Groundwater

Groundwater quantity and quality has been inventoried in the project area. It occurs in stream alluvium, basin fill, and bedrock (where it mainly flows through fractures). Groundwater quality is influenced by several factors, including naturally occurring mineralization and historic mining.

Environmental Consequences

Under all alternatives:

- Pumping will lower groundwater levels within a radius of dewatering (i.e., cone of depression) during mining. As a result, water levels in some nearby private wells will decline to varied extents. Others near discharge locations may experience a rise in water level.
- Mine waste (e.g., tailings and waste rock) stored above ground has the potential to produce acid rock drainage and/or leach metals. Groundwater quality could be degraded if these products escape containment.
- Metals leached from materials in underground mine workings—including wall rock, cemented paste tailings backfill, and waste rock—are expected to impact water quality in the deeper groundwater system during post-closure groundwater recovery.
- As discharge from WTP2 flows downstream in Harshaw Creek, a portion of the streamflow will infiltrate the subsurface. The infiltrating discharge is not expected to cause water quality exceedances, but it could cause barium, selenium, and uranium concentrations to rise above background levels in the groundwater system.

The following presents a comparison of effects between alternatives:

Alternative 1 – No Action

- Net removal of 23,000 acre-feet.
- Maximum cone of depression area (58.4 mi^2) occurs in 2079.
- Groundwater mounding concentrated around Harshaw Creek and Sonoita Creek.
- Near full recovery of groundwater levels to baseline conditions by 2254.

Alternative 2 – Proposed Action

- Net removal of 34,000 acre-feet.
- Maximum cone of depression area (49.6 mi^2) occurs in 2093.
- Groundwater mounding concentrated around RIBs.
- Near full recovery of groundwater levels to baseline conditions by 2243.

Alternative 3 – Modified Proposed Action

- Net removal has not been quantified but will likely be higher than Alternative 2 due to discharge occurring at stream-based outfalls rather than RIBs.
- Maximum cone of depression area (55.8 mi^2) occurs in 2048.
- Groundwater mounding concentrated around Goldbaum Canyon and Mowry Wash discharge outfalls.
- Near full recovery of groundwater levels to baseline conditions by 2250.

Notes: WTP2 = water treatment plant 2; RIB = rapid infiltration basin

Springs

Surface water surveys identified 80 “spring-like” features in the water resources analysis area. Of these, 31 contained water during most field visits and could be connected to either a shallow/perched or deep/regional groundwater system. Additional analysis determined that 19 of these sites are connected or potentially connected to the deep/regional groundwater system.

Environmental Consequences

Under all alternatives:

Mine dewatering activities will remove water from the regional groundwater system. Springs that are sourced from perched groundwater are not expected to be impacted. Therefore, the following impacts are associated with springs fed predominantly or completely by regional groundwater:

- Dewatering will cause an overall 13% net reduction in flow compared to baseline conditions.
- Regional groundwater contribution to three springs ceases during the dry season.
- One spring in Alum Gulch is likely to dry up for 25 years during dewatering. Flow at this spring is projected to recover fully by 2250.
- The long-term effects of climatic trends will likely reduce spring flows in the future, even if dewatering does not occur.

The following presents a comparison of effects between alternatives:

Alternative 1 – No Action

- Most springs in Alum Gulch and Flux Canyon drainages will experience dry season flow decreases of 30 to 50 percent during mining.
- Surface disturbance will not impact the springs on NFS land.

Alternative 2 – Proposed Action

- Most springs in Alum Gulch and Flux Canyon drainages will experience dry season flow decreases of 40 to 60 percent during mining.
- Three springs on NFS land fall within the construction footprint of the Primary Access Road and TSF2. Depressions around these springs will likely be filled in during construction, reducing the likelihood of groundwater daylighting at these locations. At one spring, spring flow will be captured and piped to a discharge point downgradient of TSF2.

Alternative 3 – Modified Proposed Action

- Most springs in Alum Gulch and Flux Canyon drainages will experience dry season flow decreases of 40 to 60 percent during mining.
- Direct impacts to the three springs described in Alternative 2 – Proposed Action would be avoided by using the existing site access road and shifting tailings placement to the Alternative 3 TSF location.

Notes:
NFS = National Forest Service;
TSF = tailings storage facility;
WTP2 = water treatment plant 2

Surface Water

Major drainages near the Project include the Santa Cruz River and Sonoita Creek. Most tributary streams near the Project flow north into Sonoita Creek. The largest of these tributaries is Harshaw Creek, which discharges into the ephemeral reach of Sonoita Creek upstream of Patagonia. A series of gulches and canyons drain into Sonoita Creek from the northwestern flank of the Patagonia Mountains, and streams to the southeast and southwest of the Project drain into the Santa Cruz River.

Environmental Consequences

Under all alternatives:

- Treated water discharged from WTP2 would create persistent flow along an 8-mile segment of Harshaw Creek.
- Flow rates would peak in Harshaw Creek and instream spring H16 03 at just under 9 cubic feet per second (cfs) in 2026.
- Discharge from WTP2 would not increase the flooding risk in Harshaw Creek under any alternative. The maximum discharge volume would be only 10 cfs, whereas historical flooding and peakflow estimates in Harshaw Creek are on the order of hundreds to thousands of cubic feet per second for high-recurrence interval storm events.
- Peak flows at surveyed monitoring points in Sonoita Creek would range from 7 to 9 cfs during the highest discharge period from WTP2. Increase in flow is due to an increase in groundwater recharge.
- Discharge to Alum Gulch from WTP1 would not create persistent flow in this drainage.
- During the mining period, discharge from WTP2 would have a much stronger localized influence on stream flow than climatic trends.
- Post-mining, the most likely impact to surface water from climatic trends would be a reduction in sustained flow rates at instream springs.

The following presents a comparison of effects between alternatives:

Alternative 1 – No Action

- No streams other than Harshaw Creek are forecast to have persistent flow from Project-related discharge.
- Stream flows would return to baseline conditions by about 2093.

Alternative 2 – Proposed Action

- The rapid infiltration basins would create persistent flow in East Fork Harshaw Creek and Mowry Wash.
- Stream flows would return to baseline conditions more quickly than Alternative 1 – No Action (by about 2079) because less discharge would be routed down Harshaw Creek.

Alternative 3 – Modified Proposed Action

- Direct discharge to Goldbaum Canyon and Mowry Wash outfalls would create persistent flow in Goldbaum Canyon, East Fork Harshaw Creek, and Mowry Wash. The length of persistent flow in Mowry Wash would be 1,000 feet longer than under Alternative 2.
- The time required for stream flow to return to baseline conditions would be the same as that for Alternative 2 – Proposed Action.

Note: WTP = water treatment plant

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