Bureau of Land Management Review of Hydrology Aspects of the Resolution Copper Project

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At the request of the Department of Agriculture – U.S. Forest Service (USFS), the Bureau of Land Management (BLM) provided a targeted technical review of the 2021 Final Environmental Impact Statement for the Resolution Copper (RC) Project and Land Exchange (FEIS) and supporting documents.

For this review, a team of Bureau of Land Management hydrology specialists (BLM reviewers) reviewed the hydrology and water resources aspects of the project and assessed whether the FEIS adequately addressed comments received during the FEIS development. The team focused on comments and questions raised by the Salt River Pima-Maricopa Indian Community (SRPMIC), other Tribes, and governments. All but the targeted list of SRPMIC concerns were in Volume 6 of the FEIS. Due to the substantial number of supplemental studies and amount of analysis conducted to develop the multi-volume FEIS, and the relatively short time in which to evaluate, the BLM reviewers consider this document to be a high-level review which focuses on broader topics that we believe may be deficient, under-developed, or improperly analyzed rather than a point-by-point list of technical comments.

The BLM reviewers would like to acknowledge the extensive amount of time and effort that has gone into developing this FEIS and for the obvious high level of staff and time commitment by the Tonto National Forest on the National Environmental Policy Act (NEPA) process. The NEPA process and the resulting documents in the hydrology focus area were considered sufficient except where highlighted in this summary document.

While not unexpected, the FEIS struggles under the extensive scope of the proposed project and the scale of the studies needed to inform it. Several perceived deficiencies in data analysis and interpretation or in adequacy of describing cumulative effects were later rationalized by searching the enormous number of supplementary reports, studies, and memos to file. By not adequately incorporating this information into the FEIS, the final document often reads as incomplete and subjective in its preferred approaches. As difficult as it is for seasoned technical reviewers to follow the analyses, discussion, and reasoning for the assumptions and conclusions made in this FEIS, it must pose significant difficulty for a lay audience to process the scope and scale of the impacts predicted by this project, and whether they were predicted in an adequate and reasonable way. It is understood that the magnitude of a project such as this is difficult to convey in a single document, even an expansive multi-volume one, but the reviewers felt that excessive time was spent tracking down the source material and studies necessary to understand the information and conclusions that are presented in the FEIS.

This document is structured to provide a general assessment of the FEIS and supporting documentation, followed by more specific topic area discussion containing comments and findings the BLM reviewers felt

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did not meet the analysis standards of NEPA, or suffered from insufficient evaluation or unsupported conclusions.

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Executive Summary

The BLM reviewers believe that all additional studies referenced in the FEIS should be summarized in the FEIS to promote accessibility. These additions would ultimately benefit the FEIS and the public's understanding of the action. These summaries should be sufficiently technical (as to provide the needed information) and approachable (for less technical readers to grasp the concepts). Where feasible, selected public comments could also be referenced in the FEIS in their respective sections, especially when the comment led to additional studies being performed.

The BLM reviewers identified the need for figures, coupled with a short discussion of terminology, to explain how the effects of this project are limited spatially and temporally. An example would be a figure of the geographic limitations on surface and groundwater flow.

The BLM reviewers found a few references to Arizona water law throughout the documents they reviewed but believe there is a need for a consolidated section within the FEIS that gives a brief overview of Arizona water rights related to this project.

The BLM reviewers note that the Council on Environmental Quality (CEQ) Executive Office of the President recently issued new regulations concerning NEPA.[4] Our understanding of the regulations is that the USFS *may* (but is not required to) apply the new regulations to this FEIS since the NEPA process started before September 14, 2020.[5] However, we suggest that the USFS consult with their Solicitor's Office or USFS implementation guidance (if available) about the implications of the new regulations.

With literature suggesting a higher likelihood for severe storm events in the future, the BLM reviewers believe alternatives lack sufficient discussion on climate change and the potential for catastrophic events. Climate change predictions should be discussed, and potential impacts of floods greater than the 200-year event should be incorporated into the FEIS analysis and discussion.

The FEIS groundwater model scenarios used to predict water resources impacts into the future did not incorporate any changes over time for precipitation and recharge in transient simulations. The FEIS docket contains a "Climate Change" scenario run that does not appear to be discussed in the FEIS. That scenario indicated that when reductions in recharge were simulated (which is common during drought), there were higher rates of drawdown at wells and springs compared to the static recharge scenarios presented in the FEIS, particularly to the north and east of the model area. The BLM reviewers believe the "Climate Change" scenario model run and the results from the model run should be discussed in the FEIS.

The BLM reviewers believe the potential to store some or all tailings in existing open pits in the area was dismissed too quickly and that this option should be given more than passing consideration and rise to the level of "detailed analysis". To minimize impacts, it may be feasible to place a portion of the tailings in existing pits in the area. If these existing pits cannot accommodate all the tailings from the proposed

[4] Effective May 20, 2022. See https://ceq.doe.gov/docs/laws-regulations/NEPA-Implementing-Regulations-Desk-Reference-2022.pdf

[5] See § 1506.13 Effective date.

action, a smaller tailings storage facility (TSF) alternative than that which was analyzed could be proposed for the remaining tailings.

The BLM reviewers note that the Global Tailings Review published new guidelines and industry standards for tailings management in August 2020.[6] If practicable, the FEIS would benefit from TSF breach analysis consistent with the Global Tailings Review guidelines and standards for all alternatives. If breach analysis for all alternative TSF's is impactable, a breach analysis for the preferred alternative is recommended. Based on the changing industry standards for TSFs, it may be feasible to reconsider all alternatives, including those alternatives that were originally dismissed from the analysis.

The BLM reviewers suggest looking at alternate Pyrite Cell locations within the Skunk Camp TSF layout to potentially negate exposure of the highest concentration tailings to stormwater runoff greater than the 200-year flood event. Alternatively, analysis is recommended for the permanent rerouting of Stone Cabin and Skunk Camp Washes to the west of the Skunk Camp TSF. The BLM reviewers believe a more thorough surface water hydrology characterization, as it concerns to climate change, needs to be completed for the Skunk Camp TSF.

Additional geologic cross sections should be developed, expanding beyond the eastern bounds of the groundwater model area to the Cutter Basin to highlight both the distance and the controls to groundwater flow between these two areas. The potential for the Cutter Basin to be viewed as a potential alternate water supply in the future is a plausible indirect effect of the proposed mine.

The BLM reviewers found no mention of a date for steady state in the Skunk Camp groundwater model, other than a statement that average values were used. The reviewers also found no mention within the Skunk Camp model of flood events being incorporated into the groundwater model. It is unclear whether 100, 200, and 500-year flood events factored into the projection runs.

While dewatering of the Resolution graben has been occurring since 2009, the baseline condition for analysis would be set to the start of mining. The BLM reviewers note that baseline monitoring occurred from 2003 to 2017, but dewatering started in 2009. Please explain whether the short time-period between the start of dewatering and the end of monitoring is cause for concern. For example, did the short time-period account for a delay in response between deep dewatering and a near-surface expression of the dewatering?

The BLM reviewers strongly recommend: implementing an adaptive monitoring and mitigation plan until the effects of mining have stabilized; using site photographs, vegetation monitoring, and water levels at the associated primary monitoring well (PMW) where direct measurements of spring discharge are not feasible; obtaining mitigation make up water from outside the project area; and using a threshold for potential effects to springs and GDEs that is more stringent (expanded area of impact) than the threshold used for wells. In addition, the BLM reviewers recommend that control sites be proactively implemented for data collection, a one-mile buffer be added around the modeled extent of mining impacts to the Apache Leap tuff aquifer, and that the wells, springs, and GDEs between the 10-foot

[6] See "Global Industry Standard on Tailings Management," available at https://globaltailingsreview.org/global-industry-standard/ (accessed May 10, 2022). The Global Tailings Review was convened by the International Council on Mining and Metals, the United Nations Environment Programme, and the Principles for Responsible Investment. The stated goal is to "establish an international standard for the safer management of tailings storage facilities."

contour and the 1-mile buffer be part of the monitoring and mitigation plan. Finally, the BLM reviewers suggest some of the 'potential future measures' like PF-WR-03 become a required measure.

BLM reviewers do not believe the north, south and east groundwater boundaries of the mine model are sufficient because the boundaries were not extended beyond the area of potential impact. Mineral Creek is defined as a boundary in the mine model, but the Apache Leap tuff aquifer extends past this creek and literature states that Mineral Creek is fed by the Apache Leap tuff aquifer. Additionally, the BLM reviewers suggest a figure be added that shows the spatial distribution of error between measured and simulated water levels of the mine model. How many wells will be impacted by the proposed mining and what could be the potential impacts?

The BLM reviewers note that several comments were directed at the surface water and the potential for contamination. The reviewers believe that the predicted outcome of impacts at 200 years is insufficient to address the true cumulative hydrological impacts of the action. The reviewers believe the surface water time scale should match the groundwater predictions (noting that the groundwater model was run out 1,000 years). Further, with literature pointing to less frequent but larger storms in the future because of climate change, the 1000-year flood event calculated today has the potential to be recalculated soon with a higher possibility of recurrence. A longer view of the impacts would help the public understand what impact a 1000-year stormwater event would have on the preferred alternative TSF and what the final condition of the aquifers in the mine model would be once they have adjusted to the new equilibrium. The BLM reviewers suggest additional cross-sections showing the north, south, and east mine model boundaries with justification for why the model boundaries were chosen.

Other comments from the BLM reviewers address the groundwater models for Skunk Camp and the East Salt River Valley Project.

General comments on the FEIS

Summarize Additional Studies within FEIS

Several perceived deficiencies in data analysis and interpretation or inadequacy of describing cumulative effects were later rationalized by searching the enormous number of supplementary reports, studies, and memos to file. By not adequately incorporating this information into the FEIS, the final document often reads as incomplete and subjective in its preferred approaches. The BLM reviewers believe all additional studies referred to in the FEIS should be summarized in the FEIS to promote accessibility. These comments should be sufficiently technical as to provide the needed information, but also approachable for less technical readers to grasp the concepts. Where feasible, selected comments could also be referenced in the FEIS in their respective sections, especially when the comment led to additional studies being performed.

For example, the BLM reviewers believe the mining methods section does not sufficiently present or discuss why other known mining methods were not appropriate for the project location. In Appendix F of the FEIS under *Post-DEIS Analysis of Alternative Mining Techniques*, where M3 Engineering and Technology Corporation is listed as a source for in-situ mining, the USFS could simply add the following paragraph, which was in the referenced July 13, 2020 M3 report, *Viability of In-Situ Leaching of the Resolution Copper Deposit*: "Expected copper recovery would be approximately 15%, as the Resolution Copper deposit is mostly comprised of chalcopyrite and bornite ore and not copper oxide ore, which is readily leachable." Instead, the FEIS just states it was reviewed but found not appropriate, with the M3 report listed as a source of that statement. The Reviewers believe that short statements like these, added to the FEIS for all the considered mining methods, would satisfy the comments concerned about why other mining methods were not discussed.

In another example, a comment questioned whether riparian habitats was adequately addressed in the DEIS. The response in Volume 6 of the FEIS was that the commenter was "unaware of the substantial background information, either in the project record or cited as DEIS references, that contributed to the analysis statements contained in the DEIS." The BLM reviewers believe this comment would likely have not been submitted if previous studies had been summarized within the FEIS,.

Additional Figures Would Benefit the Readers

The BLM reviewers understand hydrologic concepts like model boundaries, boundary conditions and what they represent, cumulative impacts on surface and subsurface waters from stormwater runoff with dilution, and deposition of contaminated sediments later mobilized and transported further downstream, etc. However, some of the comments indicate there are others who do not have this knowledge but are attempting to understand the effects of the proposed project.

The following comments by the BLM reviewers relate to the need for figures, coupled with a short discussion of terminology, to explain how the effects of this project are limited spatially and temporally because of geographic limitations on surface and groundwater flow. The BLM reviewers believe that the FEIS would benefit from at least one figure that shows the various basins/subbasins in the area, with a discussion about what basins/subbasins are and how they contribute to the flow of surface water and groundwater.

For example, one of the comments received by the USFS included a figure that connected the contour lines provided in the East Salt River Valley (ESRV) groundwater model report with the contour lines provided in the mine groundwater model report, and then stated there would be cumulative effects within the mine area from pumping being done in the ESRV area. The aquifer in the ESRV is not connected to the Apache Leap tuff aquifer, which could have been more apparent to the readers if a figure of basins/subbasins had been included in the FEIS and/or the geologic controls delineating these basin boundaries was shown.

The BLM reviewers also noted comments submitted that referenced shortages of water in the Pinal Active Management Area (AMA), with reference to the ESRV model domain and the area of the mine project. ADWR's Pinal AMA groundwater model covers the Maricopa-Stanfield subbasins only, and the estimates provided on depletions within the aquifer are limited to those two subbasins and do not cross into the ESRV area adjacent to the wellfield, or the area of the proposed mining activity. The BLM reviewers believe the above-mentioned figure of basins/subbasins with supporting text could have helped someone who was speculating that the depletion estimates from the Pinal AMA groundwater model could be applied to this study area. A figure of basins/subbasins would have showed that these areas are not connected, and that any reference to a depleted aquifer in the Pinal AMA should not be used to prove depletions today or in the future for the areas referenced in the FEIS.

The BLM reviewers believe there should be a map (or several maps) that show the six alternative locations plus the HUC 12 or HUC 10 outlines from USGS (depending on the circumstances) that show each alternative and how it relates to places like "Cutter Basin", Maricopa-Stanfield, the ESRV area, the Gila River, and Top of the World. The BLM reviewers would also like to see such a map under the discussions for each alternative.

Arizona Water Law

A general discussion of water law in Arizona could be warranted – for example surface water rights not being adjudicated yet and no groundwater water rights in Arizona. Additional topics that could be addressed in this discussion are if there are any Federal or State regulations that prevent destruction of springs, if anything in the basin has been assigned a water right by the Arizona Adjudication Court, if the wells take groundwater out of the Phoenix AMA and if so, what does the law state on taking water out of an AMA? The BLM reviewers found a few references to Arizona water law throughout the documents they reviewed but believe there needs to be a consolidated section within the FEIS that gives a brief overview of Arizona water rights related to this project.

The BLM reviewers believe there needs to be a discussion about the potential for a subflow zone to be established in the project area, and if the project could potentially remove water from any proposed subflow zone. Even though a subflow zone has not been established within the project area, past precedence tells us any future subflow zone will be defined using floodplain alluvial sediments, but not bedrock or older consolidated sediments. This suggestion is not implying that the USFS needs to show where that subflow zone would be drawn, just an acknowledgement that one will be defined and if the project would impact it. The FEIS also needs a discussion about only major rivers and potentially mountain front streams being involved in Arizona Adjudication proceedings, and if there is a potential to impact these rivers. The BLM reviewers would also like to see a list of the Statement of Claimants (39s)

in the study area that would likely lose their ability to claim a water right when the Adjudication Court reaches the area as part of the Adjudication proceedings.

RC is currently dewatering the aquifer and some of the comments that were expressed denote confusion about the purpose and reasoning for the pumping. The BLM reviewers suggest a paragraph be added to the FEIS to tell readers what a mineral extraction withdrawal permit is, what the purpose of such withdrawals are, and how long RC can withdrawal under that permit, even without the new project. This paragraph should also state that permits must be renewed through the State of Arizona and state how often the permits need to be renewed.

Does the General Mining Law of 1872 have a higher priority than state and federal water rights? If the General Mining Law of 1872 is a dominant factor in the water rights at stake in the project area, the BLM reviewers want to see a paragraph stating as such in the FEIS. If the law of 1872 is not a dominant factor, the BLM reviewers want to see a discussion about other Federal rights already given and any state-based water right claims that would have an earlier priority date than RC.

A GIS layer of NHD points obtained by the BLM reviewers shows a lot more springs in the area of interest than are shown in the FEIS. Are the rest of these springs/seeps already dry? Why are they not mentioned? If they are mentioned in other literature available through the FEIS web page the BLM reviewers believe there needs to be a summary in the FEIS where the groundwater dependent ecosystem (GDEs)/springs are discussed. Would it help to tally up the number of springs that would not be impacted by the project versus how many would be impacted? Do they have 39s filed on them?

The BLM reviewers noted the mention of Superstition Vistas within Chapter 4, with the statement that the project is speculative and therefore not included in the analysis. We think it is important to provide more information related to what Superstition Vistas has managed to procure with regards to Assured and Adequate Water Supply permits and what is currently considered speculative. Superstition Vistas has obtained the rights to pump in that area, but only for a fraction of their conceptual project area.

The 39s filed with ADWR as part of the Gila River Adjudication are not mentioned in the FEIS. There are several comments that were submitted about how this project will affect water rights, but only Federal water rights would have been decided to date. Have any Federal water rights been approved within the project area? How many state-based claims have been filed with ADWR within the project area? Are there any surface water claims filed with ADWR in the area? How many parties will not be able to get a state-based water right because the water source no longer exists due to the dewatering of the Apache Leap tuff aquifer? The BLM reviewers found information within the FEIS lacking about water rights in Arizona, but we acknowledge the information could have potentially been included in another report related to the FEIS that was not reviewed by the BLM reviewers. There should also be a paragraph added that state-based rights in the area have not yet gone through the adjudication court.

Review Applicability of New CEQ Regulations

As stated in the Executive Summary, the CEQ issued new regulations concerning NEPA. The BLM reviewers believe that the USFS *may* (but is not required to) apply the new regulations to this FEIS since the NEPA process started before September 14, 2020. This understanding is based on § 1506.13 Effective Date which reads "the regulations in this subchapter apply to any NEPA process begun after

September 14, 2020. An agency may apply the regulations in this subchapter to ongoing activities and environmental documents begun before September 14, 2020."

We understand that the USFS (or the U.S. Department of Agriculture) may have implementation guidance on how to interpret or comply with the CEQ regulations with respect to the FEIS. Therefore, we suggest that the USFS consult with their Solicitor's Office or USFS implementation guidance (if available) about the implications of the new regulations.

The BLM reviewers note that if the USFS applies the new CEQ regulations to the FEIS, it could require the addition of information to the FEIS. For example, information might be required related to the proposed or potential smelting operations. Page 58 of the FEIS states the final smelter destination for copper concentrate has not been determined. Though this has not been determined, it will occur somewhere, and smelting is known to have potentially significant effects on the local air and water quality at which it occurs. If the smelter location is beyond the extent of cumulative effects analysis, it still should be acknowledged as an associated environmental consequence of the action. Not currently knowing the location does not preclude a discussion of potential effects.

General Comments About Report Organization (not related to submitted comments)

Volume 1 p. 87 of the FEIS states "This alternative is required by regulation 40 CFR 1502.14(d)." The placement of this statement makes it appear that the mine is required to do these activities because of this regulation. The BLM reviewers looked up this regulation and it stipulates that when a study with alternatives is completed, then a no-action alternative must be considered. The statement in the text is misleading.

If discussions about the alternatives were decided based on information presented in other sections within the FEIS, the BLM reviewers believe those sections should be called out in the FEIS text along with the decision. For example, "For a discussion of the potential impacts to water rights from this alternative see Chapter #, Section #".

Add the water use number to the summary table given in each alternative. For example, the text earlier in the section says 590,000 acre-feet (AF) so add a line to the table that says 590,000 AF of water will be used for that alternative. Land acreage could also be added to the table as well (private, FS, BLM, State, etc.).

Technical Comments

Introduction

Adequate understanding of the surface water hydrology and hydrogeology of the mine area and proposed TSFs are key to accurately assessing the effects of mining, recovery, and for long-term stability. This includes baseline conditions, dewatering needs, drawdown in the Apache Leap tuff aquifer, impacts to groundwater dependent ecosystems and stream baseflow, seepage and transport of contaminants from the mine workings and tailings facilities, and effects of climate change, among others.

Considering the complex geology and mining-specific changes with time and the spatial and temporal scope of evaluation, all modeling and assumptions resulting from it need to be tempered with the appropriate level of acknowledgement of its limitations and uncertainty. It will be imperative that adequate monitoring be conducted and that observations are fed back into the model on a regular basis to increase the predictive capacity of the models as tools to estimate impacts. The presented extents of modeled impacts provide best estimates with reasonable degrees of certainty, but these extents should not be construed as evidence that impacts are not occurring beyond the boundaries of the presented extents. It will be imperative that adequate monitoring be conducted and that observations are fed back into the model on a regular basis to increase the predictive capacity of the models as tools to estimate impacts.

The RC project has the potential to generate significant tonnage of important ore materials, but as a result will have a significant lasting impact on the landscape that will not be repaired with any level of mitigation. Even after mining and dewatering ceases, and water levels begin to recover, hydrologic features and processes in the project area will be altered forever and, in many cases, destroyed in perpetuity.

Future precipitation and recharge conditions must be adequately addressed to evaluate the cumulative effects of mine dewatering on the impacts and recovery of water levels in wells, spring discharge, and baseflow to streams. Climate predictions of an increase in the severity of convective storm events must be adequately incorporated into assessments of future event magnitude and severity of storms related to the proposed tailings facility at Skunk Camp.

When it comes to surface features and mine waste it is important to ensure that impacts are disclosed well past the life of the mine. This involves identification of potential failure modes and more robust facilities design as these features continue in perpetuity. Because of the episodic nature of stresses like climate, earthquakes, wildfire, and stormwater events, catastrophic failure and rare natural events were not often seen as driving factors in alternative selection or mitigation planning. However, in the last few decades, with increasing news reports of tailings facility failures occurring, the potential impacts of these rare natural events appear to be increasing in importance.

According to Table R-2 in Appendix R of the FEIS, 472 comments were received with the general category of “Water resources” and comments that could touch on water related issues could also be within the general categories of “Alternative-related comments” and “Mitigation-related comments”. The number of comments received on water and water resources alone, speaks to the importance of this issue to the submitters of comments. Table 1 summarizes the topics of interest found within these comments in Volume 6 Appendix R, and those topics of interest served as a guide through the review process and for writing this report.

Table 1. Comments to the DEIS Which Guided the BLM Reviewers Strategy During Their Review

Sub-Topic	Comment/Response Number	Number of Comments
Characterization of Skunk Camp Alternative	30078-34 (WT7), 30078-35 (WT7), 463-3 (MIT3), 28824-1 (MIT1), 314-1 (MIT1), 524-15 (MIT17) lack of 200-yr, 524-18 (WT92), 524-21 (ALT1),	8
Impacts of Climate Change	30078-18 (WT4), 30075-9 (AQ11), 28449-54 (WT4)	3
Environmental Impacts	463-2 (CR12), 8030-12 (ALT22), 30078-1 (NS1), 261-10 (MIT1), 30075-3 (WT8), 30075-4 (DOC1), 30075-6 (DOC1), 30075-29 (WT17), 524-9 (WT76) only median flow used, 28449-54 (WT4)	10
Impacts to Water Sources (springs, seeps, aquifer)	235-2 (CR4), 235-18 (WT30), 235-20 (CR21), 235-23 (WT50), 8030-9 (ALT22), 30078-3 (CR4), 30078-13 (WT4_A), 30078-14 (WT42), 30078-15 (WT4), 30078-24 (WT69), 30078-25 (NS2), 30078-26 (WT19), 30078-29 (MIT3), 30078-30 (MIT1), 30078-31 (MIT1), 30078-32 (MIT1), 30078-36 (WT4), 30078-37 (DOC1), 30078-44 (NEPA-44), 30078-45 (WT54), 30078-51 (WT10), 30079-3 (WT4), 30079-4 (WT4), 322-5 (MIT1), 261-3 (MIT1), 30075-21 (MIT3), 30075-30 (MIT30), 30075-44 (WI3), 30075-46 (MIT1), 562-2 (NS1)?, 562-4 (WT4_G), 562-7 (MIT1), F1 (ALT22, ALT5, NEPA2, NS1, TS2, WT1), F2 (ALT22, ALT5, NEPA2, NS1, TS2, WT1), F3 (NS1), F4 (ALT22, ALT5, NEPA2, NS1, TS2, WT1), F6 (ALT22, NEPA2, NEPA33, NS1, TS2, WT1, WT8), 29449-56 (NEPA54), 28449-55 (WT33), F10 (ALT22, NS1, WT4, WT6)	40
Mitigation	30075-96 (MIT38), 30075-108 (MIT3), 30075-133 (MIT1), 30075-117 (MIT1), 30075-123 (MIT1), 524-6 (MIT27), 524-7 (MIT1)	7
Concerns About Native Waters	30078-17 (WT4), 30079-5 (CR4),	2
Arizona Water Law	30078-19 (WT4_H), 30078-42 (NEPA14), 30078-43 (NEPA14), 30078-44 (NEPA14), 30078-46 (WT21_C), 30078-48 (WT19), 562-6 (NEPA20) jurisdictional waters, 524-2 (MIT27) jurisdictional waters, 524-3 (MIT27), 524-5 (MIT27) jurisdictional waters	10
Baseline Conditions	30078-20 (NEPA19), 30078-21 (NEPA19), 524-1 (ALT22)	3
Basin/Sub-Basin Concerns	30078-23 (WT71), 30078-40 (WT30), 30078-41 (WT30)	3
Alternative Mining Methods	30078-28 (AMT1_B), 30078-38 (AMT1), F5 (AMT1), F6 (ALT22, NEPA2, NEPA33, NS1, TS2, WT1, WT8)	4
Limitations of Modeling Effort	30078-27 (WT61),30078-33 (WT49), 30075-18 (WT79), 30075-20 (WT79), 30075-22 (WT79), 30075-1 (WT82),	14

Sub-Topic	Comment/Response Number	Number of Comments
	30075-23 (WT79), 30075-25 (WT8), 30075-24 (WT62), 30075-2 (WT16), 30075-26 (WT61), 30075-34 (DOC1), 28449-155 (WT81), 28449-52 (WT7)	
Impacts to Water Sources	235-2 (CR4), 235-18 (WT30), 235-20 (CR21)?, 235-23 (WT50), 8030-9 (ALT22), 30078-3 (CR4), 30078-13 (WT4_A), 30078-14 (WT42), 30078-15 (WT4), 30078-24 (WT69), 30078-25 (NS2), 30078-26 (WT19), 30078-29 (MIT3), 30078-30 (MIT1), 30078-31 (MIT1), 30078-32 (MIT1), 30078-36 (WT4), 30078-37 (DOC1), 30078-44 (NEPA-44), 30078-45 (WT54), 30078-51 (WT10), 30079-3 (WT4), 30079-4 (WT4), 322-5 (MIT1), 261-3 (MIT1), 30075-21 (MIT3), 30075-30 (MIT30), 30075-44 (WI3), 30075-46 (MIT1), 562-2 (NS1)?, 562-4 (WT4_G), 562-7 (MIT1), F1 (ALT22, ALT5, NEPA2, NS1, TS2, WT1), F2 (ALT22, ALT5, NEPA2, NS1, TS2, WT1), F3 (NS1), F4 (ALT22, ALT5, NEPA2, NS1, TS2, WT1), F6 (ALT22, NEPA2, NEPA33, NS1, TS2, WT1, WT8), 29449-56 (NEPA54), 28449-55 (WT33), F10 (ALT22, NS1, WT4, WT6)	40
Contamination/Water Quality	30078-33 (WT49), 30078-52 (TS24), 30078-53 (TS24), 30078-54 (TS24), 30075-31 (WT49), 30075-32 (WT44), 30075-33 (WT48), 30075-35 (WT44), 30075-36 (WT49), 30075-37 (DOC1), 30075-38 (WT44), 30075-42 (WT44), 30075-43 (WT44), 30075-33 (WT48), 30075-41 (WT7), 30075-45 (WT57), 30075-130 (DOC1) is only asking for something to be added to a table, 30075-131 (DOC1) correction to table, 30075-132 (DOC1), correction to table, 28449-5 (DOC1) asks for an add to a sentence, 28449-49 (WT32), 28449-89 (DOC1), 524-1 (ALT22), 524-4 (WT7), 524-8 (WT37), 524-10 (WT84), 524-11 (WT32), 524-12 (WT78), 524-13 (WT47), 524-14 (WT46), 524-16 (WI26), 28449-53 (DOC1),	32

Detailed Technical Comments

Baseline Conditions

In reference to comment response WT31 and WT45, many comments centered on when the baseline condition started, on which impacts due to mining will be compared. The Groundwater Modeling Workgroup also discussed the issue, but no consensus was ever reached on which baseline condition would be most appropriate for groundwater modeling and the NEPA analysis. Concern was expressed in the comments that while dewatering of the Resolution graben has been occurring since 2009, the baseline condition for analysis would be set to the start of mining. The BLM reviewers share this concern because baseline monitoring occurred from 2003 to 2017, but dewatering started in 2009. The short time-period between the start of dewatering and the end of monitoring did not take into consideration a delay in response between deep dewatering and a near-surface expression of the dewatering. The BLM reviewers believe it may be more appropriate to analyze available groundwater level information from wells, between where dewatering is occurring and the four springs in Devils Canyon and the 14 sites on Oak Flat. A study of historical groundwater level information could identify if pre-mining dewatering appears to be expanding towards the locations being monitored, or if impacts are already being realized.

CEQ regulations define cumulative effect as one that "results from the incremental impact of the action when added to other past, present, and reasonably foreseeable 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) p. 911. By not adequately addressing the importance of regional pre-mining groundwater conditions and the effects of early dewatering associated with the Magma mine, and by including continued dewatering in the analysis of the No Action alternative, the approach to assessing cumulative impacts does not meet the requirements of the above definition.

Concerns about Native Waters / Tribal Water Supplies

The San Carlos Sub-Basin of the Safford Groundwater Basin, otherwise known as the Cutter Basin, is located east of the predicted extent of mining influence but remains a concern to tribal entities who obtain groundwater there. Modeling results and geologic controls, mainly the basement rock complex of the Pinal Mountains, indicate that the likelihood of mining impacts propagating to the Cutter Basin is low. To better address the concerns regarding the Cutter Basin, an additional geologic cross section should be developed, expanding beyond the eastern bounds of the model area to the Cutter Basin, highlighting both the distance and the controls to groundwater flow between these two areas. Comment response WT30 addresses the structural and distance controls between the modeled extent of impact and the Cutter Basin, but the text of the FEIS does not appear to.

However, the BLM reviewers believe that geologic isolation does not preclude indirect effects of mining impacting groundwater resources in the Cutter Basin. Should the effects of mining degrade water availability or water quality in the Superior Basin, the Top-of-the-World area, or potential new areas of population development, especially beyond the boundaries of model-predicted effects that may not be subject to mitigation/compensation for loss, water users may have to go elsewhere for water supply. As

an adjacent basin, the Cutter Basin may be viewed as a potential alternative supply, which could lead to an indirect effect of mining on the water resources within the Cutter Basin.

Impacts of Climate Change

Alternatives Analysis and Climate Change

All alternatives for the tailing facilities have advantages and disadvantages in their location, construction, drainage management, breach control, and other factors. With literature in the last decade pointing to a higher likelihood for severe storm events in the future, the BLM reviewers believe there could be an increase in their recurrence. Examples include:

- "Average air temperatures are rising, and it is likely that continued warming will accentuate the temperature difference between the Southwest and the tropical Pacific Ocean, enhancing the strength of the southwesterly winds that carry moist air from the tropics into the Southwest during the monsoon. This scenario may increase the monsoon's intensity, or its duration, or both, in which case floods will occur with greater frequency. Hurricanes and other tropical cyclones are projected to become more intense in the future. Since Arizona and New Mexico typically receive 10 percent or more of their annual precipitation from tropical storms, it is likely that this change will also increase flooding." https://climas.arizona.edu/blog/climate-and-floods-southwest

- "We find that floods generated by convective storms have become more common and more extreme. On the other hand, rain-on-snow floods have become rarer and less extreme." https://doi.org/10.1029/2021GL097022

- "A growing body of work suggests that the extreme weather events that drive inland flooding are likely to increase in frequency and magnitude in a warming climate, thus potentially increasing flood damages in the future." https://doi.org/10.5194/nhess-17-2199-2017

The BLM reviewers located only brief references to the analysis of flood events at each of the alternative TSF. In addition, discrepancies were noted in discussions of 100-year vs 200-year flood events. Furthermore, no discussion was found of flood events greater than 200 years. We believe each alternative lacks sufficient discussion on climate change and the potential for catastrophic events.

Please incorporate climate change predictions into the stormwater event discussion and analyze the impacts of larger floods (1,000-year flood event has been suggested by the review team) into the analysis of all alternatives. In addition, please provide a summary for each alternative that states the predicted 1,000-year event entering and exiting the TSFs. Please provide the expected spill threshold for all alternatives. This could include buffering and storage based on the TSF pond depth. Also, please provide the expected contaminants and concentrations and their change as the contact water moves downstream and additional waters dilute. Finally, please provide the required mitigation measures if such an event takes place and provide impacts analysis and extent of the contaminants. Results should

be reported in acre feet per day and ft^3/s. Results should also be added to the text of the FEIS and provided in simple visual figures and tables for reference.

Groundwater Model and Climate Change

Regarding comment response WT4 on water scarcity and competing water uses, the USFS response states "cumulative effects analysis has been expanded in chapter 4 of the FEIS to quantify the cumulative effects of competing water uses in the region and the ramifications of ongoing drought or climate change" The section in chapter 4 recognizes that temperatures continue to rise and that there is a general agreement that timing and intensity of precipitation events would change, however, the groundwater model scenarios used to predict water resources impacts in the future did not incorporate any changes over time for precipitation and recharge in transient simulations. The BLM reviewers believe this results in an under-representation of the extent and magnitude of drawdown induced by mine operation (recharge was increased during simulations for the subsidence zone), which is supported by the "Climate Change" scenario that was requested to be conducted by the Groundwater Modeling Workgroup. The "Climate Change" scenario run indicated that when reductions in recharge (which is common during drought) were simulated, there were higher rates of drawdown at wells and springs compared to the static recharge scenarios presented in the FEIS, particularly to the north and east of the model area. Examples include a nearly 150-foot increase in projected drawdown between the proposed action scenario and the climate change scenario at well HRES-06 near Top-of-the-World, and significant (greater than 10 feet) additional increases in drawdown at locations such as McGinnel Spring, Rock Horizontal Spring, Queen Creek 17.39, DHRES-16, Devils Canyon 6.1E, 6.6W, and 8.8C, and Mineral Creek 6.9. The examples given are in different areas within the model, and in a variety of lithologies. The BLM reviewers could not find any discussion of the "Climate Change Scenario" within the FEIS and believe the model run and the results from the model run should be discussed within the FEIS.

According to the Arizona State Climate Office, in May 2022 Arizona is in the 27th year of a long-term drought. Data shown on the website *azclimate.asu.edu/drought* shows drought has affected Arizona many times throughout recorded history. The BLM reviewers are concerned that the FEIS does not adequately account for permitting processes for water use, CAP water availability, partially planned developments, and decreased precipitation (and therefore changes in recharge). The Drought Contingency Plan is mentioned, but with a short comment that the drought contingency plan is ending in 2026 and therefore will not affect the project. The BLM reviewers believe the FEIS treats other water uses as "speculative", even though there is a high probability that some of these actions will either affect the amount of water available to RC, or the amount of water withdrawn by RC will affect other planned developments. There are many assumptions in the FEIS regarding availability of water to RC, but few assumptions on the availability of water due to an extended drought or other planned projects.

Impacts from climate change will have significant ramifications on hydrologic conditions in the project area during both mine operation and the extended recovery period. Increases in temperature leading to more ET losses to aquifer systems, a reduction in recharge-inducing snowfall, increase in the severity and occurrence interval of convective storm events, and basin-scale drought (reducing not only local water supplies but regional ones including where the Desert Wellfield is proposed), are all factors that influence the cumulative impact of the mining operation and tailings storage on the landscape. The BLM reviewers do not believe factors known to be associated with climate change, such as higher average temperatures, decreased precipitation, higher evapotranspiration, more frequent and potentially more

severe flooding, increase in forest fires due to dry vegetation, increased groundwater pumping due to the reduction of surface flows, and salinity, were thoroughly addressed within the FEIS.

Suggestions for Analysis of Alternatives

Tailings storage facilities continue in perpetuity after mine closure. The potential energy of upper drainage TSFs like Skunk Camp increases the likelihood of TSF failure and increases the potential spatial extent of impacts. Because of the episodic nature of stresses like earthquakes and stormwater events, the chance for catastrophic tailings storage failure during the life of the mine is low. However, for the communities and environment they depend on for resources like water, the chance for catastrophic failure and the associated impacts is an important consideration.

In August of 2020, in response to the increasing number of TSF failures around the world, the Global Industry Standard on Tailings Management was published with the goal "of zero harm to people and the environment with zero tolerance for human fatality. It requires Operators to take responsibility and prioritize the safety of tailings facilities, through all phases of a facility's lifecycle, including closure and post-closure. It also requires the disclosure of relevant information to support public accountability."

The BLM reviewers believe TSF breach analysis should be conducted for the preferred alternative following the guidelines and standards put forth by the Global Industry Standard on Tailings Management. Study results should be disclosed in the FEIS to inform alternative selection and support public accountability. This analysis is typically conducted by a qualified third party, and like other external studies, the findings should be summarized in the FEIS and should include maps for the extent of impacts and modeling outputs to inform the public. If practicable, breach analysis or some variance thereof for all alternatives should be included in the alternatives analysis to inform the decision-making process. Results from additional breach analysis will inform other permitting data needs and emergency planning and response.

With the potential for extreme stormwater events on the rise and flows that would be catastrophic to downstream resources if the proposed Skunk Camp impoundment failed, what would be the extent of the damage? Has this potential stress on the TSF been considered in the design and placement of materials? What would the extent of the damage be for all the alternatives (not just Skunk Camp)? The BLM reviewers recommend a detailed analysis of the potential extent and impacts associated with each of the alternative tailing facility locations if a catastrophic failure occurred due to the Global Industry Standard 10,000-year stormwater runoff event.

Owing to the changing standards for TSFs, it may be feasible to reopen alternatives that were originally dismissed from the analysis. An alternative that was discussed in Appendix F (Alternatives considered but dismissed from detailed analysis) was the potential to store tailings in existing open pits in the area. While many of them have legitimate rationale for dismissal, the prospect of splitting the PAG tailings into multiple sites such as Casa Grande, Copperstone, and Tohono Cyprus appears viable. It is unclear how much analysis went into the feasibility of a multi-site disposal plan, but it seems that this option should be given more than passing consideration and rise to the level of "detailed analysis" even if it were ultimately dismissed. Even if a combination of available sites still are not sufficient in storing the PAG tailings, the remainder could potentially be stored in a scaled-down version of one of the other

alternatives that was analyzed. The BLM reviewers believe this should be explored more as continued evaluation of the preferred alternative approach could potentially reveal an increasing number of concerns about its long-term reliability.

The Reviewers found no evidence within the FEIS or supporting materials that forest fires were considered in the analysis for the alternatives presented for the TSF. Due to the decades long drought Arizona is currently experiencing there is a greater chance for wildfires in the state, and the Skunk Camp location is adjacent to several mountain ranges. If a wildfire were to occur upgradient of the tailings pile, the lack of vegetation caused by the fire could have a profound effect on the local hydrology and the BLM reviewers believe this scenario needs to be addressed as an environmental impact, or as part of a climate change discussion.

It is possible the following information has been presented in other documents that were provided as reference, but the BLM reviewers believe the FEIS should state that contamination of the aquifer and rivers/streams is possible during stormwater events. Please indicate in the FEIS under what scenarios this will happen and identify the extent of contamination for each scenario. The BLM reviewers noted 10 comments expressing concern about the environmental impacts of the TSF and 40 comments about impacts to water quality. The BLM Reviewers believe there needs to be a more thorough discussion in the FEIS about this topic.

Water quality modeling results are based on the seepage collection efficiency for each alternative. However, there is little documentation on what the confidence levels are on seepage efficiency of theoretical tailings facilities. If the values presented are average or expected values, but may vary plus/minus 5% for example, how much variability does that introduce into the modeled water quality results? The reviewers believe this deserves further explanation.

Characterization of Preferred Alternative Skunk Camp TSF

BLM reviewers recognize that the alternatives presented in the FEIS are not fully developed and that the purpose of the alternatives analysis is to consider a reasonable range of alternatives that can accomplish the purpose and need of the proposed action. With that in mind the following comments are concerns about the preferred alternative. The layout and positioning of the facilities for the Skunk Camp TSF illustrated in Appendix F of the FEIS shows Pyrite Cell 1 is planned in the path of the two largest drainages entering the Skunk Camp TSF (Stone Cabin and Skunk Camp Wash). The USGS StreamStats calculated 500-year event for the Skunk Camp Wash entering the TSF is 4750 ft3/s (PII 2430 and PIu 9270 ft3/s) while the Stone Cabin Wash for the same recurrence interval is 3760 ft3/s (PII 1910 and PIu 7390 ft3/s) (StreamStats (usgs.gov) accessed on 05/03/2022).

The BLM reviewers suggest looking at alternate Pyrite Cell locations within the Skunk Camp TSF layout to potentially negate exposure of the highest concentration tailings to stormwater runoff greater than the 200-year event. Alternatively, please analyze the feasibility of permanently rerouting Stone Cabin and Skunk Camp Washes around the Skunk Camp TSF to the west. The USGS StreamStats calculated 500-year event for the Skunk Camp Wash at the downstream extent of the TSF is 13,100 ft3/s (PII 5900 and PIu 29,100 ft3/s) (StreamStats (usgs.gov) accessed on 05/03/2022). Diverting all the upstream inflow to the TSF from Skunk Camp and Stone Cabin Washes would reduce the 500-year flood event volume of

water coming into contact with tailings in the Skunk Camp TSF by more than 50%. This has the long-term benefit of rerouting potential peak flows around the tailings facility and potentially generating more robust excavated material for tailings impoundment structures. The new alignment appears to be a paleo alignment of those washes prior to the washes eroding through the bed rock.

Permanent diversion dams for the Stone Wash and Skunk Camp Washes potentially entering the TSF should be of significant size and construction to prevent the suggested 1,000-year stormwater event from gaining contact with the TSF. As mentioned above, the probability of a 1,000-year stormwater event occurring during mining operations is low, but viewed at a longer temporal scale, it is an important consideration.

The BLM reviewers believe a more thorough surface water hydrology characterization as it concerns to climate change needs to be completed for the Skunk Camp TSF. This location has the largest 100-year floodplain footprint when compared to other drainages in the area and BLM reviewers are concerned that more frequent and more severe flood events that could result from climate change have not been addressed. The more severe flood events could cause erosion and breach of the tailings pile, which would lead to contamination and impact the Gila River. This location is mostly surrounded by mountains, and with wildfires more likely due to a drier climate, the risk of flood flows caused by fires in the mountains is also a concern for the reviewers.

The BLM reviewers found no mention of a date for steady state in the Skunk Camp groundwater model, other than a statement that average values were used. Does that mean all historical water levels were averaged and that the data used was not representative of a single moment in time? There needs to be more of a discussion in the FEIS about the steady state heads used in the groundwater model.

The Reviewers found no mention within the Skunk Camp model of flood events being incorporated into the groundwater model. Were 100, 200, 500, etc. flood events factored into the projection runs? The groundwater model seemed to mainly be a tracer type study to show how far contaminants would travel if they got into the aquifer or streambed.

Impacts to Water Sources (springs, seeps, aquifer)

After significant study of the FEIS and supplemental studies the BLM reviewers believe the characterization of GDEs is inadequate. On the United States Department of Agriculture RC Project and Land Exchange Environmental Impact Statement web page under “Baseline Reports” there are inventories of springs, but only a few of those springs were included in the FEIS. The BLM reviewers did not see a discussion in the FEIS about why only a few of these GDEs were included within the study.

One of the questions sent to the USFS was a concern that there could be an impact to the subflow zone along the Salt River, due to pumping associated with the project. Since the project is nowhere near the Salt River, the BLM reviewers wonder if this comment is concerned about pumping near the Gila River. If that is the case, a cross-section showing the general geology from the East Valley wellfield to the Gila River could be used to show that pumping for this project can not impact the Gila River.

The BLM reviewers believe the FEIS does not provide enough information to satisfy the concern that the damage to the aquifer from future subsidence at Oak Flat will impact the water in Mineral Creek. If that

information is available within a supplemental source, a summary of the study should be provided in the FEIS.

In Comment Response WT19, which concerns mitigating lost flows to Queen Creek, the response states that through mitigation (measure FS-WR-04) lost flows would be replaced by direct input of water from existing wells. Since the loss of flows due to subsidence are a permanent feature of the post-mining landscape, are mitigation flows to Queen Creek planned to be permanent, or will this mitigation be like the mitigation planned for springs and GDEs, where after 10 years past active dewatering the mitigation could potentially cease. The BLM reviewers believe the response as written requires additional clarification to be adequate.

The area encompassed by the RC project, within any scenario, consists of lands managed by the USFS, State Land, and BLM, as well as interspersed private ownership. The BLM reviewers wondered if the dewatering of the shallow aquifer will forever prevent any future landowner or development from using the shallow Apache Leap tuff aquifer as a water source, which would force any development or landowner to either drill a more expensive well to a deeper water source, or force them to obtain water from another basin?

In the water budget information presented in Volume 4 Appendix H of the FEIS, there are three periods discussed which include construction, operation, and rampdown, but there is no indication that any water budget analysis was done for the period following year 45 (end of rampdown). Water budget values should be presented for out-years (perhaps 200 years to match the groundwater model) to compare the budget to pre-mining conditions.

The water balance information shown in Volume 4 Appendix H of the FEIS has exact numbers given to represent water use for each aspect of the project and is meant to convey water use between mine years 6-12, mine years 13-36, and mine years 37-46. The BLM reviewers wonder how such specific values can be calculated before the project has even begun. As part of any groundwater modeling process the initial step of creating a water budget always involves coming up with ranges based on available literature. The exact numbers presented in this report could likely change as mining progresses, and therefore should be represented as a range of values instead of exact values. The BLM reviewers would also like to see, built into the FEIS, mitigation efforts by RC if water use ends up higher than the new range of values.

The BLM reviewers believe the cumulative impact to groundwater users in the affected area are not well quantified, which should include costs to deepen or relocate wells and added costs to draw groundwater from deeper depths or treat for degraded quality prior to use. Effects more difficult to directly quantify are the long-term impacts related to loss of basin storage due to irreversible subsidence.

In Volume 2 of the FEIS on page 384 Figure 3.7.1-6 depicts “Apache Leap tuff aquifer water-level elevations and general flow directions”. The BLM reviewers think there should be a similar figure which shows the predicted water level once the upper and lower aquifers become connected through subsidence and new steady state conditions are created.

Mitigation (water)

The BLM reviewers did not find any references within the FEIS to monitoring data being added back into the mine groundwater model to determine if initial predictions were accurate or if more mitigation measures needed to be considered to get the results intended under the mitigation plan. The reviewers also wondered if the data obtained through the mitigation efforts were to be entered back into the model and the results showed mitigation efforts were not moving in the direction intended, what would RC do with the result to ensure mitigation efforts stay on track?

The BLM reviewers do not believe the FEIS does enough to acknowledge that although subsidence will be monitored, there is not much that can be done to mitigate once block caving has started. The BLM reviewers believe there needs to be a discussion within the FEIS about the limitations of mitigating the effects of subsidence and an acknowledgement that subsidence could occur in a way that has not been predicted by the modeling efforts.

According to the FEIS, the groundwater model was based on a 200-year timeframe and effects of the mining project could go on for much longer than 200 years. However, the monitoring plan (2020 Monitoring and Mitigation Plan for Groundwater Ecosystems and Water Wells by Montgomery and Associates) states monitoring will only be done for 10 years after dewatering has ceased. The BLM reviewers believe 10 years is not adequate, considering the effects will be felt for hundreds of years, and that the monitoring and mitigation action should be in place until the effects of mining on those sources have been mitigated from the effects of the mining project.

As stated in Volume 4 of the FEIS on page J-2, “The role of the Tonto National Forest under its primary authorities in the Organic Administration Act, Locatable Regulations (36 Code of Federal Regulations (CFR) 228 Subpart A), and Multiple-Use Mining Act is to ensure that mining activities minimize adverse environmental effects on National Forest System (NFS) surface resources.” The BLM reviewers want to know if the contents of this statement inhibit the agency’s ability to mitigate impacts to groundwater resources (the Apache Leap tuff aquifer) that provide water to surface resources, like springs fed by water from the Apache Leap tuff aquifer?

In Table 2 of the monitoring plan, the measurement type at the springs is listed as “visual estimate” of flow. The BLM reviewers believe "visual estimate” of flow is a qualitative, subjective, and un-repeatable approach that should not be used in the statistical analysis of discharge trends over time. If spring flow cannot be measured directly (volumetric, weir, etc.) it should not be recorded, and site photographs, vegetation monitoring, and water levels at the associated primary monitoring well (PMW) should be used instead.

Contingent monitoring wells (CMWs) are planned at some of the GDE sites, but the CMWs are only planned to be constructed and monitored once trigger levels are met at a nearby PMW. The BLM reviewers believe, when the compartmentalization by faults and the heterogeneity of the fractured Apache Leap tuff are taken into consideration, it seems plausible that impacts will be realized at some GDE sites without a nearby PMW having reached the threshold necessary to move forward with a site-specific CMW.

Installation of wells, or systems to harvest precipitation or surface water flows to mitigate for spring flow loss is a flawed approach which follows the ‘rob Peter to pay Paul’ logic (FEIS p.421) and would

more accurately be called 'passing the buck' or 'kicking the can' than 'mitigation'. The water captured by a well in the discharging aquifer system of the spring, or capturing rainfall or flow is simply taking water that would have provided another resource further downgradient. From a water budgeting perspective, the only true means of compensating for loss of spring flow is to make up for the loss of system water by augmenting with water from outside that system. Otherwise, it should be acknowledged that the mitigations as proposed have the potential for future negative impacts on other undetermined downgradient resources. The only in-basin alternative that would not impair the collective water resources of the area would be after subsidence connects the Apache Leap aquifer with the deeper aquifer; water could be collected via wells prior to being lost to the lower aquifer and redistributed back on the landscape.

The monitoring plan shows many springs having been historically impounded, diverted, or otherwise influenced. Restoration of these sites may offset the impacts of potential reductions in flow or add habitat to compensate for other areas that may experience significant reductions or total loss of discharge. The reviewers propose that a mitigation for springs and GDEs could be to remove the development structures which inhibit full ecological utilization of the groundwater discharge. However, this is the opposite of what is proposed in the plan, where impacts to flow would trigger more construction of spring boxes. If the springs in question are within a 10-foot drawdown area, only substantial site work could create a spring box that would continue to supply groundwater to the surface.

The potential for a 10-foot water level decline in a well could result in an inconvenience or could make a well non-viable for water production. By contrast, a 1-foot decline in the water table from an aquifer that supplies water to a spring could prevent discharge from occurring at the spring entirely. The BLM reviewers believe the threshold for potential effects to springs and GDEs should be more stringent (expanded area of impact) than the threshold used for wells.

A 10-foot contour line, as stated within the FEIS and provided literature, was the highest accuracy decided upon to represent the effects to the Apache Leap tuff aquifer due to mining activity, and nothing less than 10-feet of drawdown was presented. The 10-foot contour line represents the drawdown limit after 200 years, but it has been acknowledged that drawdown will still be occurring after 200 years. The BLM reviewers suggest a one-mile buffer be added around the modeled extent of mining impacts to the Apache Leap tuff aquifer, and that the wells, springs, and GDEs between the 10-foot contour and the 1-mile buffer be part of the monitoring and mitigation plan.

The BLM reviewers believe the monitoring plan should have control sites outside of the mine project area to study non-mine related impacts such as precipitation patterns, temperature, non-mine pumping, wildfire potential, etc. Control sites were mentioned as a potential in Level 2 trigger, but these control sites should be proactively implemented for data collection, rather than implemented as a reaction to decreasing flows or water levels. The use of control sites would also improve the confidence in the analysis results.

Measure PF-WR-03 is another 'potential future measure' that should become a required measure. The EIS states that quality impacts and water level declines are not anticipated due to operation of the Desert Wellfield, it should not be a voluntary potential future mitigation. If no effects are observed, there will be no action necessary, however, the BLM reviewers believe it should be a mandatory

mitigation if in fact negative impacts are observed. The uncertainty in occurrence should not preclude the requirement for action should it occur; as such, this should be a required measure.

Limitations of Modeling Effort

Skunk Camp Model

See earlier discussion of the Skunk Camp model in the "Suggestions for Analysis of Alternatives" section.

The Mine Model

The BLM reviewers do not believe the north, south, and east boundaries of the mine model extend far enough, and that the reasoning given (that only one of the sensitivity runs showed depletion at the boundaries of the model domain and therefore the boundaries are sufficient) is not an adequate justification as the impacts are based on extent of an arbitrarily selected impact threshold, and not the extent of potentially measurable impact.

Model boundaries should extend beyond areas that could potentially be impacted by the project, and since the project will impact the Apache Leap tuff aquifer, and has the potential to impact Mineral Creek, the BLM reviewers believe the FEIS did not adequately explain why Mineral Creek was chosen as a general head boundary (GHB) in the mine model, while a map of the Apache Leap tuff reviewed by the BLM reviewers shows the unit extending beyond Mineral Creek. There is also reference in the literature that states Mineral Creek is fed in places by the Apache Leap tuff aquifer, yet Mineral Creek was chosen as the boundary for the groundwater model.

The BLM reviewers noted that no pumping other than mine related pumping was added to the mine groundwater model, or at least we did not see any evidence that current stresses outside those caused by the RC mine were incorporated into the model. The BLM reviewers believe model boundaries far away from stresses to the aquifer cannot be accurately chosen unless all pumping within the Apache Leap tuff and deeper aquifer are included within the groundwater model.

Many WT comment responses provide the estimated water budget values for varying components of the mine operations, stating that while this is "complex", values are presented to the single acre-foot. By contrast, model estimates of mine impact are not presented past 10 feet of drawdown because of uncertainty. The BLM reviewers wondered if the values used to calculate the water budget (fracture flow drainage, ore moisture, tailings facility seepage control efficiency, etc.) are so well constrained that this level of precision is justified? A review of Appendix H (Mine water balance and use) does not indicate that the presented values are an average, median, or range of potential values, they are presented as one static value for each component of the overall balance.

Comment response WT36 the states "In the DEIS we compared the elevations of the subsidence crater and modeled elevations of groundwater during recovery and found that even after a period of 1,000 years they did not intersect." The BLM reviewers noted up to a 500 ft error in the water levels for the deeper aquifer in the hydrographs. Did the USFS choose water levels from hydrographs that had a lower error rate? Or did the USFS use water level elevations presented as part of the final scenario run? We are concerned that error prone water levels were used to make this assumption.

A secondary purpose of the mine model is to evaluate the effects of dewatering on the Apache Leap tuff aquifer. The BLM reviewers wondered if the collapse of Oak Flat causes the Apache Leap tuff aquifer to dewater, does the GHB used in the mine model at Mineral Creek permit the stream to dewater if the effects of the dewatering extend to Mineral Creek?

The BLM reviewers suggest a figure that shows the spatial distribution of error between measured and simulated water levels for the Apache Leap tuff aquifer and the deep aquifer are needed with any discussion of model related error in the FEIS. For example, The ADWR Salt River Valley 2009 model report has such a figure (https://new.azwater.gov/sites/default/files/SRV8306_Model_Report_1.pdf) which makes it easy to determine where the groundwater model was under and over simulating water levels in the chosen calibration run of the model.

The BLM reviewers looked at the hydrographs within the February 2019 RC Groundwater Flow Model Report in Appendix C and it appears that the Apache Leap tuff aquifer heads were simulated adequately, but that the deeper aquifer heads had errors up to several hundred feet. Is this an accurate interpretation of the hydrographs? If this is an accurate interpretation, does this error reflect the collapse of the mine over time? If that is the case, then the report needs further explanation so the reader can make the connection. If not, then there needs to be some explanation as to why the error is acceptable for the deep aquifer.

In Section 1.1 of the SWCA Environmental Consultants *Review of Numerical Groundwater Model Construction and Approach (Mining and Subsidence Area) Final* report, the modeling work group stated "Number of known private and public water supply wells within the geographic extent of the water-level impact, and assessment of impact to these water supplies". The BLM reviewers wonder if this was ever completed. If as part of the groundwater model discussion the results are to be presented using a representative well, so that a real well owned by a private entity is not used in the analysis, the BLM reviewers understand that decision. But the USFS needs to also state how many wells are registered with ADWR that could potentially be impacted given the extent of impact shown in the groundwater model. Exact locations and registry numbers are not required.

On page 410 and 411 of the FEIS the comment about well impacts is misleading. The model presented impacts at a well that was created only to symbolize pumping in a specific area (Top of the World, Superior, Boyce Thompson Arboretum). But as stated in a comment submitted to the draft EIS, all wells produce differently based on varying hydraulic conductivity and depths. The BLM reviewers believe Table 3.7.1-4 is misleading because one well is used to represent Superior, Boyce Thompson Arboretum, and Top-of-the-World. If other wells in those areas have different hydraulic conductivities or are screened in slightly different locations, the drawdown in those wells could be different from the well chosen to represent the area. Table 3.7.1-4 at least needs a statement that these wells were chosen to represent each area and a similar analysis at other wells within the same generalized area could produce different results.

Previous reviewers point to lack of adequate scientific data within the groundwater model (Comment ID 30078-27,30075-26, 28449-62, 28449-155, BGC Engineering USA Inc, 2020) which made the model a generic representation of the system versus a complex representation of the system. When beginning a groundwater model of this scale, the best approach is to build a model based on a very generic system, get it calibrated, then add complexity as the model progresses. In response to the concerns expressed by past reviewers, a generalized USFS response was given that adding additional complexity could

produce more model uncertainty by requiring additional parameters to be estimated in the absence of value data (SWCA memo 2020). The BLM reviewers looked to ADWR's approach with the complex regional groundwater models that they have built. These models are used by countless entities in support of assured and adequate water supply designations in the State of Arizona. The ADWR models follow proven groundwater methodology, and they take time to calibrate and refine their modeling approach to incorporate more complex data. Examples of data that would improve the mine model are variations of recharge, variations to evapotranspiration rates, and stresses on the aquifer not limited to RC pumping.

Comprehensive reviews of the model had been conducted prior to the release of the FEIS in 2021 by various parties. The BLM reviewers evaluated the model report, and the description of predicted impacts, prior to evaluating past assessments of the model, as well as the Water Resources Workgroup responses and modifications based on these evaluations. Remarkably, many of the same concerns expressed in past assessments of the model were identified by the BLM reviewers, indicating the concerns had never been incorporated into the groundwater model by the time the FEIS was released. According to the October 2020 SWCA report *Evaluation and Response to Public Comments on Groundwater Modeling Analysis*, prepared for the USFS, the various reasons behind not addressing these concerns were listed under "General categories of comments received" which included four categories of comments and an accompanying table (Table 1). The "General categories of comments received" section, and the accompanying table, did not address that there were definite concerns with the mine model. The section only lists reasons why the legitimate concerns should not be addressed.

The FEIS states that the model was run to 1,000 years, as this was likely necessary to bring the model to a point when effects of mine dewatering were no longer expanding, and that water levels at the edges of mine influence begin to recover. Model scenarios indicate that impacts beyond 200 years are predicted in the areas of natural discharge in Queen Creek, Telegraph Canyon, and Arnett Creek, and in water supply wells in Superior and Top of the World for many hundreds of years up to roughly 900 years. (FEIS p.411). The BLM reviewers believe it should be recognized and highlighted within the FEIS that the information presented in the FEIS does not represent the bounds of predicted impacts, merely those which can be reasonably predicted at an arbitrarily determined time step. We also believe that analyzing only three predicted outcomes, no action (with continued dewatering), life of mine, and impacts at 200 years, is insufficient to address the true cumulative effects of the action.

As addressed in comment response WT16, long term trends shown by the groundwater model have been limited to 200 years. While this time period was agreed upon by the Groundwater Modeling Group, there appears to be no reasoning provided as to why it is anything other than an arbitrary value. The BLM reviewers wondered if there were indications that there is an inflection point in predictive capability at 200 years and beyond this point certainty drops off? Without explanations as to why this alternative was chosen, one could assume that a reason 200 years was chosen was because if the spatial extent of the model was beyond this time period (say 300 or 400 years) the groundwater model results would show that mining impacts extend a significant distance past the model boundary, which would warrant an expansion of the model domain and re-analysis. The comment on the use of the 200-year time period has been mentioned multiple times in past reviews, but the response from the USFS has simply been that 200 years was the agreed-on time frame. The use of drawdown at 200 years and 10 feet was not universally agreed upon by the internal Groundwater Modeling Workgroup.

Regarding the potential formation of a pit lake, comment response WT36 states that comments on water levels rebounding and forming a pit lake are inaccurate, because "changes wrought to the aquifer by the block caving fundamentally change the hydrologic and geologic framework of the system. A return to pre-mining conditions is not anticipated, and a return to pre-mining groundwater levels is not inevitable." Model results have been provided to 200 years and have been qualitatively described as continuing to expand for many hundreds of years, even more than 1,000 years, but there is little description or presentation of what will be the new groundwater condition in this area long into the future. This project is not one where after time, even a very long time, conditions return to an approximate pre-mining condition. The BLM reviewers believe a description of what the new system will look like and how it will behave is warranted. Uncertainty may be high in this assessment, but it should not be avoided.

The WSP (2018) block cave report states that once subsidence connects the Apache Leap aquifer with the lower system (mine year 16), the Apache Leap will be draining nearly 1,600 gallons per minute (gpm) out of the upper aquifer system into the lower workings. This rate will decrease over time, but at mine year 50 it will still be draining nearly 380 gpm (600 acre-feet per year) as the Apache Leap tuff continues to move towards a new equilibrium condition. While these flows will be removed from the lower aquifer via the mine drains during mine operation, once mining is completed these flows will continue to drain from the upper aquifer until another equilibrium condition is reached, either by filling the extent of the workings and subsidence area or draining the Apache Leap aquifer. This drainage likely accounts for the single largest output of groundwater from the Apache Leap aquifer, so what does this do to new equilibrium groundwater flow directions and gradients compared to the pre-mining condition? Will existing drain points for this aquifer ever recover to pre-mining conditions or will the generation of this new base level permanently alter this system, and what is the ultimate drain point for the lower aquifer?

Figure 2.1, Surface Geology Map, within the WSP February 2019 RC Groundwater Flow Model Report, shows the locations of cross-section A-A' and B-B' which are centered on the Oak Flat area of the project. The BLM reviewers noted that neither cross-section can be used to help orient readers as to why the north, south and east groundwater model boundaries were chosen. We would like to see either new cross-sections added to the FEIS, or modifications to these cross-sections, that would help explain to reviewers of the EIS as to why WSP chose those boundary locations for the groundwater model. The BLM reviewers also believe such cross-sections would help to explain the science between basins/sub-basins and surface water/groundwater flow.

The East Salt River Valley Project Model

The BLM reviewers did not see any reference within the FEIS or provided documents to indicate site geology was used to update the 2009 ADWR Salt River Valley groundwater model. A study was published in 2017 by the Arizona Geological Survey, with funding provided by RC, of the Superstition Vistas Planning Area, within the area shown in the FEIS and accompanying documents that would be used by RC for their East Salt River Valley pumping wells. The BLM reviewers did not read this report, but the publication stated, "Depth to bedrock, and saturated thickness, were significantly increased throughout SVPA, especially along bedrock piedmonts adjacent to the Superstition Mountains and Mineral Mountains." The increased depth to bedrock has not yet been included in a published ADWR

groundwater model of the East Salt River Valley, but the BLM reviewers believe this information should be reviewed and incorporated into the groundwater model that evaluates the pumping wells for the RC project.

The BLM reviewers want more of an explanation into how dry cells were modified within the East Salt River Valley Project Model when cells went dry. The literature stated cells that went dry were modified, but the BLM reviewers did not find anything cited within the literature to indicate what scientific data was used to give the cells a greater depth to bedrock.

The BLM reviewers found, related to the FEIS, that the pumping model within the East Salt River Valley states the groundwater model takes into consideration past stored water credits that RC has in the East Valley. Within a few years other entities that have stored water within the East Salt River Valley will also be removing their stored water credits. BLM reviewers would like to know if the pumping model factors in other entities removing stored credits.

The BLM reviewers noted the location of the modeled 25-foot drawdown contour but found no mention of other water users within that 25-foot drawdown zone. Are there current water users within that 25 ft drawdown zone, and are there any future projects already approved by ADWR within that area?

The BLM reviewers believe change maps should be included in the ESRV model report, in addition to the contour maps provided in the groundwater model report. For example, illustrating how much has depth to water changed between the no-action alternative and the other alternatives.