HUDBAY

April 21, 2023

Mr. Ardy Sharifabadi
Project Manager
APP Unit, Groundwater Protection Value Stream
Water Quality Division
Arizona Department of Environmental Quality
1110 W. Washington Street
Phoenix, Arizona 85007

RE: Copper World Project – Aquifer Protection Permit Application – Response to RAIS Letter

Dear Mr. Sharifabadi:

This letter transmits responses to the Comprehensive Request for Additional Information (RAIS) issued to Copper World, Inc. (Copper World) for the Copper World Project (Project). An application for an area-wide aquifer protection permit (APP) was submitted to the Arizona Department of Environmental Quality (ADEQ) on September 21, 2022, for the Project.

ADEQ issued the RAIS letter to Copper World on February 27, 2023. This comprehensive letter included 71 requests. These requests are repeated below along with responses. Responses are either embedded in this letter or provided as a separate attachment, i.e., a single compiled document is not provided due to size.

As per the ADEQ RAIS letter, items are categorized as follows:

- General Items
- Engineering Items
- Geotechnical Engineering Items
- General Hydrology Items
- Discharge Impact Analysis – Groundwater Modeling Items

General Items

General Items cover Items 1 through 6.

Item 1: Submit a revised closure and post-closure cost estimate that includes the following items as required by Arizona Administrative Code (A.A.C.) R18-9-A201 (B)(5):

a. Please update the closure and post closure cost estimate tables, and provide the required APP closure costs. The materials cost for the process ponds and tailing storage facilities (TSFs) is $0, the revegetation and stabilization costs (labor, equipment, materials) for the discharging facilities is $0. These items are part of the APP closure requirements. ADEQ understands that some of these closure activities may be completed under a separate program.
b. The cost of materials for monitoring for 30 years is $167,810. The materials cost for the Heap Leach Facility (HLF) is $5,850. These two cost estimates do not appear to be sufficient. Please provide justifications.
c. Based on a post-monitoring period of 30 years, the monitoring costs of $70,113 do not appear to be sufficient. Please update these costs or provide more information on the original cost estimate.
d. In Section 6.2. Summary of Closure and Reclamation Costs, it seems to imply that the closure cost estimate has been approved by ADEQ. Please clarify this statement as APP closure costs are still under review.
e. Provide cost estimates for surveillance, satellite imagery, and other routine inspections for the TSFs and HLF.
f. Explain how reclaim seepage return from drain-downs of the TSFs and HLF will be managed in post-closure. If evaporation ponds are used, provide the related closure costs.
g. Provide information on the unit rates used in closure cost estimate.
h. Provide an analysis of the drain-down time-frame of the TSF and HLF to determine the duration closure and post closure period.

Response

The following closure and closure cost documents were provided to ADEQ in the September 2022 APP application submittal:

- Conceptual Closure Plan (Appendix M)
- APP Closure and Post-Closure Costs (Appendix N.1)
- ASMI Reclamation Costs (Appendix N.2)

These documents provided reclamation and closure plans and costs attributable to ADEQ and the Arizona State Mine Inspector (ASMI) under the Mined Land Reclamation Plan (MLRP). Additionally, ADEQ had requested a resorting of the closure costs, and the following post-submission document was provided:

- Copper World Project – Area-Wide APP Application – APP Closure Cost Update. Memo dated October 12, 2022.

With regard to ADEQ's questions/comments related to the closure of APP regulated facilities, the following memorandum is provided as Attachment 1:

- Attachment 1: Copper World Project – Area-Wide APP Application – Closure Approach Summary and Closure Cost Reassessment. Memo dated April 04, 2023.

APP related closure costs were reassessed and updated in the memorandum provided in Attachment 1, including an update to the SRCE spreadsheet originally provided as Appendix N.1 in the September 2022 application. In addition to closure cost revisions, the following are also clarified in the memorandum per ADEQ's request:

- Additional detail on material and unit costs, including monitoring and inspection costs;
- Facility drain-down rates and associated closure/post-closure periods; and
- Clarification on the management of drain-down fluids and closure of attendant facilities.

Updated monitoring costs are also tied to the Operation, Maintenance, and Surveillance (OMS) Manuals described under Item 3. In summary, 1a, 1b, 1c, 1e, 1f, 1g, and 1h are addressed in the memorandum provided in Attachment 1.

With regard to Item 1d, the MLRP and associated reclamation costs have been approved by ASMI. Closure costs under the jurisdiction of ADEQ were presented in the September 2022 APP application and reassessed herein as part of Item 1. Review of these costs is part of ADEQ's evaluation process. It is understood that the review of these costs is ongoing and final approval by ADEQ will occur during the finalization of the APP permitting process. Additionally, staged bonding based on Project development is proposed.

Item 2: Contingency Plan: Pursuant to A.R.S. §§ 49-243(A)(10), -243(K), and A.A.C. R18-9A202(A)(5),(11) -A204, provide the following:

a. As part of the contingency plan, the permittee shall provide an Emergency Preparedness and Response Plan (EPRP). The EPRP should be a site-specific plan. The EPRP shall be prepared as part of a community focused planning process and contain an impact assessment that will identify ways to prevent, minimize and mitigate any potential environmental and social impacts to the project affected stakeholders, and those vulnerable (neighbors, highways, ranches, habitat) and procedures that will be followed in case of a potential TSF/HLF failure.
b. Pre-defined levels for performance criteria that are based on the risk controls and critical controls of the proposed facilities. The performance levels should be developed based on the risk management plan. The plan should describe actions to be taken if performance levels are exceeded to prevent a loss of control.
c. The Plan should identify capacity and any necessary coordination with off-site emergency responders, local communities, and public sector agencies.

Response

Attachment 2 provides the following generalized Contingency Action Plan (CAP) and Emergency Preparedness and Response Plan (EPRP) prepared for the tailings storage facilities (TSFs):

- Attachment 2:
    - Attachment 2A, Tailings Storage Facility Contingency Action Plan (CAP). April 13, 2023.
    - Attachment 2B, Emergency Preparedness and Response Plan (EPRP) for the Tailings Storage Facilities. April 13, 2023.

Detailed CAP and EPRP documents will be prepared prior to the construction of the tailings facility and will be based on the finalized design and operational plans.

The CAP and EPRP documents will be regularly reviewed and updated throughout the life of the tailings facilities. Coordination with off-site emergency responders, local communities, and public sector agencies will also occur as part of these updates. This will ensure that the EPRP portion of the document appropriately considers potential risks and associated mitigation and that responses will be effective in the case of an emergency.

A Contingency Action Plan and Emergency Preparedness and Response Plan have not been prepared for the heap leach facility. These types of plans are typically not needed for heap leach facilities as they are constructed similar to waste rock facilities and generally do not have the same risks and constraints as a tailings storage facility. Heap leach facilities do require an OMS plan, as they do need to be operated correctly due to the presence of process solutions.

Item 3: Operation, Maintenance, and Surveillance (OMS) Plan: Pursuant to A.R.S. § 49-243(A)(10), A.R.S. § 49-243 (K), and A.A.C. R18-9-A204, A.A.C. R18-9-A206, and A.A.C. R18-9-A202(A)(5),(9),(11) provide an operation, maintenance, and surveillance plan for the TSF and HLF. The OMS plan should describe practical plans and procedures for all aspects of operation, maintenance, and surveillance activities associated with the proposed facilities. The plan should include the following:

a. Monitoring systems and methods for each discharging facility.
b. Early detection monitoring to detect failure.
c. Underdrain monitoring to ensure they are performing as designed.

Response

Attachment 3 provides the following generalized OMS Manuals for the TSF and HLF that respond to Items 3a, 3b, and 3c:

- Attachment 3:
    - Attachment 3A, Copper World Project – Tailings Operation, Maintenance, and Surveillance (OMS) Manual. April 12, 2023.

- Attachment 3B, Copper World Project – Heap Leach Facility Operation, Maintenance, and Surveillance (OMS) Manual. April 12, 2023.

Detailed OMS Manuals will be prepared prior to the operation of the TSF and HLF and will follow the development of detailed design and operational plans. Copper World staff will regularly review and update the OMS Manuals throughout the operational life of the tailings and heap leach facilities. The OMS Manuals will be maintained onsite and available for agency review.

Item 4: Pursuant to A.R.S. § 49-243(N) and A.A.C. R18-9-A202(B), provide an organizational chart for the operation, surveillance, closure, and post-closure of the proposed discharging facilities.

Response

A generalized organization chart is provided in the OMS Manuals (Attachments 3A and 3B of this response letter) under Item 3 showing the anticipated job classifications/function. The organizational charts will be updated throughout the life of the tailings and heap leach facilities as specific personnel are assigned.

- Attachment 3:
  - Attachment 3A, Tailings Operation, Maintenance, and Surveillance (OMS) Manual. April 12, 2023.
  - Attachment 3B, Heap Leach Facility Operation, Maintenance, and Surveillance (OMS) Manual. April 12, 2023.

Item 5: Consider a Compliance Schedule Item (CSI) for periodic Tailings Dam Safety Reviews (every ~5yrs) throughout the life of the facility from operations through the post-closure period, to include Independent Technical Review Board (IRTB) and Tailings Review Board (TRB) findings and recommended actions, and updated investigation results on critical cross-sections to provide ADEQ with an update on stability conditions and critical state of the tailings dam to demonstrate that the stability and performance is consistent with design stability.

Response

Attachment 2D provides the Tailings Storage Facility Dam Safety Review (DSR) Procedures (WSP, 2023). This document establishes the DSR for the tailings facilities that will be performed by a qualified multi-disciplinary team (herein referred to as the Independent Tailings Review Board or ITRB) using best practice methodologies at a minimum of every five years. The intent of the DSR is to identify hazards associated with hydrotechnical, geotechnical, and operational performance of the tailings facilities. The DSR provided in Attachment 2D will be updated as necessary to include new information, industry guidance or regulatory standards or pertinent changes as the Project is advanced.

- Attachment 2:
  - Attachment 2D, Tailings Storage Facility Dam Safety Review Procedures. April 13, 2023.

Additional guidelines for the safe operation of the Tailings Storage Facilities are provided as a response to Item 3.

- Attachment 3:
  - Attachment 3A, Copper World Project – Tailings Operation, Maintenance, and Surveillance (OMS) Manual. April 12, 2023.

Item 6: Provide a figure that shows the footprint and boundary comparison of the discharging facilities covered under the older APP from 2012 (INV 106100, LTF 49639) and the new APP application (INV 513690, LTF 90620). Are there shared areas between the previous APP and the new proposed APP for the Rosemont pit?

Response

Due to the 2019 court decision overturning the Forest Service's issuance of the Record of Decision and Mine Plan of Operations for the Rosemont Copper Project, and the current status of litigation, Copper World is committed to pursuing permits for construction and operation of the Copper World Project. Construction and operation of the Rosemont Copper Project will not be pursued, and the associated APP related permits will be closed. As such, there will not be any shared areas. None of the APP facilities associated with the Rosemont Copper Project were constructed.

Engineering Items

Engineering Items cover Items 7 through 20.

Item 7: The application asks for exemptions (per A.R.S. § 49-250 (B)(22)) for the following facilities: NP-PS-20-Bulk Cu/Mo thickener, ND-PS-23-Tailings Thickeners, and ND-PS-26-Concentrate Leach Fine Grinding Plant. These facilities have the potential to overflow or discharge. Please provide more information about these facilities and their operations. Consider providing BADCT for these facilities. Also, the ND-PS-39-Solvent Extraction Plant and NP-PS-42-Ammonium Nitrate Storage were listed for exemption per A.R.S. § 49-250(B)(21)-(22). Per A.R.S. § 49-250(B)(21), structures should be designed and constructed so as to allow for visual inspection for leakage. Does the design meet ADEQ's Tank Exemption Policy? Please provide more information.

Response

The following memorandum was provided in Appendix D of the September 2022 APP application:

- Copper World Project APP Facility Summary, Classification of Facilities under ADEQ's APP Program. Memo dated July 28, 2022.

This memorandum listed those facilities that were considered exempt from APP regulation and those that were considered regulated. Although BADCT is not required for exempt facilities, the exemption does require that facilities be designed, constructed, operated and regularly maintained so as not to discharge. The July 28. 2022 memorandum was designed to provide information to demonstrate that the facilities satisfied this requirement. With regard to the five (5) facilities listed in Item 7, the following facility descriptions and information are provided in addition to that provided in the July 28, 2022 memorandum.

All of the facilities listed in Item 7 are located within the Plant Site. Stormwater runoff from within the Plant Site is routed to the Process Area Stormwater Pond and recycled back into the process. Stormwater is either routed directly to the pond via surface channels or pumped to the stormwater pond from sumps located throughout the plant (unless the sump is located within a process area and pumped directly back into the circuit). The Process Area Stormwater Pond is designed to manage a 100-year, 24-hour storm event. The Plant Site is located on elevated platforms with stormwater controls preventing run-on to the plant area from upgradient areas, such as from the Waste Rock Facility.

The Cu/Mo Thickener (Facility No. ND-PS-20) will be a steel tank that receives material from the copper/molybdenum flotation circuit. The thickener recovers reagents from the copper flotation circuit prior to sending the material to the molybdenum flotation circuit. The thickener is located within a concrete lined secondary containment area and spillage, if any, is contained in the immediate vicinity and put back into the process circuit. The Cu/Mo Thickener will be constructed, operated, and maintained to minimize the occurrence of spillage or other operational upsets. Overflow alarms (such as high and high-high level alarms) will be installed to monitor tank levels. The operating equipment associated with the thickener will also be alarmed in case of equipment failure. Routine inspections of the thickener operation will also be conducted.

The Tailings Thickeners (Facility No. ND-PS-23) will include two large concrete tanks that will receive tailings slurry from the copper and molybdenum flotation circuits. The tailings will be thickened to a target solid/water ratio in the tanks prior to being pumped to the tailings storage facilities. The thickeners will be located within a contained area and spillage, if any, will be contained in the immediate area and put back into the tailings disposal system. Due to the cone shaped tank bottom, seepage from the facility, if any, would likely be detected in the underflow tunnel located below the tank center. The Tailings Thickeners will be constructed, operated, and maintained to minimize the occurrence of spillage or other operational upsets. Overflow alarms (such as high and high-high level alarms) will be installed to monitor tank levels. The operating equipment associated with the thickeners will also be alarmed in case of equipment failure. Routine inspections of the thickener operation will also be conducted.

The Concentrate Leach Fine Grinding Plant (Facility No. ND-PD-26) takes copper concentrate from the copper flotation and filtration circuit and produces a finely ground product prior to processing the material in the concentrate leach circuit. The fine grinding plant is located within a concrete lined secondary containment area and spillage, if any, is contained in the immediate area and put back into the process circuit. The Concentrate Leach Fine Grinding Plant is a closed circuit that will be constructed, operated, and maintained to minimize the occurrence of spillage or other operational upsets. Plant operations are continually monitored. Routine inspections of the grinding plant will also be conducted.

The Solvent Extraction Plant (Facility No. ND-PS-39) includes a series of tanks that are located within a concrete/secondary containment area and spillage, if any, is contained in the immediate area and put back into the process circuit. Solvent Extraction Plant will be constructed, operated, and maintained to minimize the occurrence of spillage or other operational upsets. Overflow alarms (such as high and high-high level alarms) will be installed to monitor tank levels. The operating equipment associated with the thickener will also be alarmed in case of equipment failure. Plant operations are continually monitored. Routine inspections of the plant will also be conducted.

The Ammonium Nitrate Storage facility (Facility No. ND-PS-42) includes elevated and enclosed ammonium nitrate silos. These silos (tanks) are designed to hold small ammonium nitrate spheres (or prill) used in blasting. The product is stored "dry" in the silos. The elevated structure allows inspection of the bottom and sides of the silos.

Item 8: Based on the information provided in the application, Helvetia Smelter Slag Pile (HSSP) is a closed facility pursuant to A.R.S. § 49-250(B)(11). How do you ensure that disposing of Waste Rock (WR) on the HSSP will not produce leachate that could negatively impact the aquifer? Please consider Synthetic Precipitation Leaching Procedures (SPLP) testing for the slag material.

Response

SPLP testing was performed on the Helvetia slag materials (Columbia Smelter) as part of a site investigation program conducted by Hargis + Associates, Inc. (Hargis) for ADEQ throughout the Helvetia area that was part of a consent order against ASARCO Inc. (Asarco). The following documents were associated with this work:

- Workplan for Hazardous Waste Assessment, Helvetia Mining District, Pima County, Arizona (dated March 23, 2012)
- Addendum to Workplan for Hazardous Waste Assessment, Helvetia Mining District, Pima County, Arizona (dated April 16, 2013)

Additional SPLP testing was conducted on the Columbia Smelter slag materials in order to appropriately respond to Item 8. Attachment 4 provides the results of this analysis, which demonstrates that the Columbia Smelter slag material is not expected to leach any constituent in excess of numeric aquifer water quality standards (AWQSs). Additionally, only non-acid generating (NAG) waste rock will be placed over the slag pile.

- Attachment 4: Waste Rock Placement on Historic Slag. Memorandum dated March 30, 2023.

As a note, the two Hargis documents are provided as part of Attachment 4.

Item 9: The WR Facility (WRF) will have three types of material: Non-acid generating (NAG), potential acid generating (PAG), and acid generating (AG):

a. Please provide more information regarding the placement of the NAG on the outer slopes, PAG on the interior, and encapsulating the AG.
b. During the operation, Acid-Base Accounting (ABA) analysis will be done, but not the Humidity Cell Testing (HCT) analysis or similar kinetic tests. How will you ensure that the AG/PAG material will be characterized during operations? Please include Kinetic testing in the characterization plan or provide justification for not including it.

Response

The following are responses to Items a and b:

a. It is anticipated that a minimum of 30 feet of NAG material would be placed on the outer slope of the WRF, with PAG and AG materials placed on the interior areas. PAG and AG materials would not be placed directly on bare ground surfaces or within existing drainage paths. PAG and AG materials would be placed on a base on NAG material as well as being covered with NAG material; in both cases with a minimum 50-foot NAG thickness.

   Based on the geochemistry report (Appendix G.1 of the September 2022 APP application), more than 85% of the waste rock material mined is considered NAG, and less than 1% is considered AG.

b. The current Copper World Project database/block model has assigned NAG, PAG, and AG designations based on previous sampling and testing that supported the geochemistry study (see Appendix G.1 of the

September 2022 APP application). Ongoing testing will occur during operations to confirm the formulation presented in the Waste Rock Handling Plan provided in Appendix G.3 of the September 2022 APP application. ABA sampling will be performed on a composite sample of random blasthole cuttings. The major rock type will be assigned to the sample. At a minimum, sampling will be done during the first year of operations (full production) on the following frequency:

- One per month; or
- Every 1 million tons of waste rock mined.

The testing frequency will vary thereafter if additional testing is required to update the formulation or if a change in material type or mineralization is noted. Day-to-day operations regarding the placement of waste rock will be based on the formulation which is already included in the Resource Block Model. Formulations will be updated as needed in the database/block model.

It is proposed that humidity cell tests (HCTs) and Meteoric Water Mobility Procedure (MWMP) or Synthetic Precipitation Leaching Procedure (SPLP) testing be performed throughout operations in order to confirm the range of critical release function (CRF) values used in the geochemical model (Appendix G.1 of the September 2022 APP application). These tests can also be used to inform the database/block model and override NAG, PAG, and AG designations.

It is proposed that the following tests, and test frequency, be incorporated into the WRHP:

- MWMP or SPLP testing.
  - One (1) MWMP or SPLP sample to be tested quarterly for at least the major waste rock types.
- HCT
  - HCT triggered when an ABA sample is characterized as PAG; and
  - A maximum of two (2) HCTs running simultaneously for any of the major waste rock types.

An updated Waste Rock Handling Plan (WRHP) is provided as Attachment 5 of this response letter that reflects the above changes/clarifications.

- Attachment 5: Waste Rock Handling Plan – Revision 1. Plan dated April 2023.

Item 10: Based on the Preliminary Geologic Hazards Assessment report (Appendix B), the size of the underground features and extent of underground working is not included in the AML data base. The report says that "adits and mine shafts may contain underground features of unknown size (USGS,2021)" and "some extensive developments may be present on both the eastern and western flanks of the Santa Rita Mountains such as underground mine workings and waste rock dumps which may require further investigation and mitigation such as backfilling, to reduce risks." Historic mine workings should be further investigated and engineering designs for mitigation will be required where historic workings are located within the foot print of the permanent or temporary infrastructure.

Response

The document titled Preliminary Geologic Hazard Assessment, Rosemont Copper World Project (dated January 12, 2022) was provided in Appendix B.1 of the September 2022 APP application. Additionally, Section 3.6 of the main Copper World Project APP application document states the following:

> "Historic mine workings have been identified within the footprint of the TSF-1, WRF, and the open pits. Features included in the USGS (2021) Abandoned Mine Lands database on the Project site are shown on Figure 8. The majority of the features are small surface prospect workings that are no more than a few feet in diameter and depth and would likely have little impact on mining activity. However, some more extensive developments may require additional evaluation and mitigation. Mitigation of existing historic underground mine workings within the footprint of TSF-1, the WRF, and open pits may require backfilling and detailed operational procedures for work around voids, and, furthermore, if extensive underground workings are identified in the open pit areas, a Hazard Mitigation Plan for underground voids may be required that includes void identification and safe working procedures."

In addition, Section 10.4.1.2 of the main Copper World Project APP application document states that:

> *"With regard to the TSFs, minor historic mine workings are present in the TSF-1 footprint. These are shallow workings that do not intersect groundwater and will be filled with local borrow materials."*

In general, the location and extent of historic mine workings are known and are mainly located in the pit and WRF areas. With regard to the tailings, heap leach and main plant site areas, only minor or shallow workings are found in the TSF-1 area. Mitigation of these shallow features will be part of the detailed design and foundation preparation documents associated with TSF-1.

In the WRF area, surface features, such as shallow mine workings or entrances to larger workings, will be filled/covered with local, NAG borrow. With regard to the open pit areas, concerns related to existing underground workings are twofold:

- Instability of final pit slopes; and
- Instability of working faces.

Within the pit areas, known underground hazards will be incorporated into both the short-term and long-term mine plans developed for the Project. Mitigation of these hazards will be incorporated into safe work practices and required workplace examinations.

Where required, underground workings can be verified using one or a combination of the following:

- LIDAR survey
- Geophysics
- Third-party specialist contractor

Item 11: Preliminary geologic hazard assessment reports state that based on the FEMA flood zone maps, most of the project site is located in Zone D which is defined by FEMA (as of 2021) as an area with potentially moderate to high risk of flooding, for which the probability of a flood has not been determined. How do you ensure that planned stormwater controls will effectively protect the process ponds, HLF, TSFs, and other discharging facilities? Please provide more information.

Response

Stormwater controls, such as permanent stormwater diversion channels, are designed upgradient of the TSFs and HLF using hydrological analysis of peak discharges for storm events with a 1,000-year return period. Designing diversions for the 1,000 return period storm event goes beyond the standard BADCT prescriptive requirements, which is generally between a 25 year and 500 year event. Additionally, the ore processing plant is located on an elevated platform for further flood protection.

Item 12: Water in the upstream stormwater collection gallery will be conveyed under the HLF and TSF in a solid 36-inch pipe to a downstream stormwater collection gallery. Provide information on methods to prevent the clogging of pipes. Has there been any successful implementation of this method? Please provide more information**.**

Response

The conveyance structures under the HLF and TSFs will have (1) protective grates at their inlets to limit the maximum particle size allowed to enter, and (2) design gradients that will flush through the debris component of flood water allowed to enter. Conveyance of stormwater under TSF facilities has been done at other mines including the Carlota Copper Mine in Miami, AZ, and is still functional (installed in 2007). Routine and event based inspections will be performed on the system.

Item 13: In the Site Water Management report, section 4.7.1: "the permanent diversion channels will be completed by year 5 of operations." Please explain how you will manage the non-contact stormwater in the first 5 years of operations.

Response

Permanent diversion channels will be constructed as needed as the mine progresses. Channels will be constructed at the same time as the permanent facility that it is designed to protect. The mine is being developed in stages over the first 5 years, and permanent diversion features will also be constructed with each stage. As development occurs over the first 5 years, there will be no period where an APP-regulated mine feature is constructed prior to completion of a permanent diversion feature upgradient of that feature. For example, the TSF cells are constructed as needed, and a permanent diversion feature for each cell will be installed before tailings are placed in that cell. The permanent diversion channels protecting all facilities will be completed by year 5 of operations. Prior to construction of the diversion channels, non-contact stormwater will be allowed to flow uninterrupted (same as existing conditions).

The Site Water Management Plan (SWMP, Appendix E in the September 2022 APP application) provided descriptions and figures regarding stormwater management features for the following time periods:

- Figure 5: Year -2 (start of construction period)
- Figure 6: Year 1 (year 1 of operations)
- Figure 7: Year 5 (year 5 of operations)
- Figure 8: Year 10 (year 10 of operations)
- Figure 9: Year 15 (year 15 of operations)
- Figure 10: Closure (stormwater management at full facility reclamation layout)

All stormwater diversion channels/structures that will be in place long-term, regardless of when constructed, are designed to handle a 1,000-year, 24-hour storm event. These include all perimeter diversions channels. By Year 5 of operations, all long-term stormwater diversion channels/structures will have been constructed and will be in place for the duration of operations and into the closure period. With the exception of one temporary diversion channel cutting across the F-Block (see Figures 5 and 6 in the SWMP), all channels with be constructed as permanent channels. Section 4.0 of the SWMP provides details on stormwater management for the major facilities during each of the time periods indicated above.

Item 14: The property boundary and TSF footprints are directly adjacent to State Land, and federal Bureau of Land Management (BLM) property, and private property. Please provide operational, closure and post-closure plans to ensure that the TSF operations will not disturb neighboring lands outside of the property boundary.

Response

Fencing or other barriers will generally be installed along the private land boundaries as part of a Public Access Restriction Plan (PARP) associated with a Class II Air Quality Control Permit that will be issued and administered by ADEQ for the Copper World Project. The intent of the PARP is to keep the public outside of the process area boundary defined by the Class II air permit. These same fences/barriers will serve to define construction limits; therefore, preventing unintended excursions from construction or operations equipment onto adjacent lands.

In addition to the PARP, and general conditions within the Class II Air Quality Control Permit, a Dust Control Plan and a specific Tailings Dust Management Plan are also part of the permit. The permit conditions, as well as the strategies listed in the two plans, are intended for the Project to meet National Ambient Air Quality Standards (NAAQS) at the process area boundary, i.e., the property limits, and thus protect adjacent lands from airborne dust.

The PARP, Dust Control Plan, Tailings Dust Management Plan, and the Class II Permit itself will be in place and approved prior to the start of operations. Copies of these final plans and Class II permit will be available upon request when issued.

The September 2022 APP application included the following plans:

- Site Water Management Plan (Appendix E)
- Conceptual Closure Plan (Appendix M)

As shown on the figures provided in the Site Water Management Plan, all stormwater management features will be constructed on private land. Stormwater management features are shown from the pre-operational period through to closure. Detailed channel designs will accommodate energy dissipation structures in order to reduce channel outlet velocities and thus minimize or eliminate erosional effects on adjacent lands. The routing and management of stormwater flows is designed to handle a 1,000-year, 24-hour event. The management and containment of process solutions is designed to handle a 100-year, 24-hour event.

A Stormwater Pollution Prevention Plan (SWPPP) will also be in place during construction, operations and at closure. Representative stormwater outfall locations will be selected where stormwater leaving the property will be sampled. In terms of protecting groundwater resources, conditions within the APP serve that purpose. Groundwater samples taken at designed point-of-compliance (POC) wells must meet applicable aquifer water quality limits (AQLs) at designated point of compliance wells. Contingency provisions in the APP will be in place and will be implemented should exceedances of AQLs or alert levels be detected at the POC well locations.

Finally, facility slopes and layouts have been designed to accommodate closure requirements. For example, the outer slopes of the TSFs will be constructed at 3H:1V during operations and will not require regrading at closure. Perimeter stormwater channels and access roads will remain at closure, all on private land. Placement of the heap leach and waste rock also takes final closure requirements into consideration. Therefore, closure layouts and associated regrading work, etc., will not encroach upon the property boundaries, etc.

Item 15: Calculate the magnitude of sulfate impacted water that will be discharged to the groundwater during the lifetime of the facility. Calculate the total mass loading of sulfate that will be discharged to the aquifer.

Response

The magnitude of sulfate-impacted water that will potentially impact groundwater during the lifetime of the facility and the total mass loading of sulfate that to the aquifer, were estimated using the groundwater model developed for the Copper World Project (Water Quantity Impacts Assessment. Appendix F.2 of the APP application, September 2022) and geochemical impact analysis (Geochemical Impacts Assessment. Appendix G.1 of the APP application, September 2022).

The estimated volume of impacted water includes operational years and closure years (drain down) up through 200 years after the end of mining for TSF-1 and TSF-2. This represents the volume that bypasses the seepage collection system (as managed by the seepage collection trenches during operations or active seepage management after closure or by the sulfate reducing cells during passive seepage management in the post-closure period).

The Geochemical Impacts Assessment study results include the final predicted (base case) chemical composition of tailings seepage (Table 6.3 in Geochemical Impacts Assessment in Appendix G.1 of the September 2022 APP application). Additionally, the results of two sensitivity analyses (the Standard Deviation and the Volcanic / Sedimentary Surrogate sensitivity analyses) (Table 6.6 in Geochemical Impacts Assessment) were presented.

A summary of the magnitude of impacted water and total mass loading from each of the three geochemical predictive analyses (base case and two sensitivity analyses) are provided in Table 15-1 below.

Table 15-1: Estimated Magnitude of Impacted Water - Total Sulfate Mass Loading

Facility ID	Magnitude of Impacted Water (Acre Feet)	Total Mass Loading of Sulfate, Base Case (Tons)	Total Mass Loading of Sulfate, Standard Deviation Sensitivity (Tons)	Total Mass Loading of Sulfate, Volcanic / Sedimentary Sensitivity (Tons)
TSF-1	4,695	5,156	9,355	4,244
TSF-2	1,099	1,206	2,188	993

Note: Estimate is provided up to 200-years post-closure. This value represents about 2% of the seepage bypassing the seepage collection system.

Item 16: Please provide the following regarding the tailings stacking height:

a. What is the stacking rate?
b. What operational best practices will be followed to minimize high internal pore pressures?

Response

a. The stacking rate on the TSFs will be no more than 19 ft/yr. Table 16-1 below shows the anticipated average rate of rise in feet per year. Due to the small footprint of the cells during the early stages of operating a cell, the rate of rise may exceed the presented values, but the tailings will be contained within the starter embankment and the foundation conditions will promote consolidation. Therefore, excessive pore pressures are unlikely to form during this stage of the operation.

Table 16-1: Anticipated Rate of Rise by Year

	TSF 1			TSF 2	
Year	Cell 1 (Avg Ft/Yr)	Cell 2 (Avg Ft/Yr)	Cell 3 (Avg Ft/Yr)	Cell 1 (Avg Ft/Yr)	Cell 2 (Avg Ft/Yr)
1	14.9	12.5	-	-	-
2	7.5	10.9	13.0	-	-
3	7.5	10.9	13.0	-	-
4	7.5	3.1	13.0	9.5	-
5	15.4	15.0	14.8	15.2	15.0
6	15.4	15.0	14.8	15.2	15.0
7	15.4	15.0	14.8	15.2	15.0
8	14.9	15.0	15.2	12.2	15.0
9	14.9	12.5	15.2	10.3	14.8
10	14.9	12.5	15.2	10.3	14.8
11	14.5	12.4	13.7	10.3	14.8
12	14.5	12.4	13.7	10.3	14.8
13	14.5	12.4	13.7	10.3	14.8
14	14.5	12.4	13.7	10.3	14.8
15	14.5	12.4	13.7	10.3	14.8

Note: Avg = Average, Ft = Feet, Yr = Year

b. The following will be used to minimize high internal pore pressure:

- Keeping the stacking rate below the required stacking rate of 19 ft/yr during the initial stages of cell operation and below 15.5 ft/yr during all other times. In particular, stacking rates in the upstream portion of the TSF will be strictly managed;
- A chimney drain of coarse material with high hydraulic conductivity is placed on the upstream side of the Starter Dams to reduce seepage toward the downstream cyclone sand and to mitigate saturation and excess pore pressures in the downstream sand; and
- Monitoring of the pore pressure conditions will be required. As discussed in the TSF OMS manual addressed in the response to Item 3, monitoring will include piezometers to observe groundwater and pore pressure conditions,

Item 17: Provide an estimate of water content during tailings placement. Also provide a plan and method to reduce water content during placement.

Response

Tailings water content will vary based on whether the tailings will be cyclone sand or cyclone fine tailings. See Table 17-1 below for expected water content (by weight) for the Copper World Project tailings.

Table 17-1: Anticipated Water Content by Tailings Material Type

Tailings Material	Water Content (% by weight)
Cyclone Sand Tailings	~40%
Fine Tailings (Slimes)	~34%
Whole Tailings	~40%

Measures to limit the water content of tailings during placement include:

- Using a thickener to process the tailings slurry prior to deposition. The tailings thickener will reduce the percentage of water in the tailings slurry by approximately 10%. Water removed from the thickener will be recirculated directly into the process plant for reuse.

Item 18: Provide an analysis discussing if the tailings (and HLF, and WRF) composition is expected to degrade or become chemically altered, weathered, and aged.

Response

The following table (Table 18-1) and text were reported in Piteau Associates (2022) "Rosemont Copper World Project, Geochemical Impacts Assessment" (Appendix G.1 of the September 2022 APP application) and reproduced herein.

Table 18-1 Sulfur and Calcium Summary of Project Geologic Units (Table 3-3 of Piteau [2022])

Geologic Unit	Percent of Total Mined Material (%)	Average S (%)[1]	Estimated AP ($tCaCO_3/kt$)[2]	Average Ca (%)[1]	Estimated NP ($tCaCO_3/kt$)	Estimated NPR
ABRIGO	6	0.26	8.1	17.3	432.0	53.2
ANDESITE	20	0.23	7.2	3.2	81.2	11.3
ARKOSE	4	0.12	3.8	3.6	89.6	23.5
BOLSA	6	0.23	7.1	5.6	138.8	19.5
CONCHA	<1	0.51	15.9	8.7	217.5	13.7
EARP	5	0.30	9.5	16.3	406.4	43.0
EPITAPH	5	0.38	11.8	11.5	288.5	24.4
ESCABROSA	3	0.11	3.4	25.5	637.9	189.8
GILA	1	0.10	3.0	9.3	233.7	77.2
GLANCE	7	0.27	8.4	19.7	492.2	58.8
GRANODIORITE	6	0.22	6.8	3.1	78.0	11.4
HORQUILLA	14	0.32	10.0	20.2	505.6	50.5
MARTIN	4	0.26	8.3	20.3	507.3	61.5
QMP	11	0.56	17.6	4.2	105.6	6.0
SCHERRER	5	0.75	23.4	16.9	422.6	18.0

1 Derived from Rosemont Copper World Project block model
2 Assumes all sulfur content is pyritic sulfur

"Rock materials mined from the Project are ~94% NAG, utilizing the block model classification. Each rock unit is anticipated to be characterized as NAG. Minor quantities of AG (<1%) and PAG (~ 6%), which are relatively small, are projected by the block model (Figure 3.7). Uncertainty in the block model's predictive capability for NP and AP is overshadowed by the overall abundance of calcium (and related carbonates) in the rock materials themselves. Minor variability in the block model is not expected to affect the overall nature of the deposits. Real time bench scale sampling should be conducted during mining to confirm the block model and ensure that the minor fraction of AG material is encapsulated according to the Rosemont waste rock management plan."

Table 18-1 (Table 3-3 of the Geochemical Impacts Assessment) shows that 1) the mine rock overall has less than 0.3% sulfur, and 2) the majority of waste rock to be mined is non-acid generating (NAG). This indicates that the risk of material degradation due to weather/chemical aging is low. Acid Rock Drainage (ARD) is not anticipated to be generated from this material due to the very low sulfur content.

Item 19: Provide more information on the materials that have been proposed for the cover of WRF and HLF.

a. What is the source and what are the characteristics of the materials?
b. Is there sufficient material to use for the cover?
c. What are the infiltration rates?
d. Is the material suitable for supporting vegetation growth?

Response

a. Alluvium beneath the TSFs and HLF will be used as reclamation cover during the closure of the facilities. Boreholes drilled on site and summarized in the Memorandum provided in Attachment 6 were used to develop an approximate depth to bedrock to confirm the approximate amount of alluvium available for use. The Memorandum in Attachment 6 also summarizes the laboratory testing that was conducted on the alluvial layer material.
b. Approximately 5 million cubic yards of growth media cover are needed for the HLF and TSFs; sufficient alluvium material will be removed and stockpiled during construction.
c. Laboratory testing was conducted on material from the alluvial layer using various testing methods. Results in Attachment 6 showed in-situ percolation testing with an average permeability of $4.24x10^{-3}$ to $6.91x10^{-2}$ cm/sec. The permeability of the alluvium from the laboratory testing ranged from $7.51x10^{-6}$ to $1.74x10^{-2}$ cm/sec.
d. The alluvium material was found to be suitable for soil cover.

Attachment 6 provides the following memorandum summarizing information on the reclamation cover soil planned for the TSFs and HLF:

- Attachment 6: Alluvial Cover Materials - Copper World Project Surface Facilities (TSFs and HLF). Technical Memorandum dated April 05, 2023.

Item 20: Has the water management plan considered the effects of climate change in terms of both extremes: too much water, or too little water over the life of mine and post-closure?

Response

The water balance analysis has been performed using design events that meet regulatory requirements and industrial standards. The climatic data used is based on historic records and statistics including recent events. The water balance model is anticipated to be a dynamic model and will be calibrated and updated during future stages of studies, designs, and operations. Moreover, a final mine closure plan will be prepared and submitted shortly before the end of operations, which will be based on more advanced studies and additional climatic records to be collected in the future. Some of the critical mine facilities are designed to withstand an extreme storm event such as storms with a 1:1,000 year return period.

Throughout the life of mine (LOM), the OMS Manuals and Contingency Plans, as appropriate, will be updated and used to account for uncertainties and deviations (if any) related to the inputs and assumptions used in the water balance, including seasonal fluctuations in water availability.

Geotechnical Engineering Items

Geotechnical Engineering Items cover Items 21 through 48.

Item 21: Potential Failure Modes (PFM)

The probabilities of all types of credible failure modes have not been evaluated. Pursuant to A.R.S. § 49-243(K), and A.A.C. R18-9-A202(A)(5), -A204, provide a site-specific analysis for the proposed TSFs and HLF using a methodology that considers credible failure modes, site conditions, and the properties of the discharge. This analysis should be updated whenever there is a material change either to the tailings facility or the physical area impacted. Understanding the credible failure modes provides the basis for the contingency plan and OMS plan. Please consider the following when performing the initial analysis:

a. The results of the analysis shall estimate the physical area impacted by a potential failure.
b. The PFM should inform the monitoring and surveillance program.
c. Consider inviting ADEQ to participate in the Failure Mode and Effects Analysis (FMEA) workshop.

Response

Attachment 2 provides the following documents which include site-specific failure mode analysis for the TSFs and HLF and the Contingency Action Plan (CAP) for the TSFs.

- Attachment 2:
  - Attachment 2A Tailings Storage Facility Contingency Action Plan (CAP). April 13, 2023.
  - Attachment 2C Failure Modes and Effect Analysis Report (FMEA) – Copper World Project - TSF and HLF. April 13, 2023.

Item 22: Provide the reference material for the following items:

a. A detailed engineering and permitting design of a Dry Stack Tailings Storage Facility for the Rosemont Copper Project (AMEC, 2009).
b. Geotechnical Study Report, presenting initial geotechnical site investigations conducted in 2006-2007 at the Rosemont Copper Project (Tetra Tech, 2007a) and an addendum to the 2007 Geotechnical Study Report (Tetra Tech, 2009).
c. Call & Nicholas, Inc. (CNI), 2016. Feasibility-Level Geotechnical Study for Rosemont Deposit. Report prepared for Hudbay Minerals, Inc. May 2016.

Response

The above listed documents are provided as attachments to this response letter.

- Attachment 7: Rosemont Copper Company, Dry Stack Tailings Storage Design, Final Design Report. Report dated April 15, 2009 by AMEC Earth & Environmental, Inc. (Item 22a)
- Attachment 8: Geotechnical Study, Rosemont Copper. Report dated June 2007 by Tetra Tech. (Item 22b)
- Attachment 9: Geotechnical Addendum, Volume 1 of 3, Rosemont Copper Project. Report dated February 2009 by Tetra Tech. (Item 22b)
- Attachment 10: Geotechnical Addendum, Volume 2 of 3, Rosemont Copper Project. Report dated February 2009 by Tetra Tech. (Item 22b)
- Attachment 11: Geotechnical Addendum, Volume 3 of 3, Rosemont Copper Project. Report dated February 2009 by Tetra Tech. (Item 22b)
- Attachment 12: 2015 Pit Slope Feasibility Evaluation for the Rosemont Deposit. Revision 2. Report dated January 2016 by Call & Nicholas, Inc. (Item 22c)

As a note, the Call & Nicholas 2016 report (Attachment 12) was not referenced correctly in previous documentation, i.e., Item 22c.

Item 23: Provide TSF deposition planning and material balance for every year for the first 5 years and every 5 years after that to satisfy the following:

a. To justify maintaining the 400 ft beach distance and maintaining the downstream slope of 3H:1V during operation.
b. To justify availability of enough sand material for building the centerline construction method.
c. To provide access and maintenance roads for TSFs during the operation and for final configuration and closure.

Response

a. The 400 ft beach distance and downstream embankment will be maintained at slope of 3H:1V, to ensure to meet, or exceed, the required geotechnical stability Factors of Safety (FOS).
b. The amount of sand expected from the cyclone is approximately 30% of the total whole tailings volume. The tailings facilities will require ~31% sand; any sand shortage will be made up for using locally borrowed soil or selected waste rock to construct the proposed tailings embankments.
c. Throughout the Project, the TSFs will have continuous access. TSF-1 is projected to have four ramps, and TSF-2 is projected to have two. The access roads for the TSFs are presented in Figures 4-1 and 4-2 of Attachment 13.

Attachment 13 provides the following technical memorandum to address comments on the tailings deposition, sand balance, and access configuration of the TSFs:

- Attachment 13: Tailings Deposition and Sand Balance - Copper World Project Tailings Storage. Technical Memorandum dated March 17, 2023.

Item 24: Provide a contingency plan for the centerline construction, in the event that sufficient cyclone tailings sand is not available during operation.

Response

The response below refers to the Tailings Storage Facility Contingency Action Plan (Attachment 2 of this response letter) referenced in Item 2.

The following design elements that are intended to mitigate this risk:

1) The technical memorandum addressing Item 23 (Attachment 13) presents a sand balance analysis to support the TSF design.

2) Copper World has designed a pond system (see the Primary Settling Pond shown in Drawing Numbers 104-1-007 and 104-2-024 provided in Appendix I.10 of the September 2022 APP application) that will allow whole tailings to be temporarily stored during upset conditions.

3) Within each TSF impoundment, there is plenty of near-surface alluvium material that could be used for construction of the tailings dam embankments in case of tailings sand shortages. Testing results, as presented in Figure 4-1 of the TSF Stability Memo (Appendix I.1 of the September 2022 APP application), indicate that the strength of Embankment Fill constructed of compacted foundation alluvium is higher than that of cyclone sand and should be suitable for replacement of cyclone sand if needed. Also refer to the Tailings Storage Facility Contingency Action Plan referenced in Item 2.

Item 25: Provide information for the starter dam design:

a. What kind of material will be used for the construction, rock or soil? Please specify and provide specification for material placement.
b. Provide the source of the material that will be used for the starter dam construction.
c. Provide the justification for placing the inclined chimney drain on the upstream side of the starter dam.

Response

a. The Starter Dam will be constructed with Embankment Fill consisting of soil-like material with locally borrowed alluvium/colluvium (see Section 4.3 of the Stability Analysis Memorandum-Tailings Storage

Facilities [Wood, 2022] provided as Appendix I.1 of the September 2022 APP application). Embankment Fill will be placed in thin lifts and compacted to achieve the required physical properties.

b. Embankment Fill will be sourced within the footprint of the tailings impoundment. The geotechnical investigation suggests that near-surface alluvium/colluvium is prevalent, and a majority of this material is suitable for use in constructing the Starter Dam and other embankment segments if needed. Starter dams and embankment segments may also be constructed using waste rock if the material meets engineering requirements.

c. As stated in Section 3.0 of the Stability Analysis Memorandum-Tailings Storage Facilities (Wood, 2022. Appendix I.1 in the September 2022 APP application), the incorporation of the Chimney Drain is to improve recovery of tailings water and to prevent the critical structural zones of the embankment (i.e., downstream shell zone of cyclone sand and starter dam material) from becoming saturated. The Chimney Drain will be connected to the impoundment underdrain system as called out on Drawing Numbers 104-2-030 and 104-2-036 of the Design Drawings (see Appendix I.10 in the September 2022 APP application).

Item 26: Provide a detailed stability monitoring plan for the TSF and HLF.

Response

See response to Item 3. Stability monitoring instrumentation, such as piezometers, is covered in the Tailings OMS Manual.

Item 27: Provide the downstream sand placement methodology to minimize the static liquefaction.

Response

The current seepage models do not suggest massive saturation in cyclone sand downstream of the Starter Dam (see Section 4.4 of the Stability Analysis Memorandum-Tailings Storage Facilities [Wood, 2022] provided as Appendix I.1 in the September 2022 APP application along with the response to Item 35). The risk of static liquefaction in the downstream cyclone sand is considered low, in light of the following Project features, (1) generally high permeable foundation and cyclone sand as reflected in the seepage models, (2) incorporation of the Chimney Drain along the Starter Dam upstream face and a TSF underdrain system to improve tailings water recovery and prevent saturation in downstream cyclone sand, and (3) control of dam raising rates as discussed in the response to Item 16.

Vibrating wire piezometers are planned to be installed to monitor saturation and pore pressure development in the downstream cyclone sand (refer to the Tailings Storages Facilities OMS Plan developed in response to Item 3). If modeling or monitoring during future stages of design, construction, or operation indicate potential risks of saturation and static liquefaction in the lower zone of downstream sand, the downstream segment of that particular zone can be compacted to offer a buttressing zone and mitigate static liquefaction-induced instability. Besides the relatively higher strengths to be achieved after compaction, the compacted segment of cyclone sand would behave dilatively under shearing, thus prevent development of excess pore pressure leading to static liquefaction. However, current modeling results do not suggest such a risk is credible; therefore, the design has not considered mitigation at this stage.

Item 28: Provide a plan for minimizing the risk of static liquefaction and monitoring requirements during the operation.

Response

Refer to the response to Item 27. Additionally, the Tailings OMS Manual (see response to Item 3) outlines monitoring during construction and operation.

Item 29: Provide the criteria for selecting the two cross sections used in evaluating the slope stability for the TSF.

a. Include additional cross-sections in locations that are more critical for stability.

Response

Attachment 14 provides additional cross-sections cut through the tailings storage facilities (TSFs) and also summarizes the criteria for selecting the original critical sections in the Stability Analysis Memorandum-Tailings Storage Facilities (Wood, 2022) provided in Appendix I.1 of the September 2022 APP application.

- Attachment 14: Additional Stability Analysis Copper World Project Tailings Storage Facilities. Technical Memorandum dated March 31, 2023.

Item 30: Provide justifications for using different return periods for TSF (return period of 10,000 years), HLF, and Waste Dump (return period of 2,475).

a. Justification for using various return periods for TSF final height is around 200 ft and HLF is around 400 ft.
b. Provide the procedure for obtaining 0.17g corresponding to a 10,000-year recurrence interval design earthquake.

Response

In addition to the Arizona Mining BADCT Manual, the selection of seismic design criterion has also considered the recently published Global Industry Standard on Tailings Management (GISTM), which suggests use of a 10,000-year-return as the most stringent probability-based criterion under all design conditions. Use of the return period of 2,475 years is an acceptable industrial standard and a common practice for closure and post-closure designs of HLFs and WRFs and is in compliance with the BADCT Manual. The following information was provided to ADEQ as part of the September 2022 APP application:

- Stability Analysis Memorandum-Tailings Storage Facilities (Appendix I.1)
- Stability Analysis Memorandum-Heap Leach Facility (Appendix I.2)
- Stability Analysis Memorandum-Waste Rock Facility (Appendix I.3)

Additionally, and in reference to Items 30a and 30b above:

a. Geotechnical safety hazards and risks are different between tailings dams and heap leach facilities. While the HLF of this Project is taller than the tailings dams, the service life (when solution is introduced to the heap) is rather limited. Moreover, HLF piles are generally operated under unsaturated conditions, while tailings material upon deposition is finer and wetter, and saturation (thus potential earthquake-induced impact) has to be considered as an engineering priority. After the end of leaching, no additional solution is applied to the HLF and the heap is anticipated to drain much faster than the mill tailings.
b. Refer to Table 5 of the "Site Specific Hazard Analysis and Development of Design Ground Motions (LCI, 2021) provided in Appendix B.3 of the September 2022 APP application.

Item 31: Provide the justifications for including alluvial cutoffs and the design of the cutoffs at the starter dams.

Response

As discussed in Section 4.5 of the Site Water Management Plan (Appendix E of the September 2022 APP application), the seepage collection system includes alluvial cutoffs (referred to as seepage collection trenches in the Site Water Management Plan) which are intended to:

1. Increase seepage recovery by providing a secondary collection method, in addition to the chimney drain of the Starter Dam and impoundment underdrain (seepage collection system); and

2. Provide a more favorable condition for stability due to additional pore pressure relief along the downstream toe of the tailings impoundment.

There are no alluvial cutoffs at the Starter Dams; instead, they will be constructed at the downstream toe of the TSFs. The chimney drains on the upstream embankment of the Starter Dams gather water from the TSF, then the seepage collection system drains the water to the seepage collection trenches. The water is then pumped to the Primary Settling Pond and subsequently to the process plant for reuse.

Item 32: Provide the plan view map for construction of alluvial cutoffs and seepage collection systems along the main drainages beneath both TSFs.

Response

See Drawing number 104-2-001 in Appendix I.10 of the September 2022 APP application. The alluvial cutoffs (referred to as seepage collection trenches in the Site Water Management Plan, Appendix E of the September APP application) will be located along the downstream toe of the tailings facilities. The mentioned figure has also been included herein as Attachment 15 (titled Stormwater Management Overall Site Plan).

- Attachment 15: Drawing No. 104-2-001 - Stormwater Management Overall Site Plan.

Item 33: Provide a plan view map for the location of unsuitable material that will be removed underneath the TSF and HLF locations and include the following:

a. Material characterization of the removed material.
b. Garnet Skam rock has residual value of approximately 24 degrees (Pre-Feasibility Level Pit Slope Design Study Page 91). In addition to the plan view map, provide assurance and justifications that no such material is underneath the TSF and HLF locations.
c. The location of the disposal/use of this material.

Response

With regard to Item 33a, the following materials will be removed from the footprint of the HLF:

- Vegetation
- Topsoil (stockpiled for use as future reclamation cover material)
- Debris (if encountered)
- Loose alluvium/colluvium materials will be removed from drainages throughout the entire footprint.

No other loose or deleterious materials are anticipated or known.

Additionally, the following materials will be removed from the footprint of the TSFs:

- Vegetation from areas associated with the Starter Dams, the outer embankment slopes, alignment of the seepage collection system, and perimeter areas such as roads, seepage collection trenches, and channels.
- Topsoil (stockpiled for use as future reclamation cover material)
- Debris (if encountered)
- Loose alluvium/colluvium materials will be removed from drainages (washes) that intersect, or are potentially underneath, the following areas:
    - Starter Dams
    - Outer embankment slopes

Refer to Attachment 16, Figure 33-1, for the estimated extent of unsuitable material stripping for the TSFs and HLF. Moreover, clearing of vegetation and topsoil will extend beyond the improvement area limits that require stripping to a minimum lateral distance of about 5 feet. No stripping is required where bedrock is exposed.

- Attachment 16: Figure 33-1. Unsuitable Material beneath TSFs and HLF.

With regard to Item 33b, the subsurface exploration that was part of the geotechnical investigation did not encounter "Garnet Skarn rock" within the footprints of the TSFs and HLF. Furthermore, the referenced test on Page 91 of the 'Pre-feasibility Level Pit Slope Design Study, dated January 5. 2022', which was provided as Appendix I.5 in the September 2022 APP application, is a direct shear test of a rock joint and is not representative of the strength of the rock mass.

With regard to Item 33c, the following describes candidate disposal locations and proposed use of the removed materials:

- Vegetation and Topsoil: Vegetation will generally be mulched and used as an erosion control material or used in future reclamation work. Vegetation removed from facility footprints will not be incorporated/buried in the facilities. Mulched vegetation and topsoil are to be used as growth media for closure cover, and to be temporarily stockpiled in the following locations: (1) future expansion areas of TSF/HLF (where materials will be subsequently removed for concurrent mine closure during operations [if possible] prior to construction of corresponding expansions); or (2) over backfilled pits and waste rock disposal areas.

- Debris (if any): to be disposed in (1) impoundment areas of TSFs, away from dam footprints; or (2) depleted pits and waste rock disposal areas.
- Unsuitable alluvium/colluvium (if any): if the material meets the specification for engineered fill such as for drain fill and pipe backfill, the material could be processed as needed and used for construction. Otherwise, the material could be temporarily stockpiled for use as closure cover (if it meets the specifications) or be disposed of as debris within the same disposal locations as discussed above.

Item 34: Annotate the cross sections with the available boreholes or test pits on cross-sections to justify the profile used for stability analysis.

a. Foundation is assumed to be competent; provide the material and characterization of the foundation material.

Response

Use of the strength characterized with a zero cohesion and 36-degree friction angle for the TSF foundation is conservative as stated in Section 4.4 of the Stability Analysis Memorandum-Tailings Storage Facilities (Wood, 2022) provided in Appendix I.1 of the September 2022 APP application. This strength is consistent with, and supported by, the characterization data for the foundation soils used in both the TSF and HLF Stability Analysis Memoranda (2022) provided in Appendix I.1 and Appendix I.2, respectively, of the September 2022 APP application. The shear strengths of foundation soil and bedrock used for the TSF stability evaluation of the Rosemont Copper Project are significantly higher as summarized in Table 34-1 below. However, the assigned strength for the TSF foundation, although conservative, supports the current design of the TSFs; therefore, there is no additional engineering required at the current stage. Further characterization of the foundation soil can be found in the "TSF Stability Memorandum" by Wood (2022). Attachment 17 of this response letter provides Figures 34-1 through 34-6 showing annotated cross-sections.

- Attachment 17: Figures 34-1 through 34-6, Section TSF – Static Condition

Table 34-1: Shear Strength Used

<table>
<tr><th rowspan="2">Materials</th><th colspan="2">Shear Strengths Used in Tetra Tech (June, 2007), "Leaching Facility Design, Rosemont Copper"</th><th colspan="2">Shear Strengths Used in Tetra Tech (May, 2009), "Rosemont Heap Leach Facility, Permit Design Report"</th><th colspan="2">Shear Strengths Used in this Project (modeled as Foundation Soils) "TSF Stability Memo" (Wood, 2022)</th></tr>
<tr><th>Cohesion (psf)</th><th>Friction Angle (°)</th><th>Cohesion (psf)</th><th>Friction Angle (°)</th><th>Cohesion (psf)</th><th>Friction Angle (°)</th></tr>
<tr><td>Foundation Soils (referred to as "Alluvium" in the Rosemont Copper Project APP)</td><td>2000</td><td>39</td><td>0</td><td>39</td><td rowspan="2">0</td><td rowspan="2">36</td></tr>
<tr><td>Bedrock</td><td>3500</td><td>40</td><td>3500</td><td>40</td></tr>
</table>

Item 35: Provide justification for the phreatic line for the TSF stability.

a. Cyclone sand downstream placement will not be dry and will contribute to the Phreatic line.
b. Provide data to support the permeability or provide data for permeability (the tailing material has approximately 50 to 70 percent fines).
c. The undrained shear strength of tailings is assumed to be 0.25. Provide a monitoring plan to confirm this is maintained during operations. Fine tailings and whole tailings are assumed to have the same undrained

strength as shown in Table 4-4 on Page 11, and Figure 1 l-24 on Page 78 in the Stability Analysis Memorandum Tailings Storage Facilities Rosemont Copper World Project.

d. Based on the gradation testing done by KP, the tailings material contains 50 to 70 percent fines. Provide justification for using the Phreatic Line from the seepage model.

Response

Seepage analyses have been performed on critical sections to demonstrate current assumed piezometric surfaces that are reasonably conservative at this level of engineering. Refer to Section 3.0 of the Technical Memorandum titled Additional Stability Analysis – Copper World Project Tailings Storage Facilities provided in Attachment 14 of this RAIS letter (prepared for Item 29). See below for responses to Items 35a-d:

a. Cyclone sand has a relatively high permeability. Although it is not dry, pore pressure built-up is anticipated to dissipate, and sand is to be drained relatively fast to avoid massive saturation. For this project, the foundation material also has a relatively high permeability. Moreover, with the chimney drain and the underdrain system (seepage collection system), current modeling results do not suggest massive saturation in the cyclone sand. This is further illustrated in the outputs of the seepage analysis documented in the Technical Memorandum titled Additional Stability Analysis – Copper World Project Tailings Storage Facilities (see Attachment 14 of this response letter).

b. Samples of cyclone sand have not been available; therefore, testing data of permeability is not available at this stage. As stated in Table 4-5 of the Stability Analysis Memorandum-Tailings Storage Facilities (Wood, 2022) provided as Appendix I.1 in the September 2022 APP application), the permeability coefficient of Cyclone Sand was estimated based on a review of the existing testing data along with performance data of similar projects in Arizona (e.g., Pinto Valley TSF's). The assumed value for Coarse Tailings is also consistent with the average permeability range published for "Clean, coarse, or cyclone sands with less than 15% fines" (Table 2.5 "Typical Tailings Permeability Ranges", Vick, S. G, Planning, Design, and Analysis of Tailings Dams, BiTech Publishers Ltd, 1990).

c. As illustrated in Figure 4-3 of the Stability Analysis Memorandum-Tailings Storage Facilities (Wood, 2022) provided in Appendix I.1 of the September 2022 APP application, the undrained shear strength of the tailings was assumed based on a review of data in published literature. The low boundary of the range was conservatively selected for modeling. An instrumentation plan will be implemented to monitor the performance of the tailings, including pore pressure development; refer to the Tailings OMS Manual addressed in Item 3.

d. Refer to the discussions and outputs of the seepage analysis documented in the technical memorandum addressed in Item 29, titled Technical Memorandum Additional Stability Analysis – Copper World Project Tailings Storage Facilities (see Attachment 14 of this response letter).

Item 36: Provide supporting data for the following statement on page 4 of the Stability Analysis Memorandum Heap Leach Facility (HLF) Rosemont Copper World Project: 'Material properties used in the analysis were developed from the engineering material shear strength data based on the field and laboratory investigations, the literature, and Wood's experience with similar materials".

Response

The Stability Analysis Memorandum-Heap Leach Facility (Wood, 2022) was provided as Appendix I.2 in the September 2022 APP application. Table 4-1 of this memorandum details the following:

- "Foundation Soil", remolded foundation soil samples were tested, and the shear strength was developed based on the testing results (see Figure 4-1 of the Stability Analysis Memorandum-Heap Leach Facility).
- "Embankment/Structural Fill", HLF berms will be placed and compacted using excavated foundation materials, with the same strength as of "Foundation Soil".
- "Overliner", this, as discussed in Section 1.2 of the Stability Analysis Memorandum-Heap Leach Facility (Appendix I.2), is a well-draining processed material with the largest particles smaller than 1.5 inches. Due to the granular and crushed nature of the material, the strength assumption characterized as zero cohesion and 36 degree friction angle is reasonably conservative.

- “Waste Rock”, the same as for the Stability Analysis Memorandum-Waste Rock Facility (Wood, 2022. Appendix I.3 of the APP application submittal, September 2022).
- "Leach Ore", the same as used for the Rosemont Copper Project as documented in Tetra Tech (2007), “Leaching Facility Design, Rosemont Copper” and Tetra Tech (2009), “Rosemont Heap Leach Facility, Permit Design Report”.
- "Liner Interface", based on testing results documented in Tetra Tech (2007), “Leaching Facility Design, Rosemont Copper” and Tetra Tech (2009), “Rosemont Heap Leach Facility, Permit Design Report”, as summarized in Figure 4-2 of the Stability Analysis Memorandum-Heap Leach Facility (Wood, 2022) provided in Appendix I.2 of the September 2022 APP application.

With the exception of “Leach Ore” and “Liner Interface” of which the parameters are consistent with or supported by the testing data of Tetra Tech (2007)/Tetra Tech (May, 2009), the strengths used for the Copper World Project have been more conservative than that used in work done for the Rosemont Copper Project as summarized in Table 36-1 below.

Table Item 36-1: Strengths Used in the Project

Materials	**Shear Strengths Used in Tetra Tech (June, 2007), “Leaching Facility Design, Rosemont Copper”**		**Shear Strengths Used in Tetra Tech (May, 2009), “Rosemont Heap Leach Facility, Permit Design Report”**		**Shear Strengths Used in this Project**	
	Cohesion (psf)	**Friction Angle (°)**	**Cohesion (psf)**	**Friction Angle (°)**	**Cohesion (psf)**	**Friction Angle (°)**
Foundation Soil (referred to as “Alluvium” in the Rosemont Copper Project APP)	2,000	39	0	39	0	36
Embankment Fill/Structural Fill	2,000	39	0	39	0	36
Over Liner (referred to as “Structural Fill” in the Rosemont Copper Project APP)	2,000	39	0	39	0	36

Item 37: In the evaluation of the HLF, it is assumed "the foundation materials will remain unsaturated." (see Page 6 of Report Stability Analysis Memorandum (HLF) Rosemont Copper World Project).

a. Provide justification for the assumption during the operations.
b. Provide monitoring plan in order to confirm the assumptions and contingency plan if the assumption changes during operations.

Response

a. The Heap Leach Facility (HLF) liner system (consisting of a geomembrane liner and a Liner Bedding layer) is designed to maintain integrity during construction, operation, and closure. The geotechnical investigation did not encounter any springs, or shallow groundwater table within the footprint of the HLF (Geotechnical Site Investigation Memo, Appendix I.6 in the September 2022 APP application). Therefore, saturation of near-surface foundation material that could impact the stability of HLF is not anticipated. Moreover, the liner interface shear strength testing was performed under inundated conditions (with saturation of materials below and above the tested liner), which suggests that if saturation was to occur (as a hypothetical case), safety margins as calculated would still be maintained under design conditions.

b. As detailed in Drawing Number 104-2-011 of Design Drawings (Appendix I.10 in the September 2022 APP application), a HLF Underdrain has been proposed under the Collection Berms, which will detect and collect groundwater if the foundation becomes saturated. Moreover, the site-wide groundwater table will also be monitored in wells to be installed across the site.

Item 38: The bench slope for HLF is around 39 ft with 1.3H:1V slope and it is more than the angle of repose of embankment fill. Provide the stability for bench slope.

Response

The HLF stability analysis has focused on evaluation of the overall design slope. 1.3H:1V is a presumed angle-of-repose slope of discrete lifts, which is not commonly analyzed for stability modeling in support of HLF design. The angle-of-repose slope assumed is consistent with the strength of the HLF ore, of which the internal friction angle is 38 degrees for the lower range of overburden stress (shown in Figure 4-3 of the HLF Stability Analysis Memo, Appendix I.2 of the September 2022 APP application), i.e., arctangent $(1/1.3) \approx 38$ degrees. If any lift-scale instability was to occur, it would be very localized and surficial with debris to be contained within the pad edge or by the setback benches. The HLF stability analysis was performed with the same methodology as was done for the Rosemont Copper Project and for permit applications of other projects in Arizona. Moreover, the 1.3H:1V slope is the angle-of-repose slope for HLF ore, with a strength different than that of “embankment fill”.

Item 39:

Provide the data for the following statement found on Page 8 of Report Stability Analysis Memorandum Heap Leach Facility (HLF) Rosemont Copper World Project: "These interfaces were modeled based on previously performed testing on two different reinforced GCL products supplied by CETCO" (Tetra Tech, 2007b; 2009b).

Response

The Tetra Tech memos (2007, 2009) with the interface testing results are provided as Attachments 18 and 19 to this response letter.

- Attachment 18: Leaching Facilities Design. Rosemont Copper. Report dated June, 2007.
- Attachment 19: Rosemont Heap Leach Facility. Permit Design Report. Volume 1. Rosemont Copper Company. Report dated May, 2009.

Item 40:

Provide justification for using the circular failure for the HLF for some of the cross sections.

a. The interface of the liner and GCL has a 16-degree friction angle and circular failure is not considered appropriate for this condition by ADEQ.

Response

It is a common practice to evaluate both circular and non-circular (linear) failures to support HLF slope designs. While the non-circular (block) failures are intended to evaluate potential failure envelopes that could be governed by weak layers (i.e., the Liner Interface assembly in this Project), circular failures will capture arc-shaped potential failure envelopes involving single or multiple materials that are not driven by weak or discontinuity layers. By modeling both failure modes, all potential critical failure envelopes can be evaluated in order to support a HLF design. Additionally, and in response to Item 40a:

a. The analysis includes the evaluation of both linear failures and circular failures on these sections. Circular failure searching has captured all materials including the Liner Interface layer. Critical failures that could be governed by the Liner Interface have been evaluated via non-circular or linear failures as discussed previously. Refer to Section 4.1, Table 4-2 of the Stability Analysis Memorandum-Heap Leach Facility, Appendix I.2 (Wood, 2022) in the September 2022 APP application), along with figures for discussions and modeling results with regard to circular and non-circular failure searching.

Item 41: Provide justification for using foundation as competent material using 36-degree friction angle. In the Waste Rock Facility Stability memorandum, it was mentioned that "The foundation material consists, in general, of alluvium (including GP, SP, and SW oil types), highly to completely weathered rock, and moderate to slightly weathered rock."

a. Update the cross sections with available boreholes and test pits.
b. Provide the surface geology map showing the thickness of alluvium under the waste dump.

Response

Use of the strength characterized with a zero cohesion and 36-degree friction angle for the WRF Foundation is conservative as stated in Section 3.4 of the Stability Analysis Memorandum-Waste Rock Facility (Appendix I.3 of the September 2022 APP application); this strength is consistent with, and supported by, the characterization data for Foundation Soils of other information provided to ADEQ in the September 2022 APP application, such as:

- Stability Analysis Memorandum-Tailings Storage Facilities (Appendix I.1)
- Stability Analysis Memorandum-Heap Leach Facility (Appendix I.2)

The shear strengths of foundation soil and bedrock used for the WRF stability evaluation used for the Rosemont Copper Project are significantly higher as summarized in Table 41-1 below. However, the assigned strength for the WRF Foundation, although conservative, supports the current design of the WRF; therefore, there is no additional engineering required at the current stage. See Attachment 20 (Figures 41-1 through 41-4) of this response letter for annotated cross-sections.

- Attachment 20: Figures 41-1 through 41-4. WRF Plan View – Cross-Sections.

Table Item 41-1: Foundation Soil Used for the WRF – Previous Reports

Materials	**Shear Strengths Used in Tetra Tech (June, 2007), "Leaching Facility Design, Rosemont Copper"**		**Shear Strengths Used in Tetra Tech (May, 2009), "Rosemont Heap Leach Facility, Permit Design Report"**		**Shear Strengths Used in this Project (modeled as Foundation Soils)**	
	Cohesion (psf)	**Friction Angle (°)**	**Cohesion (psf)**	**Friction Angle (°)**	**Cohesion (psf)**	**Friction Angle (°)**
Foundation Soils (referred to as "Alluvium" in the Rosemont Copper Project APP)	2000	39	0	39	**0**	**36**
Bedrock	3500	40	3500	40		

Additionally, and specific to Items 41a and b:

a. Refer to Figures 41-1 through 41-4 in Attachment 20. As shown, the thickness of alluvium is minimal and the assumption of modeling all of the WRF foundation as alluvium soil is very conservative for slope design.

b. The foundation of the WRF has been conservatively simplified to model all materials as soil as discussed in Section 3.4 of the WRF Stability Analysis Memo (Appendix I.3 of the September 2022 APP application). The underlying bedrock has much higher strength than the Foundation Soil. Therefore, for stability evaluation of the WRF design, there is no need for alluvium thickness delineation considering the conservative nature of the above simplification/assumption.

Item 42: Provide supporting data for depositing the waste rock material using 37-degree friction angle for the stability.

Response

As discussed in Section 3.4 of the WRF Stability Memo (Appendix I.3 of the September 2022 APP application), the assumed strength is reasonably conservative and lower than other previous studies completed for the Rosemont Copper Project. Table 42-1 below presents a summary of waste rock strengths that had been used from the Rosemont Copper Project.

Table 42-1: Waste Rock Strengths – Previous Reports

Materials	**Shear Strengths Used in AMEC (April, 2009), "Rosemont Copper Company, Dry Stack Tailings Storage Facility, Final Design Report"**		**Shear Strengths Used in Tetra Tech (March 12, 2010), "Rosemont Copper Company, Waste Rock Storage Area, Stability Analysis"**		**Shear Strengths Used in this Project**	
	Cohesion (psf)	**Friction Angle (°)**	**Cohesion (psf)**	**Friction Angle (°)**	**Cohesion (psf)**	**Friction Angle (°)**
Waste Rock	0	38	0	Weak Rock (Leps, 1970[1]), with friction angles ranging from 32 degrees to 50 degrees	**0**	**37**

Note 1: Leps, T. M. (1970), Review of Shearing Strength of Rockfill, Journal of the Soil Mechanics and Foundations Division, Proceedings of the American Society of Civil Engineers, Vol 96, No SM4, July 1970.

Item 43: Provide justification of not using the recent drilling program data for pit slope design study.

Response

Wood/WSP (WSP) used the geotechnical drilling data that was available at the time of completion of the Pre-feasibility level pit slope design study. Some of the geotechnical drill holes drilled in 2021 were for foundation investigations of the TSF/HLF and may not be representative of the conditions in the pit slopes. WSP reviewed the logs and laboratory testing from the geotechnical holes located outside of the pit areas to confirm that the materials were generally consistent with those used in the pit slope designs. For the Rosemont Pit, additional geotechnical data may have been collected that was not included in the CNI (2016) report. WSP determined during the initial review that the data available in the CNI (2016) Feasibility-level pit slope design study was sufficient for a Pre-feasibility level pit slope design study update for the Rosemont Pit. This CNI (2016) report is provided as part of the response to Item 22.

Item 44: For joint structure evaluation, was the oriental directional drilling used or is the data based on outcrops?

Response

Oriented core data were used for pit slope designs. For the Rosemont Pit, the analysis was based on data collected from oriented core and televiewer surveys. For Peach-Elgin, Copper World, and Broadtop Butte, the analysis was based on outcrop mapping only; the core drilled in the 2021 drilling program was not oriented. Outcrop mapping was considered sufficient for analysis of the Peach-Elgin, Copper World, and Broadtop Butte pits for a Pre-feasibility level of study.

Item 45: Provide a report presenting details of your investigation to obtain reliable data for the Rosemont Pit to clarify the following statement found on the page 18 of the Pre-Feasibility Level Pit Slope Design Study: "For this reason, independent interpretation of the stereonets shown by CNI may not be reliable."

Response

The statement "For this reason, independent interpretation of the stereonets shown by CNI may not be reliable" is meant to convey to the reader that the stereonets shown in the CNI (2016) report contain data that has been processed and altered from the original data collected in the field. As such, the data presented in the stereonets cannot be interpreted or analyzed by a standard method. The statement is not meant to suggest that the structural orientation data collected by CNI is unreliable.

Item 46: Provide details for any dewatering program proposed for the Rosemont pit found on the page 22 of Pre-Feasibility Level Pit Slope Design Study: "The stability analyses indicate that the slope have to be dewatered for approximately 300 feet behind the slope to achieve acceptable factors of safety in this configuration and overall angle."

Response

Piteau prepared a preliminary Rosemont Pit dewatering scenario using the Project groundwater model in which dewatering wells were included in the simulation. Please refer to Attachment 21, Copper World Project – Rosemont Pit – Dewatering Scenario. Technical Memorandum, File No. 4286-TM23-APP46, dated March 31, 2023.

The groundwater model results predict that the phreatic surface (top of the yellow contour, see Attachment 22, Figure 46-1) will be lowered and drawn back more than 300 feet from the slope face in the Gila formation in cross section R4 from the Pre-Feasibility Slope Design Study (Wood, 2022. Appendix I.10 of the September 2022 APP application) as shown in Attachment 22, Figures 46-1 and 46-2, of this response letter. Importantly, the model results indicate that the phreatic surface will be lowered and drawn back below and to the right of the critical slip surface in the slope stability analyses for the Gila formation. The stability analyses using the groundwater model results indicate factors of safety above the minimum design acceptance criteria for the pit slopes in the Gila and overall slopes.

Item 47: Provide justification for using the Hoek-Brown Curve For PALEOZOICS (Figure E3, Page 269), the drawn curve may not be representative of the sample points.

Response

The Paleozoic geotechnical unit represents a composite rock mass strength estimate of many different "sub-units" consisting of limestones, dolomite, siltstones, sandstones, quartzites, and conglomerates. In general, the strength of the Paleozoic rocks is classified as Strong (R4) (7,500 psi < UCS <15,000 psi) according to the IRSM Rock Strength Classification System and based on the point load testing and laboratory testing data. However, as is common in a complex geological environment, there is variation in the strength of the Paleozoic rocks as indicated in Figure E3 on page 269. The curve shown in Figure E3 (see Pre-Feasibility level Pit Slope Design Study provided as Appendix I.5 of the September 2022 APP application) represents a composite or "best fit" failure envelope estimate representing the available laboratory testing data for the Paleozoic rocks. The curve fit is based on an algorithm in the RSData computer program that uses a variety of regression techniques to develop a "best fit" to the available data points. The results of the curve fitting exercise for Unconfined Compressive Strength (UCS) and mi (intact rock constant) are within published ranges for values of UCS and mi for similar rocks.

Item 48: Provide QA/QC for all the discharging facilities. What practices will be maintained to ensure that design specifications are followed during construction?

a. Sources of high pore pressure in the foundation of TSFs and HLF should be mitigated.
b. Undrained stability should be mitigated.
c. Containment: Critical components include stability failures, piping failures, overtopping, erosion, and washouts around hard structures.

Response

The operation, maintenance, and surveillance (OMS) manuals for the tailings and heap leach facilities are provided in Attachment 3, These OMSs are guidelines to the operators which include the best available practice information to be considered, including, managing QA/QC programs, and inspection of the embankments, foundations, and the underdrain seepage collection system. These manuals will be updated as necessary to include new information, industry guidance or regulatory standards, or pertinent changes in the best practices described herein.

- Attachment 3:
  - Attachment 3A, Copper World Project – Tailings Operation, Maintenance, and Surveillance (OMS) Manual. April 12, 2023.
  - Attachment 3B, Copper World Project – Heap Leach Facility Operation, Maintenance, and Surveillance (OMS) Manual. April 12, 2023.

Additional guidelines for inspections, monitoring and response levels are presented in Attachment 2 as response Item 2.

- Attachment 2:
  - Attachment 2A, Tailings Storage Facility Contingency Action Plan (CAP). April 13, 2023.

As described in Section 20.7 of the September 2022 APP application, the quality assurance/quality control (QA/QC) for all the discharging facilities will be submitted to ADEQ prior to the start of construction. In accordance with BADCT guidance, a QA program will be implemented to document the construction methods and provide verification of the QC results.

General Hydrogeology Items

General Hydrology Items cover Items 49 through 64. Additionally, and per ADEQ:

> "Items 51 through 58 for individual discharging facilities are based on the geochemical modeling provided in Appendix G.1 of the application."

Item 49: The DIA based on the groundwater modeling indicates that extent of potential groundwater impacts from the discharging facilities will extend beyond the property boundary. Per A.A.C. A202(A)(8)(a)(i)-(ii), applicants must demonstrate that discharges will not violate the aquifer water quality standards (AWQS) at the points of compliance (POCs) or that discharges will cause additional degradation of the aquifer. Please provide a more detailed study of the potential impacts or provide detailed mitigation and contingency plans that address these potential off-site impacts.

Response

This request appears to some degree to conflate the DIA and PMA/POC concepts. As the request correctly notes, it is a prerequisite for permit issuance that an applicant demonstrates that its discharges will not cause a violation of aquifer water quality standards (AWQS) at the point of compliance (POCs) or, if AWQS at the POCs are exceeded at the time of permit issuance, that the discharges will not further degrade the quality of the aquifer. A.R.S. § 49-243(B)(2)-(3). The statute also contains requirements for delineating the PMA, which in turn determines the location of the POCs. A.R.S. § 49-244. POCs are generally located fairly close to the discharging facilities.

By contrast, the DIA is an estimate of the maximum areal extent of pollutant migration as a result of a discharge, A.R.S. § 49-201(13). Although the APP statute imposes quality requirements that must be met at the POC(s), it does not anywhere state that there can be no impacts whatsoever to groundwater quality within the broader DIA, which typically extends beyond the POCs. Stated in a different way, the statute does not prohibit impacts within the DIA. Therefore, a request to provide "detailed mitigation and contingency plans that address these potential off-site impacts" is not consistent with the statute, to the extent that it suggests mitigation is required for any impacts occurring within the DIA.

The DIA at 200-year post-closure was predicted using the Project groundwater model (Water Quantity Impacts Assessment. Appendix F.2 of the APP application, September 2022). The DIA indicates the projected areal extent of potential pollutant migration from the discharging facilities, consistent with A.R.S. § 49-201(13). Potential impacts beyond the property boundary could include increases in sulfate and TDS concentrations; the Project geochemistry analysis predicts these constituents to be above EPA non-enforceable secondary MCLs, which are based on aesthetic considerations (Geochemical Impacts Assessment. Appendix G.2 of the APP application, September 2022).

The Project facilities will be monitored for compliance with AWQS at the Point of Compliance (POC) groundwater monitoring well network locations. As necessary, groundwater monitoring will also be augmented using a network of non-POC facility monitoring wells in areas where POC wells are very close to private land boundaries. Each POC well within close proximity of a private land boundary will have a corresponding facility monitoring well located upgradient of the POC well and adjacent to the facility footprint. An example for TSF-1 is discussed in Item 60.

Detections of groundwater quality constituent concentrations above AWQS will trigger mitigation plans. Mitigation plans could include the following:

- Confirmation groundwater sampling
- Increase of frequency for groundwater monitoring to monthly in affected areas
- Site assessment
  - To determine the source and mode of facility discharge(s)
  - To delineate the vertical and lateral extents of impacted groundwater
- Discharge source controls
- Design, construction, and operation of groundwater mitigation "pump back" wells or other facility specific mitigation
- Quarterly capture zone analysis to demonstrate discharge containment.

The Project groundwater model report (Water Quantity Impacts Assessment. Appendix F.2 of the APP application, September 2022) presented a hypothetical pump-back well mitigation scenario. This mitigation scenario effectively demonstrated discharge containment in the event that groundwater constituent concentrations become elevated above AWQS at POC monitoring wells due to facility discharges.

Other facility-specific mitigation measures are listed in Item 58. Mitigation measures will be employed until groundwater monitoring results indicate compliance with AWQS.

Item 50: Per A.RS. § 49-244, the POC is defined as a vertical plane downgradient of the facility that extends through the uppermost aquifers underlying the facility. The applicant provides figures showing the POC well locations (for example, Figure 6.1 in Appendix F.2) and provides a brief narrative of the locations (page 57 of Appendix F.2). Based on this definition, the locations of POC wells 1 through 6, as proposed, appear to be downgradient of discharging facilities. Please provide additional justification for the locations of POC wells 7 through 10, as it is not clear if these locations are downgradient based on the discharge impact analysis result or the particle tracking results. This justification should demonstrate these locations are downgradient of the facility. Furthermore, please propose estimated screened intervals for all POC wells, given that the actual screened interval will be determined during well installation.

Response

The locations of POC wells (including POC-07 through POC-10) were not located based solely on the results of the Project discharge impact analysis or the particle tracking results. As noted on page 57 of the Water Quantity Impacts Analysis (Appendix F.2 of the September 2022 APP application), the criteria for selecting the proposed POC locations included the following:

- Downgradient of Project pits and facilities
- Within 750 ft of the Pollutant Management Area (PMA)
- Adjacent to surface drainage channel areas
- Site access for drilling, well construction, and monitoring activities.

The gradients used for planning the proposed locations were based on the baseline groundwater piezometric elevations and contours presented in the Project Hydrogeological Characterization (Appendix F.1 of the September 2022 APP application). In this context, the POC wells (including POC-07 through POC-10) are proposed to be downgradient of the corresponding facilities. The locations of the proposed POC wells and the baseline groundwater piezometric elevation contours are shown in Figure 50-1 provided as Attachment 23 of this response letter.

Figure 50-1 also shows estimated depths to groundwater for each proposed POC well. These depths are based on water level data from the nearest piezometer completion to each proposed POC well location (see the Hydrogeological Characterization in Appendix F.1 of the September 2022 APP application). Estimated POC well screened intervals were prepared using these data and are summarized in Table 50-1 below. The criteria for estimating the screened interval included the following:

- The screened interval will be at least 50 ft in length.
- The static groundwater level will be within, and towards the top of, the screened interval.

As noted in ADEQ's request, the actual screened intervals for all POC wells will be determined based on environmental conditions at the time of well installation.

Table 50-1: Estimated Screen Intervals for Proposed POC Wells

Well ID	Estimated Depth to Water (ft bgs)	Estimated Screen Interval (ft bgs)
POC-01	60	50 – 100
POC-02	60	50 – 100
POC-03	60	150 – 100
POC-04	80	70 – 120
POC-05	130	120 – 170
POC-06	100	90 – 140
POC-07	180	170 – 220
POC-08	360	350 – 400
POC-09	190	180 – 230
POC-10	200	190 - 240

Note: The bottom of the estimated screen interval is also the estimated total depth of the POC well.

Item 51: TSF: The standard deviation sensitivity analysis shows the potential for selenium concentrations to be above the AWQS.

Response

See response to Item 58.

Item 52: HLP: The composite seepage chemistry shows the potential for beryllium, cadmium, fluoride, selenium, and zinc concentrations to be above the AWQS.

Response

See response to Item 58.

Item 53: Broadtop Butte Pit: The sensitivity analysis shows the potential for fluoride concentrations to be above the AWQS.

Response

See response to Item 58.

Item 54: Copper World Pit: Simulated pore water chemistry shows the potential for fluoride concentrations to be above AWQS during the first five years of the mine life. The sensitivity analysis shows the potential concentrations above the AWQS for antimony, cadmium, mercury, selenium, and thallium.

Response

See response to Item 58.

Item 55: Heavy Weight Pit: The modeling results show concentrations above the AWQS for fluoride that remain for 10 years post-closure. The sensitivity analysis shows potential concentrations above the AWQS for antimony, cadmium, and thallium.

Response

See response to Item 58.

Item 56: Elgin Pit: The modeling results show concentrations above the AWQS for fluoride that increase over time. The sensitivity analysis shows potential concentrations above the AWQS for arsenic, antimony, cadmium, and thallium.

Response

See response to Item 58.

Item 57: Peach Pit: The modeling shows concentrations above the AWQS for fluoride that increase over time.

Response

See response to Item 58.

Item 58: The facilities in items 51 through 57 are listed as discharging facilities and have the potential for discharges exceeding the AWQS for several constituents. Please provide adequate BADCT information for these facilities.

Response

<u>TSFs and HLP</u>

Seepage chemistry for the TSFs is not predicted to have constituents elevated above AWQS as described in Section 6 of the Geochemical Impacts Assessment (Appendix G.1 of the September 2022 APP application). However, the Standard Deviation sensitivity analysis shows the potential for selenium concentrations to be elevated above the AWQS for the TSFs. Seepage chemistry for the HLP is predicted to potentially have concentrations of beryllium, cadmium, fluoride, selenium, and zinc elevated above AWQS.

The TSFs and HLP facilities will be monitored for constituents exceeding AWQS at the Point of Compliance (POC) groundwater monitoring well network described in Section 5 of the Water Quantity Impacts Assessment (Appendix F.2 of the September 2022 APP application), and augmented using facility monitoring wells (see further description in Item 49 related to TSF-1).

Following completion of POC well construction, ambient groundwater monitoring will be conducted to determine the Alert Levels (ALs) and Aquifer Quality Limits (AQLs) for all AWQS constituents. Corresponding facility monitoring wells will be monitored on the same schedule to establish baseline groundwater quality conditions at those locations.

Detections of water quality constituent concentrations above AWQS at a POC well location or at a facility monitoring well will trigger mitigation plans. Mitigation plans will include the following:

- Confirmation groundwater sampling
- Increase of frequency for groundwater monitoring to monthly in affected areas
- Site assessment
    - To determine the source and mode of facility discharge(s)
    - To delineate the vertical and lateral extents of impacted groundwater
- Discharge source controls
- Design, construction, and operation of groundwater mitigation “pump back” wells
- Quarterly capture zone analysis to demonstrate discharge containment.

Mitigation measures will be employed until groundwater monitoring results indicate compliance with AWQS.

With regard to BADCT design for the heap leach pad (HLP) and tailings facilities, these elements were described in Sections 10.2.1 and 10.4.1 of the September 2022 APP application, respectively.

Broadtop Butte Pit

The Broadtop Butte sensitivity analysis shows the potential for fluoride concentrations to exceed the AWQS.

Groundwater monitoring would be conducted in backfill materials and down-gradient areas of the facility to validate that AWQS are met at the POC well monitoring location(s). Should pore water quality in the backfill become elevated above AWQS and have the potential to exceed AWQS at POC well monitoring locations, two potential management options could be employed:

1. Low flow backfill pumping. Low flow pumping from a single well targeting the pit floor will create a hydraulic sink within the backfill and prevent groundwater outflow. A small pumping stress of approximately 10 gpm would be sufficient to manage groundwater outflow. Pumping discharge can be routed directly to the WRF surface and evaporated. The small pumping unit could be powered by solar panels and thus operate autonomously. This solution provides a scalable, cost-effective long-term management option for the facility.
2. Placement of a vegetated soil cover to intercept meteoric precipitation. Vegetated store and release covers have proven very effective at capturing meteoric precipitation and preventing percolation. Cover designs can be flexible and target specific exposures more susceptible to percolation. The key element of store and release covers is to promote revegetation across the dump surface. Adequate vegetation provides a flexible mitigation measure that can adapt to changing conditions such as climate variability, dump settling, and erosion.

Additionally, NAG waste rock backfill would be placed below the predicted water table in the backfilled pit.

Copper World and Heavy Weight Pits

Simulated pore water chemistry in the Copper World Pit backfill shows the potential for fluoride concentrations to be above AWQS during the first five to ten years post-closure. The sensitivity analysis shows the potential for antimony, cadmium, mercury, selenium, and thallium to be above AWQS. The Copper World North Pit sensitivity analyses indicated that long-term, overall pore water concentrations in the backfill would decline through time and that several constituent values above AWQS could occur (antimony, cadmium, and thallium). The Copper World South Pit sensitivity analyses indicated that long term pore water concentrations in the backfill would decline through time and that several new constituents (cadmium, mercury, selenium, and thallium) may become elevated above AWQS.

Geochemical analysis indicates that the Heavy Weight Pit backfill may require post-closure management due to the predicted pore water in the backfill to be elevated above AWQS for fluoride. The Heavy Weight Pit sensitivity analyses indicated that long term pore water concentrations in the backfill would decline through time, like the other backfilled pits. Several constituents (antimony, cadmium, and thallium) were also predicted to be above AWQS during the early time (<50 years) post-closure.

Predicted groundwater outflow from the Copper World and Heavy Weight pits is very low, less than 0.5 gpm, and below the threshold of practical prediction and measurement. Particle tracking of saturated pore water using the Project groundwater model indicated that migration would be limited to within the pit footprint during the 200-year post-closure period. As with the other backfilled pits, conditions may be drier than predicted for many years because of the time it will take for a wetting front to move through unsaturated backfill. The factors of i) low quantity of outflow, ii) slow migration of pore water, and iii) generally good pore water chemistry; reduce the risk of pore water backfill degrading groundwater resources and exceedances of AWQS at POC well locations.

The primary post-closure management option for the Copper World and Heavy Weight pits would be to monitor backfill water levels and chemistry. Mitigation contingencies could be implemented should groundwater degradation be measured in the backfill or surrounding bedrock. The management options for the backfill could include:

1. Installation of a monitoring well in the backfill at the pit floor to monitor water levels and pore water chemistry.
2. Mitigation measures could include:
    a) Low flow backfill pumping. Backfill pumping could achieve capture using very low pumping rates on the order of 3-10 gpm using a solar pump unit. Pumping discharge can be routed directly to the WRF surface and evaporated.
    b) Placement of a vegetated soil cover to intercept meteoric precipitation.

Additionally, NAG waste rock backfill would be placed below the predicted water table in the backfill pit.

Elgin and Peach Pits

Elgin Pit is predicted to form a small pit lake that is 51 ft deep and spans about 7 acres. Peach Pit is predicted to form a small pit lake that is 101 ft deep and spans about 6 acres. The lakes will evapoconcentrate through time and are predicted to become elevated above AWQS with respect to fluoride. The Elgin Pit sensitivity analysis showed potentially elevated concentrations of arsenic, antimony, cadmium, and thallium above AWQS.

A small component of groundwater outflow is predicted (~0.7 and 1.7 gpm, respectively) for Elgin and Peach pits, respectively), which can be managed by mitigation strategies if post-closure monitoring confirms the potential for water quality impacts. Mitigation measures may include, but are not limited to:

1. Backfill lower benches of pits using NAG waste rock.
2. Potentially implement low flow backfill pumping on the order of 3-10 gpm using a solar pump unit to achieve capture. Pumping discharge can be routed to a pond or WRF surface and evaporated.

Item 59: What is the buffering capacity of the formation downgradient of the TSF? A qualitative description will suffice. Please provide an estimate of the buffering capacity of the geologic units downgradient of the TSFs. A qualitative estimate will suffice.

Response

The potential geochemical impacts of seepage from the TSFs were analyzed in the Copper World Project Geochemical Impacts Assessment (Appendix G.1 of the September 2022 APP application). No chemical species were predicted to be elevated above AWQS in the base case analysis (Table 6.3 of Appendix G.1) and only cadmium and selenium were elevated in the sensitivity analysis (Table 6.6 of Appendix G.1).

Formations downgradient of the TSFs (in the saturated groundwater system) are comprised chiefly of Continental Granodiorite emplaced within lesser amounts of Paleozoic sedimentary rocks. Regardless of the geochemical composition of these formations, attenuation in the bedrock environment is expected to occur to a relatively lower degree than in alluvium due to the far lesser surface-to-volume ratio of the material. Neither cadmium nor selenium are expected to attenuate substantially.

- Cadmium sorption is weak in competitive situations and tends to form stable dissolved complexes which inhibit sorption and precipitation.
- As an oxyanion, selenium can be attenuated but usually to much lower degree than other metals due to its negative charge.

Prior to encountering the saturated groundwater system beneath and downgradient of the TSFs, TSF seepage would flow through unconsolidated alluvium. Attenuation of chemical species would occur to a higher degree in the alluvium beneath the TSFs than the rock-hosted groundwater system downgradient of the TSFs due in part to the higher surface-to-volume ratio of the alluvium.

Item 60: Please demonstrate that the locations of the proposed POCs 1, 2, 3, and 4 are adequate given that they are coincident with the PMA boundary, the property boundary, and the boundary of the discharging facility (TSFs). The application assumes there will be seepage that occurs through the TSFs. It's expected that an exceedance of the AWQS at any of these POCs will indicate that the AWQS has been exceeded beyond the PMA due to the short transport distance.

Response

The locations of the POCs 1, 2, 3, and 4 were analyzed together with groundwater velocity data, and the locations of proposed facility monitoring wells (non-POC wells) discussed in Item 49, to estimate how much earlier a facility monitoring well could detect groundwater impacts (lead time).

Groundwater velocities were predicted using the Project groundwater flow model (see Water Quantity Impacts Assessment in Appendix F.2 of the September 2022 APP application). The model used particle tracking to determine the extent of the Discharge Impact Area (DIA). The groundwater velocities based on particle tracks ranged from about 0.07 to 0.20 ft/day.

The distances from the subject POC wells to their corresponding facility monitoring wells are shown in Figure 60-1 (provided as Attachment 24 of this response letter) and summarized in Table 60-1 below. Table 60-1 below also summarizes the estimated range of lead times that each facility monitoring well could have for detecting groundwater impacts before detection at the corresponding downgradient POC well. The lead time for facility monitoring well to detect groundwater impacts before the corresponding POC well ranges from 1.1 to 4.5 years. This amount of lead time is considered adequate to implement mitigation measures as discussed in Item 49.

Table 60-1: POC and Facility Monitoring Well Detection Timing Analysis

POC ID	Distance from Companion Facility Monitoring Well (ft)	Estimated Facility Monitoring Well Lead Time (years)
POC-1	85	3.3 to 1.2
POC-2	79	3.1 to 1.1
POC-3	114	4.5 to 1.6
POC-4	77	3.0 to 1.1

Note: Facility Monitoring Wells are non-POC wells.

Item 61: The applicant has stated that the Rosemont Pit will not be a discharging facility as it will form a terminal pit and operate as a hydrological sink. Please provide a detailed monitoring plan to provide ongoing data that the pit is acting as a sink and no discharges are migrating beyond the property boundary.

Response

A general groundwater level monitoring plan showing existing and planned wells and piezometers is provided below that will be used to demonstrate that the Rosemont Pit is acting as a hydrological sink.

Existing and planned monitor wells and piezometers will be monitored on a routine basis to provide ongoing data for assessing the Rosemont Pit hydrological sink during operations and post-closure. The anticipated monitoring locations consist of existing piezometers and open standpipe monitor wells and planned piezometers installed adjacent to future pit dewatering wells. The locations of existing and planned monitoring locations are shown in Figure 61-1 (Attachment 25 of this response letter) and are summarized in Table 61-1 below.

The existing groundwater monitoring wells/piezometers may be replaced or supplemented with additional wells as needed through the life of mine. Additionally, the dewatering well locations (and associated piezometers) will be staged over time based on the progression of mining in the Rosemont Pit. Dewatering well locations (and associated piezometers) may also be adjusted from that shown in Figure 61-1 (Attachment 25) to reflect operational needs and field conditions.

- Attachment 25: Figure 61-1. Rosemont Pit Area Water Level Monitoring.

Table 61-1: Rosemont Pit Area Groundwater Level Monitoring Locations

Monitoring Location ID	Monitoring Location Type	Status
PC-6	Monitoring Well	Existing
PC-5	Monitoring Well	Existing
PZ-5	Piezometer	Existing
AR-2050	Monitoring Well	Existing
PC-4	Monitoring Well	Existing
DW4-16	Piezometer	Planned
DW5-16a	Piezometer	Planned
DW9-16	Piezometer	Planned
DW10-16	Piezometer	Planned
DW13-16a	Piezometer	Planned
DW13-16b	Piezometer	Planned
DW14-16	Piezometer	Planned
DW15-16	Piezometer	Planned
DW12-16aR	Piezometer	Planned
DW12-16bR	Piezometer	Planned
DW12-16cR	Piezometer	Planned
DW12-16dR	Piezometer	Planned

Item 62: Please provide a detailed summary that describes the mine pits. In the current application, the information describing the pits is found in numerous locations throughout the application. The review of the pits would be improved if all of the information was consolidated into one section or document. Please include: Figures showing the estimated pit configurations in plan view and cross section, which pits are to be backfilled and a description of the material used for fill, plan view and cross-sectional figures showing backfilled pit configurations, whether or not pits are flow-through or terminal, anticipated inflow or outflow rates, and estimated depths and surface elevations of pit lakes.

Response

A detailed summary description of the mine pits is presented in Attachment 26 of this response letter.

- Attachment 26: Copper World Project – Summary of Mine Pits and WRF Backfill. Technical Memorandum dated March 31, 2023.

Item 63: Per A.A.C. R18-9-A202(A)(8)(b)(vii) and (viii); please provide data/documentation assessing the extent and degree of any known soil contamination at the site and an assessment of the potential of the discharge to cause leaching of pollutants from surface soils or vadose materials.

Response

There has been no evidence of soil contamination at the site, such as from oil or other chemical spills, etc.

Historic mining operations have been conducted at the site as described in the September 2022 APP application. A field investigation of historic mining waste rock piles and other historic mining related features was conducted in 2012 by Hargis & Associates under the direction of ADEQ under a consent decree order against ASARCO. The results of this site investigation are provided as exhibits to the memorandum provided in Attachment 4. Capping of the old Copper World Mine tailings was conducted as part of this work.

Per the Waste Rock Management Plan (see Revision 1 in Attachment 5), NAG material will be placed on the outer slopes of the waste rock facility (WRF) with PAG or NAG materials placed to the interior. The placement of historic mine materials would also follow this plan. Due to the overall neutralizing potential of the waste rock, any potential pollutants within these historic mine materials are not anticipated to cause groundwater impacts.

Additionally, closure/reclamation cover materials for the tailings and heap leach facilities will come from surface soil materials stripped from the footprint of the tailings and heap leach facilities. These soil cover materials are not anticipated to leach pollutants and affect groundwater resources.

Discharge Impact Analysis - Groundwater Modeling Items

Additionally, and per ADEQ the following rules apply to requested items 64 through 71 based on the review of the groundwater modeling study that was used for the application:

> "A.C. R18-9-A202(A)(8): If required by ADEQ, a Hydrogeologic study that defines the discharge impact area (DIA). The DIA is the potential areal extent of pollutant migration, as projected on the land surface, as the result of a discharge from the facility, for the expected duration of the facility.
>
> A.A.C. R18-9-A202(A)(8)(a)(i): The hydrogeologic study shall demonstrate that the facility will not cause or contribute to a violation of an AWQS at the applicable point of compliance.
>
> A determination by ADEQ that the applicant has satisfactorily defined the DIA and demonstrated discharges will not violate AWQS as outlined in the above rules requires additional information. Specifically:"

Discharge Impact Analysis – Groundwater Modeling Items cover Items 64 through 71.

The groundwater model (Appendix F.2 of the September 2022 APP application) has many uses for the application. The model simulates the Project elements (production pumping wells, pit dewatering, facility seepage) with respect to the regional and local groundwater system to:

- Predict the impacts (drawdown) of the Project to springs, streams, and other stakeholders.
- Predict the nature (flow through versus terminal sink) of backfilled pits and pit lakes post-closure.
- Predict the area of potential discharge impact (DIA) using particle tracking (advective transport).
- Demonstrate the potential efficacy of pump back wells to control seepage and mitigate potential offsite discharge migration.

Item 64: In Section 3.3 (Model Calibration), page 26 of Appendix F.2 of the application, the report states "The model calibration was evaluated on the basis of its ability to:… Reproduce a global water balance that reflects Project site conditions". The ADEQ review did not find any reporting describing a model water balance. Please provide the model-simulated water balance of the calibrated steady-state model and the transient model that summarizes all inflows and outflows, including (but not limited to): general head boundary flux, drain flux, evapotranspiration, recharge flux, and groundwater flux across the domain. Please also provide model-simulated water balance snapshots at the TSFs, mine pits, and waste rock facilities. Please also compare the model-simulated budget to the conceptual water budget.

Response

Attachment 27 provides the following technical memorandum to address comments on the model-simulated water balance of the calibrated steady-state and the transient model.

- Attachment 27: Copper World Project Groundwater Model Water Balance. Memo dated March 31, 2023.

Item 65: The predictive modeling that evaluates utilizes a transient model based on the steady-state calibration. Our review did not find documentation of calibration or validation of the transient model prior to performing predictive simulations. Please provide information describing transient calibration or validation methods and results or provide a rationale as to why validation or calibration of the transient model was not needed prior to performing predictive modeling simulations.

Response

From Section 3.3.2, pages 27-29 of Water Quantity Impacts Assessment (Appendix F.2 of the September 2022 APP application), head calibration targets were derived from three sources:

- The East model, representing the Project mining area and the broad far-field system to the east extending a significant distance from the Project area. There are 491 targets derived from the East model. They represent "pre-mining, average annual, steady-state groundwater conditions" (Neirbo Hydrogeology, 2019. Groundwater Flow Model, Rosemont Copper Project).

- The West model, representing the broad far-field system to the west extending a significant distance away from the Project area. There are 24 targets derived from the West model. They represent aquifer conditions as they existed prior to 1940.
- The 2021 hydrogeological investigation program which focused on the proposed Project satellite pit mining areas and facility locations. There are 21 targets derived from this drilling program. These are static groundwater levels measured after completing open standpipes or piezometers at each location (Piteau, 2022, Hydrogeological Characterization Rosemont Copper World Project provided as Appendix F.1 of the September 2022 APP application).

The East model was based on the Neirbo (2019) flow model, which was an update to Tetra Tech (2010, Regional Groundwater Flow Model) that was prepared in support of the Rosemont Copper Project Environmental Impact Statement (EIS). The following is stated in section 4.6 (page 65) of Nierbo (2019):

> *The Flow Model simulates average annual conditions and, therefore, the pre-mining model calibration does not consider climate variability and long-term trends.*

In section 4.6.1 on pages 65 and 66, Neirbo (2019) states that:

> *Water levels in the immediate Project area and LCNCA wells that were routinely monitored demonstrate seasonal and annual fluctuations and multi-year trends. Many Project wells have exhibited declining groundwater levels since routine measurements began in 2008 through 2017.*

Neirbo (2019) concludes that:

> *Simulating these trends would require a transient model calibration. The magnitude of the seasonal trends is small and would be difficult to match with a large, regional-scale model. Groundwater-level trends evaluated in M&A (Montgomery &Associates, 2010a, Revised Groundwater Flow Modeling) determined that there were no consistent, regional-scale groundwater level trends that could be attributed to changes in recharge or groundwater pumping (M&A, 2010a,). Therefore, a transient groundwater flow model calibration, based on regional water levels was not considered feasible for Tetra Tech (2010a) or M&A (2010a).*

The West model was calibrated for steady-state and transient conditions (Mason & Bota, 2006, Regional Groundwater Flow Model of the Tucson Active Management Area). The steady-state model was calibrated against conditions as they existed in 1940. The transient model was calibrated to changing stress conditions that existed for the period of intense groundwater development between 1941 and 1999. Given that this groundwater development took place in a narrow band along the Santa Cruz River, the transient observations would likely contain little to no information that could be used to calibrate the hydraulic properties of the rock units in the Project area in the Santa Rita Mountains.

In summary:

- The West Model transient water level observation dataset likely did not contain a sufficient amount of information to be useful anywhere but near the Santa Cruz River.
- The East model did not attempt to calibrate to transient water level observations because of:
    - The difficulties of trying to simulate small, seasonal water level changes with a model that only includes average annual precipitation and evapotranspiration (ET).
    - The lack of known regional-scale groundwater processes that would impart multi-year trends in observed water levels.
- The monitoring wells associated with the 2021 drilling program do not have a long enough history to provide useful information to a transient calibration.

Also, as discussed in the response to Item 69, an analysis of the water levels for the targets in the eastern part of the model domain shows that they do not vary significantly over long periods of time. Thus, a transient calibration to these data was not warranted.

Item 66: Please provide a comparison between model-calibrated hydrogeologic parameter values and the conceptual (or starting) parameter values described in Appendices F.1 and F.2. Additionally, the ADEQ review of the report did not find a summary of a sensitivity analysis for the steady-state calibration. If the analysis was completed, please provide documentation describing the methods and results. If a sensitivity analysis was not performed, please provide the analysis or a rationale as to why one is not needed.

Response

A comparison between the conceptual and model-calibrated hydraulic conductivities is included in Attachment 28. That attachment also includes a summary of a sensitivity analysis done as part of the PEST calibration.

- Attachment 28: Copper World Project Groundwater Model Calibration and Sensitivity. Technical Memorandum dated March 31, 2023.

Item 67: Appendix F.2 states that the use of steady-state targets from different temporal periods is acceptable due to the minimal variation of the target values over time (pages 28 and 29 of Appendix F.2). Please provide a more in-depth analysis as to why this assumption is valid. For example, the report states that "... an analysis of the available data shows the groundwater levels in the eastern part of the Project model domain do not vary significantly over long periods of time." In this case, what criteria were used to determine the variation was not significant?

Response

Arizona Department of Water Resources (ADWR) reported in 2017 the following statistics for Cienega Creek Basin for three different periods of time (see Table 67-1 below).

Table 67-1: Groundwater level change statistics for Cienega Creek Basin

Period	WL change count[1]	Range (ft)	Median change (ft)	Mean Change (ft)	Stdev (ft)	Mean Rate of Change (ft/yr)
1996-2016	1/6/0	-21.2 to 39.1	-2.5	-0.1	18.6	0.0
2006-2016	2/7/0	-27.7 to 11.85	-1.4	-3.1	10.7	-0.3
2015-2016	1/8/1	-3.4 to 3	-0.7	-0.6	1.6	-0.6

Note: Information from the Statewide Groundwater Level Changes in Arizona, Water Years 1996 to 2016, 2006 to 2016, and 2015 to 2016. Open File Report No. 14, June 2017, Tables 6, 7, and 8.
Stdev = Standard deviation
[1] Number of locations with rising/falling/static water levels

This work was done to assist in identifying basins and sub-basins within the state that may need additional groundwater level monitoring. They state that “Basins and sub-basins with large water level changes (especially those with significantly declining groundwater levels) with few wells will be evaluated for additional or increased monitoring.” However, they did not discuss how “significant” would be defined.

The Groundwater Level Change application, developed by the ASU Kyl Center for Water Policy at Morrison Institute, can be used to examine historical water level changes in individual monitoring locations and for basins/sub-basins as a whole. (https://new.azwater.gov/hydrology/field-services/groundwater-level-changes). This application does not define a “significant” change, but it does present water level change across the entire state of Arizona using consistent scales of reference.

The color scales used for both the basins/sub-basins and individual wells support the notion that the water level changes in Cienega Creek basin are small compared to other wells and basins/sub-basins in the state. In particular, the bins used to apply symbols to individual wells have breaks at:

- Bin 0: Less than +/- 1 ft (0.05 ft/yr)
- Bin 1: +/- 1 ft (0.05 ft/yr) to +/- 10 ft (0.5 ft/yr)
- Bin 2: +/- 10 ft (0.5 ft/yr) to +/- 20 ft (1 ft/yr)

- Bin 3: +/- 20 ft (1 ft/yr) to +/- 40 ft (2 ft/yr)
- Bin 4: +/- 40 ft (2 ft/yr) to +/- 60 ft (3 ft/yr)
- Bin 5: Greater than +/- 60 ft (3 ft/yr)

Five of six wells analyzed for the 20-year period of record (1999-2019) indicate water level declines between -1 and -10 feet (Bin 1) and one shows a water level rise of +10.9 feet (Bin 2).

The Groundwater Level Change application classifies Cienega Creek Basin as neutral overall with changes between -1 and +1 feet over a 20-year period of record (1999-2019).

A review of 50 monitoring locations in the eastern part of the model domain, representing 96,295 water levels between April 2006 and August 2022, resulted in the following summary of results from the statistics calculated per monitoring location (see Table 67-2 below).

Table 67-2: Statistics Calculated

Statistic	Range (ft)	Standard Deviation (ft)	Scaled Standard Deviation	Average Water Level Change (ft/yr)
Min	2.00	0.46	0.0090%	-5.39
Avg	21.93	4.62	0.0921%	-1.15
Max	58.13	14.76	0.2870%	3.27

Note:

- Range is the maximum water level minus the minimum water level.
- Standard deviation is calculated in Excel using the STDEV.P function.
- Scaled Standard Deviation is the standard deviation divided by the mean water level.
- Average Water Level Change is the slope of a linear regression line passed through the data.

On average, the analysis of water level changes in these 50 locations support the assertion that water levels do not vary significantly over long periods of time. The average water level change is just -1.15 ft/yr. This rate corresponds to a change of 23 feet over a twenty-year period. This is comparable to the locations reported in the online Groundwater Level Change application.

A visual inspection of the hydrographs shows that for at least six locations, higher than average water level changes are due to high water levels observed right after installation. These higher water levels may be caused by transient, non-equilibrium conditions induced locally due to drilling and construction of the piezometers. They seem to dissipate quickly, and for the remainder of the record the water level changes are very low.

Overall, the statistical analysis combined with a visual inspection shows that the vast majority of locations do not possess significant water level trends; thus, the water levels measured at these locations can be considered to be in equilibrium (that is, steady-state) within the groundwater system as a whole.

Item 68: Please provide a figure showing the domain of the model presented in Appendix F.2 overlain over the domains of the original models (the TAMA (west) model and the Tetra Tech (east) model)

Response

A figure showing the domain of the model presented in Water Quantity Impacts Assessment (Appendix F.2 of the September 2022 APP application), overlain over the domains of the original models (the TAMA [west] model and the Tetra Tech [east] model), is provided in Figure 68-1 (see Attachment 29 of this response letter).

- Attachment 29: Figure 68-1. Previous and Current Groundwater Model Domains. Figure dated March 2023.

Item 69: Please provide a more in-depth summary of the calibration process of the steady-state model, primarily the PEST (parameter estimation software) input information or text files.

Response

The calibration process included two methods:

- Manual Calibration wherein one or two model parameters were adjusted to achieve a better fit in a focused area of the model.
- PEST Calibration wherein many parameters were adjusted simultaneously to achieve a better fit across the model as a whole.

The calibration process alternated between these two methods.

A typical PEST simulation involved the following steps:

1. Choose the parameters and the parameter ranges.
2. Choose PEST options and settings.
3. Run PEST using BeoPEST.
4. Monitor the progress.
5. Run a final model.
6. Proceeding to the next step.

The steps are outlined in greater detail below, and the contents of an example PEST Control File with input parameters are provided in Attachment 30 of this response letter:

Choosing the parameters and the parameter ranges

Early PEST runs used the following parameters and parameter ranges:

- Kx – 88 zones, global min = 5e-6, global max = 300
- Kz – 88 zones, global min = 5e-6, global max = 300
- Recharge – 14 zones, global min = 2.2816e-5 (0.10 in/yr), global max 4.5632e-3 (20 in/yr)
- ET – 18 zones, global min = 2.2816e-4 (1 in/day), global max = 3.4224e-2 (150 in/yr).
- TOTAL Parameters is 208.

Note: Kx = Kz = components of hydraulics conductivity, and ET = evapotranspiration.

In the early runs, the parameter ranges were set to be +/- 2 orders of magnitude from the initial values unless these values fell outside the range of the global minimum and maximum for each parameter group. Later runs tightened the ranges for most parameters down to +/- 1 order of magnitude.

ET and recharge were mostly insensitive, and later PEST runs only included Kx and Kz.

No parameters were tied.

Choosing the PEST options and settings

For the most part, the default PEST setting sufficed. Some of the parameters that were changed included modifying the settings to force PEST to not terminate the simulation as quickly as the default settings would allow:

- Change PHIREDLAM from 0.01 to 0.005 termination criterion for Marquardt lambda search.
- Change PHIREDSWH from 0.1 to 0.01 sets objective function change for the introduction of central derivatives.
- Change NOPTSWITCH to 1 to 10 iterations before which PEST will not switch to central derivatives computation.
- Change PHIREDSTP from 0.01 to 0.001 relative objective function reduction triggering termination.
- Change NPHISTP from 3 to 5.

In addition to PEST options and settings, the Project model experienced some non-convergence issues. An individual model run that does not converge in a PEST simulation affects the results in unpredictable ways. A PEST simulation with a significant number of non-converged models will produce garbage results. In an attempt to minimize this from happening, different model solvers were employed, and the various settings for these solvers were modified.

Attachment 30 of this response letter includes a copy of a PEST Control File from the final PEST simulation.

Run PEST using BeoPEST

Running PEST involves the following steps.

- Create the model datasets.
- Create the PEST datasets.
- Run a utility called PESTCHK that reviews all of the PEST settings.
- Resolve any issues found by PESTCHK.
- Setup BeoPEST
  - BeoPEST is a run management utility that allows PEST to run in a parallel environment.
  - Typically, for this project, PEST is run locally deployed using five agents and one run manager.
- Execute PEST
  - This is done in a DOS environment with one DOS window for each agent and one window for the manager.

Monitoring the Run

As PEST runs, the following is monitored, usually in real-time. In particular, the following is tracked closely:

- The reduction in phi.
  - phi is the objective function.
  - It is the sum of squared residuals where a residual is defined as the difference between the observed value and the model simulated value.
  - The goal of PEST is to find the combination of parameters that produces a minimum phi value.
  - To measure this, the reduction of phi is charted in terms of a percent reduction or in terms of orders of magnitude from the initial conditions.
- Composite Scaled Parameter Sensitivities.
  - These describe the relationship between observations and parameters;
  - Larger values indicate parameters for which the observations provide more information; and
  - Smaller values indicate parameters that cannot be estimated for the current observation dataset and the current model.

Final model run and analysis

A final model is updated and run with the best parameters from PEST. This includes:

- Updating the parameters with the best parameters from PEST.
- Updating the hydraulic conductivity of the General Head Boundary conditions to reflect the updated parameters.
- Updating the starting heads with heads that are in equilibrium with the revised parameters.

The results of this model are evaluated in a number of ways:

- An analysis of the convergence history. This provides insight into model stability.
- Statistical analyses of the calibration results globally and within each target group.
  - Mean error, absolute mean error, and root mean error is calculated as well as scaled versions of each of these.
  - Weighted and unweighted residuals are analyzed.
  - Cross-plots of observed vs. simulated heads are prepared and the slope, intercept, and coefficient of determination of the best-fit liner trend is tabulated.
  - Cross-plots of observed heads vs. residuals are prepared and the slope, intercept, and coefficient of determination of the best-fit liner trend is tabulated.
  - Histograms of residuals are prepared.
- A map of the spatial distribution of residuals is prepared.
- The distribution of flooded and dry cells is reviewed.
  - Early models tended to have large areas of flooded cells.

    - This was improved by introducing censored targets in the flooded areas.
- The mass balance results are reviewed. This includes analysis of:
    - The global mass balance reported by model.
    - Fluxes reported for each boundary reach.
- An analysis of the parameter changes.
    - This involved identifying which parameters increased or decreased between the initial values and the best PEST values.
    - This included an analysis of the vertical anisotropy to see if any zones had changed "sense" (that is, from $Kx > Kz$ to $Kx < Kz$ or vice versa).
    - The results of this analysis were presented as tables, cross plots of initial and final values, and as histograms of parameter changes.
- An analysis of the parameter bounds.
    - This identified which parameters changed to either their upper or lower bound and whether or not this was a one-time event during the simulation or if this was a permanent condition.

Proceeding to the next steps.

Based on an analysis of the PEST results, the next step could be:

- Another PEST run
    - Using the best parameter values from the previous runs.
    - Modifying the parameter ranges.
    - Removing insensitive parameters from the simulation.
- Manual calibration. This could involve:
    - Making adjustments to one or two parameters in an attempt to improve calibration in a focused area.
    - Introducing new zones by splitting existing zones into two or more zones to improve calibration in a focused area.

Repeat until the model is calibrated based on professional judgment.

The following PEST Control File is from the final PEST simulation:

- Attachment 30: PEST Control File

Item 70: Please provide additional particle tracking simulations that place the particle starting position at the boundaries of the pit outlines and at the entire boundary of the PMA. Alternatively, please provide an additional figure that overlays the simulated groundwater elevation contours on the particle tracking results in order to support interpretation of particle tracking results.

Response

A figure that overlays the simulated groundwater elevation contours on the particle tracking results in order to support interpretation of particle tracking results is provided in Figure 70-1 (Attachment 31 of this response letter). The particles were simulated to be released from the bottom of each facility at the last year of mining or construction of each facility. The groundwater piezometric contours are representative of the last year of mining. As a note, it is important to recognize that the particle tracks shown in Figure 70-1 reflect transient three-dimensional flow fields, and their traces are not solely reflective of the snapshot of piezometric contours illustrated.

- Attachment 31: Figure 70-1. Particle Trace and Model Contours. Figure dated March 2023.

Item 71: Please provide cross-sectional views of the model-simulated groundwater elevations and particle tracking results. In particular, provide these views for each mine pit and the TSF in an east-west orientation.

Response

Figures showing cross-sectional views of the model-simulated groundwater elevations and particle tracking results for each facility in east-west orientations are provided in Figures 71-1 through 71-13 (in Attachment 32). The locations of the cross-section traces are shown in Figure 70-1 (in Attachment 31). The cross sections (Figures 71-1 through 71-

13) also show groundwater model hydraulic conductivity zones, including Time Varying Material zones used to simulate pit excavation and backfill, where appropriate.

The particles were simulated to be released from the bottom of each facility at the last year of mining or construction of each facility. The groundwater piezometric contours are representative of the last year of mining. As a note, it is important to recognize that the particle tracks shown in Figures 71-1 through 71-13 reflect transient three-dimensional flow fields, and their traces are not solely reflective of the snapshot of piezometric contours illustrated in the cross sections (Figures 71-1 through 71-13).

The description of the model, hydraulic conductivity zones and particle tracking simulations are presented in the Project groundwater model report (Water Quantity Impacts Assessment. Appendix F.2 of the APP application, September 2022).

- Attachment 32: Figures 71-1 through 71-13. Particle Trace. Figures dated March 2023.

Please do not hesitate to contact me at (520) 495-3527 (office), (520) 260-3490 (cell) or via e-mail at david.krizek@hudbayminerals.com if you have any questions regarding this response.

Sincerely,

David Krizek, P.E.

Senior Manager, Environmental Manager, Environmental & Permitting

Attachments:

Attachment 1: Copper World Project – Area-Wide APP Application – Closure Approach Summary and Closure Cost Reassessment. Memo dated April 04, 2023. (See Item 1)

Attachment 2A: Tailings Storage Facility Contingency Action Plan (CAP). April 13, 2023. (See Items 2, 21, and 48)

Attachment 2B: Emergency Preparedness and Response Plan (EPRP) for the Tailings Storage Facilities. April 13, 2023. (See Item 2)

Attachment 2C: Failure Modes and Effect Analysis Report (FMEA) – Copper World Project - TSF and HLF. April 13, 2023. (See Item 21)

Attachment 2D: Tailings Storage Facility Dam Safety Review Procedures. April 13, 2023. (See Item 5)

Attachment 3A: Tailings Operation, Maintenance, and Surveillance (OMS) Manual. April 12, 2023. (See Items 3, 4, 5, and 48)

Attachment 3B: Heap Leach Facility Operation, Maintenance, and Surveillance (OMS) Manual. April 12, 2023. (See Items 3, 4, and 48)

Attachment 4: Waste Rock Placement on Historic Slag. Memorandum dated March 30, 2023. (Item 8)

Attachment 5: Copper World Project – Waste Rock Handling Plan – Revision 1. Plan dated April, 2023. (See Item 9)

Attachment 6: Alluvial Cover Materials - Copper World Project Surface Facilities (TSFs and HLF). Technical Memorandum dated April 05, 2023. (See Item 19)

Attachment 7: Rosemont Copper Company, Dry Stack Tailings Storage Design, Final Design Report. Report dated April 15, 2009 by AMEC Earth & Environmental, Inc. (See Item 22a)

Attachment 8: Geotechnical Study, Rosemont Copper. Report dated June 2007 by Tetra Tech. (See Item 22b)

Attachment 9: Geotechnical Addendum, Volume 1 of 3, Rosemont Copper Project. Report dated February 2009 by Tetra Tech. (See Item 22b)

Attachment 10: Geotechnical Addendum, Volume 2 of 3, Rosemont Copper Project. Report dated February 2009 by Tetra Tech. (See Item 22b)

Attachment 11: Geotechnical Addendum, Volume 3 of 3, Rosemont Copper Project. Report dated February 2009 by Tetra Tech. (See Item 22b)

Attachment 12: 2015 Pit Slope Feasibility Evaluation for the Rosemont Deposit. Revision 2. Report dated January 2016 by Call & Nicholas, Inc. (See Item 22c)

Attachment 13: Tailings Deposition and Sand Balance - Copper World Project Tailings Storage. Technical Memorandum dated March 17, 2023. (See Item 23)

Attachment 14: Additional Stability Analysis Copper World Project Tailings Storage Facilities. Technical Memorandum dated March 31, 2023. (See Item 29)

Attachment 15: Drawing No. 104-2-001- Stormwater Management Overall Site Plan. (See Item 32)

Attachment 16: Figure 33-1 Unsuitable Material Beneath TSFs and HLF. (See Item 33)

Attachment 17: Figures 34-1 through 34-6, Section TSF – Static Condition. (See Item 34)

Attachment 18: Leaching Facilities Design. Rosemont Copper. Report dated June 2007. (See Item 39)

Attachment 19: Rosemont Heap Leach Facility. Permit Design Report. Volume 1. Rosemont Copper Company. Report dated May 2009. (See Item 39)

Attachment 20: Figures 41-1 through 41-4, WRF Plan View – Cross Sections. (See Item 41)

Attachment 21: Copper World Project – Rosemont Pit – Dewatering Scenario. Technical Memorandum, File No. 4286-TM23-APP46, dated March 31, 2023. (See Item 46)

Attachment 22: Figures 46-1 and 46-2, Phreatic Surface. (See Item 46)

Attachment 23: Figure 50-1, POC Wells and Baseline Groundwater Elevation Contours. (See Item 50)

Attachment 24: Figure 60-1, Locations of Proposed TSF 1 POC and Facility Monitoring Wells. (See Item 60)

Attachment 25: Figure 61-1, Rosemont Pit Area Water Level Monitoring. (See Item 61)

Attachment 26: Copper World Project – Summary of Mine Pits and WRF Backfill. Technical Memorandum dated March 31, 2023. (See Item 62)

Attachment 27: Copper World Project Groundwater Model Water Balance, March 31, 2023. (See Item 64)

Attachment 28: Cooper World Project Groundwater Model Calibration and Sensitivity. Technical Memorandum dated March 31, 2023. (See Item 66)

Attachment 29: Figure 68-1, Previous and Current Groundwater Domains. (See Item 68)

Attachment 30: PEST Control File. (See Item 69)

Attachment 31: Figure 70-1, Particle Trace and Model Contours. (See Item 70)

Attachment 32: Figures 71-1 through 71-13, Particle Trace (See Item 71)

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