15 December 2022

Mr Stephen O'Donoghue
Director Resource Assessments
Energy, Resources and Compliance
Department of Planning and Environment
Locked Bag 5022
PARRAMATTA NSW 2124

Dear Stephen

Re: Bowdens Silver Project – Surface Water Peer Review Conclusions and Recommendations

Following review of the *Update on Independent Review – Water Balance Modelling and Surface Water Management* prepared by Earth Systems we have prepared response to the final comments, focusing on the conclusions and recommendations of the review.

In summary, following consideration of Earth Systems' recommendations and conclusions, we wish to confirm that the site water balance model, developed using WRM's extensive experience at operational mine sites in the region confirms the Project has a safe and reliable water supply and identifies no discharge from the Mine Site, including the TSF, across the range of historical climate conditions modelled. All risks from key model sensitivities have been robustly tested and assessed with the further assessment of model sensitivity to additional factors or cumulative uncertainty unnecessary.

Regarding water quality risks in the downstream environment, all water management infrastructure within the Mine Site catchment would be designed to capture all water/runoff from areas disturbed by mining operations for re-use in operations. As discharge is not proposed, the assessment of water treatment is not required. Should discharge be identified as an appropriate course of action during operations, all protocols and quality criteria would be developed and assessed in consultation with the EPA, DPE and DPE-Water. Water quality risks from TSF seepage has also been conservatively assessed with no change to beneficial uses of Lawsons Creek, even under low-flow condition. However, Bowdens Silver would undertake further assessment of TSF seepage using reactive transport modelling following detailed design.

The Project's risks to the availability of water for downstream users has been established using a calibrated Australian Water Balance Model. This model quantifies the Mine Site's existing contribution to Lawsons Creek streamflow and assesses the impacts of removing this contribution. This assessment identified the Project would have negligible impact to downstream users.

Notwithstanding this, Bowdens Silver would develop a comprehensive Water Management Plan that would be submitted to DPE for approval prior to construction. This plan would describe the range of monitoring, triggers, actions, responses and review in relation to ongoing water management.

I trust the information in the attached sufficiently and succinctly addresses the matters raised by Earth Systems however, feel free to contact myself or Nick Warren to discuss further if required.

Yours sincerely

Paul Ryall
Senior Environmental Consultant

Brooklyn Office
Level 1, 12 Dangar Road
PO Box 239
BROOKLYN NSW 2083

Orange Office
62 Hill Street
ORANGE NSW 2800

Brisbane Office
Level 54, 111 Eagle Street
BRISBANE QLD 4000

ABN: 31 002 033 712
Telephone: (02) 9985 8511
Email: admin@rwcorkery.com

Table A1
Response to Earth Systems Water Balance Modelling and Surface Water Management Review – Key Conclusions and Recommendations

Review Item	Conclusions and Recommendations	Response
1	TSF seepage modelling indicates potential surface water quality impacts (e.g. copper, zinc, cyanide and phosphorus) in Lawsons Creek, as well as groundwater quality impacts. Such impacts could be further exacerbated by AMD generation from PAF tailings, addition of other contaminants from the mine site / process plant water, or concentration of contaminants due to water re-circulation, none of which were considered in seepage modelling. A comprehensive TSF seepage quality management strategy is required.	It should be noted that the EPA has confirmed that the TSF liner presented in the preliminary design documents (ATC Williams, 2020) meets the permeability criteria of the NSW EPA. Bowdens Silver has also committed to providing additional seepage mitigation design elements. The effectiveness of TSF seepage mitigation was considered in an assessment of potential downstream water quality impacts that was presented in Section 3.3 of the *Submissions Report* (RWC, 2021). This assessment identified only copper and cyanide would exceed aquatic ecosystem guideline values in Lawsons Creek during low flow conditions, although copper concentrations in receiving waters already exceeded aquatic ecosystem guideline values. All other guideline values, including those for the protection of agricultural water uses were satisfied, indicating negligible impact to beneficial use of Lawsons Creek. On cyanide, while not assumed for the assessment, it was noted that this compound would be subjected to volatilisation processes, such that up to 90% of cyanide present may be lost from the TSF decant pond (NICNAS, 2010). In addition, further removal of cyanide (if any present) is very likely to occur upon entry to the groundwater system via processes such as the formation of insoluble iron-cyanide precipitates or formic acid (HCOOH) from hydrolysis. Notwithstanding this, Bowdens Silver has committed to undertake reactive transport modelling of TSF seepage implications following completion of TSF detailed design. This would include generation of AMD from PAF tailings involving kinetic testing of tailings. This modelling would be used to inform the seepage monitoring strategies that would be documented in the approved Water Management Plan and implemented throughout the Project-life.
2	The site water balance model does not incorporate a water quality component. This is required to fully assess potential impacts on receiving waters (e.g. from TSF seepage) and to develop treatment or other management strategies.	The design intent of all assessed water management infrastructure is the interception, capture, recirculation and re-use of water/runoff in contact with catchments disturbed by mining operations. This conservatively assumes all 'contact-waters' are of impaired quality. Therefore, the development of a water quality component in the water balance model is not necessary. Furthermore, the site water balance model identifies no discharge from the Mine Site under all modelled conditions. Should Bowdens Silver establish that water collected in the erosion and sediment control zone be suitable for release, it would request an amendment to its Environmental Protection License from the EPA. Any request to amend would be supported by information of proposed discharge water quality, consider the impacts to downstream water quality and treatment methods to meet agreed discharge water quality criteria. The response provided above addresses matters relating to TSF seepage.
3	Potential water quality impacts associated with process chemicals need to be quantitatively assessed and management measures developed accordingly, taking into account their toxicity / ecotoxicity and chemical behaviour, such as adsorption and decomposition rates.	The design intent of the processing plant detention dams is the capture of all runoff from the processing plant catchment. As identified in Table 5.6 of WRM (2022), these dams would have a collective capacity of 100 megalitres (ML) that would account for the maximum modelled volume (95ML). Furthermore, the Project would develop spill management protocols, including specific training through standard site induction and the provision of necessary equipment, as is standard practice in the mining industry. Sherpa (2020) presents a risk assessment of the transport, on-site storage and handling of dangerous goods (including process chemicals) in accordance with SEPP 33 (now Chapter 3 of the Resilience and Hazards SEPP 2021). Sherpa (2020) concluded that all qualitative environmental and land use safety risk criteria identified in *Hazardous Industry Planning Advisory Paper No. 4 Risk Criteria for Land Use Safety Planning* would be met by the Project. As noted in EIS Section 4.7.4.4, all process chemicals would be stored in bunded areas or within containers in accordance with contemporary best-practice and standards. Residual concentrations of reagents after processing would form part of the aqueous component of the tailings that would be reclaimed in the paste thickener and returned to the processing plant. Both cyanide and methyl isobutyl carbinol would progressively decompose such that their concentrations in any water discharged to the TSF would be much lower. Residual concentrations of process chemicals in TSF seepage would be considered in reactive transport modelling following detailed design of the TSF.
4	It has been confirmed that 856 ML/year of surface runoff would be removed from the Lawsons Creek catchment. This is well in excess of losses presented elsewhere in the EIS (177 ML/year; which relates to surface water runoff losses only). A review of impacts on downstream surface water, baseflow and groundwater is therefore warranted.	It is not accurate to state that 856ML/year of surface runoff would be removed from the Lawsons Creek catchment. Not all rainfall becomes runoff. In a vegetated setting rainfall that lands on the landscape may be absorbed by vegetation, evaporate from the surface of the vegetation or may infiltrate the surface, with the remaining water running off. On this basis, the Australian Water Balance Model (AWBM) developed by WRM estimated that the 550 hectare Mine Site catchment currently contributes 177 ML/year of runoff, on average, to Lawsons Creek streamflow. Once the Mine Site is developed, vegetation would be removed, a firm relatively impermeable surface developed or dams such as the TSF would be constructed within the Mine Site catchment causing a much greater proportion of rainfall to become runoff. Therefore, the figure of 856ML/year represents the volume of water that would runoff the developed Mine Site catchment and remain within the Mine Site water storage structures constructed for the Project. Fundamentally, environmental impact assessment requires the establishment of the existing environmental conditions, identification of potential changes to the existing condition as the result of the proposed development and assessment of the implications of those changes on the existing environment. By considering the streamflow implications from the loss of 177ML/year, WRM have appropriately assessed the change to the existing setting should the Project proceed. As the estimated 856 ML/year of runoff would only eventuate if the Project was approved, assessing this as a change to the local setting is not appropriate. Finally it is noted that DPE-Water did not query these findings or conclusions in their review of the Surface Water Assessment.

Table A1 (Cont'd)
Response to Earth Systems Water Balance Modelling and Surface Water Management Review – Key Conclusions and Recommendations

Review Item	Conclusions and Recommendations	Response
5	It is understood that Blackmans Gully would flow beneath the Southern Barrier (a "NAF" waste rock dump) and discharge off site, but there appears to remain a risk of drainage/seepage from the barrier entering Blackmans Gully. The Southern Barrier design should include provision for containment of all drainage (runoff or seepage) from the barrier and/or a contingency plan should be developed for Blackmans Gully.	The diversion of flows from upstream clean catchments beneath the southern barrier does not pose a risk to downstream water quality as this water would be conveyed by diversion drains and pipes/culverts and unlikely be in contact with NAF waste rock. However, there would be no water quality implications should diverted runoff come into contact with the upslope batter toe of the southern barrier as it would be constructed using benign waste rock material from the Sydney Basin sediments (WZ1). All runoff from the southern barrier itself would be collected in two downslope containment dams (refer Section 4.6.2 of WRM [2022] and Figure 3.1 of RWC [2022]).
6	Noting a greater than 50% risk of pit lake water throughflow in groundwater towards Hawkins Creek, and the potential for acid, metals and high salinity in pit water, impacts on receiving water quality need to be assessed, with and without mitigation measures. This also needs to consider potential contaminants in pit water from other sources (e.g. leachate dam, TSF, process water). A comprehensive pit lake water quality assessment is required to support solute transport modelling and impact assessment.	The outcomes of the Uncertainty Analysis are acknowledged, however Bowdens Silver has committed that the final void would be constructed as a groundwater sink. Updated groundwater modelling based on recorded aquifer parameters would be used to address any ongoing uncertainty and develop plans to address this prior to closure. These plans may include expanding the extent of the open cut pit at closure to reduce final void water levels and remove the risk of through flow occurring. Other mitigations may also be applied if justified. Bowdens Silver has accepted that any residual risks of through flow would need to be assessed through a program of reactive transport modelling to understand through flow water quality impact risks. This program would be undertaken if updated groundwater modelling predicts through flow. This assessment would form part of ongoing evaluation during operations to inform closure and rehabilitation planning as part of Bowdens Silver's mandatory obligations under the Mining Act 1992.
7	Where water management strategies are provided, they are generally focussed on managing water flows, but not water quality. Treatment of contaminated water is occasionally mentioned in passing, but no details are provided. Clear and comprehensive management strategies are required for surface water (and groundwater) to avoid over-reliance on modelling, monitoring and reactive management.	As noted above, the design intent of all water management infrastructure is the capture of all water/runoff in contact with catchments disturbed by mining operations to prevent discharge from the Mine Site. As no discharge is proposed, no treatment of contaminated water is required. Should discharge of water be proposed, the EPA have identified the assessment needed to justify this which would include development of water quality management strategies. WRM developed the site water balance and water management strategy based on the qualifications of personnel involved in the assessment, an understanding of best practice and extensive experience at active mining operations. Furthermore, the water management strategy at the Mine Site would utilise dedicated infrastructure (pumps and pipes) to facilitate water transfers around the Mine Site, as required. The level of detail provided and overall strategy proposed is entirely appropriate for a Project at this stage of the development. The modelling undertaken clearly demonstrates that the 'proof of concept', as tested, is effective in capturing, storing and preventing discharge of potentially contaminated water. Whilst the modelling has demonstrated this strategy's effectiveness, during operations, water management would also have continuous oversight 24 hours per day, 7 days per week. This direct oversight removes the risk of any over-reliance on modelling. All actions, transfer triggers and protocols would be described in an approved Water Management Plan that would be developed following approval and prior to operations.
8	For the proposed amendment, sensitivity analysis indicates that only 86% (average) or 65% (worst case) of the processing plant water requirement may be met. Furthermore, the sensitivity analysis did not include evaporation rates, dust suppressant effectiveness, other key input variables (aside from AWBM parameters and groundwater flows) or cumulative sensitivity for multiple parameters. Bowdens Silver nevertheless considers this risk acceptable in terms of the financial viability of the project.	The sensitivity analysis of the water supply arrangements is intended to demonstrate the sensitivity of the outcome to changes in particular parameters used in the assessment. It provides an indication of outlier outcomes resulting from underestimated parameters used in the assessment. The sensitivity analysis is an assessment of risk factors but should not be used for planning operations. The application of assumptions concerning evaporation rates and dust suppressant effectiveness is considered to be well constrained by the approach to modelling and the experience from other mining operations. As WRM considered the model most sensitive to runoff parameters and groundwater flows, the assessment of the sensitivity of additional factors or cumulative uncertainty in the site water balance is not considered necessary. Bowdens Silver has carefully considered the proposed water management strategies and the implications of the approach on the financial viability of the Project. Bowdens Silver remains committed to these strategies.

Table A2
Response to Earth Systems Updated Review of Water Balance Modelling and Surface Water Management

Earth Systems Recommendation – 8 June 2022	Additional Information	Potential Conditions for NSW DPE Approval	Response
Site Water Balance			
1. Seek clarification of the implications of under-estimating climate variance for the risk of uncontrolled discharge. Seek clarification of the implications of over- estimating site rainfall for project water supply reliability.	Regarding the first recommendation, clarification provided by Corkery (2022a; Table A1) indicates that long-term variance (3-5+ days) would be well replicated by SILO, while short-term variance (<3 days) would not present any risk of uncontrolled discharge due to the design capacities of the water management system. Regarding the second recommendation, this has been misunderstood in the response, as Figure 3.3 implied that site rainfall is 7% less (not more) than long-term SILO rainfall. However, an updated figure provided by Corkery (2022; Figure 3) suggests the discrepancy is 4-5% which is less of a concern.	Not applicable based on the response provided.	Noted
2. An independent check on modelled runoff coefficients / parameters should be conducted based on available measured site rainfall and flow data for Hawkins Creek.	The response by Corkery (2022a; Table A1) notes that “the derived runoff coefficients were much lower than would be expected with WRM suspecting this partly due to upstream water extraction /dams” and also that “it is possible that it’s because the site rainfall is not representative”. This is considered acceptable in the absence of reliable site rainfall and runoff data.	Not applicable based on the response provided.	Noted
3. Water balance model results should be provided for all site water volumes, on a daily basis, throughout the mine life. A site water quality model is required to assess whether site water is fit for purpose, to fully assess potential impacts on receiving waters (e.g. from TSF seepage) and/or to develop treatment or other site water management strategies.	Regarding the first recommendation, the response by Corkery (2022a; Table A1) clarifies that *“Some dams were modelled as lumped storages. These can be remodelled separately but, as the dams have been sized to contain the design rainfall (i.e. fixed ratio to catchment area), the outcomes would be the same.*” Regarding the second recommendation, it appears that no further work has been conducted to address this concern. Previous solute transport modelling did not consider the AMD risk from the tailings and was therefore not conservative, yet still indicated a significant risk to downstream water quality.	Prior to mining, develop a site water quality model to fully assess potential impacts on receiving waters (e.g. from TSF seepage), determine treatment requirements or other site water management strategies beyond those already documented.	Refer response to Review Item 2 in **Table A1**.
4. Seek further clarification of the water balance modelling method and the sensitivity of model outputs to uncertainties in runoff characteristics of different land use types.	Clarification has been provided by Corkery (2022a; Table A1) on WRM’s water balance modelling method relating to: • Representation of land use types. • TSF seepage pump-back. • Waste rock dump seepage pump-back. • TSF seepage losses to groundwater. While not quantified, it is inferred from the response that volumes of TSF seepage pump-back <u>as well as</u> TSF losses to groundwater are minor in comparison with other site water balance flows. It is understood that TSF pond surface areas were modelled, therefore it may be inferred that evaporation rates were based on pond areas, although not specifically stated in the response.	Not applicable based on the response provided.	Noted
5. Seek further clarification of the water balance modelling method and the sensitivity of model outputs to uncertainties in runoff characteristics of different land use types.	Clarification has been provided by Corkery (2022a; Table A1) on WRM’s water balance modelling method relating to lined surfaces, natural/disturbed areas and rehabilitated areas.	Not applicable based on the response provided.	Noted
6. Seek further clarification of the water balance modelling method and any implications for model outputs.	Note that this recommendation relates to a statement that groundwater and surface water collected in the main open cut pit were used as the first preference for meeting site water demands (WRM, 2020 and 2022), which appears to be inconsistent with current plans to prioritise other water sources (e.g. leachate dam, TSF decant pond). The response provided by Corkery (2022a; Table A1) states: *“Noted and acknowledged for checking. This statement considered to refer to any shortfalls in nett requirements after supply from the TSF decant pond.”*	*Pending results of checking as indicated.*	The model integrates the open cut pit, TSF and WRE as first-priority sources of make-up water for processing. This integration means that the modelled system initiates internal transfers between storages to prevent discharge from the Mine Site. For example, when open cut pit inflows exceed processing make-up demand, the excess is transferred to the TSF. The model demonstrated this approach as being fit-for-purpose with no discharge from the Mine Site predicted.

Table A2 (Cont'd)
Response to Earth Systems Updated Review of Water Balance Modelling and Surface Water Management

Earth Systems Recommendation – 8 June 2022	Additional Information	Potential Conditions for NSW DPE Approval	Response
Site Water Balance (Cont'd)			
7. Impacts on mean annual streamflow in downstream waters need to be predicted for the proposed amendment. Implications for WAL requirements may need to be reviewed.	The response provided by Corkery (2022a; Table A1) states: *"The 550 ha is made up of the TSF, Pit and Processing Plant catchments and the "NAF materials" catchments shown on Figure 8.2 of WRM (2022).* *Apart from clean water harvest sub-catchments in Blackmans Gully, runoff from the undisturbed catchment upstream of the Southern* *Barrier will not be contained on site. Rather it will be allowed to pass through the Southern Barrier via drainage pipes.* *Clean water harvesting is excluded from the catchment loss analysis as it is a basic landholder right under Section 53 of the Water Management* *Act 2000 with water able to be taken irrespective of Project approval."* Drainage/seepage water quality from "NAF" waste rock in the Southern Barrier may be found to be unsuitable for off-site release, and it appears possible that some of this drainage/seepage could report directly to Blackmans Gully. If Blackmans Gully was affected by this seepage it would need to be contained on site, with potential implications for WAL requirements. It is understood that clean water harvesting is a basic landholder right, nevertheless it is relevant to understanding the cumulative impact of the project on downstream water flows and should not be excluded from the impact assessment.	Prior to construction: • Review Southern Barrier design to ensure that it includes provision for containment of all drainage (runoff or seepage) from the barrier and/or develop a water quality contingency plan for Blackmans Gully. • Re-assess impacts on mean annual streamflow in downstream waters for the proposed amendment, with consideration of clean water harvesting as well as the provision to contain all drainage/seepage from the Southern Barrier. Also see Item 8.	Refer Review Item 5 in **Table A1** for response to matters relating to the southern barrier. The assessment of clean water harvesting is unnecessary for the following reasons: • Bowdens Silver is entitled to construct harvestable rights dams under Section 53 of the Water Management Act 2000 without the need for approval. • The Project, as presented reduces Bowdens Silver's harvestable rights dam storage capacity.
8. Seek clarification of "rainfall and runoff" terminology in water balance outputs (which appears to be inaccurate) or update impact predictions if predicted "rainfall and runoff" is actually as high as 806 ML/year (or 856 ML/year). For further context (Earth Systems, 2022): The water balance outputs indicate "rainfall and runoff" as the primary inflow to the site, averaging 806 ML/year between Year 1 and Year 14 of mining operations (WRM, 2020). This was updated to 856 ML/year in WRM (2022). This key model output is confusing to the reader as it suggests 806 ML/year (or 856 ML/year) of surface runoff would be removed from the Lawsons Creek catchment, well in excess of losses presented elsewhere in the EIS (177 ML/year). If this is correct, surface water impacts will be much higher than presented in the EIS. The reason for the increase from 806 to 856 ML/year is also unclear.	The response provided by Corkery (2022a; Table A1) states: *"The key reason for the difference between the 177ML/year and 856ML/year rainfall and runoff component of the water balance is that runoff rates are much higher within the disturbed Mine Site catchments (e.g. TSF and open cut pit) when compared to the existing undisturbed catchments. The increase from 806ML/y to 856ML/y is attributed to the TSF liner and addition of clean water harvesting."* On this basis, it is a concern that impacts on surface water / baseflow / groundwater could be much higher than presented in the EIS, which indicates a loss of 177 ML/y based on surface water runoff losses only.	Prior to construction: • Re-assess impacts on local surface water, baseflow and groundwater, noting the removal of 856ML/year from the project area catchments, rather than 177ML/y based on surface water runoff losses only.	Refer response to Review Item 4 in **Table A1**.
9. Larger sediment dam sizes are supported from both a water quality perspective (lower risk of uncontrolled discharge) and a project water supply reliability perspective. Until a sediment dam sizing is confirmed, water balance modelling should be conducted for both potential scenarios (small versus large sediment dam capacities). A water management strategy is required in the event that Blackmans Gully water is contaminated by acidic runoff or NMD from the southern barrier. Implications for the site water balance, downstream creek flow impacts and WAL requirements and may also need to be considered.	The first recommendation was accepted in the response by Corkery (2022a; Table A1). Regarding the second recommendation, the response by Corkery (2022a; Table A1) infers that only clean water from undisturbed catchments will enter Blackmans Gully. However, it appears possible that some of the Southern Barrier drainage/seepage could report directly to Blackmans Gully.	As per Item 7.	Refer response to Item 7

Table A2 (Cont'd)
Response to Earth Systems Updated Review of Water Balance Modelling and Surface Water Management

Earth Systems Recommendation – 8 June 2022	Additional Information	Potential Conditions for NSW DPE Approval	Response
Site Water Balance (Cont'd)			
10. A site water quality model is required to assess whether site water is fit for purpose and/or to develop treatment or other site water quality management strategies. For further context (Earth Systems, 2022): – In the SEARs, the EPA requires "a water balance including water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed – treatment and management methods and re-use options". – Water quality has not been included in the site water balance model by WRM. Proposed treatment methods have not been documented.	The response by Corkery (2022a; Table A1) states that: *"Where required, water recovered from water management infrastructure will be treated for use in the processing plant.* *Should discharge be proposed during operations, it would only occur from the ESC zone where water quality parameters meet those described in the Project's Environmental Protection Licence."* A site water quality model has not been developed, therefore it has not been possible to provide any detail on water treatment requirements.	As per Item 3.	Refer response to Review Item 2 in **Table A1**.
11. Seek further clarification and/or request supporting data to justify this conclusion.	The response by Corkery (2022a; Table A1) clarifies that: *"Some dams were modelled as lumped storages. However, they would still not discharge if separately modelled separately as the volume to catchment ratio would be unchanged".*	Not applicable based on the response provided.	Noted
12. Seek further clarification of these water balance model outputs.	The response by Corkery (2022a; Table A1) clarifies that: *"The TSF liner arrangement and tailings solids content has been amended since WRM (2020). Therefore, modelling of the full liner and filling rates/TSF surfaces and shape have changed.* *The Turkeys Nest Dam is operated full, with an operating level chosen to allow freeboard for the maximum direct rainfall on the surface so that it never overflows. The dam would be designed with an operating level set to achieve this.*" It remains unclear why the maximum modelled TSF pond volume (3,340ML) in Table 5.6 differs from that in Table 5.7 (3,517ML), and any implications for site water impact assessment or management.	*Pending clarification of modelled TSF pond volume discrepancy and site water impact assessment or management implications.*	The value presented in Table 5.7 is an error with the maximum modelled TSF volume confirmed as being 3,340ML, as presented in Table 5.6. The site water balance model predicted no discharge from the TSF.
13. Seek clarification of the sensitivity of the model to other key input variables, and implications for the risk of uncontrolled discharge or project water supply reliability. For further context (Earth Systems, 2022): – The sensitivity analysis for the water balance model considered 2 sets of AWBM parameters to reflect "low runoff" and "high runoff", as shown in Table 5.8 and 5.9 of WRM (2020 and 2022). – A further sensitivity analysis was conducted in which groundwater inflows were assumed to be half the predicted values.	The response by Corkery (2022a; Table A1) states that: *"Errors reported in these tables are acknowledged and will be identified and clarified However, the similar runoff parameters for the "waste rock emplacement", "rehabilitation" and "lined" in the low runoff and base case scenarios parameters are considered justifiable as the different runoff coefficients were very low to start with. Refer Item 1 for response on site vs SILO rainfall data.* *High and low rainfall scenarios have been modelled via the wet and dry periods included in the 130-year SILO dataset year).*" It is inferred that the "errors" referred to above have been addressed in Table 1 and 2 in Corkery (2022a). It appears that sensitivity analysis has not been conducted on: • Evaporation rates. • Dust suppression water volumes. • Other key model input variables. • Cumulative sensitivity associated with multiple parameters (not just sensitivity analysis of one parameter at a time).	*Pending clarification of model sensitivity to other variables, and cumulative sensitivity (multiple parameters), and implications for the risk of uncontrolled discharge or project water supply reliability.*	Refer response to Review Item 8 in **Table A1**.

Table A2 (Cont'd)
Response to Earth Systems Updated Review of Water Balance Modelling and Surface Water Management

Earth Systems Recommendation – 8 June 2022	Additional Information	Potential Conditions for NSW DPE Approval	Response
Site Water Balance (Cont'd)			
14. Seek further clarification of what the "stored volume" actually refers to and how this excess water would be managed.	The response by Corkery (2022a; Table A1) clarifies that: *"Annual increase in "stored volume" is the volume in all storages at the end of the simulation period minus the sum of the volume at its commencement (zero in this case).* *The water balance predicts a small average annual excess of inflow over outflow. Therefore, on average the water balance predicts a small volume of water remaining in storage at the end of the simulation. To expedite equilibrium final void pit lake water levels and allow TSF decommissioning/rehabilitation, the water balance model transfers excess water from the TSF decant pond to the open cut pit at the cessation of operations."*	Not applicable based on the response provided.	Noted
15. Seek clarification of the implications of under-estimating water requirements for dust suppression for project water supply reliability. For further context (Earth Systems, 2022): – In the updated water balance model (WRM, 2022) water requirements for haul road dust suppression have been significantly lowered (from 204 ML/year to 131 ML/year on average) "based on experience at nearby operations". No supporting data were provided. – No information on the proposed chemical composition has been provided, nor application rates or toxicity.	The response by Corkery (2022a; Table A1) states that: *"The reduction has been derived from recent usage metering at a nearby upper Hunter Coal mines before and after utilisation of a proprietary dust suppressant."* Supporting data were not provided, nor were uncertainties in dust suppression requirements considered in the sensitivity analysis of the water balance model. Even if a dust suppressant is proprietary, information on the proposed chemical composition, application rates and toxicity should be available from the supplier.	*Pending clarification of model sensitivity to uncertainty in water requirements for dust suppression, details on the proposed chemical composition, application rates and toxicity, and implications for the impact assessment.*	Refer response to Review Item 8 in **Table A1**. Most heavily trafficked areas on unsealed roads requiring dust suppression are within internally draining catchments (i.e. the open cut pit, haul roads, ROM pad and WRE) with any excess dust suppression water reporting collected by containment dams or the open cut pit sump. WRM has demonstrated these dams can be operated without the need for discharge.
16. Seek clarification of the project viability and the sensitivity of water supply reliability estimates to uncertainties that have not yet been modelled.	The response by Corkery (2022a; Table A1) states that: *"Bowdens has weighed up the magnitude and duration of the loss of production in deciding what is commercially sustainable for the project."*	Not applicable based on the response provided.	Noted
Final Pit Void Water Balance			
17. Seek clarification of the final pit void catchment area and whether this includes waste rock dump runoff.	The response by Corkery (2022a; Table A1) clarifies that the waste rock dump would not drain to the final void.	Not applicable based on the response provided.	Noted
18. 18. Seek clarification of the sensitivity of modelled water levels in the final pit void to pit wall evaporation rates.	The response by Corkery (2022a; Table A1) states that this recommendation is "noted" but it has not yet been addressed.	*Pending clarification of the sensitivity of modelled water levels in the final pit void to pit wall evaporation rate.*	The final void water balance has been the subject of a comprehensive sensitivity analysis. As the final void pit lake would equilibrate with the post-mining groundwater environment, groundwater inflows at higher elevations and their potential evaporation are immaterial to the overall final void water balance that would be dominated by groundwater and rainfall inputs and evaporative loss from the pit lake surface.
19. Seek clarification of the sensitivity of modelled water levels in the final pit void to groundwater inflow rates. For further context (Earth Systems, 2022): • Sensitivity analysis was conducted including: – Reducing the evaporation factor to 0.7 (WRM, 2020) or 0.8 (WRM, 2022) at the top of void. – Modifying AWBM parameters to increase runoff to the void. – Increasing groundwater inflows by a factor of 1.5 or 2.0. • It is unclear why the "increased" groundwater inflow rates (49.7 ML/year and 52.2 ML/year) are much lower than the reported groundwater inflow rate of 76 ML/year WRM (2020; Table 7.3). In the 2022 update, the "increased" groundwater inflow rates were much higher (87 ML/year and 95 ML/year) and yet comparable to the "average" of 92 ML/year (WRM, 2022; Table 7.3).	The response by Corkery (2022a; Table A1) states that the storage evaporation factors were derived from the results of monitoring of evaporation from coal mine voids at various locations in NSW and Queensland and provides a weblink reference to support this. The response by Corkery (2022a; Table A1) also notes that: *"Groundwater inflow rates are reduced by pit lake water level rises".* This does not specifically address the query raised, which relates to discrepancies in equilibrium groundwater inflow rates in Table 7.3 (WRM, 2020 and 2022). Notwithstanding this, it appears that the final pit void water balance reported by WRM (2020 and 2022) is now superseded by Corkery (2022b).	Not applicable assuming that the final pit void water balance reported by WRM (2020 and 2022) is now superseded by Corkery (2022b).	Noted

Table A2 (Cont'd)
Response to Earth Systems Updated Review of Water Balance Modelling and Surface Water Management

Earth Systems Recommendation – 8 June 2022	Additional Information	Potential Conditions for NSW DPE Approval	Response
Final Pit Void Water Balance (Cont'd)			
20. Conduct detailed review of the water balance data to better understand these issues. For further context (Earth Systems, 2022): – The modelled outputs for the "existing" climate scenario changed significantly from WRM (2020) to WRM (2022) despite the same rainfall and evaporation input data.	The response by Corkery (2022a; Table A1) clarifies that: *"WRM inadvertently enabled unscheduled timesteps in the final void model water balance model which introduced surprisingly high errors in the incorporated AWBM runoff model (which is strictly a daily timestep model).* *Figure 7.4 of WRM (2022) identifies decreasing groundwater inflows with increasing pit lake elevation that reduces to 0 at approximately 590mAHD. The increased groundwater inflows at equilibrium of WRM (2022) reflect lower final void pit lake water level at equilibrium."*	Not applicable based on the response provided.	Noted
21. Conduct a quantitative assessment of the potential impacts of pit lake water migration through groundwater on receiving surface waters. For further context (Earth Systems, 2022): – There is also a possibility of seepage towards Hawkins Creek post-mining and potential implications for receiving water quality. The sensitivity analysis in WRM (2022) indicates pit lake water levels up to 583.7 m AHD, well in excess of the elevation at which the pit lake would transition from a "sink" to throughflow conditions, which is ~579 m AHD (Jacobs, 2022). Indeed, the Response to Submissions (Corkery, 2021) refers to post mining water table contours (Jacobs, 2021) which indicate a gradient from the pit lake towards Hawkins Creek, with a potential groundwater travel time in excess of 100 years.	The response by Corkery (2022a; Table A1) states that [the possibility of seepage towards Hawkins Creek] has not been ignored and is the subject of the groundwater assessment. A *Final Void Uncertainty Analysis Report* was provided in October 2022 (Corkery, 2022b). Key findings include: – The updated modelling indicates a "greater than 50% probability of final void lake water levels exceeding 579 m AHD", the level at which throughflow conditions are expected to occur. – "In the event that the final void is considered likely to develop to a throughflow system, following equilibrium, travel time to Hawkins Creek would be in the order of 100 to 200 years." This is broadly consistent with the groundwater travel time reported by Jacobs (2021).	Conduct pit water quality modelling (taking into account acid, metals, salinity and any other contaminants) and solute transport modelling to assess potential water quality impacts in Hawkins Creek associated with throughflow from the final pit void, with and without implementation of mitigation measures.	Refer response to Review Item 6 in **Table A1**.
Water Management			
22. *Refer to recommendations in Earth Systems (2022b).*	*Refer to Earth Systems (2022b).*	*Refer to Earth Systems (2022b).*	
23. A water quality monitoring program and response management plan is required.	A water quality monitoring program and response management plan has not been developed.	Prior to construction, develop a water quality monitoring program and response management plan.	Bowdens Silver continues to collect samples for submission to a laboratory analysis as part of its surface and groundwater monitoring program. This program would be continued throughout operations and build upon the already significant database collected since 2012. All monitoring, including assessment of results and review against applicable criteria would be documented in an approved Water Management Plan that would also identify trigger action responses to potential water quality matters.
24. An assessment of potential water quality impacts associated with process chemicals is required, with management measures developed accordingly.	An assessment of potential water quality impacts associated with process chemicals has not been conducted, therefore it has not been possible to develop management measures. Impacts of TSF seepage on receiving surface water or groundwater remains a key concern.	Prior to construction, conduct an assessment of potential water quality impacts associated with process chemicals (including impacts associated with TSF seepage) and develop management measures accordingly.	Refer responses to Review Items 1 (TSF) and 3 (process chemicals) in **Table A1**.

Table A2 (Cont'd)
Response to Earth Systems Updated Review of Water Balance Modelling and Surface Water Management

Earth Systems Recommendation – 8 June 2022	Additional Information	Potential Conditions for NSW DPE Approval	Response
Water Management (Cont'd)			
25. A strategy for TSF and waste rock dump seepage flow / water quality management post-closure is required.	The response by Corkery (2022a; Table A1) states that: *"ATC Williams prepared preliminary TSF design based on significant consequence category dam due to presence of PAF tailings. Therefore, engineered design accounts for impacted water quality within TSF. Additional TSF design elements proposed in Submissions Report to reduce seepage. Reactive transport modelling report prepared.* *The closure capping design includes measures to prevent ingress of meteoric water entering stored PAF materials. Water quality and flow into leachate management dam is therefore expected to reduce over time. The WRE would be a HDPE lined facility with seepage not anticipated."* It appears that no additional work has been conducted to address the concerns raised. Cover systems and HDPE liners have a limited design life and therefore seepage to surface and/or groundwater will be inevitable in the long term. Furthermore, even if seepage volumes are low, contaminant loads and downstream impacts can be significant.	Prior to construction, develop a strategy for TSF and waste rock dump seepage flow / water quality management post- closure.	Refer responses to Review Item 1 in **Table A1** for matters relating to the TSF. The closure capping design (TSF and WRE) includes measures to prevent ingress of meteoric water entering stored PAF materials. Water quality and flow into leachate management dam is therefore expected to reduce over time. The WRE would be a HDPE lined facility with seepage not anticipated. Bowdens Silver has sought a second opinion (O'Kane, 2022) on Earth Systems position vis a vis the proposed cover system. O'Kane (2022) considers the measures presented by Bowden Silver entirely appropriate for a Project in the approval phase.
26. 26. A comprehensive pit lake water quality assessment and management strategy is required. A comprehensive TSF seepage quality management strategy is required.	Regarding the first recommendation, Corkery (2022a; Table A1) states that *"modelling identifies the final void pit lake will remain a groundwater sink with water levels well below the pit rim"*. This response does not consider the potential for seepage from the pit lake towards Hawkins Creek. Refer to Item 21. Regarding the second recommendation, Corkery (2022a; Table A1) refers to Item 25. As noted above, no additional work appears to have been conducted to address the concerns raised in Item 25.	Prior to construction, develop: • A comprehensive pit lake water quality assessment and management strategy. • A comprehensive TSF seepage quality management strategy.	Refer responses to Review Items 1 (TSF) and 6 (final void pit lake) in **Table A1**.
27. A management strategy for cyanide is required.	The response by Corkery (2022a; Table A1) states that: *"The use of sodium cyanide is regulated in NSW through the Protection of Environment Operations Act 1997 that is administered by the NSW Environment Protection Authority. Cyanide concentrations in tailings discharge is regulated at many NSW mine sites via Environmental Protection Licences issued by the Environment Protection Authority. Section 5.9.3 of the Submissions Report identifies a Cyanide Management Plan would be prepared for the Project post-approval. This plan would describe the measures to maintain cyanide levels in accordance with any Environmental Protection Licence issued for the Project."*	Not applicable based on the response provided.	Noted
28. This information needs to be provided in advance of any off site discharge from sediment basins.	The response by Corkery (2022a; Table A1) accepts this recommendation.	Not applicable based on the response provided.	Noted
29. Seek a detailed independent review of baseline surface and groundwater quality data to ensure that appropriate discharge limits or trigger values are established.	The response by Corkery (2022a; Table A1) clarifies that: "*ANZG aquatic ecosystem trigger values (95% species protection for slightly to moderately disturbed ecosystems) would be adopted for comparison of ambient surface water quality monitoring data."* It is inferred that these trigger values would also be used for identification of potential impacts on receiving groundwater quality as well as surface water quality. If reliable and independently reviewed baseline surface and groundwater quality data are not available, the use of ANZG aquatic ecosystem trigger values (95% species protection for slightly to moderately disturbed ecosystems) is supported.	Prior to construction, develop a water quality monitoring program and response management plan (as per Item 23), including management responses that would be implemented if ANZG aquatic ecosystem trigger values (95% species protection for slightly to moderately disturbed ecosystems) are exceeded in receiving surface water or groundwater.	Refer response to Item 23

Table A2 (Cont'd)
Response to Earth Systems Updated Review of Water Balance Modelling and Surface Water Management

Earth Systems Recommendation – 8 June 2022	Additional Information	Potential Conditions for NSW DPE Approval	Response
Water Management (Cont'd)			
30. A clear strategy is needed for management of "NAF" waste rock stockpile runoff, as well as sulfidic ore stockpile runoff, and the site water management system updated to reflect this.	The response by Corkery (2022a; Table A1) states that: *"Section 4.6 of WRM (2022) describes the Mine Site water management strategy with NAF and oxide ore stockpiles situated within the ESC zone. The containment zone would also include some NAF that would be used as construction materials. Whilst release of water from the ESC zone has been considered and described in reporting, all site water management infrastructure has been sized to provide containment should quality of stored water be impaired. Table 5.6 of WRM (2022) presents maximum modelled storage volumes that identifies no discharge from site."* *This does not address the possibility of some drainage/seepage from the Southern Barrier (which is a "NAF" waste rock stockpile) entering receiving waters beyond the "containment zone" or "ESC zone".* The response does not consider sulfidic ore stockpile runoff.	Prior to construction, update the site water management strategy to include drainage/seepage from all "NAF" waste rock stockpile runoff (including the Southern Barrier) as well as sulfidic ore stockpile runoff.	It is assumed that reference to *sulfidic ore* refers to the low grade ore that would be stockpiled for periodic reclamation in processing. As noted in Advisian (2020), this material would be stockpiled in two HDPE lined areas. Runoff from these stockpiles would drain to either the leachate management dam (Area 2) or against the lower embankment Area 1 from where it would be collected for re-use. If runoff from Area 1 were to overtop the embankment it would drain to the open cut pit. Therefore, runoff from the low grade ore stockpile areas would be captured in the containment zone and not discharge from the Mine Site. Runoff from all NAF waste rock stockpiles and within the southern barrier would be collected in containment dams that have been assessed as not discharging. Notwithstanding this, Bowdens Silver would monitor water quality in these dams as part of its monitoring program that would be documented in an approved Water Management Plan.
31. A clear strategy is needed for management of sediment dam water. Use of contaminated water for dust suppression should be avoided.	The response by Corkery (2022a; Table A1) clarifies that: "*Water for dust suppression would only be sourced from clean water or advanced dewatering (production) bores.*"	Not applicable based on the response provided.	Noted
32. Clarification is required on the source/s of dust suppression water. Use of contaminated water for dust suppression should be avoided.	See Item 31.	Not applicable based on the response provided.	Noted
33. Flood protection for permanent landforms should be based on a PMP design event. Consideration should be given to the potential implications for both flood water quality and stability of the waste rock dump.	The response by Corkery (2022a; Table A1) clarifies that: "*Final WRE landform would remain beyond the extent of PMF envelope*".	Not applicable based on the response provided.	Noted
34. Clarification is required on the long term flood protection strategy for the waste rock dump.	See Item 33.	Not applicable based on the response provided.	Noted