative Procedure Act and other law, must make the draft appraisal available to the public for comment with adequate time to review the document. The Forest Service should create a schedule for this public process as soon as possible. If an agency accepts the appraiser's final valuation recommendation and makes an offer of exchange to the non-Federal party, it is considered a final agency action and can be challenged in court.[19]

If the final appraised values are not equal, the parties to an exchange may agree to modify the proposal by adding or excluding lands and/or use cash equalization after making reasonable efforts to equalize the values by adding or deleting lands.[20] Under FLPMA, the cash payment is not allowed to exceed 25% of the value of Federal land to be conveyed; however, the Oak Flat legislation waived this particular provision, so the Secretary may accept a payment in excess of

[14] NDAA, 128 Stat. 3736, §3003(c)(4)(A)
[15] 36 C.F.R. § 254.9(a)(1).
[16] *Id.* at § 254.9(b)(1)(i)-(iv).
[17] *Id.* at § 254.11(b); NDAA, 128 Stat. 3736, §3003(c)(4)(B)(ii).
[18] NDAA, 128 Stat. 3736, §3003(c)(4)(B)(iv).
[19] *See* Mt. St. Helens Mining and Recovery Ltd. Partnership v. U.S., 384 F.3d 721 (9th Cir. 2004)
[20] 36 C.F.R. § 254.12(a)

25%.[21] This is a prime example of how Congress can override certain statutory requirements when it legislates a land exchange. Here, while Congress slightly altered the cash equalization requirement in this exchange, it did not fundamentally alter the equal value and appraisal process even though it could have easily done so. Therefore, the Forest Service must consider all of the factors above when determining the value of the Oak Flat area. These are some of the factors and issues that the Forest Service must account for:

a. Historic, Cultural and Scenic Values

The Forest Service must take into account the historic, scenic and cultural value of Oak Flat. The area has been protected from mining since the 1950s when President Eisenhower removed Oak Flat from mineral entry due to its cultural and natural value. The historic use of Oak Flat is well documented, and the San Carlos Apache tribe and other Tribes in the area consider it a sacred site critical to their religious freedom. It is the site of Apache Leap, a cliff where more than 80 Apache warriors chose to leap to their deaths rather than surrender to the U.S. Calvary. They will never be able to find a replacement once Resolution Copper destroys the area. There is essentially no amount of money that could replace this specific site.

b. Wildlife and Wilderness Values

Oak Flat is a rare desert riparian area located in a state where less than 10% of this type of habitat remains. These surface water resources are critical for the wildlife in the area, and if jeopardized will put all of the area's species at risk. Wildlife and flora, such as the endangered Arizona hedgehog cactus, and other cacti could be severely disturbed during mining processes. The Oak Flat site is also a prized area for birders. The agency must consider how mining will put sensitive ecological areas at risk and change the landscape forever by digging mine shafts, excavating minerals and carving roads through a once wild landscape.

c. Recreation Values

If Oak Flat is given away to Resolution Copper, the 2,400-acre area will be closed to the public. The site has been a prime recreation area for the public, especially for rock climbing and bouldering with more than 2,500 establishing climbing routes. Climbers, campers, canyoneers, bikers, and hikers enjoy the area throughout the year, all of whom will be prohibited from entering the area once it is privatized. This means that the thousands of people who visit the Oak Flat campground and recreation area's distinctive volcanic features each year will be forced to find other places to visit. Because of the mining method being employed, anything on the surface, like sacred sites, campgrounds, rock climbing cliffs, and wilderness areas are likely to collapse into a crater, which will be too unstable to allow for access even at a later date.

[21] *Id.* at § 254.12(b); NDAA, 128 Stat. 3736, §3003(c)(5)(B)(ii) ("The Secretary may accept a payment in excess of 25 percent of the total value of land or interests to be conveyed, notwithstanding section 206(b) of the Federal Land Policy and Management Act of 1976").

d. Mineral Values

Oak Flat sits 7,000 feet above what Resolution Copper says is one of the largest copper deposits in the world. The corporation has proposed to build one of the largest underground copper mines in the world to extract that ore. The lands that Resolution Copper is offering are certainly insufficient for the huge mineral deposit that the Corporation says exists. The Forest Service is required to include the value of these minerals in its valuation of the Oak Flat land. Section 3003 of the National Defense Authorization Act requires that the appraisal comply with the "Uniform Appraisal Standards for Federal Land Acquisitions," ("UAS") https://www.justice.gov/sites/default/files/enrd/legacy/2015/04/13/Uniform-Appraisal-Standards.pdf and the "Uniform Standards of Professional Appraisal Practice." The UAS requires that the market value of the minerals be fully calculated and considered in determining the value of the federal lands to be exchanged.

e. Other Environmental Values

Water Quality and Quantity. If built, the mine would use tremendous amounts of water in a desert already dealing with serious drought. Mining uses enormous amounts of water which could limit water needed for communities and the environment. It could also dramatically impact the waterways in the area. For instance, surface cracking could lead to changes in the waterway patterns and dry up area wetlands and springs.

Air Pollution. Copper mining processes emit large quantities of particulate matter, trace elements, and sulfur oxides, which can have adverse effects on human health. Particulate matter emitted from smelters may include toxic metals such as arsenic, cadmium and mercury. This project will also contribute to global warming.

Climate Impacts. The construction of this mine, and transportation to and from the mine will significantly increase greenhouse gas pollutants. Mining and mineral processing is one of the largest users of energy worldwide, and therefore contributes heavily to air pollution and global warming. Diesel fuel is used by trucks and excavators during mining and electricity is used to grind ore and refine copper. Smelting makes use of heat and a chemical reducing agent--commonly a source of carbon such as coke, or in earlier times charcoal--to decompose the ore. The full life cycle of these mining activities would emit a significant amount of greenhouse gases.

Mining Waste. Once the copper is out of the ground, it is extracted from the rock by the use of chemicals. This process, known as leaching, can put the groundwater and surface water at risk of contamination. The chemical-laden rock left behind is placed in tailings piles that can also leak pollutants into the surrounding land and water. This mine is projected to produce 1.7 billion tons of mine waste tailings, and it is still unclear where Resolution Copper will dispose of this waste.

In the Oak Flat rider, Congress incorporates by reference these same appraisal factors.[22] Thus, the appraiser will conduct the appraisal the same way as he would have under the Forest Service regulations. It is important to note that while Congress could have waived some or all of these requirements, it chose not to fundamentally alter the equal value and appraisal process in this exchange. Compared to other legislated land exchanges, in this exchange Congress preserved a significant amount of discretion for the agency.

IV. Oak Flat in the Context of Other Federal Public Land Exchanges

Congress has legislated many land exchanges over the years, and it is becoming an increasingly popular mechanism when either party wants to expedite the process. In its June 2009 Report, the U.S. Government Accountability Office (GAO) analyzed twenty legislated land exchanges passed between October 2004 and June 2008.[23] Of those twenty exchanges, the GAO found that seventeen were not processed in the same way as the BLM and Forest Service's discretionary exchanges. The most frequent differences between processing legislated and discretionary land exchanges were: (1) identifying specific lands to be exchanged; (2) requiring the agencies to conduct exchanges if requested by the nonfederal party; and (3) establishing a time frame for the completion of the exchange.[24] However, there were also three legislated land exchanges where none of the categorical provisions GAO used for comparison differed from a discretionary land exchange.[25] Thus, anytime Congress legislates an exchange, it must be scrutinized on a case-by-case basis to determine what Congress is mandating the agency to do, and/or what it has left to the agency's discretion.

Legislated land exchanges vary widely, but past exchanges have overridden environmental laws,[26] negated appraisal requirements,[27] set a deadline for the transfer of deeds,[28] and eliminated public involvement.[29] Congress can essentially put any language it wants into a bill (provided it is not unconstitutional) and none of the safeguards provided in existing statutes or regulations need be included. Therefore, whether the legislation circumvents any existing laws or regulations is critical for determining how much discretion Congress retained for the agency.

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[22] NDAA, 128 Stat. 3736, §3003(c)(4)(A) ("As soon as practicable after the date of enactment of this Act, the Secretary and Resolution Copper shall select an appraiser to conduct appraisals of the Federal land and non-Federal land in compliance with the requirements of section 254.9 of title 36, Code of Federal Regulations.").
[23] GAO Report, *supra* note 6, at 23.
[24] *Id*. at 23.
[25] *Id.* at 23-24, Table 5 (Palo Verde, California; Great Sand Dunes National Park/Baca National Wildlife Refuge, Colorado; Agua Caliente Band of Cahuilla Indians (Santa Rosa and San Jacinto Mountains National Monument), California).
[26] *See* Sand Hollow Land Exchange, PL 104-333, 110 Stat. 4093 §309 ("The exchange of lands under this section is not subject to section 102 of the [NEPA]..."; *See also* Arkansas-Idaho Land Exchange Act of 1992, PL 102-584, 106 Stat. 4937 (hereinafter "Arkansas-Idaho Act") *and* Snowbasin Land Exchange Act, PL 104-333, 110 Stat. 4093 §304 (implicitly waiving NEPA due to short deadline for transfer of deed).
[27] *See* Arkansas-Idaho Act, §2(a)(7) ("Congress finds that...appraisals of lands to be conveyed in the exchange have been completed..."); Lost Creek Land Exchange, PL 104-333, 110 Stat. 4093 §307 *and* Miles Land Exchange Act of 1998, PL 105-288, 112 Stat. 2778 (declaring lands to be of equal value and as a result, no appraisal was completed).
[28] *See* Pitkin County Land Exchange Act of 2006, PL 109-377, 120 Stat. 2660, §4(b); Snowbasin Land Exchange Act, §304(a); Lost Creek Land Exchange, §307(a)(2)(B)(I).
[29] *See* Snowbasin Land Exchange, 110 Stat. 4093 §304 (providing for no judicial review).

Legislated exchanges may also include provisions that alter the processing of a land exchange, including whether appraisals will even be undertaken. In those types of cases, transactions are handled in a manner consistent with the specific legislation. On the other hand, where guidance is not specified in the legislation, transactions are to be handled in conformance with nationally recognized appraisal standards and the regulations,[30] to the extent they apply. However, unless the legislation conflicts with existing land exchange authorities, the agency is to process the land exchange according to FLPMA and its regulations.[31]

Here, because Congress incorporated by reference the FLPMA regulations that govern the appraisal process, it clearly left the agency with considerable discretion and authority to carry out the exchange under FLPMA and other existing applicable statutes.

When looking at all of the land exchanges in which the United States has ever been a party, three distinct types of exchanges emerge. First, there are land exchanges that are congressionally-mandated and where an agency has absolutely no discretion. Second, there are land exchanges that are completely proposed by an agency which follow the discretionary process under relevant land exchange authority. Lastly, there is a broad category of exchanges where Congress directs that a land exchange take place, but maintains significant--albeit not unlimited--discretion for the agency.

The Center for Biological Diversity has analyzed more than thirty major land exchanges with the Forest Service in order to compare levels of agency discretion in Congressionally-directed land exchanges. In some land exchanges, Congress has given the agency little to no discretion; it simply mandates that the exchange take place, either waiving laws such as NEPA and/or FLPMA or declaring the values of the federal and nonfederal lands to be equal. A number of the land exchanges contained provisions that declared the land values equal, or had already established the land values.[32] As a result, the regular process of conducting an appraisal was not required. For example, the Miles Land Exchange Act provides that "[t]he value of both of the Federal and non-Federal lands to be exchanged...are deemed to be approximately equal in value, and no additional valuation determinations are required."[33] The Arkansas-Idaho Land Exchange Act of 1992 states that "the United States and [the private party] have agreed to the values and boundaries of all lands to be conveyed in the exchange and concur that the lands are of equal value,"[34] and that "appraisals of all lands to be conveyed in the exchange have been completed...."[35] This type of declaratory language leaves the Forest Service with no discretion to determine equal value, and in fact, the same statute will often waive other applicable laws, like FLPMA, as well.

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[30] *Uniform Appraisal Standards for Federal Land Acquisitions* (5th ed. 2000); 36 C.F.R. § 254.9

[31] *See* Forest Service Handbook, *supra* note 6.

[32] *See* Lost Creek Land Exchange, 110 Stat. 4093, §307 ("[t]he values of the lands and interest in land to be exchanged...are deemed equal"); Sierra National Forest Land Exchange Act of 2006, PL 109-375, 120 Stat. 2656, §3(b) ("[t]he value of the non-Federal land shall be considered to be $200,000; and...the value of the Federal land shall be considered to be $250,000"); Former Charleston Naval Base Land Exchange Act of 2012, PL 112-146, 126 Stat. 1135, §4(c) ("Notwithstanding the appraised value of the land exchanged...the values of the Federal and non-Federal land in the land exchange...shall be considered to be equal.")

[33] Miles Land Exchange Act, 112 Stat. 2778, § 2(c).

[34] Arkansas-Idaho Act, §2(a)(8).

[35] *Id.* at §2(a)(7).

Here, while Congress has mandated some form of land exchange in the Oak Flat legislation, it also did not waive FLPMA or any other law, leaving the Forest Service most of its discretion to process the land transaction. The general rule still remains that unless Congress states otherwise--*which it did not do in this exchange*--the Forest Service is to process the land exchange according to FLPMA and its regulations, including the USFS regulations. In fact, the equal value and appraisal provisions in the Oak Flat legislation are almost identical to the provisions in FLPMA and its regulations. Both provisions require that the value of the Federal and nonfederal lands "shall be equal or shall be equalized,"[36] and both require that the appraisal reflect "nationally recognized appraisal standards."[37] This language allows the appraiser to take into consideration factors such as historic, wildlife, recreation, wilderness, cultural, and other resource values, in addition to the contributory value of any interest in land such as water rights or minerals, when conducting the appraisal. Further, Congress has explicitly required the Forest Service to conduct an environmental review in accordance with the requirements of NEPA, in addition to an assessment of the cultural and archeological impacts under the National Historic Preservation Act, both of which are processes clearly left to the agency under FLPMA under this proposed land exchange.

V. Appraisal Timing Issues

Under FLPMA, after the Forest Service completes the environmental analysis, and once all the appropriate documentation and appraisals are finished, the Forest Service must decide whether to approve the exchange proposal.[38] Typically this decision is subject to appeal for 45 days after the decision is published,[39] however, Congress waived this provision in the Oak Flat legislation.[40] Nonetheless, the Forest Service still *must* approve the appraisal.[41] If the agency approves the appraisal , the parties may enter into an exchange agreement that becomes legally binding, provided that, among other things: (1) acceptable title can be conveyed; (2) no substantial loss or damage occurs to either property from any cause; (3) no undisclosed hazardous substances are found on the lands to be conveyed; and (4) the exchange proposal receives any required Secretarial approval.[42] The last step of the land transaction is the transfer of title, and unless otherwise agreed, title to both non-Federal and Federal lands pass simultaneously and are deemed accepted by both parties when the documents of conveyance are recorded.[43] Under the Oak Flat legislation, title is to be conveyed no later than 60 days after the date of publication of

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[36] National Defense Authorization Act, 128 Stat. 3736, §3003(c)(5)(A).
[37] *Id.* at § 3003(c)(4)(B)(i) [the] appraisal...shall be conducted in accordance with nationally recognized appraisal standards, including (I) the Uniform Appraisal Standards for Federal Land Acquisitions; and (II) the Uniform Standards for Professional Appraisal Practice."
[38] 36 C.F.R. §254.13(a)
[39] 36 C.F.R. §254.13(b)
[40] NDAA, 128 Stat. 3736, §3003(c)(4)(B)(ii) ("After the final appraised values of the Federal land and non-Federal land are determined and approved by the Secretary, the Secretary shall not be required to reappraise or update the final appraised value—(I) for a period of 3 years beginning on the date of the approval by the Secretary of the final appraised value; or (II) at all, in accordance with section 254.14 of title 36, Code of Federal Regulations (or a successor regulation), after an exchange agreement is entered into by Resolution Copper and the Secretary.").
[41] *Id.* ("After the final appraised values of the Federal land and non-Federal land are determined and approved by the Secretary...").
[42] 36 C.F.R. § 254.14(b)
[43] *Id.* at § 254.16(a)

the final environmental impact statement.[44] Because of the 60-day exchange mandate in the Oak Flat Rider, the appraisal process needs to be finished well before the Final Environmental Impact Statement is complete, and the appraisal process must start as soon as possible to comply with the Rider's timeline.

VI. Conclusion

The Oak Flat rider directs the agency to conduct the mandatory appraisal in accordance with the appraisal requirements under the FLPMA regulations. This means that the agency must consider the cultural, historic, wildlife, recreation, wilderness, scenic, environmental and other resource values, such as mineral and water rights, of the Federal land as if it were in private ownership for sale in an open market. In making this determination, the Forest Service must include the value of the current federal copper ore that sits underneath the Federal land to be exchanged. It also means that the Forest Service, not Resolution Copper, has final approval over whether the Federal and non-Federal lands are, in fact, equal in value.

Not only must the Forest Service include the tangible values of Oak Flat in its valuation, it must also include the religious and spiritual value of Oak Flat, which is priceless and irreplaceable. This project would destroy a sacred area that has been used as a ceremonial and burial site for the San Carlos Apache tribe and that has been protected from mining for decades. It is also considered a prime area for birders, campers, rock climbers and hikers. These types of factors must be considered when determining the value of the Federal land because, if exchanged, the public will lose all of these resources. Without a clear and transparent process to determine equal value, the Oak Flat land exchange will per se not be in the public interest.

Value of Land Exchange Parcels

Generally, the exchange parcels included in the land exchange law have poor values for conservation and recreation purposes, certainly in comparison to Oak Flat and the proposed tailings location.

For example, a report prepared by Dr. Bob Witzeman for Maricopa Audubon Society, surveyed many of the parcels to be included in the exchange. Dr. Witzeman finds that:

- Recently, the Pitcher Fire burned much of the J Slash X Ranch 147-acre ranch including both its riparian hardwoods and the ranch's adjacent ponderosa forest. With decades of overgrazing, one finds little unburned mature riparian vegetation. The stream flow currently is intermittent (underground at times) with only a trickle on the surface, even after a record wet spring. The ranch's nearly impassible 4WD access road makes this property inaccessible to the general public. Resolution's choice of ponderosa pine riparian habitat, when our Southwest's Sonoran Desert cottonwood/willow ecosystem face such monumental threats, is disturbing.
- Clearly the J Slash X, JL and LX Bar swap properties are fire sale-priced. Their absentee owners' long ago abandoned them and they are now being diligently grazed by USFS permittees who live on ranches elsewhere. These three properties will continue to be grazed by these permittees after the swap.

[44] NDAA, 128 Stat. 3736, §3003(c)(10).

- The LX Bar Ranch, offers a bone dry river bottom for the full one-mile length of the ranch. It is devoid of sufficient water to support cottonwood, willow, sycamore or ash riparian vegetation even if it were not grazed. Only three forlorn medium-to-small sycamores exist near the dry creek. There is one willow at a nearly dry, filthy, algae filled stock tank near the abandoned homestead. Like the Cave Creek and Turkey Creek swap properties, this cattle-devastated property will continue to be grazed after it is traded to the Forest Service. The acquisition of this property is of little benefit to the Tonto National Forest or the public at large.
- The J-I Ranch near Superior, is of little benefit to the Tonto National Forest or the public at large. It has hoof and feces battered livestock tanks and a short ephemeral stream with sycamore and oak vegetation.
- The 7B Ranch, consists of seven miles of bone dry San Pedro riverbed devoid of surface water. It is bereft of the San Pedro's lush willow, cottonwood, ash, sycamore or walnut riparian galleries! This is no gift to the beleaguered San Pedro riparian ecosystem, despite its 800-acre, even-aged, monoculture of upland mesquite on its east bank. The west bank is ecologically sterile, consisting of the dying mining town of Mammoth and huge piles of tailings from the defunct mine.
    - Satellite photographs show large area within the property have been clearcut in the past and diminish the habitat value of the parcel
    - There would be little or no water available for this parcel as BHP, the minority partner in the project, has permitted a planned 35,000 home residential development just upstream from this property.
    - Rio Tinto, under its Kennecott subsidiary, has applied for permits to conduct mineral exploration within a roadless area near the 7B ranch.

These properties must be assessed based on their real value to the public and not from the inflated value that Rio Tinto has placed on them.

The EIS must consider the following:

- The negative aspects of these properties as well as any possible positive values.
- Cumulative and reasonably foreseeable nearby activities that could affect the value of these parcels.
- Public access to these properties.
- While the land exchange law requires that these properties be withdrawn from mining if they were to be transferred to the public, there is no mention of a buffer area around these properties to protect what value they currently possess. It makes little sense to add a property to the National Forest System or to the Bureau of Land Management lands if that property would be so heavily impacted by surrounding development as to be valueless.

Highest and Best Use of the Land

Oak Flat and other lands included in the footprint of Rio Tinto's proposal currently have many uses (recreation, religious observation, subsistence gathering, grazing, and other uses). The proposal would preclude those uses for the foreseeable future. The highest and best use of Oak Flat is not for the short-term gains that may occur as a result of this proposal, but rather for the longer term and intangible uses that currently occur and could occur, absent this proposal.

Purpose and Need for the Project

The Forest Service has limited the purpose and need for this project needlessly and incorrectly. Regardless of the Agency's views of its obligations under both normal mining laws and the mining laws as altered by the NDAA, the Forest Service must not inappropriately narrow the need and purpose for this action.

US laws remind us that:

- "Obviously, an applicant cannot define a project in order to preclude the existence of any alternative sites and thus make what is practicable appear impracticable." *Sylvester v. U.S. Army Corps of Engineers*, 882 F.2d 407, 409 (9th Cir.1989).
- "No decision is more important than that delimiting what these 'reasonable alternatives' are ... One obvious way for an agency to slip past the structures of NEPA is to contrive a purpose so slender as to define competing "reasonable alternatives" out of consideration (and even out of existence) ... If the agency constricts the definition of the project's purpose and thereby excludes what truly are reasonable alternatives, the EIS cannot fulfill its role." *Simmons v. United States Army Corps of Engineers*, 120 F.3d 664, 666 (7th Cir. 1997).
- "An agency may not define the objectives of its action in terms so unreasonably narrow that only one alternative from among the environmentally benign ones in the agency's power would accomplish the goals of the agency's action, and the EIS would become a foreordained formality." *Friends of Southeast's Future v. Morrison*, 153 F.3d 1059, 1066 (9th Cir. 1998).
- The statement of purpose and need for the proposed action is crucially important to the adequacy of an EIS because it "delimit[s] the universe of the action's reasonable alternatives." *Citizens Against Burlington v. Busey*, 938 F.2d 190, 195 (D.C. Cir. 1991). *See also Wyoming v. U.S. Dep't of Agric.*, 661 F.3d 1209, 1244 (10th Cir. 2011) ("how the agency defines the purpose of the proposed action sets the contours for its exploration of available alternatives.").
- As the Court observed in *Webster v. U.S. Department of Agriculture*, 685 F.3d 411, 422 (4th Cir. 2012), "[o]nly alternatives that accomplish the purposes of the proposed action are considered reasonable, and only reasonable alternatives require detailed study. . . ." Thus, in *Citizens Against Burlington,* the court warned that "[a]n agency may not define the objectives of its action in terms so unreasonably narrow that only one alternative from among the environmentally benign ones in the agency's power would accomplish the goals of the agency's action, and the EIS would become a foreordained formality." 938 F.2d at 195.
- Moreover, the agency may not adopt private interests as its own in crafting a purpose and need statement that essentially foreordains approval of the project. *Nat'l Parks and Cons. Assn v. BLM*, 606 F.3d 1059, 1070 (9th Cir. 2010).
- Federal courts have routinely found that NEPA prevents federal agencies from effectively reducing the discussion of environmentally sound alternatives to a binary choice between granting and denying an application. See e.g., *Save Our Cumberland Mountains v. Kempthorne*, 453 F. 3d 334, 345 (6th Cir. 2006).

4. Comments on Specific Impacts

Air Quality

Construction, mining operations, tailings piles, the subsidence zone, vehicle emissions from trucks, and reclamation activities related to the Resolution Copper Mine and along transportation and utility corridors will increase dust, airborne chemicals, and mobile emissions in the region and could compromise air quality standards. Particulate matter 2.5 microns in size ($PM_{2.5}$) would increase over background levels and particulate matter 10 microns in size (PM_{10}) would also increase over background levels, and could contribute to an exceedance of National Ambient Air Quality Standards (NAAQS) for particulates. Air emissions from the proposed Resolution Copper Mine could cause and contribute to the degradation of visibility in the Superstition Wilderness Class I airshed.

Mines are known to create problems with blowing dust due to many miles of dirt roads, and exposed and denuded surfaces such as tailings and waste rock piles. Due to the amount of subsidence associated with this mine, it is quite likely the entire area will be devoid of vegetation and that also means more dust. This dust can contain a variety of toxic materials, and can cause exceedances of air quality standards. The Forest Service must consider the impacts of the air pollution that would be generated by this mine on the health of both employees and area residents, region-wide visual impact on scenery and view sheds, and the impact on plant and animal life. Consideration of the impacts on recreational values and property values should be evaluated as well.

There are real and significant public health issues related to particulate emissions that must be considered in the draft EIS. When particulates ($PM_{2.5}$ and PM_{10}) are inhaled, they can affect the heart and lungs and increase respiratory symptoms, irritation of the airways, coughing, breathing difficulty, and more. The elderly, children, and those with respiratory or other health issues are at greatest risk relative to particulate pollution. A study released in 2008 by the Arizona Department of Environmental Quality (ADEQ) showed that when the levels of PM_{10} in Central Phoenix were high, there was a significant increase in asthma incidents in children.[45]

There are also significant health impacts from the Hazardous Air Pollutants (HAPs) emitted by this proposed facility. Several of the HAPs are known or suspected carcinogens, affect development and reproduction, and our immune systems. Chemicals found in fugitive dust that are of significant concern include: Arsenic, Beryllium, Cadmium, Chromium, Cobalt, Lead, Manganese, Mercury, Nickel, Selenium, and Antimony (page 35-36 GPO). The impacts of these emissions on public health and the environment, potential contamination of water, and other factors should be thoroughly evaluated in the draft EIS.

The draft EIS must fully evaluate the direct and indirect impacts of this project on the air quality in the area. For example, tailings and waste piles will be sources of dust. Prevailing winds can blow this dust toward residential areas. The likelihood that the air quality in the National Forest and surrounding residential areas such as Superior, Queen Valley, and Superstition Vistas will be

[45] Arizona Children's Health Challenge Grant, Arizona Department of Environmental Quality, December 2008.

degraded by both dust and truck exhaust associated with mine operations is significant, and must be addressed in this draft EIS.

The high silica content in the ore body and host rocks, found to be 20 to 50 percent (page 104 GPO) is also of concern. If workers are exposed to respirable dust containing silica, then they are vulnerable to numerous serious health risks. This must be evaluated in the draft EIS.

The draft EIS should also ask and answer the following questions:

- What is the current air quality of the area and how will the mine and tailings pile affect it? Note that portions of Pinal and Maricopa counties are nonattainment areas for particulates.
- What are the wind velocities (minimum, maximum, and average) at the mine site and the tailings sites throughout the year and in which directions are the prevailing winds?
- How far would windblown materials travel from the sites and in what directions?
- What would be the composition of the windblown materials and what are the associated health risks? Are their hazardous materials included?
- What are the expected emissions and what would the composition be of those emissions? What kinds of hazardous air pollutants are associated with the mine and associated activities?

The draft EIS should consider whether any specific air pollutants emitted as a result of the mine's activities (including but not limited to coarse and fine particulate matter, volatile organic compounds, and carbon monoxide) would negatively affect the National Ambient Air Quality Standards ("NAAQS") established under the Clean Air Act, 42 U.S.C. 7409. Specifically, would the mine's activities contribute to exceedances of the NAAQS?

The Filter Plant and Loadout Facility, portions of the Magma Arizona Railroad Company (MARRCO) Corridor, and most of EPS are already within the boundaries of a designated PM_{10} non-attainment area (pg. 37 of Mining Plan of Operations). The impacts from these and other activities should be considered relative to the NAAQS.

The draft EIS must also evaluate a full range of measures to mitigate the impacts to air quality, including revegetation with native plant species, minimizing travel on dirt roads or cross-country, minimizing and finding alternative locations for tailings, and the full range of best management practices for reducing air pollutants. Monitoring and mitigation strategies for fugitive dust may not be sufficient or might cause new problems. The dust-suppression program for the gravel roads used at Project sites that involves periodic watering and/or chemical treatment (page 205 GPO) creates additional issues of further increases in water usage and also adding more chemicals to the area. Additionally, the plan to set reasonable speed limits on access roads within the General Project Area (GPA) (page 205 GPO) falls short as a dust-prevention solution since no enforcement strategies were set forth to ensure vehicles will obey speed limits. Further, the strategy to mitigate fugitive dust emissions at the TSF remains vague, as it states the emissions "will be monitored and actively managed with sprinklers and dust suppressants as necessary" (page 205 GPO). However, the plan does not expand upon the amount of fugitive dust "necessary" to trigger action. That should be identified and evaluated in the draft EIS.

The DEIS should study in detail the fugitive dust potential of all tailings designs and systems being considered, as well as study the site-specific impacts fugitive dust problems would have at any of the proposed tailings locations. Mitigating practices – particularly tailings cover design – should be fully assessed and specialists should be consulted regarding these potential practices.

Climate Change

The Tonto National Forest must analyze the impacts of the proposed project relative to climate change. In November of 2013, the President issued Executive Order 13653—Preparing the United States for the Impacts of Climate Change.[46] This executive order requires agencies to consider the impacts of climate change relative to proposed actions. Therefore, it is the responsibility of the Forest Service to reduce to evaluate this proposal relative to its climate change impacts.

The Intergovernmental Panel on Climate Change's (IPCC) assessment demonstrates that climate change – in particular as a result of anthropogenic drivers contributing to climate change – is a pressing issue that must be addressed by the world's communities.[47] Much focus is on mitigating and adapting to climate change by reducing greenhouse gas emissions. The IPCC assessed the "current scientific understanding of impacts of climate change on natural, managed and human systems, the capacity of these systems to adapt and their vulnerability."[48]

The nation's public lands, and especially the national forests, play a critical role in providing habitat and protection for hundreds of fish and wildlife species. The vast majority of the public has repeatedly made clear that it places a high value on the use of National Forest System lands for fish and wildlife protection. With a growing and sprawling population, resulting in the continued fragmentation of private lands, along with the unprecedented uncertainty created by the current climate crisis, the Forest Service must address the issues of climate change relative to this proposed project.

When compared to the 20th century average, the western United States has experienced an increase in average temperature during a recent five-year period that was 70 percent greater than the world as a whole.[49] Of special concern is that the increase in temperatures occurs more at higher elevations than lower elevations, affecting snow resources which supply much of the western United States' fresh water supply.[50] The IPCC projects that warming of the western

[46] https://www.gpo.gov/fdsys/pkg/FR-2013-11-06/pdf/2013-26785.pdf
[47] IPCC, 2007: Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, M. Tignor and H.L. Miller (Eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA (http://ipcc-wg1.ucar.edu/wg1/wg1-report.html).
[48] IPCC, 2007: Summary for Policymakers. In: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Groups III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, M. Tignor and H.L. Miller (Eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA (www.ipcc.ch/SPM13apr07.pdf) ("IPCC Report").
[49] Saunders, Stephen, C. Montgomery, T. Easley, and T. Spencer. 2008. Hotter and Drier, 2: The West's Changed Climate. Arizona's New Mexico's average temperatures were 2.2 1.3 degrees Fahrenheit warmer in 2003-2007 than for the previous 100 years. (Hotter and Drier, 41)Saunders 2008:43)
[50] Hotter and Drier, Saunders *et al*., 2008:5.

climate will continue, making it imperative the Tonto National Forest consider the impacts of global warming on each proposed action, including travel management.

Global climate change presents a significant threat to the current ecosystems of the southwest.[51] One indication of climate change in the Southwest is that with increasing average temperatures, especially in summer, both the diversity and composition of flowering plant taxa are changing, particularly at higher elevations.[52] Rare and endemic species; species relatively "immobile" due to limited pollinators, seed dispersal, or reproduction; and species at higher elevations are particularly vulnerable to climate change.[53] Wetlands and high-elevation communities such as spruce forests face particularly serious threats in southwestern forests.

Betancourt (2007) suggested that "the abrupt warming beginning in the 1980's" may be responsible for the "exponential spread of buffelgrass (*Pennisetum ciliare*) in the Sonoran Desert, which will continue to spread northward and upward with progressive warming." It seems likely that warmer winter temperatures are a factor in the establishment of invasive species at higher elevations.

The National Climate Assessment issued in 2014 stated, "The Southwest is already experiencing the impacts of climate change."[54] That includes increases in temperatures, which, coupled with the heat-island effect in our cities, will mean higher cooling costs, increased threats (and the associated costs) to public health. The health of Arizona urban residents is also at risk as heat stress has been "the leading weather-related cause of death in the United States since 1986, when record keeping began – and the highest rates nationally are found in Arizona."[55]

The language in the RCM Mining Plan of Operations regarding climate change is vague, at best. It makes references to possible renewable energy use, efficiency, and reducing Greenhouse Gas emissions, but there are no details and no numbers (page 195-196 GPO).

The environmental analysis must consider and disclose the potential consequences of this mine in the Tonto National Forest in conjunction with the impacts of climate change.

Greenhouse Gas (GHG) Emissions

In December 2014 the CEQ released "Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts" that describes how Federal departments and agencies should consider the effects of greenhouse gas emissions and climate change in their NEPA reviews. The guidance recommends a reference point of 25,000 metric tons of CO2-equivalent emissions on an annual basis, below which a quantitative analysis of GHG emissions is not recommended.

Of course, some quantitative analysis is required to determine whether or how the mine's emissions compare to the 25,000 metric ton threshold. Information needed to compute GHG emissions is not directly available from the GPO, but two simple estimates can be made. The

[51] Weltzin and McPherson, 1995.
[52] Breshears, et al., 2008; Crimmins, et al., 2008; Kelly and Goulden, 2008, Parmesan and Yohe, 2003.
[53] Morse et al., 1995.
[54] http://nca2014.globalchange.gov/report/regions/southwest
[55] http://nca2014.globalchange.gov/report/regions/southwest

GPO does state that a peak of 3 million tons of concentrate will be produced per year. So just the transportation by rail of concentrate over a distance of 500 miles, by itself, could result in an annual carbon dioxide footprint comparable to the 25,000 metric ton threshold. The GPO also states that the mine will produce ore at an average rate of 132,000 tons per day with a maximum 165,000 tons per day. The electrical energy (kWh) required just to lift the mass of this ore thousands of feet to the surface corresponds to tens of thousands of metric tons of equivalent CO2 per year, even without considering conveyor efficiency, etc.

Therefore, a quantitative analysis of the GHG emissions in accordance with the White House Council on Environmental Quality ("CEQ") guidelines must be performed under direct supervision of the Forest Service, and the results shown in the EIS. This must account for emissions from all sources attributable to the proposed mine, including mobile and stationary engines burning hydrocarbons within or going to and from the mine facilities, hydrocarbon fueled generators providing electricity to the mine, hydrocarbon fueled transportation of copper concentrates to remote smelting facilities, and loss of CO2 sequestration capacity due to destruction of vegetation.

RCM's main source of power would be a grid intertie to Salt River Project ("SRP") power. RCM's demand is likely to be in the hundreds of megawatts, and given that SRP power is roughly 85% powered by coal and natural gas, carbon emissions to power RCM will be extremely high. Carbon emissions from both power generation and the operation of all fuel-operated mining machinery must be calculated both annually and over the life of mine in the DEIS. These scoping comments do not intend to go into detail about the scientific consensus as to why climate change is an enormous threat to humans, wildlife, and the economy, especially in desert climates facing water scarcity issues. It is, however, worth reiterating the numerous efforts of the federal government to combat climate change, such as the Clean Power Plan, the Bureau of Land Management proposed methane emissions reductions rule, the EPA methane emissions reduction rule, the Renewable Fuels Standard, renewable energy tax credits, and the vehicle gas mileage standards. Since the TNF is a federal agency, it has an obligation to align its priorities in the NEPA process to that of its sister agencies that are going to great lengths to reduce greenhouse gas emissions. It should also follow CEQ's guidance regarding how to consider climate change impacts in all NEPA processes.

The DEIS should include alternatives for RCM's proposed power supply designed to reduce emissions. Preferably, an alternative would include RCM's own renewable power generation, and hybrid heavy machinery (many mines already use hybrid equipment) to run from these renewable sources. Solar thermal power generation is already being successfully deployed in similar desert environments to provide reliable, baseload power using molten salt as an energy storage medium. Solar thermal operations utilizing dry cooling achieve major water savings over wet cooling, and should be considered for all new facilities. An SRP intertie could serve as a backup option to provide conventional energy only when RCM's own power systems fail to do so. An alternative such as this will be an important step to showcase that a new mine does not by definition lead to increased carbon emissions.

Also, TNF should consider the downstream carbon footprint of the mine as well, including the following:

- Transportation (by all methods across the entire chain of custody from assembling of raw materials for equipment and mine supplies to the removal of wastes)
- Smelting and final processing.
- Pumping and movement of water from original sources (ie., the Colorado River) to last use at the mine.
- Production of electricity.
- Use of fossil fuels beyond transportation.

Seismicity and Geologic Hazards (GPO Section 2.2.6.)

The choice of the Maximum Credible Earthquake as the Maximum Design Earthquake for a tailings dam is an appropriately conservative choice for the design seismic event (ICOLD 2001). For most structures, including the design of buildings and other structures that are designed with finite lifetimes, the choice of a Maximum Design Earthquake is often one with a recurrence interval significantly less than that of the Maximum Credible Earthquake, since these structures will not be used indefinitely.

Tailings dams, however, require a very conservative choice of design event. Once these structures are built, it is not economically or environmentally viable to move the waste that is impounded behind the dam. The dam must hold this waste safely in perpetuity. We don't know how long 'perpetuity' means, but 10,000 years (e.g. the approximate time since the last ice age) is a minimum approximation. The conservative choice for the MCE would be the 1-in-10,000-year earthquake (ICOLD 2001). This would be the equivalent of using the Probable Maximum Flood as the maximum flood event that could be experienced at the dam.

A prime factor in choosing a lesser earthquake than the 1-in-10,000-year event is that it is less costly to construct a dam for the smaller event. This is illustrated by the data presented in Appendix I, Table 3. The peak ground acceleration (PGA) at the proposed Near West tailings site for the 10,000-year event is 0.350 g, and for the 5,000-year event it is 0.263 g. Put another way, the PGA for the 10,000-year event is 33% higher than for the 5,000-year event.

This cost savings to the mine operator could, however, lead to significant taxpayer expenditure for future generations if the dam should fail. This is relevant because financial sureties for mines do not cover catastrophic events like dam failure.

Recommendations: If an earthquake less than the Maximum Credible Earthquake (1-in-10,000-year event) is used, an explanation is needed to explain to the public the reason for assuming a higher level of risk than recommended by experts.

Hazard Analysis

Site-Specific Hazard Analyses (GPO Appendix I)

Comparison with National Seismic Hazard Maps (Section 5.3)

In addition to recommending/using the 1-in-5,000-year seismic event, instead of the MCE, the contractor URS notes:

Our site-specific values for a 2,475-year return period using a V_S30 of 1200 m/sec are significantly lower at 0.07 g, 0.05 g and 0.05 g for the PVO. (GPO 2016, Appendix I, p. 5-2)

URS is predicting less horizontal shaking than does the US Geological Survey. While they offer a detailed explanation for this, there is more than mere technical calculation that should be involved in this decision. If URS were predicting greater shaking than the USGS, then the choice would be clear – use the larger, more conservative estimate. However, the URS calculation are showing less shaking than the USGS. Again, an example at the New West tailings location, the USGS value for the comparison earthquake (a 1-in-2,500-year event) the PGA is 0.12 g, while the URS value is 0.05 g. The URS value is less than half the USGS value.

The URS choices make building a tailings dam much less expensive that would be using the USGS values. Do we have enough confidence in the URS site-specific calculations to justify using less conservative values than those provided by the USGS?

Recommendation: As with the choice of the maximum design earthquake, the choice of less- conservative predictions for magnitude of ground accelerations must be justified by the public officials responsible for protecting the public.

Ground Subsidence Prediction and Management

The GPO indicates that the mining operation will cause considerable subsidence over a large area in the vicinity of the mine. The environmental impacts of a large subsidence crater would be harmful enough even on land that would become private as a result of the Land Exchange. The impacts are even more alarming where subsidence can potentially damage natural and cultural objects on nearby lands that will still be public after the Land Exchange. Of course, at the time of this writing, there is a possibility that the Land Exchange may be repealed, and the EIS must consider impacts to land that would remain public in that event. GPO Volume I, Exhibit 3.2-3 and Volume II, Figure 2.2-5a indicate that the subsidence predicted by RCM will come within only 1500 to 2000 feet of the Apache Leap escarpment.

Due to the close proximity of the RCM's predicted subsidence to such an environmentally and culturally sensitive area, it is essential that 1) the extent of the subsidence be correctly predicted, and that 2) legally binding procedures for managing and controlling the extent of the subsidence are precisely specified to assure that public lands are not damaged.

The focus of these comments is on the primary impact, i.e. the extent of the subsidence. Consequential impacts of subsidence on water, wildlife, plants, cultural, and other environmental objects must also be covered in the EIS.

Subsidence Prediction

Considering that a huge subsidence crater may be one of the most visible and damaging impacts of the proposed mine, it is surprising that the GPO provides no information or references substantiating the subsidence predictions that it presents. To assure that the subsidence predictions presented by the EIS are accurate, impartial, and unbiased, an independent subsidence prediction study must be conducted under direct supervision of the Forest Service by an entity

totally separate from and independent of the proponents of the mine (RCM). The results can then be compared with the results presented in the GPO.

Without an independent study, especially with the absence of data in the GPO, it doesn't take much imagination to conclude that the subsidence could be much worse than RCM's predictions, with subsidence angles larger than those shown in GPO Exhibits 3.2-3 and 3.2-4. Documents describing details of the prediction methods and the results of the independent subsidence study must be referenced in the EIS, accessible as downloadable documents available for public scrutiny. These need to indicate how local geological rock data and local geological structures, including faults, are employed as input data to numerical simulations. No such reports are currently shown in the References listed at the end of GPO Volume I, or in the References at the end of GPO Appendix E, "Subsidence Management".

In the absence of validating data, it might be assumed that important geological features have been ignored in RCM's subsidence predictions. For example, GPO Volume II, Figure 2.2-5b shows the West Boundary fault extending up to the lower level of the Tertiary Volcanics, but not extending through the tuff to the surface. Readily available satellite imagery (e.g. Google Earth) and topographic maps, however, show a narrow surface depression extending northwest to southeast roughly parallel with and 2000 to 4000 feet east of the Apache Leap escarpment. Much of this depression is within the Fracture Zone of GPO Volume I, Exhibit 3.2-3 and a small fraction of the depression is actually near the outer portion of the Caved Rock Zone. If this depression is the topographic expression of a fault (possibly the West Boundary fault) or other major subsurface feature, then it could have a significant effect on the extent of subsidence near Apache Leap. The Forest Service must investigate whether this observed depression is an indication of a significant geological feature, and if so, assure that the EIS properly accounts for it in the subsidence prediction.

The EIS must analyze the possible impacts of ground subsidence including damage or destruction of Apache Leap, and US Highway 60, that would still be on public lands after the Land Exchange. It must analyze the well-known recreational areas that would be damaged, such as the Oak Flat Campground, and rock climbing areas such as Oak Flat East, Oak Flat West, and Euro Dog Valley, on lands that would remain public in the event that the Land Exchange is repealed.

Subsidence Management

The Forest Service must assure that legally-binding management procedures are in place to protect nearby lands, such as Apache Leap, from potential damage or destruction caused by ground subsidence.

The GPO in Section 4.2, "Environmental Protection Elements of the Proposed Project", and in Appendix E, "Subsidence Management Plan" states that subsidence will be controlled by limiting the lateral extent of the block caving panels, by not mining some ore, and by monitoring the subsidence.

The Subsidence Management Plan does not, however, describe management processes, or discuss how limits and thresholds will be established. It provides details only on how subsidence will be monitored and reported. It mentions "corrective actions and contingency plans" but does not

define or specify them. So the GPO, as it now stands, is deficient in that it contains no legally-binding provisions that protect nearby public lands, including Apache Leap, from damage or destruction due to ground subsidence.

According to guidelines by CEQ, the EIS should also prescribe mitigation of impacts. In this case the mitigation would consist of measures taken to limit the extent of subsidence to assure that it does not damage nearby sensitive public lands, including Apache Leap, or US 60. Therefore, the EIS must specify mandatory management processes for implementation of such measures. An example would be the criteria and specific actions for limiting or cessation of mining operations when critical levels of certain measurements are reached. The EIS must also define requirements for reporting of related information to the USFS in documents accessible to the public. The fact that the GPO Subsidence Management Plan does not adequately specify how subsidence will be managed is a good reason for the specification to be done independently of RCM. Any related modifications of the GPO must be completed in time to be referenced in the Draft EIS.

Water Resources

The anticipated water demands of the Resolution Copper mine project will be substantial, impacting surface and groundwater supplies at Oak Flat and throughout the region, as well as current and future available water supplies for the State of Arizona. Until the GPO is clarified and the full water demands and water sources for the mine are fully revealed and the impacts fully disclosed though unbiased modeling and scientific study, the TNF is unable to consider (or fairly disclose) the potential environmental effects of the mine as required by NEPA, 26 C.F.R. § 288.8 and applicable law.

To be sure, Resolution Copper does little in its GPO to assist the TNF with these obligations or to fully and accurately disclose its total water demands for the mine to the public at large. Resolution Copper reveals at only a single place in the GPO what it believes its total estimated water needs for the life of the mine will be. Specifically, RMC suggests that "[a] current estimate of the total quantity of water needed for the life of the mine is 500,000 ac-ft." GPO, V-1, Sec. 3.6.1, Water Balance, Sources, and Management at 174 (emphasis added).[56] TNF perpetuates the lack of transparency on this important topic by failing to disclose this critical total water demand number in either the NOI, 81 Fed. Reg. at 53, or in the Scoping Notice sent out to interested parties. *See* 81 Fed. Reg. 14829.

While Resolution Copper's total demand estimate of 500,000 AF (which is no doubt very conservative) is a vast quantity of water, especially given the nature of the ongoing drought in the Southwest and the impending shortage declaration on the Colorado River (which is the source of Central Arizona Project (CAP) water relied upon by Resolution Copper for a significant portion of the mine's water needs), this estimate is actually far less than what close scrutiny of the GPO's figures and tables actually reveals. Careful review of Resolution Copper's cryptically written Tables and Figures, including Figures 3.6-1a, 3.6-1b and 3.6-1c and Tables

[56] It is unclear if Resolution Copper's estimates in the GPO also include the potable water demands needed for the mine operation which will be served by Arizona Water Company? *See, e..g.,* GPO at 178. This should be clarified.

3.6-1, 3.6-2, and 3.6-3, actually shows that over the course of the mine (Years 1-45),[57] Resolution Copper in fact predicts it will need at least **786,626 AF of water** for its mine project. *See* Attachment A (Resolution Copper Estimated Water Usage Spreadsheet).[58] While Resolution Copper also promises in the GPO to maximize "water reuse" for the mine, GPO at 173, 175, further scrutiny of the figures discussed above shows that of the 786,626 AF of water estimated to be needed for the mine, **at least 759,995 AF of this water will need to come directly from Arizona's water supplies** – either from CAP water (direct, recovered/LTSC) or from groundwater (including mine dewatering, Type II groundwater rights, and groundwater pumping *via* Mineral Extraction Permits).[59] *See* Attachment B (The Resolution Copper Mine Project – A 759,995 Acre-feet Bucket Full of Arizona Water!).[60] 759,995 AF is enough water to serve 1 million households in Phoenix for at least 3 whole years.[61] This raises the following question: where will Resolution Copper get the 759,995 AF of water it estimates is needed for the 45 year life of the mine?

- Resolution Copper explains in its GPO, Sec. 3.6.1.1, Sources at 174, that it has 312,000 AF of long-term storage credits (LTSC) from banked/stored CAP in NMIDD (located in the Phoenix AMA) and says it has purchased 37,000 AF of LTSC from Gila River Water Storage LLC, for a total existing water supply of 349,000 AF. Contrary to Resolution Copper's misleading statement in the GPO at 174 (which suggests the mine has 65% of its water supply locked up), Resolution Copper actually has less than half of the water supply needed for the mine secured.

- **Resolution Copper will need to satisfy the remaining balance of water for the mine (totaling 410,995 AF) from Arizona's existing and future water supplies** -- water

[57] In the narrative portion of the GPO, Resolution Copper refers to the life of the mine as 40 years. However, in a number of the GPO's key tables and figures, including those discussed here, Resolution Copper references a 45 year life of mine, presumably to include construction and start up, as well as the first years of closeout, though this is not made clear in the GPO. This should be clarified.

[58] The numbers and colors shown in the attached spreadsheet (Attachment A) for the various water demands, losses, inflows and uses for the mine project have been taken directly from Resolution Copper's Figures 3.6-1a, 3.6-1b and 3.6-1c in an effort to accurately estimate, in a single and easy to read spreadsheet, the total amount of water its mine project will need over the 45-year life of the mine. Given the critical importance of water in Arizona, the failure of Resolution Copper to provide an easy to understand and accurate estimate of its total water demand for the mine undermines the purpose of the GPO under Part 288 and the TNF scoping process.

[59] Although Resolution Copper's Tables and Figures refer to an amount of "reclaimed" water to be used at the mine (totaling 13,014 AF) mostly at the TSF, this water is essentially in a closed loop that does not add to the total water supply needed for the mine. The only water that will be added back to the system in a way that supplements the water supplies needed for the mine is water Resolution Copper refers to as "Estimated Filter Return", which is shown in green in Figures 3.6-1a, 3.6-1b and 3.6-1c, GPO, V-2. This water is recovered from the Filter Plant in the amount of 26,631 AF over the 45 life of the mine. *See id*. All other water needed for the mine must come from Arizona's water supplies.

[60] Numbers in Attachment B showing total consumptive use of mine project for the 45-year life of mine are taken from RCM's Figures 3.6-1a, 3.6-1b and 3.6-1c, GPO, V-2.

[61] Based upon the common rule of thumb that 1 acre-foot is sufficient water to support 4 households for a year. *See* http://www.azwater.gov/AzDWR/IT/documents/Layperson's_Guide_to_Arizona_Water.pdf

supplies that are increasingly the subject of intense competition and shortages, and which are needed by other Arizona water users, such as municipalities and farms, as well as entities like Central Arizona Groundwater Replenishment District (CAGRD).[62]

- TNF must consider the direct, indirect and cumulative impacts to Arizona's water supplies and to Arizona's water users stemming from Resolution Copper's use of CAP water as a future source of supply for the mine as part of its current NEPA process.

- Resolution Copper will not longer have easy access to CAP water supplies given the drought and impending shortage on the Colorado River. While in the past, Resolution Copper could purchase "excess" CAP for storage in and recovery, CAP excess water is no longer readily available due to current shortfalls of Colorado River water and the impending declaration of a "shortage" on the Colorado River by the Secretary of the Interior. A shortage declaration, which would place Arizona in a dire situation (as documented in many recent news accounts)[63] will be triggered, in part, by extremely low levels at Lake Powell and Lake Mead due to a persistent 16-year drought and a lack of rains/snowpack that supplies the Colorado River. This has restricted or totally curtailed CAP excess water supplies, making them an unlikely future water supply for the mine.

- For many of these same reasons, Resolution Copper's reliance on the fact that Arizona Department of Water Resources (ADWR) has recommend that Resolution Copper receive an "allocation" CAP Non-Indian Agricultural (NIA) water from the Bureau of Reclamation in the amount of 2,238 AFY is also illusory. As an initial matter, the NEPA review for this allocation is not complete and the allocation has not yet been finalized. More importantly, however, TNF should consider the fact that the future reliability of the CAP NIA water has plummeted due to the impending shortage on the Colorado River, as Lake Mead hit the elevation of 1,075 earlier this summer, and it is unlikely to recover

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[62] CAGRD was created by the Arizona State Legislature to provide a mechanism for landowners and water providers to demonstrate an "assured water supply" under the State's Assured Water Supply Rules, which became effective in 1995, in order to allow the platting and construction of future houses in certain metropolitan areas of Arizona (Active Management Areas). CAGRD has recently realized it faces substantial shortfalls in existing water supplies needed to fulfill its mission. See http://www.cagrd.com

63 See, e.g., Susanna Eden, Madeline Ryder, Mary Ann Capehart, Closing the Water Demand-Supply Gap in Arizona, Arroyo, University of Arizona Water Resources Research Center, http://wrrc.arizona.edu/publications/arroyo-newsletter/arroyo-2015-Closing-Demand-Supply-Gap, (2015). (Noting that in the event of a severe water shortage, Arizona's allocation of Colorado River water could be reduced to zero before California's allocation is cut).

Abrahm Lustgarten, Less Than Zero, Propublica, July 17, 2015, https://projects.propublica.org/killing-the-colorado/story/groundwater-drought-california-arizona-miscounting-water (Citing to the 2014 ADWR report which warned that due to growth, water demand could "outstrip existing supplies" by 2035).

Caitlin McGlade, Arizona May Give UP Even More Colorado River Water, AZ Central, Apr. 26, 2016, http://www.azcentral.com/story/news/local/arizona-water/2016/04/25/arizona-may-give-up-even-more-colorado-river-water/83523820/ (Based on recent negotiations with CA, NV and AZ, Arizona may lose almost 200,000 more acre-feet of its share if a first-level shortage is declared, compared to cuts in a prior 2007 agreement). .

(without human intervention) by the close of the accounting period for purposes of a shortage declaration. Under even a Level 1 shortage, Arizona will immediately lose its entitlement to 320,000 AFY of water. At a Level 2 shortage, defined to be an elevation at Lake Mead of 1,050, Arizona will take a 400,000 AFY cut, and at a Level 3 shortage (Lake Mead elevation 1,025) Arizona will no longer be entitled to 480,000 AFY of CAP.[64] Should Lake Mead hit "dead pool" all bets are completely off in terms of CAP reliability in Arizona. Based on the foregoing, Resolution Copper's reliance on 2,238 of CAP NIA as a future source of water for the mine is misplaced.

- As part of the EIS, TNF should require additional analysis to determine how much additional CAP water will actually be available (if any) for the mine project – not just in the form of paper rights, but in liquid form – under the various shortage conditions discussed above, along with the timing and likelihood of occurrence of those conditions.

There are other significant water concerns raised by the GPO and Resolution Copper's mine project. For example, the GPO lacks sufficient information about the location and extent of Resolution Copper's "CAP recovery well field" vis-à-vis the location of the groundwater savings/recharge facilities where the CAP LTSCs are purportedly located. More information is required.

- In the GPO, Resolution Copper fails to show the location of CAP recovery well field on its maps and figures vis-à-vis the groundwater savings/recharge facility or facilities where Resolution Copper has its LTSCs. It is also unclear where all of the LTSC to be recovered under this proposal are actually located.

    - The CAP recovery well field, which would consist of 30 wells with a capacity of 400 gpm per well, will be sited somewhere along the MARRCO Corridor between the CAP canal to the west and SR 79 to the east. The CAP recovery well field will provide a legal means for Resolution Copper to pump groundwater from a location along the MARRCO Corridor, in (essentially) exchange for Resolution Copper's LTSC, which Resolution Copper explains it has banked at a groundwater savings facility located to the west of the well field at New Magma Irrigation and Drainage District (NMIDD) in the Phoenix AMA. While there is likely to be little hydrological connection between the LTSC stored in the groundwater savings facility at NMIDD and the groundwater pumped from the CAP recovery well field, the water pumped from the well field is deemed, as a legal matter, to be a means to "recover" Resolution Copper's LTSCs.

[64] In light of the impending "shortage" on the Colorado River, Governor Ducey has been negotiating with its low basin state counterparts, California and Nevada, in an effort to implement "voluntary" cuts in advance of a shortage declaration. While the final results of these negotiations have yet to be revealed, it is well documented that these voluntary cuts would immediately impact agricultural priority water along with other CAP priority water entitlements. This further challenges the reliability of Resolution Copper's reliance on CAP NIA water as a future water supply for its mine.

- The GPO should be clarified regarding the locations of the LTSCs. While Resolution Copper states in the GPO that it has banked 312,000 AF of LTSCs exclusively at NMIDD (presumably the closest groundwater savings/storage facility to its CAP recovery well field), this is in contrast to the statements Resolution Copper recently made to ADWR in its recent 2013 application for a reallocation of CAP NIA water. *See* Table 5.1, *Resolution Copper Mining Application for Non-Indian Agricultural (NIA) Water Allocation*, submitted to ADWR, June 14, 2013 (ADWR NIA Application) at 12. Specifically, in its 2010 ADWR NIA Application, Resolution Copper stated that as of December 2012, it had accrued LTSCs in NMIDD and also in Roosevelt Conservation GSF, the Tonopah Desert Recharge Project and the Hohokam Irrigation District.

- The GPO also provides that future water needs for the mine would also be met by the recovery of 37,000 AF of LTSC from Gila River Water Storage LLC, though the GPO fails to explain how these credits will be recovered for the mine project. It is assumed, however, that these LTSCs will be recovered through the use of the same CAP recovery well field. However, the GPO does not explain where these LTSCs are located, since the Gila River Water Storage LLC maintains water storage permits from ADWR to bank water at various recharge facilities throughout central Arizona.[65]

- The locations of the LTSC and the location of the proposed CAP recovery well field should be clarified. Plainly, the extent of the spatial and hydrologic disconnect between where water is recharged and where it is recovered goes directly to the potential impacts of the CAP recovery well field and its cone(s) of depression on the groundwater supplies of the area. For decades, more groundwater has been pumped from Arizona's aquifers than has naturally recharged back into the aquifers.[66] This was the genesis of Arizona's 1980 Groundwater Management Act and the creation of Active Management Arizona's (AMAs), like the Phoenix AMA and Pinal AMA. Artificial recharge through water storage has been seen as a tool to meet the goal of the Groundwater Management Act, that is "safe yield." However, as ADWR has recently acknowledged, "[h]igh water tables, low water tables, water quality, physical availability, and third party impacts are all conditions that can be affected positively or negatively by the siting and operation of recharge facilities."[67] In addition, ADWR has concluded that

> [Because] there is no requirement that a storer recharge and recover in the same sub-basin, which has created a spatial and

[65] *See* http://www.gilawater.com/about/grws.aspx

[66] *See id.*

[67] *ADWR's Enhanced Aquifer Management: Alternative Cut to the Aquifer Proposal* (2013) at 1.

> hydrologic disconnect between where water is recharged and where it is recovered. In some cases, it has led to water being recovered or used in different sub-basins far from where it was recharged. While some areas have experienced aquifer rebound and stabilization from these practices, other areas have declined. Additionally, given the significant number of credits in storage, there is a great potential for future groundwater level impacts depending on where stored water is recovered. This imbalance in areas with significant historic pumping and resulting cones of depression may pose an impediment to continued economic development and raises questions about Arizona's long term groundwater supply.[68]

- Given the obvious need to better understand and analyze in the forthcoming NEPA process the extent of the spatial and hydrologic disconnect between where Resolution Copper's LTSCs have been recharged/saved and where these LTSCs will be recovered for the mine, this critical matter should be clarified in the GPO, before the NEPA process can move forward. While Resolution Copper says in the GPO that it will "comply" with ADWR requirements to not impact private wells through the use of its CAP recovery well field, GPO at 224, this alone is insufficient under NEPA. TNF should require more information on this topic upfront and fully analyze the direct, indirect and cumulative impacts of the CAP recovery well field on the water supplies for the region and on the surrounding environment.

- The purpose of the Queen Valley Pumping Station should be clarified. The GPO explains that "[t]he 12,000-gpm (760-L/s) Queen Valley Pump Station will be located on the northern side of the MARRCO Corridor between US 60 and Hewitt Station (Figure 3.0-1d)." GPO at 170. It is unclear from the GPO what the purpose of the Queen Valley Pumping Station would be? From a review of the GPO it appears that it might serve to wheel mine water supplies to the WPS or elsewhere within the mine project. However, in the TNF scooping notice, entitled "Resolution Copper Project and Land Exchange, Environmental Impact Statement", the attached map showing the "Mine Proposal Components" labels the location of the Queen Valley Pumping Plant (#5) as being the location of another "well field." This should be clarified. Certainly, if the Queen Valley Pumping Station does include another well field, the impacts of this well field must also be fully disclosed and analyzed in the EIS.

If Resolution Copper is unable to reliably meet its remaining water needs for the 45-year life of the mine (410,995 AF) through the acquisition and use of CAP water due to, among other things, impending shortages on the Colorado River as discussed above and competition for water resources in the State of Arizona, then where will the water come from? The likely answer is it will come directly from groundwater pumping (mine dewatering and raw well water) *via* its Type II Rights and existing or future Mineral Extraction Permits.[69] In fact, Resolution Copper

[68] *Id.* at 2 (emphasis added).
[69] *See* Table 5.4, ADWR NIA Application at 15 (Setting forth Resolution Copper's "Priority Allocation of Fresh Water" for the Mine).

readily conceded this fact in its 2013 application to ADWR for its allocation of NIA CAP water, where it shows that even with an allocation of 3,000 AFY of CAP NIA and available LTSC, the mine will still have the need to perform substantial groundwater pumping *via* its Type II Rights and through Mineral Extraction Permits. *See, e.g.*, Figure 5.5b, ADWR NIA Application at 19.

- Because of the very real need for the development of significant groundwater wells (beyond the CAP recovery wells) is not acknowledged in the GPO and the location of these wells is also know revealed or discussed, TNF should require Resolution Copper to update the GPO in this regard, so that TNF can adequately disclose, model and analyze the impact of potentially a vast amount of future groundwater pumping for the mine on the human environment under NEPA and applicable law.[70] This is particularly critical since Section 3003 requires the TNF to utilize a "single" NEPA document for this process -- meaning the TNF may only get a single opportunity to examine this critical question through the lens of NEPA. Certainly, at a time of prolonged drought and impending water shortages in the State of Arizona, the development of likely numerous groundwater wells needed to serve the mine (coupled with the mine dewatering discussed further below) will have an undeniable impact on the environment of the region and the water supply for the State of Arizona. This must be examined under NEPA. For example, the community of Queen Valley has lowered its per capita water usage significantly over the last few years. However, the mine will likely deplete over 100x as much water from the Queen Creek drainage as Queen Valley will on a daily basis. Indeed, in past years, Queen Creek flowed steadily through Queen Valley, but this has not been the case since Resolution Copper started dewatering the EPS (Shaft #9 and #10) and bypassing this water from the Queen Creek drainage to agricultural fields downstream at NMIDD. It is also well documented that Queen Valley well levels have been dropping over the years. While the ongoing drought may have played a partial role in these declines, many in Queen Valley attribute these drops to Resolution Copper's decision to bypass Queen Creek. However, once mining operations at the EPS begin in earnest, existing and future mine dewatering impacts will increase substantially and the water produced by mine dewatering will be used entirely for the mine operation, likely having a substantial additional impact on Queen Creek and the downstream wells at Queen Valley. TNF should carefully consider and potentially require independent groundwater modeling of these potential effects as part of the NEPA process.[71]

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[70] The EIS needs to account for the possible continuation of drought conditions over the lifetime of the mine, along with projected growth of demand by other water users in the lower Colorado River basin. Continuing drought and cutbacks might not affect Resolution Copper's legal right to its banked LTSC, but it could affect the practical availability of those credits. The EIS must take into account how the availability of water reserves during a severe water shortage would depend on the priority of the Resolution Copper's banked credits relative to municipalities or other users having possibly higher seniority within the CAP. It must also account for the CAP itself having junior priority relative to certain other major users on the lower Colorado River. For example, the Colorado River Basin Project Act of 1968, which authorized the CAP, made the priority of the CAP water supply subordinate to California's apportionment in times of shortage.

[71] It has recommended to TNF in the past that the U.S. Geological Survey be brought onto this project as a cooperating agency to perform independent groundwater modeling and perhaps other analyses to ensure that TNF is able to rely on unbiased and scientifically informed information as part of the NEPA process.

- TNF should examine alternative water sources and mine designs to limit the water needs and impact of the project. Based upon the foregoing, the TNF should examine alternative sources of water supply for the mine, including but not limited additional purchases of existing LTSC and the use of reclaimed water from outside sources, such as effluent from municipal wastewater treatment plants or treated brackish groundwater. The TNF should also consider other potential alternatives for mine design and operations, including but not limited to, a design that would remove the use of a slurry system to transport the tailings and copper concentrate, potentially provide for dry stacked tailings and a full suite of other water conservation measures.[72]

- Resolution Copper will also rely on the inflow of groundwater at the EPS to support its mining operations (which is likely to be significant), potentially draining the regional aquifers, including the shallow alluvial aquifer at Oak Flat, and dewatering base flow and surface flows in Queen Creek, Ga'an Canyon and Mineral Creek. Resolution Copper predicts that groundwater inflow at the mine works, tunnels and shafts at the EPS will be no more than 1,839 AFY during years 1-7.[73] It estimates that groundwater inflow will be 2,580 AFY at years 8-36, and 1,654 AFY at years 37-45.[74] These estimates are not credible for a number of reasons:

    - The proposed block and cave mine would remove ore from as deep as 7000 feet below ground surface (bgs). The existing Shaft #9 at the Magma Mine has been dewatering since 2009 and lowered the water table to more than 3000 feet bgs. It is likely that that is drawdown of more than 1000 feet, although pre-mine levels were not discussed. Such drawdown can obviously cause huge drawdown cones that could extend miles from the mine and affect groundwater, and surface water, in adjacent watersheds including Pinto Creek to the north.

    - The cones of depression may also impact municipal supply wells in Queen Valley, Superior and outlying residential areas. As noted above, the current proposal would use all of this water for the mine project and would not serve to recharge the local aquifer in a meaningful way.

    - Alternatives to be considered. As part of the NEPA process, TNF should include an alternative that would allow for this dewatered water to be returned to the general hydrogeological system from which it was taken, injected as deep as possible, in order to reduce the size of the cone of depression which will form around the mine workings and accelerate the time frame for that cone to ultimately recharge after mining ceases. Resolution Copper's current plan would remove this groundwater permanently, which is an inferior practice

[72] Resolution Copper's own estimates show that at least 733,364 AF of water will be lost over the 45-year life of the mine, mostly due to evaporation as well as other losses. *See* Attachment A.

[73] *See* Figure 3.6-1a, GPO, V-2.

[74] *See* Figure 3.6-1b and Figure 3.6-1c, GPO, V-2, respectively.

compared to injecting it in strategic locations where it is more likely to recharge the cone of depression and reduce the chances of life-supporting and spiritually significant springs and seeps, as well as municipal supply wells, in the area to permanently dry out or experience lower water tables. The EIS should take a hard look at technologically feasible methods to reduce the surface and groundwater impacts from the cone of depression. This practice is common in other mining jurisdictions, and in Nevada, for example, is required by the state water engineer.

- Dewatering impacts will extend from the mine depending on the geology of the site. Segmentation in the aquifer would constrain the spread of drawdown and confining layers or aquitards could prevent connections between shallow and deep aquifers. It is the deep aquifers that are dewatered and it is the shallow aquifers that support surface water flows. Formations between the two control the extent of the hydraulic connection.

- The GPO makes it apparent that the company believes the Concentrator Fault west of the ore body will prevent the spread of the drawdown. There are also faults north of the ore body (between it and Pinto Creek basin) that could segment the groundwater aquifer, with groundwater from each segment not mixing. The shallow aquifer is the Apache Tuff Aquifer, which is bounded on the west by the Apache Leap. Tertiary conglomerate underlies the tuff and the PO treats it as a confining layer separating the shallow from the deep aquifer. Figures 2.2-5b and 2.3-7, GPO, V-2, show that the deep bedrock outcrops west of the mine (and west of Magma), which indicates that is the recharge zone for the deep bedrock groundwater.

- The GPO does not clearly disclose an estimated dewatering rate in its narrative. Rather, Resolution Copper merely states that mine dewatering will provide only "minor" water supplies for operations, *see* GPO, V-1 at 174, and implies that most water sources will be elsewhere. Because it discusses drawdown due to current dewatering, it is essential to have the pumping data to assess the impacts. Furthermore, as discussed above, given the gross shortfall in available water supplies for the mine, mine dewatering will have to be a substantial portion of the mine's water portfolio.

- Groundwater levels recovered to 2100 ft bgs by 2009 from earlier dewatering at the EPS that ceased in 1998. GPO, V-1 at 72. Current water levels are 3100 to 3500 feet bgs in DHRES-02, closest to the mine workings. *Id*. at 73. The GPO is not clear about whether that is a drawdown caused by dewatering since 2009. If so, it suggests the groundwater recovered over 1000 feet from 1998 to 2009. It is not clear however because well DHRES-02 was developed only in 2008.

- The pressure response at DHRES-01_66 and less so at DHRES-01_375 (Montgomery 2010, Figures 8 and 9) demonstrate a linkage through the aquitard that supposedly separates the deep aquifer from the shallow aquifer.

As dewatering began in 2009, the pressure in these transducers began to decrease, up to more than 50 meters, which is indicative of water being drawn from the aquitard into the deep bedrock. This is the type of connection that will facilitate dewatering the deep bedrock for mining to propagate into surface aquifers and eventually into shallow groundwater, the Apache Tuff aquifer.[75] It will eventually lower water levels in that aquifer and significantly impact the spring flow and surface water flow from the shallow aquifer. Montgomery's explanation that the effects are due to construction problems or geologic anomalies (p 7) simply misunderstands the site. The fact that piezometers on DHRES-02 do not respond similarly simply means the piezometers are positioned differently from fractures. It is a reason for far more deep monitoring wells with multiple ports to assess shallow and deep vertical gradients.

- Montgomery makes a grossly simplified calculation to justify a poor assumption regarding vertical flow through the system. The higher pressure in the Apache Tuff, as much as 100 meters higher, as compared to the deep aquifer, does represent a general downward gradient driving flow downward (recharge into the deep aquifer). However, the calculation suggests a total flux of just 25 gpm based on a very simplified conceptualization. A very few preferential flow pathways (fractures) could establish a very significant flow through just some small area of aquitard.

- Montgomery Figure 15 shows deep groundwater response to dewatering Shaft #9. Piezometer DHRES-02 is closer to the shaft and it responded both quicker and had more drawdown than more-distant piezometer DHRES-01. DHRES-01 also had differing responses as function of the depth of pressure transducer. Montgomery does not interpret the data accurately however. The responses resemble a leaky confined aquifer rather than a fully confined one. It is critical that any modeling based on this data accurately reproduce this leaky aspect of the deep bedrock.

- The groundwater monitoring locations shown on Figure 2.3-4 are grossly insufficient in number and depth. Dewatering at this site will go to as much as 7000 bgs, meaning drawdown could be as much as 7000 feet if there is a connection.[76] For this reason, it is absolutely essential this site have numerous

[75] Prior studies at Oak Flat have demonstrated that the Apache Leap Tuff is highly fractured resulting in potential for significant fracture flow through the unsaturated zones. *See, e.g., Geochemical Evidence of Preferential Flow of Water Through Fractures in Unsaturated Tuff, Apache Leap, Arizona*, R.L. Basset, E.L. Hardin and D.L. Thompson, Department of Hydrology and Water Resources, University of Arizona, Tucson, *Applied Geochemistry*, Vol. 13, pp. 185-95 (1998).

[76] Indeed, Resolution Copper realized substantial additional inflow of water into Shaft #10 as it reached greater depths. See Sinking America's Deepest Shaft, Development and Blast Applications for Resolution Copper's No. 10 Shaft, Friscor, S., E&MJ (April 2014) at 28. T. Goodell, general manager for shaft development for Resolution Copper, was quoted as saying, "The consultants told us that we would have little or no water below 4,000ft." He

deep monitoring wells with pressure transducers at every fracture zone with water between the surface and the bottom of the ore body. These monitoring wells must extend north to at least the headwaters of the Pinto Creek drainage, west into the Queen Creek drainage, and south to the south end of the Ga'an Canyon watershed. The wells should be multiport with intervals at every water producing fracture zone. Once established and baseline fluctuations monitored for at least a year, several additional deep wells should be constructed into the ore body. These wells should also have multiport for pumping. Several thirty-day pump tests should be competed with continuous monitoring at all of the levels in all of the monitoring wells. It is only with this substantial data that Resolution can have any accuracy to its prediction of drawdown due to dewatering, including the extent of drawdown and whether it will reach the surface.

  - The monitoring wells must extend north of any faults, especially if those faults could be a flow barrier or conduit. It is entirely inappropriate to make hydrologic assumptions about faults without significant data. The discussion in the GPO at 73 regarding the depth to deep groundwater ranging from 160 to 1150 feet bgs highlights the concerns. The wide variation in depth to groundwater suggests there are different fracture flow systems that have different pressures.

- To summarize, based on the foregoing, mine dewatering scoping issues include:
  - Mining will dewater bedrock as much as 7000 feet below ground surface.
  - The GPO does not actually provide accurate dewatering estimates.
  - Groundwater drawdown will extend for many miles from the proposed mine and continue even after the mine is closed.
  - The GPO does not present adequate hydrogeologic characterization to indicate that segmentation would limit or prevent the expansion of dewatering.
  - Dewatering at depth would impact the water table in shallow aquifers by drawing groundwater from the surface to deep bedrock.
  - The GPO does not present adequate hydrogeologic characterization of any geologic formations between the shallow aquifers and deep bedrock to justify claims of no or little effect.
  - Characterization should include deep wells with multiport sampling ability to assess differing groundwater levels, vertical gradients, and to provide information on pumping yield at differing levels. The deep wells should also characterize the profile of geochemical information.
  - Pumping tests of deep bedrock fractures with monitoring of all other multiport wells are necessary to understand and predict dewatering of such a deep system.

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went on to note that "[t]hey [the consultants] kind of missed that call. We hit it all in one spot and it was quite dramatic." *Id.* at 32.

Water Depletion

Another key aspect of water depletion that is not adequately explored in the GPO, is the substantial long term loss to the system that will occur at the EPS and the Tailings Site Facility, after the mine project is closed out. This must be disclosed in greater detail in the GPO and fully modeled and analyzed in the NEPA process.

- For example, in the GPO, Resolution Copper estimates that total inflow to the underground mine working at the EPS during the 45 year life of the mine will be at least 6,073 AF.[77] However, the GPO does not estimate future depletions to the regional groundwater supply due to the fact that the underground mine workings and the deep pits created by subsidence will take "hundreds to thousands of years to re-saturate…." GPO at 210 (emphasis added). During this period of time, water in the surrounding aquifers will continue to flood into the underground mine workings dewatering the surrounding aquifers and connected surface supplies, while the deep pit lakes created by subsidence from the mine will continue to dewater the surrounding aquifers forever, as the water migrates into the pit and is evaporated. This will result in substantial additional impacts to the hydrologic systems, which are not disclosed in the GPO. These should be disclosed and carefully evaluated and modeled in the EIS.

- For this reason, (and other discussed herein and in the comments of others), the TNF should examine alternative mine development designs that do not rely on the block cave method, including cut and fill and potentially even more innovative mining methods for Oak Flat, in order to limit future groundwater infiltration into the underground mine works and deep pits at EPS and thereby, impacts to the local and regional water supply and the environment as a whole.

- Perpetual maintenance of the TSF and the capture of inflow participation and runoff at the TSF (or any other TSF chosen by the mining company) will also result in additional losses to regional groundwater supplies after mine close out well into the future, if not forever. Estimated future water losses from TSF that will occur after closure should be disclosed and evaluated in the EIS.

As documented here and in the scoping comments of other commentators, the potential water impacts of the Resolution Copper's mine project will be significant, to say the least. TNF should not proceed forward to conduct its "single" EIS on the mine and exchange under NEPA and Section 3003 until the GPO is clarified and the water issues have been disclosed, modeled and studied. Such models and studies must include appropriate alternatives for the mine and the direct, indirect and cumulative impacts of this massive mine project in light of all past, present, and reasonably foreseeable future actions known to the TNF, including those disclosed by Resolution Copper in the GPO, V-2, Figure 2.5-1 as well as other activities. *See, e.g.,* 40 CFR §§ 1502.16, 1508.8, 1508.25(c).[78]

[77] *See* Figures 3.6-1a. 3.6-1b and 3.6-1c, GPO, V-2.

[78] Cumulative effects are defined as, "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually

Use of Outdated BADCT Standards

The GPO relies on using the Arizona Department of Environmental Quality ("ADEQ") Best Available Demonstrated Control Technology (BADCT) standards for design and to prevent water pollution. Are these standards good enough in light of ADEQ testifying in court recently that the AZ BDCAT standards need to be revised?

Acid Mine Drainage

Acid Mine drainage is one of the most significant and problematic impacts of a mining operation. In the case of RCM, most of the rock extracted from the workings is expected to generate acid (PAG) and increase metals loading to water resources over time, perhaps for thousands of years. This will be most problematic at the proposed tailings impoundment as runoff water and water collected from underdrains will likely be acidic and laden with heavy metals. While the plan of operations notes methods of PAG and NPAG separation and tailings deposition that will help to minimize this threat, acid drainage is still expected, and post-closure water treatment under the current plan is expected to be a significant expense after closure. The DEIS should include an alternative that would not require water treatment in perpetuity – specifically, the mine would achieve neutral drainage chemistry within 10 years of the cessation of mineral production. This alternative would likely rely on some of the other alternatives mentioned in these comments that would vastly reduce or eliminate the need for a new tailings impoundment subject to PAG runoff and underdrain collection. If those alternatives are not included in the DEIS, the tailings impoundment would have to be designed to achieve neutral drainage some other way. In addition, the USFS cannot approve perpetual treatment under its environmental and reclamation responsibilities under the Organic Act and related mineral-related laws and regulations.

We know from organizational experience that the entire idea of active water treatment in perpetuity is flawed, yet it remains to be incorporated into mine plans and designs even today. Modern mines are commonly proposed and built that will require between $1 and $10 million per year to operate water treatment plants as far as 5,000 years into the future. These plants require expensive parts, filters, lime treatment, and large amounts of electricity into order to protect surface and groundwater from continuous degradation. It is simply out of touch with reality to suggest that any mine company will have a presence thousands of years from now and will be proactively managing toxic water discharges from a mine it built thousands of years before. In reality, these environmental liabilities are certain to either be paid for by taxpayers of the distant future, or simply neglected altogether.

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minor but collectively significant actions taking place over a period of time." 40 CFR § 1508.7. In a cumulative impact analysis, an agency must take a "hard look" at all actions. TNF analysis of cumulative impacts must give a sufficiently detailed catalogue of past, present, and future projects, and provide adequate analysis about how these projects, and differences between the projects, are thought to have impacted the environment. Without such information, neither the courts nor the public can be assured that the TNF provided the hard look that it is required to provide under NEPA. *See Te-Moak Tribe of Western Shoshone v. U.S. Dept. of Interior*, 608 F.3d 592, 603 (9th Cir. 2010) (rejecting EA for mineral exploration that had failed to include detailed analysis of impacts from nearby proposed mining operations).

In the case of RCM, the danger lies within the possibility of tailings contaminating regional groundwater supplies used by many throughout the region. A cessation of pumping of tailings runoff and underdrain water would result in a tremendous amount of acidic, toxic water simply discharging into the ground. A similar situation exists at the Bingham Canyon Mine in Utah, where a contaminated groundwater plume that originated within waste rock dumps has migrated downgradient and has impacted agricultural and residential wells alike. The threat continues, as this plume is constantly moving closer to a major river and denser housing developments, requiring around-the-clock groundwater pump and treat operations to lessen the impacts, with limited success. A similar plume exists at the Sierrita Mine near Green Valley, Arizona, as well as many other sites throughout the United States and the world.

Given the magnitude of RCM's proposal, it is virtually guaranteed that at some point, acid drainage will begin to have an impact on regional groundwater quality if water treatment in perpetuity is required. It is best to avoid acid generation in the first place using the alternatives described above. RCM has an obligation to future generations to design the mine in such a way that water draining from tailings long in the future discharges at a neutral pH. If this cannot be achieved, tailings should be placed back underground, or at an existing brownfield site(s). It is simply unfair to future generations to place this burden upon them.

Analysis of subsidence crater lake formation.

The DEIS should include independent hydrologic assessments regarding the formation of a lake over time within the subsidence crater. This analysis should include evaporation rates during and after formation, and the impacts of a possible groundwater cone of depression associated with that perpetual evaporation. This analysis should also include pit lake chemistry and evapoconcentration over time, and it should quantify the duration of long term pit lake water treatment obligations, if any are possible.

Mine Design

MARRCO corridor/ filter plant

What negative impacts will affect the community of San Tan Valley regarding the RCM concentrate filtration plant and loading facility?

- Noise
- light pollution
- air quality
- traffic
    - auto and rail
- smell

What happens when pipelines (water, tailings, concentrate) break?

Slurry concentrate lines

- How durable are the slurry pipes?
- How often would they need repairs?
- Why are slurry lines proposed to be underground?
- What is the PSI within the slurry concentrate lines when under full capacity?

- Is there a schedule for replacing the slurry concentrate lines?
- How will breaks in the line be handled?
- What are the reagents used in slurry? How much of that reagent stays in the concentrate?

Will Rio Tinto be using the rail system from Superior to the San Tan filter plant in any capacity?

Rio Tinto plans to drill 30 water wells at undetermined spacing between where the MARRCO utility corridor crossed the CAP canal and where the MARRCO corridor crosses Highway 79. There is no indication as to exactly where these wells would be drilled.

- How much water would be extracted from each well per day?
- What effects would the drawdown of the water table for the numerous pumps have on Superior's desert wells, pumps, and water supply?
- What effects would the drawdown from these wells have on farming practices?
- What effects would the drawdown from these wells have on homes and business near the MARRCO corridor?
- What effects would the pumping have on local water supply, stock pond pumps, and waterways?
- Would pumping from these water wells create subsidence in the region?
- The EIS must calculate the negative socioeconomic impacts of drawdown of the water table from these wells.
- What cones of depression would be created?
- Howe large would these cones of depression be?
- How long would it take for the water table to return to normal after pumping ceases?
- The EIS must provide an accurate and complete set of baseline data before any disturbance of the MARRCO corridor occur.

Tailing pipelines

The tailings slurry pipelines are designed to leak into an open canal.

- Would these canals be lined? This is a reasonable NEPA alternative and required to minimize impacts under the Organic Act and part 228 regulations.
- What is the quantity of toxic material that would leak into the canal and how would it be cleaned up?
- What would be the hazards to wildlife and birds from material within the catchment canals below the tailings pipelines?

West Plant Site

- What negative impacts (noise, dust, lighting, pollution, traffic, smell, etc..) will affect the town of Superior residents from west plant operations?
    - ore extraction
    - crushing
    - milling
    - transportation
    - shipping concentrate
    - concentrate processing

- What other ores and/or commodity metals will be transported by truck out of the west plant?
    - Volume
    - Tonnage
    - number of vehicles
    - size
- Where would gold and silver be processed?
    - How would other metals be processed?
    - What would be the final disposition of metals other than copper and molybdenum?
- Would there be any separation of radioactive or transuranic materials from the ore stream?
    - What would be the disposition of these materials?
    - What would be the hazards associated with these substances found in the ore stream?
- How much fly ash and other materials would be used for concrete at the West Plant Site?
    - Where would these materials come from?
- What methods would be used to prevent dust from drifting over Superior from the WPS?
- What is the salt content of the CAP water and what impact would it have on equipment and other features?

Tonnage of Ore and Development Rock (GPO Section 3.2.2.)

The mine will have an Intermediate Rock Stockpile with a capacity of 498,000 yd^3 (774,000 tons, or 702,000 metric tonnes), and a Development Rock Stockpile with a capacity of 10.3 Myd^3 (16.0 Mtons, or 14.5 M metric tonnes). Once mine production commences, no waste rock will be produced.

It is not clear what will happen to the Intermediate and Development waste rock on mine closure. It is noted in the section on Environmental Commitments that: "No waste rock will be left on site at closure." (GPO 2016, p. 198). There is no clear discussion of what will happen to waste rock brought to the surface. If it is all to be processed through the mill, that should be clearly stated. It could also be disposed in the tailings pond with the cleaner tailings, but there is no discussion of this option. It could also be returned underground, if space permitted.

Recommendation: A thorough discussion of the final disposal for the Intermediate and Development waste rock should be undertaken in the DEIS. Several alternative disposal methods, including processing through the mill, and co-disposal in the tailings pond, should be discussed.

There is no mention in the GPO of geochemical testing for the waste rock. Since at least some of the development rock must necessarily come from zones adjacent to the ore, it is likely that at least some of this waste rock will be potentially acid generating.

Recommendation: All waste rock to be left on the surface should be tested for its potential to develop acid rock drainage and/or neutral drainage.

Tailings

- What would prevent a break or failure of the mine tailings site?
- How much water would be used for dust suppression at the tailings site?
- What criteria was used to determine the difference between acid-generating waste and non-acid-generating waste?
- What negative impacts will affect existing wildlife and birds located in and around the tailings site (current and future)?
- All tailings facilities must be engineered for a 1,000-year Maximum Probable Flood as are many public and private structures.
- Will tailings be stable for a 24-hour rainfall event?
- Will all stormwater be retained or treated that is embanked or behind the tailings?
- Will any spoiled water flow to the local or regional aquifers of waterways?
- Will any test of vibration or seismic effects be carried out for the tailings for various stages of soil moisture? (Will liquefaction occur?)
- Will there be any monitoring for groundwater seepage into Queen Creek or Ga'an Canyon?
- What hydrological methodology and return period will be used for watersheds impacting the tailings?
- How much of the processing reagents stays in tailings?
    - Would these reagents react in any negative ways with the rest of the tailings?
- How is non acid generating rock separated from acid generating rock? In other words, how do you know which is which if they come from the same area? What criteria are used?
- How much water would be required to keep water on top of the tailings (pond)?
- How much water would evaporate from the tailings pond per day?
- The EIS should study and release Preliminary Environmental & Engineering Alternatives for every parcel they looked at for tailings.
- The proposed location of the tailings pile is less than four miles upstream from Queen Valley on the Queen Creek drainage.
    - This area is one of the highest used recreational areas east of Phoenix in Tonto National Forest. Hundreds of ATVers, hikers, horseback riders and other off road vehicles use this area every WEEK and would be lost forever if this site is approved by the Forest Service.
    - The location is east of Queen Valley and prevailing winds from that direction would most certainly bring pollutants into the community.
- Another problem with the location of the tailing pile being upstream and next to Queen Creek is the high probability of pollutants getting into the Queen Valley water source.

Tailings Placement (GPO Section 3.3.10.2)

It is typical for copper mines in the southwest to use upstream-type tailings dam construction, and Resolution Copper is also selecting this method for dam construction in its mine proposal.

> *The preferred embankment construction method identified for the scavenger tailings uses an upstream construction method that allows for concurrent reclamation and rehabilitation. (GPO 2016, p. 131)*

Downstream construction is the safest type of construction from a seismic standpoint, but is more expensive.

> *In general, dams built by the downstream or centreline method are much safer than those built by the upstream method, particularly when subject to earthquake shaking. ... Dams built by the upstream method are particularly susceptible to damage by earthquake shaking. There is a general suggestion that this method of construction should not be used in areas where there is risk of earthquake. (ICOLD 2001)*

Upstream construction is the least secure because it relies on the stability of the tailings themselves as a foundation for dam construction (Davies, M.P. 2002). Tailings are generally placed behind the dam in a slurry from the mill, and can remain saturated for long periods. Saturated, unconsolidated material is very susceptible to liquefaction under seismic loading.

> ***Recommendation: A thorough evaluation of an alternative to upstream-type dam construction should be evaluated due to long-term inherent failure risk associated with upstream-type dams.***

But upstream dam construction, often using the coarse fraction of the tailings, is the cheapest option, and is still routinely employed in tailings dam construction today. Yet upstream construction has been banned in Chile due to numerous failures during seismic events. While Arizona does not pose the same level of risk for earthquakes that Chile faces, there is significant potential for earthquakes in Arizona.

And in fact, even though there is no discussion of downstream-type dam construction in the GPO, this type of construction is depicted in Figure 3.3-8a – Typical Embankment Section Alternative, of the GPO.

Tailings Site (GPO Section 3.3.10.3)

As a result of the tailings dam failure at Mt. Polley, British Columbia, the Expert Panel that reviewed this accident recommends a number of improvements to tailings impoundment construction and management, including:

> *The goal of BAT for tailings management is to assure physical stability of the tailings deposit. This is achieved by preventing release of impoundment contents, independent of the integrity of any containment structures. In accomplishing this objective, BAT has three components that derive from first principles of soil mechanics:*
>
> *1. Eliminate surface water from the impoundment.*
> *2. Promote unsaturated conditions in the tailings with drainage provisions.*
> *3. Achieve dilatant conditions throughout the tailings deposit by compaction. (Expert Panel 2015)*

Underdrains are a key component to attaining and maintaining unsaturated conditions in a tailings impoundment, but the blanket drains proposed for the project would leave a majority of the tailings partially or fully saturated. The design and construction of underdrains for the entire impoundment is easily accomplished and is not costly. Underdrains to desaturate the tailings,

especially the scavenger tailings, would add to long term impoundment safety.

Recommendation: The discussion of underdrains should be expanded to include underdrains in the impoundment itself, not just at the toe of the tailings dam, as in Figure 3.3.9. The Mt. Polley Expert Panel recommends desaturation of all tailings.

Tailings Storage Facility Stormwater Management Plan (GPO Section 4.5.4.4)
In discussing the seepage collection ponds, which would collect potentially contaminated seepage from the tailings impoundment, it is noted:

> *The stormwater that seeps through the tailings will be collected in a series of rockfill underdrains that report to one of 11 seepage collection dams. Each of these dams will have a low-permeability core- and-grout curtain and will be keyed into bedrock to limit seepage to the environment. These seepage dams will also collect all stormwater that runs off of the tailings embankments (S5) and are sized to store the runoff from a 200-year 24-hr storm without discharge. The seepage collection dams are designed with emergency spillways that are sized for the 1,000-year, 24-hr storm. (GPO 2016, pp. 218-219)*

It is also noted that after reclamation and closure:

> *... the seepage collection ponds ... will remain as evaporative sinks post closure. (GPO 2016, p. 297)*

There is no discussion of whether after closure could the seepage + stormwater overwhelm the ponds? What will the worst case water quality of the discharge be during a storm larger than the 200-year 24-hr storm? What will the impacts of probable maximum flood be on the spillways that are designed for the 1,000-year, 24-hr storm?

Recommendation: There needs to be further analysis and discussion of maximum events on water quality and facility design during maximum discharge events.

Alternative Mining Systems to be Considered

San Manuel Mine
The EIS should study the reopening of the San Manuel mine as an alternative to a mine at Oak Flat. This mine was a relatively clean producing mine and has substantial amounts of ore remaining underground.

Filtered Tailings (Dry Stack) Tailings
The high likelihood of CAP water shortages makes it imperative to consider methods for conserving water in the mining operations. Use of filtered/dry stack tailings not only conserves water, but also reduces the area required for tailings storage, and eliminates the need for liquid impoundment with its associated hazards and potential liability of a toxic spill. Filtered tailings are also a necessary feature of the backfill alternative recommended in these comments.

The GPO recommends the disposal of tailings as thickened slurry. Such tailings would have a solids content of only 35% to 65%, similar to when they emerged from the flotation concentrator, and they can be pumped and transported through pipes. Containment at the disposal facility requires retention dams, as described in the GPO. Tailings dams are subject to failure, with a likelihood of 5% over a period of 50 years. Seepage of contaminated water into the underlying ground from the tailings ponds is also a major concern.

The alternative recommended here is the use of filtered tailings, also known as dry stack tailings. They have much lower water content, 11% to 18%, with a consistency similar to damp sand or uncured adobe. This is a newer technology than thickened slurry, but the number of projects successfully using filtered tailings is growing, and the technology is well proven. Filtered tailings offer a number of advantages, including:

- Reduced water use. The amount saved depends on the recycling systems, but a minimum saving of 25% compared to thickened slurry is a reasonable expectation.

- Elimination of hazards and liability due to spills of toxic liquids caused by tailings dam failure. Tailings dams are relatively unreliable. Historically, there is about a 5% chance that any tailings dam will fail in 50 years.

- Reduction of toxic seepage down to about 10% of what it would be for thickened slurry.

- Reduced land use. The footprint of a filtered tailings disposal facility can be about a quarter of the area required for thickened slurry.

- Elimination of water handling infrastructure at the disposal facility.

- Reduced reclamation costs.

- Possible use of the tailings material as backfill replacing the mined material, resulting in elimination of the subsidence crater and elimination of land use for tailings disposal.

A potential disadvantage of filtered tailings is the economic cost of a sizeable filtration plant between the concentrator and the tailings disposal site. It's been stated that filtered tailings are suited only for small operations, no more than about 20,000 tons per day, but the reasons for that are not clear. It's certainly not obvious why the filtration process could not be scaled up to the capacity planned for this mine. The mining industry may not have much experience with large scale filtration plants, but according to GPO Table 3.3-1, the rate of tailings production in the first 3 to 5 years is much less than later, so early experience could be gained with a smaller plant.

With regard to experience, although the mining industry has been constructing tailings dams for about 100 years, failure rates indicate that the industry still has not mastered the challenges of building a reliable tailings dam as proposed in the GPO.

Because of the advantages listed above, it is recommended that an alternative action that uses filtered (dry stack) tailings rather than thickened slurry tailings be considered and adopted. A study must be conducted under direct supervision of the Forest Service comparing the advantages and disadvantages of filtered tailings versus thickened slurry as proposed in the GPO with respect to various factors including those mentioned above. The comparison must evaluate the advantages and disadvantages for the public, and not just for RCM. Although the land may cost RCM nothing, its value to the public is significant. The land saved by using filtered tailings is a benefit to the public, and its monetary value should be determined by an appraisal. The comparison must also include the expected cost of a tailings dam failure when thickened slurry tailings are used as proposed in the GPO. The results must be presented in the EIS.

Resolution Copper DEIS sub-alternatives for dry tailings design

The RCM DEIS should also consider sub-alternatives regarding the most appropriate type of dry tailings design, based on water consumption, fugitive dust, groundwater protection, and visual impacts. Since different designs have different characteristics and tradeoffs, the public deserves to know which design options are available, and what the pros and cons are for each one, before commenting on the DEIS. These designs and systems should be vetted by the Tailings Dam Expert Panel – prior to inclusion as DEIS sub-alternatives. The TNF should provide water balance analysis and consumptive loss numbers for each sub-alternative.

Aqueous tailings present numerous risks and problems, and alternatives to them should be considered in the DEIS from the standpoint of both water conservation as well as catastrophic failures, including those caused by seismic activity. Wet tailings at RCM would require enormous amounts of water to be added to tailings for slurry transport. This water will be lost from the local hydrological system, as it will be embodied within the tailings for decades or more and will not serve to recharge local aquifers. The DEIS should independently verify RCM's claimed amounts of water that will accumulate in the tailings impoundment over time.

In desert climates, aqueous tailings result in continuous evaporation from the surface of the water cover, as well as from other areas of the tailings impoundments where moisture is present. A tailings impoundment the size of RCM's proposal can result in the evaporative loss of many thousands of acre feet of water per year (or perhaps more) as the pond grows in size. The DEIS should also independently verify RCM's claimed amount of water that will be lost to evaporation each year from the tailings impoundment.

Dry designs can achieve more than a 50% reduction in water consumption compared to conventional aqueous designs. Desert states like Arizona – places in which competition over water is being experienced, and is getting worse with climate change – should no longer consider water-intensive technologies of yesterday when viable, proven alternatives already exist to greatly reduce water consumption.

In addition to water consumption, there have been numerous catastrophic tailings dam failures in recent years, and new research has determined that tailings dam failures globally are increasing in severity and rate, driven by the use of larger and higher tailings dams to accommodate the

waste generated by mining increasingly lower grade deposits.[79] The two following examples of modern mine failures demonstrate just how severe the consequences can be. In addition to the acute impacts resulting from the immediate effects of a tailings dam failure, chronic long-term impacts can result from non-recoverable tailings that result in irremediable effects.

Tailings Dam Failure History

Mount Polley, BC

On August 4, 2014, a tailings dam failure occurred in British Columbia at the Mt. Polley Mine, where an estimated 25 million cubic meters of tailings were released into Hazeltine Creek and Quesnel Lake – salmon habitat and a tributary of the Fraser River. The spill occurred at a modern mine, built in 1997. The tailings dam, which failed during mine operations, lasted for less than 20 years. Originally designed as a centerline construction dam, it was later allowed to construct an additional raise using an entirely upstream construction.[80] Mine safety experts and media articles have called the spill one of the biggest environmental disasters in modern Canadian history.[81]

Samarco, Brazil

On November 5, 2015, a major tailings dam burst at the Samarco Mine in Brazil, sending 150 million tons of tailings slurry and contaminated water into the Rio Doce. The tailings buried an entire village, killing at least seventeen people.[82] The spill migrated down the Rio Doce, killing fish, destroying river banks, and eventually reaching the Atlantic Ocean over 200 miles away. Hundreds of thousands of people have been affected – their drinking water sources destroyed and their agricultural operations heavily compromised.

The mine is owned by a joint partnership between mining giants Vale and BHP Billiton, and best available data indicates the tailings dam was constructed in 2009.[83] A lawsuit between the Brazil government and the mine puts the damages related to the dam disaster at roughly $4.8 billion.[84]

Tailings Dam Expert Panel

As a result of the Mount Polley tailings dam failure, the BC government convened a panel of independent technical experts to investigate the cause of the failure and provide recommendations for how to reduce the potential for catastrophic failures in the future.[85] The

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[79] Chambers, David M., and Newland Bowker, Lindsey. "The risk, public liability and economics of tailings storage facility failures," July 21, 2015. Available at: http://csp2.org/files/reports/Bowker%20%26%20Chambers%20-%20Risk-Public%20Liability-Economics%20of%20Tailings%20Storage%20Facility%20Failures%20%E2%80%93%2023Jul15.pdf

[80] Independent Expert Engineering Investigation and Review Panel: Report on Mount Polley Tailings Storage Facility Breach, January 30, 2015. Available at: https://www.mountpolleyreviewpanel.ca/sites/default/files/report/ReportonMountPolleyTailingsStorageFacilityBreach.pdf

[81] https://www.salmonbeyondborders.org/uploads/3/9/0/1/39018435/enviro_disaster_cbc.pdf

[82] http://www.cnbc.com/2016/01/21/samarco-brazil-move-closer-on-48b-dam-disaster-settlement.html

[83] http://blogs.agu.org/landslideblog/2015/11/10/fundao-dam/

[84] http://www.cnbc.com/2016/01/21/samarco-brazil-move-closer-on-48b-dam-disaster-settlement.html

[85] Independent Expert Engineering Investigation and Review Panel: Report on Mount Polley Tailings Storage Facility Breach, January 30, 2015. Available at:

panel made a number of key recommendations, including using best available technology to fundamentally shift tailings storage away from tailings ponds that store water to dry tailings. This included recommendations to:

- Eliminate surface water from the impoundment
- Promote unsaturated conditions in the tailings with drainage provisions
- Achieve dilatant conditions (setting to a solid) throughout the tailings deposit by compaction.

According to the Mount Polley expert panel, "improving technology to ensure against failures requires eliminating water both on and in the tailings: water on the surface, and water contained in the interparticle voids."[86] Only this can provide the kind of redundancy that prevents catastrophic releases.

U.S. Tailings Dam Failures

Tailings dam failures are an issue at U.S. mines as well. A recent analysis of U.S. copper mines operating in 2010, representing 89% of U.S. copper production, found that 28% had experienced partial or full tailings dam failures.[87] Given these statistics, partial and/or total tailings dam failures should be considered a reasonably foreseeable outcome in the NEPA context, particularly since tailings dams become a permanent feature of the landscape, after mining ceases.

Previous research pointed out that most tailings dam failures occur at operating mines, and that 39% of the tailings dam failures worldwide occur in the United States, significantly more than in any other country (Rico, et. al., 2008a, p. 848). A recent Alaska example of a tailings release involves the overtopping of the Nixon Fork dam in 2012.[88]

For these reasons, the DEIS should include an independent risk analysis of the proposed tailings dam design, including seismic risk, in addition to putting forth a range of sub-alternatives for dry tailings management and storage systems and designs.

Alternatives to the proposed tailings location

The General Plan of Operations does not sufficiently address the barriers to other proposed tailings locations, so the DEIS should. In particular, the DEIS should analyze brownfields sites as preferred locations for tailings deposition. Existing open pits – especially pits with pit lakes formed or anticipated to form, are ideal locations for RCM's tailings. The Pinto Valley mine was briefly discussed as a potential option, yet was disregarded due to some limited ongoing operations at the site. The DEIS should consider Pinto Valley even if placing tailings there would have some impact on what might remain of that operation by the time it would begin accepting tailings from RCM.

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https://www.mountpolleyreviewpanel.ca/sites/default/files/report/ReportonMountPolleyTailingsStorageFacilityBreach.pdf

[86] Id.

[87] Earthworks, U.S. Copper Porphyry Mines Report: the Track Record of Water Quality Impacts Resulting from Pipeline Spills, Tailings Failures and Water Collection and Treatment Failures. 2012. Available at: https://cfpub.epa.gov/ncea/bristolbay/recordisplay.cfm?deid=182065

[88] Alaska Department of Natural Resources, "Warning for Violation of Certificate of Approval to Operate a Dam Nixon Fork Tailings Dam," March 19, 2012.

The benefits of a brownfield alternative are major. Many square miles of National Forest land currently used for a variety of sustainable uses would be saved from complete destruction, and the potential impact to groundwater underneath these lands would be eliminated. Using pits that have, or will form, pit lakes brings the added benefit of stopping evaporation from the surface of the lakes, as that water is ultimately replaced by a dry surface. This will allow these sites to avoid the perpetual groundwater drawdown fueled by constant evaporation, and will allow for pre-mining groundwater conditions to return to normal better and faster than if a pit lake were to remain in place.

Geochemical modeling and additional levels of tailings management at RCM will be needed to ensure that tailings placed in existing pits will not lead to increased groundwater contamination at a chosen site, but efforts should be made to study many brownfields alternatives, even if they are some distance away from RCM, as slurry pipelines are capable of transporting tailings long distances, and should be considered. Finally, more than one brownfield sites should be considered in the DEIS. Given that RCM's tailings volume, as proposed, could fill more than one existing open pit, additional sites should be chosen to accommodate all tailings from RCM for its entire projected life. In a mine backfill scenario, RCM's tailings would be minimal compared to the current plan, therefore making it much more feasible to consider brownfields sites for tailings.

These various alternatives should consider a range of tailings deposition techniques, preferably with an emphasis on dry tailings deposition but also evaluating the option of saturated tailings (the risk of catastrophic failure is zero in existing no-outlet pits) if engineers believe it would be the only feasible method. Indeed, the environmental benefits could still far outweigh the negative impacts even in an aqueous tailings scenario.

East Plant

- What impacts would occur in the old Magma mine workings (tunnels, drifts, stopes, etc.) as a result of the proposed block caving method?
- With the intense heat at 7,000 feet, what effects would this have on all mucking, loading apparatus, crushing facilities (and let's not forget workers)?
- Allowing RCM's block caving method, what guarantees will be in place to prevent negative hydrological and geological impacts within and below the subsidence area of the mine and surrounding region?
- The EIS should study whether block caving is the only way to mine this ore body.
- The EIS should study whether cut and fill would be an acceptable mining method
    - The EIS should study how much less waste would be produced by a cut and fill mine
- Are there any other methods of mining that could be used to mine at Oak Flat?
- The EIS should do an independent study of the ore samples.
- Of the 594 pieces of equipment that are projected to be used at the EPS:
    - how many would be diesel?
    - How many would be electric?
    - What are the impacts of these pieces of equipment?
    - How many would be robotically operated?

    - How many would be manually operated?
- The GPO says that fog plumes from the cooling towers and shafts would be at least 330 feet above the east plant site.
    - Is this a traffic hazard?
    - What impact on flora and fauna?
    - Would these plumes affect the cultural importance and uses of Oak Flat?
- Dust containing 50% silica would be released from exhaust shafts.
    - What would be the impact of these dust clouds impact on health and safety of people, plants, and animals?
- What is the salt content of the CAP water and what impact would it have on equipment and other features?
- Where or what are the final flows of outfall of mine water or stormwater from the bottom of the ore body graben?
- Will there be any perched water tables of flows away from the ore body?
- Are there any mines in the world where Block Cave mining has been conducted at 4000 feet or below?
- How much fly ash and other materials would be used for concrete at the West Plant Site?
    - Where would these materials come from?
- How would the quality of water found and used in the mine itself effect mine equipment?
    - Would the acidic nature of the water prematurely age equipment?
- Will underground water be clean enough for mining even after it has gone through the mine's filtration system?
- What is the quality of effluent going back underground to be used for mining operations?
- All EPS site facilities must be engineered to withstand at least 1,000-year flood event or more.
- How knowledgeable is the Forest about the operations contemplated in the GPO? Do you have miners that have actually seen these processes worked with this type of mining?
- If the land at Oak Flat is too expensive to mine, what happens to the land?
    - Could it be sold for development?
- BHP owns 45 percent of Resolution Copper and also owned the existing mine at Pinto Valley where the tailings were originally supposed to go. BHP sold that mine recently. That site could be bought back which would take the tailings pile off of Forest Service land. This alternative should be studied in the EIS.

Block caving will result in the loss of Oak Flat due to subsidence, and the DEIS must consider alternatives to this mining practice that would enable mining to occur without significant surface disturbance. Other techniques could be employed by RCM, and with concurrent filling of workings (including the possibility of filling block cave voids) with tailings as the mine life proceeds, mining could occur in such a way as to limit underground void space to a small fraction of that of block caving, virtually eliminating the potential for surface subsidence. The DEIS should evaluate these possibilities thoroughly. If RCM claims that this is not feasible, it should be able to provide TNF with detailed reasons as to why alternative techniques cannot be employed from an engineering – rather than economic – standpoint. Existing cut and fill (or similar) operations throughout the world should be used as a comparative tool, and third party mining engineers should be consulted with to verify or challenge RCM's findings regarding the

technical (not economic) feasibility of alternative mining techniques that do not result in surface subsidence.

Employing rigorous mine backfilling techniques will also reduce the necessary size of a tailings impoundment substantially. Because tailings would be pumped back underground, only a fraction of the tailings would need to be placed in a tailings impoundment. The DEIS should provide models showing the difference in tailings size requirements under this scenario compared to the current plan.

Backfill Using Filtered Tailings

The subsidence crater, with its destruction of the environment over such a large area, is a major impact of the proposed mine. The tailings storage facility, with its large footprint and possibility of toxic spills and seepage, presents another major impact. Backfilling is recommended as an alternative action to greatly reduce or eliminate both of these impacts. Of course elimination of the crater and the TSF will have a significant effect on the reclamation process.

The backfill material should be filtered (dry stack) tailings. Thickened slurry as proposed in the GPO would be unsuitable for backfill due to its mechanical weakness and to a high likelihood of contaminated liquid seeping into lower working levels of the mine and into natural aquifers.

The backfill can be applied underground or on the surface. Underground backfill has been used successfully for years in mines where there is access to the chamber where the fill is being applied. In a block or panel caved mine the caved void is not directly accessible, so insertion of the backfill into the void by some other means, such as additional shafts, chutes, etc. would be required. To avoid wasting ore, the backfill must be inserted into the caved void above the ore body, i.e. after all of the ore in a panel has caved. Intentional fracturing of the upper part of the ore body could be considered. To prevent surface subsidence, the backfill must be inserted before the caving progresses upward through the overburden. The technical feasibility of underground backfill thus depends on whether the required synchronization between ore extraction, caving, and fill insertion can be reliably achieved. The potential advantage of this method is that it leaves the surface relatively undisturbed, except for the fill injection points and roadways.

Surface backfill would place the fill material on top of the subsidence zone. It would not prevent subsidence, but simply fill in the expected subsided volume to achieve a topography that approximates the pre-mining condition. Reducing hazards to personnel and equipment from surface subsidence that might occur during the backfill operation might require the fill to be deposited either before any ore has been withdrawn directly underneath the current fill deposition or after caving has stabilized. For reclamation the top layer of soil would be removed before mining, and used as cover after completion of backfill. Surface backfilling would result in more surface disturbance than underground backfilling, but it would support revegetation, and would still avoid leaving a huge subsidence crater. One major impact of a subsidence crater is its capture and diversion of rainfall away from natural surface flows and into the lower parts of the crater, where it can mix with potentially acid generating rock. An advantage of surface backfill is that it, along with the soil cover, can and should be designed to prevent water from flowing into the fill volume and mixing with potentially acid generating rock. Although the mining

industry may have little or no experience with the application of filtered tailings as surface backfill, this method of tailings deposition is not too different from the way it would be done at a conventional filtered tailing storage site. So there appears less doubt about the feasibility of surface backfill.

Although underground backfill offers less surface disturbance than surface backfill, it is a relatively unproven technology. So first a detailed study must be conducted under direct supervision of the Forest Service to determine the technical feasibility of underground backfill, and the results should be presented in the EIS. If underground backfill does appear feasible then it could be tested and developed on a small scale during early phases of the mining operation.

Under this alternative action, if either the feasibility study or small scale testing indicate that underground backfill is not feasible, then surface backfill would be applied. Even if underground backfill were feasible, selective application of both surface and underground backfill could be considered, possibly using underground backfill in some portions of the project to minimize surface disturbance and using surface backfill elsewhere. In the event the Land Exchange is repealed, then selective application can be used to protect areas of special recreational and scenic value.

A study must also be conducted under direct supervision of the Forest Service to evaluate the advantages and disadvantages of the backfill alternative with respect to environmental impact, and the results must be presented in the EIS. This must include the monetary value and other benefits to the public of the land proposed for the TSF, since backfill eliminates the TSF and relocates the tailings disposal to the EPS. In the event that the Land Exchange is repealed, then the EIS must also show the benefit of backfill with respect to the public land that would have been totally destroyed by the subsidence crater.

Tailings Impoundment Liners

RCM's current proposal does not include a liner under the tailings impoundment. The DEIS should closely examine the validity and case history of this practice. Given the acid drainage potential as well as the current plan to use aqueous tailings, detailed study of contamination migration to groundwater must occur. The use of a liner should also be analyzed in the DEIS for dry tailings to decrease acid drainage risk.

Tailing impoundment Cover (GPO Section 3.3.10.4)

The closure cover for the impoundment, as depicted in Figure 3.3-10, shows that there will be exposed cleaner tailings on the surface of the impoundment as operation ceases (and therefore there will also be additional cleaner tailings that will be covered only by thin layers of scavenger tailings). It is then planned that the exposed cleaner tailings will be covered by 0.3 meters of compacted fill (source for the compacted fill?), 0.7 m of mechanically placed scavenger tailings, and 0.15 m of sand & gravel to encourage growth of plants on the reclaimed surface. The scavenger tailings will have a cover of only 0.15 m of sand & gravel.

The tailings cover is designed to be a "store and release" evaporative cover for closure (GPO 2016, p. 296). First, at approximately 6-inches in thickness, the scavenger tailings cover is too thin to be a store and release cover. Second, even at approximately 4-feet in thickness, the

cleaner tailings cover is still going to allow some infiltration, especially if water can pond on the surface during storm events.

As planned, the PAG cleaner tailings will probably generate metal oxidation products which will be flushed from the tailings as seepage enters the tailings during large storm events.

This entire problem could be solved by designing a secondary double-lined impoundment inside the primary impoundment, that would hold the cleaner tailings. This impoundment could be capped by a single liner at closure, so the cleaner tailings could remain saturated. The cleaner tailings impoundment would essentially be buttressed by the main impoundment of scavenger tailings, which would be maintained unsaturated by underdrains beneath the entire scavenger tailings impoundment.

Recommendation: EIS should investigate a lined impoundment for PAG material (cleaner tailings and development waste rock) which would minimize the amount of contamination that could leave the tailings facility via groundwater.

Reclamation Financial Assurance (GPO Section 6.14)
It is noted that:

Currently, financial assurance for reclamation has been accomplished or is in process to fulfill three requirements:

- *West Plant Site APP: $15,581,000 irrevocable letter of credit for closure and post-closure monitoring*
- *Individual APP: $6,334,000 bond for closure and post-closure monitoring*
- *AMLRA: $6,020,000 bond (in process) (GPO 2016, p. 302)*

There is no discussion in the GPO or appendices of how these amounts were calculated. These amounts, in total, are low, especially for a mine as large as Resolution Copper. A financial assurance estimate that turns out to be too low can put the public/taxpayer at risk for tens or hundreds of millions of dollars. All of the assumptions and calculations for these amounts, and for all aspects of the FA/bond, should be disclosed during the EIS process so that the public can comment on their viability.

Recommendation: EIS should analyze how this estimate compares to closure and post-closure financial assurances for similar mine facilities in Arizona.

Reclamation and Bonding

How can RCM provide only $28 million in bonding capacity for closure within the approximate 20 miles of mine and impacted public and private lands?

Mining as recently as a half century ago has left our lands littered with the decaying remains of mining facilities, accompanied by polluted lands and waters resulting from inadequate reclamation. This has been exacerbated by relying on taxpayers to pay for reclamation following bankruptcies of the mine operators. The public is still hurt by the Mining Law of 1872, along

with a multiple use policy that allows use of public lands in a way that denies public use for extended periods of time, ending up with lands that may have become so damaged that they are not suitable for any use. People who want to use the land for recreation often have to pay use-fees, but are still discouraged from littering, while mine operators pay nothing for dumping tailings on public lands.

Some of these problems may have been partially resolved by the provisions of 36 CFR 228A of 1974 and the Forest Service Guide for Reclamation Bond Estimation and Administration of 2004. It is essential that these rules be fully and strictly followed to provide maximum protection of public lands and of the taxpayers. Following are some specific issues related to reclamation and bonding that must be addressed in the EIS and/or by modifications to the GPO.

Preparation of Bonding Estimates

The Forest Service Guide in Step 5, "Estimation of Direct Reclamation Costs" allows Forest Service personnel, contractors, or the operator to prepare the initial bonding estimates. The operator, RCM in this case, has obvious incentives to minimize costs. So to assure credibility of the estimates, and to protect the taxpayers, it is essential that all bonding estimates be prepared by the Forest Service or by contractors under direct supervision of the Forest Service.

These initial estimates must be shown in the EIS in a form that discloses component costs for each facility proposed in the GPO, including EPS, WPS, TSF, etc. and for each category of reclamation tasks as defined by Step 4 of the Forest Service Guide, including Interim Operation and Maintenance, Hazardous Materials, Water Treatment, etc. The EIS must specify the reclamation tasks in such a way that they are legally binding on the operator.

Liability Not Covered by Bonding

Step 6 of the Forest Service Guide includes contingencies, but the Guide states it "*is not a way to estimate the cost of worst-case scenarios, such as a spill of fuel during transport or tailings dam failure - - - -* ".

Thus, the Guide seems to cover only bonding for predicted costs of reclamation (e.g. tailings dam construction), but apparently does not cover liability insurance for unplanned events (e.g. consequences of a tailings dam failure). So, even under today's rules, compensation for damages due to a spill, such as at Gold King Mine, which in 2015 dumped toxins into the Animas and San Juan Rivers, would probably be a burden placed on the taxpayers. A similar failure at the Tailings Storage Facility (TSF) of the proposed mine would endanger the environment along Queen Creek, including the community of Queen Valley. Although tailings dams are supposedly a "mature" technology (in use for about 100 years), their failure rates are about 1/1000 per year, or a 5% chance that any tailings dam will fail in 50 years. i.e., they are not reliable.

Therefore, the EIS must state such consequential damages as possible environmental impacts and include an estimate of their expected monetary costs.

Long Term Maintenance

Step 4 of the Forest Service Guide specifies "Long Term Operation, Maintenance and Monitoring" as one of the reclamation tasks. GPO Section 6.12 "Reclamation Goals and

Performance Standards" states that RCM will monitor reclamation success for 5 years following decommissioning, but it says nothing at all about maintenance.

First of all, 5 years is an absurdly short time to watch for something to go wrong in a decommissioned mine and its associated tailings. The above mentioned Gold King Mine near Silverton, CO ceased operations around 1924, and significant toxic leakage had been occurring there for several years prior to the 2015 incident.

In contrast to Section 6.12, GPO Section 6.4 "General Reclamation Procedures and Schedule" states "Post closure care and maintenance would occur for a number of years following the completion of final reclamation. This time frame will be further refined during the NEPA process." Again the GPO provides no description of the maintenance tasks.

Assuming that the "NEPA process" referred to in the GPO Section 6.4 is the development of the EIS, then the EIS must establish a maintenance schedule covering a time frame of much more than 5 years (a minimum of 50 years), as well as specify legally binding requirements for the maintenance tasks to be performed, including standards to be met, and/or the GPO must be modified to provide that information. In the latter case modifications to the GPO must be completed in time to be referenced in the Draft EIS.

East Plant Site Reclamation

There is an inconsistency in GPO Section 6.5 "East Plant Site Closure and Reclamation". It first states "No additional reclamation is anticipated in the block caving zone--" Shortly after that it states: "All the remaining mineralized (but non-economic) rock in the block cave area would be overlain by a thick sequence of inert/net neutralizing rock". This inconsistency must be resolved, and appropriate modifications be made to the GPO in time to be referenced in the Draft EIS.

The EIS must state that according to the GPO, the subsidence crater will not be reclaimed and will be off-limits to the public for decades into the future.

Change of Ownership

Historically the mining industry has had many examples of ownership changing several times during the lifetime of a typical mine. Change of ownership is not specifically covered in the Forest Service Guide, but the EIS must cover this possibility. In the event of a change in ownership the reclamation requirements and associated bonding must remain in effect, and apply to any new owner.

Self-Bonding

The EIS must confirm that self-bonding to cover reclamation is totally unacceptable.

Wildlife and Biology

The proposed RCM project would transform large portions of the Tonto National Forest (TNF) from natural habitat to an industrialized mining and mine waste zone. The Environmental Impact Statement (EIS) must, by law, consider the mine's direct, indirect and cumulative impact

on native biota and the ecosystems that support these species, to include foreseeable impacts to threatened and endangered species, migratory birds and other species of conservation concern. The GPO acknowledges these legal requirements (pages 229-230). An adequate EIS must analyze the potential impact of a range of reasonable alternatives to the affected area's biology and ecology to a sufficient level of detail that allows for the comparison of alternatives. The EIS must also detail how the identified impacts can be avoided altogether (where possible) and minimized. For those impacts that are unavoidable under a reasonable range of alternatives, adequate conservation and mitigation measures must be identified and agreed upon in consultation with federal and state agencies.

Below we identify a range of potential impacts from the RCM project to wildlife and the ecology of the affected area that require detailed analysis, additional studies, inter-agency consultations and careful consideration by TNF throughout the NEPA process.

Oak Flat

Avifauna

Several biotic communities (Interior Chaparral, Madrean Evergreen Woodland, Interior Riparian Deciduous Forest and the Arizona Upland Subdivision of Sonoran Desertscrub) converge in a relatively small area around the proposed mine site. This combination of complex biotic communities interspersed with riverine, pond, and cliff habitat, attract an abundance of avifauna to Oak Flat and the surrounding area (Oak Flat).

Individual observations, E Bird listings, North American Migration Count (NAMC), and Audubon Christmas Bird counts combine to offer a rich picture of the birds that utilize the proposed mine site. In addition, Westland Resources (Westland), compiled prior data, conducted independent surveys, and published the *Bird Survey and Occurrence Record Compilation* in 2012. This compilation documents the occurrence of 172 bird species at Oak Flat.

Data Analysis

Data from previous surveys and independent observations allow the FS a rare opportunity to thoroughly evaluate the impact the proposed RCM project will have on native biota. Although, RCM considered federally listed and USFS Migratory Species of Concern, relatively little mention was made of how the hundred or so other potentially vulnerable species will be affected. In order to rectify this deficiency, all bird observations at Oak Flat should be cross-referenced with the following vulnerability ratings:

- North American Bird Conservation Initiative (NACBI) Watch list – State of the Birds Report (2016).
- Arizona Department of Game and Fish (AzGFD) – Species of Greatest Concentration Need (SGCN). This list should be updated to include all species that have been observed in the Affected Area (AA).
- Partners in Flight (Arizona Bird Conservation Initiative or ABCI) Priority Species Rankings – include all birds with a score of 20 and above.
- Migratory Bird Treaty Act (MBTA) – All birds sighted in the AA should be included in the analysis.

- US Fish and Wildlife Service (FWS) listings (endangered, threatened, candidate, and species of concern).
- US Forest Service (FS) – Management Indicator Species (MIS), Sensitive (S), and Migratory Species of Concern (MSBC). The latter two lists should be updated to actually reflect the bird species that occur in in the AA.

To examine the rarity of birds that utilize Oak Flat, we cross referenced Westland's avian compilation data with scorings from NABCI. This first-ever conservation vulnerability assessment of all native bird species that occur in Canada, the continental U.S., and Mexico was compiled by a team of experts from all three countries. This analysis, based on vulnerability scores from multiple factors, created a *Watch List* of species of the highest conservation concern. Birds with scores of 14 or higher, or a concern score of 13 and a deeply declining population trend, were considered to be in jeopardy of extinction without the application of significant conservation measures. In addition to the two federally listed birds that have been observed in the AA, nine species met the Watch List criteria. **Birds identified by the NACBI Watch List should be provided the same treatment as federally listed species in terms of the level of detailed analysis, impact avoidance, minimization and mitigation measures**. In addition, 7 other bird species nearly made the Watch List with scores of 13. Impacts to these declining species should also be analyzed and their utilization of Oak Flat should be closely monitored.

In preparing the Biological Assessments and Evaluations, the USFS should insure that the EIS utilizes historical data from all available reliable sources, assesses the risk the mine and tailings pose to vulnerable avifauna, and considers alternatives to avoid impacts to populations of all affected species. For all bird species known to be of conservation concern, the EIS should evaluate the direct, indirect and cumulative impacts of the proposed mine, to include the following:

- What will the impacts to avifauna be from the dewatering, and subsequent de-vegetation of riparian areas and aquatic habitats?
- How will loss of habitat from the subsidence crater and ancillary facilities impact resident, breeding and wintering avifauna?
- How will powerlines affect birds? Will they create additional nest/perching sites for predatory species e.g. ravens?
- What impact will the loss of avian breeding and wintering habitats have on native bird populations?
- How will water pollution and waste/settling ponds affect avifauna and successful migration?
- How will noise pollution, vibrations from equipment and lighting impact these species? How will these impacts affect migration, breeding behaviors and breeding success?
- What impact will the loss of habitat have on avian food resources, including local populations of prey species?
- How will a dramatic increase in edges and "edge effects" due to mine construction and ancillary facilities impact breeding behaviors and success (e.g. noise impacts to bird communication and other breeding behaviors, and increased avian predation and nest parasitism)?

Federally Listed Bird Species

Of the four sub-species of willow flycatcher only one, the Southwestern Willow Flycatcher (SWFL), is federally listed as endangered. On at least two occasions, observations of an undifferentiated willow flycatcher have been made at Oak Flat. According to the *Arizona Breeding Bird Atlas* (2005), the peak migration for the SWFL is in early September with stragglers through mid-October. As both sightings of this species were made during September, is it possible that the SWFL is utilizing Oak Flat as a stop-over during migration.

Westland Resources (2011) has also documented the federally threatened Western Yellow-billed Cuckoo (WYBC) in nearby Mineral Creek and possibly in Ga'an Canyon. According to Westland (2015) survey report, "A total of five YBCU detections were recorded during the 2015 survey: one from the Middle Ga'an Canyon transect and four from the Mineral Creek transect (Figures 3 and 5; Appendix B). The YBCU at Middle Ga'an Canyon was detected during the first survey (June 22). At Mineral Creek, three different YBCUs were detected during the third survey, on July 23, including two different YBCUs at one calling station and the third YBCU approximately 2,400 ft (732 m) up the canyon. The fourth detection at Mineral Creek was during the fourth survey (August 6), more than 1 mile down the canyon from the two that were detected together.". The Forest Service should undertake the following:

- Conduct field research to determine if, and the extent to which, the Southwestern Willow Flycatcher is utilizing the affected area.
- If the presence of SWFL is confirmed, habitat for this species should be mapped and quantified.
- Continue to conduct annual WYBC surveys. Expand WYBC survey areas to include oak woodland and mesquite habitats; particularly in bands surrounding major drainages and near water sources (surveys for WYBC conducted by Westland and the Tucson Audubon Society (2015) in "sky island" drainages have detected consistent WYBC occurrence and breeding behavior). Habitat for this species should be mapped and quantified.
- The EIS should analyze how the WYBC, and its habitat in the affected area, will be affected by mining facilities and operations. Consultation with the FWS, under Section 7 of the Endangered Species Act (ESA), should be conducted concerning both SWFL and WYBC.
- The EIS should identify impact avoidance and minimization measures, as well as adequate mitigation measures for both SWFL and WYBC.

Oak Flat Migratory Birds

In addition to providing habitat for breeding and wintering birds, Oak Flat hosts a large variety of migrating avifauna. The 1918 Migratory Bird Treaty Act (MBTA) prohibits the take and possession of birds and their parts, nests, and eggs without a valid USFWS permit.

With regard to the Migratory Bird Treaty Act of 1918, the FWS states:

> Specific provisions in the statute include: Establishment of a Federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or

carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird." (16 U.S.C. 703)

This prohibition applies to birds included in the respective international conventions between the U.S. and Great Britain, the U.S. and Mexico, the U.S. and Japan, and the U.S. and the Russia. Authority for the Secretary of the Interior to determine, periodically, when, consistent with the Conventions, "hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any . . .bird, or any part, nest or egg" could be undertaken and to adopt regulations for this purpose. These determinations are to be made based on "due regard to the zones of temperature and to the distribution, abundance, economic value, breeding habits, and times of migratory flight." (16 U.S.C. 704).

The RCM proposal has a high potential to result in mortality and harassment of migratory birds and to impact "the zones of temperature, distribution, abundance, economic value, breeding habitat and times of migratory flight", and therefore should be disclose and analyzed in depth in the EIS, in consultation with the FWS.

In addition, Executive Order # 13186, issued by President Bill Clinton in 2001, places procedural requirements on the analysis of federal actions on the conservation of migratory birds. RCM's GPO (page 229) "anticipates that a Migratory Bird Treaty Act analysis will be completed" during preparation of the EIS. That analysis should cover all of the migratory species identified by the FWS that have been observed in the AA. The EIS should also identify migratory corridors favored by particular species and analyze whether other avenues for migration will be available to those birds if impacts associated with RCM facilities result in the inability of migratory species to successfully migrate through this key portion of TNF.

Many of the birds which utilize the AA are neotropical migrants. These species conduct long distance trips between Canada, the United States, Mexico, Central and South America. Additional protection for these birds is provided by the 2000 Neotropical Migratory Bird Conservation Act (NMBCA) and should be considered in the EIS.

The MBTA analysis proposed by the GPO should:

- Comply with the procedural requirements of Executive Order #13186.
- Analyze the corridors used by each migrant species documented in the affected area.
- Evaluate the viability of migratory corridors and stop-over sites if Oak Flat and the TSF are converted from native habitat to mining facilities.
- Calculate the amount of riparian habitat used by migrants now and the amount that will remain if the mine is built, to include projections of habitat loss due to de-watering
- Calculate the amount of all habitat types utilized by migratory species in the affected area that is projected to be lost or degraded by the RCM proposal.
- Evaluate concerns stipulated in the NMBTA.

Although the TNF lists 25 Migratory Species of Concern for Oak Flat it is likely that this list does not reflect current knowledge of species that utilize the AA.

- Update the TNF MSBC listings to reflect current knowledge and consider the following:
  - Evaluate existing data, and if necessary, conduct surveys to identify migratory bird species that occur in the AA.
  - Differentiate between neotropical and local migrants and determine of the extent to which these species are utilizing the AA and surrounding areas.
  - Identify all vulnerable species that utilize the AA including those listed by the following organizations: FWS, Watch Listed by NABCI, Arizona State SGCN, and APIF Priority Species.

Once a complete list of migratory bird species is completed, the USFS should evaluate the direct, indirect and cumulative impacts to resident, wintering, and breeding bird species from the proposed mine and ancillary facilities, addressing the following issues and questions:

- How will populations of vulnerable migratory species be impacted and protected?
- How will the projected loss of habitat, and especially the dewatering and de-vegetation of riparian zones and wetted areas, affect migratory birds?
- What are the impacts to nesting and roosting habitats, including cliffs?
- What will the impact of the subsidence crater and associated loss and alteration of habitat characteristics have upon these species?
- What are the impacts from noise, vibration, and disturbance upon migratory species?
- How will the presence of toxic waste water and other open water bodies impact migratory bird species?
- Given that most bird migration occurs at night, what impact will artificial lighting have on migratory bird behaviors, including habitat selection, local and regional movements and breeding success?
- What impact will the mine have on food supply, including local populations of prey species?
- How will the proposed powerlines that will be required to power the RCM proposed project impact bird species?
- How will the likely increase in the distribution of non-native vegetation impact migratory birds?
- Given that the Colorado River Basin Project Act of 1968 places Arizona's claim on Colorado River water in a subordinate position, what impact would a loss of Colorado River water have on local surface water and groundwater and what effects can be projected for bird populations?
- What wildlife management tools will insure that birds survive even if RCM fails to actively monitor birds at the mine site?

Tailings Facility

Avifauna

RCM's proposed tailing storage facility (TSF) lies immediately west of Superior, Arizona and one km north of the Boyce Thompson Arboretum. Sandwiched between an Important Bird Area (IBA) and the Superstition Wilderness, the TSF supports a diverse array of avifauna. Surveys conducted by Westland (*Results of Bird Surveys Conducted at Near West, 2013*) in April and June of 2013 discovered a total of 59 bird species. While these data provide a good foundation

for an avian inventory, it is likely that these abbreviated surveys missed numerous species. For example, during a field trip to the TSF in the spring of 2016, Maricopa Audubon members observed numerous bird species that were not observed by Westland. Records from the nearly adjacent Boyce Thompson Arboretum document the occurrence of over 200 bird species.

Birding trips by Maricopa Audubon Society members to Happy Camp Canyon, Potts Canyon, Hewitt Canyon and across the Montana Road suggest, that birds found on, or near, the TSF may be utilizing desert washes that extend from the Queen Creek drainage to migrate into the Superstition Wilderness. Maricopa Audubon birding trips in spring of 2016 documented an abundance of migrants in riparian vegetation, including Bell's Vireo, Black-headed Grosbeaks, Lark Sparrows, and Western Tanagers.

Due to the relatively small amount of data that has been collected on the TSF, it is likely that the importance of this area to migratory bird species has been underestimated. While the *Migratory Bird Treaty Act Report for the Baseline Hydrological and Geotechnical Data Gathering Activities on the Tonto National Forest, Pinal County* (2015), examines existing data, it is not adequate to the satisfy requirements of the MBTA.

The Final Environmental Assessment for the *Resolution Copper Mining and Baseline Hydrological and Geotechnical Data Gathering Activities Plan of Operations, (USDA 2016)* suggests that no cottonwood/willow riparian forest occurs in the project area. However, substantial riparian zones are adjacent to the TSF in Hewitt and Camp Canyons, and along portions of the Arizona Trail. These areas will likely be impacted by mining activities and are heavily utilized by migratory bird species as well as for nesting by passerines and raptors.

- Although the *Migratory Bird Treaty Act Report for Baseline Hydrological and Geotechnical data Gathering Activities on the Tonto National Forest* (2015) provides useful information, a full research study delineating the utilization of the TSF migratory birds should be conducted. We suggest a three-year field study would be appropriate to fulfill the requirements of the Migratory Bird Treaty Act.
- AzGFD, and to a lesser extent the TNF, have data which specifically evaluates the rarity of birds in the TSF. Both agencies should update their vulnerable species lists to reflect existing and future data.
- All habitat concerns previously stated for avifauna at Oak Flat should also be applied to species on the TSF.

The EIS should carefully analyze the direct, indirect and cumulative impacts to riparian habitats, as this increasingly rare habitat type supports the life cycle of many migrant species. "[r]iparian woodlands comprise a very limited geographical area that is entirely disproportionate to their landscape importance… and immense biological interest. It has been estimated that only 1% of the western United States historically constituted this habitat type, and that 95% of the historic total has been altered or destroyed in the past 100 years (Krueper 1993, 1996). Riparian woodlands are among the most severely threatened habitats within Arizona. Maintenance of existing patches of this habitat, and restoration of mature riparian deciduous forests, should be among the top conservation priorities in the state." (ABCI Conservation Plan, 1999)

Oak Flat and Tailings Storage Facility

Mammals

Special Status Species: Ocelot

On April 18, 2010, an ocelot was killed by a motorist near the proposed mine site on Highway 60 between Superior and Top of the World. At the behest of federal and state officials, the ocelot's carcass underwent a forensic analysis that determined the ocelot was wild in origin. The nearest known breeding population of ocelots is currently thought to be located in northern Sonora, Mexico. The highway where the ocelot died is further away from the Sonoran breeding population than any ocelot dispersal distances documented in the scientific literature. Therefore, it is possible a breeding population exists in southern Arizona. Furthermore, based upon known habitat characteristics of the Sonoran population, suitable habitat for the ocelot clearly exists in the AA.

In order to evaluate this important, yet elusive endangered species, the FS should conduct the following:

- Investigation of all unconfirmed sightings of ocelots
- Work in conjunction with federal and state agencies to conduct a credible survey for ocelot in the affected area.
- Map and analyze the impact of the RCM project on suitable / potential habitats and movement corridors.
- Evaluate the impact of the RCM project upon the potential for future ocelot natural re-colonization and/or reintroductions to the affected area.
- Consultation with the US Fish and Wildlife Service, under Section 7 of the Endangered Species Act, should be conducted concerning ocelot to prevent the further endangerment of this species.

Bats

Nineteen species of bats have been detected in Oak Flat and in the vicinity of the TSF. In addition, AzGFD suspects several other bat species could occur in the AA. Many bats that occur in and around the AA are designated SGCN by the state, and one, the Lesser long-nosed bat, is listed as endangered by the FWS. Bat populations across the United States are now at risk due to the presence of white-nose syndrome, other diseases and habitat loss. The FS should prioritize the following:

- Continue bat inventories in the RCM AA and in the surrounding area.
- Update vulnerable species listings for all bat species that utilize, or may potentially utilize the AA.
- Evaluate impacts to bats from RCM's facilities on breeding, wintering and roosting habitat.
- Determine the impacts to foraging sites, including ponds, other water bodies and riparian zones that bats may potentially use.
- Quantify the impacts to bats from habitat loss/de-vegetation, degradation, water pollution, artificial night lighting, noise, vibration, and other disturbances associated with the mine and ancillary facilities.

- Evaluate the impacts to bat prey species, nectar-producing plants and other food sources from habitat loss.
- Evaluate the impact to plants and other species due to the potential loss of pollination services provided by bats and other mutualistic relationships.
- Consultation with the US Fish and Wildlife Service, under Section 7 of the Endangered Species Act, should be conducted concerning the lesser long-nosed bat to prevent the further endangerment of this species.
- Consultation with federal and state wildlife agencies should occur to identify best management practices, conservation and mitigation measures for all affected bat species.

Other Native Mammal Species

Few mammals, with the exception of bats, have been studied at Oak Flat or the TSF. However, camera traps set out by Westland and the Arizona Mining Reform Coalition have documented habitat use in Oak Flat by mountain lion, bobcat, fox, coyote, coatimundi, black bear, deer, javelina, skunk and ringtail. In addition to these species, bighorn sheep utilize cliff faces and associated desert vegetation near the western border of the TSF. Habitat for many mammal species will be irretrievably lost from the development of RCM's proposed facilities. The FS should study the impact of RCM's plan on common mammalian species, and address the following:

- Provide an inventory, population estimate, and density of all mammal species that inhabit the AA.
- Determine whether certain features within these areas, such as springs, food, or mineral sources, may be critical to the survival of mammal populations that inhabit the AA or surrounding lands.
- How will migratory corridors for big game and other species be affected by the RCM project?
- Examine how the proposed mine and ancillary facilities will impact mammal habitat selection, usage, foraging/hunting abilities
- What impact will RCM have on prey species for carnivorous mammals?
- What impact will artificial night lighting, noise, vibration, olfactory pollution and associated disturbances have upon mammals?
- Conduct a radio-telemetry study to determine the usage of the TSF by bighorn sheep.
- What will be the impacts on mammals from dewatering riparian zones, ponds, springs and wetted areas?
- How will habitat loss, fragmentation and edge effects impact mammalian species' habitat selection, territories, dispersal movements, breeding behaviors and breeding success?
- Consultation with federal and state wildlife agencies should occur to identify best management practices, conservation and mitigation measures for all affected mammals.

Fish, Reptiles and Amphibians

Sonoran Desert Tortoise

Surveys for Sonoran Desert Tortoise (SDT) were conducted on the TSF during late summer of 2012 and 2013 *(Results of Sonoran Desert Tortoise Survey in the Tonto National Forest Near Superior Arizona* (2013). Findings from this study suggest that the TSF provides quality, year

round habitat for this species. Westland concluded that tortoises were widely distributed throughout the study area, with increased concentrations noted in certain desert washes. Unfortunately, the limited scope of these surveys did not permit density calculations for SDT that inhabit the proposed TSF.

Core, higher density populations of this species tend to be "island like" and associated with steeper terrain and aspects, making the species very vulnerable to connectivity disruptions associated with the development of mines, roads, transmission lines, pipelines, and other associated infrastructure. In addition, ravens have been documented use transmission lines as a means to scout out and prey upon young tortoises.

Although a "not warranted" decision concerning the listing of the SDT was made by the FWS, there are still significant concerns about their survival. In order to help prevent a future listing of the SDT the FS should address the following concerns:

- Conduct SDT surveys throughout the TSF that enable density to be calculated.
- Quantify how the destruction of a significant amount of SDT habitat will impact the Superstition tortoise population.
- How will edge effects impact tortoise habitat selection, movements, breeding behaviors and breeding success? For example, powerlines often provide nesting/perching structures for avian predators. Will this increase in nesting substrate result in predation of SDT juveniles? What will the impacts of raven predation be? How will this be avoided, addressed and/or mitigated for?
- How will the footprint of RCM's proposed project, including roads and ancillary facilities, impact desert tortoise burrows? For example, how many tortoise burrows are anticipated to be caved-in and lost due to the development of the proposed mine and associated human activities and maintenance? How much roadkill is anticipated, and how can that impact be avoided and minimized through best management practices and mitigation?
- How will the genetic diversity of tortoises in the Superstitions be affected?
- What will be the protocol for tortoise monitoring and relocation? Will pre-construction monitors be required?
- Consultation with the USFWS and AZGFD concerning desert tortoise should occur to map habitat, identify and map important habitat features, and to identify best practices and conservation and mitigation measures to prevent the further endangerment of this species.
- Mitigation measures that are specific to habitat fragmentation, direct mortality from burrow cave-ins, collisions with vehicles, raven predation and other impacts identified through consultation should be identified, developed and implemented.

Other Reptiles, Fish, and Amphibians

Westland conducted surveys for amphibians and reptiles during 2003, 2004 and 2011 in portions of the AA. Although surveys were intended to be comprehensive, the AzGFD predicts that several species of SGCN reptiles went undetected during this effort.

The GPO repeatedly assumes that water shortages rule out the possibility of many species inhabiting the AA. For example, no surveys were conducted for invertebrates in the TSF because

it was determined to lack perennial streams. However, springs, seeps and ephemeral water sources that potentially support indigenous biota are present in both Oak Flat and the TSF. Furthermore, additional species may not have been detected as amphibians aestivate during periods of drought.

Although not observed in 2011, the lowland leopard frog--a federal Species of Concern, a 1A SGCN, and a Forest Service Sensitive species--has been observed in both Ga'an Canyon and in nearby stock tanks. It is likely that this species still persists in the AA and that additional survey work will be needed to detect it.

In 2000 AzGFD biologists surveyed the section of Mineral Creek immediately downstream of the confluence with Ga'an Canyon. Three species of fish including the native Gila longfin dace, green sunfish and the federally endangered Gila Chub were collected. A subsequent survey by AZGF in 2002 found that Mineral Creek was "totally devoid of fish"; it is unknown what caused this extirpation. In August of 2006, AZGF biologist restocked Mineral Creek with Gila longfin dace. This species was present when Westland Resources biologists surveyed Mineral Creek in November of 2007. Currently, the Gila longfin dace is a considered to be a Sensitive species by the FS. Although no native fish species were discovered in Ga'an Canyon in 2007 (Westland 2009) it is possible that the pools in Ga'an Canyon could once again support substantial populations of native fish species.

- What will be the impact of the RCM proposed project on the Gila Chub, and the prospect of recovery and/or successful reintroduction of this species?
- What will be the impact to Gila Longfin dace, and the prospect of reintroduction of this species?
- Consultation with the US Fish and Wildlife Service, under Section 7 of the Endangered Species Act, should be conducted concerning Gila Chub. Consultation with USFWS and AzGFD should be undertaken to identify best practices and conservation and mitigation measures for Gila Chub and Gila longfin dace.

The FS must first determine what fish, reptile, and amphibian species are present, based on actual data, rather than assumptions. The FS should study the impact of RCM's plans on these species, addressing the following:

- Determine whether the lowland leopard frog still inhabits the AA; if it does, the EIS should analyze impacts to this species, and discuss measures to avoid, minimize and mitigate impacts to this population.
- Assess the impacts on fish, reptiles and amphibians due to habitat loss and/or contamination.
- Conduct a detailed inventory of springs, seeps, water holes in the affected area and the native biota they support.
- What impacts can be expected from dewatering, including loss of riparian areas, springs, and water holes?
- Analyze the impact of the proposed mine and ancillary facilities in terms of habitat loss, degradation, fragmentation and the resulting isolation of populations..

- How will the proposed mine and ancillary facilities impact habitat selection, foraging/hunting local prey species populations, breeding behaviors and breeding success?
  For example, how will edge effects associated with changes in microclimate, artificial night lighting, noise, vibration, olfactory pollution and associated disturbances impact fish, amphibians and reptiles?

Plants

Several biotic communities (Interior Chaparral, Madrean Evergreen Woodland, Interior Riparian Deciduous Forest and the Arizona Upland Subdivision of Sonoran Desertscrub) converge in a relatively small area around the proposed RCM project. These complex plant communities already suffer from their proximity to the urban pollution of Phoenix, prior mining in the area, overgrazing and climate change. Climate change affects the diversity and composition of plant communities, particularly at higher elevations. Studies also suggest climate change has contributed to the spread of invasive buffelgrass - *Pennisetum cliare*, in the area. In accordance with Executive Order 13653, the EIS must evaluate the project's impact on climate change; plants in an upland desert environment can be expected to be particularly affected.

The GPO acknowledges that Arizona law imposes procedures for the treatment of invasive and noxious plant species; the GPO promises that RCM will develop a plan to control noxious weeds (p. 240). The GPO (p. 247) commits RCM to consultation with TNF before noxious weed control measures are implemented and to using chemicals approved by TNF to control invasive species.

The EIS should address the following issues and questions:

- General locations of Arizona hedgehog cactus *Echinocereus triglochidiatus* in the affected area and how many individuals are expected to be impacted and/or lost; identification of critical / suitable habitat; results of the FS's consultation with the FWS under the ESA concerning direct, indirect and cumulative impacts to the Arizona hedgehog cactus; and measures proposed to avoid, minimize and mitigate damage to individual cacti and habitat from the proposed mine and ancillary facilities;
- Expected extent of de-vegetation in the affected area from construction, mining activity, and air pollution, identifying particular species of concern;
- What impact on endemic plant communities can be expected using different assumptions about dewatering of springs, ponds and riparian zones?
- What will be the impact from invasive plants upon native plant communities under various scenarios?
- Do the existing TNF procedures designed to control invasive plants and designating chemical agents to control noxious weeds require revision in light of the scale of the RCM project?
- Whether RCM has produced the plan to control invasive species promised in the GPO and whether that plan is adequate.
- How will cross-contamination of non-native and invasive seed species between sites via all RCM machinery and staff operations be analyzed and addressed?

- What will be the impact to species in the affected area that have symbiotic and mutualistic relationships with native plants? How will those impacts be analyzed and addressed?
- What will be the impact(s) upon native vs. non-native plant composition and abundance, fire regimes, and trophic interactions in the affected landscape? How will those impacts be addressed?
- Consultation with the US Fish and Wildlife Service, under Section 7 of the Endangered Species Act, should be conducted concerning the Arizona hedgehog cactus to prevent the further endangerment of this species.

Fencing and "Non-lethal harassment"

The GPO concedes that RCM's wildlife plans are "preliminary" (p. 237). The GPO says that mammals will be excluded through perimeter fencing and birds through "non-lethal harassment." What will be the impacts to mammals and birds from exclusion fencing and the proposed non-lethal harassment techniques (e.g. habitat fragmentation / population isolation, site avoidance, unintentional mortality, sites and sounds of hazing techniques, open pipes, getting "hung-up" on fencing and other hazards for mammals and birds associated with fencing and harassment)? Appendix X, totaling five pages, purports to be a Wildlife Management Plan but in fact simply lists mine facilities where birds and other wildlife can be anticipated and states general plans to exclude, watch, or otherwise protect them.

- The EIS must include a detailed analysis of the impacts of perimeter fencing
- The EIS must include a detailed description and analysis of non-lethal harassment.
- Alternatives in the EIS must analyze alternatives that seek to avoid, minimize and mitigate for fencing and non-lethal harassment. What exactly does RCM mean by "non-lethal harassment?" Non-lethal harassment must be clearly defined in the EIS. The EIS must be based on approval of concrete, specific measures to protect wildlife. The Forest Service must insure that a comprehensive, sensible Wildlife Management Plan replaces the current Appendix X.

Land Exchange

- How would the flora and fauna be affected by the land exchange?
- How does the land exchange affect threatened, endangered, candidate, migratory and SGCN species?
- How will ecosystem structures, functions and composition be affected by the land exchange?
- The land exchange and the RCM proposal require separate, but mutually informed analyses regarding their respective impacts to flora and fauna. Analyses must be detailed enough to be able to compare alternatives.
- The EIS must analyze the loss vs. gain of all habitat types as a result of the land exchange and RCM proposal.
- Does the land exchange achieve "like for like" in terms of wildlife habitat loss vs. gain of habitat types? If not, how will this be addressed through modifications, conditions and mitigation measures?
- Does the exchange ensure the integrity of riparian habitats such as the 7B exchange parcel protected from nearby developments (i.e. the water rights associated with the approved 35,000 unit development adjacent to the 7B on BHP property near San Manuel

that threaten to dewater this reach of the San Pedro River)? If not, how will this be addressed through modifications, conditions and mitigation measures?

- What will be the impact of the land exchange in terms of wildlife and habitat resources, watchable wildlife opportunities and associated revenues? Is the land exchange in the best interest of the public in terms of wildlife and habitat resources, watchable wildlife opportunities and associated economic revenues? How will losses of watchable wildlife opportunities and economic revenues be addressed and mitigated for?
- The "No Action Alternative" for the land exchange should be analyzed and discussed in relation to the public interest and the land exchange legislation.

Springs

As noted in the water section above, contrary to preliminary analysis supplied by the proponent, there appears to be a hydrological connection between deeper groundwater areas that will be dewatered due to mining activity and a shallow groundwater layer near the surface of the AA. This carries the potential to impact many springs in the area. Springs are keystone features of the landscape, providing microhabitat for specific spring-dependent plant and invertebrate species and water sources for a myriad of animal species. Many spring dependent species are rare and endemic.

While there appears to be only one mapped spring in the land exchange/subsidence area, three unmapped springs in the vicinity were visited and surveyed by Sky Island Alliance (SIA) staff and volunteers in December 2015, including a large cienega and a small cave seep within the land exchange/subsidence area and a deep pool in a drainage close to the edge of that impacted area. Several more surface water areas were observed that could be the result of spring flow, but these were not formally surveyed. It is highly likely that the three surveyed springs within and immediately adjacent to the land exchange/subsidence zone would be dewatered and destroyed.

A 1901 topo map (available at http://historicalmaps.arcgis.com/usgs/) indicates that travel routes through the Oak Flat area passed immediately adjacent to the three springs SIA surveyed. SIA has noted that in some areas that contain many springs, a significant percentage are unmapped, as only the most useful (for human needs) tend to show up on historical maps, so it is likely that there are more springs in the Oak Flat area that have simply not been mapped or studied. A thorough search for evidence of springs in the area should be conducted, and any extant springs that are found should be formally surveyed, including the documentation of rare and endemic species.

The Springs Stewardship Institute database shows approximately 20 springs within 5 miles of the Oak Flat area, 130 within 10 miles, and 408 within 20 miles. It is quite possible that the effects of groundwater pumping/dewatering will reach far beyond the immediate land exchange/subsidence area, depending on hydrology. A thorough, independent analysis should be conducted with regard to the hydrology of the area, how it fits within the larger region, and impacts to regional spring resources.

In general, it appears that the Oak Flat area is an important shallow groundwater area with much potential to support springs, and it is likely that historical and ongoing mining activities have already negatively impacted or obliterated surface waters. Many drainages in the area have mesic

habitat, more than what would generally be expected for an area of such relatively sparse rainfall. The EIS should analyze all available historical data to determine to the greatest extent possible what spring resources have already been lost and the potential for further losses, in order to fully inform its analysis of the potential cumulative impacts of groundwater pumping/dewatering that would result from RCM and the currently proposed TSF.

Another key part of the EIS analysis on this subject is the relative location of springs on the landscape and their effects on wildlife movements and metapopulations. For instance, a series of springs within a reasonable distance of each other could provide critical support for dispersing species, but destroying those springs and creating much larger gaps in surface water availability could have very serious regional impacts on population viability and movement corridors for a range of species. There is a potential wildlife linkage zone that parallels U.S. Highway 60 in this area, and its utility could be severely compromised dues to the impacts of RCM, including the loss of important springs in the area. The EIS should analyze this linkage area, including the role that springs play and the potential impacts of RCM and the currently proposed TSF on its ecosystem functionality.

There are six springs mapped within the footprint of the currently proposed tailings storage facility (TSF). The same considerations apply to this area as at Oak Flat, with regard to the potential for more unmapped springs and endemic species to exist there, as well as their importance to wildlife linkages and ecosystem functionality. A thorough search for evidence of springs, formal surveys of extant springs, and documentation of species present should also be conducted in the TSF area, as well as an analysis of their role in the larger landscape.
Lastly, springs often have very important cultural significance in Native American contexts, so Tribes should be consulted as to the cultural significance and historical use of any springs that are included in the EIS analysis. According to verbal communication of San Carlos Apache oral history, at least one of the springs surveyed by SIA fits this description.

Cultural/Historic/Religious

"Cultural Resources" provides the blanket term for places, objects, and associated traditions that constitute essential links between the past and the present. Fragile, irreplaceable, and generally nonrenewable, cultural resources are recognized using various terms of reference in many Arizona State and U.S. Federal laws, regulations, and policies, including but not limited to historic properties (NHPA); human remains, cultural items and cultural patrimony (NAGPRA), sacred sites (E.O. 13007), and elements of the human environment (NEPA).

The following discussions emphasize the definition, recording, evaluation, and management of prehistoric and historic archaeological sites containing physical evidence of past human activity. Other types of cultural resources are discussed as well, although specific cultural beliefs and traditions are referenced only when necessary to link them to the physical landscape.

At the outset, the project as proposed would violate numerous federal laws, Executive Orders, and policies designed to protect Native American historical, cultural, and religious uses and resources including the Sacred Site(s) noted herein, and thus cannot be approved.

Definition and Recording of Cultural Resources

Archaeological sites consist of bounded spaces or linear features that contain physical evidence of past human behavior. The exact definition of what does or does not qualify as an archaeological site, however, can vary between land management agencies. Federal standards are not uniform amongst all agencies, environmental settings, or cultural frameworks. State, county, and local laws and regulations (where they exist) can differ from federal standards and from each other. This cross-jurisdictional patchwork of definitions and standards can result in very different conclusions about the presence, absence, type, and significance of archaeological remains within a given area. Furthermore, these standards have changed over time. The general trend among professional archaeologists and land managers is toward recognition of a greater diversity and age range of cultural resources, but this has not been consistently applied and many issues are still dealt with on an ad-hoc basis. For example, depending on the standards applied, a given area containing many small, closely-spaced cultural resources may be split into numerous individual archaeological sites; or the same set of resources might be lumped together into a single large archaeological site. As a second example: large low-density artifact scatters that may be keyed to certain landscapes or resource zones have not always been defined as archaeological sites, instead being written off as non-site "background noise" or isolated occurrences with no important research potential.

The EIS should address the following questions related to the definition and recording of archaeological sites.

- Exactly what written standards were used to define what does, or does not, constitute a cultural resource, a historic property, or a sacred site?
- Were the standards consistent across all land jurisdictions?
- Did the standards change during or after the time the archaeological surveys were conducted?
- What was the minimum age at which human-made artifacts and features were required to be recorded as cultural resources?
- If archaeological sites were defined on the basis of some minimum number of artifacts within a given area of dispersal, what scientific evidence backs up such a judgment?
- How were site boundaries defined?
- If artifacts were observed outside of an identified site, how were they recorded and evaluated?
- Were non-site artifacts viewed as evidence of meaningful land use patterns that may not be apparent through studies limited to discrete, bounded sites?
- What written criteria were used to differentiate between low-density artifact scatters that were recorded as sites, and broadly-distributed artifacts that were recorded as isolated occurrences?
- Did the written standards specify that artifact scatters lacking surface features would be recorded as sites?
- Did the written standards specify that all surface cultural features would be recorded as sites even if they lacked associated artifacts?

Adequacy of the Cultural Resource Identification Efforts

The outcome of an archaeological survey depends on innumerable variables. There are generally three types of survey that can be applied to a given project area: Class I (an inventory of known

sites based on background research); Class II (sample survey designed for general characterization of cultural resources within a project area); and Class III (100% pedestrian survey conducted by archaeologists walking closely-spaced, parallel transects across the landscape and examining the ground surface to locate all areas meeting the definition of an archaeological site). Each type of survey has its advantages and limitations. The Class I inventory is an essential starting point that provides a framework for understanding the type and distribution of sites that may exist within the project area, but it is strictly a literature review with no new fieldwork. Class II sample surveys, utilizing any desired field sampling technique, can be useful for predictive modeling about site types and distribution across the landscape, but by definition such surveys are incomplete and they are useful primarily for academic or research purposes rather than development of specific site management plans. Class III surveys are designed to provide 100% surface coverage of a given project area, and although they are the most effective way of locating archaeological sites their success is predicated upon a wide variety of human and environmental factors. A fourth, informal and sometimes unacknowledged survey technique is also available. Judgmental surveys are keyed to certain landscape features conducive to human activity: springs, streams, fertile soil, rock shelters, hilltops, natural travelways, defensive spaces, proximity to natural food sources, etc. Judgmental surveys can result in the discovery of many archaeological sites, including some that may not be found using more formal techniques; but judgmental work also employs the circular logic of finding sites only where sites are expected to be found.

Regardless of the type of field survey being conducted, however, the results are inherently affected by certain recurring factors: crew skill and experience, ground visibility, vegetation, topography, light, weather, and the practical realities of access, distance, length of the work day, budgets, and deadlines. Inadequate Class I background research prior to fieldwork can also sabotage a project by providing poor, incomplete, or outdated information about the types of archaeological sites that are likely to be present. A well-meaning but inexperienced survey crew turned loose in difficult country without adequate training or background information is likely to make mistakes, take shortcuts, and fail to identify not only individual sites but whole classes of sites. The most common types of sites missed are those associated with mobile groups that lived lightly on the land, leaving few features or objects of material culture behind. The presence of such sites may indicate PaleoIndian, Archaic, or Apache use of the land, and failure to identify them would result in a major mischaracterization of the archaeology and human history of the project area.

The EIS should address the following questions about the adequacy of the archaeological survey conducted for this project.

- Did all project supervisory personnel and field directors meet or exceed the current Secretary of the Interior's standards for education and experience required to perform archaeological identification, evaluation, registration, and treatment activities?
- Was a thorough Class I literature review conducted for the project area prior to the initiation of survey, including the locations of all previously conducted surveys and all previously recorded sites?
- Did the Class I literature review also incorporate the results of previous studies near but outside the project area (for example, projects in the US 60/Superior area, the Whitlow Dam area, the Boyce Thompson Arboretum, the Cholla-Saguaro Transmission Line,

Togetzoge Pueblo, the Carlota Mine, and the Globe/Miami area) in order to provide a broader framework for understanding the types and significance of cultural resources within the project area?

- Were these Class I studies reviewed by all field personnel prior to the initiation of fieldwork?
- Was there a written project manual or other source of guidance provided for field personnel in order to ensure consistent techniques, sound judgments, and accurate results?
- Was the entire project area subject to a Class III, 100% surface archaeological survey?
- What interval was used between survey transects?
- Did rough topography and dense vegetation in some portions of the project area prevent survey transects from being consistently followed?
- Were some portions of the project area subjected only to Class II sample surveys, and if so what sampling design was used and how did it serve the project's goals?
- Were some areas subjected only to judgmental survey, and if so what criteria were used to select the surveyed areas and based on what scientific methodology?
- Were judgmental surveys used to re-check landscape features where conventional survey transects might be impractical, such as steep cliffs or canyon walls where petroglyphs, rock shelters, artifact caches, and preserved perishable materials might be present?
- Were all archaeological sites fully recorded, or were some only partially recorded (i.e., those that might extend beyond the project area boundary)?
- If some sites were not fully recorded, how could their National Register eligibility be fully and properly evaluated?
- In what manner were sites evaluated to contain, not contain, or have the potential to contain buried cultural materials?
- Were all sites plotted onto project area maps and aerial photographs using at least one GPS point?
- Were all sites drawn in scaled plan view so as to indicate the absolute and relative locations of all features, artifact concentrations, diagnostic artifacts, sample observation units (if used), and landscape features important for understanding site location and setting?
- Were field personnel trained and tested on their ability to recognize the subtle but unique attributes of Apache sites?
- Were Apache archaeologists hired as professional crew members to identify, record, and evaluate archaeological sites?
- Were tribal cultural staff, elders, and traditional practitioners asked to visit sites and/or culturally sensitive locations, and to provide comments regarding their meaning and significance?

Adequacy of "Old" Survey Data

Archaeological survey standards and techniques have changed greatly over time. Sites that are recognized and recorded today may have gone unrecognized, or considered insignificant, by previous surveyors. In addition, archaeological survey results within a given area can vary over time due to conditions outside of the archaeologists' control. Previously-recorded sites may have been disturbed or destroyed by a variety of human activities, including but not limited to road

construction, ORV use, recreational camping, target shooting, trash dumping, mining, construction or maintenance of pipelines and powerlines, cattle grazing, range infrastructure, and vandalism. Natural process of soil erosion, arroyo cutting, rock spalling, rockslides, tree falls, wildfires, and animal activity can also change the look and qualitative values of a known site over relatively short periods of time.

Due to the many changes in archaeological survey techniques over a period of time, the ongoing application of new knowledge and insights acquired from recent archaeological studies, and the dynamic nature of the environment in which archaeologists work, the results of archaeological surveys conducted more than approximately 10 years ago should be carefully re-evaluated. In some cases, resurvey may be necessary to ensure that the archaeological information is current, accurate, and presented in accordance with the lead agency's standards. These conclusions are supported by the Arizona State Historic Preservation Office (SHPO) in a publication entitled "SHPO Position on Relying on Old Archaeological Survey Data" (SHPO Guidance Point No. 5, 2004).

The EIS should address the following issues related to previous archaeological surveys.

- Will archaeological surveys conducted more than 10 years ago be relied upon for discussion of archaeological resources within the project area?
- Were older surveys conducted in a manner consistent with currently-applicable standards regarding professional qualifications of survey crews, survey transect width, site definition criteria, and accurate GPS locational data?
- What actions will be taken if recent surveys completed in or around the project area resulted in the identification of different site types, site components, or settlement patterns from those discussed in old survey reports, suggesting that certain types of resources were not recognized and recorded during the older surveys?
- How were isolated artifact and/or feature occurrences (IO's) treated during the previous surveys, and is it possible that materials originally recorded as IO's should be included in the expanded boundaries of known sites, or that they qualify as distinct sites based on current definitions and standards?
- Were site numbers assigned to all identified sites?
- Were National Register-eligibility recommendations provided for all identified sites?
- Have recent geomorphological and/or ethnobotanical studies in or around the project area resulted in the correlation of certain site types with landforms or plant communities that could help archaeologists locate sites in areas that were previously not considered sensitive (e.g., deeply buried sites in alluvial settings, cultivated agave stands, agricultural fields around springs or cienegas, encouraged or managed oak groves, plants used in basketry)?
- If the integrity of a given previously recorded site has likely changed since the site was recorded – e.g., through erosion that may have exposed new features or artifacts – will the site be re-recorded to document its present characteristics and re-evaluate its National Register eligibility?
- Were previous surveys conducted with demonstrable knowledge of, and sensitivity to, the types of artifacts and features associated with Apache archaeological sites?
- Will previous survey results be re-analyzed to identify any correlations of site types with specific resource zones and landscape features that are now known to be significant to the

Apache, and which are considered contributing elements of the Chi'chil Bildagoteel Historic District and Traditional Cultural Property?

Historic Contexts and Research Designs

The identification, recording, and evaluation of archaeological and historical sites must take place within a framework of knowledge obtained from close review of previous studies conducted within and immediately adjacent to the project area. Previous relevant work from the surrounding region must also be reviewed. This is true for archaeological projects of all types and at all scales. A project as vast and landscape-transforming as the proposed Resolution Copper Mine, which could potentially cause adverse effects to hundreds of archaeological and historical resources, will require proportionately greater effort. Extensive Class I background research should lead to a series of historic contexts (thematic statements) that draw upon the results of these previous studies. Specific research questions applicable to the project area can then be tiered off the contextual statements. Over-reliance on previous research may, however, backfire when the resources within the project area prove to be substantially different in number, type, and character than what was expected. Similarly, generic "canned" thematic statements and research questions, commonly recycled from one project to the next, may prove to be inadequate or inappropriate for the nature and significance of the resources and their distribution across complex and varied environmental settings. Thus, the archaeological and historical studies must be rigorously grounded in the best-available knowledge and science, yet flexible enough to accommodate new information, ideas, and techniques as the work is in progress. The research must be multi-faceted, designed with the totality of the project in mind, and yet able to focus on the smallest details and subtleties that are necessary for any meaningful understanding of the archaeological and historical resources within the project area.

The EIS should address the following issues regarding historic contexts and research designs that may be developed for any phase of archaeological and cultural research within the project area:

- What process has been or will be used to identify overarching thematic statements and detailed research questions, and how will these be linked and organized?
- Were Class I-based historic contexts developed in advance of the archaeological survey to help interpret and evaluate the sites during their initial recording?
- Were background materials and historic contexts reviewed by all field personnel prior to the initiation of fieldwork?
- Did the historic contexts emphasize land use patterns from the earliest times to the late historic period without arbitrary divisions into archaeologically-invented time periods and unsupported cultural group names (e.g., Archaic, Hohokam, and Salado)?
- Did the historic contexts incorporate the idea of "whole landscape" archaeology, where the entire landscape serves as the analytical unit rather than spatially-segregated, bounded or point-plotted subunits of the landscape?
- Is the Upper Queen Creek watershed (including the creek itself, all of its tributaries, the outer rim of its basin, and the associated interior landscape features) considered as an integrated geographical, environmental, and cultural entity?
- Was Oak Flat identified as an important ecotone with biological, hydrological, geomorphological, and meteorological characteristics that may have had special significance to Native Americans?

- Did thematic statements and research questions address the potential importance of Oak Flat as a crossroads for travel, trade, communication, and integrative social and ceremonial activities?
- Were research themes developed regarding questions of conflict, defense, lookouts, and fortified sites?
- Will a new ethnographic study (not just a rehash of previous studies) be conducted as part of the planning phase of this project?
- Will the ethnographic study include interviews with Native American elders, medicine men, storytellers, singers, dancers, artists, food gatherers, and other holders of traditional knowledge?
- Will ethnographic studies also include Euro-American communities with strong ties to the project area, such as the multi-generation Hispanic mining families of Superior?
- Will military records, land surveys, maps, census data, and other primary sources be directly accessed and cited as part of the ethnographic study?

Proper Application of National Register Criteria

According to Section 106 of the National Historic Preservation Act, archaeological and historical sites are evaluated relative to four areas of significance: Criterion A (associated with events that have made a significant contribution to the broad patterns of our history); Criterion B (associated with lives of persons significant in our past); Criterion C (a significant and distinguishable entity whose components lack individual distinction); and Criterion D (property that has yielded, or is likely to yield, information important in prehistory or history). Seven aspects of integrity are also considered: location, design, setting, material, workmanship, feeling, and association. An archaeological or historical site that meets at least one of the four criteria of significance, and which retains the aspects of integrity that are most important to its significance, may be listed on the National Register of Historic Places, or considered eligible for inclusion on the list. Sites which have not been properly evaluated must be further studied in order to determine whether they meet the eligibility standards. Only sites that meet none of the four criteria, or which lack important aspects of its integrity, are not eligible. If numerous sites are present within a large project area, it is important the standards be applied in a consistent, project-wide manner. The standards must also be applied within a broad framework of knowledge and specific research questions applicable to the project area.

The EIS should address the following questions regarding the evaluation of archaeological and historical sites for their eligibility for listing on the National Register of Historic Places (NRHP):

- Will eligibility considerations be guided by project-specific, project-wide thematic statements and research questions?
- What measures will be taken to ensure the consistent application of the NRHP criteria and integrity considerations throughout the duration and spatial extent of the project?
- Will archaeological and historical sites be individually field-evaluated by the cultural resource Principal Investigator prior to the development of NRHP recommendations?
- Is Criterion D the only criterion that will be considered for archaeological sites pre-dating the Euro-American occupation of the project area?
- What factors will distinguish “eligible” archaeological sites from those of “indeterminate” eligibility requiring further investigations, such as archaeological testing?

- Will NRHP-eligible sites be formally proposed for National Register listings, with the necessary paperwork prepared and forwarded to the Keeper for review?
- Would one or more Historic Districts be considered in order to encompass multiple eligible properties within a bounded geographical area?
- Can eligible properties representing multiple time periods, cultures, and land uses be combined within a single District?
- Will the 21 pre-Apache archaeological sites in the NRHP-listed Chi'Chil Bildagoteel Historic District be considered eligible on their own merits, even though they are not associated with the stated period of Apache significance (post-A.D. 1300)?

Euro-American Archaeology

Discussion of archaeological sites in the project area has been focused on the prehistoric and Apache occupations. Many additional sites, however, are associated with Euro-American land uses within and adjacent to the project area. Archaeological and historical sites may be associated with early land surveys, military activities, ranching, hunting, mining, Depression-era work projects, transportation corridors, and recreational facilities. Of special note are the picnic areas, campgrounds, and other public features constructed by the Civilian Conservation Corps in the 1930s. Additionally, hundreds of check dams, contour terraces, and rock alignments in the Oak Flat area form a substantially intact and visually impressive record of CCC erosion control techniques across a rugged landscape.

The EIS should address the following questions about the treatment of historic archaeological sites and human-made features:

- Will historic contexts and detailed research questions be prepared for historic-period cultural remains within the project area?
- What "period(s) of significance" will be used to evaluate the NRHP eligibility of historic sites and features?
- What archival sources will be examined to better understand historic land uses within and adjacent to the project area?
- Will oral histories be conducted with local elders and the descendants of families with long-time connections to the project area?
- How will spatially-extensive sets of related features (e.g., CCC erosion control features; ranching-related features such as developed springs, corrals, and rock fences; intersecting or intertwined linear features) be recorded?
- Will the CCC erosion control system be mapped and recorded in its entirety on a feature-by-feature basis?
- Will the social, as well as recreational, significance of Oak Flat to the town of Superior and its component populations be examined and documented, and the effects of the proposed mining assessed and avoided or reduced?

Mitigation of Archaeological and Historical Sites

This topic is far too complex, with too many current variables and unknowns, for adequate discussion as a mere scoping issue. Instead, a few general questions are provided below:

- Will the guiding historic contexts, research questions, and mitigation plans be opened up for peer review by professional archaeologists and historians, and their comments taken into consideration?

- Will peer reviewers be able to visit selected archaeological and historical sites before, during, and after mitigation?
- Will Native American communities be provided with the same opportunities for review, comment, and site visits as the peer review team?
- Will mitigation standards be applied in a consistent manner throughout all parts of the project area, regardless of land jurisdiction?
- Will all NRHP-eligible sites be fully mitigated?
- What sampling techniques will be employed within and between sites?
- Will sites be monitored for human remains and previously-unidentified buried features during post-mitigation construction activities?
- Is monitoring possible in the subsidence zone and the tailings pile area?

Chi'chil Bildagoteel Historic District and Traditional Cultural Property

Much of the federally-owned land within the proposed mining area was added to the National Register of Historic Places (NRHP) on February 26, 2016. The Chi'chil Bildagoteel Historic District and Traditional Cultural Property (henceforth referred to as the District) includes 17 archaeological and historical sites related to protohistoric and historic Apache occupation of Oak Flat and Apache Leap. The District meets all four of the National Register Criteria for significance: Criterion A (associated with events that have made a significant contribution to the broad patterns of our history); Criterion B (associated with lives of persons significant in our past); Criterion C (a significant and distinguishable entity whose components lack individual distinction, including groves of oak trees and other culturally-significant natural resources); and Criterion D (property that has yielded, or is likely to yield, information important in prehistory or history). Specific areas of significance include ethnic heritage/Native American; religion; social history; and archaeology. The District consists of a cultural landscape, a suite of natural and cultural features and associations that retains its integrity of location, design, setting, materials, workmanship, feeling, and association. The period of significance is from A.D. 1300 to the present day, reflecting everything from the earliest known Apache sites to the modern-day Apache cultural and religious activities and the collection and use of subsistence and ceremonial resources. Also contained within the District are 21 known archaeological sites occupied by other Native American groups including (but not limited to) the Hohokam and Salado cultural traditions. These 21 sites are considered non-contributing components of District because they are believed to pre-date the Apache occupation of Oak Flat and Apache Leap. The 21 sites nonetheless deserve and require full documentation, assessment, and treatment in their own right as historic properties likely eligible for the National Register.

The EIS should address numerous questions related to the Chi'Chil Bildagoteel Historic District and its values as a federally-recognized Traditional Cultural Property:

- Which of the four types of NRHP significance will be adversely affected by land privatization and subsequent mining-related activities in the District?
- What types of adverse effects will occur to the natural and cultural resources that contribute to the District's eligibility?
- What types of mitigation will be required for the loss of natural and cultural values that contribute to the District's NRHP eligibility under each of the four criteria?
- Which of the seven aspects of integrity will be adversely affected by privatization of the land and subsequent mining-related activities in the District?

- What types of adverse effects will occur to those aspects of integrity that characterize the District in its current state?
- How will adverse effects to the District's current integrity be mitigated?
- Has the entire Area of Potential Effect (including the outermost limits of the subsidence zone) been surveyed for Apache archaeological and cultural sites?
- If currently-unknown Apache archaeological and cultural sites are identified during future surveys and consultations, will they be evaluated under the NRHP eligibility criteria and added to the District?
- Are Apache cultural beliefs tied to specific, identifiable locations and landscape characteristics that will be adversely affected by the proposed land privatization and mining operations?
- What adverse effects will occur to petroglyph sites within the District that may be tied to Apache beliefs about the *ga'an* spirits who drew pictures on the rocks to remind people about the right way to live?
- Does the District contain locations associated with the Apache tradition of "place-naming" and the use of these named places in storytelling and cultural practices?
- What effects would land privatization and physical destruction of landscape features have on the ability of the Apaches to continue their place-naming tradition, and the cultural practices associated with these place names?
- Will viewsheds, lines of sight, and spatial relationships between geographic features that are important in Apache history and culture be adversely affected by mining-related changes to the landscape and topography, and/or by dust and haze generated by mining-related activities?
- Have visual simulations been performed of the project's impacts to visual resources?
- Will Apache religious beliefs and ceremonies be adversely affected by the physical destruction of the landscape where the *ga'an* spirits are said to dwell underground?
- Given the history of Apache aboriginal territory being fragmented by modern ideas of land ownership and economic development, and the resulting loss (through physical destruction and/or access restrictions) of many sacred and ceremonial areas, what will be the cumulative effects of the proposed action on the Apache's ability to continue with the ceremonies, beliefs, and traditions that are tied to specific places on the land?
- What measures have been taken to ensure that archaeological sites lacking easily-recognized diagnostic artifact or feature types have not been misclassified as prehistoric sites and characterized as non-contributing elements of the District?
- On what basis were 21 archaeological sites that are believed to pre-date the Apache occupation classified as non-contributing components of the District?
- For management purposes, are the 21 archaeological sites believed to pre-date the Apache occupation considered eligible for listing on the NRHP on their own merits?
- Is it possible that the earliest Apache occupation may have temporally overlapped with the so-called Hohokam and Salado cultures, and that these cultures may have interacted with the Apache?
- Do the known Apache sites and the apparently pre-Apache sites represent a meaningful pattern of persistent land use extending from the prehistoric era to the present?

- Will historical Euro-American sites located within the boundaries of the District be recorded, evaluated, and managed according to the same standards that would apply to similar sites outside of the District?

Secondary and Indirect Effects to Historic Properties

The project's effects will inevitably, and through a variety of means, spread out into the surrounding landscapes and communities. The EIS should identify and address any foreseeable secondary and indirect effects to historic properties, including but not limited to the following questions:

- What visual impacts may occur to the historic Boyce Thompson Arboretum due to the large nearby tailing pile and the associated dust and haze?
- Will the historic structures and character of old downtown Superior be affected by physical, visual, and socioeconomic impacts attributable to the proposed action?
- What impacts may occur to historic properties outside of the project area when Oak Flat and other nearby scenic and recreational areas are closed to the public, and recreational activities (including off-road driving, camping, shooting, etc.) are diverted onto other lands and concentrated into smaller areas?
- Will historic properties outside of the project area be subject to the effects of seismic events within the subsidence zone (e.g., earthquakes, rockfalls, and landslides)?
- How will historic properties along Queen Creek downstream from the project area be affected by major physical and hydrological changes in the upstream basin?
- Will changes in air quality increase the possibility of acid rain that could degrade rock art sites and other types of historic properties outside of the project area boundaries?
- If imported fill is required at any location, for any reason, at any time during any phase of the project, will that fill be acquired from a source that has been surveyed for cultural resources, and any necessary historic property treatment at the source has been completed?

Socioeconomics and Employment

Economics and associated employment are of course inherently important impacts. In addition, employment (aka "jobs") is often the primary, or only, focus of attention in political campaigns and in legislation relating to large scale projects. This is a peculiar time to be commenting on employment in a copper mine, since hundreds of southern Arizona workers have lost their jobs in copper mining within the past two years. As recently as 1999, about 50 miles southeast of Oak Flat, over 2200 workers were laid off by the closure of the San Manuel mine, owned by BHP Billiton. Through subsidiaries, BHP Billiton also owns 45% of Resolution Copper Mining. A familiar sounding story is that at one time the San Manuel mine was the largest underground copper mine in the world in terms of production capacity, size of the ore body, and infrastructure. Another familiar story is that of copper market fluctuations, which led to these layoffs.

The "Copper Triangle" area of Arizona, including Superior, Miami, and Globe, is a region that remains economically stagnant after decades of reliance on mining as the primary industry. The EIS needs to clearly show whether or not this one additional mine, even of such huge proportions, is likely to improve the pathetic socioeconomic history of mining in the Copper

Triangle. So far, it does not appear that the wealth of this mine would lead to diversification of the local economy.

Two studies have been conducted that give widely disparate views of the economic impact of the proposed mine. A study commissioned by RCM, conducted by Elliott D. Pollack & Company, "Resolution Copper Company Economic and Fiscal Impact Report, Superior, Arizona", published in 2011, paints a very rosy picture of the mine's economic impacts. These results, focusing primarily on employment income and taxation, have been extensively used by RCM in promoting the mine.

A study performed for the San Carlos Apache Tribe by Power Consulting, Inc., "Exaggerating the Net Economic Benefits of the Proposed Resolution Copper Mine, Superior, Arizona: A Critical Review of Resolution's Economic Impact Analysis", published in 2013, reviews the Pollack report, and predicts economic impacts that are much more pessimistic.

The GPO references only the optimistic Pollack report, but not the more pessimistic Power report. To help resolve disparities between these reports, the Forest Service must conduct an economic impact study, funded by neither proponents nor opponents of the mine, that will review these previous studies, as well as provide an up to date independent prediction of the socioeconomic impacts of the mine. The EIS must show the results of that study, and the study must accomplish the following:

- Consider fluctuations in the market for copper and corresponding employment fluctuations – the EIS cannot assume 24/7 operation of the mine for 40 years at 100% capacity

- Account for required expansions in public services paid by taxpayers, such as fire departments and other emergency services, education, repair and enhancement of roadways.

- Focus on the immediate surrounding area as well as the entire state, for example in contrast to the Pollack report's estimate of $10 billion from taxes to the state of Arizona, only $284,000 would go to the local area. Instead of the Pollack report's estimate of 3,700 direct and indirect jobs, only 893 would go to the local region. Instead of a projected $221-million-dollar payroll impact, the local payroll impact would be $56.2 million. These figures would also fluctuate with mine production in the future just as they have in the past, making these estimates even smaller.

- Account for the fact that most of the value of the proposed mine at Oak Flat could create would be realized out of state. Only 4% of the mineral value produced from the proposed mine would go to local residents in the form of local wages. Over one-half would go to national and international investors. 71% of projected tax flows to governments would go to the federal government, not to Arizona governmental entities.

- Consider the significant long-term economic consequences for the State and region caused by environmental degradation. Mining displaces most other regional economic

activities. Environmental degradation and the inherent instability of mining operations discourages growth in mining towns, causing further specialization and lack of economic diversification in mining in these towns. The environmental, social, and landscape costs associated with mining actually discourages residential and business growth, tourism and future opportunities for economic diversity.

- Consider that metal mining jobs have not reduced unemployment or assisted local economic vitality for more than 100 years in Superior and surrounding towns in the "Copper Triangle". There has not been a history of sustained prosperity and economic vitality. Mining displaces most other regional economic activities, and discourages growth in mining towns, causing further specialization and lack of economic diversification.

- Consider that the plan to operate the mine at Oak Flat using highly automatic equipment will reduce blue collar jobs and shift toward a smaller, highly skilled workforce that could be located hundreds or more miles from the mine. Over the last 50 years, even while copper production rises, employment in copper production has fallen. This trend would continue dramatically as robotics and remote operating centers continue to change the landscape of mine employment.

- Account for the displacement of other economic activities due to water problems associated with the proposed mine. The proposed mine at Oak Flat would increase competition for water in an already very arid region and would draw down the local water table to allow deep ore mining. The mine will also cause water pollution adding to the negative economic impact.

- Recognize that Arizona no longer depends on copper mining as a significant source of economic vitality. Current total personal income resulting from metal mining statewide is only four-tenths of one percent of income from all sources. 50 years ago, that total was four percent. However, the state economy was able to expand steadily despite the dramatic decline of the role of metal mining in Arizona.

- Account for the economic value of tourism and outdoor recreation, and the fact that revenue from tourism and outdoor-related activities is now more than twice the revenue from mining. The presence of the massive subsidence crater, tailings facility, and other mine facilities will cause a loss of tourism revenue, and the EIS must clearly state how that compares with the increased revenue from mine employment.

- Account for the impact of the mine, with its massive subsidence crater, tailings facility, and other mine facilities on decreases in property values, new residents, and new industries.

- Account for possible emigration of people not employed by the mine due to its negative social impacts.

- Account for the effect of mine-related transportation interference on transportation associated with non-mine business activity.

- Account for the effects of automation on the skill levels required for the workforce of the mine, whether currently unemployed workers would have the required skills, and where the work would be located. Operational control of the automated mine would require higher skill levels, and could be performed hundreds of miles from the mine.

The EIS must include both positive and negative socioeconomic impacts, and must consider impacts on the public, and not just on RCM. Although RCM pays nothing for the land used at the TSF, the EIS must state the appraised value of this land as an adverse economic impact on the public. In the event that the Land Exchange is repealed then the monetary value of the land destroyed by the subsidence crater must also be treated as an adverse impact.

Predicting the socioeconomic effects of this project should not rely on RCM's promises. The EIS should also consider the historical record of RCM's parent companies, Rio Tinto and BHP Billiton over the past century with regards to human and labor rights, and environmental ethics.

The most devastating social impacts of this project are the ones that are most difficult to put into the words of an objective statement. These are its impacts regarding the basic human spiritual need for natural, wild, and sacred places. It is impossible to put an objective value on the wonders of nature. So we often use a single endangered species to bear the entire burden of protecting a vast natural area. At Oak Flat it is the Native Americans who have taken upon themselves much of the burden to protect a space that is sacred to them. All land should be sacred to all people, and therefore treated with love and respect. The fact that this project sacrifices another of the natural, wild, sacred places needed by all humanity, and needed by all wild creatures, at a time when there is a growing scarcity of such places, is an impact that must be fully discussed in the EIS.

Transportation

This project, as proposed, would create a serious impact to the transportation infrastructure of the region. The GPO casually describes highway use for transportation of workers and materials to the various plant facilities and the railroad traffic to the Union Pacific railroad at Magma but is silent about where these trip originate, the impact to the roads themselves, the impact to other users of the roads, and the cost of upkeep to the roads as a result of additional traffic this project would require. The GPO is completely silent about the impact of transportation to the final destination of the concentrates for final processing.

The Forest Service is required to analyze all potential impacts from the proposed project whether those impacts take place on public lands or not.

The Forest Service is required to calculate the carbon footprint from increased transportation loads due to this proposal.

The mine plan identifies an alarming number of huge trucks carrying toxic chemicals and explosives that would be traveling on local highways for 40+ years. The EIS must analyze the environmental, social, economic, safety, and emotional issues associated with this type of increase in use of this highway. In addition to the uses during mining, the EIS should also include identification of staging areas and temporary roads needed for the preproduction phase, and for the reclamation and closure phase.

The main travel corridor from the Phoenix metropolitan area may not have emergency services sufficient to handle the types of situations that could arise if a mine were located here. The EIS should identify the types of emergencies that could occur at a mine like this, including those that would occur on the roads used by traffic to and from the mine. It should also identify where the closest emergency services are, what types of services are available, and what additional resources would be necessary, including costs and who would pay, to handle the additional burden of the mine.

Local fire departments would need more resources in funding, equipment and trained personnel to deal with potential spills and crashes that increased trucking would likely generate. The implications of heavy toxic trucking on local highways are concerns that should be addressed in the EIS

For all of the below mentioned points that need to be analyzed, the Forest Service needs to consider:

- The additional cost of maintaining roads, bridges, ports, railroads, and other transportation facilities.
- The full costs to the public (both here in the US and outside the US as necessary), for the use of public transportation facilities.
- The social cost and inconvenience to the public from increased transportation loads due to this proposal.
- The cost for law enforcement from increased transportation loads due to this proposal.
- The cost for emergency services from increased transportation loads due to this proposal.
- The cost to both public and private employers from increased travel times from increased transportation loads due to this proposal.
- The health costs due to increased pollutants from increased transportation loads due to this proposal.
- The cost and inconvenience to local schools from increased transportation loads due to this proposal.
- The cost to local businesses, especially along Highway 60 in Superior from increased transportation loads due to this proposal.
- The strain on the general fabric of society from increased transportation loads due to this proposal.
- The full cost of additional traffic management (traffic signals, extra lanes, etc.) that would be required due to this proposal.
- The cost of disruptions due to excess mine traffic during peak traffic periods such as shift changes and truck schedules.

The GPO anticipates conservatively, due to probably inflated rates of carpooling and other factors, up to 437 daily trips to the EPS from construction workers during the estimated 13 years of mine construction. This is an average across a 24-hour day. During shift changes, the traffic would be considerably more. The EIS must analyze the effects of increased traffic, especially during shift changes.

The GPO anticipates conservatively, due to probably inflated rates of carpooling and other factors, up to 1,098 daily trips to the WPS from construction workers during the estimated 13 years of mine construction. This is an average across a 24-hour day. During shift changes, the traffic would be considerably more. The EIS must analyze the effects of increased traffic, especially during shift changes.

The GPO anticipates conservatively, due to probably inflated rates of carpooling and other factors, up to 335 daily trips to the GPA during the estimated 40 years of mine operation. This is an average across a 24-hour day. During shift changes, the traffic would be considerably more. The EIS must analyze the effects of increased traffic, especially during shift changes.

The burden on our public transportation system is considerably more. While personnel would be traveling in cars and trucks, the majority of material and equipment needed for the mine would be from much large 18-wheel trucks hauling many tons.

The GPO anticipates that a total of 92,747 large truck shipments would be needed during the construction phase of the proposed mine. This is over 10,000 trucks per year during construction. While Rio Tinto averaged those shipments across 365 days per year, 24 hours per day, shippers operate much differently in the real world.

During the operations phase Rio Tinto anticipates that 221,993 truck trips would be needed to haul materials to the EPS. Over their estimated 36 years of hauling, that would be 6,166 trips per year. While Rio Tinto averaged those shipments across 365 days per year, 24 hours per day, shippers operate much differently in the real world.

During the operations phase, Rio Tinto anticipates that 128, 776 trips would be needed to deliver material and haul concentrate from the WPS. This, according to Rio Tinto, would be a maximum of 11 trips per hour.

The impacts from more than 443,516 large truck trips to and from the GPA is a major impact, yet Rio Tinto does no analysis of the impacts of these nearly ½ million trucks going to and from their destinations. The EIS must do these calculations.

The EIS needs to analysis the full impact to the transportation infrastructure in both the United States and in other countries from, but not limited to:

- Shipping of copper concentrate to the final processing destination, including the impact to other countries and oceans. Note that the GPO is silent on the final destination of the copper concentrate.

- Shipping of the molybdenum concentrate to the final processing destination, including the impact to other countries and oceans. Note that the GPO is silent on the final destination of the molybdenum concentrate.
- Shipping of equipment from the point of purchase to the final destination.
- Shipping of materials along the entire chain of custody from mining of those materials to the final destination within the GPA.
- Movement of personnel from their place of residence to their final destination within the GPA.
- The shipment of waste offsite.

The Forest Service needs to analyze the effects of subsidence caused by the mine proposal, including subsidence from block cave mining and from dewatering within the entire GPA on roads, bridges, tunnels, railroads and other transportation facilities. This includes an analysis of the potential collapse of Apache Leap and areas of Oak Flat from a miscalculation by Rio Tinto.

The Forest Service needs to analyze the loss of closed roads due to this proposal to recreation, grazing, and other activities within the total GPA.

Portions of Highway 60 are designated as scenic highways. The Forest Service needs to analyze the effects this proposal would have on this designation to tourism and any and all other uses.

Rio Tinto calculates that mine personnel would carpool at a rate of 1.7 people per car getting to and from the mine. While those rates sound good, are they realistic? If carpooling does take place, what would be the cost and impacts to the public from possible park and ride facilities?

The GPO does not contemplate assisting with any infrastructure to facilitate carpooling. The Forest Service should analyze what additional infrastructure would be needed to facilitating carpooling and require that Rio Tinto pay for those costs.

The transportation impacts of the proposed mine must be evaluated under direct supervision of the Forest Service, and the results shown in the EIS. The GPO describes some aspects of transportation, but not impacts. Section 3.4.1 of the GPO identifies primary access routes in the vicinity of the project, while Section 3.4.2 identifies categories of transportation for various project phases and sites, with the traffic described in terms of trips.

The EIS must expand on this to establish traffic flows in terms of number of vehicles and miles driven on each route, for various project phases and sites. Vehicle weight is correlated with roadway deterioration and emissions. So the analysis must be done for different classes of vehicle weight. From this the EIS must determine impacts on traffic flow, safety, deterioration and maintenance of public roadways, and GHG emissions. Impact on traffic flow can be represented by the increased number of vehicles, and increased trip time. Impact on safety would be shown by the increased likelihood of crashes. Deterioration and maintenance of public roadways should be expressed as increased monetary costs that would be paid by the taxpayers. The EIS must identify potential bottlenecks resulting from increased traffic, and estimate the cost for improvements including widening and enhanced traffic controls. The impacts should include

the possibility of accidental spills of toxic chemicals and their effect on the immediate vicinity as well as migration into water resources.

Safety Concerns

- What are the toxic chemicals that would be used in this mine, and at what concentrations?
- What types of emergency equipment would be needed to deal with these chemicals in an emergency situation?
- How would the company prevent these chemicals from getting into our groundwater and surface water in the event of a spill?
- What would the company do if the toxic chemicals get into the groundwater or surface water?
- How long would it take for the groundwater beneath the mine site to move into the Queen Creek and Ga'an Canyon watersheds?
- With the entire central AZ mining region experiencing higher rates and different types of cancer (than the national average), will the Forest Service research and address the negative health impacts of this massive project, not only to the local residents of Superior, but also those residents within 30 to 50-mile radius of the entire mining project?
- What types of chemicals, hazardous materials, explosives, gases, fuels, etc. will be transported through Superior and other traffic corridors for the operation of this mine?
- Water underground has minerals. Whenever underground water comes in contact with skin it needs to be immediately washed off with clean water to avoid skin problems. Where would clean water come from to prevent these problems?
- What type of clothing & equipment will be required by the workers to remain safe in light of extreme humidity, heat, contaminated water, and other hazards?

Air Blast

The EIS must address employee safety. Safety is mentioned in Section 4.13 of the GPO, but it says absolutely nothing about methods that will be used to prevent the occurrence of air blast.

Air blast is well known as a hazard in block caving. The air blast and associated fatalities that occurred at the Northparkes Mine in Australia in November 1999 led to a number of lessons learned, recommendations, and procedures to help prevent air blast. Precautions, such as air gap monitoring and control, that must be followed to help prevent air blast, are well known and documented, for example in the "Cave Mining Handbook".

There is no apparent reason for RCM to have completely ignored the subject of air blast in the GPO. Considering the size of the proposed mine, air blast prevention must be a major consideration. The EIS must include air blast effects as a possible environmental impact, and that mandatory procedures to help prevent air blast must be specified in the EIS as a mitigation. Any related modifications to the GPO must be completed in time to be referenced in the Draft EIS.

In using the block cave method, what will prevent vacuum pockets from developing in the ore body, thereby collapsing and creating concussion cave ins? What measure will be taken to

ensure the safety of miners?

Light and noise pollution

The EIS must establish the impacts of the mining operation on surrounding areas and ecosystems with regard to light produced by the mine, noise produced by the mine, and the visual appearance at points of significant scenic importance.

Section 4.1 of the GPO states that the noise levels at the mine site currently meet county standards and that additional monitoring will be conducted as the project proceeds. The current noise levels may include contributions from RCM's pre-mining activities, and thus would not accurately represent the ambient noise level. That should be obtained by ceasing RCM's operations long enough to measure the ambient noise levels. Section 4.13.8 of the GPO discusses some measures that will be taken to protect workers and the town of Superior from noise. It also states that noise surveys will be completed during the NEPA process. Assuming that the NEPA process is the development of the EIS, then the results of these surveys must be referenced in the Draft EIS. The GPO has very little to say about artificial lighting.

The EIS must provide quantitative predictions of noise and artificial light levels in areas and points surrounding the proposed mining operation. This would include:

- Identification of key observation points, including but not limited to the town of Superior, Queen Valley, US Highway 60, the southern edges of the Superstition Wilderness Area, Boyce Thompson Arboretum, occupied buildings, and other points determined by the Forest Service.

- Identification of key sources of noise and light pollution, including but not limited to mine facilities at EPS, WPS, TSF and Tailings Corridor, Filter Plant and Loadout Facility, Queen Valley Pump Station, Wells along the MAARCO Corridor, the rail line southwest of the Loadout Facility, transportation, and other sources determined by the Forest Service.

- For each of the above sources, the predicted noise and light levels at each of the key observation points.

- For each of the above sources, predicted contours of sound level covering areas where the sound level is greater than 50 dBA.

- For each of the above observation points, the EIS must state the predicted impact of the mine-produced light or noise on the usual activities conducted at that site.

- The above should be done for each phase of the mining operation, including Construction/Development, Mining/Ore Processing, Closure and Post-Closure.

The EIS must state the impacts of noise, vibration, and artificial light on plants and animals normally inhabiting the surrounding areas. This must consider distinct species, such as bats, that may be sensitive to certain combinations of light and sound.

To assure a complete evaluation of impacts, the Forest Service must first characterize the vibration and sound produced by block/panel caving, possibly by reviewing data from mines already in operation, possibly by computer simulation.

If the above studies reveal particular observation points or plants and animals with unique responses to vibration, sound, or light, then, where possible, the EIS must specify mitigations, including sound barriers, mufflers, light hoods or screens, and spectrally controlled LED lighting.

The EIS must establish procedures enabling entities affected by noise, light, or loss of scenic value to submit complaints, and for mitigating actions to be taken in response to those complaints.

The DEIS should analyze the effects of light and noise pollution from the mining operation, and include alternatives to reduce these impacts. These include using cutting edge LED technology and generally reducing the amount of outdoor lighting to protect night sky viewsheds and reduce impacts to nearby observatories, campgrounds, outdoor education centers, and residents of Superior and outlying residential areas such as Queen Valley.

Recreation

Recreation is a major factor in the overwhelming public opposition to RCM. As the TNF is acutely aware, rock climbing, camping, off road vehicle use, hiking, and wildlife viewing are among the most popular uses of Oak Flat, Queen Creek, Apache Leap, Ga'an Canyon, and the proposed tailings location. The loss of these opportunities can and should be quantified and studied in a number of ways within the DEIS:

1.) Direct financial impacts. Recreation brings in direct revenue to nearby communities through the purchase of food, lodging, fuel, and other goods and services. The DEIS should study the fiscal impacts of all the aforementioned activities phasing out over time, even though mine-related economic benefits might occur as well.

2.) Environmental impacts due to increased use at other sites:
When recreation access is severed, the result tends to be that alternative sites see more use, placing a burden on both the environment at those sites and those who manage them. The DEIS should take a hard look at recreation trends at all places impacted by RCM, and study how public lands nearby may be impacted as such recreational use is diverted to new areas. This should include, for example, the costs imposed to the TNF and other land managers for building new campgrounds to account for the loss of Oak Flat, and the cost of trail building and road maintenance should new climbing areas be developed to account for the loss of existing areas.

3.) Psychological impacts resulting from the loss of public access to public land:

Public access to public land is to many a fundamental right of being an American. Americans generally assume that lands they grew up enjoying will be there for their grandchildren, not sold to a foreign mining company. The resentment felt by many over what they may perceive as a fundamental betrayal by their federal government comes with psychological impacts. The DEIS should include a Health Impact Assessment (HIA) based on these psychological impacts. The HIA should include users of all types, and should place a primary emphasis on Native Americans, as their loss of access is tied to thousands of years of history and a type of deeply embedded spiritual connectedness to the land.

4.) Assessment of increased civil disobedience:
The DEIS should also assess the level of civil disobedience that could occur from these recreational and spiritual losses; for example, recurring protests in which activists chain themselves to RCM equipment is likely, considering that many activists have said publicly that they will never stand down from this fight under any circumstance. The DEIS should assess increased demand on local and regional police forces and specialized law enforcement units with this in mind, and the costs associated with these increased demands.

Recreation at Oak Flat

Oak Flat has been Federally protected from all mining activity since 1955. In spite of being located in an established mining district, the Eisenhower administration realized the recreational importance of Oak Flat for camping and other recreational uses and specifically withdrew it from mining for those purposes by issuing PLO 1229.

Oak Flat is an important and irreplaceable recreational resource for rock climbers and boulderers in Central Arizona. Over the last several decades, climbers from the Phoenix metro area, just 50 miles away, have developed the climbing potential at Oak Flat and turned it into a destination winter climbing area.

The proposed Resolution mine project will result in the largest loss of recreational rock climbing in the history of the United States. This will be due to surface subsidence caused by a block cave mining method that Resolution proposes for this project. The rock climbing resources at Oak Flat are irreplaceable, and cannot be mitigated for or managed under a 1:1 replacement strategy common in mitigation and restoration plans. Oak Flat climbing is a high value, site-specific resource with significant historical value.

For fifteen years running, until 2004, Oak Flat was the location for the world's largest rock climbing competition—the Phoenix Boulder Blast. With eight hundred competitors and thousands of spectators, the annual event was attended by climbers from across the country and also drew a number of international competitors. Oak Flat is still heavily used by recreational rock climbers and boulderers and the out of print 400-page guidebook to the area by Marty Karabin routinely fetches $200 or more on eBay, due to high demand.

The campground itself is still heavily used and it is often full on weekends during the cooler months. In addition to climbers, hikers, bikers, bird watchers, off-road vehicle riders and others come to Oak Flat for the wonderful recreational opportunities the area affords.

The loss of Oak Flat will diminish quality of life measures for those who currently recreate there and will also have negative financial impacts for Oak Flat users, the surrounding communities and the entire State of Arizona.

The Forest Service should perform a detailed economic study that measures the economic impacts associated with displacing recreational users from Oak Flat. According to figures published by the Outdoor Industry Association and the Arizona Mining Association, outdoor recreation currently contributes more than twice as many dollars to the State of Arizona as does the entire mining industry in the State. Oak Flat is only 50 miles from Phoenix, AZ, currently the 5th largest city in the United States and there is no comparable area that could serve as a reasonable substitute for the loss of Oak Flat, in terms of accessibility.

The Forest Service should also perform a detailed economic mining study that evaluates other mining methods to block caving that would cause no surface subsidence and minimal surface disturbance—so that any future mining at Oak flat would be compatible with continued recreational and cultural uses of Oak Flat. It is insufficient to simply accept Resolution's claim that block caving is the only economically viable mining method for this project. It is significant that the proposed Twin Metals mine project in Minnesota is envisioning backfilling with tailings to reduce the amount of above ground tailings storage.

Impacts to Boyce Thompson Arboretum

3,200 different desert plants are found within the arboretum, located immediately downstream from the mine project in the Queen Creek drainage. More than 230 bird and 72 terrestrial species have been also been seen at the arboretum over the years, as both permanent and migratory species. The Forest Service should carefully study the potential impacts to birds and other wildlife at the arboretum caused by the mine either intentionally or unintentionally discharging water into Queen Creek. A separate study should also be done on likely environmental impacts to arboretum wildlife from the 6,000+ acres of toxic tailings material that will be piled 600ft high directly north of the arboretum across highway 60.

Impacts to Regional Trails and Trailheads

The NEPA process should also carefully disclose and evaluate the direct, indirect and cumulative impacts from the construction, development and use of the TSF, expansion of the MARRCO rail corridor, the development and existence of massive transmission lines, pipelines and other mine facilities on recreational opportunities to the west of the WPS, both on and off TNF lands. This includes, but is not limited to, the values of the Arizona Trail, Lost Trail, Picketpost Trailhead and other trails/and trailheads throughout the region.

Impacts to Ga'an Canyon

The Forest Service should conduct a new, independent study of the hydrology of Oak Flat to determine what impacts (i.e. dewatering) could occur in Ga'an Canyon and other areas adjacent to the mine project footprint. Hydrology done to date by Resolution Copper has been proven to be wholly inadequate in understanding the complex hydrology of the area, as evidenced by the need for Resolution to suspend drilling activities in their #10 shaft for an entire year when large unexpected amounts 170-degree water were encountered.

Wildlife Oriented Recreation

According to AZGF, Arizona provides some of the best wildlife viewing in the nation. Tucson Audubon estimates that the total economic impact of bird watching in Arizona is $1.4 billion per year. For many years, birdwatchers and nature enthusiasts have flocked to Oak Flat to observe the wildlife species that inhabit the area. As human populations increase in the Phoenix metro area, this portion of the Tonto National Forest will become increasingly valuable for recreation. The economic gain for Superior from wildlife observation is incalculable and will undoubtedly outweigh the benefit that temporary jobs, created by RCM, will produce.

Power Needs and Problems

SRP and Resolution Copper are planning for major new 230kV and 69kV transmission lines and power substations for this mine project. In the Federal Register dated March 18, 2016, under "Nature of Decisions to be Made" the Forest Service contemplates issuing a special use permit for these activities. It is unclear from this language whether the Forest Service intends to exempt the power lines and substations from full EIS analysis and instead only require the special use permit alone. If so, this is improper, as the construction of these transmission lines and substations constitute major environmental actions by themselves and are also connected actions directly related to the overall mine project.

This is clearly evidenced by the Resolution mining plan of operation dedicating an entire section to the provision of power for the project (section 3.5.1., in the version of the mining plan currently appearing on the Forest Service website) and also evidenced in Section 3003 of the 2015 National Defense Authorization Act, specifically stating that "approvals for the construction of associated power" must be included in the EIS:

"ENVIRONMENTAL ANALYSIS.—Prior to conveying Federal land under this section, the Secretary shall prepare a single environmental impact statement under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et 25 seq.), which shall be used as the basis for all decisions under Federal law related to the proposed mine and the Resolution mine plan of operations and any related major Federal actions significantly affecting the quality of the human environment, including the granting of any permits, rights-of-way, **or approvals for the construction of associated power, water, transportation, processing, tailings, waste disposal, or other ancillary facilities.**"

New 230kV transmission lines from the existing 115kV substation (which will be expanded) to the mine will have to be run through a new corridor or right-of-way through the Tonto National Forest and cannot be run through the existing power line right-of-way. That is because the existing 115kV lines will also need to remain in place. The Forest Service therefore must study all environmental issues associated with allowing a new power line corridor. These issues include possible impacts on existing wildlife, air and water quality, among others. The environmental impacts associated with the new, larger 230kV substation also need to be carefully studied by a full EIS.

In a similar way, the new 69kV transmission line along the MARRCO corridor and new 69kV substation near the load out facility also need to be thoroughly studied for potential impacts to

wildlife, air and water quality issues and other possible environmental impacts. This aspect of the mine project deserves a full EIS treatment.

In addition, the Resolution Copper mine plans to produce more than one billion pounds of copper per year for decades to come and it has been estimated that 40 million BTUs are needed to produce one ton of copper. Since the RCM mine would therefore require additional electrical power equivalent to a city of over 500,000 people, several impacts need to be investigated:

- The environmental effects of increased generation at the power plant site due to the increased power demand from the mine should be studied.
- This remote power generation for the mine project should be included in evaluating the overall carbon footprint and total greenhouse gas emissions of the mine project itself.
- How this increased power generation and usage would impact Pinal County's total energy use and its ability to meet current air pollution and emission standards should also be studied.
- Will residential customers be picking up any of the tab since RCM will get a price break?
- How much $ and power does it take to pump water from Lake mead to the plant site?

Carbon footprint calculations and alternatives to grid-supplied power

RCM's main source of power would be a grid intertie to SRP power. RCM's demand is likely to be in the hundreds of megawatts, and given that SRP power is roughly 85% powered by coal and natural gas, carbon emissions to power RCM will be extremely high. Carbon emissions from both power generation and the operation of all fuel-operated mining machinery must be calculated both annually and over the life of mine in the DEIS. These scoping comments do not intend to go into detail about the scientific consensus as to why climate change is an enormous threat to humans, wildlife, and the economy, especially in desert climates facing water scarcity issues. It is, however, worth reiterating the numerous efforts of the federal government to combat climate change, such as the Clean Power Plan, the Bureau of Land Management proposed methane emissions reductions rule, the EPA methane emissions reduction rule, the Renewable Fuels Standard, renewable energy tax credits, and the vehicle gas mileage standards. Since the TNF is a federal agency, it has an obligation to align its priorities in the NEPA process to that of its sister agencies that are going to great lengths to reduce greenhouse gas emissions. It should also follow the White House Council on Environmental Quality's guidance regarding how to consider climate change impacts in all NEPA processes.

The DEIS should include alternatives for RCM's proposed power supply designed to reduce emissions. Preferably, an alternative would include RCM's own renewable power generation, and hybrid heavy machinery (many mines already use hybrid equipment) to run from these renewable sources. Solar thermal power generation is already being successfully deployed in similar desert environments to provide reliable, baseload power using molten salt as an energy storage medium. Solar thermal operations utilizing dry cooling achieve major water savings over wet cooling, and should be considered for all new facilities. An SRP intertie could serve as a backup option to provide conventional energy only when RCM's own power systems fail to do so. An alternative such as this will be an important step to showcase that a new mine does not by definition lead to increased carbon emissions.

Also, TNF should consider the downstream carbon footprint of the mine as well, most notably the transportation and smelting of RCM's ore.

Analysis and quantification of water consumption from power generation.
As noted above, RCM's power demands will likely be in the hundreds of megawatts. Thermoelectric power generation in the US, on average, accounts for roughly 40% of the nation's total consumptive water use. RCM's power generation – if using grid power or on-site solar thermal generation (especially wet cooled solar thermal generation) – will therefore be a major element of the mine's overall water consumption matrix, the estimations for which must be included in the DEIS in addition to direct water consumption from mining operations.

From "The Resolution Mine Project of Oak Flat, Arizona: An Analysis of Social and Environmental Impact Assessments" (Cvitkovic, 2016)

- The Southeast Arizona Land Exchange challenges human rights and environmental protection. Through literature review and primary research, Cvitkovic determined that Resolution's methods of AMD prediction and social assessment are insufficient, thus the EPA and the TNF are unable to effectively review the social and environmental risks of the Resolution Project. Cvitkovic's thesis has identified the following areas for revision: The methodologies used by Resolution Copper to conduct Acid Base Accounting, Synthetic Precipitation Leachate, and Humidity Cell AMD prediction baseline tests are out of date and should be redone using more recent evidence-based methods.
    - Currently, for the Acid Base Accounting (ABA) static test, Resolution uses procedures from Price (1997) and Soregaroli and Lawrence (1998). Since their publication, further research has been conducted on the ABA test (White et al., 1999; Smart et al., 2002; Price, 2009; Chotpantarat, 2011; Bouzahzah et al., 2015).
    - Resolution claims to have adjusted rock masses and rock ratios for some of their samples due to rock type and sample availability, making their results difficult to compare with project preliminary testing results from other mines (General Plan of Operations, 2013).
- Current geochemical tests do not fully characterize long-term AMD potential, do not effectively translate between the lab and the field, and do not adequately account for the influence of mineralogy or microbial activity on the character and rate of AMD.
    - Stewart et al. (2006) highlighted the issue of lag time ambiguity in ABA and NAG tests. Lag time refers to the phenomena that over time, acid is generated from dissolution of previously stored oxidation products (like jarosite) in addition to oxidation of sulfide minerals, and neutralization rates slow. Long-term acid neutralization is not measured in any accepted AMD prediction test, despite research by Miller et al. (2009) that incorporated a number of publications (Sherlock et al., 1995; Jambor et al., 2002, 2007) to propose a methodology for evaluating lag time based on comparing acid generation rate to non-carbonate acid neutralization rate.

- Bouzahzah et al. (2015), similar to the claim by Brough et al. (2013), found that mineralogical static tests are most effective when sample mineralogy is known in detail, particularly Fe-Mn-bearing carbonates.

- The United States industry standards and federal requirements for AMD predictive testing lack specificity, making comparison between mine projects unfeasible.
    - Evaluation of test results is a fundamental part of any scientific experiment. Currently, ABA, NAG, combined ABA and NAG, Humidity Cell Testing, and the Synthetic Precipitation Leach test are the AMD characterization tests run by Resolution that have clear classifications for pollution risk, though this does not necessarily mean that industry standards exist for these tests. Other experiments, such as Saturated Column Leaching and petrographic tests, are evaluated on relative scales that cannot be easily translated into a specific pollution level predictor.
- There is no identified threshold for predicted AMD test results, which furthermore complicates assessment of the total pollution impact of the Resolution Project.
    - Though presumably Resolution has detailed information about the expected impact on the mine project, it is not publically available. Nonetheless, even with knowledge of the mine's potential impact there is no existing threshold based on AMD test classification beyond which a mine project is terminated. In the current system, even if Resolution's data suggests a high probability of AMD generation, it is up to the EPA to determine whether or not the risk is too great.
- The Resolution Project unjustly threatens an area sacred to the San Carlos Apache, and a Social Impact Assessment should be conducted to understand the history of oppression experienced by the San Carlos, evaluate how the mine fits into Resolution Copper's relationship with the San Carlos, and to recognize the human rights implications of the mine at Oak Flat.
    - A robust social impact assessment with specific attention to the San Carlos Apache would introduce human rights discourse into the risk evaluation of the Resolution Mine project as a whole. A Social Impact Statement would acknowledge historical harms that have occurred and place the current situation in a broader context. The proposed Social Impact Statement would expand the definition of a cultural resource to include how stakeholder communities care for and relate to Oak Flat and other areas potentially affected by the mine. It would be a process of research into the past and present social importance of the area, and an acknowledgement of how the Resolution Mine fits into the broader social history of Oak Flat, as well as how the land swap and mine will fundamentally change the local community's connection to that place. The expanded definition of "cultural resource" still adheres to the goals of NEPA, and would in fact enhance observance of NEPA's policy objectives.
        - Social Impact Assessments (SIA) have been a part of the NEPA process since the act's passage in 1970, however the use of SIAs is not routine in the United States (Burdge, 2002). This is in large part due

to the 1986 U.S. Council on Environmental Quality guidelines, which do not specifically mandate that research into social impacts be reported in an SIA.

- Commonly, when an EIS is written, attention to social impact is interpreted as public involvement during the EIS drafting process (Vanclay, 2015). Public involvement in a "scoping" format is extremely important to the NEPA process, but it should not act as a replacement of an SIA. In the case of the Resolution Mine, this is the current reality. An SIA requires genuine community engagement, not simply consultation, in which stakeholder communities have the ability to influence management of social issues (Burdge, 2002). Social impact should be awarded the same level of attention, research, and funding as the geologic and environmental contexts at Oak Flat.
- Additional agents must enforce acknowledgement from Resolution in the Social Impact Statement. The US Forest Service is the official federal agency with the power to grant the mine permit to Resolution Copper, and thus it is the Forest Service that has the power to demand a Social Impact Statement be added to the NEPA process.

The EIS consultants, the EPA, and the Tonto National Forest are unable to effectively review the social risk and overall environmental risk of the Resolution Project with the insufficient social impact assessment and AMD prediction tests used in Resolution's Baseline Geochemical Data. The Southeast Arizona Land Exchange and Resolution Mine should not be permitted until improved research is conducted and the true impact of these projects can be defined.

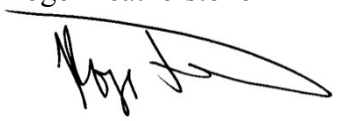
In addition, the Tonto National Forest must also consider environmental justice principles in its evaluation of the mine project given the disproportionately high and adverse human health and environmental effects to low-income, minority and tribal populations that the mine project presents. *See Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations."*

Conclusion

Please include the Arizona Mining Reform Coalition, Access Fund, Center for Biological Diversity, Concerned Citizens and Retired Miners Coalition, Concerned Climbers of Arizona, Earthworks, Maricopa Audubon Society, Patagonia Area Resource Alliance, Save the Scenic Santa Ritas, Save Tonto National Forest, Sierra Club – Grand Canyon Chapter, Tucson Audubon Society, Valley Unitarian Universalist Congregation – Green Sanctuary, WildEarth Guardians, Alida Q Montiel, and Cyndi Tuell as interested parties and direct all future public notices and documents to us at the addresses below.

Sincerely,

Roger Featherstone



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Glossary – List of Acronyms

AA	Affected Area
ABA	Acid Based Accounting
ABCI	Arizona Bird Conservation Initiative
ADEQ	Arizona Department of Environmental Quality
AF	Acre feet
AFY	Acre Feet per year
AMD	Acid mine drainage
AMLRA	*Arizona Mined Land Reclamation Act*
AMRC	Arizona Mining Reform Coalition
APP	*Arizona Aquifer Protection Program*
AzGFD	Arizona Department of Game and Fish
APIF	Arizona Partners in Flight Bird Conservation Plan
BADCT	Best Available Demonstrated Control Technology
bgs	Below ground surface
BOR	Bureau of Reclamation
CAP	Central Arizona Project
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DEIS	Draft Environmental Impact Statement
EIS	Environmental Impact Statement
EA	Environmental Assessment
EPS	East Plant Site
FLPMA	Federal Land Policy Management Act

FS	U.S. Forest Service
FWS	U.S. Fish and Wildlife Service
Ga'an Canyon	Devils Canyon
GAO	U.S. Government Accountability Office
GHG	Greenhouse Gas
GPA	General Project Area
GPM	Gallons per Minute
GPO	General Plan of Operations (Also MPO, PO)
HAP	Hazardous Air Pollutants
HIA	Health Impact Assessment
IBA	Important Bird Area
ICOLD	*International Commission on Large Dams*
IPCC	The Intergovernmental Panel on Climate Change
kV	kilovolt
kWh	kilowatt hour
MARRCO	Magma Arizona Railroad Company
MBTA	Migratory Bird Treaty Act
MCE	Maximum Credible Earthquake
MIS	Management Indicator Species
MSBC	Migratory Species of Concern
MPO	Mining (General) Plan of Operations (also GPO, PO)
NMBCA	Neotropical Migratory Bird Conservation Act
PAG	Potentially acid generating

PO	(General) Plan of Operations (also GPO, MPO)
NAAQS	National Ambient Air Quality Standards
NACBI	North American Bird Conservation Initiative
NAGPRA	Native American Graves Protection and Repatriation Act
NAMC	North American Migration Count
NDAA	National Defense Authorization Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMIDD	New Magma Irrigation and Drainage District
NPAG	Non potentially acid generating
NRHP	National Register of Historic Places
PGA	Peak ground acceleration
PM_x	Particulate matter size no greater than x microns
RCM	Resolution Copper Mining
Rio Tinto	Resolution Copper Mining
SDT	Sonoran Desert Tortoise
SGCN	Species of Greatest Concentration Need
SHPO	Arizona State Historic Preservation Office
SIA	Social Impact Assessment
SRP	Salt River Project
SWFL	Southwestern Willow Flycatcher
TNF	Tonto National Forest
TSF	Tailings Storage Facility
USFS	U.S. Forest Service

USFWS	U.S. Fish and Wildlife Service
USGS	U.S, Geological Service
Vs30	Average shear wave velocity in the top 30 m of soil
WPS	West Plant Site
WYBC	Western Yellow-billed Cuckoo

Attachment A

Resolution Copper Mine Estimated Water Usage Based on RCM's GPO Figures*

ATTACHMENT A
Resolution Copper Mine Estimated Water Usage
Based on RCM's GPO Figures*

*GPO,V-2, Figure 3.6-1a, Years 1-7	Acre-Feet Per Year	Number of Years	Total Acre-Feet
CAP and Well Raw Water Supply	6,309	7	44,163
Groundwater	1,839	7	12,873
Treated Effluent	35	7	245
Inflow Precipitation and Runoff (to Seepage Ponds)	130	7	910
Inflow Precipitation and Runoff (to Tailings Storage Facility (TSF))	925	7	6,475
Total Estimated Inflow/Groundwater Usage Years 1-7	9,238	7	64,666
Estimated Filter Return (water saved, and reused from filter plant)	342	7	2,394
Total Estimated Water Needed Years 1-7	**9,580**	**7**	**67,060**

*GPO, V-2, Figure 3.6-1b, Years 8-36	Acre-Feet Per Year	Number of Years	Total Acre-Feet
CAP and Well Raw Water Supply	16,038	29	465,102
Groundwater	2,580	29	74,820
Treated Effluent	35	29	1,015
Inflow Precipitation and Runoff (to Seepage Ponds)	272	29	7,888
Inflow Precipitation and Runoff (to Tailings Storage Facility (TSF))	1,972	29	57,188
Total Estimated Inflow/Groundwater Usage Years 8-36	20,897	29	606,013
Estimated Filter Return (water saved, and reused from filter plant) Years 8-36	774	29	22,446
Total Estimated Water Needed Years 8-36	**21,671**	**29**	**628,459**

*GPO, V-2, Figure 3.6-1c, Years 37-45	Acre-Feet Per Year	Number of Years	Total Acre-Feet
CAP and Well Raw Water Supply	6,096	9	54,864
Groundwater	1,654	9	14,886
Treated Effluent	35	9	315
Inflow Precipitation and Runoff (to Seepage Ponds)	396	9	3,564
Inflow Precipitation and Runoff (to Tailings Storage Facility (TSF))	1,743	9	15,687
Total Estimated Inflow/Groundwater Usage Years 37-45	9,924	9	89,316
Estimated Filter Return (water saved, and reused from filter plant)	199	9	1,791
Total Estimated Water Needed Years 37-45	**10,123**	**9**	**91,107**

TOTAL WATER USAGE OVER 45 YEARS (LIFE OF MINE)	Acre-Feet Per Year	Number of Years	Total Acre-Feet
CAP and Well Raw Water Supply			564,129
Groundwater			102,579
Treated Effluent			1,575
Inflow Precipitation and Runoff (to Seepage Ponds)			12,362
Inflow Precipitation and Runoff (to Tailings Storage Facility (TSF))			79,350
Total Estimated Inflow/Groundwater Usage over 45 Years (Life of Mine)			759,995
Estimated Filter Return (water saved, and reused from filter plant) over 45 Years (Life of Mine))			26,631
TOTAL ESTIMATED WATER NEEDED OVER 45 YEARS (LIFE OF MINE)			**786,626 ACRE-FEET**

Total Acre-Feet of Lost Water (Evaporation/Other Losess) over 45 Years (GPO, V-2, FIGURES 3.6-1a, 3.6-1b and 3.6-1c) **733,364**

Total Acre-Feet of Reclaimed Water over 45 Years (GPO, V-2, FIGURES 3.6-1a, 3.6-1b and 3.6-1c) **13,014**

Attachment B

The Resolution Copper Mine Project
A 759,995 AF Bucket Full of Arizona Water!

ATTACHMENT B

THE RESOLUTION COPPER MINE PROJECT -
A 759,995 ACRE-FEET BUCKET FULL OF ARIZONA WATER!

Attachment C

The Resolution Mine Project of Oak Flat, Arizona: An Analysis of Social and Environmental Impact Assessments

The Resolution Mine Project of Oak Flat, Arizona:

An Analysis of Social and Environmental Impact Assessments

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2016

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ABSTRACT

The proposed Resolution Copper Mine at Oak Flat, Arizona is currently under review by the Environmental Protection Agency (EPA) and the Tonto National Forest (TNF) in accordance with the National Environmental Policy Act. The Resolution Project is associated with the Southeast Arizona Land Exchange bill (2014), in which 2,400 acres of the Tonto National Forest around Oak Flat are set up to be exchanged for 5,200 acres of Rio Tinto Copper Company property. This thesis examines the validity of the methods used by Resolution Copper, Rio Tinto's subsidiary, to assess the social and environmental impacts of the Resolution Mine, and to determine how Resolution researches the potential environmental and social changes that will occur if the land swap and mine are approved. Resolution's methods for predicting Acid Mine Drainage (AMD) are specifically examined and in this piece. Similarly, this thesis examines Resolution's methods of assessing the social impact of the mine and land swap as it is felt by the San Carlos Apache, who consider Oak Flat a sacred site for the female coming of age ceremony, *Na'ii'ees*. Through literature review and primary research, it was determined that Resolution's methods of AMD prediction and social assessment are insufficient. The EPA and the TNF are unable to effectively review the social and environmental risks of the Resolution Project with the insufficient social impact assessment and AMD prediction tests used in Resolution's Baseline Geochemical Analysis. The Southeast Arizona Land Exchange and Resolution Mine should not be permitted until improved research is conducted and a more complete impact of these projects can be defined.

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INTRODUCTION

The two main purposes of this thesis are to evaluate the validity of the methods used by Resolution Copper to assess social and environmental impact, and to determine how Resolution researches the potential environmental and social changes that will occur if the land swap and mine are approved. Two study approaches will be examined. First, an environmental approach is used to examine and compare Resolution's methods of Acid Mine Drainage (AMD) baseline testing with current scientific and industry recommendations for AMD predictive testing. Specifically, what AMD baseline tests are needed to complete a thorough acid generation potentiality profile for the Resolution Mine? What methods of testing will Resolution use to create an AMD predictive model, and are these methods satisfactory when compared with scientific and industry standards? Second, a social science approach is used to analyze Resolution's methods of engaging with communities impacted by the proposed Resolution Mine. Specifically, how does Resolution assess the social impact the mine and land swap will have on the San Carlos Apache? How could Resolution improve its communication with San Carlos Reservation residents?

BACKGROUND

Geology and Environmental Impact

The proposed location for the Resolution Project is near Oak Flat, Arizona in the Southeast corner of the Tonto National Forest. An escarpment known as Apache Leap defines the topography of the region. The Apache Leap escarpment is part of the Basin and Range province, which is defined by broad smooth-floored basins separated by narrow mountain ranges, and covers much of Nevada, Utah, and Arizona. The Basin and Range structure in the Superior district consists of N-NW trending normal faults, including the Concentrator fault and West Boundary fault associated with the escarpment (Hehnke, 2012). The Resolution graben, which contains the copper ore body, is bounded by a system of faults that strike N-NE, and dip steeply west (Hehnke, 2012).

The ore body is a large porphyry copper-molybdenum system that reaches depths of 4,500-7,000 feet (Hehnke, 2012). The ore deposit is defined by a 1% copper shell of mineralization that extends for a maximum of 1.2 miles in the E-NE direction and 0.9 miles in the N-NW direction at 2,500 feet (Hehnke, 2012) (Figure 2). Most lithologies within the ore body have a 1-3% copper grade, excluding the Upper Proterozoic Pinal Schist, which has less than 1%. The main lithological units containing copper mineralization in the ore body are the Paleogene Heterolithic Breccia (Hbx), Cretaceous volcaniclastics (Kvs), igneous Diabase and Apache Group sedimentary rock (pCy), and Paleozoic Limestone (Pz). The Mesozoic host rock consists of Cretaceous volcaniclastics (Kvs) that make up the upper 17% of the copper shell and contain a large percentage of the mineralization's pyrite halo (Manske, 2002). The Paleogene

Breccia contains 10% of the copper mineralization within the shell. The highest copper grade found in the system (>3%) is located in the upper-central portion of the ore body in the Paleogene Breccia and Upper Proterozoic Apache Group diabase sill. Late Cretaceous aged felsic intrusive rock from the Laramide Orogeny makes up a 3,000 feet wide E-NE trending corridor through the center of the copper deposit, and hosts the majority of molybdenum mineralization (Hehnke 2012). Potassic alteration, phyllic alteration, and advanced argillic alteration zones characterize veins throughout the ore body with mineralogical makeups of pyrite (FeS_2), chalcopyrite ($CuFeS_2$), anhydrite ($CaSO_4$), bornite (Cu_5FeS_4), molybdenite (MoS_2), and quartz (Manske 2002). Advanced argillic zones are primarily bornite and chalcocite-digenite. Unlike other porphyry systems in the region, the Oak Flat porphyry deposit has a hypogene copper grade >1%.

The copper-molybdenum porphyry system contains rocks that are at risk for AMD, which occurs when sulfur-rich minerals (sulfate, sulfide) oxidize and dissolve, creating low pH waters with high sulfate content and often high concentrations of toxic elements (Becker, 2015). The most common oxidation pathway for AMD involves exposure of pyrite (FeS_2) to water. The oxidation process is controlled by concentration of sulfides, pH, oxidant type, oxidant concentration, mineral morphology, trace element content, and the local microbial community (Parbhakar-Fox et al., 2015). The oxidation of iron proceeds abiotically and also biotically, at which point acidophilic microorganisms, such as the bacteria *Acidithiobacillus ferooaxidans*, become the determining factor in oxidation rate (Evangelou and Zhang, 1995; Bowell et al., 2000). In AMD formation, oxygen reacts with pyrite and forms Fe^{2+}, which subsequently oxidizes to Fe^{3+} (Table 1). The Fe^{3+} leaches pyrite and other mineral sulfides, decreasing the pH of water present. The dissolved concentration of Fe^{3+} forms hydroxides ($Fe(OH)_3$) and oxy-hydroxides (FeOOH). Other sulfur-bearing minerals, such as bornite, chalcopyrite, and chalcocite which are all found in the Oak Flat deposit, may undergo similar oxidation pathways.

The order of sulfide reactivity has been reported as: pyrrhotite > galena – sphalerite > pyrite – arsenopyrite > chalcopyrite (Moncur et al., 2009).

Table 1. Typical oxidation reaction of iron minerals in AMD.

Reaction 1
$FeS_2 + 7/2O_2 + H_2O \rightarrow Fe^{2+} + 2SO_4^{2-} + 2H^+$
$2FeS_2 + 7O_2 + 2H_2O \rightarrow 2FeSO_4 + 2H_2SO_4$
Reaction 2
$Fe^{2+} + 1/4O_2 + H^+ \rightarrow Fe^{3+} + 1/2H_2O$
Reaction 3
$Fe^{3+} + 3H_2O \rightarrow Fe(OH)_3 + 3H^+$
Reaction 4
$FeS_2 + 14Fe^{3+} + 8H_2O \rightarrow 15Fe^{2+} + 2SO_4^2 + 16H^+$

Acid generation can be neutralized by dissolution of carbonate rocks in and around the porphyry (Acid Neutralization Capacity). Minerals with high neutralization capacity include calcite, aragonite, dolomite, siderite, hornblende, and biotite. The rate of dissolution and the degree of pH buffering produced by each mineral varies according to mineral composition.

A number of other factors contribute to the acid generation and neutralization potentials of rock units: mineralogy, weathering rate, grain size, mineral association, and morphology. Therefore, AMD production is extremely site-dependent, and calls for a swath of successional testing to determine the AMD potential of mining and tailings at specific locations.

There are two main locations within the Resolution Project area that are at considerable risk of AMD: the East Plant Site mine complex and the West Plant Site tailings storage facility. According to the Resolution Copper General Plan of Operations (2013), mined rock is transported via conveyor belt from the East Plant Site to the West Plant Site, northwest of the town of Superior. The West Plant Site holds the concentrator complex that exports, via separate pipelines, waste rock tailings to a nearby stockpile and copper concentrate slurry to a filter plant. The East Plant Site is defined by a surface geology of Neogene Apache Leap Tuff (Figure 4).

The West Plant Site contains Quaternary and Neogene basin-fill deposits, while the potential tailings storage location includes Paleozoic and Precambrian sedimentary rocks, Older Precambrian Pinal Schist, Neogene Apache Leap Tuff, and undifferentiated Neogene Volcanic rocks (Resolution 2013) (Figure 4).

The tailings storage location as proposed in the 2013 General Plan of Operations is five miles to the northwest of the West Plant Site, and is connected by a corridor for the tailings pipeline. The site is bound by Roblas Canyon and Potts Canyon, with an elevation of about 2,700 feet and a depth to groundwater that ranges between 10 to 55 feet (Hehnke, 2012). Both the underground mining activity and the open tailings storage are at risk for AMD generation during and after the Resolution Project

Local Community Impact

There are a number of key stakeholder communities involved in the Southeast Arizona Land Exchange and Resolution Project. The Resolution Project site lies within the "Copper Triangle," a mining-intense region defined by a number of small towns, including: Superior, Miami, Globe, and Hayden. Superior is the closest town to Oak Flat and the Resolution Project, and is home to the main office of Resolution Copper. Superior was founded in 1882 as a copper mining town, and supplied labor for the Magma Copper mine until its closure in 1995. Superior is now home to 2,837 residents who are primarily Latino or White (Resolution, 2013). Hayden is home to the currently operating Ray Mine Complex, while Miami and Globe were founded in 1876 for copper mines that have now closed. Hayden has a predominantly Latino population, in contrast to the almost entirely White populations of Miami and Globe. These towns, established in conjunction with specific mines, have endured a number of boom and bust economic cycles. The job potential of the Resolution Project and the economic benefit of the mine are of great concern to local town residents. The Resolution Project would greatly increase the population of Superior, affecting education, housing, and public services.

Currently, the reservation has about 9,400 residents, most of whom are Native American (Resolution, 2013). The San Carlos Reservation borders the Copper Triangle and is approximately 45 miles from the Resolution Project site at Oak Flat. Mining on the San Carlos Reservation has been predominantly for asbestos, and not for copper. Negotiations between the San Carlos Tribal Government and Arizona state government have kept water available to the San Carlos people, but the lack of sovereignty is worrisome in such an arid environment where control of water resources is tense.

Oak Flat is a sacred site for the San Carlos Apache. The female puberty ceremony *Na'ii'ees*, called the Sunrise Ceremony in English, has occurred at Oak Flat for generations. The Sunrise Ceremony is one of the most important rituals for the San Carlos Apache, and is an

important demonstration of their spiritual beliefs, connection to place, celebration of female identity and power, and identity as Apache people (Perry, 1993). The ceremony comes from the story of White Painted Woman, who came from beneath the Earth and brought the Apache people when she saw that it was a good place to live (Perry, 1993). The Southeast Arizona Land Exchange would make Oak Flat private land owned by Rio Tinto. Consequently, the Resolution Mine would impact the environmental setting of the sacred area. In particular, culturally significant plants, such as the Emory Oak for which the area is named, would become cutoff from the San Carlos Apache. The impact of the land swap and mine to the religious freedom of the San Carlos Apache is grave, and poses a strong counterpoint to the potential economic benefit for the reservation residents and local towns.

METHODS

The geologic component of this study analyzes Resolution's baseline geochemical testing for its ability to predict AMD formation. Sources used for environmental analysis included the 2013 Resolution Copper General Plan of Operations (GPO), peer reviewed literature, and industry-specific guides. Detailed reading of the GPO was done to identify critical and relevant data, testing methodologies, and claims about AMD potential made by the company. In particular, the methodologies used by Resolution for the 2013 GPO baseline geochemical testing were analyzed for:

- Modernity (e.g. How recently was this methodology updated to include recommendations from recent research?)
- Ability to accurately predict AMD (e.g. Will this test provide a good estimation of AMD potential?)
- Abidance to industry standards and best practices
- Abidance to federal and state regulations (e.g. NEPA, Clean Water Act, Arizona Aquifer Protection Program, etc.).

Literature review was focused on industry and scientifically recommended best practices for AMD prediction, new research on AMD test methodology, and analysis of current test procedures. Specific research was done on current industry guidelines for AMD predictive testing in the United States, with background research conducted to understand the policies in place for environmental regulation.

The social component of the project is an analysis of Resolution Copper's community outreach methods and relationship with the San Carlos Apache. In addition to characterizing this relationship, there was deeper investigation into how the Resolution Mine fits into the broader San Carlos Apache history. Research consisted of applying theories of trust, ethics, risk

management, and reparations to the situation at Oak Flat. Research was also done on environmental management public policy and the Social Impact Assessment associated with the National Environmental Policy Act. Fieldwork for this project occurred in October 2015 and consisted of interviews with employees of Resolution Copper, mining reform activists, Tonto National Forest staff, and residents on the San Carlos Apache Reservation. The interviews qualitatively characterized the relationship between Resolution Copper, stakeholder communities, and the San Carlos Apache, and provided information on the success of outreach programs. In addition to interviews, research in Arizona included a tour of the Oak Flat Campground and the proposed mine location to obtain a sense of the landscape and the connection of Oak Flat to the San Carlos culture.

DATA

A summary of the AMD prediction geochemical tests used by Resolution Copper are provided (Table 2) with additional information about the limitations and advantages of each test. To describe the test limitations and advantages, information was gathered from peer reviewed literature ("References" column of Table 2). Grain Size Analysis was left partially blank because there were no articles discussing its specific significance for AMD prediction. Similarly, micron scale petrography had no sources speaking directly to its function in predicting AMD.

The testing progression (Figure 1) and sampling procedure (Figure 2) used by Resolution to gather geochemical data for mine waste show the range of qualitative and quantitative information (seven AMD prediction tests run) and the large sample set used for analysis (239 samples). The progression from static to kinetic testing involves a reduction in sample size based on the selection criteria for the Humidity Cell (Net Neutralization Potential between -20 and +20 T $CaCO_3$/kT rock and Neutralization Potential Ratio between 1 and 3). The sample set was reduced by 77% after selection for kinetic level testing (239 to 54 samples), and again reduced by 74% after selection for the Saturated Column Leach Test (54 to 14 samples).

Table 2. Table of AMD testing techniques used by Resolution Copper, including their advantages and limitations (adapted from Parbhakar-Fox et al., 2015)

Test	Description	Advantages	Limitations	References
Sampling	Relative abundance at site determines amount of sample	Identify and characterize geologic setting	-No global standard procedure -Sample selection may be non-systematic, and could result in bias	Price (2009)
Whole Rock Chemical Analysis	-Strong acid digestion and ICP-MS -Test for radioactivity	Quantitative total metals and metalloids	-ICP is costly and time consuming -No trace metals are reported	Price (2009)
Acid Base Accounting (ABA)	Neutralization Potential (NNP = ANP - AGP) and Neutralization Potential Ratio (NPR = ANP/AGP)	Industry standard test, many labs offer testing	-AGP overestimated if based on S_{total} -AGP and ANP tests are not performed on exactly same sample material -ABA process is not standardized, site by site comparison not possible -ANP from carbonate mineral	White et al (1999) Smart et al (2002) Price (1997) Soregaroli and Lawrence (1998)
Net Acid Generation (NAG)	Addition of H_2O_2	-Waste classification	-Organic matter interferes with measurements - H_2O_2 quality must be ensured -Calcite and dolomite may react during NAG testing, $Ca(OH)_2$ and alkaline pH values result	Smart et al (2002) Stewart et al (2006) Hageman et al (2007)
Synthetic precipitation leach	EPA Method 1312 (1994); pH 4.2 (local precipitation)	-Screening tool for leachable metals	-Extraction of fluid concentration and pH test are not appropriate replicas of natural environment	Smart et al (2010) Hageman et al (2007)
Humidity Cell tests	ASTM D5744 Method (1996)	-Indication of leachable metals/metalloids	-Mineral precipitation does not reflect actual mine site conditions -Day 7 rinse may remove all reaction products -No integration of mineralogical and microtextural analyses	Sapsford et al (2009) Gonzalez-Sandoval et al (2009)
Grain Size Analyses	ASTM D422-07 (2007)		-Crushed sample, not in situ -Post HCT completion	
Saturated Column Testing	AMIRA P387A method (not used by RCM)	Indication of leachable metals/metalloids	-Unrealistic replication of climatic conditions -No integration of mineralogical and microtextural analyses	Smart et al (2002) Parbhakar-Fox et al (2013)
Petrography (mm scale)	Scanning Electron Microscopy	Examination of sulfide and carbonate textures	-Not standardized -Technically challenging -Not statistically valid	Blowes and Jambor (1990) Parbhakar-Fox (2011)
Petrography (micron)	SEM (Scanning Electron Microscopy)	(same as above)	(same as above)	
Bulk mineralogy	XRD (X-Ray Diffraction)	Quantitative mineralogy	Expensive; Detection limits; Identification of trace phases impossible	Paktunc (2001) Lapakko (2002)

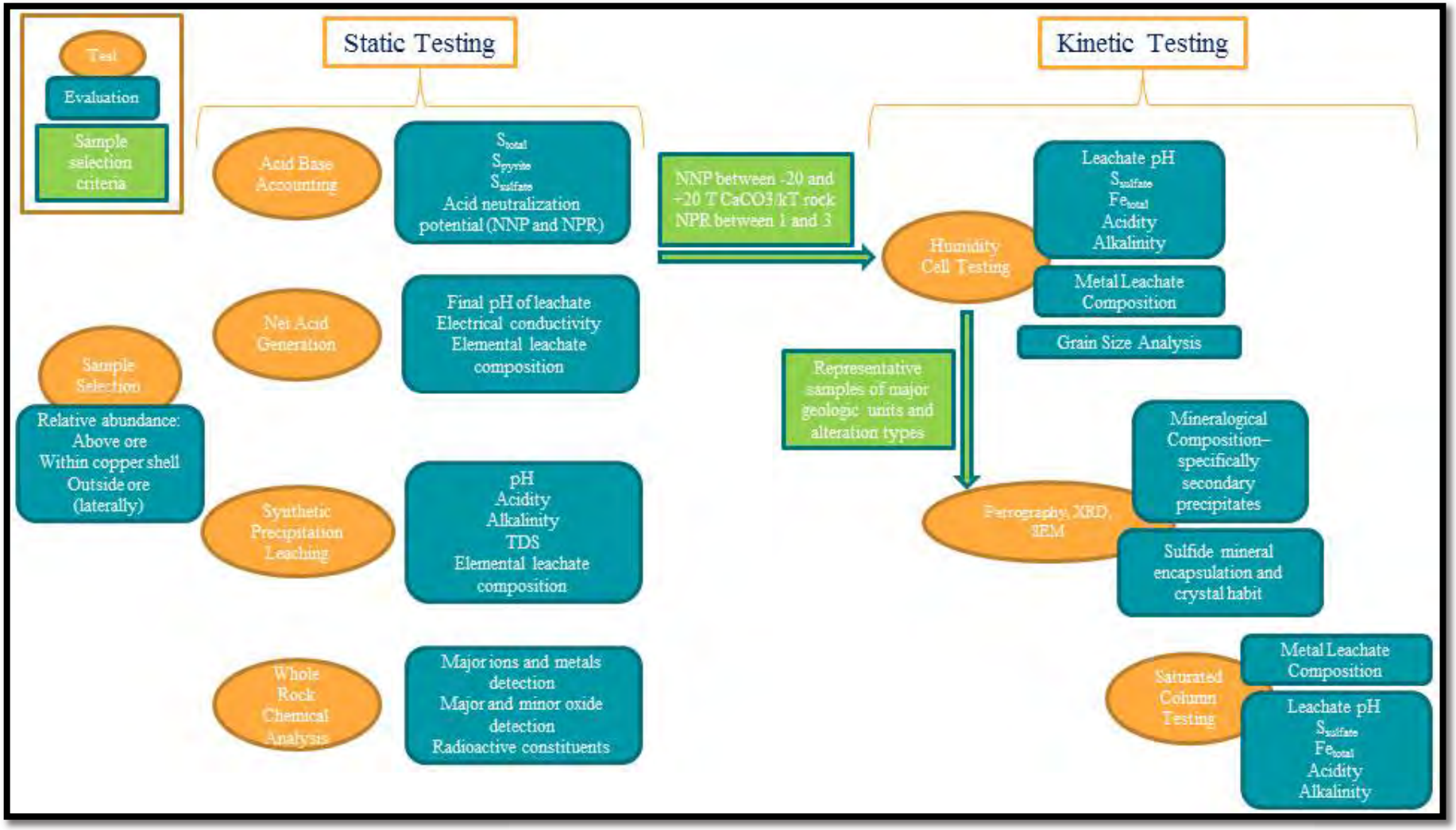

Figure 1. Resolution's geochemical testing schematic showing the test, resulting information, and sample selection criteria.

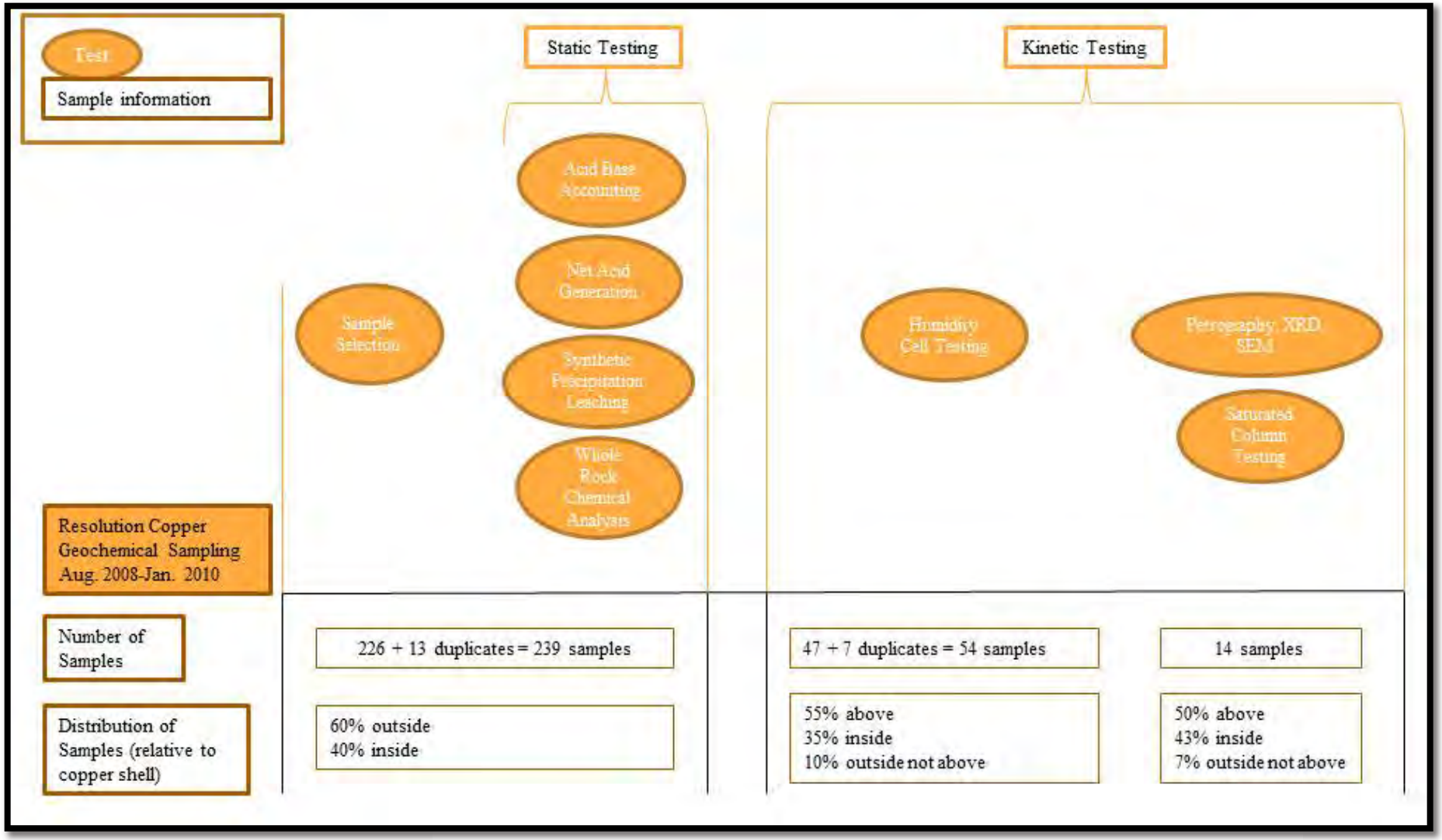

Figure 2. Sample quantity and location for Resolution's geochemical testing.

DISCUSSION

This project studies the methods by which social and environmental impacts of the Resolution Mine are researched and evaluated. Resolution Copper has conducted baseline testing to determine the potential for Acid Mine Drainage from the copper mining waste rock. This project examines how effectively Resolution Copper can predict the AMD potential of the mine by evaluating the validity of their baseline AMD testing methodologies. The potential location for the Resolution Mine is an area in the Tonto National Forest used by the San Carlos Apache for religious ceremonies. This research project analyzes the efficacy of the methods of social impact assessment used by Resolution Copper with respect to the unique social risks faced by the San Carlos Apache.

Geologic and Environmental Implications

Testing Procedures and Recent Research

The testing methodologies used by Resolution Copper are primarily from the 1990's, with two tests run using research from 2006-2007 (Stewart et al.; ASTM).

Currently, for the Acid Base Accounting (ABA) static test, Resolution uses procedures from Price (1997) and Soregaroli and Lawrence (1998). The testing procedures from Price are outlined in the Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia (1997). This guide provides the testing procedures referenced in the subsequent guidelines document used by the Ministry of Energy and Mines in BC. However, since its publication, further research has been conducted on the tests

referenced in the guide, specifically ABA (White et al., 1999; Smart et al., 2002; Price, 2009; Chotpantarat, 2011; Bouzahzah et al., 2015).

White et al. (1999) recommended $S_{sulfide}$ be used to calculate the maximum potential acidity after finding that S_{total} values overestimated the calculated potential acidity. Resolution's baseline testing used the $S_{sulfide}$ value to calculate the potential acid generation, as suggested in the procedures laid out by Price (1997). The conversion calculation used to find the maximum potential acidity involves converting weight percent of sulfur mineral content into kg $CaCO_3$/t using a stoichiometric factor of 31.25 (Price, 1997). It has been shown that this factor is inaccurate for samples containing sulfides other than pyrite (Paktunc, 1999; Price, 2009; Chotpantarat, 2001). The mineralogy of the Resolution Project porphyry includes bornite (Cu_5FeS_4), chalcocite (Cu_2S), and chalcopyrite ($CuFeS_2$) in addition to pyrite. There has not been significant research into whether or not these alternate sulfide minerals impact the accuracy of the stoichiometric factor used in conversion of the mineral weight percent, but it is possible that over- or underestimation of the maximum potential acidity occurs. Currently, scientists have reached the point of identifying the issue but not suggesting new stoichiometric solutions (Paktunc, 1999; Price, 2009; Chotpantarat, 2001). There is no indication that revisions for ABA procedural effectiveness have been implemented into the ARD Guide for BC, or considered in Resolution's geochemical testing.

Resolution uses the Net Acid Generation test procedure from Stewart et al (2006) to quantify acid forming potential and resolve uncertainties in the ABA predictions. This procedure continues to be the industry standard and no recent research has suggested a need for alteration. The procedure published by Stewart et al (2006) is one of the more recent procedures incorporated into the Resolution Baseline Geochemical Testing. The procedure outlined for Grain Size Analysis in the ASTM D4422-07 is the most recent of all the baseline tests, and no protocol alteration has been proposed.

The Synthetic Precipitation Leach test assesses risk of water contamination from mine waste metal leachate. It is officially regulated by the EPA's Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846), published in 1994 and updated in 2004. Methodologies described in the SW-846 are used to evaluate a mine proposal's compliance with the Resource Conservation and Recovery Act. Method 1312, used by Resolution Copper for their Synthetic Precipitation Leach tests, is not on the EPA's list of validated test methods for waste testing, though it is still the standard procedure used in the US (EPA, 2016). There has been additional experimentation since 2004 on Method 1312 that has not yet been incorporated into the EPA guideline document (Stewart et al., 2006; Smart et al., 2010). However, Hageman et al. (2015) found that in a comparison of the U.S. Geological Survey Field Leach Test, the EPA Method 1312, and the EPA Method 1311, the USGS Field Leach Test produced similar results to a modified EPA Method 1312. This suggests that though Resolution used the preferred procedure, the specific modification may not have been the same as the industry standard.

Similarly, Resolution used a variation of the procedure for Humidity Cell Testing outlined in the ASTM guide from 1996. The ASTM testing procedures from 1996 have been critiqued for their applicability to actual mine site conditions (Parbhakar-Fox et al., 2015). Resolution conducted Humidity Cell testing from August 2008 to January 2010 (General Plan of Operations, 2013). Within this time frame, Resolution's use of the ASTM (1996) was in alignment with federal requirement. However, as evidenced by the fact that ASTM released a more updated guide in 2013 including suggestions from Sapsford et al. (2009) and Gonzalez-Sandoval et al. (2009), the 1996 procedure is not acceptable for predicting AMD leachate chemistry. Additionally, Resolution claims to have adjusted rock masses and rock ratios for some of their samples due to rock type and sample availability, making their results difficult to compare with project preliminary testing results from other mines (General Plan of Operations, 2013).

Furthermore, revision of select rock masses and ratios makes analysis within the Resolution sample set more difficult, because relative material quantities are not consistent.

After Humidity Cell testing was completed, Resolution scientists selected samples for Saturated Column Testing to monitor leachate quality over time. The Saturated Column procedure used by Resolution does not align with the AMIRA P387A method, which is the industry standard. The AMIRA procedure for Saturated Column Testing was last updated in 2002 with findings from Smart et al. (2002). Between the AMIRA and Resolution methodologies there are key differences in column diameter and height, sample preparation, and leach duration.

Mineralogical testing involved petrography, SEM, and XRD, and methodologies were not specified. There currently is no industry standard, though much research has gone into how mineralogy can be interpreted for AMD prediction (Blowes and Jambor, 1990; Paktunc, 2001; Lapakko, 2002; Raudsepp and Pani, 2003; Parbhakar-Fox, 2011).

Critique of Testing Procedures

Overall, there are three potential issues associated with Resolution's choice of procedure for AMD prediction testing:

1) The industry-recommended procedure is not up-to-date with published research
2) New research has come out since Resolution started Baseline Testing in 2008
3) The guideline is loosely defined such that Resolution is not mandated to use more up-to-date procedures.

Research into the modernity of the baseline geochemical testing revealed that Resolution's procedure is not in line with current scientific and industry procedures.

In addition to questioning the modernity of the methodologies used by Resolution, it is worth considering the limitations of the tests themselves. The field of research around AMD prediction and prevention has been working in partnership with the resource extraction industry to determine the most effective, cheap, and fast tests to use. An important new work by Parbhakar-Fox et al. (2015) reviews AMD prediction test methods and practices, and identifies the advantages and limitations of all tests used for AMD prediction. A similar analysis is presented in Table 1, focusing specifically on the testing used by Resolution.

There are a few key limitations worth highlighting. First, the Acid Base Accounting (ABA) procedure has changed in large part due to the work of Stewart et al. (2006). ABA determines the acid forming and neutralization potential of a sample by quantifying the amount of sulfide present (Parbhakar-Fox et al., 2015). This study observed limitations such as overestimation of acid generation due to counting non-acid forming sulfide minerals in the total sulfur quantity, and overestimation of acid neutralization from inclusion of iron-rich carbonates (such as siderite), which do not generally react with acid. These issues were dealt with via procedural changes that involve a better understanding of how to quantify acid forming and neutralizing minerals. As mentioned previously, however, the impact of different sulfide minerals on the stoichiometric conversion of percent sulfide to kg $CaCO_3$/t is unresolved. The complexity of how mineralogy affects acid generation estimates reveals that ABA predictive test results are susceptible to over- and under-estimation.

Stewart et al. (2006) also highlighted the issue of lag time ambiguity in ABA and NAG tests. Lag time refers to the phenomena that over time, acid is generated from dissolution of previously stored oxidation products (like jarosite) in addition to oxidation of sulfide minerals, and neutralization rates slow. Long-term acid neutralization is not measured in any accepted AMD prediction test, despite research by Miller et al. (2009) that incorporated a number of publications (Sherlock et al., 1995; Li, 2000; Jambor et al., 2002, 2007) to propose a

methodology for evaluating lag time based on comparing acid generation rate to non-carbonate acid neutralization rate. Estimation of lag time effects is still a challenge for AMD characterization, and means a potential for future AMD to be overlooked by more immediately predicted AMD conditions.

There has also been considerable research into the capacity to which static and kinetic test results can be effectively extrapolated from the lab to the field (Bethune et al., 1997; Frostad et al., 2000; Lapakko, 1994; Liao et al., 2007; Miller et al., 2003). Laboratory results are only effective predictors if they can be applied to field conditions. Factors such as climate are difficult to reproduce in lab scenarios like a Humidity Cell, and in general leach tests used for AMD prediction (Synthetic Precipitation Leach test, Humidity Cell test, Saturated Column test) are not appropriate replicas of the natural environment where AMD may occur (Parbhakar-Fox et al., 2015). A large number of *in situ* field tests have been proposed to obtain more accurate and site-specific weathering conditions (Parbhakar-Fox et al., 2015). Such tests include drill core evaluation (Parbhakar-Fox et al., 2011), paste pH (Smart et al., 2002; Hammarstrom et al., 2003; Hageman, 2007; Noble et al., 2012 as cited in Parbhakar-Fox et al., 2015), field leach tests (Hageman, 2007; Andrina et al., 2006; Smith et al., 2009), and wall washing (Price et al., 1997; Price, 2009). Mining companies always use some combination of field tests during baseline testing, but the main issue with this category of tests is that the results are not predictive. The AMD research field is still in the process of developing a predictive test, either for the field or the lab, which effectively replicates environmental conditions. Without an understanding of how mine wastes will react in specific environments, it is possible that AMD prediction models are over- or under-estimations of the amount of AMD expected to occur within a certain time frame.

New Branches of AMD Testing

The suite of testing used by Resolution for the Baseline Geochemical data focuses heavily on chemical analysis, as the title implies. However, research in the AMD field has

increasingly shown how mineralogy and microbiology play a key role in sulfate oxidation and acid generation (Wang, 1996; Jambor et al., 2002; Smart et al., 2002; Weber et al., 2004; Parbhakar-Fox et al., 2006; Parbhakar-Fox et al., 2010; Moncur et al., 2009; Brough et al., 2013; Becker et al., 2015; Bouzahzah et al., 2015). The tests used by Resolution, and the evaluation metric for each test, do not fully account for the mineral and microbial influence on AMD generation.

Mineralogy in Characterization of AMD Potential

The relationship between mineral texture and acid neutralizing capacity has been studied extensively (Wang, 1996; Jambor et al., 2002; Smart et al., 2002; Weber et al., 2004; Parbhakar-Fox et al., 2010; Moncur et al., 2009; Brough et al., 2013; Becker et al., 2015). Mineral texture in the context of AMD includes the amount, morphology, reactivity, alteration, surface area, and spatial relationship of acid-forming and -neutralizing mineral phases. Weber et al. (2004) reported on how fine-grained framboidal pyrite effects ABA, NAPP, NAG, and column leach tests, and found that framboidal pyrite has the capacity to mask neutralizing components of a sample's mineralogy during NAPP testing. It can also impact the oxidation rate of sulfide during NAG testing, requiring additional H_2O_2. These findings demonstrate how mineral morphology can impact AMD prediction tests, and adds weight to the importance of mineralogical description and quantification during AMD testing. It is typical for mineralogy to be used to explain conflicting results between tests, but there is additional opportunity to use mineralogy at all stages of AMD characterization (Becker et al., 2015). In particular, XRD and SEM data could be used more effectively to describe sample mineralogy, both qualitatively and quantitatively (Brough et al., 2013). Bouzahzah et al. (2015) evaluated how sample mineralogy affects AMD static test results, using kinetic tests to validate the results of the static trials. Similar to the claim by Brough et al. (2013), the study found that mineralogical static tests are most effective when sample mineralogy is known in detail, particularly Fe-Mn-bearing carbonates. Bouzahzah et al.

made the concurrent observation that mineralogical approaches to AMD testing are not often used because of difficulty in precisely quantifying sample mineralogy.

In response to the need for quantifiable mineralogical data, the Acid Rock Drainage Index was developed by Parbhakar-Fox et al. (2010) (Figure 8). The index is used to predict acid formation based on intact rock texture using five parameters: sulfide content, sulfide alteration, sulfide morphology, content of neutralizing minerals, and sulfide/neutralizer spatial relationship (Parbhakar-Fox et al., 2010). The ARDI uses micro and mesoscale analyses to quantify the acid forming potential of a sample. Parbhakar-Fox et al. claim that textural analysis should be used as its own predictive test, not as a component of geochemical testing (as ingrain size analysis after Humidity Cell Testing). The ARDI classification has been shown to agree with routine static and kinetic test classification, implicating that mineralogical micro and mesoscale observations done early in the sampling process could be a cheaper and faster way to detect the AMD potential of a sample.

Sample mineralogy is needed for AMD characterization. Mineral characteristics can be quantified early in site evaluation for AMD potential, and mineralogy can be assessed as an AMD indicator outside of geochemical static and kinetic test reference frames. Nonetheless, it is also a necessary supplement for interpreting static and kinetic tests.

Microbiology in Characterization of AMD Potential

Microbial action, particularly microbially-catalyzed oxidation of sulfide minerals, is present in almost all mine waste at risk of AMD. However, static and kinetic tests do not take into account microbially-driven acid generation and consumption, nor do they account for AMD lag time due to populations of ferrous iron and sulfur-oxidizing organisms (Hesketh et al., 2010).

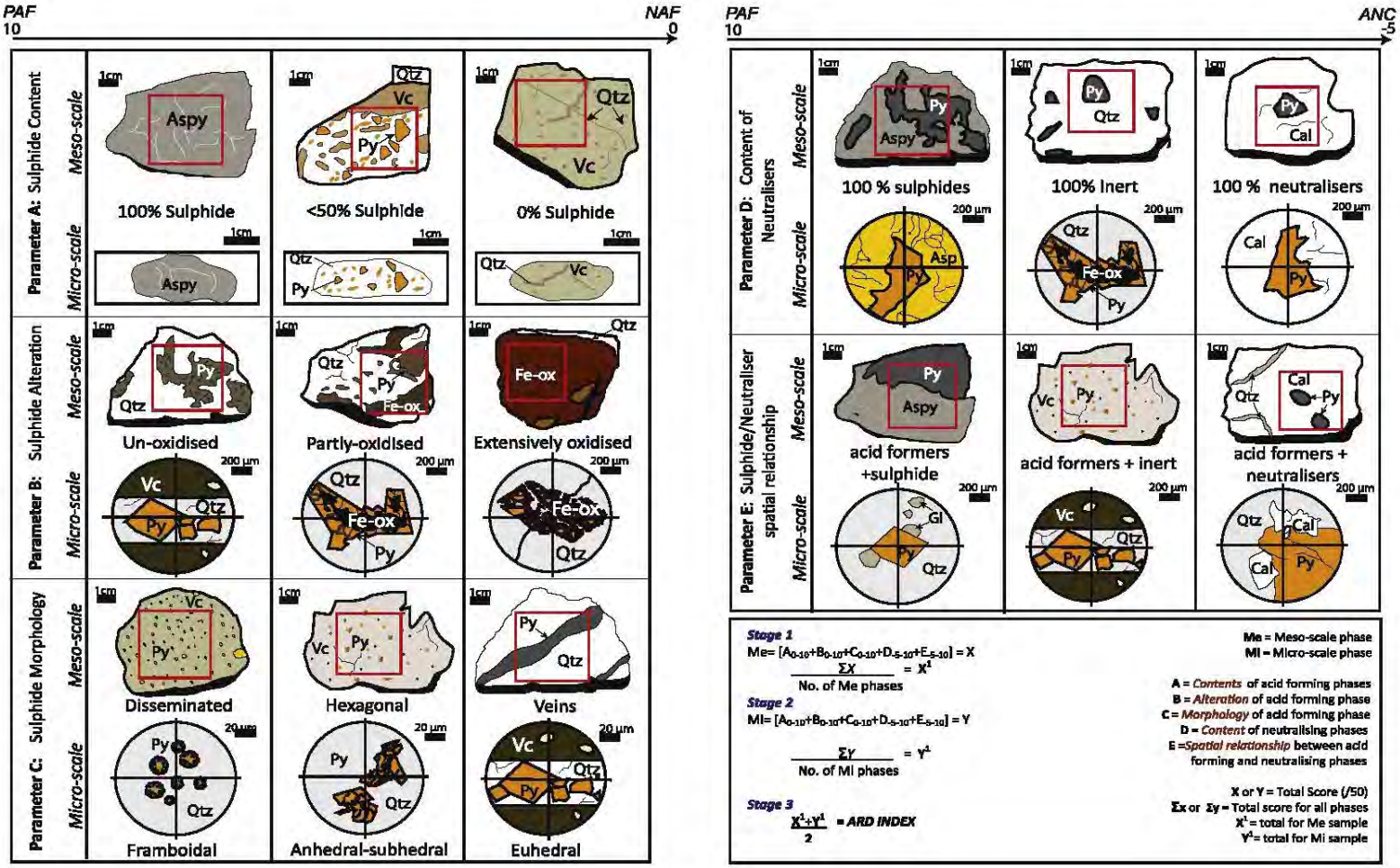

Figure 3. Acid Rock Drainage Index developed by Parbhakar-Fox et al. (2011).

Bioleaching has been studied for its ability to extract valuable minerals from sulfides (Dixon and Peterson, 2004; Watling, 2006; Pradhan et al., 2008) more than it has been studied for its effects on AMD. Research into biokinetic AMD testing has been patchy (Bruynesteyn, 1984; Bryan, 2006; Ardau et al., 2007). Hesketh et al. (2010) conducted a study comparing a biokinetic shake flask test for AMD prediction to geochemical static tests. The study found that decreasing pH corresponded to an increase in ferric iron concentration and redox potential, which was linked to biological activity driving ferrous iron and sulfide oxidation (Hesketh et al., 2010). These results showed that biological activity is fundamentally involved in AMD generation, and conditions favorable to bioleaching should be noted when making AMD prediction models.

Unclear Industry Standards

When passed in 1976, the Resource Conservation and Recovery Act mandated that methods for hazardous waste testing outlined in the EPA's SW-846 must be followed exactly as written. However, in 2005, the EPA implemented the Methods Innovation Rule (MIR), allowing for more flexibility in lab procedure so long as quality assurance measures were maintained. In fact, the MIR allowed for testing to be done using non-SW-846 methods as long as they abided by the EPA's parameters to protect human health and the environment (Methods Innovation Rule).

Internationally, the most prominent resource in the AMD testing industry is the GARD Guide, first published in 2009 and updated in 2014 by the International Network for Acid Prevention (Verburg, 2014). The GARD Guide outlines prediction tests, preventative actions, and management protocols related to AMD. However, it does not act as a regulatory or standard-setting tool, therefore a company like Resolution has no need to abide by the suggested procedures outlined in the Guide. While the GARD Guide acts as a useful compendium of AMD research advancements and methodologies, it is also a resource for understanding issues in AMD

prediction science. For example, in the description of saturated column testing, the Guide states there is no existing industry standard (International Network for Acid Prevention 2014).

Evaluation of test results is a fundamental part of any scientific experiment. Currently, ABA, NAG, combined ABA and NAG, Humidity Cell Testing, and the Synthetic Precipitation Leach test are the AMD characterization tests run by Resolution that have clear classifications for pollution risk, though this does not necessarily mean that industry standards exist for these tests (Table 3). Other experiments, such as Saturated Column Leaching and petrographic tests, are evaluated on relative scales that cannot be easily translated into a specific pollution level predictor. For petrographic analysis, this reinforces the significance of the ARDI as a tool to quantify pollution potential of a sample based on its mineralogy. In Resolution's testing schematic (Figure 6), the Saturated Column Leach Test is the final experiment in the baseline suite, and is meant to act as a predictor of long term AMD generation. As stated in the GARD Guide, the Saturated Column Leach test has no industry standard, and similarly there is no recommended long-term AMD leach rate to indicate safe versus unsafe environmental conditions.

There is further difficulty when attempting to use the Resolution Copper baseline data to determine the total impact of the mine. Though presumably Resolution has detailed information about the expected impact on the mine project, it is not publically available. Nonetheless, even with knowledge of the mine's potential impact there is no existing threshold based on AMD test classification beyond which a mine project is terminated. In the current system, even if Resolution's data suggests a high probability of AMD generation, it is up to the EPA to determine whether or not the risk is too great.

Federal Assessment of the GPO

The federal assessment for which Resolution Copper conducted its Baseline Geochemical Testing is called the Environmental Impact Statement (EIS), which is a document used for federal

Table 3. Table of AMD predictive test methods for result classification.

Test	Result	Units	Classification
Whole Rock Chemical Analysis	Above average metal/metalloid content in rocks		Metal/metalloid enriched
	Below average metal/metalloid content in rocks		Not metal/metalloid enriched
Acid Base Accounting	NNP < -20	T $CaCO_3$/ kT Rock	Acid Generating (AG)
	-20 < NNP < +20	T $CaCO_3$/ kT Rock	Potentially Acid Generating (PAG)
	NNP > +20	T $CaCO_3$/ kT Rock	Not Potentially Acid Generating (NPAG)
Net Acid Generation	NAG pH < 4.5	pH	Potentially Acid Generating (PAG)
	NAG pH > 4.5	pH	Not Potentially Acid Generating (NPAG)
Combined ABA and NAG	NAG pH < 4.5 and NNP > 0		Potentially Acid Generating (PAG)
	NAG > 4.5 and NNP < 0		Not Potentially Acid Generating (NPAG)
Synthetic Precipitation Leaching	Above U.S. drinking water ave. concentration	Mg/L	Potential risk of water contamination
	Below U.S. drinking water ave. concentration	Mg/L	Low potential risk of water contamination
Humidity Cell Tests (HCT)	High Sulfate concentration	Mg/L	Potential for acidic leachate
	Low Sulfate concentration	Mg/L	Low potential for acidic leachate
	High abundance of leachable constituents	Mg/L	Potential for environmental contamination
	Low abundance of leachable constituents	Mg/L	Low potential
	pH < 4.5	pH	Potential for acidic leachate
	pH > 4.5	pH	Low potential for acidic leachate
Saturated Column Leaching	Slow change of solute concentration over time	Mg/L /week	Potential for prolonged environmental contamination
	Rapid change of solute concentration over time	Mg/L /week	Low potential
	Slow change of pH over time	pH/week	Potential
	Rapid change of pH over time	pH/week	Low potential
Petrography and SEM	Low sulfide encapsulation	%	Potential for sulfide oxidation
	High sulfide encapsulation	%	Low potential for sulfide oxidation
	Few sulfide reaction rims	%	Low potential for sulfide oxidation

review by the EPA. A third party consultant is hired by the decision-making party to draft the EIS, which is then submitted to the EPA. In the case of the Resolution Project, SWCA Environmental Consultants have been hired by the Tonto National Forest (TNF) to review the General Plan of Operations and determine how effectively it adheres to federal law. Specifically, the EIS is drafted in compliance with the National Environmental Policy Act (NEPA). NEPA mandates that Federal functions and resources be used to:

1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2. Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
3. Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
4. Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;
5. Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
6. Enhance the quality of renewable resource and approach the maximum attainable recycling of depletable resources. (National Environmental Policy Act Sec. 101)

It is a challenge to make a mine proposal such as the Resolution Project adhere to these NEPA standards. SWCA is tasked with evaluating how effectively Resolution will be able to abide by NEPA throughout the mining process. A part of the EIS process is proposing alternative mine plans that better adhere to federal law and incorporate concerns raised during the public comment period, called scoping. SWCA and the EPA are responsible for providing TNF with various options. However, the EPA does not have the authority to accept or deny the permit

application. Ultimately, the Tonto National Forest (TNF) makes the final decision. However, if the mine proposal clearly breaks a federal law, the EPA can postpone the EIS process until Resolution revises its General Plan of Operations. Such federal laws include the Clean Air Act, Clean Water Act, and Endangered Species Act.

Interpretations

The EIS process is grounded in having accurate data. The EPA and SWCA Consultants are unable to effectively review the pollution risk and overall environmental risk of the Resolution Project if the AMD prediction tests are insufficient. For the numerous reasons explained above, Resolution's Baseline Geochemical Data is not sufficient. Test methodology insufficiencies include:

- Lack of prediction of long term AMD production and complications as mine projects progress;
- Humidity Cell data is obtained from more inaccurate and out of date tests;
- By using their own testing method, as with the Humidity Cell and Saturated Column Leach tests, Resolution complicates any interpretation of their results when compared with other available AMD prediction data.

There is also a lack of mineralogical and microbiological interpretation for AMD prediction in the General Plan of Operations. Resolution should perform more in depth mineralogical analysis of its suite of samples, and obtain a better understanding of the microbial community at the tailings location. The current reliance on geochemistry and exclusion of quantified mineralogy in industry standard testing is impacting the accuracy of AMD prediction. Additionally, further mineralogical investigation would not be a cost burden on Resolution, and might provide a better understanding of the AMD potential. Geochemical static and kinetic tests do not account for

microbial activity even though it is a key variable. The microbial community at the tailings site location for the Resolution Project should be better understood before proceeding with the mine.

While having some flexibility in AMD testing procedures can lead to more site-specific results, overall, the Methods Innovation Rule added ambiguity to methodology standards and made comparison between AMD test results much more difficult. The lack of standardized testing methodologies, and therefore lack of delineation between "acceptable" and "unacceptable" results, is of great concern in evaluating the potential risk of AMD. Currently, the AMD evaluation criteria used by the EPA are not test specific, but rather deal with AMD classification as part of a larger evaluation. The short and long term effects of AMD are damaging enough to require test specific cutoff points, which can then be used to determine a threshold for AMD potential. While it is concerning that industry standards are not clearer, there is hope that by identifying issues in the industry there will continue to be efforts to solve these problems.

Social Impact Implications

In addition to environmental concerns, there are issues of social injustice associated with the Southeast Arizona Land Exchange. The area of Oak Flat, Arizona is sacred land to the San Carlos Apache Nation, and is the location for the proposed Resolution Copper mine. Rio Tinto has been attempting to claim Oak Flat for copper mining since 2001, and has repeatedly been rejected.

Resolution Copper interacts with a number of stakeholder communities in Arizona: the San Carlos Apache Tribe, local town residents, mining reform activists, and the Tonto Forest Service. Despite their interconnectedness, these communities are not in open communication (CWG, 2015). In particular, communication between the San Carlos Apache and Resolution

Copper is minimal and single faceted (CWG, 2015). The issue at hand is the creation of an illusion of rapport between the mining company and the San Carlos Apache, built on the testimonies of a few San Carlos members endorsed by Resolution Copper.

In order to open communication between the San Carlos Apache and Resolution Copper, some kind of trust must exist. Distrust exists because grave past harms committed against the San Carlos Apache have yet to be acknowledged by the US Government and Resolution Copper. Human rights discourse is rare in the mine proposal and permitting process as it now stands in the United States, despite the fact that social impact is a component of the National Environmental Policy Act. As a key stakeholder in the Resolution Project at risk for further violation of human rights, the San Carlos Apache are owed a certain level of accountability from Resolution Copper.

In this case, accountability could come as a formal acknowledgement from Resolution, and by extension Rio Tinto, for how the mine fits into a history of ongoing persecution of the Apache. Acknowledgement is an important step in the process of reparations for Native Americans, and can aid healing of past harms (Meyers, 2000; Spelman, 2002; Coates, 2014). Furthermore, acknowledgement, distinct from apology, as a form of accountability could open up communication between Resolution Copper and the San Carlos Tribe. To facilitate acknowledgement, Resolution Copper should conduct a robust analysis of the impact the Southeast Arizona Land Exchange and Resolution Mine will have on the San Carlos Apache, with a discussion of how the mine fits into a broader history of the tribe. The analysis should be included in Resolution Copper's federal mine permit application as a formal Social Impact Statement.

Social impact should be awarded the same level of attention, research, and funding as the geologic and environmental contexts at Oak Flat. A Social Impact Statement would serve to acknowledge the social context of the mine with relation to specific stakeholder communities and nations. In particular, a balanced assessment would include discussion of how the mine benefits

and/or harms certain communities. Social Impact Assessments (SIA) have been a part of the NEPA process since the act's passage in 1970, however the use of SIAs is not routine in the United States (Burdge, 2002). This is in large part due to the 1986 U.S. Council on Environmental Quality guidelines, which do not specifically mandate that research into social impacts be reported in an SIA. More commonly, when an EIS is written, attention to social impact is interpreted as public involvement during the EIS drafting process (Vanclay, 2015). However, in the EIS framework, social impact and cultural significance are described in economic, historical, and scientific terms, and in most cases, the professionals involved in drafting the EIS are natural scientists who are not equipped to conduct social science research (Feudenburg, 1986). The implementation of social impact assessment is rare in the United States NEPA process, lending to an imbalance in evaluation criteria and perspectives.

To assist the EIS process, Resolution Copper is required to submit a General Plan of Operations to the Tonto National Forest Service, and by extension SWCA. Currently, the Resolution Copper General Plan of Operations has a section devoted to "Cultural Resources", which are historically or archaeologically significant sites. The proposed Social Impact Statement would expand the definition of a cultural resource to include how stakeholder communities care for and relate to Oak Flat and other areas potentially affected by the mine. It would be a process of research into the past and present social importance of the area, and an acknowledgement of how the Resolution Mine fits into the broader social history of Oak Flat, as well as how the land swap and mine will fundamentally change the local community's connection to that place. The expanded definition of "cultural resource" still adheres to the goals of NEPA, and would in fact enhance observance of NEPA's policy objectives.

Preparation of the EIS involves a public comment period called "scoping". Any individual, group, or organization can give letters of commentary to the party contracted to draft the EIS, and all concerns raised in the scoping period are researched by the contractor and

incorporated into the draft. Public involvement in a "scoping" format is extremely important to the NEPA process, but it should not act as a replacement of an SIA. In the case of the Resolution Mine, this is the current reality. Unlike public scoping, which occurs at a late stage in project development, an SIA involves research into the social changes implicated in a project, and it necessarily intends to influence decision-making and management of social issues (Vanclay, 2015). An SIA requires genuine community engagement, not simply consultation, in which stakeholder communities have the ability to influence management of social issues (Burdge, 2002). Internationally, SIAs are performed under guidance of the International Association of Impact Assessments, which outlines how SIAs are conducted in an ethical manner that incorporates human rights (Vanclay and Esteves, 2011). Resolution Copper has abided by the NEPA process and prepared baseline data for an EIS. However, an SIA is not being conducted. Mining companies, particularly those with the level of power held by Rio Tinto and Resolution Copper, have little to gain from acknowledging the human rights implications of their actions. In light of this truth, additional agents must enforce acknowledgement from Resolution in the Social Impact Statement. The US Forest Service is the official federal agency with the power to grant the mine permit to Resolution Copper, and thus it is the Forest Service that has the power to demand a Social Impact Statement be added to the NEPA process.

The environmental firm hired for the Southeast Arizona Land Exchange and mine is SWCA Environmental Consultants, an Arizona firm that has worked with a number of other mining companies in the state. If a Social Impact Statement were to be added to the NEPA process, companies such as SWCA would be required to expand their workforce to include experts able to assess social impact. Such experts must have tact while examining communities. Native American nations in particular have a long history of tokenization that is a risk during social investigation. A social impact process guided by community members would be ideal, not far from the model of the CWG. Members with different opinions from diverse sectors of San

Carlos society would gather to write the statement and aid SWCA. Overall, third party contractors, particularly community engagement consultants, could play a huge role in facilitating community discussions about future social impacts of the Resolution Mine in the context of historical harm.

The public engagement firm Godec, Randall, & Associates was hired by Resolution Copper in 2013 to lead the Community Working Group. Local community members representing different stakeholder entities were appointed to the committee, and all meetings were open to the public. Various guests were invited to educate the committee on issues of community importance, such as employment opportunities with Resolution and the environmental risk associated with the mine. Over the past two years, Godec, Randall, & Associates have compiled notes on issues of concern raised by the local community. Inclusion of a Social Impact Statement would create the opportunity for open community dialogue to occur at the CWG about human rights issues related to the Resolution Mine. In particular, San Carlos members may feel more inclined to participate in the CWG in the event that the social impact assessment necessarily must take their rights and history into account.

Outreach between Resolution and the San Carlos Apache has occurred in a few ways, with varying degrees of formality. Representatives from the San Carlos Tribal Government have been invited to the CWG, and San Carlos resident Karen Jones, sits on the committee as an unofficial representative. Currently, two members of the San Carlos Tribe are employed by Resolution Copper to conduct outreach on the reservation, and have thus far held two community forums in San Carlos. The mining company believes these employees would not decide to work for Resolution without the approval of tribal elders (CWG Members, 2015). Additionally, the mining company sees a difference in the opinion of the San Carlos Tribal Government, which officially disapproves of the land swap and mine, and the opinions of the reservation residents. Employees of Resolution have heard San Carlos residents say they want the mine to happen for

economic reasons, which is in direct conflict with the position of the Tribal Government and Apache Stronghold (CWG Members, 2015). At a local meeting of the CWG, a San Carlos resident claimed he was in support of the mine and was looking for a job. He added that, even as a traditional singer with a group of medicine men in San Carlos, he has never been told Oak Flat is sacred (CWG Members, 2015). Unsurprisingly, Resolution Copper has augmented San Carlos members' statements of support for the Resolution Mine.

Resolution Copper relies on a small group of individuals from the reservation who are willing to engage in conversation, representing a minority of the San Carlos population. Various forms of outreach from Resolution to the local community exist with an understanding that the public distrusts the mining company. Despite the number of methods, open communication between the San Carlos and Resolution is minimal. In an interview with a San Carlos resident who wishes to remain anonymous, it was noted that most San Carlos residents who work for or engage with Resolution Copper are from Apache scout families (2015). The interviewee additionally noted that, "They are so assimilated that it's just a job for them" (Anonymous, 2015). Local media also plays a role in Resolution's outreach to local communities. Resolution Copper supported an article by San Carlos resident Dale Miles explaining the claim that Oak Flat is not a sacred site. A number of points confound Miles' claim: he claims to be the official Apache tribal historian, but no such position exists; Miles said he had not read anything about Oak Flat being sacred, yet most of Apache history and beliefs are translated through oral tradition; Miles is Christian and does not participate in traditional ceremonies (Anonymous, 2015). The communication that occurs between Resolution Copper and the San Carlos ends up conveying truth for a small yet amplified group, ultimately degrading trust and nullifying the relationship between other members of the reservation and the mining company.

To build trust, the social impact assessment would ideally research how the Resolution Mine fits into the San Carlos Tribe's broader history of oppression. Key issues to assess include

historical oppression and its relation to underdevelopment on the San Carlos Reservation, as well as the complex formation of the reservation and how that affects the current social climate around the Resolution Mine. The San Carlos Apache, as with all Native American nations, suffered serious human rights violations during the era of colonization, culminating in attempted genocide. An oft-quoted phrase of the 19th century came from General Philip Henry Sheridan in 1869: "The only good Indian I ever saw was a dead Indian" (Perry, 1993, p.5). The legacy of persecution has continued through to the present, and impacts the relationship between the U.S. Government and indigenous nations across the country, particularly with regard to resource use. The conquest of Apache land and resources equals a loss of tribal sovereignty. As historian Richard Perry notes, "The process by which the Western Apache came to lose control over their territorial base amounted to a loss of access to an adequate supply of food. In the aftermath, their survival in the reservation period was subject to the decisions of others and largely beyond their control" (1993, p.101). Control is at the crux of sovereignty and is a key ambition in the struggle for Native American rights.

Lack of sovereignty, as it relates to resource control, continues today. Residents do not own the San Carlos Reservation land, it is owned by the federal government. As a San Carlos resident questioned, "Who knows whether or not the feds will take away reservation land next if they're proposing to swap National Forest land? They usually take land when they need resources" (Anonymous, 2015). Maps of Federal Reserve property equate Native American reservations with other areas such as parks and trusts, highlighting this concern. The American Dream that Native Americans are pressured to conform to is impossible on the San Carlos Reservation because property is not owned. San Carlos residents primarily live in mobile homes, as U.S. banks will only finance goods on the reservation they can easily repossess. This reality of powerlessness demonstrates how the U.S. forces Native American assimilation with Western culture while simultaneously making success and stability in the dominant culture impossible.

The issue of property and resource control is particularly alarming with regard to mining. The 1872 Mining Act states that a company can follow a mineral vein underground no matter where it goes, and early mining laws still govern the resource extraction policies of Arizona (Perry, 1993). Through this system, mining companies are given greater property rights than most citizens, let alone citizens with issues of rights violations like Native Americans. Further, mining does not create economic opportunity to the degree that companies claim. Unemployment on the San Carlos Reservation hovered between 50-80% from 1960-1990, despite the large amount of mining activity in the region at that time (Perry, 1993). The creation and forced population of the San Carlos Reservation limited their historical resource control and created issues of sovereignty, which have directly caused underdevelopment and have continued a legacy of persecution.

Coverage of San Carlos history in a Social Impact Statement would necessarily include the process by which the San Carlos Reservation was created and populated. The formation of the reservation is of great importance to the current social politics surrounding the Resolution Project. When the San Carlos Reservation was established in 1871, tribal members from the Coyotero, Pinal, and Arivaipa Apache nations were collectively forced onto the reservation (Perry, 1993). Additionally, as explained in an interview with a San Carlos resident who wishes to remain anonymous, Apache scouts who helped the U.S. Cavalry conquer local tribes were kept on the reservation with those they had betrayed (2015). Until Wendsler Nosie became Tribal Chairman in 2008, every chairman since the establishment of the San Carlos Tribal Government had been a descendent of an Apache scout family, highlighting an unequal power dynamic on the reservation. The mixing of tribes on the reservation means that today, residents of San Carlos don't all share the same belief in what areas are sacred, and there are members who legitimately do not claim Oak Flat as religiously significant, as suggested by the San Carlos visitor at the CWG. Subsequently, Resolution Copper amplifies the voices of San Carlos residents who say Oak Flat is not a sacred site. The complexity of the social climate on the San Carlos Reservation

affects the tribe's relationship with Resolution Copper, and demonstrates how integral social context is for assessing the impact of the Resolution Mine. Furthermore, an understanding of the social context provides insight into how outreach efforts can be more fairly pursued by Resolution Copper.

A Social Impact Statement serves as an acknowledgement for the injustices that have occurred throughout the San Carlos Tribe's history. As Wendsler Nosie, director of the Apache Stronghold campaign, mentioned in a Congressional Forum on the land swap bill, "It is unethical to fail to recognize how people were traumatized by years of war and placement on a reservation by force by the military…The US has not come to terms with its history" (Nosie, 2015). Nosie does not specify a particular community in the United States, such as the government, but applies his claim to the entire country. He calls for a reckoning with the past, framed in a way that acknowledges the human rights violations committed against Native Americans.

Scholars of African American studies have called for the US government and civil society to embark on a similar reckoning with past injustice. A number of parallels exist between the violence and oppression faced by African Americans over the course of US history and the experience of Native Americans. Ta-Nehisi Coates, in his *Atlantic* article "The Case for Reparations", specifically calls for the US Government to make reparations for the history and legacy of African-American enslavement. Coates poses a demand similar to Nosie's call for recognition, and helps conceptualize why acknowledgement is a form of repair for grave past harms that have caused ongoing persecution. Coates defines reparations as "the full acceptance of our collective biography and its consequences" (Coates, 2014). Basically, Coates clarifies the purpose of acknowledgement in the process of repair by succinctly stating that, "The first thing people have to come to is the idea that yes, there is something owed" (Coates, 2014). Though a Social Impact Statement from Resolution Copper would not mean a formal acceptance by the U.S. Government for its history with Native Americans, mandating an acceptance, an

acknowledgement, from Resolution Copper about its collective biography with respect to the San Carlos Apache is part of the first step to recognizing that something is owed. Furthermore, an acknowledgment for how the Resolution Mine will impact the San Carlos Tribe necessarily leads to an understanding that the mine poses human rights violations. There are layers of responsibility at play. Resolution owes the San Carlos people a certain level of accountability with regard to the mine and land swap. Pursuing corporate accountability will further clarify Resolution's responsibility in stopping the shameful tradition of indigenous persecution as it relates to resource extraction.

Acknowledgment is more appropriate than apology in this situation. Perhaps counter-intuitively, reparation in the form of an apology from the U.S. Government and Resolution Copper is undesirable, as sincerity seems nearly impossible. Apology is unlikely to come from a mining company abiding by its mission. In her book *Repair,* Elizabeth Spelman states, "The question is not whether it [apology] is possible but whether it is desirable" (2002), suggesting that even though an apology for the oppression endured by the San Carlos Apache is possible, it may not be ideal. Spelman further explains how repair beyond apology can be beneficial to the victim: "If reparations mean from the side of the payers not having to say you're sorry, it also means from the side of the payees not being called upon to forgive, not being pressed to forgo resentment" (Spelman, 2002). If the San Carlos are not ready to give up resentment, and are not called to forgive, reparations that do not center on apology are most fitting for this situation. Coates and Spelman would also contend that Resolution Copper is not in a position to apologize because it is unaware of the need for reparations. Acknowledgement can act as a first step in the process of reckoning with past injustice, and establishing a capacity to repair.

Additionally, acknowledgement for past harms can help restore trust in community. Trust is key for open communication, yet in the troubled relationship between mining companies and the general public, trust should not be expected. Accountability, in place of trust, is

attainable through earnest acknowledgement of injustice. Sandman, who works with natural resource companies, adds that, "The problem is that my clients expect the public to trust them. They keep asking to be trusted, instead of working to be accountable so they don't need to be trusted" (2009). Understanding the social impact of the Resolution Mine is a key way to be accountable to local stakeholder communities. A Social Impact Statement also necessarily ties communities together by recognizing the social bonds that will be affected by the land swap and mine. Professor Linda Ross Meyer captures the importance of recognizing social bonds in the process of trust building when she says:

> If one assumes that we are already bonded, the question about wrong is asked differently. The wrong of wrong is not harm to the victim as an individual, but the breaking of trust with one's community and the injury to the victim as a community member." (2000)

In this case, whole communities fill the roles of victim and perpetrator, but the placement of trust as central to justice is nonetheless fitting. Resolution cannot see itself as separate from stakeholder communities and must recognize its bonds with the local region, despite its relatively recent establishment and association with Rio Tinto. The proposed land swap and mine fit into a history of broken trust. Meyer also introduces the importance of community in the process of reparations. Acts of accountability by Resolution Copper can demonstrate that stakeholder communities are being heard, and a Social Impact Statement shows acknowledgement of that hearing. Professor Jill Stauffer explains the importance of hearing by saying, "Survivors want the harms they have undergone to be heard, and the wrongness of them affirmed in a lasting way not only by the perpetrators but by the surrounding society" (2013). Hearing is not the same as listening, and it involves greater understanding. The social impact assessment of the Resolution Mine and land swap could be a process of cultivating an understanding for how the Resolution Mine fits into a wider regional history, and how it interacts with the historical injustices faced by

the San Carlos Tribe. A formal statement in this case would be a demonstration of hearing, and an acknowledgment of responsibility.

A robust social impact assessment with specific attention to the San Carlos Apache would introduce human rights discourse into the risk evaluation of the Resolution Mine project as a whole. A Social Impact Statement would acknowledge historical harms that have occurred and place the current situation in a broader context. Acknowledgement is the beginning of a process, not the end. As Stauffer points out, "Narratives of recovery and reconciliation may reinscribe oppression by declaring problems solved or by settling on one official story that silences certain flows of history that form the lifeblood of some remaining survivors" (2013). The Social Impact Statement will not satisfy the need for reparations and justice for Native Americans, and the San Carlos Apache in particular. The issues resulting from years of genocide and oppression will not be solved by corporate accountability. And yet, greater accountability is necessary, particularly from Resolution Copper and Rio Tinto in the Southeast Arizona Land Exchange. The only way to make a corporation such as Resolution Copper, and by extension Rio Tinto, accountable for acknowledging social risk is by making it a mandatory part of the Environmental Impact Statement and federal mine permitting process they are required to engage in. This makes the EPA responsible for assessing the quality of the Social Impact Statement, which at this stage it is not equipped to do. Nonetheless, a change in how mines applications are conducted and evaluated at the federal level is necessary, and a social impact model can provide insight into how community engagement with indigenous populations should be conducted by resource extraction companies worldwide.

From this analysis, I have identified two major concerns with Resolution Copper's proposed Resolution Mine. First, the methodologies for AMD predictive testing are in need of revision and upgrade. The modernity of Resolution's AMD testing procedures, the procedures themselves, and the lack of effective industry standards all raise issue with the Baseline

Geochemical Data, and question its sufficiency for use in federal review of the Resolution Mine. Second, current federal review of the mine proposal does not take social impact into account to a meaningful degree. The lack of a Social Impact Statement has allowed Resolution Copper to maintain poor community outreach practices, particularly with regard to the San Carlos Apache.

CONCLUSION

The Southeast Arizona Land Exchange challenges human rights and environmental protection. The current review of the Resolution Mine under NEPA should address these challenges and seek to provide clear, qualitative, and quantitatively sound information to decision-making bodies such as the EPA and Tonto National Forest. This thesis has identified the following areas for revision before the Resolution Project might be approved:

- The methodologies used by Resolution Copper to conduct Acid Base Accounting, Synthetic Precipitation Leachate, and Humidity Cell AMD prediction baseline tests are out of date and should be redone using more recent evidence-based methods.

- Current geochemical tests do not fully characterize long-term AMD potential, do not effectively translate between the lab and the field, and do not adequately account for the influence of mineralogy or microbial activity on the character and rate of AMD.

- The United States industry standards and federal requirements for AMD predictive testing lack specificity, making comparison between mine projects unfeasible.

- There is no identified threshold for predicted AMD test results, which furthermore complicates assessment of the total pollution impact of the Resolution Project.

- The Resolution Project unjustly threatens an area sacred to the San Carlos Apache, and a Social Impact Assessment should be conducted to understand the history of oppression experienced by the San Carlos, evaluate how the mine fits into Resolution Copper's relationship with the San Carlos, and to recognize the human rights implications of the mine at Oak Flat.

The EIS consultants, the EPA, and the Tonto National Forest are unable to effectively review the social risk and overall environmental risk of the Resolution Project with the insufficient social

impact assessment and AMD prediction tests used in Resolution's Baseline Geochemical Data. The Southeast Arizona Land Exchange and Resolution Mine should not be permitted until improved research is conducted and the true impact of these projects can be defined.

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