11-38. TSF LEAKAGE RISK

Concern:
Treatment of contaminants in the TSF is not presented in the EIS. The TSF is planned to be constructed on a fault. 1.6 ML/day of TSF leakage is planned without considering the fault risk. The planned monitoring places few controls on compliance with the design and there is no contingency plan to remediate leakage. No peer review of contamination risks has been presented.

Query response to the following SEARs for SSD 5765:

- A description of the existing environment likely to be affected by the development, using sufficient baseline data
- A description of mitigations and
    - Whether these are best practice and represent a full range of measures
    - Whether they will be effective / key performance indicators
    - Contingency plans for residual risks / monitoring and reporting on environmental performance
- Part 3: Any interference with an aquifer caused by the development does not exceed the respective water table, water pressure and water quality requirements specified for item 1 in columns 2, 3 and 4 of Table 1 of the *Aquifer Interference Policy 2012* for each relevant water source listed in column 1 of that Table
- Part 3: impacts to significant water resources or threatened species are minimised to the greatest extent practicable
- DRG, Attachment 2A requires rehabilitation methods including
  e) monitoring for rehabilitation
  i) details of triggering intervention
  k) details of post rehabilitation management
  l)i) assessment of rehabilitation techniques against objectives
  l) ii) assessment of potential acid mine drainage
  l) iii) processes to identify and management geochemical risks throughout mine life
  m) iii) groundwater assessment for final water level in any tailing storage facility void
  o) consideration of controls
- DRE/DPE requires a Water Management Strategy that considers
    - the existing surface and groundwater qualities
    - a robust baseline
    - a description of how groundwater and aquatic ecosystems will be monitored, Trigger Action Response Plan and trend identification

DISCUSSION

Leachate from the TSF could contaminate the aquifer if controls are not put in place. No treatment schedule for contaminants is presented. Controls include:

a. a 0.45 m thick clay liner (ATC Williams, 2020, p. 17), after referring to an EPA 'benchmark position' of a minimum 1 m thickness clay liner with maximum permeability (hydraulic conductivity) of 1 x 10^{-9} m/sec (ATC Williams, 2020, p. 8)
b. 'in-situ' testing of 5 x 10^{-10} m/sec hydraulic conductivity on 'Foundation Clay – Compacted'
c. A bituminous geomembrane (BGM) liner on the TSF embankment

These controls are insufficient to prevent seepage from the TSF (ATC Williams, 2020, p. 24). 0.2 m^3/d (2.23 x 10^{-6} m^3/sec) of leakage under the embankment is anticipated when the decant pond elevation is 615 mAHD in Figure A.1 of ATC Williams (2020). In the same report on page 25, ATC Williams (2020) also anticipates 160 m^3/d of seepage under the embankment, and that some of this may bypass the seepage collection ponds (p.

26). While the trigger for action is not stated, the proposed 'contingency' is to build more seepage collection down gradient.

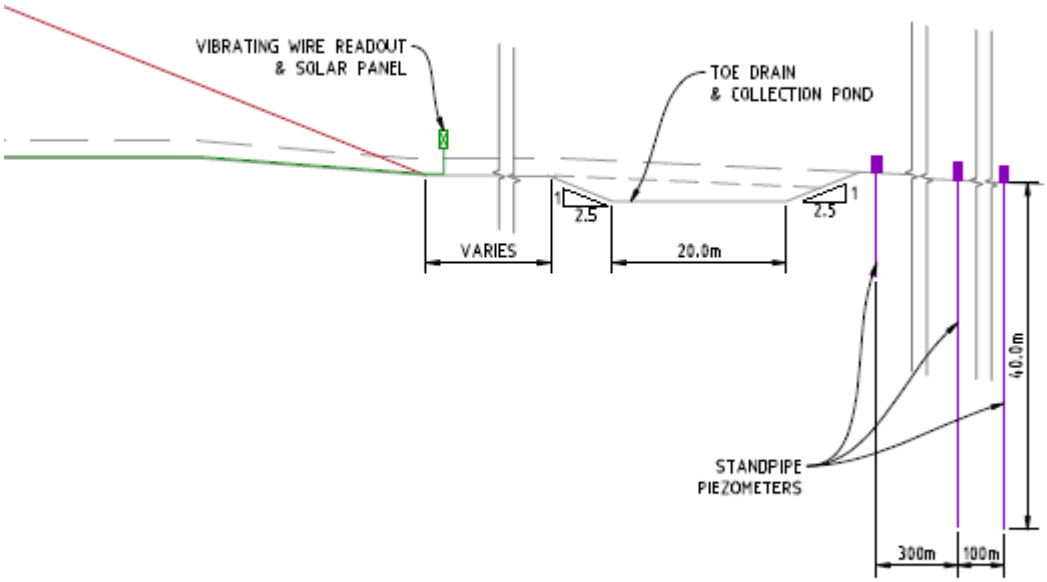

Figure 1: Indicative design of conceptual seepage collection pond(s). Source – Figure 18 of (ATC Williams, 2020)

The indicative seepage collection infrastructure (Figure 1) is valid for a small area due west of the TSF (see Figure 2).

On a wider scale, assuming 20 m of tailings thickness, 1.35 litres per day per m^2 of TSF liner is anticipated (Jacobs (Australia), 2020, pp. 5-128). If this is applied over the indicative TSF area of 117 ha (R. W. Corkery & Co. Pty. Limited, 2020, p. xvii), this equates to a leakage rate of 1.35 x 1,170,000 = 1.58 million litres per day to the aquifer. The EIS proposes to maintain this leakage rate after mining ceases (R.W. Corkery and Co. Pty Limited, 2020).

To calibrate this estimate, four standpipe piezometers are proposed near the embankment. None are listed around the TSF to detect leakage towards Lue Village or to monitor leakage into the pit lake.

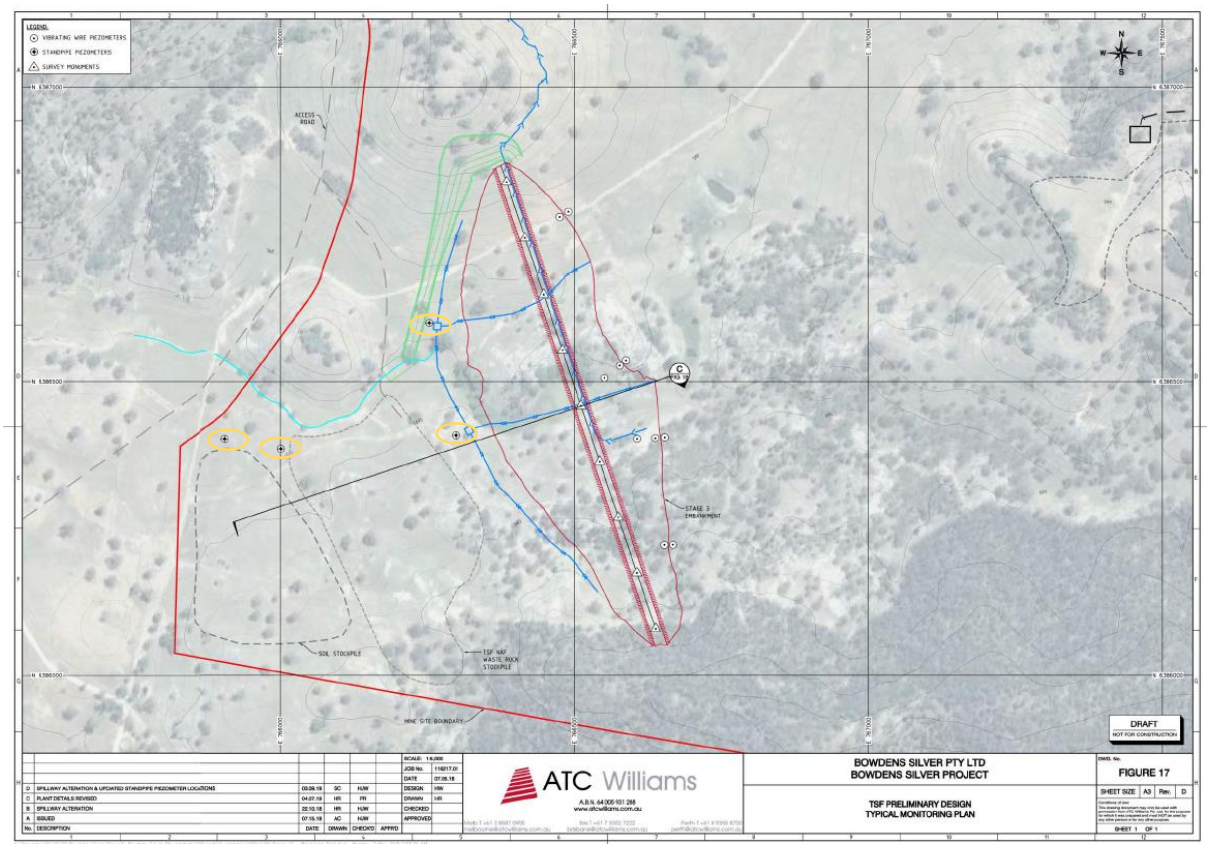

Figure 2: Four planned piezometers for leakage monitoring. Source - Figure 17 (ATC Williams, 2020)

As the foundation clay liner will be subject to wetting and drying cycles which may cause clay cracking when the TSF is commissioned, as well as upward groundwater pressures, detail around maintaining the design hydraulic conductivity estimate of 5 x 10^{-10} m/sec would help justify the liner proposed.

Faults have the potential to readily transmit large quantities of groundwater. The only reference to the faults mapped beneath the planned TSF is on page 2 of ATC Williams (2020). ATC Williams (2020 p.2) suggest leakage through faults (Figure 3) is considered in 'Section 7'. Transmissive faults can form a highly transmissive underground flow conduit in a preferred direction, potentially to a significant receptor. No reference to faults

can been seen in Section 7 and the TSF design and monitoring plan in ATC Williams (2020) does not appear to consider the leakage risk posed by faulting (ATC Williams, 2020).

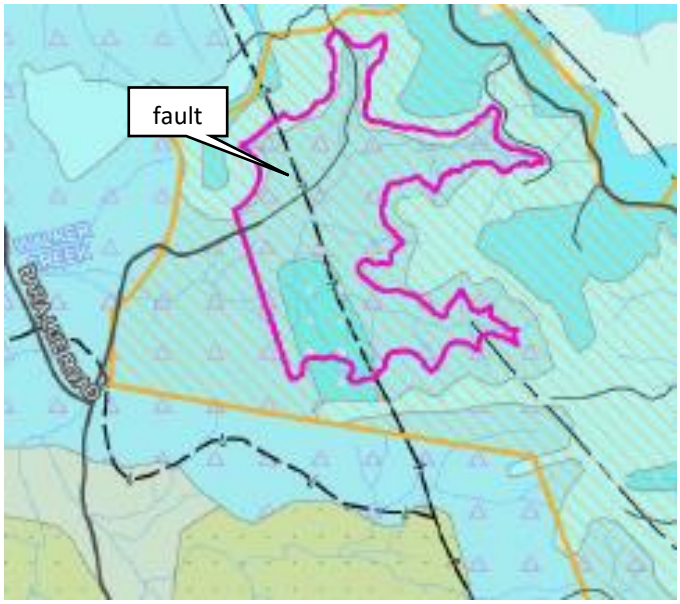

Figure 3: Structural geology – adapted from Figure 11 of (Jacobs (Australia), 2020, pp. 5-57)

The TSF is proposed to be operated in accordance with ANCOLD 2012 Guidelines (Cardno, 2020, pp. 10-20), however, these are guides to risk categories. The Guidelines on Tailings Dams – Planning, Design, Construction, Operation and Closure – REVISION 1 (July 2019) may be a more suitable guide, however, a greater focus on groundwater is recommended than provided in ANCOLD.

A structured groundwater risk assessment including contingency plans in case of leakage as well as a treatment plan for the contaminants would create a more robust EIS proposal. Rainfall is allowed to infiltrate the TSF cover on abandonment, potentially causing overflows and no trigger levels for 'minimising the quantity of water that infiltrates the tailings in the TSF' (R.W. Corkery and Co. Pty Limited, 2020, pp. A5-73) are presented for successful rehabilitation.

REFERENCES

ATC Williams, 2020. *Tailings storage facility preliminary design,* Melbourne: Bowdens Silver Pty Limited.

Cardno, 2020. *Aquatic Ecology Assessment,* Sydney: Bowdens Silver Mine.

Jacobs (Australia), 2020. *Part 5 - Groundwater Assessment,* Sydney: Silver Mines Pty. Limited.

R. W. Corkery & Co. Pty. Limited, 2020. *EIS Bowdens Silver Project,* Sydney: Bowdens Silver Pty Limited.

R.W. Corkery and Co. Pty Limited, 2020. *EIS Appendices,* Sydney: Bowdens Silver.