Arizona Mining Reform Coalition – Access Fund –
Concerned Citizens & Retired Miners Coalition –Earthworks – Sierra Club

May 31, 2022

Via Email (Kasanneni.swathi@azdeq.gov)

Arizona Department of Environmental Quality
Water Quality Division
Swathi Kasanneni
1110 W. Washington St.
Phoenix, AZ 85007

Re: Comments and Objections to ADEQ's Renewal of the Resolution Copper Mining AZPDES Permit No. AZ0020389 (LTF No. 90471)

Dear Ms. Kasanneni:

These comments are submitted on behalf of Arizona Mining Reform Coalition, the Concerned Citizens & Retired Miners Coalition, the Access Fund, Earthworks, and the Sierra Club, (Coalition) to the Arizona Department of Environmental Quality (ADEQ) pertaining to ADEQ's proposal to renew the Arizona Pollutant Discharge Elimination System (AZPDES) Permit No. AZ0020389 for Resolution Copper Mining (RCM) in order to facilitate new mining facilities and activities and new sources of discharge associated with its mining project near Superior, Arizona.

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: the Center for Biological Diversity, Concerned Citizens and Retired Miners Coalition, Concerned Climbers of Arizona, Courtland Ghost Town, Dragoon Conservation Alliance, Earthworks, 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.

Access Fund is a national, non-profit advocacy organization whose mission is to keep climbing areas in the United States open and to conserve the climbing environment. Founded in 1990, the Access Fund supports and represents over 7 million climbers nationwide and all forms of climbing, including rock and ice climbing, mountaineering, and bouldering. The Access Fund helps establish climbing ethics, promotes volunteerism, and advocates access to and sustainable use of federal and non-federal lands. The Access Fund works closely with land management agencies, environmental organizations, climbing groups, and businesses linked to use of the outdoors on conservation projects, land acquisitions, and climbing policy.

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.

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.

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 3.7 million members and supporters with more than 12,000 members in Arizona as part of the Grand Canyon (Arizona) Chapter. Our members have long been committed to protecting and enjoying the Tonto National Forest, Arizona waters, and have a significant interest in the proposed Resolution Copper Mine and related activities.

The Arizona Mining Reform Coalition and many, if not all, of the organizations signing on to these comments, previously provided written comments to ADEQ in 2010. In 2016 the Arizona Mining Reform Coalition and some of the undersigned organizations appealed ADEQ's decision to grant the 2016 permit to the Arizona Water Quality Board's decision to approve to the prior versions of this AZPDES permit. Because many of our prior concerns remain relevant to ADEQ's current proposal to renew RCM's AZPDES permit, the 2010 comments, 2016 comments and 2016 appeal documents are expressly incorporated here by reference as if stated in full in these comments. We also expressly incorporate here by reference, as if stated in full, the comments submitted on this matter by the Inter Tribal Association of Arizona (ITAA), the San Carlos Apache Tribe, and Apache Stronghold on this matter.

The proposed AZPDES permit would allow discharges of mine site stormwater from existing Outfall 001 and discharge of treated mine project water from existing Outfall 002 (as of 2010) to an unnamed wash, tributary to Queen Creek, located upstream of Boyce Thompson Arboretum and the local community of Queen Valley as well as other downstream communities. As discussed in greater detail below, the proposed AZPDES permit is contrary to the federal Clean Water Act ("CWA"), 33 U.S.C. §§ 1251 *et seq.*, and as a federal program delegated to the state, and contrary to other applicable federal and state laws and regulations, including the CWA's anti-backsliding requirements, 40 C.F.R. § 122.4(i) and standards that protect the receiving waters of Queen Creek, which is listed as impaired under Sec. 303(d), and other requirements.

ADEQ should, among other things, stay the issuance of an AZPDES permit for RCM until ADEQ has finally completed a Total Maximum Daily Load (TMDL) study for Queen Creek. ADEQ's failure to complete the TMDL for Queen Creek for over 20 years, coupled with its lack of any plan to complete the TMDL, is a gross failure of ADEQ's responsibilities under the Clean Water Act. From our review of the TMDL records made available to us, it appears that ADEQ

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has struggled to complete a TMDL study for Queen Creek due to, among other things, the significant level of background copper in its receiving waters. If ADEQ is, in fact, unable to complete a waste load allocation for Queen Creek (which is listed on the 303(d) list as impaired for copper, lead, and selenium), ADEQ should not issue an AZPDES permit for Resolution that would allow additional copper loading in the Creek. Accordingly, until this issue is resolved in compliance with the CWA, and only after a TMDL has been completed, should ADEQ revisit this draft AZPDES permit and institute robust standards, limitations, and permit requirements in conformance with existing law that are truly protective of the environment, public health, and the receiving waters of Queen Creek.

The Coalition's specific comments and objections to the currently proposed AZPDES permit are set forth below.

1. The Discharge from Outfall 002 is a New Discharge from a New Source Which Requires RCM to Secure a Separate AZPDES Permit, Among other Requirements

The Coalition once again asserts that the Resolution's Mine is a "new source" within the meaning of 40 C.F.R. §§ 122.2 and 122.29. ADEQ's arguments to the contrary continue to be unavailing. Because these arguments are well known to ADEQ, we will not restate our reasoning for our position here, but instead reference our previous written comments on this permit from 2010 and again, from 2016, which are expressly incorporated here as if set forth in full. We also incorporate the arguments made by the Arizona Mining Reform Coalition in our appeal of the 2016 permit and our subsequent litigation over this permit, and the San Carlos Apache Tribe, in its ongoing litigation surrounding this permit, including its detailed briefings before the Arizona Court of Appeals.

2. ADEQ incorrectly conflates Outfall 001 and Outfall 002 into a single permit

In fact, there should be two permits; one stormwater (for Outfall 001) and one treated industrial wastewater from dewatering the mine (for Outfall 002).

3. ADEQ Cannot Issue the Proposed AZPDES Permit Until A TMDL for Queen Creek Has Been Completed

As noted briefly above, the Coalition urges ADEQ to stay the issuance of an AZPDES permit for RCM until ADEQ has finally completed a Total Maximum Daily Load (TMDL) study for Queen Creek. ADEQ's failure to complete the TMDL study for Queen Creek for over 20 years, coupled with its apparent lack of any discernable plan to complete the TMDL in the foreseeable future, is a gross failure of ADEQ's responsibilities under the Clean Water Act. From our review of the TMDL records made available to us, it appears that ADEQ has struggled to complete a TMDL study for Queen Creek due to the significant level of background copper in its receiving waters. If ADEQ is, in fact, unable to complete a waste load allocation for Queen Creek, ADEQ should not issue an AZPDES permit for Resolution that would allow additional copper loading in the Creek.

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The reach of Queen Creek from the headwaters to Superior WWTP discharge has been listed on Arizona's 303(d) List of Impaired Waters due to exceedances in dissolved copper loading (since 2002), lead (total) (since 2010), and selenium (total) (since 2012). Other reaches of Queen Creek and its tributaries are also listed on the 303(d) List of Impaired Waters due to exceedances in dissolved copper loading.[1]

ADEQ has been working on this TMDL since at least 2002 when the reach of Queen Creek was first impaired for copper loading, but it has never been completed. In late 2017, ADEQ released a draft TMDL for public comment on three reaches of Queen Creek, Arnett Creek and two unnamed drainages.[2] The Coalition's review of various drafts of the TMDL study and other related records (obtained via a public records request), shows repeated and direct references by ADEQ to Resolution and this AZPDES permit. Our review also reveals that ADEQ has been engaged, for many years, in an unsuccessful attempt to reconcile the TMDL and its Waste Load Allocation with Resolution discharge.

In September 2018, after nine months of silence following the close of the 2017 TMDL public comment period, ADEQ circulated an email with the subject: "Queen Creek TMDL Update: Project on Hold." The email stated:

> "Greetings Interested Parties,
> Thank you for your interest in the Queen Creek TMDL project.
>
> Following two public meetings held by ADEQ to discuss the draft report, written feedback was gathered which revealed technical issues needing to be addressed. In order to best achieve our mission to protect public health and the environment of Arizona, ADEQ is suspending normal project activities until these issues can be completely resolved. Once resolved, we will provide an update and the TMDL project can move forward."[3]

In April 2022, a public records request with ADEQ filed by ITAA requested updated documents and materials on the status of this long-overdue Queen Creek TMDL. In May 2022, the ADEQ Records Division responded noting that "[t]here has been no movement on completing the Queen Creek TMDL", therefore ADEQ "didn't expect to find any more recent documentation" than the September 2017 Queen Creek TMDL draft.[4]

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[1] *See* Arizona's 2018 303(d) List of Impaired Waters: https://static.azdeq.gov/pn/pn_303d_2018draft.pdf. *See also* ADEQ Surface Water Monitoring and Assessment: https://azdeq.gov/programs/water-quality-programs/surface-water-monitoring-and-assessment. *See* Queen Creek TMDL Factsheet: https://azdeq.gov/sites/default/files/middlegila_qc_headwater_fs.pdf

[2] *See* ADEQ Public Notice of TMDL Analysis for Three Reaches of Queen Creek, Arnett Creek and Two Unnamed Drainages (September 2017): https://azdeq.gov/public-notice-tmdl-analysis-three-reaches-queen-creek-arnett-creek-and-two-unnamed-drainages

[3] Email from ADEQ dated September 2018.

[4] Email from ADEQ Records Center received May 2022.

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It is clear that rather than completing the TMDL in conformance with the Clean Water Act (which it apparently cannot do if this permit is issued), ADEQ has instead simply chosen to forego this mandatory requirement. ADEQ has not, however, decided to forego issuance of the instant AZPDES permit, which will result in unlawful copper loading to Queen Creek. This violates the Clean Water Act.

It is also noteworthy that ADEQ appears to have no discernible plan to complete the TMDL. The Ninth Circuit Court of Appeals, in the case of *Columbia Riverkeeper v. Wheeler,* 944 F.3d 1204 (9th Cir. 2019) involved a citizen suit to compel the EPA to develop and issue a long-overdue TMDL for the Columbia and Snake Rivers, after years of inaction by the states of Washington and Oregon. In this case, the Ninth Circuit found that "[w]here a state has failed to develop and issue a particular TMDL for a prolonged period of time, and has failed to develop a schedule and credible plan for producing that TMDL, it has no longer simply failed to prioritize this obligation. Instead, there has been a constructive submission of no TMDL, which triggers the EPA's mandatory duty to act." *Id.* at 944 F.3d at 1211.

ADEQ's prolonged inaction on the Queen Creek TMDL for over 20 years, and the project's suspension in September 2018, coupled with ADEQ's May 2022 admission of "no movement on completing the Queen Creek TMDL," indicates that ADEQ lacks a schedule or credible plan for producing the TMDL. Indeed, ADEQ has done the opposite of prioritizing this obligation, even though ADEQ simultaneously seeks to issue an AZPDES permit to Resolution that will result in more copper loading to an already impaired water. The 2022 Water Quality in Arizona 305(b) Assessment Report Appendix D, notes the priority ratings on these water bodies as Medium and Low.

41	QUEEN CREEK	15050100-014A	COPPER	Medium
42	QUEEN CREEK	15050100-014A	LEAD	Low
43	QUEEN CREEK	15050100-014B	COPPER	Medium
44	QUEEN CREEK	15050100-014C	COPPER	Medium
45	UNNAMED TRIB (UCQ) TO QUEEN CREEK	15050100-1000	COPPER	Low
46	DEVILS CANYON	15050100-1662	COPPER	Low
47	DEVILS CANYON	15050100-1662	MERCURY	Low
48	ARNETT CREEK	15050100-1818	COPPER	Medium
49	UNNAMED TRIB (UCQ) TO QUEEN CREEK	15050100-1843	COPPER	Low

Finally, even Arizona's TMDL statutes (A.R.S. § 49-231 et seq.) require that regarding 303(d) lists "Total maximum daily loads that are required to be developed for WOTUS that are included for the first time on subsequent lists shall be developed within fifteen years of the initial inclusion of the water on the list." (A.R.S. § 49-233(B), emphasis added). This has not occurred.

The fact that ADEQ has not completed the required TMDL for the impaired water in this case does not mean that the discharger or ADEQ is free to bypass the strict requirements of the Clean Water Act and issue this permit. To the contrary – the AZPDES permit cannot be issued until the TMDL is completed.

ADEQ disregards the fact that Queen Creek is impaired for copper (and also selenium and lead), based on the apparent assumption that as long as RCM's discharge complies with water quality standards, the discharge must be permitted. That is not the law. The obvious objective of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of our Nation's waters. Even if the discharge itself will not violate water quality standards (which has

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not been shown to be the case here), the Clean Water Act prohibits discharges of a pollutant into an impaired water body if that pollutant is the reason for the impairment (*i.e.,* the reason why the stream is on the 303(d) list), unless certain stringent planning and stream remediation efforts have been finalized and are in place – which has not been done in this case.

Here, Queen Creek is listed as impaired for copper and the discharge permitted under the renewed AZPDES permit—which is a "new discharge" from a "new source" under 40 C.F.R. §§ 122.2 and 122.29 (as discussed above) —will contain copper (among other pollutants). Under the CWA, such a discharge will "cause or contribute" to water quality violations and cannot be permitted without a plan in place to ensure that the stream can and will achieve the standard. *See* 40 C.F.R. § 122.4(i)("Prohibitions. No permit may be issued: (i) To a new source or a new discharger, if the discharge from its construction or operation will cause or contribute to the violation of water quality standards"). <u>This regulation is a flat-out prohibition against any new discharge that would cause or contribute to a violation of a water quality standard</u>.

Furthermore, this regulatory requirement of the CWA allows for only one limited exception—in 40 CFR § 122.4(i)—to the prohibition of discharges into impaired waters that already are violating the standard. In order for a discharge of the pollutant in question to be allowed, the EPA regulations require strict assurances that: (1) the stream can handle the new discharge and still meet the standard, and (2) that specific plans are in place to ensure that the stream will be brought back to health—*i.e.*, achieve the applicable water quality standard for that waterbody.[5] Thus, the permit applicant has the dual burden of demonstrating that "there are sufficient pollutant load allocations to allow for the discharge" and that "existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards." That has not occurred here.

As noted in prior comments on the 2010 and 2016 AZPDES (which are still applicable today, if not more so given the new mine activities at issue), the Ninth Circuit Court of Appeals has directly affirmed this reading of the CWA and its regulations. In *Friends of Pinto Creek v. United States E.P.A.*, the U.S. Court of Appeals overturned a water quality discharge permit issued by the federal EPA for a copper mining project in Arizona. *See Friends of Pinto Creek v. U.S. E.P.A.*, 504 F.3d 1007 (9th Cir. 2007), *cert. denied*, 129 S.Ct. 896 (2009).

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[5] Specifically, 40 C.F.R. § 122.4(i) requires that:

> The owner or operator of a new source or new discharger proposing to discharge into a water segment which does not meet applicable water quality standards or is not expected to meet those standards even after the application of the effluent limitations required by sections 301(b)(1)(A) and 301(b)(1)(B) of CWA and for which the State or interstate agency has performed a pollutants load allocation for the pollutant to be discharged, must demonstrate, before the close of the [NPDES permit] public comment period that:
>
> (1) There are sufficient remaining pollutant load allocations to allow for the discharge; and
>
> (2) The existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards.

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The critical issue in that case was whether a discharge permit could be issued that would add a pollutant to Pinto Creek, a water body that did not meet the applicable water quality standard for that pollutant—in that case, dissolved copper. The EPA-issued permit was vacated and remanded on the ground that such a discharge violated the impaired waters provision of the CWA. Presently, the ADEQ is proceeding to a head-on collision with that court precedent and the rule of law by persisting in this permit renewal.

In *Pinto Creek*, the Court of Appeals framed the fundamental issue as: "[w]hether the issuance of the permit to discharge a pollutant, dissolved copper, into Pinto Creek, which already exceed the amount of dissolved copper allowed under the Section 303(d) Water Quality Standards, is in violation of the Clean Water Act and applicable regulations?" *Pinto Creek*, 504 F.3d at 1009. The Court said that such a discharge would violate the CWA. The Court's decision squarely rejected the "offset" defense raised by EPA, the discharger, and ADEQ (which had certified the discharge under CWA Section 401). *Id.* at 1012. Relying on the stated objective of the CWA "to restore and maintain the chemical, physical, and biological integrity of the nation's waters," the court held that "[t]he plain language of the first sentence of the regulation is very clear that no permit may be issued to a new discharger if the discharge will contribute to the violation of water quality standards." *Id.*

The Court further held that: "[t]here is nothing in the Clean Water Act or the regulation that provides an exception for an offset when the waters remain impaired and the new source is discharging pollution into that impaired water." *Id.* The court noted that 40 C.F.R. § 122.4(i) allows for an exception to this strict rule only "where a TMDL has been performed." *Id.* "[T]his exception to the prohibited discharge by a new source provides that the exception does not apply unless the new source can demonstrate that, under the TMDL, the plan is designed to bring the water into compliance with applicable water quality standards." *Id.*

The Court also noted that, in addition to the requirement that a TMDL be performed, the discharger must demonstrate that two conditions discussed in 40 C.F.R. § 122.4(i) have also been met. That is, (1) there are sufficient remaining pollutant load allocations to allow for the discharge, and (2) the existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards. 40 C.F.R. § 122.4(i). *See Pinto Creek*, 504 F.3d at 1013.

The Court of Appeals required that these compliance plans must not only show what pollutant load reductions are needed to bring a water body back to health, but also actually how these reductions will be achieved. Specifically, the Court pointed out that the error of both the EPA and the mining company was that the objective of 40 C.F.R. §122.4(i)(2) is not simply to show a lessening of pollution, but to show how the water quality standards will be met if the mine was allowed to discharge pollutants into the impaired waters. *Pinto Creek*, 504 F.3d at 1014.

The Court further found that "compliance schedules" must be established for all "existing dischargers" into Pinto Creek, so that the stream could accommodate the new and increased copper discharges from the mine. *Id.* at 1012-13. In this regard, the Court noted that all point sources must be subject to these compliance schedules (*i.e.,* plans designed to reduce the pollutant loading from each source so the stream segment would be brought into compliance

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with water quality standards). *Id.* The Court specifically rejected EPA's argument that only currently permitted point source discharges were subject to the "compliance schedule" requirement. *Id.* at 1013.

The Court, therefore, established the basic procedure that must be followed before a new NPDES permit can be issued for a discharge to an impaired water:

> If point sources, other than the permitted point source, are necessary to be scheduled in order to achieve the water quality standard, then EPA must locate any such point sources and establish compliance schedules to meet the water quality standard before issuing a permit. If there are not adequate point sources to do so, then a permit cannot be issued unless the state or [the discharge permit applicant] agrees to establish a schedule to limit pollution from a nonpoint source or sources sufficient to achieve water quality standards.

Id. at 1014.

On this point, EPA had correctly argued that nothing in the CWA compelled it to act against other dischargers. However, the Court pointed out that its ruling did not force EPA to take any action requiring existing discharges to reduce their pollutant loadings. Rather, "[t]he EPA remains free to establish its priorities; it just cannot issue a permit to a new discharger until it has complied with [40 C.F.R.] § 122.4(i)." *Id.* at 1015.

The fact that ADEQ has not completed the required TMDL for the impaired water in this case does <u>not</u> mean that the discharger or ADEQ is free to bypass the strict requirements of the CWA, as the Court in *Pinto Creek* has emphasized. Under the CWA, a discharge to an impaired water is prohibited, <u>unless pursuant to a valid and completed TMDL for that stream the compliance schedules are established for the various discharges</u>.

4. A Renewal or "Amendment" of the Permit is Not Permitted During the Ongoing Appeal

As ADEQ is aware, AZPDES Permit No. AZ0020389 (signed January 19, 2017, effective January 23, 2017) has been appealed. See *San Carlos Apache Tribe v. State of Arizona, et al.* Arizona Court of Appeals, Division 1, Case No. 1 CA-CV 21-0295. ADEQ is also certainly aware that this appeal of this permit is <u>ongoing</u>.

As an appealed AZPDES Permit, it is subject to A.R.S. § 49-324(E). At the time the AZPDES Permit was signed, A.R.S. § 49-324(E) read:

> "E. Notwithstanding section 41-1092.11, if a notice of appeal of a permit that is issued under article 3.1 of this chapter is filed, those permit provisions that are specifically identified in the notice of appeal as being contested and those other permit provisions that cannot be severed from the contested provisions are automatically stayed while the appeal is pending, including during any court proceedings. Uncontested permit provisions that are severable from the contested

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provisions are effective and enforceable thirty days after the director serves notice on the applicant, the water quality appeals board and any party who commented on the proposed action of the conditions that are uncontested and severable."

A.R.S. § 49-324(E) was amended in 2021 (H.B. 2042, signed Feb. 24, 2021), substantially reducing the range of this stay provision. However, since the appeal predates these changes, these new changes do not apply to this ongoing AZPDES Permit appeal.

A.R.S. § 1-244 states that "No statute is retroactive unless expressly declared therein", which has not occurred here. Arizona courts have repeatedly affirmed this. A statute has prospective operation only, unless the statute plainly indicates an intent that it has retrospective effect. *Rodriquez v. Terry* 79 Ariz. 348 at 350 (1955); *Cummings v. Rosenberg* 12 Ariz. 327 (1909). Unless a statute expressly applies retroactively, it presumptively applies prospectively. *State v. Fell* 209 Ariz. 77 at 83 (App. Div. 2 2004) (review granted, affirmed 210 Ariz. 554). See also, *San Carlos Apache Tribe v. Superior Court ex rel. County of Maricopa*, 193 Ariz. 195 at 205 (1999), citing *Hall v. ANR Freight System, Inc.*, 149 Ariz. 130 at 139 (1986): "Legislation may not disturb vested substantive rights by retroactively changing the law that applies to completed events."

In short, ADEQ's deliberately reckless disregard of controlling case law in an attempt to simply move forward normally with this application "like any other"[6] is illegal. The current AZPDES Permit materials have been silent as to whether this permit would continue to be stayed once issued and tacitly reveals that in ADEQ's view it would not. ADEQ cannot side-step the Legislature's exclusive authority to determine when and whether a statute will apply retroactively. ADEQ also cannot bypass or "moot" the stay of this AZPDES Permit simply by taking action to renew or reissue a stayed permit that is subject to ongoing appeal. Such actions are unconstitutional and a blatant violation of law.

Lastly on this illegal ADEQ maneuvering, ADEQ appears to take the position that Resolution has applied for a "reissuance", not an amendment, of their permit, this conclusion is nonsensical and contrary to their own permit materials. Multiple permit changes, *i.e.* "amendments" have been requested by Resolution in their Permit Application. *See* Permit Fact Sheet at VII, p.5-6; *see also* Resolution's Permit Application dated July 23, 2021, received *via* public records request). All of these illegal machinations undertaken by ADEQ in a twisted attempt to justify its unlawful efforts to issue the AZPDES permit to RCM can avoid the harms and liabilities they pose to ADEQ officials, RCM, and to the people and State of Arizona, if ADEQ simply obeys the law and stays the issuance of this permit until conclusion of the litigation as required by Arizona law.

5. Monitoring and Testing Parameters for Cyanide in Outfall 001 and 002 Discharges Were Changed to Cyanide (as free cyanide) Without Notice or Explanation

[6] *See* Email from Chris Montague-Breakwell to Swathi Kasanneni dated July 27, 2021 at 5:09 PM (received via Public Records Request) stating in relevant part "issue the permit as we normally would" and "start processing this application like any other."

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"Cyanide" has been a required parameter for trace substance monitoring at Outfalls 001 and 002 since at least 2010 (*see* 2010 AZPDES Permit at Tables 2.a and 2.6, p. 4-5; *see* 2016 AZPDES Permit at Tables 2.a and 2.b, p. 6). The February 1, 2022 Draft Permit also indicates that "Cyanide" is still a required parameter for trace substance monitoring at Outfalls 001 and 002 (Tables 2.a and 3.b, p. 5-6). Moreover, Resolution's AZPDES Renewal and Amendment Application submitted July 23, 2021 ("Application") does not request any changes to monitoring parameters for cyanide.

This parameter for Assessment Level Monitoring at Outfalls 001 and 002, however, was changed from "Cyanide" to "Cyanide (as free cyanide) in the March 9, 2022 Draft Permit (Tables 2.a and 3.b, p. 5-6)." No explanation whatsoever is given for this change and the change is not flagged anywhere in the materials.[7] ADEQ also did not make any adjustments associated with this change in the concentration assessment levels. These changes should be justified and explained by ADEQ.

Another unexplained amendment appears regarding Discharge Characterization Testing for Outfalls 001 at Table 4.a (*see* 2/1/22 Draft Permit at p. 8 as "Cyanide"; *see* 3/9/22 Draft Permit at p. 8 as "Cyanide (as free cyanide)" and for Outfall 002 at Table 4.b (*see* 2/1/22 Draft Permit at p. 9 as "Cyanide"; *see* 3/9/22 Draft Permit at p. 9 as "Cyanide (as free cyanide)").

These are major changes. Cyanide is a chemical compound, and many types of cyanide are acutely toxic. Cyanide content can be measured in multiple ways – as total cyanide, or as different categories of form (as available cyanide, as free cyanide, etc.). Changing assessment monitoring from "Cyanide" (presumably total cyanide, which is the sum total of all inorganic chemical forms of cyanide that can dissociate and release free cyanide under certain conditions) to "Cyanide (as free cyanide)" is a reduction in scope. It would not capture total cyanide in the discharges from Outfalls 001 and 002.

In all of these changes, the assessment level concentrations have not been adjusted. Therefore, under these new permit amendments, levels of total cyanide in the discharges are allowed to be much higher than before, since only free cyanide levels are now being tested. That is inconsistent with requirements of law.

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[7] Copies of the AZPDES Draft Permit and Draft Fact Sheet were first circulated for public review on February 1, 2022. (The Coalition, who is obviously an interested party to this permit, was never notified about the release of this Draft of the permit.) However, the Public Notice versions of these AZPDES Permit materials circulated on March 9, 2022, were not identical to the previously circulated versions. The material changes between the two draft permits were neither flagged to the public nor explained by ADEQ. This is problematic, including for the obvious reason that interested parties have now had over a month to review the versions first circulated, and were neither anticipating nor notified of any changes made by ADEQ between the documents. This impairs the public's ability to meaningfully review and comment on the draft permit and it is inconsistent with the public notice and comment requirements under Arizona law. It is also thereby in violation of the public's constitutional rights to adequate and effective notice and due process as guaranteed by the Fifth and Fourteenth Amendments.

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6. The Definition of a "Qualifying Storm Event" for Whole Effluent Toxicity Monitoring Was Changed by a Factor of 20 Between the Permit Drafts, With No Explanation

Under the AZPDES Permit terms, the permittee is required to monitor discharges for Whole Effluent Toxicity (WET). If toxicity is detected in the samples above certain levels, follow-up testing and additional processes for Toxicity Identification Evaluation (TIE)/Toxicity Reduction Evaluation (TRE) under the permit are required.

The February 1, 2022 Draft Permit (Part I(D), pages 7-8) states that WET Monitoring samples for Outfall 001 are to be collected at Collection Pond No. 105 (CP-105) during qualifying storm events, defined as "rainfall in the amount of 0.1 inches or more with in [sic] the first 24-hours of the storm event."

This definition was changed by a factor of 10 in the subsequent March 9, 2022 Draft Permit (Part I(D), pages 7-8), without any notice or explanation to the public: "A qualifying storm event is rainfall in the amount of one inche [sic] storm in the first 24-hours."

The definition for 'qualifying storm event' is a new addition. However why this definition was changed silently between the two documents by a factor of 10 is never explained. Rainfall events occurring in excess of 0.1 inches in 24 hours are far more frequently occurring than rainfall events occurring in excess of 1 inch in 24 hours. This means sampling for WET Monitoring testing would occur far less frequently than was first proposed, with no explanation or rationale. ADEQ has therefore limited the protective nature of the permit without notice to the public, and the reason why this permit terms were changed, and at who's request has never been disclosed. At minimum, this tactic violates the notice and comment requirements under Arizona law and the U.S. Constitution as mentioned previously herein above.

7. The Requirement for an Annual Best Management Practices (BMP) Report Was Removed, With No Explanation

The February 1, 2022 Draft Permit (Part IV(C)(12), page 22) contained a new provision to require that a BMP Annual Report to be submitted to ADEQ by September 30th of each year "that documents compliance, and any changes to the BMP Plan." This entire section (12) was deleted from the March 9, 2022 Draft Permit (page 22), again without notice to the public or any explanation in violation of ADEQ's notice and public comment obligations under Arizona law.

8. The Permit Renewal Application is Administratively Incomplete: Failure to Obtain Water Quality Data on the Potential Discharge Through Outfall 001

The Process Flow Diagram (shown below) and Site Drainage Maps attached to the AZPDES Renewal Application[8] indicate that stormwater from across the West Plant site drains to and is

[8] *See* Form 2C, Attachment 1 (dated July 9, 2021) to AZPDES Renewal Application (obtained *via* Records Request). *See also* Form 2F, Attachment 1 (dated July 14, 2021) to AZPDES Renewal Application (obtained *via* Records Request).

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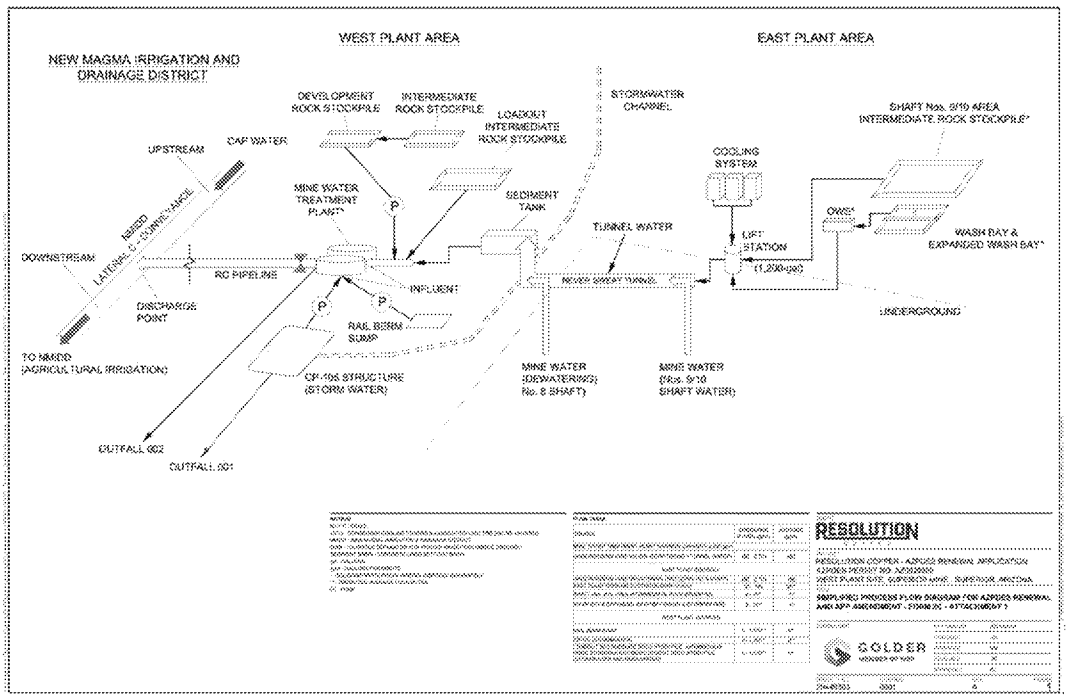
collected in Collection Pond No. 105 (CP-105, formerly "Indian Pond") where it can then be discharged through Outfall 001. The West Plant Site is located north of Highway 60 in Superior, just north of Queen Creek, and drains south towards Queen Creek.

The West Plant site contains a significant amount of toxic pollutants in the area produced by smelting activities, emissions, tailings ponds, and other mine waste from previous mining activities. There are multiple sites located across the West Plant site which have the potential to convey pollutants and other constituents of concern into Queen Creek via discharge of stormwater at Outfall 001.



Given the historic contamination from mining activities in the area, as well as ADEQ's duties under its administration of the AZPDES program, obtaining data on the quality of stormwater which <u>could be drained</u> into CP-105 and discharged through Outfall 001 is a key task.

Resolution, however, notes that data on the quality of the stormwater which could be discharged through Outfall 001 "has not been obtained."[9] It also does not appear to be in the process of being obtained. Form 2F (dated July 22, 2021 at p.3, attached to AZPDES Permit Renewal Application) at Section 5.2 states: "No discharge through Outfall 001 has occurred therefore, no discharge data is available. Certification based on absence of active operations, completion of extensive reclamation work, diversion and containment control measures, and ability to pump water to MWTP." ADEQ appears to see no issue with this problem, since they did not require any additional information from Resolution Copper on this matter and they apparently failed to obtain this data independently.

[9] *See* cover letter to AZPDES Renewal Application (obtained *via* Records Request).

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The Fact Sheet (p.4) notes that a total of just two water quality samples have been collected. "In 2021, two water samples were collected and tested from water impounded at CP-105 during precipitation events less than a 10-year 24-hour event." No additional samples or data gathering activities are noted, and thus, this appears to be the entirety of water quality data collected for potential discharge through Outfall 001.

Given that stormwater in CP-105 may be discharged to Queen Creek via Outfall 001 without treatment, ADEQ must obtain and fully review baseline water quality data for the potential discharge at Outfall 001 post-reclamation to ensure compliance with the discharge limits imposed by the AZPDES permit. This is fundamental, nothing less than this should be permitted. It is also critical that the water quality data be developed on the influent to assure the successful operation of the MWTP. This is also a critical task, since the failure to fully apprehend the nature of the influent can result in treatment plant failure and a noncompliant discharge.

For all of those reasons, the permit renewal application is administratively incomplete.

9. The Permit Renewal Application is Administratively Incomplete: Failure to Obtain Sufficient Water Quality Data on the Potential Discharge Through Outfall 002

The East Plant Site is east of the Town of Superior. The Process Flow Diagram (shown on the prior page) indicates that waters from various sources at the East Plant Site are collected and transported to the Water Treatment Plant at the West Plant Site through the Never Sweat Tunnel.

The Application at Form 2C(I) states that contributing flows to Outfall 002 come from "Various Combined Sources" such as "mine dewatering, stormwater, etc." and references an attachment. Yet, the attachments do not distinguish, or specifically list these various sources. Furthermore, there is no evidence from the materials we have reviewed that any sampling of the feed water from these various sources has occurred.

The Application further says that since no discharge from Outfall 002 to Queen Creek has occurred, "data in the tables is based on sampling of the treated water from the MWTP that is sent to NMIDD." This appears to consist of only 12 samples collected between 2018 and 2021 (Form 2C, Attachment 3 of the Application).

ADEQ should require that feed water quality data from these "various combined sources" at the East Plant Site be collected and analyzed for purposes of this permit. Data on the inflow into MWTP is essential to the ongoing functionality of the MWTP. ADEQ's failure to require this information is inconsistent with their mission and obligations in administering the Clean Water Act. For all of those reasons, the permit renewal application is administratively incomplete.

10. The Permit Renewal Application is Administratively Incomplete: In the Absence of Water Quality Data for Potential Outfall 001 Discharge, RCM's Request to Change Permitted Discharge at Outfall 001 from a 100-Year, 24-Hour Storm Event to a 10-Year, 24-Hour Storm Event is Unsupported and Contrary to Law

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In the cover letter to their AZPDES permit renewal application,[10] RCM states: "Currently the permit allows for discharge for flow in excess of a 100-year 24-hour storm event, RCM is requesting that be changed to a 10-year 24-hour storm event" (emphasis added). A 100-year storm event means a storm with a statistical probability of exceedance of 0.1% in any given year. A 10-year storm event means a storm with a statistical probability of exceedance of 10% in any given year.[11] This means that in any given year, there would be a 10% probability of RCM discharging untreated stormwater collected from the West Plant Site at CP-105 containing potential pollutants, into impaired Queen Creek.

The remainder of the application materials reviewed contain no justification or explanation in support of this request. In addition, and perhaps of greater concern, is that ADEQ makes no attempt in the permit materials we have reviewed to consider and review this requested change or to give any reason why it may or may not be warranted, or note whether the conditions and computations required by 40 C.F.R. § 440.131(b) have been met. This substantial and potentially dangerous change is not even listed in the Factsheet at Table VII (which supposedly lists all the major changes in the proposed permit).

40 C.F.R. § 440.131(b) states:

> **(b)** ***Storm exemption for facilities permitted to discharge.*** If, as a result of precipitation or snowmelt, a source with an allowable discharge under 40 CFR part 440 has an overflow or excess discharge of effluent which does not meet the limitations of 40 CFR part 440, the source may qualify for an exemption from such limitations with respect to such discharge if the following conditions are met:
>
> (1) The facility is designed, constructed and maintained to contain the maximum volume of wastewater which would be generated by the facility during a 24-hour period without an increase in volume from precipitation and the maximum volume of wastewater resulting from a 10-year, 24-hour precipitation event or treat the maximum flow associated with these volumes. In computing the maximum volume of wastewater which would result from a 10-year, 24-hour precipitation event, the facility must include the volume which would result from all areas contributing runoff to the individual treatment facility, *i.e.*, all runoff that is not diverted from the active mining area and runoff which is not diverted from the mill area.
>
> (2) The facility takes all reasonable steps to maintain treatment of the wastewater and minimize the amount of overflow.

[10] Dated July 23, 2021. Obtained *via* Public Records Request.

[11] https://www.usgs.gov/special-topics/water-science-school/science/100-year-flood

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(3) The facility complies with the notification requirements of § 122.60(g) and (h). The storm exemption is designed to provide an affirmative defense to an enforcement action. Therefore, the operator has the burden of demonstrating to the appropriate authority that the above conditions have been met.

CP-105 has a capacity of just 90 acre-feet (Fact Sheet, p.3). Nothing in ADEQ's materials analyzes how the 90 acre-feet in total volume has been allocated. There is no information or analysis, for example, on the total volume of water that would be generated by the permittee from all areas contributing runoff in a 24-hour period, in the absence of any additional increase in volume from precipitation, despite this being an express requirement of § 440.131(b)(1). In addition, ADEQ appears to have also failed to separately compute the maximum volume of any addition of flows to CP-105 stemming from a 10-year, 24-hour storm event, despite this also being an express requirement of § 440.131(b)(1). Absent these critical calculations, ADEQ has no way of knowing whether a storm exemption should be applied, and it has no way of knowing what the potential volume and frequency of an untreated discharge could be. This violates the applicable requirements of law noted above.

It cannot be overemphasized that if this permit change is granted by ADEQ, untreated discharges would be allowed from Outfall 001 during any rain event that exceeds a 10-year, 24-hour storm event (an occurrence which can happen with great frequency during Arizona's monsoon season) (Fact Sheet, p.3). This reasonably can be anticipated to occur during the life of this permit. And while RCM "has the option" of treating the water in CP-105 and discharging it through Outfall 002, there is nothing in the permit that requires this. This present an unnecessary risk to the public at large and the designated uses of Queen Creek and it is inconsistent with the requirements of the Clean Water Act.

For all of those reasons in this section and sections 8 and 9 above, and as additionally presented herein below in section 17, pursuant to Arizona Revised Statutes §§ 41-1072 through 41-1079, and Arizona Administrative Code R18-1-501 through R18-1-525, the RCM permit renewal application is administratively incomplete. So, therefore, ADEQ cannot renew that permit and RCM must apply for new permits for the discharges proposed for Outfall 001 and Outfall 002.

11. ADEQ Fails to Adequately Analyze the Potential Impacts to Queen Creek Resulting from a Simultaneous Discharge of Stormwater Through Outfall 001 and Mine Water Through Outfall 002

ADEQ has failed to analyze the potential impact to Queen Creek and the human environment from the simultaneous discharge of stormwater through Outfall 001 and mine water through Outfall 002. While Outfall 001 and Outfall 002 are technically separate points of discharge, they both discharge into Queen Creek at virtually the same place. Indeed, the AZPDES permit provides the same longitude and latitude for both Outfalls. Thus, rain events that could necessitate a stormwater discharge at Outfall 001 could easily correlate to discharges of mine water at Outfall 002, resulting in the co-mingling of these discharged waters almost immediately in Queen Creek.

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Given RCM's expressed desire to begin discharging through Outfall 002 (particularly when the water is not needed for irrigation by the New Magma Irrigation and Drainage District (NMDD)) it is very likely that there will be a number of significant and powerful rain events that could cause RCML to significantly exceed discharge limitations from Outfall 001. If this discharge is co-mingled with existing discharges mine water from Outfall 002, the adverse impacts to Queen Creek and the surrounding aquifers could be magnified substantially. Nevertheless, the possible collective impact and loading to Queen Creek from the co-mingling of these discharged waters and the possible impact to downstream aquifers and surface waters does not appear to have been analyzed by ADEQ. This concern is elevated in light of the potential TDS issues discussed above.

12. ADEQ improperly relies on "Virtual" site inspections

We are aware that ADEQ has been conducting site inspections virtually and would like to know if site inspections related to this permit will be virtual or in person. While we understand concerns due to the COVID-19 pandemic to limit human interaction, relying on the permittee alone to provide photos and other "evidence" that would be gleaned by an actual on-site visit, should not become ADEQ policy.

13. The Public Hearing Was Insufficient

ADEQ held a Public Hearing was held on April 11, 2022 at 6:00 p.m., in a purported attempt to comply with the AZPDES amendment permit category (Individual Permit, Major Industrial Facility, Public hearing).[12] Some of our Coalition members attended this hearing. This Public Hearing lasted just 30 minutes. It was stated by ADEQ during the Public Hearing that this was "not an opportunity" for the public to ask questions. Instead, ADEQ representatives provided only a brief description of the AZPDES Permit to the public. No specifics at all were provided on the amendments being requested. This directly violates the requirements of the Arizona Administrative Code (AAC) R18-1-402 (General Public Hearing Procedures), which specifically require more detail during Public Hearings. See at subsection D (emphasis added):

> "D. A general public hearing shall be conducted so as to do both of the following:
> 1. **Inform the public of the exact nature of the action or issue,** and
> 2. Allow time for persons to make statements and submit written comments."

The Merriam-Webster dictionary defines "exact" (in its adjectival usage, as used above) to mean: "1: exhibiting or marked by strict, particular, and complete accordance with fact or a standard and 2: **marked by thorough consideration or minute measurement of small factual details.**" (Emphasis added).

None of the requested amendments to this permit were discussed at the Public Hearing. Certainly, no interested member of the public who made the time to register for and attend this Public Hearing at the end of a long day would characterize ADEQ's presentation as having met

[12] *See* Billable Hours Report for LTF No. 90471; *see* 18 AAC Ch. 1, Art. 10, Table 10 (p.25).

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the first prong of this two-part requirement. This fails to adequately inform the public and comply with applicable law.

14. Resolution's Concurrent Application to Significantly Amend the Related Aquifer Protection Permit Has Not Been Disclosed

It is our understanding that Resolution recently also submitted an application to amend their Area-wide Aquifer Protection Permit (APP) No. P-101703 involving the West Plant Site, which is directly related to the current AZPDES Permit and which covers at least a substantial amount of the same area. We also understand the requested amendments have already been granted by ADEQ.[13] That is problematic for ADEQ.

15. Climate change

Even in the past six years, climate change has altered precipitation patterns. In the future there will be more frequent and more high-intensity storms. There will be velocity coming out of outfall 001, with significant volume and pollution load. The system does not appear designed for the kind of storm events we will see in the future. In addition to high intensity storms, climate change has also been felt through catastrophic fire. Because of loss of vegetation due to fire, absorption of pollutants is lost. Fire impacts the receiving stream's ability to assimilate the discharge to a catastrophically degree. The stream is already impaired, and will be worse after the fire. Queen Creek is no longer an appropriate receiving stream.

16. Environmental Justice – Public Responsiveness

As the town of Superior is an "environmental justice" effected community, ADEQ should have done more to both analyze how this permit could and will affect minority communities in Superior and downstream and also ADEQ should have been more accommodating to minority communities in explaining this permit and the effects on surrounding communities. In one example, we continue to have issues with the way ADEQ conducts its public meetings. Contrary to Arizona statutes, ADEQ does not allow the public an opportunity to ask any questions about the permit to ADEQ experts and staff who wrote the draft permit.

Not only does ADEQ forbid the public from asking questions during the public meetings, the person listed in the public notice as a contact for more information and questions has been out of the office and unavailable to the public for much of this comment period, with no temporary or permanent successor in place. What good is it to provide a contact to be reached for more information and then not have any contact person available?

ADEQ claims to be transparent, but by not allowing the public a chance to be better informed about the permit, it makes it almost impossible for the public to make informed comments. In addition, it should be noted that both the Fact Sheet and the Draft permit are so laden with jargon, incomprehensible acronyms and misspellings and typos that it is nearly impossible for the public to understand without assistance.

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[13] *See* Report for LTF No. 93849 (APP, Individual Permit, Other Amendment), now granted.

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17. A complete permit renewal application has not been received in a timely manner

ADEQ rules say that in order for a permit to be renewed, it must be submitted in a complete fashion at least 180 days before the existing permit is due to expire. In this case Resolution Copper submitted an application on July 23, 2021, just 3 days before the 180-day deadline required in A.A.C. R18-9-B904(B)(1). However, as noted in the Fact Sheet on page 21, Resolution Copper submitted "supplemental information to the application…" on November 12, 2021, November 29, 2021, and December 1, 2021. As presented herein in this section and sections 8 through 10 above, because the renewal application was not submitted completely by 180 days before expiration of the permit, this permit cannot be renewed and application for new permit(s) must be submitted by Resolution Copper.

18. Impacts to cattle grazing

Given the June 2021 fires that burned much of the headwaters of Queen Creek and the subsequent erosion from both rains and cattle grazing, it is probable that additional heavy metals including copper, selenium, and lead, have washed into Queen Creek increasing the burden of pollutants to an already impaired stream. Cattle grazed on land adjacent to Queen Creek below Outfalls 001 and 002, are in danger of accumulating higher than allowed heavy metals from Resolution Copper's discharges. This all must be properly analyzed before the any permit can be renewed or otherwise granted.

19. Comments Specific to the Draft Fact Sheet

Without explanation, the Draft Fact Sheet changes pollution limits for several contaminants from TBEL to WQBEL without explanation. Please provide the rational for making this change and explain why this cannot be considered backsliding.

Page 4, V., Description of Permitted Discharge: Specifically, where and when were the discharge samples listed in the table taken (both for Outfall 001 and 002)?

Please explain the scientific or regulatory rational for the statement: "Because of the increased flow during any discharge event, the data listed below likely overstate the solids that would be contained in any actual discharge."

Page 5, VI. Status of compliance with the existing AZPDES permit: Was the June 10, 2021 inspection in person, or was it a "virtual" inspection? If this was a virtual inspection, how was it conducted and what material was provided?

Why were there no lab reports reviewed from 2017?

Page 6, VII. Proposed permit changes: Please explain and justify the rational of switching from a TBEL standard to a WQBEL standard for Cadmium and Mercury.

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Page 6, VIII. Determination of effluent limitations and assessment levels: You state that the "Superior Mine" is an existing source? As we discuss elsewhere in these comments, the Resolution Copper mine is a new source. Why do you call this the Superior mine rather than the Resolution Copper mine like the US Forest Service and other agencies do?

Page 8, Whole effluent toxicity (WET): While we agree that it makes sense to not require WET tests when there is no discharge, specifically your statement that the discharge does not occur over seven consecutive calendar days, we disagree with your watering down testing requirement further by saying, …" and is not repeated more frequently than every thirty days." This seems to give another opportunity not doing WET testing. We cannot find anything in the draft permit or fact sheet on the frequency that WET testing is required, but the plain reading of this section leads one to believe that testing only need take place not less than once a month no matter how often it rains.

Page 11: Why is no monitoring required for TDS or TSS?

Page 13: Why is monitoring not required for antimony, arsenic, beryllium, boron, or barium?

Page 18, XI. Special Conditions: Has ADEQ confirmed or has any evidence to believe Resolution Copper's statement that the CP-105 Pond is designed and maintained to contain the volume associated with a 100-year, 24-hour storm event? In light of climate changes, we may expect that 100-year storm events could occur with much more frequency. Is CP-105 designed to withstand back-to-back 100-tear storm events?

20. Comments Specific to the Draft Permit

Ambient Monitoring: In describing ambient monitoring, the permit states that they will take samples "shortly after flow begins." This should be more specifically defined.

Page 1: Would this permit be signed in 2027, or is this a typo?

Page 3, Table 1.a: Is monitoring requested at the discharge point of Outfall 001 only when it is discharging, or is monitoring from the CP-105 Pond allowed during periods when discharge does not occur at Outfall 001? As we understand that discharge from CP-105 to Outfall 001 is an open unlined ditch, is ADEQ at all concerned about the impact of discharge water as it travels to Outfall 001 to the human and natural ecosystem?

Throughout the Draft Permit: There seems to be inconsistencies in the tables in the draft permit. For example, Page 6 contains Table 4.a and the next table on page 7 is Table 5.b. Is this a typo or is something missing from the Permit?

As we discuss elsewhere in our comments, it is very difficult to navigate the draft permit and fact sheet. ADEQ should make an effort to make documents easier for the public to understand, especially when it is so difficult to communicate with ADEQ staff for clarification.

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Page 11: Does ADEQ have any way to double check that the quality and accuracy of data submitted by Resolution Copper is truthful?

Especially as ADEQ relies more and more on the permittee to supply monitoring and other data, the opportunity for a permittee to "cheat" of the data and further degrade our communities and the environment.

21. ADEQ Should retain the Limit on Total Dissolved Solids of 1200mg/l Required by the 2010 AZPDES Permit

We strenuously objected to ADEQ removing the Total Dissolved Solids (TDS) limits in the 2016, which is still under appeal by the San Carlos Apache Tribe. The current draft permit still does not contain a limit for TDS from Outfall 002. The Coalition will not retype our objections to the removal of TDS limits from our 2016 comments and objections, but as we have already incorporated those comments reference as if stated in full in these comments, they still stand here.

The decision to remove the TDS limit is not permissible under the CWA, as it violates the strict anti-backsliding requirements found in existing law, including Section 402(o) of the CWA. Generally, the anti-backsliding requirements prohibit ADEQ from reissuing an AZPDES permit containing interim effluent limitations, standards or conditions less stringent than the final limits contained in the previous permit, with limited exceptions. To be clear, this requirement of the CWA <u>also prohibits</u>, with some exceptions, the reissuance of permits originally based on best professional judgment (BPJ) that incorporate limits less stringent than those in the previous BPJ-based permit. This is the rule.

The very real concerns about TDS possible impacts to Queen Creek, its habitat and vegetation and on downstream water users and important places like Boyce Thompson Arboretum, still remain. Indeed, even assuming that the TDS levels in the effluent have leveled off to a <u>yearly</u> average of 2000 mg/L (which masks the extreme spikes witnessed throughout sampling year), as discussed below, EPA recommends a TDS limit of 500 mg/L for public drinking water systems. ADEQ and RCM have failed to show that discharges to Queen Creek with a TDS of 2000 mg/L will not be harmful and that no limit is appropriate.

Under the proposed AZPDES Permit, RCM can elect whether to send the treated effluent to NMIDD or to discharge the mine effluent into Queen Creek, which could result in significant TDS loading to Queen Creek over the life of the Permit. This presents numerous concerns, some of which are briefly summarized below:

- It is not clear from the materials we have reviewed precisely what the elements of the Total Dissolved Solids are. TDS is a measure of all constituents, or elements, dissolved in water. This can include inorganic anions (negatively charged ions) like carbonates, chlorides, sulfates and nitrates. The inorganic cations (positively charged ions) include sodium, potassium, calcium and magnesium. Without knowing more about the composition of the TDS that will be discharged from the mine, it is difficult to analyze the potential impacts from the discharge of high levels of TDS to Queen Creek's

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receiving waters or to conclude that the discharge is "free from pollutants in amounts or combination" that might harm or inhibit aquatic life, cause an objectionable odor or off-flavor in aquatic organisms, become toxic to animals, livestock, plants or other organisms (particularly over time with limited dilution), impair recreational uses of Queen Creek, including at Boyce Thompson, or change the color of the surface water from natural background levels of color. *See, e.g.,* draft AZPDES Permit at Sec. D at 7. This must be analyzed and clarified.

- Sulfate is a constituent of TDS and may form salts with sodium, potassium, magnesium and other cations. Sulfates are a particular concern in this instance but this has not been discussed in the current permit documents or addressed in any way. Indeed, ADEQ has not even set alert levels for sulfates under the permit. This must be clarified and corrected.

- Under the Federal Safe Drinking Water Act, the EPA classifies TDS as a secondary maximum contaminant level (sMCL) with a recommended maximum level of 500 mg/L.[14] Even at 500 mg/L, these elevated levels of TDS can impact the taste of water and damage water treatment equipment. The minimum TDS levels we can expect from the RCM MWTP are 2000 mg/L. This is a significant difference. Many states have prohibited discharges of TDS beyond the sMCL of 500 mg/L due to the varying harms associated with the discharge of TDS. The downstream community of Queen Valley relies on shallow wells located in the alluvium along Queen Creek. We have seen no information showing that ADEQ has examined possible impacts of elevated levels of TDS on Queen Valley's water supply and water treatment equipment. Does that information exist, and if so what is it?

- Queen Creek is an intermittent stream at best with a limited capacity to assimilate (dilute) the TDS discharged from Outfall 002 to acceptable levels (less than 500 mg/L). There is no evidence in the materials we have reviewed that shows that ADEQ has considered this problem. In addition, because of Queen Creek's limited flows and the arid nature of the region, it is unclear whether there will be a sufficient amount of sudden freshets to flush the salt, sulfates and other TDS elements out of the riparian zone or whether these elements will collect in the root zones of the riparian plants and trees located along Queen Creek and eventually kill this vegetation, including potentially the special and unique vegetation at Boyce Thompson or at the golf course in Queen Valley.[15]

For all of the reasons discussed above, there can be no doubt that the removal of TDS limitations in the proposed Permit violates the CWA anti-backsliding requirements and it is simply a very bad idea. ADEQ should exercise its authority to protect water quality and downstream water

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[14] https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals

[15] The draft AZPDES Permit only contemplates "short-term" chronic toxicity tests which are insufficient to measure the chronic exposure likely resulting from the removal of TDS standards.

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supplies and not abdicate this obligation under the CWA and its agency mission for the convenience of RCM.

22. ADEQ must hold an anti-degradation hearing before this permit can be granted

ADEQ cannot issue the proposed AZPDES permit until a Total Maximum Daily Load (TMDL) for Queen Creek has been completed. The receiving stream for this permit, Queen Creek, has been listed on Arizona's 303(d) List of Impaired Waters due to exceedances in dissolved copper loading (since 2002), lead (total) (since 2010), and selenium (total) (since 2012). Other reaches of Queen Creek and its tributaries are also listed on the 303(d) List of Impaired Waters due to exceedances in dissolved copper loading. ADEQ has failed to prepare a TMDL report to bring Queen Creek back into compliance for more than 20 years. Yet, the renewed permit would allow Resolution Copper to add addition copper, lead, and selenium to an already impaired stream.

The headwaters of Queen Creek are in Pinal County Arizona and is part of the Middle Gila Watershed. Exceedances affect uses including livestock grazing, partial body contact (swimming), irrigation, and wildlife habitat.

In addition, since ADEQ has been so negligent in resolving the impaired nature of Queen Creek, on behalf of the thousands of members of our coalition member groups collective members in Arizona, we hereby request that the ADEQ hold a public anti-degradation hearing, with adequate notice and comment periods, regarding the impacts to Queen Creek in Arizona from the continued intentional delay in addressing the TMDL and that would result from the proposed AZPDES renewal permit.

23. ADEQ must analyze the functional capacity of Queen Creek before this permit can be granted

ADEQ has made no attempt to analyze the functional capacity of the receiving stream in a scenario where maximum discharges from Outfalls 1 and 2 occur coincide with a major flood event on the Queen Creek watershed. Unlike most discharges with relatively easy access to major streams, Queen Creek flows through a gauntlet of obstacles including Boyce Thompson Arboretum immediately below the outfall site, the community of Queen Valley, and the crossing of a major highway. In addition, the creek traverses so-called Superstition Vistas (future home of up to a million people as per development promoters), the Central Arizona Canal, and then joins with the Roosevelt Canal at about Chandler Heights Road and Higley in the southeast valley where it makes its final run to the Gila River.

A revised AZPDES permit should analyze the ability of Queen Creek to handle both Resolution Copper discharges and storm runoff in maximum flow scenarios.

Conclusion

In conclusion, the renewal application and draft AZPDES Permit are fatally flawed and issuance of the proposed permit renewal would violate the CWA, Arizona law, federal law, and other

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applicable authorities. Given that the permit renewal application is incomplete, the application should be denied. Furthermore, the need to complete a TMDL study for Queen Creek and the ongoing litigation and related stay, any such permit should not be granted but should instead be held in abeyance until both of those fundamental events have been completed. Only on final conclusion of those contingencies should ADEQ take a hard, close look at the permit(s) involved and undergo a complete and proper permitting process, ensuring adequate protections for the environment, the public health and the waters of Arizona.

And ADEQ must hold a public anti-degradation hearing as requested, with adequate notice and comment periods, regarding the impacts to Queen Creek in Arizona from the continued intentional delay in addressing the TMDL and that would result from the proposed AZPDES renewal permit.

Please include the Arizona Mining Reform Coalition, Concerned Citizens & Retired Miners Coalition, the Sierra Club, the Access Fund, and Earthworks as interested parties and direct all future public notices and documents to us at the address below.

Sincerely,

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Representative Raul Grivalva
Terry Rambler, Chairman, San Carlos Apache Tribe
Alexander B. Ritchie, Attorney General, San Carlos Apache Tribe
Maria Dadgar, MBA, Executive Director, Inter Tribal Association of Arizona, Inc.
Apache Stronghold

Attachments:

- Arizona Mining Reform Coalition comments on 2010 permit renewal
- Arizona Mining Reform Coalition et al. comments on 2016 permit renewal
- Arizona Mining Reform Coalition et al. comments on ADEQ draft TMDL for Queen Creek
- ADEQ's draft TMDL analysis for Queen Creek (9/18/2017)

ED_013248_00000094-00024

Attachment 01

July 30, 2010

Ms. Carrolette Winstead
Arizona Department of Environmental Quality
APP & Drywell Unit Manager, Groundwater Section
1110 West Washington Street
Phoenix, AZ 85007
Cw6@azdeq.gov

Re: **Comments on Notice of Intent to Issue AZPDES Permit (AZ0020389) to Resolution Copper Mining, LLC**

Dear Ms. Winstead:

Thank you for the opportunity to comment on the draft Arizona Pollutant Discharge Elimination System (AZPDES) Permit for the proposed Resolution Copper Mining-Superior Operations facility. On behalf of the Coalition itself and the members of the Arizona Mining Reform Coalition individually, we submit in a timely fashion the following comments and objections to these draft permits. These comments also incorporate the comments of the San Carlos Apache Tribe and the Inter Tribal Council of Arizona by reference as if fully set forth herein.

The **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. Members of the Coalition include: The Grand Canyon Chapter of the Sierra Club, Earthworks, Save the Scenic Santa Ritas, The Dragoon Conservation Alliance, the Groundwater Awareness League, Concerned Citizens and Retired Miners Association, the Center for Biological Diversity, and the Sky Island Alliance.

Background

The Arizona Department of Environmental Quality (ADEQ) proposes to issue AZPDES Permit (AZ0020389)) to Resolution Copper Resolution Mining, LLC (RCM), a wholly owned subsidiary of Rio Tinto and BHP, two giant multi-national mining companies. The permit would regulate the discharge of stormwater and polluted water from the Superior Operations mine site. Water would be discharged from two point sources. One point source, Outfall 001, would discharge storm water from the Superior Operation mine site. The second point source, Outfall 002, would discharge treated water from mine dewatering operations from Shaft No. 9 of the old Magma Copper Mine. The fact sheet states that discharges from both outfalls are to a tributary of Queen Creek, a water body on the §303(d) list of impaired waters due to copper contamination.

ADEQ administers a variety of programs to improve the health and welfare of our citizens and to ensure that the quality of Arizona's air, land and water resources meet health-based standards that also protect natural resources. ADEQ indicates that it is

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committed to leading Arizona and the nation in protecting the environment and improving the quality of life for the people of our state. It is clear that, as written, the draft NPDES permit is inconsistent with ADEQ's mission and contrary to the Clean Water Act, 33 U.S.C. §§ 1251 *et seq*. Therefore, we ask that ADEQ modify the draft permit and require the company to meet standards and include provisions in the permits that fully protect the environment and the health and welfare of our citizens, and that are consistent with the provisions of the Clean Water Act

The National Pollutant Discharge Elimination System permit program was established as part of the Clean Water Act and the provisions allow for delegation of the program to the states, which the Environmental Protection Agency has done with Arizona. Pursuant to that delegation, any AZPDES permit issued by Arizona must comply with the Clean Water Act and EPA regulations, in addition to all state requirements. 40 CFR § 123.25.

The discharge of additional copper into a stream already impaired for copper violates the CWA

ADEQ and RCM apparently are under the assumption that as long as a discharge complies with water quality standards, the discharge must be permitted. That is not the law. Even if the discharge itself will not violate water quality standards (which has not been shown to be the case here), the Clean Water Act prohibits discharges of a pollutant into an impaired water body if that pollutant is the reason for the impairment (i.e., the reason why the stream is on the 303(d) list), unless certain stringent planning and stream remediation efforts are in place – which has not been done in this case.

In this case, the receiving water is 303(d) listed for copper, and the discharge will contain copper (among other pollutants). Under the Clean Water Act, such a discharge will "cause or contribute" to water quality violations and cannot be permitted without a plan in place to ensure that the stream can and will achieve the standard. EPA's long-standing regulations prohibit the issuance of an NPDES permit for a new discharge where the discharge may "cause or contribute to" the violation of water quality standards:

> § 122.4 Prohibitions. No permit may be issued:
>
> (i) To a new source or a new discharger, if the discharge from its construction or operation will cause or contribute to the violation of water quality standards.

This is a flat-out prohibition against any new discharge that would cause or contribute to a violation of a water quality standard.

This EPA regulation allows for one limited exception – in 40 CFR § 122.4(i) – to this prohibition of discharges into impaired waters that already are violating the standard. In order for a discharge of the pollutant in question to be allowed, the EPA regulations require strict assurances that (1) the stream can handle the new discharge and still meet the standard and (2) that specific plans are in place to ensure that the stream will be brought back to health—i.e., achieve the applicable water quality standard for that waterbody. Specifically, the EPA regulations require that:

> The owner or operator of a new source or new discharger proposing to discharge into a water segment which does not meet applicable water quality standards or is not expected to meet those standards even after the application of the effluent limitations required by sections 301(b)(1)(A) and 301(b)(1)(B) of CWA and for which the State or interstate

> agency has performed a pollutants load allocation for the pollutant to be discharged, must demonstrate, before the close of the [NPDES permit] public comment period that:
>
> (1) There are sufficient remaining pollutant load allocations to allow for the discharge; and
>
> (2) The existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards.

40 C.F.R. § 122.4(i).

Thus, the permit applicant has the dual burden of demonstrating that "there are sufficient pollutant load allocations to allow for the discharge" and that "existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards." That has not occurred here.

The Ninth Circuit Court of Appeals has directly affirmed this reading of the CWA and its regulations. In *Friends of Pinto Creek v. United States E.P.A.*, the court overturned a water quality discharge permit issued by the federal EPA to a large copper mining project in Arizona. *Friends of Pinto Creek v. U.S. E.P.A.*, 504 F.3d 1007 (9th Cir. 2007), *cert. denied*, 129 S.Ct. 896 (2009). The critical issue in the case was whether a discharge permit could be issued that would add a pollutant to Pinto Creek, a water body that did not meet the applicable water quality standard for that pollutant—in that case, dissolved copper. The court vacated and remanded the EPA-issued permit on the ground that such a discharge violated the impaired waters provision of the CWA.

In *Pinto Creek*, the Ninth Circuit framed the fundamental issue in the case as: "Whether the issuance of the permit to discharge a pollutant, dissolved copper, into Pinto Creek, which already exceed the amount of dissolved copper allowed under the Section 303(d) Water Quality Standards, is in violation of the Clean Water Act and applicable regulations?" *Pinto Creek*, 504 F.3d at 1009. The court said that such a discharge would violate the CWA.

The Ninth Circuit's decision squarely rejected the "offset" defense raised by EPA, the discharger, and ADEQ (which had certified the discharge under CWA Section 401). *Id.* at 1012. Relying on the stated objective of the CWA "to restore and maintain the chemical, physical, and biological integrity of the nation's waters," the court held that "[t]he plain language of the first sentence of the regulation is very clear that no permit may be issued to a new discharger if the discharge will contribute to the violation of water quality standards." *Id.*

The court held that: "[T]here is nothing in the Clean Water Act or the regulation that provides an exception for an offset when the waters remain impaired and the new source is discharging pollution into that impaired water." *Id.* The court noted that 40 C.F.R. § 122.4(i) allows for exception to this strict rule "where a TMDL has been performed." *Id.* "[T]his exception to the prohibited discharge by a new source provides that the exception does not apply unless the new source can demonstrate that, under the TMDL, the plan is designed to bring the water into compliance with applicable water quality standards." *Id.*

The court noted that, in addition to the requirement that a TMDL be performed, the discharger must demonstrate that two conditions are met. These two conditions are contained in the two numbered clauses in 40 C.F.R. § 122.4(i): (1) There are sufficient remaining pollutant load allocations to allow for

the discharge; and (2) The existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards. 40 C.F.R. § 122.4(i). The Ninth Circuit specifically held that, in order for the "exception" to the prohibition of new discharges into impaired waters to apply, both clauses needed to be met by the permit applicant. 504 F.3d at 1013.

The Ninth Circuit required that these compliance plans must not only show *what* pollutant load reductions are needed to bring a water body back to health, but also actually *how* these reductions will be achieved.

> The error of both the EPA and Carlota is that the objective of . . . [40 C.F.R. § 122.4(i)(2)] is not simply to show a lessening of pollution, but to show how the water quality standards will be met if Carlota is allowed to discharge pollutants into the impaired waters.

Pinto Creek, 504 F.3d at 1014.

The *Pinto Creek* court further found that "compliance schedules" must be established for all "existing dischargers" into Pinto Creek, so that the stream could accommodate the new and increased copper discharges from the mine. *Id.* at 1012-13. The court held that all point sources must be subject to these compliances schedules (i.e., plans designed to reduce the pollutant loading from each source so the stream segment would be brought into compliance with water quality standards). *Id.* The court specifically rejected EPA's argument that only currently permitted point source discharges were subject to the "compliance schedule" requirement. *Id.* at 1013. The *Pinto Creek* court established the basic procedure that must be followed before a new NPDES permit is issued for a discharge into an impaired water:

> If point sources, other than the permitted point source, are necessary to be scheduled in order to achieve the water quality standard, then EPA must locate any such point sources and establish compliance schedules to meet the water quality standard before issuing a permit. If there are not adequate point sources to do so, then a permit cannot be issued unless the state or [the discharge permit applicant] agrees to establish a schedule to limit pollution from a nonpoint source or sources sufficient to achieve water quality standards.

Id. at 1014. On this point, EPA had correctly argued that nothing in the CWA compelled it to act against other dischargers. However, the *Pinto Creek* court noted that its ruling did not force EPA to take any action requiring existing discharges to reduce their pollutant loadings. Rather, "[t]he EPA remains free to establish its priorities; it just cannot issue a permit to a new discharger until it has complied with [40 C.F.R.] § 122.4(i)." *Id.* at 1015.

The fact that Arizona has not completed the required TMDL for the impaired water in this case does not mean that the discharger or the agency is free to bypass the strict requirements of the CWA as held by the court in *Pinto Creek*. Indeed, under the CWA, the discharge into an impaired water is prohibited, unless, pursuant to a valid TMDL for that stream, the compliance schedules are established for the various discharges as held by the *Pinto Creek* court. For example, in *Friends of the Wild Swan*, the Ninth Circuit upheld a Montana federal district court's stay of the issuance of NPDES permits for new sources or discharges to impaired waters pending completion of TMDLs. 74 Fed. Appx. 718, 723-24, 2003 WL 21751849 (9th Cir. 2003). The court prohibited EPA from issuing any new NPDES permits

"until all necessary TMDLs are established for a particular WQLS [water quality limited stream]"). *Friends of the Wild Swan, Inc. v. U.S. EPA*, 130 F. Supp.2d 1199, 1203 (D. Mont. 1999), *affirmed in relevant part*, 74 Fed. Appx. 718: 2003 WL 21751849 (9th Cir. 2003). The district court's action was taken pursuant to 40 C.F.R. § 122.4(i) and was set forth as a remedy to compel the state of Montana to complete TMDLs for a number of impaired waters. *See also Friends of the Wild Swan v. United States Environmental Protection Agency*, 130 F.Supp.2d 1207, 1209 (D.Mt. 2000).

There is insufficient characterization of the water coming into the water treatment plant.

The draft permit and fact sheet are unclear about the characterization of the water coming into the treatment plant. The fact sheet for the AZPDES permit talks about one sample of the mine water taken in July of 2008 and possibly another sample taken in December of 2008. It is not clear where the sample was taken nor is it clear whether the sample is actually representative of the more than two billion gallons of water that would be treated and released. How can the agency and the public make an informed decision about the effectiveness of the water treatment if we have no idea as to the actual composition of the polluted water coming from the mine? The agency must require additional and adequate characterization of these waters prior to proposing to approve the permit(s), subject to public notice and comment.

The permits are unclear about the amount of water released at Outfall 002 that would be fully or only partially treated.

RCM is currently discharging polluted mine water though a pipeline to the New Magma Irrigation and Drainage District that has been partially treated using High Density Sludge (HDS). The permit requires additional treatment of the polluted water by Reverse Osmosis (RO) before discharge at Outfall 002. However, the permit allows RCM to blend water treated only by HDS and water treated by both methods before release at Outfall 002. The permit does not specify the amount of the blend, or the actual final treatment requirements before release to Queen Creek. Since the permit only requires RCM to test once a month, there is no way to assure that there will not be permit violations without knowing the final composition of water before discharge into Queen Creek.

Exceedances above lowest standards are allowed for copper and other metals

Although the tables and data in the fact sheet and the AZPDES draft permit are confusing and use several different units of measure, it appears that RCM will be allowed to exceed the standards for several metals. The lowest standard for cadmium is 0.63 ug/L, but the limit at Outfall 002 for the monthly average is 50 ug/L. For mercury, the lowest standard is 0.01ug/L, but the limit at outfall 002 in the draft permit is 1 ug/L. (This would make the allowable amount of mercury released a hundred-fold more that the lowest standard. Mercury is a terribly toxic and hazardous substance once released into the ecosystem especially when it is allowed to change from elemental mercury to methlymercury.)

The permit only requires testing for metals once a month. It would be very easy for RCM to adjust the flow coming from Outfall 002 the day of the test to assure that the permit limits are met and then exceed those limits the rest of the month. In cases like that with copper, where the monthly average limit appears to be slightly under the lowest standards (8 ug/L in the draft permit as opposed to the lowest standard or 10.5 ug/L) it would be extremely easy to fudge the test period to meet the standard on that day only. Because Queen Creek is already impaired for copper, the allowable copper discharged should be zero.

It would also be helpful if ADEQ standardized units of measure to make it easier for the public to understand the draft permit and make appropriate comparisons.

Conclusion

Overall, the draft permit suffers from a number of factual and legal errors that must be rectified prior to the issuance of any of the proposed permits. Due to these errors, ADEQ must revise the draft permit and submit the revised draft permits for public comment. We welcome the opportunity to participate in that process.

Thank you.

Sincerely,

Roger Featherstone, Director
Arizona Mining Reform Coalition
PO Box 43565
Tucson, AZ 85733

CC: Benjamin H. Grumbles, Director, Arizona Department of Environmental Quality, bhg@azdeq.gov

Attachment 02

Arizona Mining Reform Coalition – Concerned Citizens & Retired Miners Coalition – Save Tonto National Forest – Sierra Club

And John Krieg

July 12, 2016

Via Email (resolutioncoppermine@azdeq.gov)
and U.S. Mail

Arizona Department of Environmental Quality
Water Quality Division
Attn: Swathi Kasanneni
1110 W. Washington St., 5415B-3
Phoenix, AZ 85007

Re: Comments and Objections to ADEQ's Renewal of the Resolution Copper Mining AZPDES Permit No. AZ0020389

Dear Ms. Kasanneni:

These comments are submitted on behalf of Arizona Mining Reform Coalition ("AMRC"), the Concerned Citizens & Retired Miners Coalition, Save Tonto National Forest, the Sierra Club, and John Krieg, to the Arizona Department of Environmental Quality (ADEQ) pertaining to ADEQ's proposal to renew the Arizona Pollutant Discharge Elimination System (AZPDES) Permit No. AZ0020389 for Resolution Copper Mining (RCM) in order to facilitate new mining facilities and activities and new sources of discharge associated with its mining project near Superior, Arizona.

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 **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.

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 35,000 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.

John Krieg owns a residence in Queen Valley and lives directly downstream from the area affected by these permits.

The Arizona Mining Reform Coalition previously provided written comments to ADEQ in 2010 in reference to the prior version of this AZPDES permit. Because many of our prior concerns remain relevant to ADEQ's current proposal to renew RCM's AZPDES permit, these comments are expressly incorporated here by reference.

Improper conduct of the one scheduled public comment meeting

Before getting into our comments, we have been notified by one of our members that the public meeting scheduled on July 12, 2016, in Superior, Arizona, was closed early without notification to the public and that he was not able to give oral comments.

This is troubling as the public notice for comments found on your website at: https://www.azdeq.gov/public-notice-call-comments-azpdes-az0020389 clearly states that a Public Hearing will be held at the Superior Junior/Senior High School, 100 W. Mary Drive, Superior, AZ 85173, on July 12, 2016, from 6:00pm to 9:00pm. The purpose of the public hearing is to allow the public to make comments for the record. Yet our Coalition member arrived at the Superior Junior/Senior High School, 100 W. Mary Drive, Superior, AZ 85173, on July 12, 2016, at 7:00 pm, well within the scheduled time of the meeting, and found no one at the High School from ADEQ and certainly no public meeting where he could give testimony. He states that there was no notice anywhere visible that the meeting had ended before the allotted time. There may have been other members of the public that tried to attend the meeting to give testimony, but were unable to do so since you had ended the meeting early.

We request that you convene another public comment meeting that is duly and properly scheduled and advertised and that remains in session for the entire scheduled time and that you reopen the comment period until the close of that meeting. We further request the right to supplement these comments until the end of this new comment deadline.

Comments

As discussed in greater detail below, the proposed AZPDES permit would allow discharges of mine site stormwater from existing Outfall 001 and discharge of treated mine project water from

existing Outfall 002 (as of 2010) to an unnamed wash, tributary to Queen Creek, located upstream of Boyce Thompson Arboretum and the local community of Queen Valley as well as other downstream communities. As written, the proposed AZPDES permit is contrary to the Clean Water Act, 33 U.S.C. §§ 1251 *et seq.* and applicable law, including the CWA's anti-backsliding requirements, 40 C.F.R. § 122.4(i) and standards that protect the receiving waters of Queen Creek, which is listed as impaired under Sec. 303(d), and other requirements. The permit renewal also proposes to remove important permit requirements, including specific limits on Total Dissolved Solids (TDS) and to retroactively approve RCM's failure to construct the mandatory Reverse Osmosis (RO) system required by RCM's current Aquifer Protection Permit (APP) No. P105823 (which is directly associated with this AZPDES permit),[1] among other failures.

ADEQ should revisit the draft AZPDES permit to institute robust standards, limitations and permit requirements in conformance with existing law that are truly protective of the environment, public health, and the receiving waters of Queen Creek. AMRC's specific comments and objections to the currently proposed AZPDES permit are set forth below.

1. The Discharge from Outfall 002 is a New Discharge from a New Source Which Requires RCM to Secure a Separate AZPDES Permit, Among other Requirements

Under the proposed AZPDES permit (as in the 2010 Permit), ADEQ once again treats RCM's discharge of mine water through Outfall 002 (which is a product of mine dewatering stemming from the installation of new mine shafts sunk to extraordinary depths (below 7,000 feet) and new tunnels, wells and related structures which have been recently built to facilitate development of totally new mine facility and project), as an "existing discharge," and not a "new discharge" as contemplated in the Clean Water Act and 40 C.F.R. §§ 122.2 and 122.29, presumably because (in its view) any discharges of pollutants from the site predate 1979.[2] For this same reason, ADEQ

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[1] The 2016 ADEQ Draft Fact Sheet fails to inform the public that RCM has, simultaneous to this application, requested a "significant amendment" to its APP which is directly related to this AZPDES Permit. The amendment would, among other things:

- Revise the design flow of the MWTP to 2.16 mgd (average flow rate)
- Include additional source water to be treated by the MWTP's HDS system
- Remove certain treatment standards
- Change the location of the proposed point of compliance
- Revise compliance schedules and monitoring tables

Given the material changes to the APP that are directly related to the current AZPDES Permit, ADEQ should stay the issuance of this Permit pending completion of the APP and provide full notice to the public on the connected nature of these two permits.

[2] The historic Magma Mine was operated at the West Plant Site by RCM's predecessor in interest, most recently BHP, from 1914 to 1996. These historic mine facilities, which have since been closed out or remediated, contained an old slag pile and smelter, concentrator, tailings ponds and waste rock. The mine expanded to the East plant site in 1970, and began construction of Shaft #9, which was later left dormant after the mine closed. *See Resolution Copper Company Site Introduction Presentation, dated February 2005, ADEQ File: Resolution Copper Mining, LLC Background Information, Inventory #101703* (obtained through written public record requests (2010)). Today Shaft #9 has been deepened substantially, Shaft #10 has been developed, and

also apparently concludes that RCM's new mine project (which is presently the subject of a recent Mining Plan of Operation filed with the Tonto National Forest Service) is an "existing facility" and not a "new source," under these same regulations.[3]

At this point, ADEQ's continued instance that the seepage pumping and mine dewatering effluent to be discharged from RCM's mine project through Outfall 002 is nothing more than an "existing discharge" from an "existing facility" is simply not credible and strains the imagine beyond what the law permits.[4] It is well documented that RCM is planning on developing a totally new mine project.[5] Indeed, RCM's Mining Plan of Operations is presently the subject of ongoing public scoping comments under the National Environmental Policy Act (NEPA),[6] – plans that include certain of the new activities, facilities and structures discussed in the instant Draft Permit, ADEQ Fact Sheet and Public Notice. ADEQ's continued conclusions to the contrary, despite the known facts about this project, violate the law. The RCM project should be acknowledged as a new source that presents a new discharge and it should be required to apply for and receive a new AZPDES permit for the discharges associated with Outfall 002. As discussed below, RCM should also be prohibited from discharging additional copper to Queen Creek since this receiving water is already impaired for copper.

2. The Discharge of Additional Copper to Queen Creek, which is Already Impaired for Copper, Violates the Clean Water Act

Several reaches of Queen Creek remain listed on Arizona's 303(d) List of Impaired Waters due to exceedances in dissolved copper, while other segments are impaired for lead (total) and selenium

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RCM has submitted plans for the development of a massive block cave mining operation at Oak Flat. *See* footnote 4, *infra*.

[3] *See* *http://www.resolutionmineeis.us/*

[4] Even in the Fact Sheet ADEQ admits that the Superior Mine, which operated as an "underground mine with an onsite smelter" has been shut down since 1998. Fact Sheet at 2. Interestingly, the Fact Sheet also states that "active mining is not occurring" at the site, but then in the next paragraph says that the "main source of water sent to the MWTP is from dewatering operations from the underground mine." What ADEQ ignores is that the "underground mine" that is currently being developed by RCM is a totally different mine, with different depths (among other things) than the BHP mine that was shut down long ago.

[5] The Resolution copper deposit is one of the largest undeveloped copper deposits in the world with an estimated copper resource of 1.7 billion metric tons at an average grade of 1.52 percent copper. *See* http://www.resolutionmineeis.us/about-project

[6] *See* footnote 3, *supra*.

(total).[7] Dissolved copper loading has been found to exceed ADEQ surface water quality standards at least since 2002 in Queen Creek. *See* Queen Creek (TMDL) Maximum Daily Load Fact Sheet.[8]

ADEQ disregards the fact that Queen Creek is impaired for copper (and also selenium and lead),[9] based on the apparent assumption that as long as RCM's discharge complies with water quality standards, the discharge must be permitted. That is not the law. The obvious objective of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of our Nation's waters. Even if the discharge itself will not violate water quality standards (which has not been shown to be the case here), the Clean Water Act prohibits discharges of a pollutant into an impaired water body if that pollutant is the reason for the impairment (*i.e.,* the reason why the stream is on the 303(d) list), unless certain stringent planning and stream remediation efforts have been finalized and are in place – which (as discussed below) has not been done in this case.

Here, Queen Creek is listed as impaired for copper and the discharge permitted under the renewed AZPDES permit, which is a "new discharge" from a "new source" under 40 C.F.R. §§ 122.2 and 122.29 (as discussed above), will contain copper (among other pollutants). Under the CWA, such a discharge will "cause or contribute" to water quality violations and cannot be permitted without a plan in place to ensure that the stream can and will achieve the standard. *See* 40 C.F.R. § 122.4(i) ("Prohibitions. No permit may be issued: (i) To a new source or a new discharger, if the discharge from its construction or operation will cause or contribute to the violation of water quality standards"). <u>This regulation is a flat-out prohibition against any new discharge that would cause or contribute to a violation of a water quality standard</u>.

Furthermore, this regulatory requirement of the CWA allows for only one limited exception – in 40 CFR § 122.4(i) – to the prohibition of discharges into impaired waters that already are violating the standard. In order for a discharge of the pollutant in question to be allowed, the EPA regulations require strict assurances that (1) the stream can handle the new discharge and still meet the standard and (2) that specific plans are in place to ensure that the stream will be brought back to health—*i.e.*, achieve the applicable water quality standard for that waterbody.[10] Thus, the permit

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[7] *See Arizona's 2012/2014 List of Impaired Water.*; *see also* http://legacy.azdeq.gov/environ/water//assessment/download/middle_gila_2016.pdf#page=44

[8] Available at http://www.azdeq.gov/sites/default/files/middlegila_qc_headwater_fs.pdf

[9] There is confusion in the Permit and Fact Sheet as to whether or not the locations of Outfall 001 and Outfall 002 are above or below the Superior WWTP (which serves to divide these two segments of Queen Creek) and therefore whether or not the receiving waters of Queen Creek for this permit are impaired for selenium and lead as well as copper. To the extent the receiving waters are, in fact, also impaired for selenium and lead, the proposed permit cannot allow for discharges of selenium or lead for the same reasons discussed here regarding copper.

[10] Specifically, 40 C.F.R. § 122.4(i) requires that:

> The owner or operator of a new source or new discharger proposing to discharge into a water segment which does not meet applicable water quality standards or is not expected to meet those standards even after the application of the effluent

applicant has the dual burden of demonstrating that "there are sufficient pollutant load allocations to allow for the discharge" and that "existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards." That has not occurred here.

As noted in prior comments on the 2010 AZPDES (which are still applicable today, if not more so given the new mine activities at issue), the Ninth Circuit Court of Appeals has directly affirmed this reading of the CWA and its regulations. In *Friends of Pinto Creek v. United States E.P.A.*, the court overturned a water quality discharge permit issued by the federal EPA to a large copper mining project in Arizona. *See Friends of Pinto Creek v. U.S. E.P.A.*, 504 F.3d 1007 (9th Cir. 2007), *cert. denied*, 129 S.Ct. 896 (2009). The critical issue in that case was whether a discharge permit could be issued that would add a pollutant to Pinto Creek, a water body that did not meet the applicable water quality standard for that pollutant—in that case, dissolved copper. The court vacated and remanded the EPA-issued permit on the ground that such a discharge violated the impaired waters provision of the CWA.

In *Pinto Creek*, the Ninth Circuit framed the fundamental issue as: "[w]hether the issuance of the permit to discharge a pollutant, dissolved copper, into Pinto Creek, which already exceed the amount of dissolved copper allowed under the Section 303(d) Water Quality Standards, is in violation of the Clean Water Act and applicable regulations?" *Pinto Creek*, 504 F.3d at 1009. The court said that such a discharge would violate the CWA. The Ninth Circuit's decision squarely rejected the "offset" defense raised by EPA, the discharger, and ADEQ (which had certified the discharge under CWA Section 401). *Id.* at 1012. Relying on the stated objective of the CWA "to restore and maintain the chemical, physical, and biological integrity of the nation's waters," the court held that "[t]he plain language of the first sentence of the regulation is very clear that no permit may be issued to a new discharger if the discharge will contribute to the violation of water quality standards." *Id.*

The court further held that: "[t]here is nothing in the Clean Water Act or the regulation that provides an exception for an offset when the waters remain impaired and the new source is discharging pollution into that impaired water." *Id.* The court noted that 40 C.F.R. § 122.4(i) allows for an exception to this strict rule only "where a TMDL has been performed." *Id.* "[T]his exception to the prohibited discharge by a new source provides that the exception does not apply unless the new source can demonstrate that, under the TMDL, the plan is designed to bring the water into compliance with applicable water quality standards." *Id.* The court also noted that, in addition to the requirement that a TMDL be performed, the discharger must demonstrate that two conditions discussed in 40 C.F.R. § 122.4(i) have also been met. That is, (1) there are sufficient remaining

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limitations required by sections 301(b)(1)(A) and 301(b)(1)(B) of CWA and for which the State or interstate agency has performed a pollutants load allocation for the pollutant to be discharged, must demonstrate, before the close of the [NPDES permit] public comment period that:

(1) There are sufficient remaining pollutant load allocations to allow for the discharge; and

(2) The existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards.

pollutant load allocations to allow for the discharge; and (2) the existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards. 40 C.F.R. § 122.4(i). *See Pinto Creek*, 504 F.3d at 1013. The Ninth Circuit required that these compliance plans must not only show what pollutant load reductions are needed to bring a water body back to health, but also actually how these reductions will be achieved. Specifically, the Court pointed out that the error of both the EPA and the mining company was that the objective of 40 C.F.R. §122.4(i)(2) is not simply to show a lessening of pollution, but to show how the water quality standards will be met if the mine was allowed to discharge pollutants into the impaired waters. *Pinto Creek*, 504 F.3d at 1014.

The *Pinto Creek* court further found that "compliance schedules" must be established for all "existing dischargers" into Pinto Creek, so that the stream could accommodate the new and increased copper discharges from the mine. *Id.* at 1012-13. In this regard, the Court noted that all point sources must be subject to these compliances schedules (*i.e.,* plans designed to reduce the pollutant loading from each source so the stream segment would be brought into compliance with water quality standards). *Id.* The court specifically rejected EPA's argument that only currently permitted point source discharges were subject to the "compliance schedule" requirement. *Id.* at 1013. The *Pinto Creek* court established the basic procedure that must be followed before a new NPDES permit is issued for a discharge to an impaired water:

> If point sources, other than the permitted point source, are necessary to be scheduled in order to achieve the water quality standard, then EPA must locate any such point sources and establish compliance schedules to meet the water quality standard before issuing a permit. If there are not adequate point sources to do so, then a permit cannot be issued unless the state or [the discharge permit applicant] agrees to establish a schedule to limit pollution from a nonpoint source or sources sufficient to achieve water quality standards.

Id. at 1014. On this point, EPA had correctly argued that nothing in the CWA compelled it to act against other dischargers. However, the *Pinto Creek* court noted that its ruling did not force EPA to take any action requiring existing discharges to reduce their pollutant loadings. Rather, "[t]he EPA remains free to establish its priorities; it just cannot issue a permit to a new discharger until it has complied with [40 C.F.R.] § 122.4(i)." *Id.* at 1015.

To be sure, the fact that ADEQ has not completed the required TMDL for the impaired water in this case does not mean that the discharger or ADEQ is free to bypass the strict requirements of the CWA as held by the court in *Pinto Creek*. Indeed, under the CWA, the discharge to an impaired water is prohibited still, unless, pursuant to a valid and completed TMDL for that stream, the compliance schedules are established for the various discharges as held by the Pinto Creek court.

Interestingly, ADEQ has been working on a TMDL Study for Queen Creek for a number of years – since well prior to ADEQ's issuance of the 2010 AZPDES permit to RCM. It is difficult to understand precisely why this study has not yet been completed. Certainly, ADEQ's failure to complete the study is an abdication of its responsibilities under the CWA.

Furthermore, the fact that the ADEQ Draft Fact Sheet acknowledges that the receiving waters of Queen Creek are listed as impaired under 303(d) for copper (2002), lead (2010) and selenium (2102) and then goes on to suggest (almost in passing) that "[t]he TMDL has not yet been completed **but the discharges from the facility have been included in the TMDL study**" cannot not obviate the violations of the CWA discussed above. Indeed, to the contrary. The fact that ADEQ may have completed or come close to completing a TMDL study for Queen Creek and may have even included RCM's anticipated discharges as part of this study (without any public review or disclosure as part of this permit process) calls for ADEQ to stay its consideration of RCM's AZPDES permit for Outfall 002, at least until the TMDL is fully completed and has been fully examined and reviewed by the public and EPA.

Interestingly, this reference to a completed (but not disclosed) TMDL study, inserted by ADEQ in the Fact Sheet, indicates that ADEQ plainly understands that its failure to finalize the long anticipated TMDL for Queen Creek is a problem under the CWA. ADEQ's understanding is also acknowledged in the permit reopener provision of the prior AZPDES permit issued in 2010, which provides that "[t]his permit shall be reopened when the Total Maximum Daily Load (TMDL) for this water segment…is completed." *Final Authorization to Discharge Under the Arizona Pollutant Discharge Elimination System* at 22, dated December 6, 2010. In sum, ADEQ's flagrant disregard for the fact that Queen Creek is impaired for copper violates the CWA.

3. ADEQ Should Not Remove the Existing Limit on Total Dissolved Solids of 1200mg/l Required by the 2010 AZPDES Permit; This Violates the CWA

In 2009 RCM began operating the mine water treatment plant (MWTP) utilizing ADEQ lime and soda ash in a high density sludge (HDS) process to remove metals in the mine water from Shaft #9. *See* Memo to Casey McKeon, RCM from Patty McGrath, SRK Consulting, dated June 26, 2015, Subject: AZPDES Permit No. A0020389; Revision of TDS Limit (SRK Memo) (obtained via ADEQ public records request (2015)). However, as the result of previously submitted public comments regarding the potential discharge of high levels of TDS received by ADEQ in 2006 in reference to a draft AZPDES permit for the MWTP, ADEQ began to engage RCM about the potential to limit the discharge of TDS to Queen Creek. Specifically, concerns about the potential discharge of high levels of TDS to Queen Creek were raised by the Director of the Boyce Thompson Arboretum (located downstream on Queen Creek) and University of Arizona Soil Scientist, Dr. James Walworth, who warned that the discharge of water containing high TDS levels "is a major concern" as it "will likely cause serious long-term ecological damage."[11] Dr. Walworth also suggested that the water "should receive additional treatment, or be used for another purpose."

After discussions with RCM, both in reference to the 2010 AZPDES Permit for Outfall 002 and in reference to the related APP (APP #P-105823), ADEQ included a daily maximum TDS limit in the 2010 AZPDES Permit of 1200 mg/L for Outfall 002. Because the HDS treatment process does

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[11] *See Email communication from Mark Beirner, Ph. D., Director of Boyce Thompson Arboreteum to Joan Card, ADEQ Director, Water Quality Division, dated September 13, 2006 re: Permit No. AZ002038*; *Email communication from Dr. James Walworth, Department of Soil, Water and Environmental Science, U of A, to Joan Card, ADEQ Director, Water Quality Division, dated September 3, 2006, re: Resolution Copper Mining Company Discharge Permit* (obtained via ADEQ public records request (2008)).

not remove TDS, RCM committed to treat a portion of the HDS treated water to remove TDS through the construction of a reverse osmosis (RO) plant as a component of the MWTP. *See* ADEQ 2010 AZPDES Permit Fact Sheet at 2; SRK Memo at 2. The ADEQ 2010 Fact Sheet explains that "during wet months when the NMIDD [New Magma Irrigation and Drainage District] has a lower demand for the mine water, it will be treated with HDS and RO before being discharged through Outfall 002…." Fact Sheet at 2. The Fact Sheet went on to note that RCM "has the ability to adjust the ratio of HDS raw effluent to RO effluent for the final blended effluent at the outfall in order to met permit requirements." *Id.*

However, despite RCM's commitment to construct the RO treatment plant in both the 2010 AZPDES and the 2010 APP (#P-105823) (a factor that was considered by ADEQ in issuing both permits and reflected the understanding of the protective measures reviewed by the public as part of the public review process for the permits), the RO treatment plant was never constructed by RCM. For this reason, (or perhaps due to other benefits to RCM of sending the mine water to NMIDD), RCM purportedly has not discharged to Queen Creek through Outfall 002 under the 2010 AZPDES Permit. In the SRK Memo (which was provided to ADEQ as part of the current permit application packet) SRK Consultant, Patty McGrath, suggests that ADEQ should remove the TDS limit found in the current AZPDES permit, despite acknowledging that without the RO process, TDS levels in the MWTP effluent are still greater than the 1200 mg/L limit set in the 2010 AZPDES Permit. *See* SRK Memo at 4.

ADEQ has apparently adopted the rationale of the SRK Memo and now proposes to provide no limit whatsoever for TDS in the proposed AZPDES Permit. For the reasons set forth below, ADEQ should revisit this issue and, at the minimum, maintain the existing permit limit of 1200 mg/L in the new AZPDES Permit for Outfall 002.

The decision to remove the TDS limit is not permissible under the CWA, as it violates the strict anti-backsliding requirements found in existing law, including Section 402(o) of the CWA. Generally, the anti-backsliding requirements prohibit ADEQ from reissuing an AZPDES permit containing interim effluent limitations, standards or conditions less stringent than the final limits contained in the previous permit, with limited exceptions. To be clear, this requirement of the CWA also prohibits, with some exceptions, the reissuance of permits originally based on best professional judgment (BPJ) that incorporate limits less stringent than those in the previous BPJ-based permit. This is the rule.

In an effort to get around the anti-backsliding requirements of the CWA, ADEQ suggests that backsliding is permitted with regard to the TDS limit pursuant to 40 C.F.R. § 122.44(l)(2)(i)(B)(1), which provides that a less stringent limit can be applied if information is available which (1) was not available at the time of permit issuance; and (2) which would have justified the application of a less stringent effluent limit at the time of the permit's issuance. *See* ADEQ 2016 AZPDES Permit Fact Sheet at 6; *see also* SRK Memo at 4. ADEQ rationalizes its position by suggesting that because the prior TDS limit was purportedly based on failures of whole effluent toxicity (WET) tests from a bench-scale study performed with simulated effluent and we now have WET sample results from actual MWTP effluent which show that all three surrogate WET species passed acute and chronic toxicity testing criteria with samples ranging from 1900 to

2140 mg/L, the justification for a TDS limit of 1200 mg/L no longer exists and no TDS limit need be set in the proposed permit. 2016 AZPDES Permit Fact Sheet at 6.

While it is true that ADEQ now has the benefit of 10 WET testing sample results submitted by RCM with sample dates ranging from 2013-2105, *see id.*, this handful of results cannot be accurately characterized as available new information under the first prong of 40 C.F.R. § 122.44(l)(2)(i)(B)(1). This is particularly so when it appears that the above described WET testing was based on very limited sampling of the MWTP effluent by RCM over a 3 year period – only 10 WET sample results were submitted by RCM – with the date and timing of these samples unknown. *Id.*

Indeed, a review of the SRK Memo shows that while average yearly TDS levels have declined over time at the MWTP (both effluent samples and influent samples), these samples are marked by significant spikes in TDS levels both in the effluent from the MWTP and in the influent to the MWTP. SRK Memo at 3. For example, the effluent shows significant TDS spikes as recently as 2014-2015 well above 3000 mg/L, while the influent entering the MWTP shows spikes above 6000 mg/L in 2012-2013 and spikes above 3000 mg/L in 2014-2015. Yet, the samples used for the WET testing appear to have never exceeded 2140 mg/L. *See* Fact Sheet at 6. This convenient result and the limited nature of testing undermines ADEQ's conclusion that TDS in the effluent will not causing toxicity. Accordingly, this does not constitute sufficient new information within the meaning of the first prong of 40 C.F.R. § 122.44(l)(2)(i)(B)(1).

Under the second prong of 40 C.F.R. § 122.44(l)(2)(i)(B)(1), the new information (had it been available at the time of the prior AZPDES permit) must support the application of a less stringent effluent limit (or in this case, no limit whatsoever) to fit within the enumerated exception to the CWA's strong anti-backsliding requirements. This is not the case here, since the very real concerns about TDS possible impacts to Queen Creek, its habitat and vegetation and on downstream water users and important places like Boyce Thompson Arboretum, still remain. Indeed, even assuming that the TDS levels in the effluent have leveled off to a yearly average of 2000 mg/L (which masks the extreme spikes witnessed throughout sampling year), as discussed below, EPA recommends a TDS limit of 500 mg/L for public drinking water systems. ADEQ and RCM have failed to show that discharges to Queen Creek with a TDS of 2000 mg/L will not be harmful and that a less stringent limit (meaning no limit) would have been appropriate.

RCM has noted that the estimated maximum discharge capacity of Outfall 002 is 3.6 MGD. 2016 AZPDES Permit Fact Sheet at 3. Under the proposed AZPDES Permit, RCM can elect whether to send the treated effluent to NMIDD or to discharge the mine effluent into Queen Creek, which could result in significant TDS loading to Queen Creek over the life of the Permit. This presents numerous concerns, some of which are briefly summarized below:

- It is not clear from the materials we have reviewed precisely what the elements of the Total Dissolved Solids are. TDS is a measure of all constituents, or elements, dissolved in water. This can include inorganic anions (negatively charged ions) like carbonates, chlorides, sulfates and nitrates. The inorganic cations (positively charged ions) include sodium, potassium, calcium and magnesium. Without knowing more about the composition of the TDS that will be discharged from the mine, it is difficult to analyze

the potential impacts from the discharge of high levels of TDS to Queen Creek's receiving waters or to conclude that the discharge is "free from pollutants in amounts or combination" that might harm or inhibit aquatic life, cause an objectionable odor or off-flavor in aquatic organisms, become toxic to animals, livestock, plants or other organisms (particularly over time with limited dilution), impair recreational uses of Queen Creek, including at Boyce Thompson, or change the color of the surface water from natural background levels of color. *See, e.g.,* draft AZPDES Permit at Sec. D at 7. This should be analyzed and clarified.

- Sulfate is a constituent of TDS and may form salts with sodium, potassium, magnesium and other cations. Sulfates are a particular concern in this instance (the RO plant was originally intended to address sulfates) but this has not been discussed in the current permit documents or addressed in any way. Indeed, ADEQ has not even set alert levels for sulfates under the permit. This should be clarified and corrected.

- Under the Federal Safe Drinking Water Act, the EPA classifies TDS as a secondary maximum contaminant level (sMCL) with a recommended maximum level of 500 mg/L.[12] Even at 500 mg/L, these elevated levels of TDS can impact the taste of water and damage water treatment equipment. The minimum TDS levels we can expect from the RCM MWTP are 2000 mg/L. This is a significant difference. Many states have prohibited discharges of TDS beyond the sMCL of 500 mg/L due to the varying harms associated with the discharge of TDS. The downstream community of Queen Valley relies on shallow wells located in the alluvium along Queen Creek. We have seen no information showing that ADEQ has examined possible impacts of elevated levels of TDS on Queen Valley's water supply and water treatment equipment.

- Queen Creek is an intermittent stream at best with a limited capacity to assimilate (dilute) the TDS discharged from Outfall 002 to acceptable levels (less than 500 mg/L). There is no evidence in the materials we have reviewed that shows that ADEQ has considered this problem. In addition, because of Queen Creek's limited flows and the arid nature of the region, it is unclear whether there will be a sufficient amount of sudden freshets to flush the salt, sulfates and other TDS elements out of the riparian zone or whether these elements will collect in the root zones of the riparian plants and trees located along Queen Creek and eventually kill this vegetation, including potentially the special and unique vegetation at Boyce Thompson or at the golf course in Queen Valley.[13]

- RCM is presently planning to locate the mine tailings from the RCM mine just outside Superior, Arizona, at an unlined site up gradient of Queen Creek. This could result is significant acidic drainage entering Queen Creek. This could adversely impact the capacity of Queen Creek to assimilate the high levels of TDS contemplated under the permit.

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[12] https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals

[13] The draft AZPDES Permit only contemplates "short-term" chronic toxicity tests which are insufficient to measure the chronic exposure likely resulting from the removal of TDS standards.

- Under the 2010 AZPDES Permit that limited TDS to 1200 mg/L, RCM was required to monitor for TDS once a month (1x/month). Under the current proposal, which does not have any TDS limit, RCM is merely required to take a sample one time every six months (1x/6 months). This monitoring requirement is grossly insufficient to protect the human health and environment of Queen Creek. With no TDS limit in the permit, monitoring should be much more vigorous.

For all of the reasons discussed above, there can be no doubt that the removal of TDS limitations in the proposed Permit violates the CWA anti-backsliding requirements and it is simply a very bad idea. ADEQ should exercise its authority to protect water quality and downstream water supplies and not abdicate this obligation under the CWA and its agency mission for the benefit of RCM.

4. ADEQ Fails to Adequately Analyze the Potential Impacts to Queen Creek Resulting from a Simultaneous Discharge of Stormwater Through Outfall 001 and Mine Water Through Outfall 002

ADEQ has failed to analyze the potential impact to Queen Creek and the human environment from the simultaneous discharge of stormwater through Outfall 001 and mine water through Outfall 002. While it is true that Outfall 001 and Outfall 002 are separate points of discharge, they both discharge into Queen Creek at virtually the same place. Indeed, the AZPDES permit provides the same longitude and latitude for both Outfalls. Thus, wintertime rain events that could necessitate a stormwater discharge at Outfall 001 could easily correlate to discharges of mine water at Outfall 002, resulting in the co-mingling of these discharged waters almost immediately in Queen Creek.

Given RCM's expressed desire to begin discharging through Outfall 002 (particularly when the water is not needed for irrigation by NMDD) it is very likely that there will be a number of significant and powerful rain events that could cause RCML to significantly exceed discharge limitations from Outfall 001. If this discharge is commingled with existing discharges mine water from Outfall 002, the adverse impacts to Queen Creek and the surrounding aquifers could be magnified substantially. Nevertheless, the possible collective impact and loading to Queen Creek from the co-mingling of these discharged waters and the possible impact to downstream aquifers and surface waters does not appear to have been analyzed by ADEQ. This concern is elevated in light of the potential TDS issues discussed above.

In conclusion, the draft AZPDES Permit is fatally flawed and its issuance would violate the CWA, Arizona law and other applicable authorities. ADEQ should refrain from issuing this Permit until a complete and proper permitting process can be undertaken and adequate protections for the environment, the public health and the waters of Arizona can be developed.

Please include the Arizona Mining Reform Coalition, Concerned Citizens & Retired Miners Coalition, Save Tonto National Forest, the Sierra Club, and John Krieg as interested parties and direct all future public notices and documents to us at the address below.

Sincerely,

Roger Featherstone

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Attachment 03

Arizona Mining Reform Coalition – Center for Biological Diversity – Concerned Citizens & Retired Miners Coalition – Concerned Climbers of Arizona – Dragoon Conservation Alliance – Patagonia Area Resource Alliance – Save the Scenic Santa Ritas – Save Tonto National Forest – Sierra Club

December 5, 2017

Via Email: (palmer.kyle@azdeq.gov)

Arizona Department of Environmental Quality
Water Quality Division
Attn: Kyle Palmer
1110 W. Washington St.
Phoenix, AZ 85007

Re: Comments on Draft Total Maximum Daily Load (TMDL) analysis for three reaches of Queen Creek located near Superior, AZ

Dear Mr. Palmer:

These comments are submitted on behalf of the Arizona Mining Reform Coalition, Center for Biological Diversity, Concerned Citizens & Retired Miners Coalition, Concerned Climbers of Arizona, Dragoon Conservation Alliance, Patagonia Area Resource Alliance, Save the Scenic Santa Ritas, Save Tonto National Forest, and the Sierra Club, to the Arizona Department of Environmental Quality (ADEQ) regarding the draft Total Maximum Daily Load (TMDL) analysis for copper developed by the Arizona Department of Environmental Quality (ADEQ) for three reaches of Queen Creek, Arnett Creek, and two unnamed drainages located near Superior, Arizona.

1. COMMENTING 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 **Center for Biological Diversity** is a non-profit public interest organization with headquarters located in Tucson, Arizona, representing more than 1.5 million members and supporters nationwide dedicated to the conservation and recovery of threatened and endangered

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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.

Concerned Climbers of Arizona is an Arizona group that advocates for continued recreational access to climbing areas that are threatened by development or other forms of encroachment.

Dragoon Conservation Alliance is a grassroots coalition of southern Arizona landowners and decades-long activists working to protect their community and the Sonoran and Chihuahuan bioregions.

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. The current focus is on preventing the proposed open-pit copper mine in the Santa Ritas.

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 60,000 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 Queen Creek and other waters of the Tonto.

2. INTRODUCTION

Under section 303(d) of the Clean Water Act, states are required to identify their polluted waters and to establish a total maximum daily load for each pollutant in the water body. A TMDL analysis is then completed to establish baseline measurements of pollutant materials in those water bodies, and to identify potential reductions needed to attain standards.

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Queen Creek Reach No. 15050100-014A, (headwaters to the Superior Wastewater Treatment Plant discharge), has been listed on Arizona's 303(d) list as impaired for dissolved copper since 2002. Reach No. 15050100-014B, (Superior Wastewater Treatment Plant discharge to Potts Canyon) has been listed as impaired for dissolved copper since 2004. Reach No. 15050100-014C (Potts Canyon confluence to the Whitlow Dam) has been listed as impaired for dissolved copper since 2010.[1] As a condition of these listings, ADEQ is required to prepare a TMDL analysis for Queen Creek to identify the amount of pollutants the water body can receive and still meet water quality standards. On October 4, 2017, a draft TMDL analysis was released for public comment.

The draft report raises more questions than it answers. In reading the report and the underlying record, we have serious concerns about the methodology used (including the computer models outlined), the report's conclusions, and the correctness of ADEQ's analysis.

For the reasons explained below, the TMDL prepared by ADEQ fails to comply with the Clean Water Act and applicable laws. ADEQ should not finalize the TMDL as presented, but rather, must pull the TMDL draft and reconsider what the appropriate limits are for loading in the impaired reaches of these water bodies, particularly in light of the pending Arizona Pollution Discharge Elimination Permit (AZPDES) proposed for issuance by ADEQ for the proposed Resolution Copper mine.

One of the biggest flaws in the analysis is ADEQ's decision to use only concentration based discharge limits on point sources that do not discharge to the creek continuously. The reliance on concentration based limits alone, with no mass limit, would allow a future discharger, for example Resolution Copper (should they move forward with plans to mine Oak Flat) to impair Queen Creek for copper by itself, without exceeding their permitted concentration limit.

3. GENERAL COMMENTS

The draft TMDL report recommendations would not lower TMDL levels to safe limits
From the draft Queen Creek TMDL, it is evident that ADEQ has struggled for many years to find a way to reconcile the differences between the naturally occurring background sources of copper with the anthropogenic sources found in the system stemming from the hundreds of old mining operations in the area, ultimately concluding that most of the copper loading originates in the upper reaches of Queen Creek and particularly from the Oak Flat basin. The draft TMDL report also states that current mining activities are not a major contributor to the impairment of Queen Creek for dissolved copper (Table 8, pages 28-29) and that "their complete removal will not impact the impairments predicted under the existing conditions scenario." In other words, if copper contributions from current mining activities are all set to zero, Queen Creek remains highly impaired for copper from the background sources theorized above. As discussed below, this same approach to modeling used by ADEQ can be used to demonstrate why the TMDL analysis prepared by ADEQ violates the requirements of the Clean Water Act, since it fails to

[1] This first reach is also impaired for lead (2010) and selenium (2012). Based on information available to us, the TMDL also does not appear to adequately address the loading factors for these impairments. *See* Arizona's 303(d) List of Impaired Waters.

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include a mass based waste load allocation for dissolved copper stemming from discharges to Queen Creek approved by ADEQ in AZPDES Permit No. AZ0020389. [2]

Waste Load Allocation (WLA) for Resolution Copper

Under the Clean Water Act, ADEQ is required in the Queen Creek TMDL to list those permitted facilities found in the region that may contribute to loading in Queen Creek and to describe the type of waste-load allocations the facilities are permitted to meet. ADEQ takes the position that these facilities are required to meet either concentration-based limits (WQBELs) or mass-based limits. Under this analysis, ADEQ considers the Superior Wastewater Treatment Plant to be the only continuously discharging facility and, therefore, the only facility subject to a mass-based discharge limit.

The Resolution Copper mine received an AZPDES permit from ADEQ to discharge treated mine water to Queen Creek Outfall 002 and associated water on December 6, 2010. This permit was recently renewed with some modifications. Perhaps due to historical voluntary arrangements between Resolution Copper and New Magma Irrigation and Drainage District (NMIDD) that provided a means for Resolution to historically avoid discharges to Queen Creek by piping treated mine discharge water to agricultural fields located within the New Magma Irrigation & Drainage District (NMIDD), ADEQ has now misclassified Resolution Copper as a "non-continuous discharger" in the TMDL. This misclassification serves to conveniently justify (in ADEQ's view) ADEQ's decision to omit in its TMDL analysis the impacts that Resolution Copper's mass-based waste load allocation (WLA) will have on the receiving waters of Queen Creek, particularly vis-à-vis dissolved copper, despite the fact that Resolution Copper will be discharging five times as much water at Outfall 002 under its AZPDES permit as the Superior Wastewater Treatment Plant is capable of discharging. Indeed, Resolution Copper estimates a discharge volume of 3.6 MGD,[3] while the Superior Wastewater Treatment Plant's maximum discharge design capacity is 0.75 MGD.[4]

For reasons that are unsupported by the AZPDES permit, ADEQ concludes in the TMDL that Outfall 002 is not designed to discharge on a continuous basis (TMDL, p. 37). However, nowhere in the AZPDES permit materials does it specify that Resolution Copper has received a classification as a non-continuous discharger or that discharges from Outfall 002 are only allowed by ADEQ under the AZPDES permit on a non-continuous basis. In fact, the AZPDES permit itself makes clear that ADEQ has not imposed any discharge limit (by volume or by seasonality) for Outfall 002,[5] and it is completely silent about any maximum discharge design capacity.

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[2] ADEQ has notified the public of its intent to renew (as modified) Resolution Copper's AZPDES Permit No. AZ0020389. The permit, however, has not yet been issued in final form due to pending litigation by interested parties. Nevertheless, for purposes of these comments, we reference the most recent AZPDES permit, unless otherwise noted herein.

[3] *See* Response to Comments on AZPDES Permit No. AZ0020389, p. 18. ADEQ writes: "RCML noted the estimated maximum daily discharge from Outfall 002 is 3.6 MGD." http://static.azdeq.gov/pn/responses_resolution_cu.pdf

[4] *See* Draft Queen Creek TMDL, p. 36.

[5] *See* Draft AZPDES Permit for Resolution Copper, p. 5 (2016).

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ADEQ appears to be using the discharge design capacity of Outfall 002 as a basis to conclude in the TMDL that Resolution will not be able to continuously discharge under their AZPDES permit; however, the basis for this conclusion (which is fundamental to its TMDL analysis) remains unclear. This should be clarified.

Also, while the 2010 AZPDES permit issued to Resolution Copper allowed for discharges to Queen Creek through Outfall 002, the permit required that all discharges be treated to reduce Total Dissolved Solid (TDS) using a Reverse Osmosis (RO) system to be constructed at the Mine Wastewater Treatment Plant. However, Resolution Copper never constructed the RO system. Accordingly, to the extent ADEQ's analysis is based upon a discharge design capacity that was reduced by an RO system as originally contemplated in the 2010 AZPDES permit, this would be factually incorrect, since that RO system was never built, and the RO requirement has been removed from the AZPDES permit. In fact, a letter from Resolution Copper to Mr. David Haag at ADEQ states regarding the discharge design of Outfall 002 "…the maximum flow rate for the discharge was based on the treatment design of the RO system." See Letter dated August 7, 2015 regarding an amendment to APP No. P-105823. In short, since there is no RO requirement in Resolution Copper's current AZPDES permit, ADEQ erred if it considered this standard in discussing the design of Outfall 002 in the TMDL.

Furthermore, in a memo to Resolution Copper prepared by SRK Consulting, Inc. regarding their AZPDES permit to discharge into Outfall 002, it states at page 2: "RCML would like the alternative to discharge through Outfall 002 during the winter months and potentially at all other times but has not discharged due to the inability to meet the 1200 mg/l TDS limit."[6] The SRK Consulting memo is silent about any inability to continually discharge based on design capacity. Further, the TDS limit in the AZPDES permit has since been raised, potentially removing any apparent obstacle to continuous discharge, assuming there ever was one.

It should also be noted, as discussed above, that Resolution Copper's arrangement to discharge water at NMIDD is a separate and independent relationship outside of ADEQ's control. That is, NMIDD may or may not agree at any given time, to accept Resolution Copper water for irrigation purposes. By the same token, Resolution Copper may choose solely of its own accord to discharge continuously to Queen Creek under its AZPDES permit or it may choose to instead pipe this water to NMIDD. None of these choices are under ADEQ control, since the permit itself allows for nothing short of continuous discharge. Thus, it would also be inappropriate and legally inaccurate for ADEQ to rely on this arrangement as the hinging point for classification of Resolution Copper Outfall 002 as a "non-continuous discharger" for the purposes of TMDL.

By relying on its conclusion that Resolution Copper is not a continuous discharger, ADEQ fails to consider mass-based limits which, based on the anticipated discharge volume, potentially violates the daily load limit on a daily basis, undermining the validity of the TMDL, and violating the Clean Water Act.

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[6] *See* Memo dated June 26, 2015 from Patty McGrath at SRK Consulting to Casey McKeon at Resolution Copper Mining regarding AZPDES Permit No. AZ0020389; Revision of TDS Limit.

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TABLE 1.b: Discharge Limitations and Monitoring Requirements for Outfall 002

Parameter	Maximum Allowable Discharge Limitations (6)		Monitoring Requirement (1)	
	Concentration Limits (µg/L)			
	Monthly Average	Daily Maximum	Monitoring Frequency	Sample Type (5)
Discharge Flow (MGD) (2)	Report	Report	Continuous	Metered
Cadmium (3)	50	100	1x/month	24-hr Composite
Copper (3)	8.5	17	1x/month	24-hr Composite
Iron	820	1640	1x/month	24-hr Composite
Lead (3)	2.7	5.4	1x/month	24-hr Composite
Mercury	1	2	1x/month	24-hr Composite
Selenium	2	3	1x/month	24-hr Composite
Zinc (3)	72.0	144	1x/month	24-hr Composite
Hardness($CaCO_3$) Discharge	Report (mg/L)	Report (mg/L)	1x/month	24-hr Composite
Hardness($CaCO_3$) Receiving Water	Report (mg/L)	Report (mg/L)	1x/month	24-hr Composite
Total Suspended Solids (TSS)	20 mg/L	30 mg/L	1x/month	24-hr Composite
pH (4)	Not less than 6.5 standard units nor greater than 9.0 standard units		1x/month	24-hr Composite

As shown in Table 1.b., above, taken from the AZPDES Draft Permit, Resolution Copper's AZPDES permit provides for an average monthly discharge limit of 8.5 µg/L and a daily maximum limit of 17 µg/L, with a 1x/month monitoring frequency.[7] However with no mass limit calculated in the TMDL (regardless of continuous or non-continuous discharging status), **it is almost certain that Resolution Copper's daily discharges will exceed daily TMDL load limits for copper at water volumes far below what Resolution Copper has estimated it will discharge under its AZPDES permit to Outfall 002.**[8] This is likely to result in daily violations, even at relatively low discharge volumes. ***See Attachment A.***

Under Resolution Copper's own estimated maximum daily discharge of 3.6 MGD to Outfall 002 (or 13,627,482.42 Liters), the 55 grams/day TMDL limit would be exceeded by a factor of two. **In other words, the daily load of copper into Queen Creek would be 115.8 grams – more than twice the TMDL daily load impairment level of 55 grams per day.** If Resolution should discharge at the higher daily maximum concentration limit of 17µg/L, the daily discharge would then be some 420% of the TMDL impairment limit.

By declining to consider and regulate the mass-based limits in the TMDL for Resolution Copper, the largest permitted point-source discharger in the study area, ADEQ is not moving towards a non-impaired system, but rather, knowingly allowing Queen Creek, a water body already impaired for copper, to be further impaired. This violates the Clean Water Act and ADEQ's obligations to protect Arizona's waters.

Furthermore, it is also currently unclear how compliance with the AZPDES permit's maximum allowable discharge limit that allows for a **monthly average** concentration limit of 8.5 µg/L, could possibly be measured when sampling is reportedly only being done under the AZPDES **one time** per month (Table1.b). Information on how the "monthly average" is actually calculated

[7] *See* Table 1.b, taken from AZPDES Draft Permit No. AZ0020389.

[8] *See* Response to Comments on AZPDES Permit No. AZ0020389, p. 18. ADEQ writes: "RCML noted the estimated maximum daily discharge from Outfall 002 is 3.6 MGD."

in the AZPDES has not been provided, though it is difficult to understand how ADEQ can take an average from a single monthly measurement. [9] Based on this lack of available data, it appears possible that the monthly average for concentration limits under the permit for Outfall 002 may be being calculated on an annual basis (i.e. dividing by 12 months of sampling, regardless of whether discharge has occurred all 12 months). This is a critical question that must be clarified for purposes of the TMDL because if non-discharging months are being used to calculate the monthly average, then the results of these calculations can mask the existence of monthly discharges that exceed the TMDL daily load limits for copper.

EPA regulations require mass based limits

The Queen Creek draft TMDL report relies on the methods outlined in the 1991 EPA *Technical Support Document for Water Quality-based Toxics Control (*TSD) for calculating chronic and concentration-based (WQBEL) dissolved copper water quality standards. This *Technical Support Document* states that mass-based effluent limits are required by NPDES regulations (40 C.F.R. 122.45(f)) exempting pollutants which cannot be represented appropriately by mass and when applicable standards and limits are expressed in terms of other units of measurement. Other than these exceptions (which are not applicable here), 40 C.F.R. 122.45(f) requires that "all pollutants limited in permits shall have limitations, standards or prohibitions expressed in terms of mass."

Also, it is important to understand that discharges through Outfall 002 are very likely to be under low flow (thus, low dilution) conditions. Additional pollutant quantity monitoring requirements are recommended in low dilution scenarios. At page 111, the *Technical Support Document* states: "At the extreme case of a stream that is 100 percent effluent, it is the effluent concentration rather than the effluent mass discharge that dictates the instream concentration. Therefore, EPA recommends that permit limits on both mass and concentration be specified for effluents discharging into waters with less than100-fold dilution to ensure attainment of water quality standards."

The 1991 "Technical Support Document For Water-Quality-based Toxics Control" that ADEQ cites in the TMDL has additional guidance requirements on implementing mass-based standards. It says (look at PDF pages 130 to 131, Section 5.7.1):

> "Mass-based effluent limits are required by NPDES regulations at 40 CFR 122.450. The regulation requires that all pollutants limited in NPDES permits have limits, standards, or prohibitions expressed in terms of mass with three exceptions, including one for pollutants that cannot be expressed appropriately by mass. Examples of such pollutants

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[9] As noted above, the concentration limits permitted in the Discharge Limitations described in the AZPDES permit (Table 1.b.) provide for a daily maximum discharge of 17 µg/L, with an average monthly limit of 8.5 µg/L. However, because sampling is required **only one time per month** under the permit, calculating an average within a month is impossible. This means that at any given day during a period of discharge, the daily maximum could well exceed the 17 µg/L limit and this may not be reflected in sampling information provided to ADEQ. This, is turn, could wildly skew the reported monthly average concentration for copper (and other parameters) and in turn, result in a TMDL model that fails to accurately represent the actual concentration of copper being loaded into Queen Creek on a daily basis – destroying the validity of the analysis contained in the TMDL.

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are pH, temperature, radiation, and whole effluent toxicity. Mass limitations in terms of pounds per day or kilograms per day can be calculated for all chemical specific toxics such as chlorine or chromium. Mass-based limits should be calculated using concentration limits at critical flows. For example, a permit limit of 10 mg/l of cadmium discharged at an average rate of 1 million gallons per day also would contain a limit of 38 kilograms/day of cadmium. Mass-based limits are particularly important for control of bioconcentratable pollutants. Concentration-based limits will not adequately control discharges of these pollutants if the effluent concentrations are below detection levels. For these pollutants, controlling mass loadings to the receiving water is critical for preventing adverse environmental impacts. However, mass-based effluent limits atone may not assure attainment of water quality standards in waters with low dilution. In these waters, the quantity of effluent discharged has a strong effect on the instream dilution and therefore upon the RWC. At the extreme case of a stream that is 100 percent effluent, it is the effluent concentration rather than the effluent mass discharge that dictates the instream concentration. Therefore, EPA recommends that permit limits on both mass and concentration be specified for effluents discharging into waters with less than 100 fold dilution to ensure attainment of water quality standards."

In addition, 40 C.F.R. Part §122.45 requires in part:

(e) Non-continuous discharges. Discharges which are not continuous, as defined in §122.2, shall be particularly described and limited, considering the following factors, as appropriate:

(1) Frequency (for example, a batch discharge shall not occur more than once every 3 weeks);

(2) Total mass (for example, not to exceed 100 kilograms of zinc and 200 kilograms of chromium per batch discharge);

(3) Maximum rate of discharge of pollutants during the discharge (for example, not to exceed 2 kilograms of zinc per minute); and

(4) Prohibition or limitation of specified pollutants by mass, concentration, or other appropriate measure (for example, shall not contain at any time more than 0.1 mg/1 zinc or more than 250 grams (1/4 kilogram) of zinc in any discharge).

(f) Mass limitations.

(1) All pollutants limited in permits shall have limitations, standards or prohibitions expressed in terms of mass except:

(i) For pH, temperature, radiation, or other pollutants which cannot appropriately be expressed by mass;

(ii) When applicable standards and limitations are expressed in terms of other units of measurement; or

(iii) If in establishing permit limitations on a case-by-case basis under §125.3, limitations expressed in terms of mass are infeasible because the mass of the pollutant discharged cannot be related to a measure of operation (for example, discharges of TSS from certain mining operations), and permit conditions ensure that dilution will not be used as a substitute for treatment.

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> (2) Pollutants limited in terms of mass additionally may be limited in terms of other units of measurement, and the permit shall require the permittee to comply with both limitations.

The idea that RCC Outfall 002 isn't "designed to discharge on a continual basis" is something that never appeared in the AZPDES permit, but is relied upon by ADEQ in the TMDL to assign only a concentration-based WLA (and not a mass-based WLA). Please explain this descrepency.

2013 Modeling Report

The Queen Creek TMDL Modeling Report prepared by Louis & Berger (January 2013), which is the primary basis of the TMDL,[10] contains factually inaccurate information pertaining to the Resolution Copper AZPDES permit. It is both surprising and alarming that the 2013 Modeling Report has not been updated to reflect critical data related to the AZPDES for Resolution Copper. For example, the 2013 Modeling Report states, at page 4:

> According to the file and ADEQ Permits Staff, the facility is reportedly designed to contain all runoff up to and including the 100-year, 24-hour event. Thus, the RCC discharge point 001 is non-discharging in the range of storm magnitudes being simulated for the estimation of the copper and lead loads (Chapter 3). **RCC has proposed, and then withdrawn, an AZPDES permit application to discharge treated mine dewatering water to Queen Creek adjacent to their existing 001 outfall. At this point, there is no information that a future request to discharge this water is pending.** Currently, water is transported approximately 30 miles westerly of Superior via pipeline to an irrigation district. The water transfer currently occurs during the growing season only, reportedly **forcing RCC to halt mine dewatering during the winter months.** [Emphasis added].

As an initial matter, it is clear that the 2013 Louis & Berger report completely fails to take into account the fact that Resolution Copper has, in fact, been issued an AZPDES at least since 2010 that **allows** for treated mine to be discharge at Outfall 002 into Queen Creek. Which raises the question as to whether or not this model, which is plainly outdated, can be used to accurately predict the amount of dissolved copper being contributed by each modeling basin. Certainly, it does not consider the permitted contributions of the largest permitted project in the entire project watershed (Resolution Copper). Furthermore, it has been well documented and it is commonly known that Resolution Copper has not ceased mine dewatering during winter months, and that water is in fact seeping into Shaft #10 at inflow rate of up to 600 gpm.[11] It is not clear why this information has not been updated.

How was the overland flow from Oak Flat determined to be a major contributor copper?

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[10] The function of the model is to predict the amount of dissolved copper being contributed by each modeling basin utilizing both the sampling data and the meteorological data of the entire project watershed. TMDL at 14.

[11] *See* Fiscor, Steve. "Sinking America's Deepest Shaft: Development and Blast Applications for Resolution Copper's No. 10 Shaft" in Engineering & Mining Journal, April 2014.

Hardness
The Queen Creek draft TMDL incorporates hardness calculations (dissolved calcium and magnesium), but seems to point to controversy not only about the conclusions of the analysis, but also the underlying data. On page 14, the report states that hardness data supplied by ADEQ to the modeling team was discovered to have been "inaccurate." This raises a number of questions. For example, when were those inaccuracies discovered and how were they corrected? The January 2013 modeling report has been presented to the public as a final version of the report, and it has been posted alongside the draft Queen Creek TMDL report. Yet, the draft Queen Creek TMDL report brushes this off by stating on page 14: "The original total hardness values were not used in the modeling of the dissolved copper, and the updated values do not affect the modeling results." What errors in the prior data were being corrected? Additionally, what changed in the model, what was omitted and included and when? In fact, Matthew Bolt, a Life Scientist with EPA who has been reviewing ADEQ's Queen Creek TMDL, has specifically asked for an accounting of how the updated data in the current draft TMDL was reconciled with contradictory data presented in the original report's hardness table, and how those changes were made between the data, the modeling report, and the draft TMDL. (*See Email from Matthew Bolt sent July 13, 2017 at 6:12 p.m.)* It is unclear from the records we have reviewed on this matter, whether this accounting was ever provided to EPA. This should be clarified and, if necessary, addressed.

The draft should be revised to include the correct data.

Are Tables 3.4 and 3-6 (which we assume come from a 2013 final modeling report by the Louis Berger Group) available to the public?

ADEQ fails to identify polluters that should be required to clean up "legacy" pollution
The draft TMDL report states that Queen Creek and various tributaries are impaired for copper and that most of the copper loading originates in the upper reaches of Queen Creek and particularly from the Oak Flat modeling basin. ADEQ theorizes that the majority of copper comes from background sources although some comes from smelter deposition from older mining operations. The report concludes that there is no culpability in the smelter deposition of copper from any current dischargers to Queen Creek.

However, in an ADEQ internal ADEQ document titled Queen Creek Modeling Report Comments dated August 17, 2012, says,

- "Low soil Cu in Oak Flat area suggests this is not an NPS source area that can be remediated
    - The OF area is an issue- it has low Cu in the rock but is a major source of copper. Mine says it must be smelter fall out not natural background. We will need to explore this more. I asked LB to summarize the WQ and soil data for all of the tuff in the area."

Here it is clear that ADEQ learns that there is low natural background copper and a "mine" (Rio Tinto's Resolution Copper project?) says that the high levels of copper in the Oak Flat area is from smelter fallout.

The major (only?) smelter operating upwind from the Oak Flat area would have been the Magma smelter in Superior, Arizona. ADEQ asserts in numerous documents that Rio Tinto's Resolution

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Copper operations have been an ongoing continuation of Magma's operations in the past (This is a position that we dispute. We maintain that the new Resolution Copper project is a new mine and a new operation.)

If ADEQ is correct that Rio Tinto's Resolution Copper project is a continuation of Magma Copper's older operations and if the "Mine" (Resolution Copper) admits that much of the copper loading at Oak Flat is from "smelter fall out," then it is clear that Rio Tinto is responsible for high levels of copper in the Queen Creek watershed downwind from the Magma smelter in Superior. Therefore, ADEQ should require that Rio Tinto clean up this "fall out" before they are allowed to add more copper loading to Queen Creek.

Effect of Resolution Copper dewatering of Oak Flat area on water levels in Queen Creek
Rio Tinto is currently dewatering (at the rate of at least 600 gallons per minute) from the Numbers 9 and 10 shafts at Oak Flat. This water is piped to Superior for minimal treatment and then piped to the New Magma Irrigation District near Phoenix. The water, taken from the Queen Creek watershed bypasses the impaired sections of Queen Creek.

What effect does this dewatering have on the impairment of Queen Creek from copper and other elements? What would happen if this dewatering ended and these 600 gallons per minute stream of water were to reenter Queen Creek? The draft report does not answer these questions.

4. COMMENTS ON SPECIFIC SECTIONS OF THE DRAFT TMDL REPORT

1.0 Introduction
Why has it taken so long for ADEQ to complete this process? It is our understanding that EPA regulations require state agencies to submit (and have approved) a schedule to establish TMDL standards for impaired streams every 2 years. Some sections of Queen Creek were listed as impaired in 2002.

Has data submitted by Resolution Copper Company (Rio Tinto) been independently verified?

Who was the contractor hired to do the modeling and does this contractor have any ties to regulated companies or other conflicting interests?

2.2 Climatic Setting
The data used for summer weather patterns in the Superior area seems to be outdated and underestimating current conditions. Should that be updated? Does the analysis consider the impacts of future climate change including generally higher temperature, continuing drought conditions, and more violent storms?

Where did the rainfall data come from? Did the data come from only a few locations, or did you use data from different points throughout the watershed? Would differences in rainfall amount in the subbasins affect your conclusions?

5.0 Modeling of the Data
Did ADEQ use the correct model?

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Figure 5 of the draft shows that ADEQ did not include a number of the sub-basins in their modeling. Since some of the sub-basins not used in the modeling are quite large, the modeling exercise itself is fatally flawed. Why are some sub-basins not used? What rationale was used to choose the basins used? How were the "representative" basins chosen to assure that they are truly representative?

How does this affect the validity of entire analysis?

5.2 Hydrologic Calibration

This section points to one of the real problems of this analysis: That ADEQ is making assumptions not based on any data and tweaking the modeling to confirm their assumptions. How can you say, "Even though a large amount of data was collected at sites throughout the watershed, it was still not enough for statistical methods to be applicable"? You can't base an analysis like this on visual agreement of the results, you must have a rational and scientifically based rational for your assumptions.

Figure 6 does not support the draft reports conclusion that actual data matches simulated modeling. Was this a cherry-picked graph or do other sub-basins also show any kind of correlation? To us, Figure 6 does not show an acceptable visual agreement between observed and simulated flows.

5.3 Dissolved Copper Calibration of the Model

As with Figure 6, there is simply not enough data in Figure 7 to support ADEQ's conclusions.

6.2 Margin of Safety

The ADEQ MOS used is not nearly conservative enough. If Rio Tinto gets underway, the MOS should be much higher.

The TMDL report forecasts that the used portions of the already permitted WLA's will remain unused and therefore available as a MOS. This relies on a permittee not using their full allotment. Is there a better option?

7.0 Implementation

In general, this section needs a lot more definition of specific actions that much be performed. There needs to be projects with goals and timelines outlined in this section that will help reduce the illegal loading of copper in Queen Creek.

6. CONCLUSION

In conclusion, the draft Total Maximum Daily Load (TMDL) analysis for three reaches of Queen Creek located near Superior, AZ, is fatally flawed and its issuance would violate the CWA, Arizona law, and other applicable authorities. ADEQ should write a new draft that provides adequate protections for the environment, the public health and the waters of Arizona can be developed.

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Please include the Arizona Mining Reform Coalition, Center for Biological Diversity, Concerned Citizens & Retired Miners Coalition, Concerned Climbers of Arizona, Dragoon Conservation Alliance, Patagonia Area Resource Alliance, Save the Scenic Santa Ritas, Save Tonto National Forest, and the Sierra Club, as interested parties and direct all future public notices and documents to us at the addresses below.

Sincerely,

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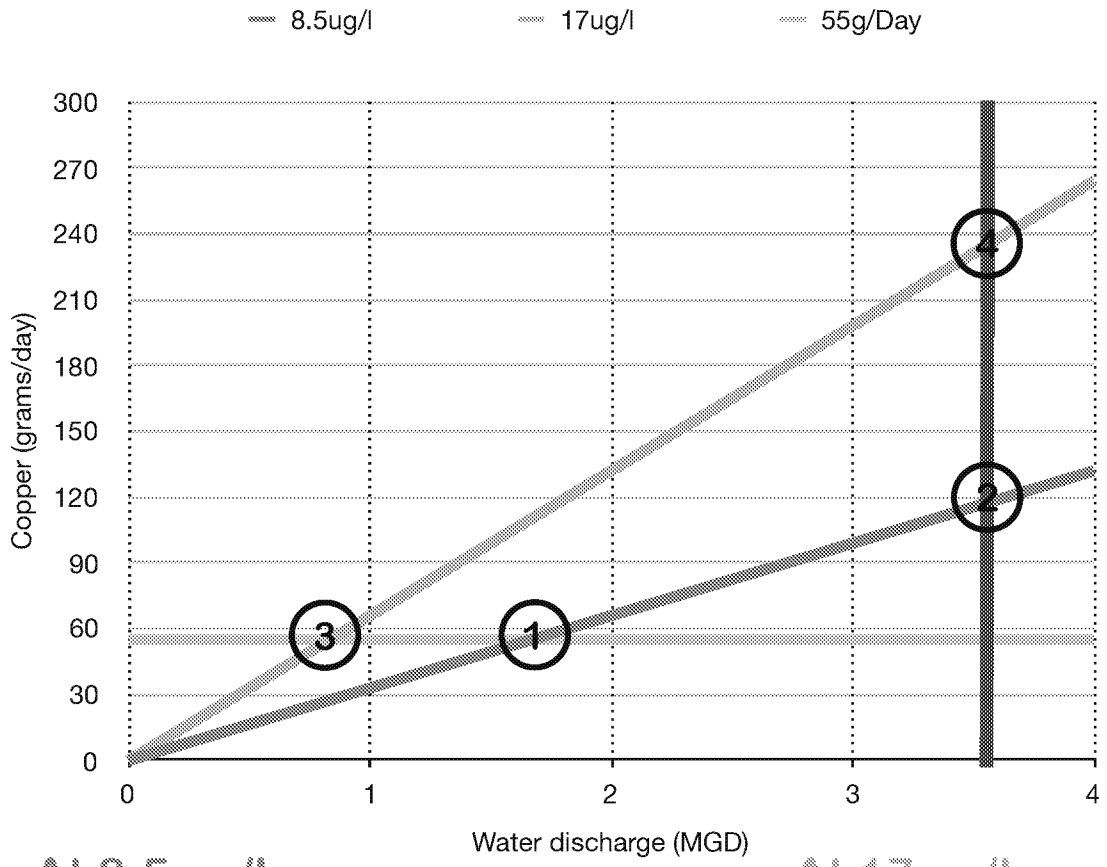
Permitted Cu Discharges by RCM Into Queen Creek at Outfall 002



At 8.5 ug/L (Monthly Average Concentration Limit):

1 TMDL daily mass limit (55 grams of Cu per day) is exceeded when 1,708,235 gallons are discharged

2 Total Cu discharged at RCM's 3,600,000 MGD estimated daily discharge volume?

115.8 grams/day

At 17 ug/L (Daily Maximum Concentration Limit):

3 TMDL daily mass limit (55 grams of Cu per day) is exceeded when 854,118 gallons are discharged

4 Total Cu discharged at RCM's 3,600,000 MGD estimated daily discharge volume?

231.6 grams/day

Attachment 04

Queen Creek

Reach 15050100-014A: Headwaters to confluence with the Town of Superior WWTP discharge
Reach 15050100-014B: Confluence with the Town of Superior WWTP discharge to the confluence with Potts Canyon
Reach 15050100-014C: Potts Canyon confluence to the Whitlow Dam

Arnett Creek

Reach 15050100-1818: Headwaters to the confluence with Queen Creek

Unnamed Drainages

Reach 15050100-1000: Headwaters to the confluence with Queen Creek
Reach 15050100-1843: Headwaters to the confluence with Queen Creek

Total Maximum Daily Loads (TMDL)

For

Dissolved Copper

Arizona Department of Environmental Quality

September 18, 2017

Publication number: OFR-17-03

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LIST OF ABBREVIATIONS

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
AgL	Agriculture-Livestock watering
ADOT	Arizona Department of Transportation
ARS	Arizona Revised Statutes
AZPDES	Arizona Pollution Discharge Elimination System
A&Wedw	Aquatic and Wildlife-effluent dependent water
A&Ww	Aquatic and Wildlife-warm water
BLM	Bureau of Land Management
BMP	Best Management Practice
cfs	cubic feet per second
CGP	Construction General Permit
EDW	Effluent-dependent water
EPA	Environmental Protection Agency
ft.	feet
FC	Fish consumption
FBC	Full Body Contact
GIS	Geographic Information System
kg/day	kilograms per day
LA	Load Allocation
MGD	Million Gallons per Day
µg/L	micrograms per liter
mg/L	milligrams per liter
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System Permit
MSGP	Multi-Sector General Permit
NB	Natural background
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
PBC	Partial Body Contact
QAQC	Quality Assurance / Quality Control
RCC	Resolution Copper Company
SWPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TNF	Tonto National Forest
TSD	Technical Support Document (for Water Quality-based Toxics Control)
UAA	Use Attainability Analysis
USFS	United States Forest Service
USGS	United States Geological Survey
WIP	Watershed Improvement Planning
WLA	Waste Load Allocation
WQBEL	Water Quality Based Effluent Limit
WRCC	Western Regional Climate Center
WWTP	Waste Water Treatment Plant

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1.0 INTRODUCTION

A Total Maximum Daily Load (TMDL) is the maximum amount, or load, of a water quality parameter which can be carried by a surface waterbody, on a daily basis, without causing an exceedance of surface water quality standards. TMDL calculations are made for waters listed as impaired on the state's 303(d) List. Data collection for the TMDL helps to identify if the impairment to water quality still exists. If the impairment is still present, the data can be utilized to identify the possible source(s) of the pollutant(s) and whether the source is due to human activity, or is due to natural background conditions. The Clean Water Act requires that every two years, states submit a list of impaired waters and a schedule to establish TMDLs to the Environmental Protection Agency (EPA). The EPA reviews and approves the 303(d) Lists and schedules. EPA also approves or disapproves of any TMDLs that the state may propose. Queen Creek has been divided into the following three hydrologic reaches: 15050100-014A (Headwaters to confluence with the Town of Superior WWTP discharge), 15050100-014B (Town of Superior WWTP discharge to the confluence with Potts Canyon), and 15050100-014C (Potts Canyon to the Whitlow Dam). Arnett Creek has the same reach number from its headwaters to its confluence with Queen Creek: 15050100-1818. Two unnamed drainages, 15050100-1000 and 15050100-1843 are tributary to Queen Creek in the upper Queen Creek Canyon area just downstream of Oak Flat. All six reaches are currently found in Arizona's 2012/2014 303(d) list of impaired waters for exceedances of dissolved copper standards. Reach 014A was originally listed in the Arizona 303(d) list of 2002, and 014B was added to the 303(d) list of 2004. Reaches 014C, 1818, 1000, and 1843 were listed as impaired for dissolved copper in Arizona's 2010 305(b) report.

Work on the Queen Creek TMDL was initiated in late 2002/early 2003 by Arizona Department of Environmental Quality (ADEQ) personnel as a part of the TMDL planning process. This initial work involved monitoring programs and modeling studies that were designed to identify and to quantify the various sources of copper within the watershed. In February of 2010, personnel from the TMDL Unit completed the calibration and validation of the preliminary modeling for dissolved copper in the Queen Creek watershed. This initial early work was followed up by the collection of more water samples, plus the addition of soil and rock samples. Discharge data was collected, and rain gauges were used to collect rainfall information from the top and bottom of the watershed. Data regarding climatic conditions was also collected by a remote weather station established by ADEQ near the top of Pinal Peak. Resolution Copper Company (RCC) also supplied metrological data from two weather stations that the company operates within the project area. In late 2011 a contractor was hired to handle the last portions of the modeling process. Modeling of the additional data exhibited an acceptable hydraulic and pollutant calibration and indicated that natural background in bedrock and soils, semi-active mines, and suspected historic smelter fallout, constitute the main sources of copper in the Queen Creek watershed.

The goal of the Queen Creek TMDL project was to develop the site characterization and water quality data set needed to calculate the TMDLs for dissolved copper in the listed reaches of Queen Creek, Arnett Creek, and the unnamed drainages. The sampling and modeling results have been used to accomplish the following:

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1) Identify sources of pollutant loading, including natural background, nonpoint and point source contributions.
2) Identify the critical condition(s) for loading.
3) Calculate the pollutant loads and allocations for the identified load sources.
4) Calculate the required load reductions.

A by-product of sampling at various sites throughout the project watershed was the ability to assess whether other pollutants were also appearing with enough frequency to be considered an issue. Results of the sampling, combined with existing historical data, triggered the 303(d) listing of Reach 15050100-014A (Queen Creek; Headwaters to the confluence with Superior WWTP discharge) in 2010 for lead, and in 2012 for selenium. The older historic issue of dissolved copper is addressed in this TMDL document. Once the dissolved copper TMDL has been established for the impaired reaches, a schedule for the lead and selenium TMDLs will be developed.

2.0 Physical Setting

2.1 Physiographic Setting

Queen Creek is a sub-basin of the Middle Gila River watershed. Appendix B of Arizona's surface water standards (Arizona Administrative Code, Title 18, Chapter 11, Article 1 [AAC-18-11]) divides the Gila River into the following three watersheds: the Upper Gila, the Middle Gila and the Lower Gila. The Middle Gila watershed begins at the San Carlos Reservoir / Coolidge Dam (spillway elevation approximately 2,500 feet) and ends downstream at the Painted Rock Reservoir dam (elevation approximately 600 feet). In total, the Middle Gila watershed drains an area of approximately 12,250 square miles, and includes the lakes and drainages of the Phoenix metro area. In the past, Queen Creek drained directly to the Gila River near the northern boundary of the Gila River Indian Reservation. Currently the drainage has been engineered to flow into the Roosevelt Water Conservation District (RWCD) canal, where it will ultimately drain into the Gila River. The entire Queen Creek watershed covers an area of approximately 250 square miles.

The Queen Creek TMDL project area, as seen in **Figure 1**, is located within the Basin and Range Lowlands province. A portion of the northern most part of the watershed and a small section of the eastern tip are located in the Central Highlands province. The reaches of Queen Creek above Superior are best described as falling in the transition zone between the two provinces. All reaches below this point are located within the Basin and Range Lowlands province.

The headwaters of Queen Creek are located in the Pinal Mountains, specifically the northeastern slope of Fortuna Peak (elevation approximately 5,000 feet). The channel flows southeast for approximately three miles before turning slightly and flowing south for about 0.5 miles. At this point the channel turns back and begins draining in a southwesterly direction towards Superior. About 4.5 miles below the headwaters, the channel passes beneath US Highway 60 and drains southwest through the narrows of Queen Creek Canyon for about 2.8 miles. It is at this point, approximately 7.3 miles below the headwaters that the channel exits the foothills just north of the Apache Leap formation at the northern end of the Dripping Springs Mountains and proceeds through Superior in a west, southwesterly direction. At approximately 8.4 river miles below the headwaters, the channel passes under US Highway 60 a second time, and continues on for about another 1.2 miles where it begins receiving treated effluent from the Superior WWTP. The channel drains west, flowing along the northern base of Picketpost Mountain to the confluence of Arnett

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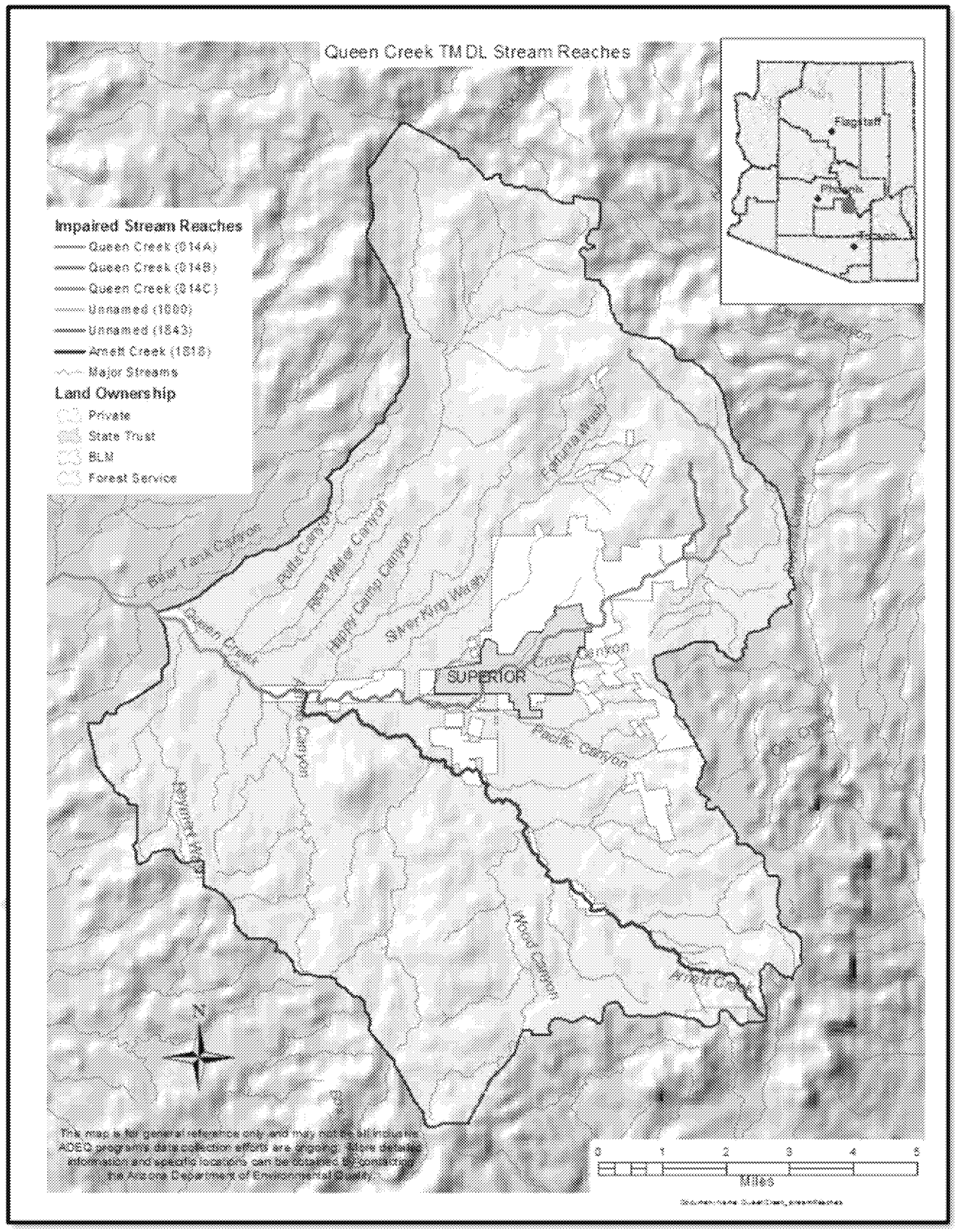

Figure 1: General Map of the Queen Creek Project Area

Creek (a distance of approximately 3.5 miles). About 0.15 miles downstream of the mouth of Arnett Creek, Queen Creek passes under US Highway 60 a third time. It then drains in a northwesterly direction for approximately 1.6 miles to the confluence with Potts Canyon (elevation approximately 2200 feet). Below Potts Canyon the channel drains in a westerly direction for about 5.5 miles towards the Whitlow Dam flood control structure (elevation approximately 2080 feet).

Those reaches of Queen Creek that lie above the city are typically narrow, reaching widths of about 30 feet or less. As the drainage runs through town, the channel width begins to increase. Below the confluence of Arnett Creek, the channel once again begins to widen and by the time it reaches its confluence with Potts Canyon the channel of Queen Creek has widened substantially. Aerial views show the presence of overflow side channels and braiding in the main channel. Cobble bars and mid-channel bars were observed in Queen Creek from the mouth of Potts Canyon to the sample site downstream at Queens Station during field sampling visits. At Queens Station the channel width has increased to over 100 feet in some areas. Flow measurements at this site were often impossible to perform during run-off events due to the depth, velocity and width of the active channel.

The Queen Creek watershed is located in an area of the state that has generally sparse population numbers. The entire watershed is located in Pinal County. Pinal County has a population of approximately 376,000, making it the third-most populous county in Arizona. Casa Grande is the largest city in the county with a population of about 49,000 (U.S. Census Bureau, 2010). The Town of Florence has about 25,500 (U.S. Census Bureau, 2010) people and is recognized as the county seat of Pinal County. Superior is the largest town within the Queen Creek sub-basin, with a population of about 2800 people (U.S. Census Bureau, 2010).

2.2 Climatic Setting

Like the majority of Arizona, hot summer temperatures and mild winter conditions typify the climatic conditions of the Queen Creek basin. Superior is located at an elevation of about 3000 feet. The higher elevation keeps Superior cooler on average than Phoenix and the other urban areas of the valley. Summer temperatures in the lower elevations of the project watershed can still reach into the 100's.

The higher elevations of the upper reaches will tend to be somewhat cooler throughout the year, and though snow fall is not common in this area it does occasionally occur when cycles of wet, cold weather move through the watershed. Data from the Western Regional Climate Center (WRCC) indicates that in February of 2001, 4.00 inches of snowfall was recorded at the Superior monitoring site. However, records show that prior to February 2001, the last recorded snowfall occurred in 1975-76, a stretch of approximately 24 years. This time frame of consecutive years without recorded snowfall in Superior is the longest since data collection had been initiated in July of 1919. Areas of the upper Queen Creek Canyon at elevations above 3000 feet will receive winter snowfall when conditions of moisture and temperature occur in the proper combination. Snow was observed during the winter rain sampling of late 2007 and early 2008 period on the peaks just north of the Oak Flat area. Late winter storms in 2016 deposited several inches of snow in the upper elevations of the Queen Creek Canyon area.

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Rainfall in this area follows a pattern similar to much of Arizona. During the early warming period of summer the hot dry air in the lower elevations of the state begins to rise into the upper atmosphere. As the heated air rises, moist tropical air is pulled mainly from the Gulf of California (also known as the Sea of Cortez), and a small portion is pulled west from the Gulf of Mexico. The heavier moist air fills the void produced by the rising dry air. This invasion of very wet, warm air creates ideal conditions for localized storms of short duration and sometimes very large volumes of rain. Winter storms tend to be much longer in duration with considerably less intensity. During these cooler months the prevailing east winds off the Pacific Ocean push mid-latitude cyclonic storms across California and Arizona. The volume of rainfall produced by the different types of seasonal storms may be similar, but the duration and spatial extent are usually quite different. **Table 1** shows Western Regional Climate Center (WRCC) precipitation data for the Superior area for the period of 1920 to 2006.

Seasonal means indicate that the winter and summer months do receive the most moisture, but that the spring and fall months, which are sometimes described as dry months, also account for a significant amount of the annual mean. Inquiries to the WRCC indicate that more current information is still being reviewed for approval so that it can be released to the public.

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Table 1: Precipitation data for the town of Superior, AZ

SUPERIOR, ARIZONA

Period of Record General Climate Summary - Precipitation

Station:(028348) SUPERIOR

From Year=1920 To Year=2006

	Precipitation											Total Snowfall		
	Mean	High	Year	Low	Year	1 Day Max.		>= 0.01 in.	>= 0.10 in.	>= 0.50 in.	>= 1.00 in.	Mean	High	Year
	in.	in.	-	in.	-	in.	dd/yyyy or yyyymmdd	# Days	# Days	# Days	# Days	in.	in.	-
January	2.00	11.29	1993	0.00	1924	2.56	24/1943	5	4	2	0	0.3	6.4	1933
February	1.98	7.34	2005	0.00	1924	2.53	13/2005	5	4	1	0	0.5	7.5	1939
March	2.02	7.48	1992	0.00	1933	3.66	22/1954	5	4	2	0	0.3	6.0	1922
April	0.80	3.89	1952	0.00	1937	1.49	02/1999	3	2	1	0	0.1	2.5	1921
May	0.34	2.60	1992	0.00	1929	1.73	02/1941	2	1	0	0	0.0	0.0	1921
June	0.26	2.06	1955	0.00	1923	1.24	23/1972	1	1	0	0	0.0	0.0	1921
July	1.91	5.84	1921	0.04	1995	2.00	18/1976	7	4	1	0	0.0	0.0	1921
August	2.80	11.03	1963	0.47	1952	3.80	14/1990	8	5	2	1	0.0	0.0	1920
September	1.48	5.36	1983	0.00	1928	2.75	18/1946	4	3	1	0	0.0	0.0	1920
October	1.18	8.68	1972	0.00	1934	3.72	30/1959	3	2	1	0	0.0	0.0	1920
November	1.43	5.85	1931	0.00	1929	2.66	13/1941	4	3	1	0	0.0	3.0	1964
December	2.13	10.43	1965	0.00	1929	2.92	15/1967	5	4	2	1	0.2	4.5	1968
Annual	18.34	35.77	1978	4.90	2002	3.80	19900814	54	35	13	4	1.4	8.0	1976
Winter	6.11	23.65	1993	0.92	1964	2.92	19671215	16	11	5	1	1.0	9.0	1969
Spring	3.16	11.57	1941	0.01	1955	3.66	19540322	10	6	2	1	0.4	8.0	1976
Summer	4.97	11.22	1990	0.81	2002	3.80	19900814	16	10	3	1	0.0	0.0	1921
Fall	4.09	12.21	1972	0.20	1938	3.72	19591030	11	8	3	1	0.0	3.0	1964

Table updated on Jul 14, 2008

For monthly and annual means, thresholds, and sums:
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered
Seasons are climatological not calendar seasons
Winter = Dec., Jan., and Feb. Spring = Mar., Apr., and May
Summer = Jun., Jul., and Aug. Fall = Sep., Oct., and Nov.

2.3 Hydrogeology

The watershed area for the Queen Creek/Arnett Creek project area is approximately 99 square miles. This figure was calculated using the farthest downstream sampling site on Queen Creek (MGQEN030.06), which is located at 33°17'48.459''N / 111°12'39.236''W in reach 014C. The sample site is 1.3 miles downstream of the reach break between 014B and 014C. Neither Arnett Creek, the three reaches of Queen Creek nor the two unnamed drainages being addressed in this TMDL meet ADEQ's definition of a perennial water ("a surface water that flows continuously throughout the year"). Short reaches of spatially intermittent flow have been observed in the narrow reaches of Queen Creek that flow through Queen Creek Canyon, and in the lower reaches of Arnett Creek. Most of Queen Creek and its tributaries flow through sparsely inhabited areas of

the watershed. A reach of approximately two miles in the middle section of the main channel does run through Superior. There are no perennial tributaries to Queen Creek, although small stretches of flow have been observed from seeps that occur near the channels. Most of these only flow for short distances due to the small amounts of water being discharged. Some of the sub-watersheds of Queen Creek which have been sampled for this TMDL include Potts Canyon, Whitford Canyon, Rice Water Canyon, Alamo Canyon, Arnett Creek, Happy Camp Canyon, Silver King Wash, Telegraph Canyon, Wood Canyon, Pacific Canyon, Belmont Canyon, Donkey Canyon, Cross Canyon, and numerous unnamed drainages either flowing into the sub-watersheds or directly into Queen Creek.

As noted earlier, the reach of Queen Creek from the Superior WWTP discharge to the confluence of Potts Canyon is listed in Appendix B of Arizona's Water Quality Standards for Surface Waters (AAC 18-11) as an effluent-dependent water (EDW). ADEQ defines an EDW as a surface water that would be ephemeral if not for the discharge of treated wastewater to the channel. Currently the Superior WWTP is not discharging at its maximum capacity, which limits the downstream extent of the EDW reach. The arboretum utilizes the effluent for watering vegetation throughout the site, and typically marks the channel with signs advising that the water in the stream is non-potable and unfit for drinking.

Pump Station Spring is located at N 33°20'23''/W 111°03'48'', which is approximately 1.9 miles downstream of the headwaters near the Omya Inc. pit. United States Geologic Survey (USGS) topographic maps show this as the only named spring located near the main stem of Queen Creek. Discharge from this spring is minimal, although it may help to maintain soil saturation just downstream of its location. Work by the U.S. Forest Service (USFS) indicates that although there are springs present within the watershed, the amount of water being discharged to the surface is in most cases minimal.

Many of the drainages in the upper reaches of Queen Creek will sometimes flow intermittently after periods of wet weather due to the presence of exposed or shallow bedrock within the channel. The lack of a significant alluvial layer in these areas of Queen Creek Canyon limits the ability of runoff to infiltrate as deeply as it does in the other sections of the main channel. Reaches of the main stem in Queen Creek Canyon and portions of the creek bed as it enters Superior (**Figure 2**) also show areas of relatively thin alluvial deposition over the exposed Gila Formation bedrock. The highest rate of stream flow loss due to infiltration occurs at the point where the channel exits Queen Creek Canyon (Jones & Stokes 2000).

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Figure 2: Looking upstream from the Magma Avenue Bridge

The valley below Queen Creek Canyon consists of cemented sandstones and conglomerates of the Gila Formation covered by a layer of unconsolidated sediments of varying sizes. **Figure 2** illustrates the bedrock layer and large boulders that are present in the channel upstream of the Magma Avenue Bridge, approximately 0.4 miles below the point where the channel exits the narrow confines of the Queen Creek Canyon. As the channel progresses downstream the sediment size decreases and the depth of the alluvial material gradually begins to increase. Flows downstream of the canyon become more intermittent and short lived as the infiltration of surface water into the alluvium below the channel begins to occur more rapidly. The channel constricts as it drains westward along the north-facing base of Picketpost Mountain, a large fault-block feature that lies between Queen Creek and the Arnett Creek drainage. Below this constriction point flows in the creek become more ephemeral in nature, as the depth to bedrock (or other impermeable layers) increases significantly.

2.4 Land Management and Ownership

The majority of the land in the Queen Creek TMDL project area is public land, under the management of the USFS (see **Figure 1**). This forest service land makes up approximately 90 percent of the TMDL project watershed. It is administered by the Tonto National Forest, (TNF). TNF oversees the public grazing of cattle that occurs within the watershed, and also manages the harvesting of vegetation for commercial and private use.

Although timber harvesting is a viable commercial enterprise in other areas of Arizona's national forests, the removal of timber in the TMDL project area is uncommon. The presence of mainly

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scrub vegetation throughout much of the area makes timber harvest financially challenging. Although commercially valuable types such as Ponderosa Pine are found in the higher elevations of the project area, they do not occur in the large stands found in other parts of the state. As with most public land, outdoor recreational activities such as camping, off-road recreational vehicle operation, hunting, etc., are also quite popular. For many years the Queen Creek Canyon area has been a popular site for rock climbing.

A very small portion of land managed by the Bureau of Land Management (BLM) is located near the headwaters of Arnett Creek, and an even smaller piece of land managed by the State Land Department is located adjacent to and east of the BLM parcel. Together these two pieces of land make up less than 0.5 percent of the project area. The rest of the land within the project area is privately owned, the majority of which falls within the boundaries of the Town of Superior. Land owned by mining interests makes up the second largest portion of private land. Historically, one of the largest employers in the area has been the mining industry. Mining does not employ the large numbers of people in this area that it has in the past, but it is still recognized as one of the important industries that help to fuel Arizona's economy. Mining is discussed in greater detail in Section 4.2.5.

2.5 Geology

The geology along Queen Creek from its headwaters to the Town of Superior consists of mineralized Precambrian metamorphic and igneous outcrops throughout the region which are overlain by upper Precambrian and Paleozoic sedimentary rocks (**Figure 3**). The Precambrian rocks are extensively intruded by diabase. Several intrusive bodies of granitic composition are of late Mesozoic and early Tertiary age. Large areas are covered by unmineralized Tertiary volcanic rocks known as Apache Leap Tuff. Sedimentary rocks have been tilted and the area has been extensively broken by block faults of several different ages. The geology from Superior to the confluence with Potts Canyon is predominantly Quaternary Alluvium with Gila Conglomerate.

Fortuna Peak, a Quaternary Dacite Conglomerate formation, overlies the Precambrian Diabase and Pinal Schist formations. Queen Creek, originating on the slopes of Fortuna Peak, flows southeast through the Paleozoic units, the Cambrian Bolsa Quartzite, the Devonian Martin Limestone, the Mississippian Escabrosa Limestone and the Pennsylvanian Naco Limestone. These units, having been exposed due to the extensive folding and faulting within the area, help form and direct the path of Queen Creek. Queen Creek continues its path through the Tertiary Rhyolite and Apache Leap Tuff formations. East of Superior, Queen Creek flows once again through the exposed and faulted Paleozoic formations previously listed. The Concentrator Fault separates the Paleozoic formations from the Quaternary Alluvium deposit which encompasses the remainder of Queen Creek's path to Potts Canyon.

Copper deposits in the Superior area are a by-product of volcanic activity in Arizona that occurred approximately 15 to 40 million years ago, during a period referred to as the Mid-Tertiary. Geologists agree that this is one of several volcanic periods in Arizona's history and believe that the eastward movement of the episode was caused by a decrease in the angle of the sub-ducted oceanic plate beneath the region. Middle Tertiary volcanic deposits are common and fairly widespread throughout the Basin and Range Province. Volcanism during this period was locally

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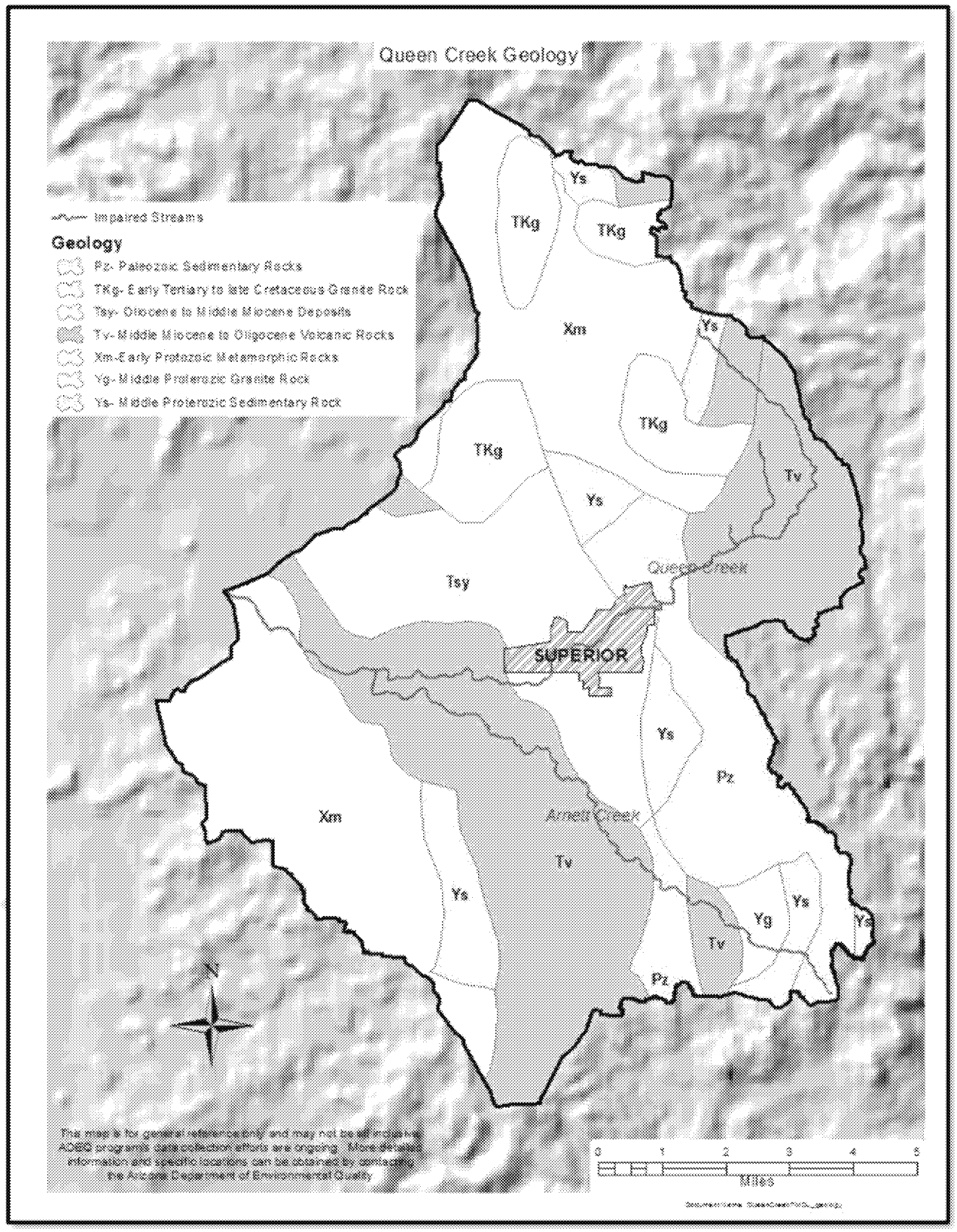

Figure 3: Geologic Map of the Queen Creek Project Area

accompanied by deposition of precious and base-metal veins from hot fluids that circulated near the centers of the volcanic activity and also along major fault lines.

The geologic make-up of the various sub-watersheds directly effects the total hardness present in various reaches of Queen Creek's main stem and also the tributaries that feed into it. The Oak Flat area consistently produces fairly low total hardness sample results. The volcanic tuff that makes up a great deal of the sub-watershed is relatively young in geologic terms, and has not been subjected to the erosional effects that other geologically older areas have been. The area typically has a thin alluvial layer, and in some spots the tuff is completely exposed. Rain water runs off very quickly, with little opportunity to soak through what little alluvial material is present. Without the ability to percolate through sufficient alluvial material the rain water cannot acquire the mineral carbonates that contribute to the levels of total hardness. Other sub-watersheds with better developed alluvial deposition will typically show higher levels of total hardness, in some cases over ten times higher than those seen in certain drainages of the Oak Flat area. Sample collection and geologic data has also shown the volcanic tuff in the project area to be one of the biggest contributors of copper when compared to other geologic features.

2.6 Vegetation and Wildlife

The vegetation within the Queen Creek project area varies most notably by differences in elevation. Arizona Sycamore, Arizona walnut and velvet ash are common within the riparian corridor of the headwaters area of Queen Creek. As the channel drops in elevation, the vegetation along the stream channel transitions into a mixed riparian woodland that includes cottonwood, willow, ash, seepwillow, desert broom, and netleaf hackberry. The upper banks of the channel are inhabited by a shrubby mesquite bosque through the Town of Superior. In lower portions of the channel around and below Superior, the invasive saltcedar tree (*Tamarix*) is not an uncommon sight. In the upland portions of the watershed the conditions are cool and moist enough to support areas of Madrean Evergreen Woodland. This type of woodland usually occurs below montane conifer forest, and is often recognized as a transitional step to pine forests. The most common trees for this type of woodland are evergreen oaks (several species), Alligator Juniper, One-seed Juniper and Mexican Pinyon Pine.

Below this woodland the vegetation changes to a scrubland assemblage referred to as Interior Chaparral. Arizona chaparral is normally found at mid-elevations of 3,445 to 6,560 feet. Shrub Live Oak is the most prevalent chaparral species and sometimes occurs in almost pure stands. It is more commonly found with shrubs like Birchleaf Mountain-mahogany, Skunkbush Sumac, Silktassel Bush, Wright Silktassel, and Desert Ceanothus, all of which may locally become the dominant vegetative component if the proper conditions are present. Hollyleaf Buckthorn, Cliffrose, Desert Olive, Arizona Rosewood, Lowell Ash Barberry and Manazanita are all less common, but are still considered an important component of Arizona chaparral. At the lower boundaries of the chaparral component lies the Sonoran Desertscrub community. The Sonoran Desertscrub region has been subdivided by Shreve (1951) into seven distinct components, two of which are present in the project area: Arizona Upland and Lower Colorado River Valley. Arizona Upland covers the majority of the lower Queen Creek project area. This biotic community derives its name from the fact that over 90 percent is located on broken or sloping ground, and on multi-dissected sloping plains commonly found in the transition zone between Interior Chaparral and

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Sonoran Desertscrub. Within the Queen Creek project area two differing sub-divisions of the Arizona Upland occur, the Paloverde-Cacti-Mixed scrub series and the Jojoba-mixed Scrub series. Below the Arizona Upland community at the lowest elevations of the Queen Creek valley is the Lower Colorado River Valley subdivision. This community is normally found on the broad, flat, dry floor of the valley and occurs in two sub-divisions: the Creosote-White Bursage series and the Saltbush series. Creosote bush does tend to intrude on the slopes depending on moisture availability, while White Bursage tends to be limited to the valley floor. Dry drainages found within the Sonoran Desertscrub tend to be areas of water accumulation, and are usually areas where less xeric types of plants such as Seepwillow can be found.

Wildlife includes rock, cactus and canyon wrens, verdins, gnatcatchers, and white-winged and mourning doves. Beechey ground squirrel, desert cottontail, black-tailed jackrabbit, raccoon, gray fox, stripped skunk, deer and javelina have been observed near Queen Creek (Jones & Stokes, 2000).

2.7 Land Cover and Use

USGS data indicates that shrub and brush rangeland total 97.51 percent of the watershed area. Some of the more common sources of copper, including strip mines, quarries, and gravel pits, only make up 0.03 percent of the watershed area. **Table 2** breaks down the various land types and use classifications according to the USGS National Land Cover Dataset.

Table 2. Land Use Classification of the Queen Creek TMDL project watershed

Land Use	Total Area, meter^2	Total Area, mile^2	Percentage
Shrub & Brush Rangeland	237,129,864.7	91.56	97.51%
Residential	2,267,111.4	0.88	0.93%
Industrial	1,759,441.9	0.68	0.72%
Evergreen Forest	980,544.1	0.38	0.40%
Commercial & Service	400,335.2	0.15	0.16%
Other Urban Or Built-Up Land	164,889.8	0.06	0.07%
Transportation & Communication & Utility	163,375.1	0.06	0.07%
Bare Exposed Rock	127,600.6	0.05	0.05%
Sandy Areas Other Than Beaches	112,185.7	0.04	0.05%
Strip Mines & Quarries & Gravel Pits	69,994.8	0.03	0.03%
Total:	243,175,343.5	93.89	100.0%

3.0 Numeric Targets

3.1 Clean Water Act Section 303(d) List

ADEQ first listed 15050100-014A (Queen Creek – headwaters to the confluence with the Town of Superior WWTP discharge) as impaired for non-attainment of the Aquatic and Wildlife-warm water (A&Ww) designated use in 2002 due to dissolved copper exceedances. Reach 014B (Queen Creek – from the confluence with the Superior WWTP discharge to the confluence of Potts Canyon) was listed as impaired for copper in 2004. Reach 15050100-014C (Queen Creek – Potts Canyon to the Whitlow Dam), reach 15050100-1818 (Arnett Creek – headwaters to the confluence

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with Queen Creek), and the two unnamed drainages (15050100-1000 & 15050100-1843) were all listed as impaired for dissolved copper in 2010. TMDL allocations must be developed for those waters listed on the 303(d) list. TMDLs determine the amount of a given pollutant(s) that the water body can withstand without creating an impairment of that surface water's designated use(s). The most recent 305(b) report on the assessment of Arizona's surface waters (2012/2014) indicates that reaches 014A, 014B, and 014C of Queen Creek, Reach 1818 of Arnett Creek, and the two unnamed drainages remain listed as impaired for dissolved copper.

3.2 Beneficial Use Designations

ADEQ codifies water quality regulations in AAC 18-11. Designated beneficial uses, such as fish consumption, recreation, agriculture, and aquatic biota, are defined in AAC 18-11-101 and are listed for specific surface waters in AAC 18-11, Appendix B. AAC 18-11-104 describes the different designated uses that ADEQ recognizes, and how they are used for the protection of surface water quality

The designated uses for the listed reaches of Queen Creek in Arizona's water quality standards for surface waters are as follows:

014A - Headwaters to the confluence with the Town of Superior WWTP discharge at 33°16'33"/111°07'44" = Aquatic and Wildlife, warm water (A&Ww), Partial Body Contact (PBC), and Agricultural Livestock watering (AgL)

014B - Confluence with the Town of Superior WWTP discharge to the confluence with Potts Canyon at 33°17'17"/111°11'36" = Aquatic and Wildlife, effluent dependent water (A&Wedw), and PBC

014C - Potts Canyon confluence to the Whitlow Dam = A&Ww, Full Body Contact (FBC), Fish Consumption (FC), and AgL

1818 - Arnett Creek; Headwaters to the confluence with Queen Creek = A&Ww, FBC and FC

1000 - Unnamed drainage; Headwaters to confluence with Queen Creek = A&We and PBC

1843 - Unnamed drainage; Headwaters to confluence with Queen Creek = A&We and PBC

Arnett Creek and the two unnamed drainages are not currently listed in Appendix B of Arizona's surface water quality standards. In cases where a water body is not listed in Appendix B, but it is a tributary to a listed surface water, standards are determined through the application of the tributary rule found at AAC 18-11-105. The rule states that A&Ww, FBC, and FC standards apply to an unlisted tributary that is a perennial or intermittent surface water and is below 5000 feet in elevation. Arnett Creek meets the criteria in that it is spatially intermittent in lower reaches of the drainage and that its channel lies entirely below the 5000 foot elevation cut-off. AAC 18-11-105 states that the aquatic and wild life ephemeral (A&We) and PBC standards apply to an unlisted tributary that is an ephemeral water. The two unnamed drainages meet the criteria in that they only flow in response to storm water and their channels always lie above the ground water table.

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The three reaches of Queen Creek, Arnett Creek, and the two unnamed drainages are all impaired due to the exceedance of the dissolved copper standard for the Aquatic and Wildlife designated uses, even though they represent different habitat types. Aquatic and Wildlife, warm water, is defined by ADEQ as the use of a surface water by animals, plants, or other warm-water organisms, occurring at an elevation of less than 5000 feet for habitation, growth, or propagation. The A&Wedw designated use is applied to those surface waters, classified under AAC 18-11-113, that owe their existence to a point source discharge of wastewater. The A&We designated use protects those organisms that use an ephemeral water body for habitation, growth, or propagation.

3.3 Applicable Water Quality Standards

The dissolved copper standards for all the impaired reaches are total hardness based, which is expressed as calcium carbonate in milligrams per liter (mg/L). Total hardness is analyzed from the corresponding water sample and is the sum of the dissolved molar concentrations of Ca^{2+} and Mg^{2+}, the two most common divalent metal ions found in the environment. The A&Ww copper standard has both acute and chronic limits. Ephemeral water bodies are only subject to the acute criteria, because they do not experience the long term flows that are needed to define chronic exposure. Chronic criteria for dissolved copper can range from 0.18 µg/L at a total hardness of 1 mg/L to 29.28 µg/L at a total hardness of 400 mg/L. Although the two unnamed drainages meet ADEQ's definition of an ephemeral water, the A&Ww chronic dissolved copper standard is being applied to determine loading and reductions due to the fact that both drainages are direct tributaries to the main stem of Queen Creek.

3.3.1 Total Hardness Data

While reviewing the total hardness data that had been supplied by ADEQ to the modeling team it was discovered that some of the data were inaccurate. The revised total hardness data set was statistically re-analyzed and the results were used to revise two tables located within the final modeling report (The Louis Berger Group, Inc., 2013): Table 3.4; Existing Conditions 24-hour Average Dissolved Copper Concentrations (µg/L) and Table 3-6; Existing Conditions Scenario Dissolved Copper Allocation Analysis. The revised tables can be found in Section 5.3 of this report.

The original total hardness values were not used in the modeling of the dissolved copper, and the updated values do not affect the modeling results. The function of the model is to predict the amount of dissolved copper being contributed by each modeling basin, utilizing both the sampling data and the meteorological data of the entire project watershed. The historical total hardness data, and the data collected just prior to the running of the model were used to determine the average total hardness value, solely for the purpose of establishing what the average dissolved copper standard should be at the pour point of the individual modeling basin. By determining the applicable standard, a target value is confirmed, allowing the TMDL calculations to go forward.

4.0 Source Assessment

4.1 Summary of Point Sources

Omya Inc., Superior, AZ, a limestone quarry, has been operating since 1999. Its quarry is adjacent to Queen Creek in the headwaters area, approximately 3.5 miles north of Highway 60 with its processing facility located within Superior. The quarry produces limestone for use in high-grade

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food and pharmaceutical products. Omya Inc. produces approximately 100,000 tons per year of calcium carbonate with 60 percent used for industrial purposes and the remaining 40 percent for food products. Omya's Arizona Pollution Discharge Elimination System (AZPDES) Multi-sector General Permits (AZMSG) include AZMSG-63038 for the quarry site and AZMSG-63037 for the in-town processing site. Discussions with the compliance section of ADEQ have indicated that currently only the in-town site is active, processing material shipped from their operations in California.

Imerys Perlite USA, Inc., a perlite mining facility, lies approximately 2 miles south of Highway 60. The main offices for the operation are located north of Highway 60, just off of Forest Service Road 229. The facility has been operating since 1950 and covers an area of approximately 6 acres with 160 filed claims. Two artesian wells are located on the facility site and they periodically discharge into Queen Creek. Imerys currently has an MSGP, AZMSG-61700.

Resolution Copper Company is in the initial stages for the opening of its east plant operations. In 1995, exploratory drilling by the Magma Copper Company discovered the "Resolution Deposit". The deposit lies about 7,000 feet deep and has been estimated at approximately 1.7 billion metric tons, and contains approximately 1.52 percent copper. The company plans on reaching production by 2020. RCC's permits include AZMSG-63061 for the east plant operations and AZMSG-62880 for the west plant operations. The west plant operations are located just north of Superior at the site of the old Magma Copper Company. The west plant operations have an existing AZPDES permit, AZ0020389 – outfall 001 & 002. Both outfalls are permitted to discharge to Queen Creek, but do not discharge on a continual basis.

The Silver King Mine has been mining silver intermittently since 1875. The most productive years were from 1875 to 1889. For the next 100 years small scale operations would occasionally come in and work the site. The mine was inactive when the TMDL was initiated, but is currently active again. The Silver King Mine has an MSGP, AZMSG-83151. The mine site is located in the headwaters of the Silver King Wash watershed, a sub-watershed of the Queen Creek watershed. Silver King Wash flows into Queen Creek, just west of Superior near the Boyce Thompson Arboretum.

Kalamazoo Materials Inc. is a small sand and gravel mining operation that is located about 3.5 miles south, southeast of Superior. The site covers approximately 220 acres and sits at the top of an unnamed ephemeral drainage that is a tributary of the upper Arnett Creek sub-watershed. The facility currently has an MSGP, AZMSG-100816.

The Town of Superior WWTP is a publicly owned facility that receives domestic wastewater from both residential and commercial sources. Currently, the only industrial discharger that is connected to the system is the Omya processing plant. The plant's treatment process involves influent screening, grit removal, activated sludge biological treatment, solids settling in secondary clarifiers, tertiary filtration, chlorination, and de-chlorination. The sludge that is produced is processed for moisture removal through the use of drying beds before being taken from site for disposal. The current individual Arizona Pollutant Discharge Elimination System (AZPDES) permit, AZ0021199, authorizes discharges of treated effluent to Queen Creek.

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4.2 Summary of Nonpoint Sources

Nonpoint source pollution occurs as water flows through geologic features and over the lands surface. As the water flows, it picks up both natural and man-made pollutants which can then ultimately make their way into lakes, rivers, wetlands, coastal waters and groundwater sources. Sampling can sometimes show that naturally occurring sources of pollutants can be contributing in amounts that may be the major source of on-going exceedances. In other cases human activities such as road construction can expose pollutant sources, which can then become a significant source each time a rain event occurs. Certain geologic features may contain naturally high levels of a specific parameter, or parameters, which simply through the act of erosion are present in concentrations that are sufficient to trigger exceedances of the applicable water quality standards. Some common anthropogenic nonpoint sources of copper to surface waters include impacts from mining (storm water run-off, smelter deposition, etc.), copper plumbing fixtures, automobile brake pads, copper roofs and gutters, copper-containing pesticides and industrial sources such as automotive repair shops. The lack of large scale agriculture in the area means that copper-containing pesticides are not a common source for this area. Most structures in the watershed use asphalt or ceramic shingles, so copper run-off from roofs and gutters is also not a significant problem. There are a few auto repair shops located in the project watershed, but the number is small. Copper plumbing fixtures are probably present in some of the older structures, but the number of buildings and the possible contribution are unknown at this time. Copper from brake dust is also a source due to the amount of traffic that uses Highway 60 for travel, and its proximity to the channel of Queen Creek. The contribution of copper from brake dust is also unknown at this time. In this watershed the most obvious anthropogenic sources of dissolved copper are from mining impacts.

4.2.1 Agriculture

There is currently no large scale agricultural activity occurring within the Queen Creek TMDL project area.

4.2.2 Forest

Evergreen forest areas comprise only 0.40 percent of the total watershed area and are located at the higher elevations present along the northern edges of the watershed. This land is under the management of the USFS and falls completely within the boundaries of the Tonto National Forest. These areas are used more for recreation than for lumber production and are not recognized as traditional sources of copper.

4.2.3 Roads

An issue which has been researched in both California and Washington is the impact on surface waters from brake pads that contain copper. Manufacturers have utilized copper in the production of brake pads because it effectively transfers frictional heat that is produced when the brake pad makes contact with the rotor. Each time a driver applies the vehicles brakes, a small amount of copper dust is deposited on the surface of the roadway. Subsequent storm events then wash the material into the nearest drainage where it has the potential to negatively impact water quality. Unpaved roads in sparsely populated areas are not normally considered as a significant source due to light use of these roadways and a road surface that is typically graded dirt which is much more porous than a heavy-use, hard surface road. Highway 60 which runs parallel to Queen Creek

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through a good portion of the Queen Creek Canyon is subject to high traffic use at times and also has sections where the incline of the road has the potential for heavy brake use by motorists.

4.2.4 Urban/Developed

The copper impacts from the lightly developed areas in the Queen Creek watershed are slight. As noted previously, copper impacts from urban areas come mainly from water systems that utilize copper piping and from buildings that use copper in the architectural design of the house (copper roofs, etc.). Given the relative small footprint of Superior and the other small communities found in the watershed, and the low intensity of development in these areas, urban development is a minor contributor to copper issues in the project area. Recent development and future plans utilize home construction methods that are designed to minimize the influence of copper impacts.

4.2.5 Mining

The Globe-Miami Mining District has long been an area of metal mining due to the highly mineralized geology present in the area. Historically, the discovery of silver was the trigger for the mining boom in the area. The Silver King Mine, mentioned previously, operated from 1875 to 1889 and began producing again from 1918 to 1928. The amount of silver extracted during the two time frames represents a total of approximately 6.2 million troy ounces of silver. In the early 1900's the price of silver began to decline, as interest in the copper found in the area began to pick-up. In 1910, William Boyce Thompson had just purchased the Inspiration mine in Globe and was also looking at mining claims in the Superior area. After Thompson purchased the Silver Queen mining properties for 130,000 dollars, he and his partner George Gunn formed the Magma Copper Company. Magma mined copper and produced dependably for the next fifty years. In the 60's, Magma began cutting back on its production and by 1995 it had stopped production. At present the mine is owned by RCC. Small to large sized mining operations can be found within the project area, although not all are currently active. Some exist as claims yet to be worked. Those facilities with AZMSGP permits are located on private land with the exception of the open pit mine location for Omya Inc., which is located near the headwaters of Queen Creek on forest service land. The locations of mines identified by the U.S. Bureau of Mines are illustrated in **Figure 4**. The mine locations have been grouped into four categories:

DEVEL DEPOSIT – the resource has been defined and development has been initiated
EXP PROSPECT – the resource has been defined by exploration methods
PAST PRODUCER – a previously operating mineral property, where the equipment or structures have been removed or abandoned
PRODUCER – a currently operating mineral property.

An unknown number of historically old, relatively small hand dug mines exist throughout the project area. Soil samples were collected from the tailing piles of some of these old workings to try and characterize the soils and geology of these areas. The majority of these small, abandoned hand dug mines are located on USFS land. These abandoned mines that lack any type of permit coverage and/or pollution controls are good examples of nonpoint source impacts from mining. There are typically no mechanisms in place to control contributions of copper from storm events. Mines with permit coverage and BMP's in place, whether they are active or inactive, are more rightly recognized as point sources of pollutants. Mining activities have the potential to contribute as either point source or nonpoint source based on the circumstances.

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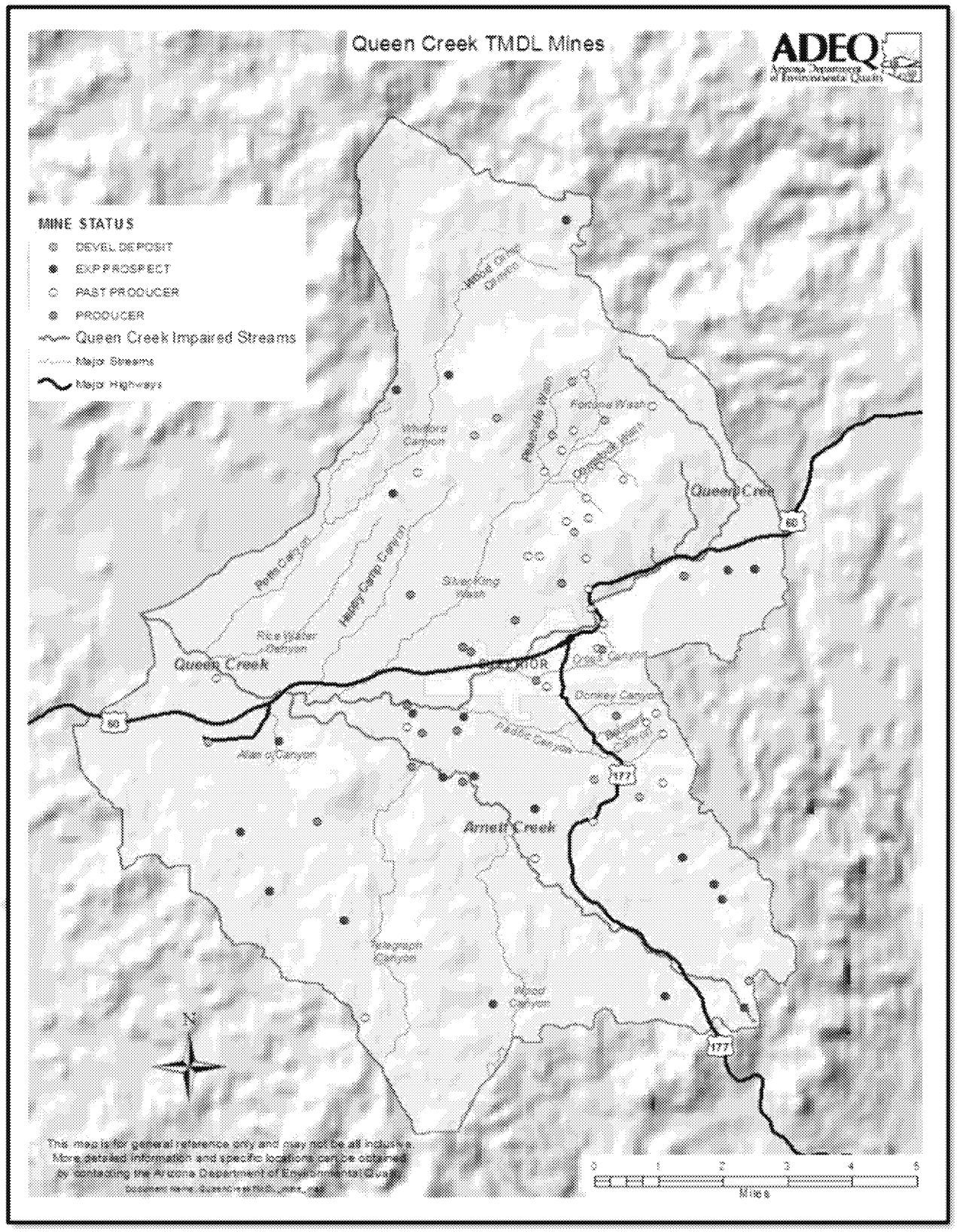

Figure 4: Documented Mine Locations within the Queen Creek Project Area

The removal of the ore and the subsequent crushing and milling process produce dust containing microscopic-sized copper particles. This dust is then spread by the movement of the wind until it ultimately settles to the ground. Subsequent storm runoff has the potential to wash the copper-contaminated dust into the nearest water body. Liquid and gaseous waste containing copper are both produced during the smelting phase of copper production. The waste water and sludge produced by the smelting process can contain traces of copper, and the extreme heat of the procedure produces gaseous emissions such as sulphur dioxide, nitrous oxide, and a number of toxic metal fumes. Deposition of particulate matter from older smelters that operated prior to being regulated for omissions has also been documented as a non-point source of copper and other metals.

Drainage or runoff from abandoned mining operations and prospect shafts can also be a contributor to nonpoint sources of copper and other metals. Tailings piles and remnants of acid leaching operations are normally the largest contributors from abandoned mining operations. Overburden material found near the mouths of prospect shafts and excavated mines are not usually as common a source for copper as tailings and waste rock material. Overburden material is typically coarse and not finely crushed like tailing and waste rock material, so it is not as easily erodible. If the overburden material does have high sulphur content the possibility of weak sulfuric acid leaching can increase as rain water flows over the material. Work around the state at various mine sites has shown that the contribution of metals from tailings piles can in some cases be significant. The active facilities have made physical changes at the sites to control storm water run-off from tailings. This typically involves physical alteration of the boundaries around the facility to stop any run-off generated on the site to be contained on the site. The number of abandoned mines in the project area is unknown, but most are small hand dug operations with a small amount of tailings usually located near the mouth.

4.2.6 Grazing

There are two grazing allotments in the project area. The Superior allotment covers an area of approximately 99 square miles and includes the lower and mid reaches of the project. The Devils Canyon allotment covers an area of about 33 square miles and encompasses most of the upper reaches of Queen Creek. Grazing impacts that accelerate erosion can lead to increased copper loading through loading of sediment into the stream. Observations of grazing impacts around the sampling sites did indicate that grazing impacts in the watershed appear to be slight, and are considered a minor source of copper loading.

5.0 Modeling of the Data

The term computer modeling is a phrase that refers to the use of a software program that is designed to simulate what might occur in a given situation based on the input of known data to help drive the simulation in the correct direction. Some computer-based models can be looking at things on a global scale, such as weather forecasting and climate change. Other types such as water quality modeling have the ability to work with large watersheds like the Amazon or Mississippi Rivers, but can also be applied to watersheds with drainage areas less than one square mile in size. Water quality models are typically designed to simulate the movement of parameters such as dissolved copper, from the source to the ultimate endpoint. In the natural environment, chemical, physical, and biological processes can affect both the transformation and the transportation of parameters such as dissolved copper. A good water quality model will have the ability to analyze the primary

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variables such as the hydraulic nature of the watershed, the potential loading sources, and the meteorological factors when simulating the fate of the parameter(s) in question. These separate factors are normally addressed within the model by individual modules that employ an algorithm to adjust factors such as air temperature versus evapotranspiration, pH changes, etc.

When personnel from ADEQ first began considering the agency's modeling approach to the Queen Creek watershed data, the decision was made to use the Hydrologic Simulation Program FORTRAN (HSPF) to simulate the hydrology and the transport of dissolved copper in the main stem of Queen Creek above sample site MGQEN030.06. This includes all of reaches 014A & 014B, and 1.3 stream miles of reach 014C. The fact that it is developed and supported by the USGS and EPA, and has been successfully applied in the TMDL analysis of complex watersheds throughout the country made it a logical choice. The modeling was also applied to those sub-watersheds of the project watershed where water quality data had been collected (ADEQ, 2010). The HSPF program is an element of the exposure assessment model developed by the USEPA referred to as the Better Assessment Science Integrating point & Non-point Sources, or BASINS (USEPA, 2001). The USEPA designed BASINS as a tool for both watershed management and TMDL development that can be used freely by any agency or organization dealing with issues of water quality. It works by incorporating a geographic information system (GIS) with data analysis and analytical modeling tools. The *ADEQ Queen Creek TMDL Modeling Report* is available for review through ADEQ. It was finalized in 2013 by the Louis Berger Group, located in Washington D.C.

The HSPF component of BASINS is a wide-ranging model dealing with watershed hydrology and water quality, which has the ability to simulate the pollutant run-off from various geologic formations within the watershed. It accounts for the specific watershed characteristics such as physical conditions, variations in rainfall and climate, etc., and it also predicts point and non-point sources of dissolved copper within the project watershed, along with the contribution of the various sources. By simulating the source and fate of dissolved copper, along with the in-stream hydraulic and sediment-chemical interactions, the modeler is able to produce a predicted time history of water quantity and quality at any point in the watershed that can be directly compared to the applicable water quality standard. Because the model has been calibrated hydrologically, the modeler is also able to predict the in-stream pollutant concentrations and loading under various hydrologic situations.

5.1 Modeling Implementation

BASINS was first utilized to delineate the watershed into 95 smaller modeling basins. The model was then able to use both the physical data and the land use data to develop a more detailed description of the characteristics of each modeling basin, which works to improve the over-all accuracy of the HSPF model. The modeling basin delineation is based on topographic characteristics, land use, and geology. The basins were created using a Digital Elevation Model (DEM), stream reaches obtained from the National Hydrography Dataset (NHD), and both stream flow and in-stream water quality data. The furthest downstream point in the modeling basin is typically referred to as the pour-point of the basin. This is the point where the model predicts the loading from the basin into the receiving surface water, based on the discharge data and the water

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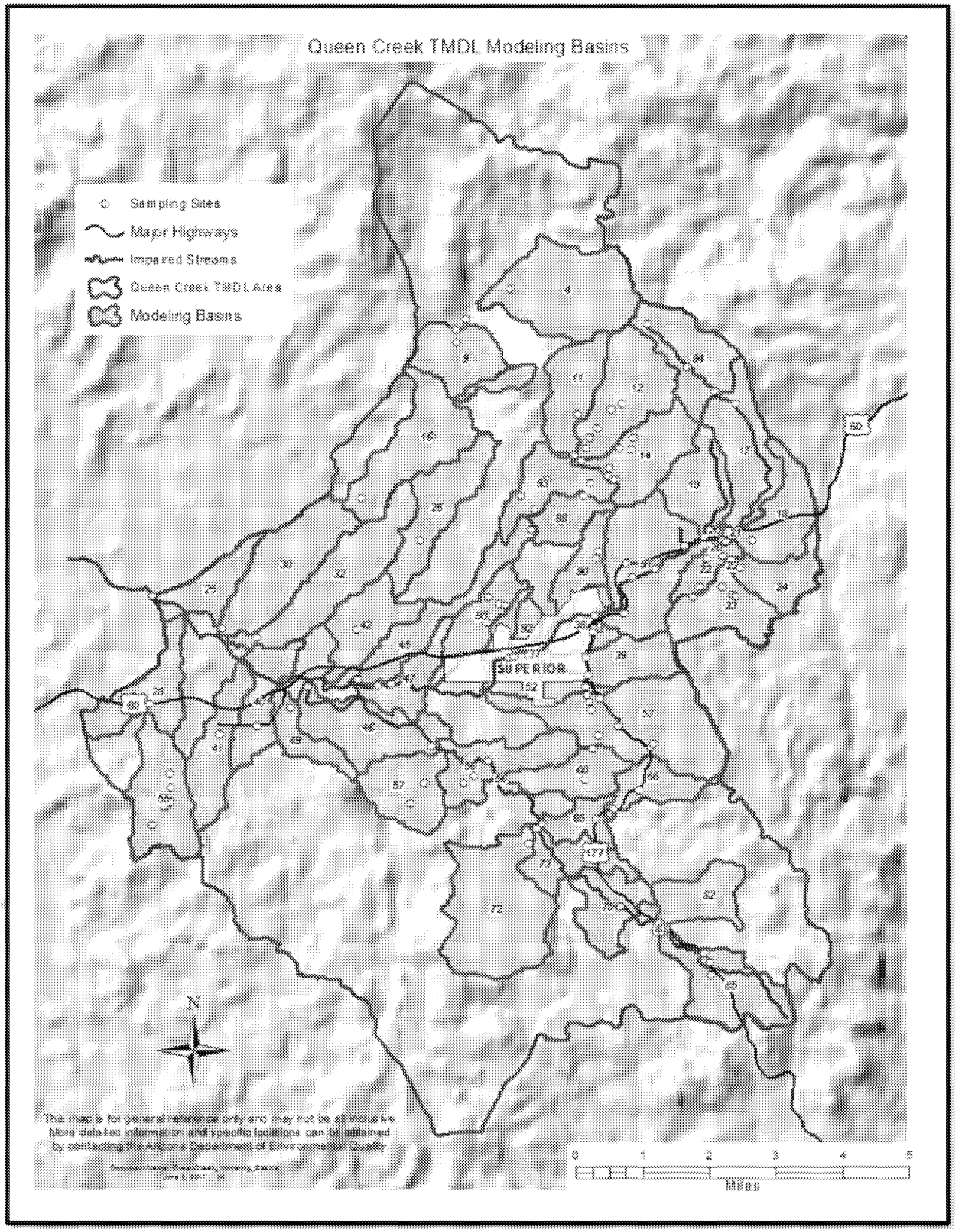

Figure 5: Modeling Basins that have Water Quality Data

quality sampling data from the sites located within the basin. **Figure 5** shows the location of those modeling basins that have available water quality data and were used in the modeling process.

5.2 Hydrologic Calibration

Once the modeling basins have been established the stream discharge data and the weather data can be utilized to establish calibration of the watershed hydrology. In hydrologic terms, Queen Creek flows tend to be storm driven and are usually short in duration. Flows in Arnett Creek tend to be similar in nature. Based on the assumption that these flows represent the normal hydrologic conditions, plus the availability of high frequency stream stage data collected by the pressure transducers stationed at sites throughout the watershed, and readily available local meteorological data, the decision was made to establish the time-step intervals for the model to be set at fifteen minutes. Calibration of the model can be a lengthy process, due to the fact that the modules which simulate different aspects of the hydrologic cycle must be continually adjusted each time the model is run. The results of the modeling runs are compared to the recorded discharges from the various sample sites to gauge the similarity between the simulated flows, and the actual observed in-stream flows. A large amount of data is needed to statistically gauge calibration results. Even though a large amount of data was collected at sites throughout the watershed, it was still not enough for statistical methods to be applicable. Visual agreement of the results must be utilized. The hydrologic calibration results for the various modeling sub-watersheds indicate acceptable visual agreement between the observed and the simulated surface water flows. Sensitivity analysis is always performed during the calibration process where input parameters are adjusted until the modeling results are acceptable, which includes agreement between the model output and the observed flow data. **Figure 6** illustrates the hydrology calibration for modeling basin # 46 – Arnett Creek, and indicates an acceptable visual agreement between observed and simulated flows.

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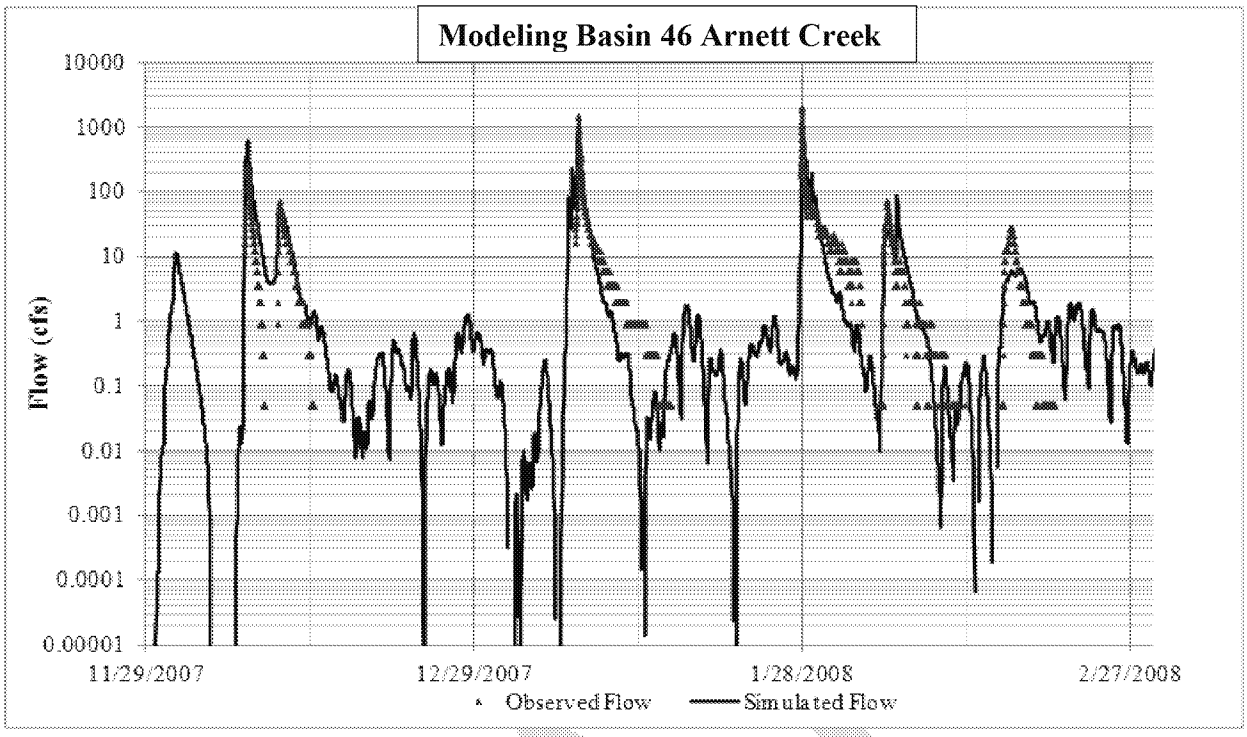

Figure 6: Observed vs Simulated Flows in Modeling Basin 46- Arnett Creek

5.3 Dissolved Copper Calibration of the Model

Calibration of dissolved copper is similar to the hydrologic calibration in that the observed in-stream sample data is compared to the simulated in-stream concentrations. In the case of dissolved copper, the modules of the model are used to simulate the sources of copper and also the environmental factors that are important in determining where in the watershed it is transported to. Like the hydrologic calibration, the dissolved copper calibration can be a time consuming process. Because the model is dealing with modeling basins of differing geologic features, run-off potentials, etc., the fate of dissolved copper can vary from one modeling basin to another. The water quality calibration proceeded from the most upstream reach (basin 94) to the furthest downstream reach (basin 25). Further modeling refinements were made at several monitoring stations (using the hard rock copper data as a guide) to achieve a better fit between observed and simulated average dissolved copper concentrations. The water quality calibrations were performed at each monitoring station located at each modeling basin outlet, and at several monitoring stations located in the main stem of Queen Creek. The calibration process compares the simulated copper time-series and the observed dissolved copper observations during the period spanning from November 29, 2007 to February 27, 2008. **Figure 7** depicts the dissolved copper calibration at modeling basin 46 – Arnett Creek, the same modeling basin sited in the previous figure. The dissolved copper calibration results from this basin and others within the project watershed indicate acceptable agreement between observed and simulated concentrations of dissolved copper.

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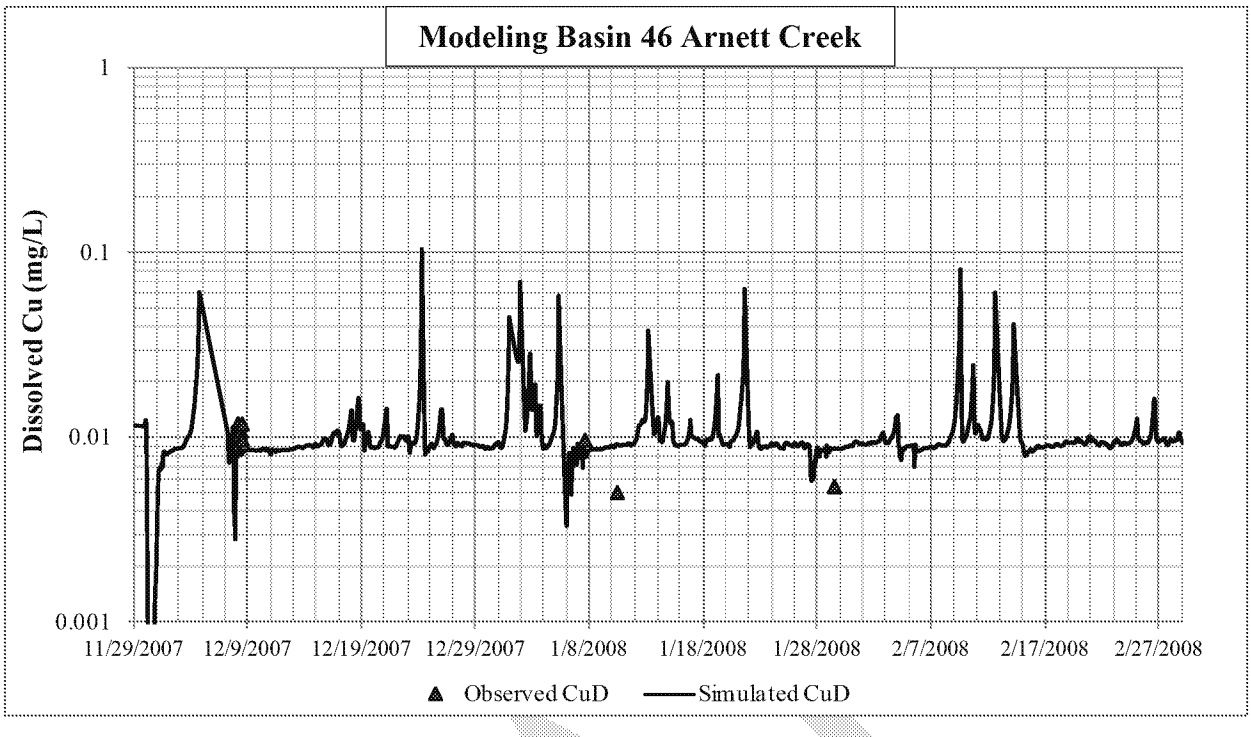

Figure 7: Observed vs Simulated Dissolved Copper in Modeling Basin 46 - Arnett Creek

5.4 Existing Conditions Scenario

When the HSPF model has been calibrated for both hydrology and dissolved copper it is then used to estimate pollutant loads under a number of different simulations. Typically the running of existing conditions scenarios is the first step in the process. An important aspect of running any type of scenario in the TMDL development process is how to define the critical conditions for a receiving waterbody. In streams like Queen Creek and Arnett Creek, critical conditions are defined as storm water run-off flows, and use an event based approach. To determine which storm type produces the highest amount of dissolved copper loading, a series of synthetic storms were modeled utilizing the calibrated hydrology and copper data. Five storm types were modeled; the 2-year 1-hour storm event typical of summer monsoon storms, and four other winter storm types: 2-year 24-hour, 10-year 24-hour, 25-year 24-hour and the 100-year 24-hour event. Each storm type has an average and maximum 24 hour flow predicted to be generated at the pour point of the various modeling basins. This data is used to calculate the loading of dissolved copper by storm type, which helps to determine the critical storm conditions used in calculating the TMDL.

Data on precipitation depths and distributions for the synthetic storms presented in **Table 3** were obtained from the National Oceanic and Atmospheric Administration (NOAA). The Soil Conservation Service (SCS) precipitation distribution type identifies whether the storm event is classified as a summer storm or a winter storm. Type II refers to summer storms, type IA refers to winter storms. In addition to rainfall data, the HSPF model requires additional data such as potential evapotranspiration, air temperature, etc.; these additional meteorological data were extracted from similar time periods from the ADEQ 2007 weather data set used for the calibration.

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Similar to the HSPF model calibration, the synthetic storm weather data was distributed to each modeling basin based on proximity to the rain gage and elevation. The synthetic storms conditions were then imposed on the calibrated HSPF model to implement the existing conditions scenario.

Table 3: Characteristics of the Synthetic Storms

Storm Event Return Period and Duration	SCS Precipitation Distribution Type	Omya Rain Gage Precipitation Depth (inches)	Boyce Rain Gage Precipitation Depth (inches)
100-yr, 24-hr	IA	6.20	4.64
25-yr, 24-hr	IA	4.89	3.67
10-yr, 24-hr	IA	4.08	3.06
2-yr, 24-hr	IA	2.78	2.08
2-yr, 1-hr	II	1.18	0.99

The resulting 24-hour average dissolved copper concentrations and the 24-hour loads are depicted for each sub-basin and synthetic storm in **Tables 4** and **5** respectively. Under each synthetic storm condition, attainment with the A&Ww chronic criteria was assessed at the pour point of each representative modeling basin using the average observed total hardness and the 24-hour average predicted copper concentration (**Table 4**).

Table 4: Existing Conditions 24-Hour Average Dissolved Copper Concentrations (µg/L)

Modeling Basins	(1)Average Hardness (mg/L)	Acute Criterion (ug/L)	Chronic Criterion (ug/L)	Existing Conditions				
				2Yr 1H	2Yr 24H	10Yr 24H	25Yr 24H	100Yr 24H
Oak Flat Basin 22	34	4.86	3.56	35.1	32.7	33.2	33.6	35.0
QC Hwy 60 Basin 17	105	14.07	9.34	20.6	18.6	18.8	18.8	19.2
QC Magma Avenue Basin 91	63	8.70	6.03	23.4	22.9	22.1	22.8	23.6
QC Mary Avenue Basin 38	106	14.20	9.41	22.3	13.5	16.9	17.3	18.6
QC blw Mine Disch. Basin 92	96	12.93	8.65	12.5	0.8	12.3	14.1	15.4
Apex Wash Basin 50	182	23.63	14.94	13.1	3.9	11.4	13.0	14.5
QC Arboretum Basin 47	358	44.69	26.63	4.7	7.0	11.5	12.6	13.7
Silver King Wash Basin 45	262	33.30	20.40	14.3	9.1	10.1	10.3	10.5
Happy Camp Canyon Basin 42	460*	49.62	29.28	10.2	10.6	13.0	14.5	15.3
Arnett Creek Basin 46	98	13.19	8.80	9.0	4.3	5.7	5.9	6.3
Alamo Canyon Basin 49	116	15.46	10.17	6.8	6.9	8.0	8.6	8.8
Potts Canyon Basin 30	129	17.08	11.13	10.6	6.0	7.3	7.3	7.4
Reymert Wash Basin 28	432*	49.62	29.28	5.7	6.8	7.8	8.5	8.9
QC Outlet Basin 25	131	17.33	11.28	14.4	12.4	12.1	12.3	12.4

Average Concentration Exceeds Chronic Criterion

* = Use cap of 400 mg/L total hardness

(1) – Average Hardness represents updated values from the original table based on a review of available total hardness data as discussed in Section 3.3.1

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The dissolved copper attainment analysis found in **Table 4** is performed at each basin outlet and across representative monitoring stations (model basins) along the Queen Creek main stem. The resulting water quality at each modeling basin outlet is considered representative of the water quality conditions within the whole sub-basin. The concentrations and loads at modeling basin 22 (Oak Flat Sub-basin) take into account all the hydrologic and water quality processes occurring in all the upstream sub-basins including modeling basins 23, and 24 that feed into modeling basin 22. Presenting the modeling results at the outlet of a sub-basin or a watershed is the recommended approach to use in watershed-based studies. (Louis Berger, 2013)

The dissolved copper concentrations and loads resulting from the five synthetic storms are presented at the outlet of each sub-basin and at several representative modeling basins in the main stem of Queen Creek including the watershed outlet (modeling basin #25). The analysis indicates that under all five synthetic storm conditions, the upper reaches (modeling basins 22, 17, 91, and 38) of Queen Creek will exhibit exceedances of the chronic dissolved copper criteria.

Table 5: Existing Conditions 24-Hour Average Dissolved Copper Loads (kg/day)

Modeling Basins	Existing Conditions				
	2Y-1Hr	2Y-24Hr	10Y-24Hr	25Y-24Hr	100Y-24Hr
Oak Flat Basin 22	0.197	0.243	1.372	2.356	3.950
QC Hwy 60 Basin 17	0.040	0.080	0.704	1.318	2.306
QC Magma Avenue Basin 91	0.259	0.330	2.220	4.166	7.573
QC Mary Avenue Basin 38	0.255	0.300	2.151	4.070	7.472
QC below Mine Discharge Basin 92	0.079	0.003	1.118	2.906	6.230
Apex Wash Basin 50	0.023	0.004	0.086	0.236	0.569
QC Arboretum Basin 47	0.008	0.001	0.352	1.549	4.861
Silver King Wash Basin 45	0.021	0.004	0.060	0.148	0.524
Happy Camp Canyon Basin 42	0.028	0.004	0.031	0.161	0.673
Arnett Creek Basin 46	0.024	0.005	0.164	0.766	2.528
Alamo Canyon Basin 49	0.017	0.003	0.025	0.116	0.484
Potts Canyon Basin 30	0.097	0.006	0.370	0.723	1.745
Reymert Wash Basin 28	0.008	0.002	0.013	0.061	0.259
QC Outlet Basin 25	0.101	0.007	0.356	1.497	6.958

Because of the significant transmission losses of flow and pollutant loads in the Queen Creek watershed, the intensity, duration, and return period of each synthetic storm affect the dissolved copper loads at downstream model sub-basins in the main stem of Queen Creek differently. **Tables 4 and 5** are used to estimate the magnitude of the allowable loads and the related load reductions required at each sub-basin outlet and modeling basin in the main stem of Queen Creek. **Table 6** presents the allowable dissolved copper loads and the corresponding reduction using the most stringent chronic criterion for dissolved copper.

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Table 6: Existing Conditions Scenario Dissolved Copper Allocation Analysis

Modeling Basins	(1)Maximum Allowable 24-Hour Load (kg)					Estimated Dissolved Copper Reductions to Comply with the Maximum Allowable Load (%)				
	2Y 1Hr	2Y 24Hr	10Y 24Hr	25Y 24Hr	100Y 24Hr	2Y 1Hr	2Y 24Hr	10Y 24Hr	25Y 24Hr	100Y 24Hr
Oak Flat Basin 22	0.020	0.026	0.147	0.249	0.402	89.9	89.3	89.3	89.4	89.8
QC Hwy 60 Basin 17	0.018	0.041	0.350	0.656	1.120	55.0	48.8	50.3	50.2	51.4
QC Magma Avenue Basin 91	0.066	0.087	0.605	1.100	1.937	74.5	73.6	72.7	73.6	74.4
QC Mary Avenue Basin 38	0.108	0.210	1.199	2.212	3.783	57.6	30.0	44.3	45.7	49.4
QC blw Mine Disch. Basin 92	0.055	0.036	0.789	1.782	3.500	30.4	0	29.4	38.7	43.8
Apex Wash Basin 50	0.026	0.015	0.113	0.271	0.588	0	0	0	0	0
QC Arboretum Basin 47	0.046	0.003	0.814	3.284	9.447	0	0	0	0	0
Silver King Wash Basin 45	0.030	0.010	0.120	0.294	1.023	0	0	0	0	0
Happy Camp Canyon Basin 42	0.079	0.007	0.072	0.330	1.289	0	0	0	0	0
Arnett Creek Basin 46	0.024	0.009	0.256	1.150	3.559	2.1	0	0	0	0
Alamo Canyon Basin 49	0.025	0.005	0.032	0.137	0.557	0	0	0	0	0
Potts Canyon Basin 30	0.103	0.011	0.569	1.108	2.636	0	0	0	0	0
Reymert Wash Basin 28	0.043	0.007	0.050	0.208	0.845	0	0	0	0	0
QC Outlet Basin 25	0.080	0.006	0.334	1.374	6.323	20.8	14.3	6.2	8.2	9.1

(1) – Loading targets represent updated values from the original table based on a review of available total hardness data as discussed in Section 3.3.1

The dissolved copper reductions presented in **Table 6** were developed using the estimated allowable dissolved copper load that will meet the most stringent criteria, and the loads developed under the existing conditions scenario. These estimated reductions address dissolved copper loads from the mining operations, soil contamination in the Oak Flat modeling basin due to historic smelter operations, and the copper loads present as natural background from normal erosion.

The existing conditions scenario modeling results indicate that dissolved copper concentrations and loads are elevated at the outlet of the Oak Flat modeling basin contributing significant dissolved copper loads to Queen Creek. It has been theorized that the elevated levels of dissolved copper are due to past emissions from mining process operations, such as historic smelting operations and elevated natural background levels contributed by the exposed volcanic tuff material which has been shown to have a high copper content (see table 3-2; The Louis Berger Group, Inc., 2013). Soil contamination in this case is suspected to be from historic smelting operations emissions that occurred at the west plant site and were carried up Queen Creek Canyon by the prevailing winds. These same winds also had the ability to carry other sources of copper, such as contaminated dust from the tailings piles, into the upper reaches of Queen Creek.

5.5 Dissolved Copper Mining Background Scenario

Once the existing conditions scenario has been used to determine what reductions are needed at the various modeling basins, the model can then be utilized to help determine the loading attributable to the suspected sources. The first suspected source of copper to be modeled was the possible contribution by past and present mining activities. To assess the contribution of the land-based mining loads, a modeling scenario was implemented using the assumption that all the land-based mining-related copper loads are eliminated in the Queen Creek watershed. **Table 7** depicts the mining-areas identified by ADEQ and included in the Queen Creek HSPF model. A total of

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772 acres, representing the footprint of abandoned, inactive, and semi-active mines, were included in the Queen Creek dissolved copper HSPF model. As the table indicates, the total mining acres make up only 1.3 percent of the watershed drainage area, a relatively small portion when considering the entire watershed. The five synthetic storms were each modeled utilizing a simulation where the copper contributions from the 772 acres located within the modeling basins listed in **Table 7** were set to zero. By turning these acres to zero contribution, the background contribution from the remaining area within the modeling basin was still being accounted for by the model. Only the background contribution from the mining area is being ignored, along with any contribution from the mining activity itself.

Table 7: Mining Areas in the Queen Creek Watershed Model

Sub-basin	Modeling Basin #	Acres
Oak Flat	22	26
Queen Creek	94	32
	91	6
	38	8
	53	11
Apex Wash	88	39
	89	176
	50	29
Silver King Wash	11	1
	12	1
	14	8
RCC Superior Wash	90	163
	36	73
	92	77
Arnett Creek	63	1
Potts Canyon	9	1
	16	1
Reymert Wash	55	119
	Total Mining Acres	**772**
	Percent of Watershed Drainage Area	**1.3%**

The results of the dissolved copper mining background scenario, expressed as a 24 hour dissolved copper load in kg per day for the modeling basins, can be seen in **Table 8.** It also illustrates the existing conditions scenario results for comparison. This scenario indicates that the dissolved copper loading from the mining areas identified within the 772 acres is not a major contributor and their complete removal will not impact the impairments predicted under the existing conditions scenario. In other words, the simulated dissolved copper mining loads are relatively small when compared to the other contributions such as the copper found in the native rock and soils, and the historic copper processing fallout in the Oak Flat sub-basin and to some extent the remnants of this same fallout in the entire Queen Creek watershed.

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Table 8: Existing Conditions and No Mining-Background Scenarios - 24-Hr Dissolved Copper Loads (kg/day)

Modeling Basins	Existing Conditions Scenario					Mining-Background Scenario Without Land-Based Mining Loads				
	2Yr 1H	2Yr 24H	10Yr 24H	25Yr 24H	100Yr 24H	2Yr 1H	2Yr 24H	10Yr 24H	25Yr 24H	100Yr 24H
Oak Flat Basin 22	0.197	0.243	1.372	2.356	3.950	0.195	0.240	1.356	2.328	3.904
QC Hwy 60 Basin 17	0.040	0.080	0.704	1.318	2.306	0.038	0.076	0.676	1.265	2.213
QC Magma Avenue Basin 91	0.259	0.330	2.220	4.166	7.573	0.255	0.324	2.175	4.083	7.428
QC Mary Avenue Basin 38	0.255	0.300	2.151	4.070	7.472	0.251	0.295	2.107	3.990	7.329
QC blw Mine Disch. Basin 92	0.079	0.003	1.118	2.906	6.230	0.077	0.003	1.096	2.843	6.080
Apex Wash Basin 50	0.023	0.004	0.086	0.236	0.569	0.004	0.001	0.013	0.037	0.091
QC Arboretum Basin 47	0.008	0.001	0.352	1.549	4.861	0.008	0.001	0.346	1.518	4.668
Silver King Wash Basin 45	0.021	0.004	0.060	0.148	0.524	0.020	0.004	0.055	0.137	0.484
Happy Camp Canyon Basin 42	0.028	0.004	0.031	0.161	0.673	0.028	0.004	0.031	0.161	0.673
Arnett Creek Basin 46	0.024	0.005	0.164	0.766	2.528	0.024	0.005	0.164	0.766	2.526
Alamo Canyon Basin 49	0.017	0.003	0.025	0.116	0.484	0.017	0.003	0.025	0.116	0.484
Potts Canyon Basin 30	0.097	0.006	0.370	0.723	1.745	0.097	0.006	0.370	0.723	1.743
Reymert Wash Basin 28	0.008	0.002	0.013	0.061	0.259	0.007	0.001	0.011	0.054	0.229

5.6 Oak Flat Dissolved Copper Scenario

One of the main issues illustrated by both the existing conditions scenario and the dissolved copper mining background scenario is that the majority of copper loading is occurring in the upper reach (014A) of Queen Creek, and more specifically from the Oak Flat modeling basin. The final copper modeling simulation run was the Oak Flat dissolved copper scenario. This scenario helps in evaluating the estimated contribution from the Oak Flat modeling basin and also helps gauge its impact on the downstream modeling basins. To run the scenario, the modules which imitate copper run-off from the Oak Flat basin were adjusted until the levels of dissolved copper at the pour point were meeting the applicable water quality standard. **Table 9** depicts the resulting simulated dissolved copper concentrations and attainment analysis under both the Oak Flat scenario and the existing conditions scenario. Reductions of the copper loads contributed by a mixture of natural background and possible copper processing fall out in the Oak Flat area will only impact those sub-basins located on the Queen Creek main stem downstream of the Oak Flat modeling basin which are noted. The table indicates that reductions of copper loads in the Oak Flat modeling basin will have a considerable impact on the downstream concentrations in the modeling basins located on the main stem of Queen Creek. It also illustrates that the reduction in copper from the Oak Flat basin is not significant enough to be the only cause of the impairment in the upper segments of Queen Creek. Even though the model predicts decreases in the 24-hour average concentrations in the modeling basins downstream of the Oak Flat basin (modeling basins 91, 38, and 92), the predicted levels are still not meeting the applicable water quality standards. It should be noted that basins 22, 91, 38 and 92 typically have lower total hardness values when compared to other modeling basins in the project watershed. The lower the average total hardness for the modeling basin, the stricter the applicable dissolved copper chronic criteria for waters with the A&W designated use.

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Table 9: Existing Conditions and Oak Flat Scenarios - 24-Hr Average Dissolved Copper Conc (µg/L)

Modeling Basins	Existing Conditions Scenario					Oak Flat Scenario - Without Smelter Fallout & Background Loads				
	2Yr 1H	2Yr 24H	10Yr 24H	25Yr 24H	100Yr 24H	2Yr 1H	2Yr 24H	10Yr 24H	25Yr 24H	100Yr 24H
Oak Flat Basin 22	35.1	32.7	33.2	33.6	35.0	2.72	2.71	2.76	2.78	2.90
QC Hwy 60 Basin 17	20.6	18.6	18.8	18.8	19.2	20.6	18.6	18.8	18.8	19.2
QC Magma Avenue Basin 91(1)	23.4	22.9	22.1	22.8	23.6	15.7	9.7	11.5	11.7	11.9
QC Mary Avenue Basin 38(1)	22.3	13.5	16.9	17.3	18.6	14.3	5.8	8.9	9.4	10.0
QC blw Mine Disch. Basin 92(1)	12.5	0.8	12.3	14.1	15.4	11.0	0.8	6.6	8.0	8.9
Apex Wash Basin 50	13.1	3.9	11.4	13.0	14.5	13.1	3.9	11.4	13.0	14.5
QC Arboretum Basin 47(1)	4.7	7.0	11.5	12.6	13.7	4.3	7.0	6.5	8.0	9.2
Silver King Wash Basin 45	14.3	9.1	10.1	10.3	10.5	14.3	9.1	10.1	10.3	10.5
Happy Camp Canyon Basin 42	10.2	10.6	13.0	14.5	15.3	10.2	10.6	13.0	14.5	15.3
Arnett Creek Basin 46	9.0	4.3	5.7	5.9	6.3	9.0	4.3	5.7	5.9	6.3
Alamo Canyon Basin 49	6.8	6.9	8.0	8.6	8.8	6.8	6.9	8.0	8.6	8.8
Potts Canyon Basin 30	10.6	6.0	7.3	7.3	7.4	10.6	6.0	7.3	7.3	7.4
Reymert Wash Basin 28	5.7	6.8	7.8	8.5	8.9	5.7	6.8	7.8	8.5	8.9
QC Outlet Basin 25(1)	14.4	12.4	12.1	12.3	12.4	14.4	12.4	12.1	11.7	11.7

Exceeds Chronic Criterion

(1) Those modeling basins of Queen Creek that are downstream of the Oak Flat basin

Table 10: Existing Conditions and Oak Flat Scenarios - 24-Hr Dissolved Copper Loads (kg/day)

Modeling Basins	Existing Conditions Scenario					Oak Flat Scenario				
	2Yr 1H	2Yr 24H	10Yr 24H	25Yr 24H	100Yr 24H	2Yr 1H	2Yr 24H	10Yr 24H	25Yr 24H	100Yr 24H
Oak Flat Basin 22	0.197	0.243	1.372	2.356	3.950	0.016	0.020	0.113	0.194	0.325
QC Hwy 60 Basin 17	0.040	0.080	0.704	1.318	2.306	0.040	0.080	0.704	1.318	2.306
QC Magma Avenue Basin 91(1)	0.259	0.330	2.220	4.166	7.573	0.078	0.115	0.975	2.021	3.976
QC Mary Avenue Basin 38(1)	0.255	0.300	2.151	4.070	7.472	0.077	0.102	0.936	1.966	3.922
QC blw Mine Disch. Basin 92(1)	0.079	0.003	1.118	2.906	6.230	0.031	0.003	0.477	1.460	3.489
Apex Wash Basin 50	0.023	0.004	0.086	0.236	0.569	0.023	0.004	0.086	0.236	0.569
QC Arboretum Basin 47(1)	0.008	0.001	0.352	1.549	4.861	0.007	0.001	0.126	0.763	2.967
Silver King Wash Basin 45	0.021	0.004	0.060	0.148	0.524	0.021	0.004	0.060	0.148	0.524
Happy Camp Canyon Basin 42	0.028	0.004	0.031	0.161	0.673	0.028	0.004	0.031	0.161	0.673
Arnett Creek Basin 46	0.024	0.005	0.164	0.766	2.528	0.024	0.005	0.164	0.766	2.528
Alamo Canyon Basin 49	0.017	0.003	0.025	0.116	0.484	0.017	0.003	0.025	0.116	0.484
Potts Canyon Basin 30	0.097	0.006	0.370	0.723	1.745	0.097	0.006	0.370	0.723	1.745
Reymert Wash Basin 28	0.008	0.002	0.013	0.061	0.259	0.008	0.002	0.013	0.061	0.259
QC Outlet Basin 25(1)	0.101	0.007	0.356	1.497	6.958	0.101	0.007	0.356	1.218	5.867

(1) Those modeling basins of Queen Creek that are downstream of the Oak Flat basin

Table 10 shows the 24-hour dissolved copper loads predicted under both the existing conditions scenario and the Oak Flat dissolved copper scenario. **Table 11** summarizes the percent contribution of dissolved copper loading by the five different storm types in the Oak Flat modeling basin and the modeling basins located downstream.

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Table 11: Oak Flat Scenarios - Smelter Fallout & Background Dissolved Copper Load Contribution

Modeling Basins	2Y-1H	2Y-24H	10Y-24H	25Y-24H	100Y-24H
Oak Flat Basin 22	91.7%	91.7%	91.3%	91.3%	91.8%
QC Hwy 60 Basin 17	0.0%	0.0%	0.0%	0.0%	0.0%
QC Magma Avenue Basin 91(1)	69.7%	65.2%	55.8%	51.2%	47.5%
QC Mary Avenue Basin 38(1)	70.0%	66.0%	56.2%	51.5%	47.5%
QC below Mine Disch. Basin 92(1)	60.6%	0.0%	57.1%	49.5%	44.0%
Apex Wash Basin 50	0.0%	0.0%	0.0%	0.0%	0.0%
QC Arboretum Basin 47(1)	10.6%	0.0%	63.9%	50.5%	39.0%
Silver King Wash Basin 45	0.0%	0.0%	0.0%	0.0%	0.0%
Happy Camp Canyon Basin 42	0.0%	0.0%	0.0%	0.0%	0.0%
Arnett Creek Basin 46	0.0%	0.0%	0.0%	0.0%	0.0%
Alamo Canyon Basin 49	0.0%	0.0%	0.0%	0.0%	0.0%
Potts Canyon Basin 30	0.0%	0.0%	0.0%	0.0%	0.0%
Reymert Wash Basin 28	0.0%	0.0%	0.0%	0.0%	0.0%
QC Outlet Basin 25(1)	0.00%	0.00%	0.01%	18.6%	15.7%
Total All Segments	50.9%	64.2%	50.6%	44.2%	35.8%

(1) Those modeling basins of Queen Creek that are downstream of the Oak Flat basin

The numbers presented in **Table 11** indicate that the Oak Flat dissolved copper loads make up a significant proportion of the loads at the basins located downstream on the main stem of Queen Creek (modeling basins 91, 38, 92, and 47). Under the low return-interval type storms (2 year-1-hour and 2 year-24-hour) the copper loads from the Oak Flat modeling basin are not transported all the way down to the outlet of the watershed (modeling basin 25). Under the 10-year 24-hour storm the Oak Flat dissolved copper load has an insignificant impact on the load in the outlet of the watershed. Under the higher frequency storms (25-year 24-hour and 100-year 24-hour) the contribution of the Oak Flat dissolved copper load constitutes 16 to 19 percent of the dissolved copper load at the outlet of the Queen Creek watershed.

The Oak Flat scenario addressed the contribution of the anthropogenic contamination of the soils in the Oak Flat modeling basin and highlighted the magnitude of these loads and their impact on the downstream segments in the Queen Creek watershed. The conclusion that can be drawn from the Oak Flat scenario is that the copper content found in the soil and rocks of various locations other than the Oak Flat modeling basin, are still significant enough to cause exceedances of the dissolved copper criteria. The Mining-Background scenario indicated that the dissolved copper mining loads transported at the outlet of the sub-basins and in the main stem of Queen Creek are not a significant source of copper in the watershed.

Based on the implementation of the various dissolved copper scenarios, it is apparent that the copper content in soils and rocks is the dominant factor causing the exceedances of the dissolved copper criteria in the various segments of the Queen Creek watershed. This copper content in soils and rocks is believed to be a combination of the natural copper content of the local geology and the historic copper processing fallout present in the Queen Creek watershed.

6.0 TMDL Calculations

The term TMDL is defined as the maximum quantity of a parameter, in this instance dissolved copper, which a surface water can receive without exceeding the water quality standards for the

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applicable designated uses supported by the water body. As observed in the previous discussion of the modeling approach, when calculating the maximum loading value of a pollutant the quantities are normally referenced as kilograms per day (kg/day). These daily loads are normally determined using the average daily flow in cubic feet per second (cfs) and the average daily concentration of the parameter in question. The averages for the two factors are determined by utilizing all the available flow data and all dissolved copper data documented within the modeling basin. The formula for determining a TMDL is:

$$TMDL = \sum WLA + \sum LA + NB + MOS$$

$\sum$WLA: The sum of the waste load (point source) allocations

$\sum$LA: The sum of the load (nonpoint source) allocations

NB: Natural background levels

MOS: Margin of safety

6.1 Critical Conditions

Storm water run-off, or storm flow, constitutes the critical loading conditions to the intermittent and effluent dependent reaches of Queen Creek, and Arnett Creek. Storm flow also makes up the critical loading conditions for the ephemeral reaches of the unnamed drainages. The important issue is to determine which storm type contributes the highest level of dissolved copper loading. **Table 4** from the discussion of the existing conditions scenario illustrates that the critical loading conditions occur during run-off from the 2-year 1-hour type storm. Dissolved copper concentration results from the 100-year 24-hour storm type are almost identical when comparing the sums and the averages of the modeling basins with the 2-year 1-hour storm type. Overall, in those modeling basins where the dissolved copper levels are exceeding the chronic criterion, the majority are being affected more by the input from the 2-year 1-hour storm type than from any of the other storm types that were used in the existing condition scenario. Linking the TMDL analysis to the 2-year 1-hour storm type also makes any effectiveness monitoring that may occur later in the project easier to conduct. The 2-year 1-hour type storm (average of 1.08 inches) (National Oceanic and Atmospheric Administration, 2011) is common during summer monsoon season periods when the probability of a heavy, but short-lived storm will occur every year is 50 percent. The 100-year 24-hour storm type (average of 5.18 inches) (National Oceanic and Atmospheric Administration, 2011) typically has a longer return period between occurrences, which makes monitoring for the effects of this storm type more problematic.

6.2 Margin of Safety

The calculation of a TMDL looks at the contributions from the various point and nonpoint sources. It also includes a margin of safety (MOS) that is designed to address uncertainties in the TMDL process. If the MOS is allocated a numeric portion of the TMDL, it is referred to as an explicit MOS. An implicit MOS is commonly addressed by making environmentally conservative assumptions when calculating the TMDL. For the Queen Creek TMDL the largest source of

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dissolved copper is believed to be a nonpoint mix of natural background and deposition from the by-products of the copper extraction process. Applying an explicit MOS would be difficult in this project when the fractions contributed by each are unknown. However, the use of an explicit MOS to account for the impact of future sources associated with the expansion of mining activity in the area is applicable. Because much of the infrastructure is currently in place, the expansion will not have the impact that a new mine would have. Impacts from new roads, increased traffic and an increase in the population of the town are some of the expected future sources. The Queen Creek TMDL will adopt a 5 percent explicit MOS that will be applied solely to impacts from future growth within the watershed. An implicit MOS will be applied to the current sources and the predicted modeling impacts from dissolved copper.

While some Arizona TMDL projects that rely on storm water run-off can have trouble collecting a sufficient amount of data, the Queen Creek project was fortunate to have a number of both summer and winter type storms present during the data collection period for the model. A large number of both grab and automated samples were collected during this time frame. The data that was collected was then checked using established ADEQ quality assurance quality control (QAQC) procedures to verify that it was valid and of good quality. As noted in the prior discussions of the model calibration for both hydrology and dissolved copper, the results for the various reaches indicates acceptable agreement between the observed data and the modeled simulations.

As previously noted, an implied MOS is addressed through the use of various conservative assumptions within the framework of the model that are applied during the different modeling scenarios. A conservative assumption typically over estimates the concentration or loading of a parameter during the running of the various modeling scenarios. Listed below are the conservative assumptions that have been identified in the running of the HSPF model for the Queen Creek TMDL:

- **The Use of Chronic Criteria Versus Acute Criteria**

By applying the chronic criteria as the concentration that must not be exceeded within the different reaches of Queen Creek, the model is assuming the most stringent applicable dissolved copper criteria. As discussed previously, the hydrology of Queen Creek is primarily driven by storm water run-off. Other than the flow below the WWTP discharge, the only other extended flows of any type are short spatially intermittent stretches located in the upper reaches of the Queen Creek Canyon area. Even though these stretches may flow long enough that they cannot be defined as ephemeral, most will occasionally dry up during the year. However, storm flows may extend longer than four days. The application of chronic criteria is a more conservative approach than applying the acute criteria, which are typically 1.5 times greater than the applicable chronic criteria.

- **Overestimation of the Contribution from Small, Abandoned Mines**

During the process of identifying the various nonpoint sources of dissolved copper, the contribution from historic, mainly hand-dug mines was addressed. A few of the many locations were physically inspected by members of ADEQ who were involved in data collection for the TMDL. This allowed for a visual inspection of the disturbed area around the mine site. In the majority of cases the mines were identified using satellite images of the project watershed. The most accurate method of defining the disturbed area would be to either physically survey each

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mine site, or to delineate by hand using ArcMap software. Because of the large number of these types of mines identified in the project area, both approaches would have been difficult to perform given both the amount of work and time involved. To assess the impacts from these mines an approach was used that attempted to customize the disturbance footprint of some of the larger mines and also some of the mines that represented the most average size observed throughout the watershed. Areas of disturbance were created that would adequately assess the impacts from both large and average sized abandoned mines. The disturbance area for anything larger than an average size mine utilized the area determined for large mines. The disturbance area for mines meeting the definition of average or smaller used the footprint determined to fit the average size mine. By using this approach, the area of disturbance for some mines would be relatively accurate for fairly large and average size mines. For the majority of mine sites that do not fit into either category, the applied area of disturbance will be larger than the actual area of disturbance, resulting in over estimation of the dissolved copper being contributed by the disturbed areas around the mines.

- **Using the Average Flow Versus the Maximum Flow of the Synthetic Storms**

When running the scenarios to determine the loading of dissolved copper for the different modeling basins, the average flow generated by the five storms during a 24 hour period was used instead of the maximum flow generated by the storms during the same 24 hour period. The maximum flow generated represents the greatest discharge that can be produced at the pour point of the modeling basin based on the various attributes of the modeling basin. The concentrations of dissolved copper are typically going to be higher at the average flow due to the higher amount of dilution taking place at the maximum flow. The loading of dissolved copper occurs at a higher rate using the average flow because of the dilution present at the maximum flows. This conservative approach to flow types allows for the loading to be calculated utilizing the flow type with the higher concentration of dissolved copper.

- **Applying Rainfall Gathered at the High Elevation Gauge to the Entire Watershed**

Rainfall data was collected from two sources maintained by ADEQ and also from a gauge maintained by the RCC, located at the west plant site near Superior. When applying the rain gauge data to the model for the hydrologic and the dissolved copper calibration/validation, the rain gauge data from the upper elevation site was applied to the entire watershed down to the valley floor. The rainfall amounts at the upper gauge were larger than the other two sites, so by applying the larger amount to the calibration/validation simulations the model produces dissolved copper run-off concentrations that are higher than normally seen under real world conditions where the rainfall amounts in the mid to lower elevations of the watershed are typically going to be less than in the upper elevations. The predictive simulations utilize a synthetic weather record. As discussed previously, its base is a portion of the weather data from the calibration/validation period, but then the weather data is modified by "splicing-in" the five different design storm events.

6.3 TMDL Loads and Allocations

As noted previously, there are three reaches of Queen Creek, one reach of Arnett Creek, and two unnamed reaches that are located within the project area, all are impaired for dissolved copper:

1) 014A – Queen Creek; headwaters to the Superior WWTP outfall at 33°16'33''/111°07'44''
2) 014B – Queen Creek; Superior WWTP outfall to confluence with Potts Canyon

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3) 014C – Queen Creek; Potts Canyon confluence to the Whitlow Dam
4) 1818 – Arnett Creek; headwaters to the confluence with Queen Creek
5) 1843 – Unnamed Drainage; headwaters to the confluence with Queen Creek
6) 1000 – Unnamed Drainage: headwaters to the confluence with Queen Creek

Although both 014A and 014C are large in stream miles compared to reach 014B, only about 1.25 miles of 014C is actually located in the project area. This includes the stream segment from Potts Canyon to the pour point of modeling basin 25. TMDLs have been calculated for the three points on Queen Creek that correspond to the changes in reach numbers, and also for Arnett Creek, and for the two unnamed drainages. Because there are no modeling basins for reach 014B of Queen Creek below basin 47 (QC Arboretum; **Table 11**) that have associated water quality data, the calculated TMDL for modeling basin 25 (QC Outlet; **Table 11**) will be applied to reach 014B and reach 014C of Queen Creek. The modeling work has shown that the main impacts are occurring within the upper reaches of Queen Creek, and field work has verified that there are no activities besides grazing that contribute to dissolved copper loading (through increased erosion), below the confluence of Potts Canyon. The required load reduction will allow both segments to attain the applicable dissolved copper water quality standards, so the application to both reaches is an acceptable approach.

6.3.1 Waste Load Allocations

Point source discharges to surface waters in Arizona are required to obtain an AZPDES permit. The permit establishes effluent limitations for pollutants discharged by the facility. The permit also stipulates the monitoring requirements that the facility must adhere to. At present there are two individual AZPDES permits, eight MSGP permits, and one MS4 permit located within the Queen Creek TMDL project watershed. There are also currently eleven facilities with Construction General Permits (CGP) within the TMDL project watershed. **Table 12** contains the names of permitted facilities within the project area, their permit number, the type of permit, and the type of WLA that the facility is required to meet. This can be either concentration based, which is referred to as a Water Quality Based Effluent Limit (WQBEL), or mass based. CGP permitted facilities are not listed in **Table 12** due to the fact that they are typically short-lived. Listing those that are current now may not accurately reflect what will be current when the TMDL has been finalized. Although CGP permits are not listed, current permits must meet a WQBEL waste load allocation. WQBELs are discussed in more detail in section 6.3.1.2.

ADEQ will assign load allocations, rather than waste load allocations, for the inactive and abandoned mine site sources located within the watershed that do not have permit coverage. If future data and information provide for the application of permit coverage to these mines then the mass based LAs assigned will be converted to WLAs and incorporated as WQBELs using the methods outlined in the EPA's *Technical Support Document for Water Quality-based Toxics Control* (TSD) (EPA, 1991). Such conversions must conserve or reduce loadings. Increases to loadings will require revision and resubmission of the TMDL for approval. Where inactive and abandoned mine sites meet the non-point source grant criteria, then Clean Water Act 319(h) funds may be available through the ADEQ Water Quality Improvement Grant Program. The CWA §319 grant funds from the EPA through ADEQ can be used for remediation purposes of non-point sources where, mining and extraction has ceased, mining will not foreseeably be restarted, and

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management projects will be maintained. Per grant condition, installed BMP's "shall be operated and maintained for the expected lifespan of the specific practice and in accordance with commonly accepted standards." Point source discharges will still receive a WLA and ADEQ will apply its full suite of regulatory tools to address the impacts from each site.

Table 12: Active AZPDES Permits

FACILITY	PERMIT NUMBER	PERMIT TYPE	WASTE LOAD ALLOCATION
Resolution Copper, LLC; Superior operations	AZ0020389 – outfall 001 & 002	Individual AZPDES	WQBEL
Town of Superior WWTP	AZ0021199 – outfall 001	Individual AZPDES	Mass Based = 0.024 kg/day
Resolution Copper, LLC; east plant operations	AZMSG-226925	MSGP	WQBEL
Resolution Copper, LLC; west plant operations	AZMSG-226848	MSGP	WQBEL
Imerys Perlite USA, Inc.	AZMSG-226183	MSGP	WQBEL
Omya Arizona	AZMSG-226914	MSGP	WQBEL
Omya Arizona; Quarry	AZMSG-226915	MSGP	WQBEL
Gila Rock Products, LLC	AZMSG-232797	MSGP	WQBEL
Silver King Mine	AZMSG-232850	MSGP	WQBEL
Kalamazoo Materials, Inc.	AZMSG-234018	MSGP	WQBEL
Arizona Department of Transportation	AZS000018-2015	MS4	WQBEL

6.3.1.1 Mass Based WLAs

Currently the Superior WWTP is the only facility of the two individual AZPDES permittees that has an outfall which discharges on a continual basis. As a result of its continual discharge, it is the only permitted mass based WLA within the Queen Creek TMDL project area. As noted in **Table 12**, the facility has one outfall. The confluence of the WWTP effluent discharge and Queen Creek marks the point at which the aquatic and wildlife designated uses change from A&Ww to A&Wedw, and it is also the point where reach 014A becomes reach 014B. The WLA of 0.024 kg/day for reach 014B of Queen Creek was derived by using the permitted monthly dissolved copper average of 8.6 µg/L, the maximum design discharge capacity of 0.75 MGD (= 1.16 cfs average/24 hours), and a conversion factor of 0.002445. Discharge records for January 2015 to April 2016 indicate an average monthly flow of approximately 173,000 gallons per day, or approximately 23 percent of the maximum design discharge capacity.

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Resolution Copper has two outfalls covered by permit number AZ0020389. Outfall 001 is designed to be used as an emergency discharge release point only in the event that the holding capacity of the storm water holding facility is exceeded. On-site holding ponds at the west plant site contain storm water run-off from the facility, and are designed to withstand up to and including a 100-year, 24-hour type storm. If a storm event were to occur that had capacity to overwhelm the system, the 001 outfall would be used to discharge the run-off into Queen Creek. Outfall 002 is the discharge point for the mine's treated wastewater system. The treated wastewater is a by-product of pumped water from the East Plant location. This treated wastewater is normally used by irrigation districts in the Florence area. The 002 outfall is for the discharge of treated wastewater into Queen Creek on those occasions when the irrigation districts are unable to take the water. Because neither outfall is designed to discharge on a continual basis, the Resolution Copper outfalls are not assigned a mass based WLA, and are therefore subject to a concentration based WLA, as described in the following section.

Future WLAs for new or expanded individual AZPDES permits will be based upon the applicable chronic dissolved copper WQS and will be applied as WQBELs calculated using the methods outlined in the EPA *Technical Support Document for Water Quality-based Toxics Control* (TSD) (EPA, 1991).

6.3.1.2 Concentration Based WLAs

Concentration based WLAs will be applied, as a WQBEL, to all existing and future permittees covered under all sectors of the MSGP, CGP, and MS4 permits. Both the AZPDES Industrial Stormwater (MSGP) and the AZPDES Industrial Stormwater Non-Mining MSGP address run-off from operations that may have the potential to negatively impact surface water quality. MS4 permits aid in the management of stormwater runoff from urbanized areas into surface waters. For the permittees listed in **Table 12** with either an MSGP permit or an MS4 permit, the WLA will be based upon the applicable hardness based aquatic and wildlife chronic copper standard of the receiving water according to AAC R18-11 Appendix A, Table 11. The same WLA conditions will apply to the individual AZPDES permit for Resolution Copper. As mentioned previously, **Table 12** does not list the AZPDES CGPs associated with construction activity mainly due to the fact that these type of permits are normally short lived. This type of permit addresses storm water discharges from construction activities that have the potential of entering a surface water of the state. CGPs would also be required to meet concentration based WLAs for discharges that leave the site. As with MSGPs, the WLA will be also be based upon the applicable aquatic and wildlife chronic copper standard as dictated by the total hardness value of the receiving water.

Permittees can demonstrate compliance with the WLA by either direct sampling of outfall discharges or demonstrate that best management practices quantitatively reduce the discharge of pollutants to a level that meets the WQBEL. If sample results exceed the WLA, permittees should evaluate the effectiveness of BMPs, modify or implement new BMPs, or provide additional measures to improve water quality.

The discussion of the existing conditions scenarios in Section 5.4 involved analysis of whether the acute and chronic criterion were being met at the pour point of the modeling basins during each of the storm types. This also required the application of the average total hardness for the sampling data collected within the basin. An analysis of the average total hardness of the sub-basins used in

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the modeling of the Queen Creek water quality data demonstrates that as you move from the headwaters of the drainage to its mouth, the hardness increases. This is typical in most drainages that originate in mountainous terrain and flow into alluvial fill valleys. As the slope of the channel decreases, water velocity slows and the rate of sediment deposition increases. The total hardness levels increase as the water flows through more porous substrate, accumulating greater amounts of dissolved solids. **Table 13** illustrates the average total hardness for each reach of Queen Creek. The numbers were derived by determining which modeling basins make up the three separate reaches of Queen Creek and then using the total hardness measured under storm conditions. The results show that the application of WQBELs will be stricter in the upper reach of Queen Creek (014A) where the total hardness values are lower than the downstream reaches. This guarantees that daily loading requirements will not be exceeded in reaches 014B and 014C, where hardness values will be higher resulting in less strict WQBELs for permittees. Even though the total hardness in 014C is only slightly higher than 014B, the same situation is applicable, discharges by a permittee to 014B would still be stricter than if the discharge were to reach 014C.

Table 13: Average Total Hardness by Reach (Queen Creek)

	Reach 014A	**Reach 014B**	**Reach 014C**
Average Total Hardness; mg/L	98	123	131

Permittees must demonstrate compliance with the WLA as specified in their permits. If sample results exceed the WLA, permittees should evaluate the effectiveness of BMPs, modify or implement new BMPs, or provide additional measures to improve water quality.

6.3.2 Load Allocations

Once the WLAs have been established, the LA can be calculated. As previously noted, the TMDL is equal to the sum of the WLAs (point source), the MOS, NB, and the sum of the LAs (nonpoint sources). In the case of the Queen Creek TMDL, there is no method to differentiate what the amount of NB dissolved copper is versus what amount is due to historical nonpoint mining impacts. Because the two cannot be separated, the LA figures located in **Table 13** are essentially a combination of inputs from both nonpoint source impacts and natural background contributions. The Queen Creek TMDL has a single mass based WLA assigned to the City of Superior WWTP. For the reaches of the TMDL not impacted by this discharge (014A & 014C), the TMDL consists of the LA portion only. If discharges from MSGP facilities located within these reaches meet their concentration based WLAs, the daily loading of dissolved copper will not exceed the TMDL assigned to the reach. If any sources currently assigned load allocations are later determined to be point sources requiring AZPDES permits, the portion of the LAs applied to these sources are to be treated as WLAs for purposes of determining appropriate WQBELs pursuant to 40 CFR 122.44(d)(1). The two unnamed drainages had not been listed as impaired when the modeling for the TMDL was initiated. During the modeling of the five storm types under the various scenarios, simulated copper loading was not addressed in the two unnamed drainages. TMDL calculations

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expressed in **Table 14** for the two reaches were determined using the average values for flow, dissolved copper concentration, and total hardness that had been collected from all sampling sites located in the two drainages. Due to the lack of synthetic storm modeling simulation data on the two unnamed drainages, it is difficult to establish mass based WLAs and mass based load reductions. The best approach is to use the average total hardness value and the average dissolved copper for each drainage to represent the current existing condition and establish the reductions needed based upon the applicable downstream chronic standard for dissolved copper.

Table 14: TMDL Calculations by Surface Water Reach

REACH DESCRIPTION	REACH	TMDL[1] (kg/day)	WLA (kg/day)	LA[2] (kg/day)	5% MOS
Queen Creek: Headwaters to the confluence w/the Superior WWTP discharge (0.7 cfs)[3]	014A	0.055	0.0[(5)]	0.052	0.003
Queen Creek: Superior WWTP discharge to the confluence w/Potts Canyon (2.9 cfs)[3]	014B	0.080	0.024[(5)]	0.052	0.004
Queen Creek: Potts Canyon to the Whitlow Dam (2.9 cfs)[3]	014C	0.080	0.0	0.076	0.004
Arnett Crk: Hdwtrs to conf w/Queen Creek (1.1 cfs)[3]	1818	0.024	0.0	0.023	0.001
Unnamed Drainage (UQ2): Hdwtrs to the conf with Queen Creek (1.4 cfs)[4]	1000	0.014	0.0	0.013	0.001
Unnamed Drainage (UQ3): Hdwtrs to the conf with Queen Creek (8.4 cfs)[4]	1843	0.104	0.0	0.103	0.001

The WLAs for all reaches include the concentration based WLA described in section 6.3.1.2

1) Includes implicit margin of safety
2) The NB and LA have been summed into one allocation
3) Flow rate used in calculating the TMDL for each reach (2yr-1hr storm; 24 hr average)
4) Average flow rate used in calculating the TMDL for the unnamed tributaries
5) Includes concentration based WLAs

6.4 Load Reductions

In order for the impaired reaches of Queen Creek, Arnett Creek, and the two unnamed drainages to meet applicable water quality standards and the TMDL, reductions in the daily loading of dissolved copper must occur. The reaches and required reductions are shown in the following tables. Each table addresses the reductions needed for the individual modeling basins that

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contribute to the impaired reaches of Queen Creek, Arnett Creek, and the two unnamed drainages. **Table 15** covers Arnett Creek and the three reaches of Queen Creek, and includes the existing daily load and concentration for each basin, the target load and concentration for the basin, and the percent estimated reduction needed to meet the targets for each basin. The target concentration and target load are based on meeting aquatic & wildlife chronic dissolved copper criteria. Because the standard for dissolved copper is hardness dependent, both the target concentration and the target load are based on the average total hardness value derived from data collected at sites within the modeling basin. The table also represents the critical conditions of the 2-year, 1-hour storm type. As discussed in Section 6.3, the loading numbers for modeling basin 25 will be applied to both 014B and 014C. Because of this the load reductions required for each reach are identical. Within modeling basin 51 is the confluence of Queen Creek and the discharge from the Superior WWTP. This is the segmentation point from reach 014A to 014B, but the basin itself contains neither water quality or discharge data. Load reductions will be required at the pour point of modeling basin 92, located approximately 0.8 miles above basin 51.

Reach 014A shows the highest load reduction required of the four impaired reaches. As discussed in section 5.4, modeling of the existing conditions scenarios illustrated that the majority of the dissolved copper loading is occurring in the upper basins of reach 014A. **Table 6** of section 5.4 shows that large reductions are required above basin 92 for the 30.4 percent load reduction to be met. The load reduction required at the Oak Flat modeling basin is approximately 90 percent, about three times higher than basin 92. The necessary load reductions below the Oak Flat basin decrease as the channel moves down through the canyon, but the amount of load reduction needed at the pour point of basin 38 is 63.3 percent a figure that is twice as high as basin 92. Basin 38 is located only 0.2 miles upstream of basin 92. On the other end of the spectrum, **Table 15** illustrates how small the difference is between the existing load and the target load for Arnett Creek. The kg/day for both loads had to be expressed to four decimal places. Rounding it to three places as the other loads are expressed would have made the numbers identical. Because the two impaired unnamed drainages were not included in the various synthetic storm modeling scenarios, the estimated reductions illustrated in **Table 16** for the two drainages are based on the average total hardness of each reach.

Table 15: Load Reductions for the impaired reaches of Queen Creek and Arnett Creek

Model Description & Number	Existing Load kg/day	Target Load kg/day	Existing Conc µg/L	Target Conc µg/L	% Estimated Reduction (of daily load)
Queen Creek below Mine Disch; #92 (Reach 014A)	0.079	0.055	12.5	8.65	30.4%
Queen Creek Outlet; #25 (Reach 014B)	0.101	0.080	14.4	11.28	20.8%
Queen Creek Outlet; #25 (Reach 014C)	0.101	0.080	14.4	11.28	20.8%
Arnett Creek; #46	0.0242	0.0237	9.0	8.80	2.1%

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Table 16: Dissolved Copper Concentration Reductions for the two Unnamed Drainages

Model Description & Number	Average Total Hardness mg/L	Average Dissolved Copper µg/L	Dissolved Copper Target Concentration µg/L	% Estimated Reduction (of Avg Dissolved Copper
Unnamed Drainage (UQ2): Hdwtrs to the conf with Queen Crk; Reach – 1000	41	42	4.18	90.1
Unnamed Drainage (UQ3): Hdwtrs to the conf with Queen Crk; Reach – 1843	51	19	5.04	73.5

7.0 TMDL Implementation

Currently there are no planned remediation projects to address the issue of dissolved copper present within the project area. The modeling scenarios have suggested that the source of the high levels of dissolved copper found in the upper reaches of Queen Creek are from a combination of natural copper from the native geology and historic copper processing impacts. Although the presence of abandoned, mainly historic hand-dug mines in the watershed have not been shown to be a significant contributor of dissolved copper, the remediation of some of the larger sites would help to decrease the amount of daily loading to either Arnett Creek or Queen Creek depending on the location of the mine. ADEQ will work with the US Forest Service and private landowners to investigate and address the possible implementation of remediation projects at these abandoned mine sites.

Because the RCC's operations have the potential to be a source of copper within the Queen Creek watershed, ADEQ will implement steps to monitor dissolved copper impacts from the facilities. This will involve the annual review by ADEQ of RCC's Stormwater Pollution Prevention Plan (SWPP) for dissolved copper levels, and the tracking of stormwater BMPs as RCC progresses through the various site developments.

In an effort to determine the impact from brake dust run-off from the highway into Queen Creek, ADEQ will discuss with the Arizona Department of Transportation (ADOT) the possibility of working cooperatively to monitor outfalls covered under their MS4 permit. This would consist of intercepting stormwater runoff from paved road surfaces and collecting water quality samples to try and characterize the degree of impact from this particular nonpoint source issue.

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ADEQ will also conduct effectiveness monitoring after the plans for Resolution's east plant site have been implemented and the mine has been developed. This effectiveness monitoring will also target any other locations in the project watershed where remediation work has been performed in an effort to reduce dissolved copper loading. **Table 17** contains information regarding the anticipated milestones for the completion and implementation of the TMDL.

Table 17: Milestones for TMDL Completion and Implementation

Milestone	FY19	FY20	FY21
TMDL completed by ADEQ	X		
TMDL approved by EPA	X		
ADEQ to work with ADOT about possible cooperative monitoring of stormwater run-off from paved roads	X		
ADEQ to talk with potential grantees regarding funding for potential water quality improvement projects	X	X	
Implementation of grant funded water quality improvement projects	X	X	X
ADEQ conducts implementation effectiveness monitoring on grant projects & mine development	X	X	X
Annual SWPP review of permitted facilities	X	X	X

8.0 Public Participation

ADEQ has held public meetings in Superior to help spread information about the project and to also take questions from those interested in the outcome. The initial public meeting was held on June 14, 2005. The last meeting was held on January 11th of 2007, during the period when much of the water quality data was still being collected. ADEQ plans on holding at least one more additional public meeting in the Superior area for discussion of the draft TMDL for Queen Creek. If the need arises, additional public meetings may be scheduled.

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