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To: Cheryl Low
CC:
Date: 14/09/2026
Subject: RFI responses for groundwater modelling

1 Introduction

This response memo has been prepared to address the concerns raised in the submissions received on the modelling work undertaken for the Bendigo Ophir Gold Project. Documents considered in this response memo are:

- [Badenhop \(2026\)](#)
- [Webster Brown \(2026\)](#)
- [Morgan \(2026\)](#)
- [Greer \(2026\)](#)
- [McDonald \(2026\)](#)

We have reviewed the above documents and provide responses to the key points and themes raised. Specifically we address concerns raised in the following areas:

1. The modelling work does not include the new datasets that were collected in [Burgess \(2026\)](#).
2. The shallow model is not calibrated.
3. The structural components of the model including the thickness of layers, the lack of assessment of climatic variability.
4. The likelihood of hydrological containment.
5. Potential data errors in the calibration dataset.
6. The quality of the calibration of the deep model, including model fit, and calibration data selection.
7. The stochastic modelling suite creation and selection.
8. Impacts of reduced under drainage performance.
9. The pathway for lost seepage and the partitioning between surface water (SCO1) and groundwater fluxes.
10. Impacts of lost seepage on the Lindis River and the wider receiving environment.

2 Modelling Does not Include New Datasets

A key concern raised in the submissions is that the modelling work does not include the new datasets that were collected and reported in [Burgess \(2026\)](#). The modelling and the data collection was undertaken concurrently, and the new datasets were not available at the time of the modelling work. We recognise this as a limitation of the modelling work and suggest that the modelling and predictions should continue to be updated as new data becomes available. Development of the RAS (Rise and Shine deposit) pit and the associated mine related landforms will provide a unique opportunity to collect new data and further refine the model. It is not possible to assess the new head measurements against the model predictions as observations were not saved in these locations in the model. Of the new hydraulic conductivity measurements only one falls outside our prior distribution, the hydraulic conductivity in fresh bedrock in GWO2C with a measured hydraulic conductivity of $1 \times 10^{-5} \text{ m/s}$ vs the minimum in the model parametrisation of $1 \times 10^{-6} \text{ m/s}$. Note that this bore occurs within the Thompson's Gorge Fault area within the model and drillers notes suggest that they may have encountered a fault zone in this borehole. The maximum hydraulic conductivity in the model parametrisation of the Thompson's Gorge Fault is $3.16 \times 10^{-5} \text{ m/s}$, which is consistent with the measured hydraulic conductivity in GWO2C. Therefore, we suggest that the measured hydraulic conductivity in GWO2C is more representative of the Thompson's Gorge Fault than the fresh bedrock. In total, while the inclusion of the new datasets, particularly head measurements, would improve the model calibration, we do not believe that any of the measured values are inconsistent with the model prior parametrisation. We have not undertaken a direct comparison of

the measured hydraulic conductivity values to the posterior modelled hydraulic conductivity values. The modelled values represent a bulk hydraulic conductivity of the model cell, while the measured values represent a point measurement, limiting the use of a direct comparison.

3 Shallow Model Calibration

All reviews correctly note that the shallow model was not optimised to existing measurements. This was a deliberate decision made by the modelling team. The shallow model should be considered a model prediction (e.g., forward modelling assessment) rather than a replication of the existing conditions. The deep model is a larger scale model that replicates the full system and optimises the parameters for all hydrogeological units (alluvium and colluvium, weathered schist, and unmodified schist). The separation of the shallow and deep models was undertaken due to the scale dependency of the mine related landforms. Modelling the dam, drainage, and fill components of the mine related landforms at the coarser resolution of the deep model would not be appropriate. Where the shallow model is not modified by the mine related landforms (e.g., the weathered schist outside the “dam” areas), it is identical to the deep model and produces exactly the same flow fields. The only new components and parameters of the shallow model that are not explicitly represented in the deep model are:

- A band of potential alluvial sediments that may be present in the valley bottoms (`aluv_k`).
- The constructed layers for the mining related landforms (e.g., SHFILL (Shepherds Creek Valley Fill), SHELF (Shepherds Creek Engineered Landform), TSF (Tailings Storage Facility), SiltPond (Shepherds Creek Silt Pond)).
- The modified components of the weathered rock under the mining related landforms (e.g., `utsfd_weath_k`).
- The mine related drainage system components (e.g., `shfill_drn_cond`, `tsf_drn_cond`).

Optimisation of these parameters, except the alluvial sediments, is nonsensical as the landforms do not exist and so no data can be collected to calibrate the model against. The alluvial sediments were included as a sensitivity analysis to assess the potential impact for a higher hydraulic conductivity band of sediments in the valley bottoms. Inclusion of the alluvial sediments in the optimised deep model was considered, but rejected for two reasons. First, the scale of the alluvial sediments is inconsistent with the scale of the deep model. Second, there is minimal data to constrain the hydraulic conductivity of the alluvial sediments. If these sediments were included in the optimisation of the deep model, then the parametrisation of these sediments would have been fixed in the forward model predictions. The choice to allow the stochastic suite to vary the alluvial sediments in the shallow model was made to better assess the potential impacts associated with these sediments.

The framing of two coupled models in the reporting, rather than a single model with a current and prediction state, was done to better communicate the differences between the existing conditions and the forward model predictions. Accurately considering the shallow model as a forward model prediction, rather than a replication of the existing conditions, makes the concerns raised about the lack of calibration of the shallow model irrelevant.

4 Structural Components of the Model

There are a number of potential concerns raised in the reviewed documents regarding the structural components of the model. The first is a concern that the deep model was not fully conceptualised, and therefore that the model does not accurately represent the system. We disagree with this concern, while the reporting conceptualisation is relatively sparse, the model framework is largely based on the conceptualisation presented in [Dumont et al. \(2025\)](#), with the additional representation of the weathered schist and quaternary alluvium and colluvium sediments. Additionally, the model conceptualisation is built on the extensive hydrogeological conceptualisation of the site detailed in the application reports, in particular: [Rekker \(2025\)](#), [Weber \(2025\)](#), [Rekker and Dumont \(2025\)](#). We acknowledge that the model conceptualisation was not explicitly re-iterated in the reporting this was done for brevity's sake and to avoid repeating information. We recognise that the reviewers may not have had time to consider the previous reports.

There was also criticism of the model structure, particularly that the model did not explore the variability of the thickness of the QALCL (Quaternary Alluvium and Colluvium) and weathered schist layers. This was an explicit decision made by the modelling team as both the layer thickness and the hydraulic conductivity of these layers produce similar effects on the flow field. Specifically MODFLOW solves Darcy's law, so the flow is proportional to the product of the hydraulic conductivity and the thickness of the layer. Instead of varying both the thickness and the hydraulic conductivity concurrently, we chose to fix the thickness of the layers and vary the hydraulic conductivity to capture the variability in the flow field. In our report we did highlight that the constant thickness and non-spatially varying hydraulic conductivity of the QALCL could be a potential cause of the misfit of the discharge flows measured to the surface drains. While this limitation exists, the key predictive outputs of the model focus on the potential for seepage to bypass the "dam" features. These features are constructed directly on the weathered schist, so the lack of spatial variability in the hydraulic conductivity of the QALCL is unlikely to affect this predictive output. We suggest that the wide range of hydraulic conductivity values used in stochastic inversion should largely accommodate the structural errors of a constant thickness layer.

Concerns were also raised regarding the lack of consideration of climatic variability in the model. Again this was an explicit decision and the rationale was detailed in the modelling report. Briefly, the model focuses on mass balance and the potential for seepage to bypass the collection systems. We used a very large range of recharge values in the stochastic suite. This large range of recharge values should accommodate the potential variability in the climate on annual or greater timescales. The impacts of short term weather variability (e.g., wet period and storm events) were not considered because these effects will predominantly impact the surface water system and the water mass balance of the seepage collection system. These impacts were beyond our scope, and we focused on the longer term potential for mass to be lost from the system through seepage bypassing the collection system via the weathered and unmodified schist.

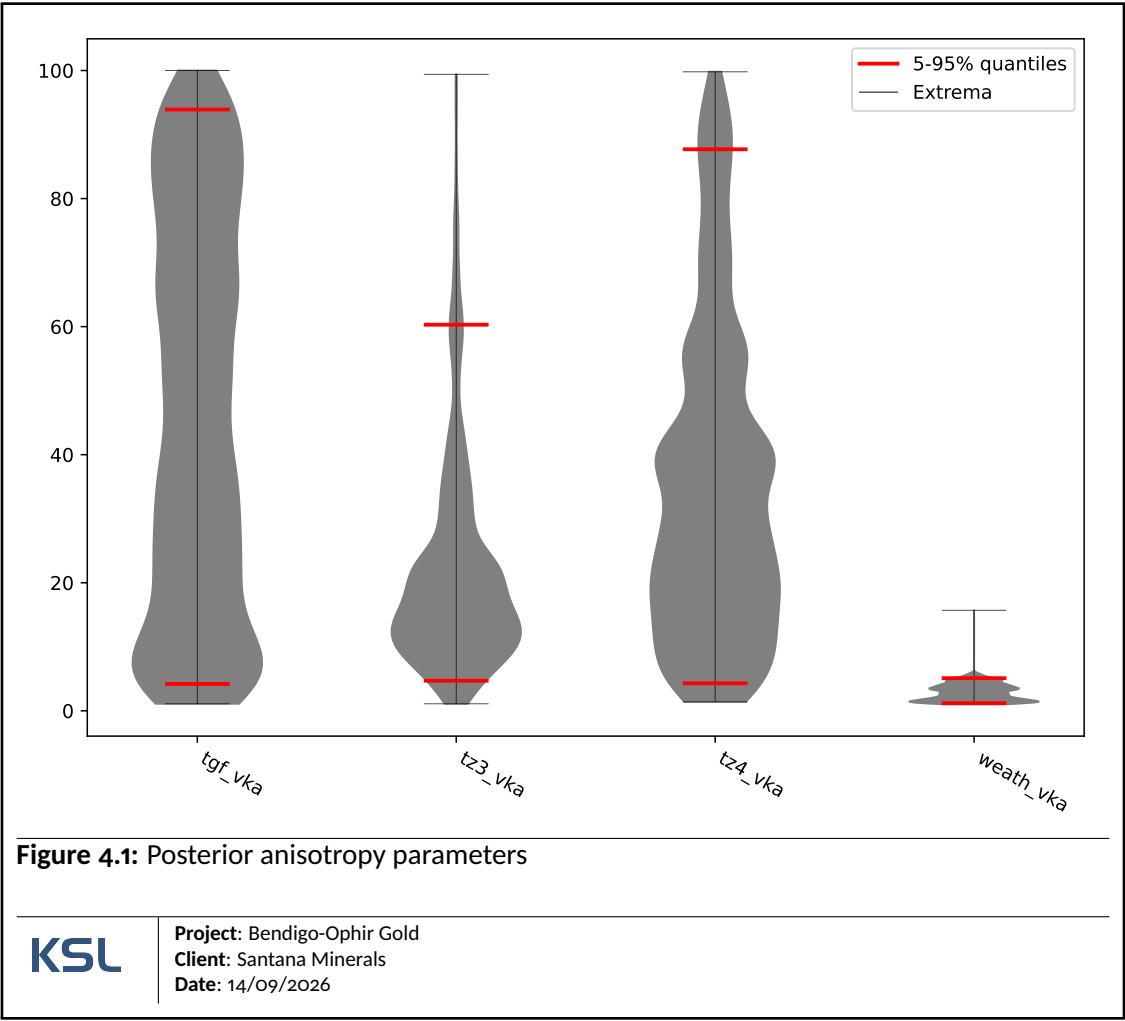
Finally, there were concerns that the model structure would bias discharge to the surface drains and therefore underestimate the potential for lost seepage. These concerns dominantly focused on the fact that vertical anisotropy could not be more than 1 (e.g., horizontal hydraulic conductivity is always greater than or equal to vertical hydraulic conductivity), the boundary conditions structure, and the structure of the OFFSHORE ("Off-shore" boundary to allow for seepage to flow out of the model domain) zone. The vertical anisotropy defines the sub-cell vertical anisotropy of the MODFLOW grid. The concern is that fracturing may yield preferential vertical flow pathways, particularly in the fresh schist. The weathered schist is unlikely to have preferential vertical flow on a large scale as the weathering process will be more present in the upper layers of the schist. Indeed, an assessment of the available hydraulic conductivity data for the weathered and fresh schist (figure A.9) shows decreasing hydraulic conductivity with depth, which is consistent with the weathering process. The presence of preferential flow pathways is a limitation of the modelling undertaken, but also there is no clear evidence that these preferential flow pathways exist. If having preferential vertical anisotropy was important to replicate the observed data, then the optimisation would have tightly constrained the posterior at the boundary (e.g., at 1). Figure 4.1 shows the prior and posterior distributions of the vertical anisotropy for the weathered schist and fresh schist. The results do not demonstrate a model optimisation that was significantly limited by the prior distribution limit. Therefore, we suggest that this decision is unlikely to significantly affect the predictive outputs of the model.

We disagree with the concern that the boundary condition structure biases flow to the surface drains. If we assume that the groundwater system is hydrologically contained to the valley (discussed in Section 5), then flow from the system cannot discharge:

- North (through the north ridge) to Dry Creek
- South through Mt. Moka to Bendigo Creek (noting that Clearwater Creek is present in the model domain).
- East upgradient and through Thomsons Saddle to Thomsons Creek.

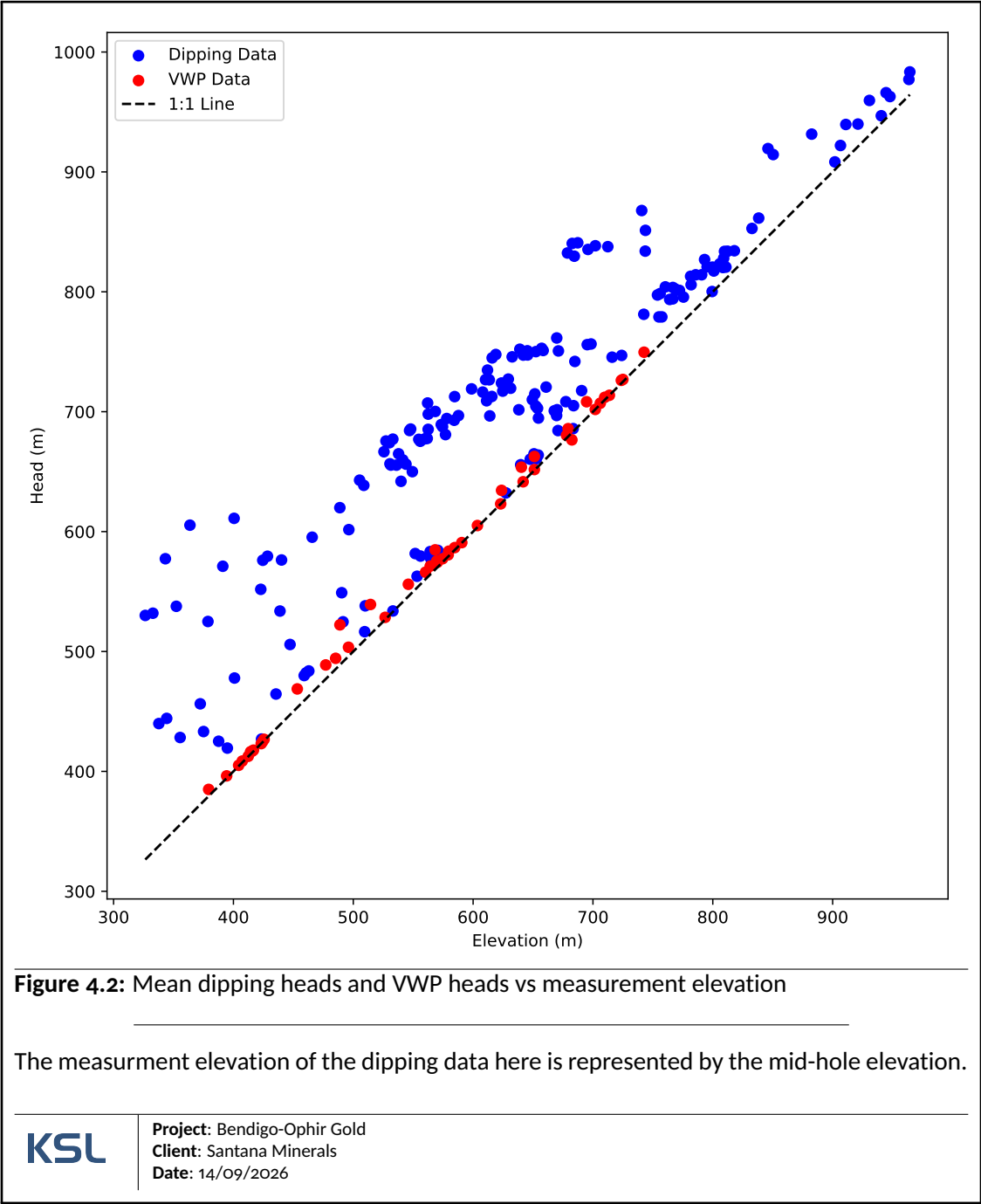
Therefore, the possible discharge points are:

1. The land surface (e.g., surface drains, Shepherds Creek, etc.)
2. West through the foothills West of point 705 to the alluvium of the range front.



3. West beneath the Shepherds Creek gorge to the range front.
4. Very deep flow through the unmodified schist to the Ardgour Aquifer.

The land surface drains accommodate pathways 1 and 2. Pathway 3 is accommodated in the shallow model by the presence of the weathered schist drains at the end of the Shepherds Creek gorge. In the deep model this pathway must be accommodated by the surface drainage at the end of the Shepherds Creek gorge (drain inverts at 400m). The final pathway is accommodated by the OFFSHORE zone. We suggest that the structure of the offshore zone is more likely to bias flow to the offshore zone than to the surface drains. The OFFSHORE zone is a DRN (Drain Boundary Condition), which means that it also is only a discharge point for the system. The inverts of the OFFSHORE DRN are at the top of the model cell ± 15 m (which is parameterised). Almost all measured groundwater dipping data and 80% of the VWP (Vibrating Wire Piezometer) data (revised, see [Section 6](#)) are above their measurement elevation ([Figure 4.2](#)). Therefore, setting the OFFSHORE DRN inverts at the top of the model cell is likely to be lower than the actual groundwater at that location. Additionally, the OFFSHORE DRN is located in every layer of the model (apart from layer 1 and 2), which means that the OFFSHORE DRN is the lowest discharge point in the model. Finally, the choice to remove layer 1 and 2 from the OFFSHORE zone was in part to ensure that no recharge from the surface could elevate groundwater levels in the OFFSHORE zone and reduce discharge to the OFFSHORE zone. Some flux may discharge to the surface rather than to the discharge zone in the deep model in Shepherds Creek gorge in the deep model only. However once the coupled model is included (e.g., for the prediction of interest), this flux will be captured by the drains in the weathered schist in the shallow model. The impacts of this partitioning is discussed further in [Section 11](#).



5 Likelihood of Hydrological Containment

There are concerns raised about the hydrological containment of the system. By hydrological containment we understand that the documents are referring for the potential for large scale flow that is not consistent with the general flow direction of Shepherds Creek. That is flow to the North, South, or East across the sides and the back of the valley, respectively. Our model assumes hydrological containment in its design and conceptualisation. We consider such an assumption is valid given the consistent relationship between the elevation and groundwater head of the observations in the valley (see, [Figure 4.2](#)). All evidence suggests that in the current state higher groundwater heads are present on the valley sides, with general discharge towards the valley bottom of Shepherds Creek.

There is a further concern that dewatering of the RAS pit may cause a loss in the hydrological containment of the system. The RAS pit is located in the middle of the model domain, which would induce flow from the northern boundary to the pit, not the other way. Similarly, if the RAS pit dewatering causes a loss of containment to the South, then we would expect to see contaminant discharge into the surface drains in the Clearwater Creek area. No model realisations showed any discharge to this area. Loss of containment to the East is unlikely as this is upgradient of the RAS pit.

Our modelling did suggest some sensitivity of discharge to the RAS pit and OFFSHORE zone with increasing dewatering of the RAS pit. However, we note that the sensitivity of OFFSHORE to pit dewatering was generally quite low (predictor importance of < 0.025). The sensitivity of discharge to the RAS pit was somewhat higher (predictor importance of < 0.075). The discharged mass percentages to the RAS pit were generally low for most models. [Figure 5.1](#) shows the discharge to the RAS pit and OFFSHORE zone vs simulation type. There is minimal impact of full dewatering on the TSF lost seepage, but there is some increase in the SHFILL and SHELF lost seepage associated with the full dewatering of the RAS pit. These numbers are included in the full lost seepage assessment, but splitting them out here demonstrates the potential impacts of mine dewatering.

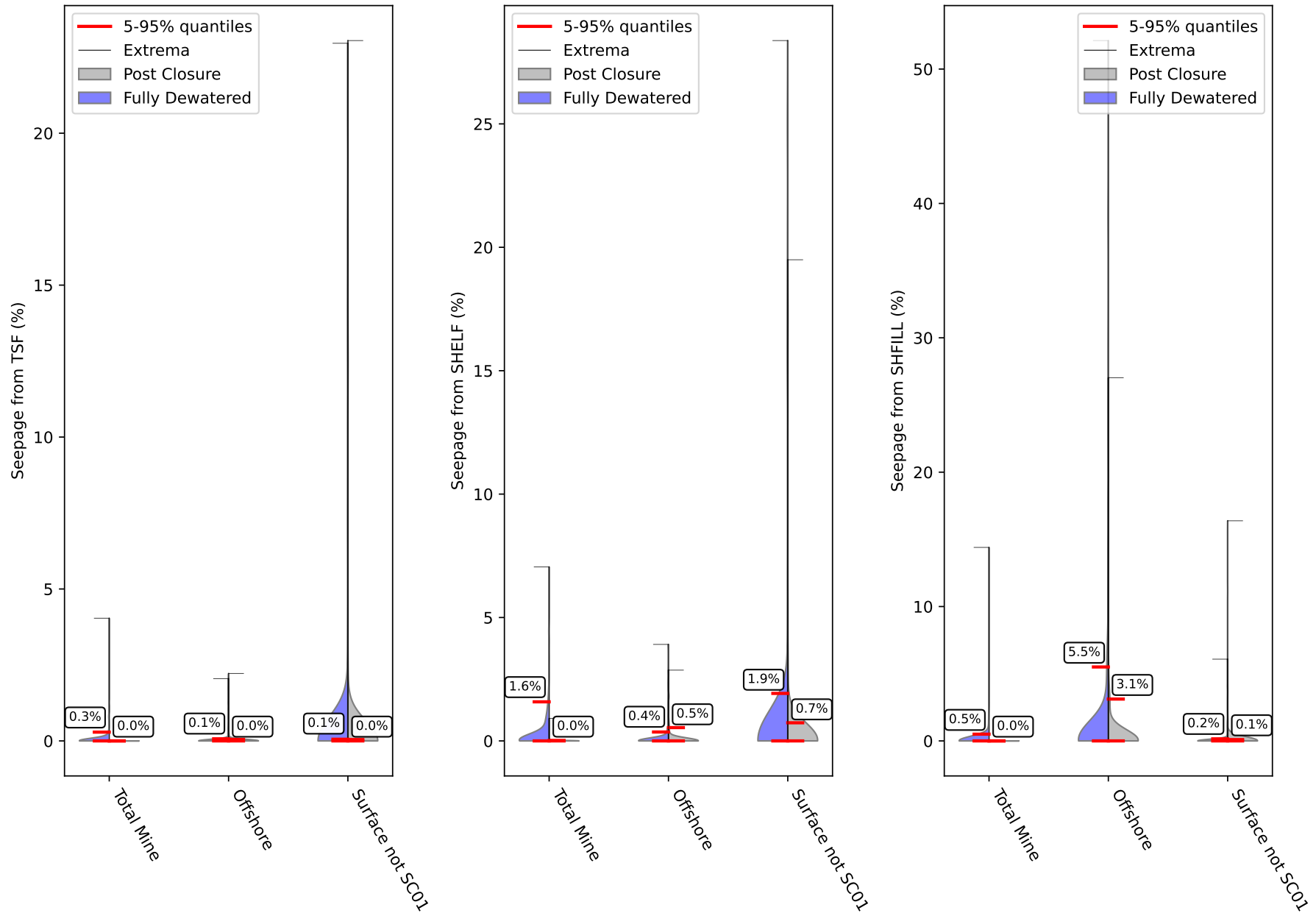


Figure 5.1: Pit, offshore and other discharges vs simulation type

Note that the high seepage loss in the TSF Surface not SC01 in the violin plot is due to a failure of the kernel estimator. The 95th percentile is near zero for this factor.

6 Potential Data Errors in the Calibration Dataset

Morgan (2026) identified a discrepancy in the both the elevation and groundwater head of GWO4 and GWO5. We have investigated these discrepancies. The differences in the piezometer elevation are due to two factors. The first is a simplified approach undertaken in Burgess (2026) where an average dip and dip direction was used to calculate the VWP elevation in a dipping borehole. Our approach uses each individual survey step (e.g., 50.5 degrees from 5 to 10 m depth). This results in a discrepancy of approximately 2 m between the elevations used to calculate heads in Burgess (2026). There is also a typographical error in Burgess (2026), which means that incorrect elevation values were recorded. Note that we have confirmed with the author that this error only affects the reported VWP elevation in table 3 of Burgess (2026), and does not affect the reported groundwater head elevations in table 4.

There are 3 contributing factors to the discrepancy in the groundwater head of GWO4 and GWO5. First and most significantly, on review we have identified a unit conversion error within the calculation of the groundwater head for GWO4 and GWO5 in our submitted modelling work. The implications of this error are discussed further below. The second is the discrepancy in the VWP elevation, which is discussed above. The third is that the values in Burgess (2026) are based on the mean groundwater head for the full period of record. We have undertaken an outlier analysis of the groundwater head data and removed potential outliers, which will affect the mean groundwater head.

Reanalysis after correcting for the unit conversion errors and the typographical error in Burgess (2026) shows much better agreement between the values used in the model and the values reported in Burgess (2026) (Table 6.1). We believe that the revised values presented below are more accurate, but the differences between these values and those of Burgess (2026) are unlikely to significantly impact downstream uses.

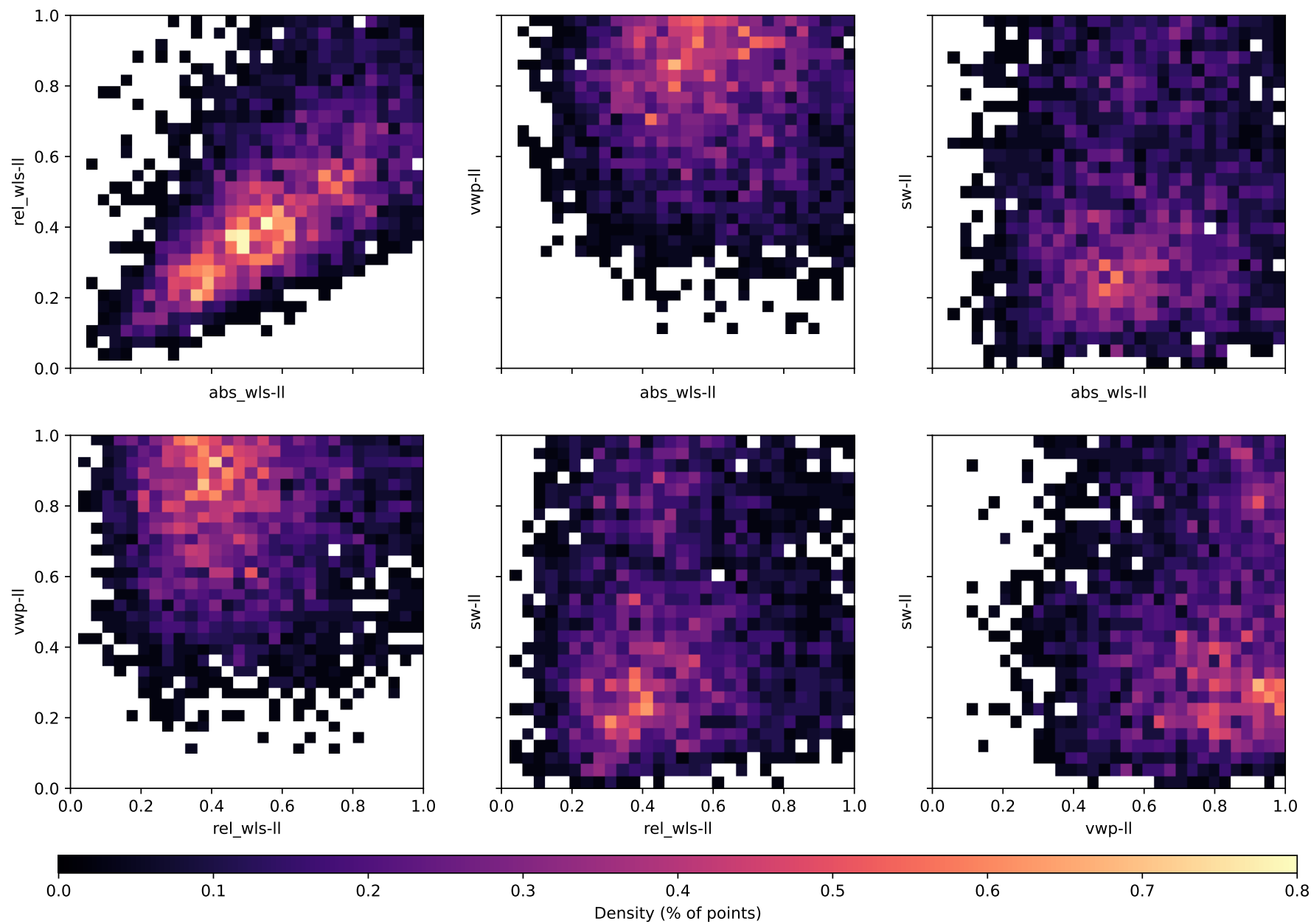
Table 6.1: Revised groundwater head and VWP elevations for GWO4 and GWO5

Piezo	Reported		Used in Model	
	Elevation (m)	Head (m)	Elevation (m)	Head (m)
GWO4 - S20457	497.1	504.7	496.0	503.5
GWO4 - S20458	478.1	489.9	477.0	488.8
GWO5 - S20061	527.8	529.7	526.6	528.5
GWO5 - S2230879	487.2	496.2	485.3	494.3
GWO5 - S2628896	455.8	471.2	453.3	468.8

The unit conversion error affects all VWP targets, but does not impact the dipping or groundwater level surveys. The revised VWP values are shown in Figure 4.2. The VWP observations show a very different relationship with depth than the dipping and groundwater level surveys. The dipping and groundwater level surveys show relationship with depth, but the slope of the line is less than 1. These data see elevated groundwater heads at lower elevations relative to the measurement elevation. The VWP data shows an almost perfect 1:1 relationship with depth. To our knowledge the VWP are installed in boreholes and then fully grouted. This strong 1:1 relationship raises concerns that the VWP are not accurately measuring the groundwater head. In fracture flow systems, the groundwater head may vary significantly over small distances. If a VWP is placed away from any active fractures, it may not accurately measure the average groundwater head at a given depth at the scale of the model cell.

To assess the impacts on the model, we have re-analysed the full suite of deep models with the revised VWP targets. The comparison between the components of the objective function for the revised VWP targets is shown in Figure 6.1. There is tension between the VWP and other head targets as shown by the lack of a relationship between the two objective function components. There will be some impacts on the relationship because the VWP targets were mis-optimised in the optimisation. However, we would expect some relationship between the two objective function components if they were both indicative of the same system. Given the strong 1:1 relationship of the VWP targets with depth, we suggest that the dipping and groundwater level surveys are a

more accurate representation of the system. The original deep model optimisation provided a good fit to both the dipping and groundwater level surveys, so we suggest that the model is still a good representation of the system.



7 Quality of the Deep Model Calibration

Multiple concerns were raised regarding the quality of the deep model calibration, including:

- The model misfit to the surface water discharge data and the potential for this misfit to affect the predictive outputs of the model.
- The removal of dry and artesian wells from the calibration dataset.
- The calibration statistic used and reported.

These concerns exclude the potential data errors in the calibration dataset, which are discussed in [Section 6](#). The model significantly over-estimates discharge to the surface drains / Shepherds Creek. [Badenhop \(2026\)](#) suggests that this misfit indicates that there should be significantly more flow in the deep groundwater system than is represented in the model. We disagree with this conclusion as discussed in the modelling report. There is a fundamental tension between the surface water discharge and the groundwater head targets, with head targets preferring higher recharge values and the discharge targets preferring lower recharge values. A higher deep groundwater discharge is a mechanism to accomplish this, but it is not the only mechanism. Another mechanism is that the simplification of the QALCL layer in the model and the steady state assumptions of the model may cause the misfit. It is possible that the deep schist system is preferentially impacted by the higher recharge periods (e.g. wet periods) than the drier periods. If this is true, effectively the deep system is recharged predominantly during precipitation events and periods of higher Shepherds Creek flows. Excess recharge during these periods would then be refused and runoff to form the peak flows in Shepherds Creek. During drier periods, the deep system would not be recharged to the same extent, but the very low hydraulic conductivity of the system would prevent significant drops in groundwater heads during these periods. Thus, for the model to fit the observed groundwater levels, which are primarily occur in the fresh schist layers, the model would require higher recharge on average and would overpredict the surface water flows. This would be consistent with the conceptual understanding of the system where the groundwater-surface water interactions are more reflective of the QALCL and/or weathered rock than the fresh schist and the generally significantly decreasing hydraulic conductivity with depth. We suggest that a complex relationship between the timing of recharge and the response of the deep groundwater system is more likely than a discharge equivalent to the median of Shepherds Creek flow through the low hydraulic conductivity fresh schist groundwater system. Additionally, the confined framing of the system (a simplification) could yield a higher discharge rate as more water may be transported through the weathered schist and QALCL layers in the model than is actually present in the system. In reality, portions of this surficial layers likely become dry and therefore significantly reduce flow. On balance, the misfit of the surface water discharge targets is not likely to indicate mistaken routing of flow in the deep groundwater system, but rather a simplification of the system and the steady state assumptions of the model.

[Morgan \(2026\)](#) suggested that the removal of dry and artesian wells from the calibration dataset was inappropriate. We strongly disagree with this concern. Four dry wells were removed, one of which was on the southern side of Clearwater Creek, and the other three were near the ridge top at the RAS and Come In Time deposit sites. All four wells had many adjacent wells with measured groundwater heads (not dry), so these dry wells would likely result in prior data conflicts. Similarly one of the five artesian wells was located in the RAS pit area with many adjacent wells with measured groundwater heads (not artesian). The remainder of the artesian wells were located in the Srex deposit area, associated with the thicker QALCL in this area, and unlikely to materially affect the predictive outputs of the model as all contaminant sources modelled fall outside the Rise and Shine Creek catchment.

Finally, [Morgan \(2026\)](#) raised a concern about the lack of a traditional calibration statistic. This was a deliberate decision by the modelling team. Single calibration statistics are a seductive measure of model fit as they simplify a complex model with advantages and disadvantages into a single number. These calibration statistics (including the one suggested in [Morgan \(2026\)](#)) are often scaled based on somewhat arbitrary weighting strategies to highlight observation importance and accommodate different target types (e.g., surface water fluxes vs groundwater heads). We eschew the statistic in favour of providing a detailed assessment of the model fit with multiple figures describing the relationship between the modelled and measured values.

8 Consistent Posterior Distribution

Due to time pressures, the assessment of lost seepage was undertaken using a componentwise approach. That is that each component of the seepage system was assessed independently and the posterior discharge distribution reported was not from the same posterior suite of model realisations. This was an oversight as the design characteristic of reduced hydraulic conductivity in the SUMP (Shepherds Creek Engineered Landform Seepage Collection Sump) was not applied to the SHFILL and TSF components of the seepage system.

To address this oversight, we created a consistent posterior distribution by filtering the full suite of model realisations for all design characteristics – heads in the TSF below 700 m, hydraulic conductivity of the weathered schist under the SUMP $< 1 \times 10^{-6} \text{ m/s}$, and the presence of the SHFILL underdrainage. The results of this filtering are shown in [Figure 8.1](#). The revised results show a significant reduction in lost seepage from the TSF. This occurs because the previous assessment of the TSF lost seepage did not include the design characteristic of the SUMP hydraulic conductivity, which serves to significantly control any seepage which is lost from the TSF. There is also a slight reduction in the lost seepage from the SHELF. The 95th percentile decreases from the previous value, but the distribution is relatively unchanged. Essentially the filtering of the TSF heads removes several outliers, which then serves to reduce the 95th percentile of the SHELF lost seepage. This is an example of the sensitivity of upper percentiles to outliers in the distribution. SHFILL lost seepage 95th percentile is increased from c. 10% to c. 15%. This is most likely due to the reduced number of realisations, but also may be affected by the reduced losses from the TSF and SHELF components of the seepage system (e.g., SHFILL water replaces the TSF/SHELF water). While an increase in the SHFILL lost seepage may seem concerning, the contaminant production from and recharge area of the SHFILL is significantly lower than the TSF and SHELF components of the seepage system. So the increase in the SHFILL lost seepage in the context of decreased lost seepage from the TSF and SHELF components of the seepage system likely yields a net decrease in the total contaminant load to the receiving environment. This is further discussed in [Section 12](#)

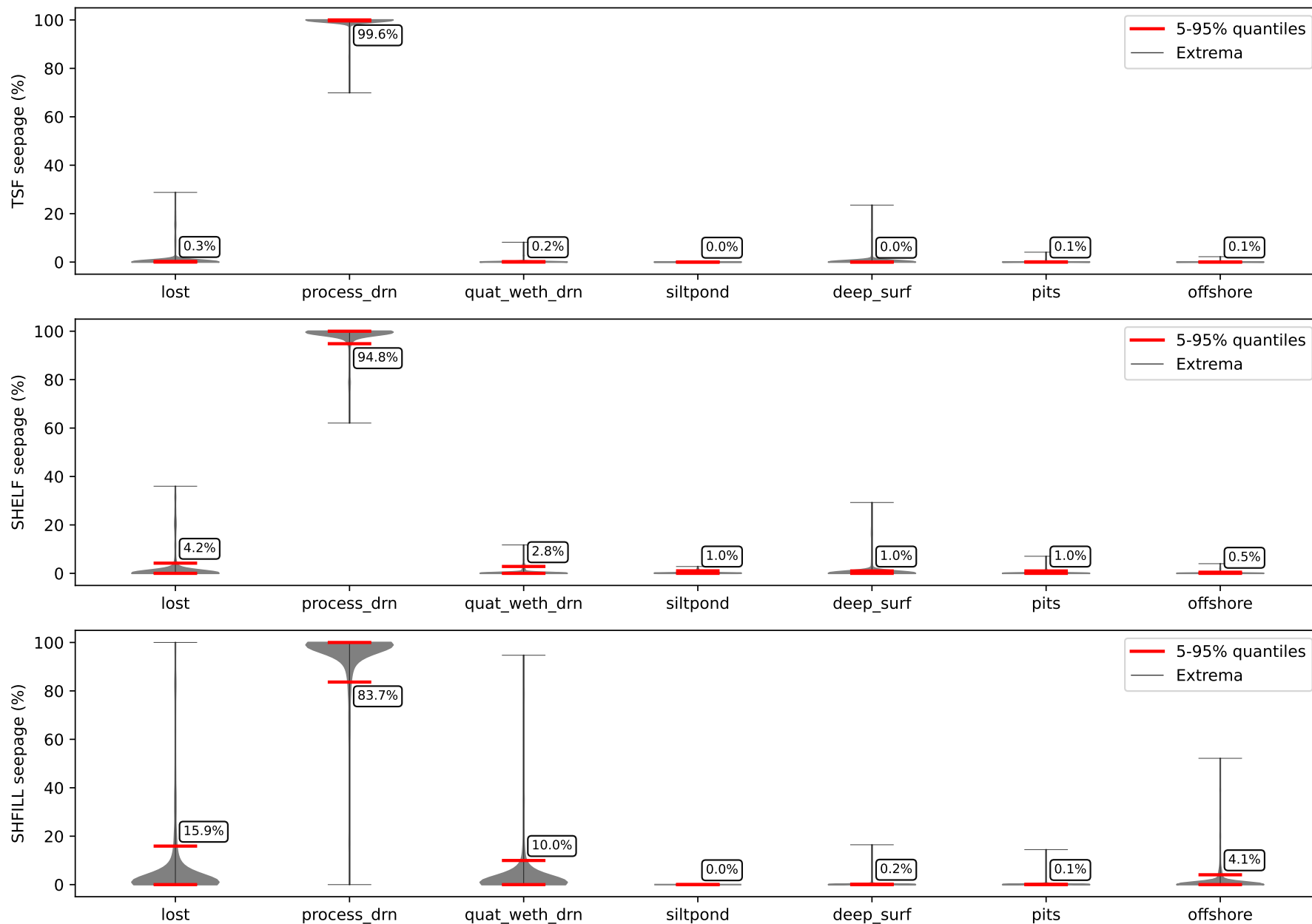


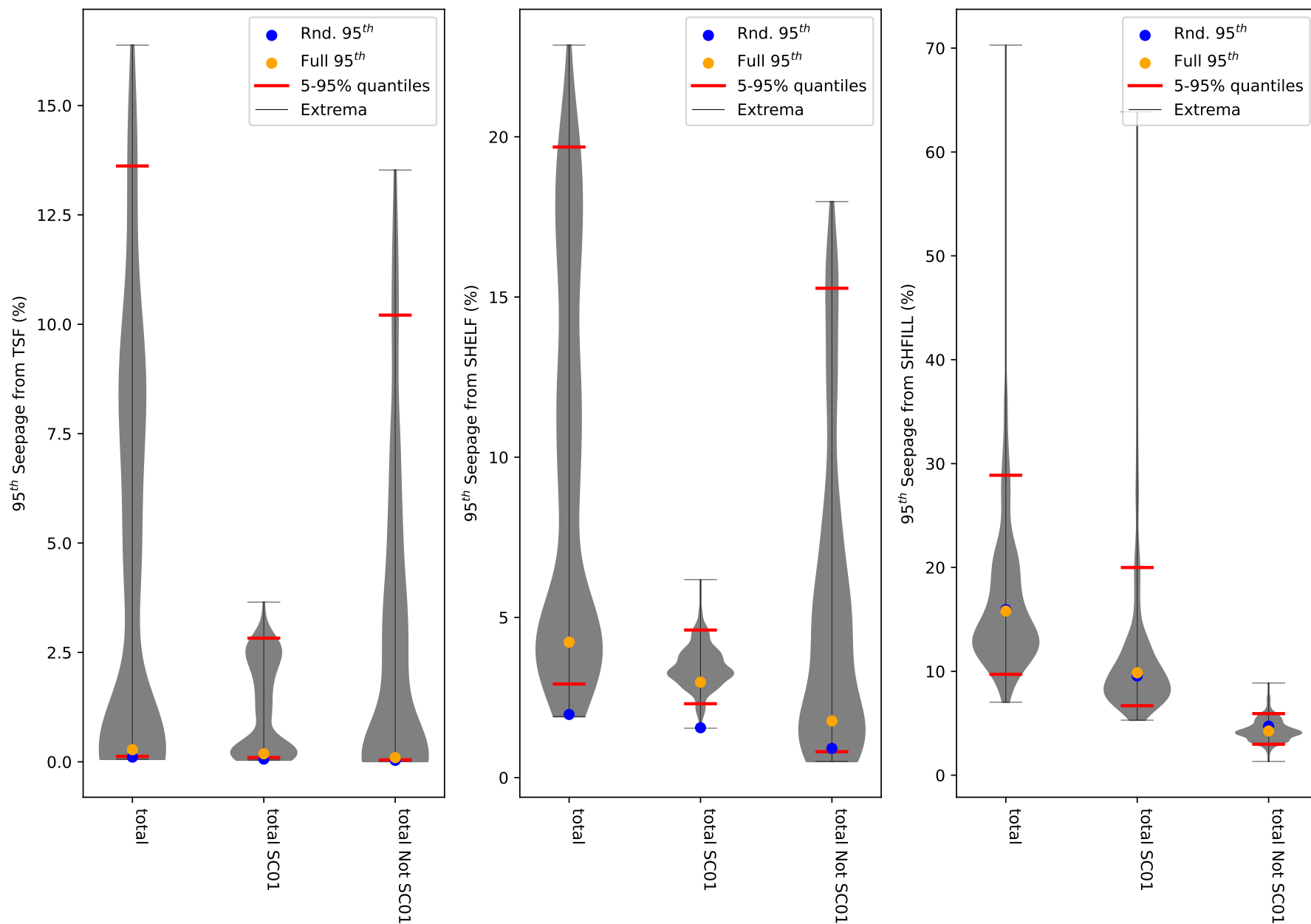
Figure 8.1: Revised seepage estimates from consistent posterior distribution

The values presented here differ from those presented in the report as they are based on a consistent posterior distribution defined by: heads in the TSF below 700 m, hydraulic conductivity of the weathered schist under the SUMP $< 1 \times 10^{-6} \text{ m/s}$, and the presence of the SHFILL underdrainage.

9 Stochastic Modelling Suite Creation and Selection

Concerns were raised regarding the stochastic forward suite creation and selection. Morgan (2026) suggested that the stochastic suite was not created in a manner that was consistent with the assumption that the probability of a model realisation in the stochastic suite is the same as the probability of the model parameters. We agree that this is the case, but disagree with the ultimate conclusion that the stochastic suite may under-predict the potential for lost seepage. The goal was to explore the unlikely but possible parameter space that affects the seepage rate as opposed to the random parameter space. In a raw stochastic suite many model realisations will be “wasted” on parameter combinations that do not affect the prediction of interest. To assess the potential bias of the non-random suite, we ran the same filtering step on all models and only the initial 1620 models (yielding 208 unique realisations) that were selected randomly from parameter space. We then compare the 95th percentile of those 208 models to bootstrapped random set of 208 models which match the filtering criteria and were selected from the guided suite. The results are shown in Figure 9.1. The results suggest that the guided suite provides a biased posterior, with the bias to predict higher rates of lost seepage. This provides confidence that the seepage estimates provided here are very conservative and that the true lost seepage rates are likely to be lower than those presented in our report.

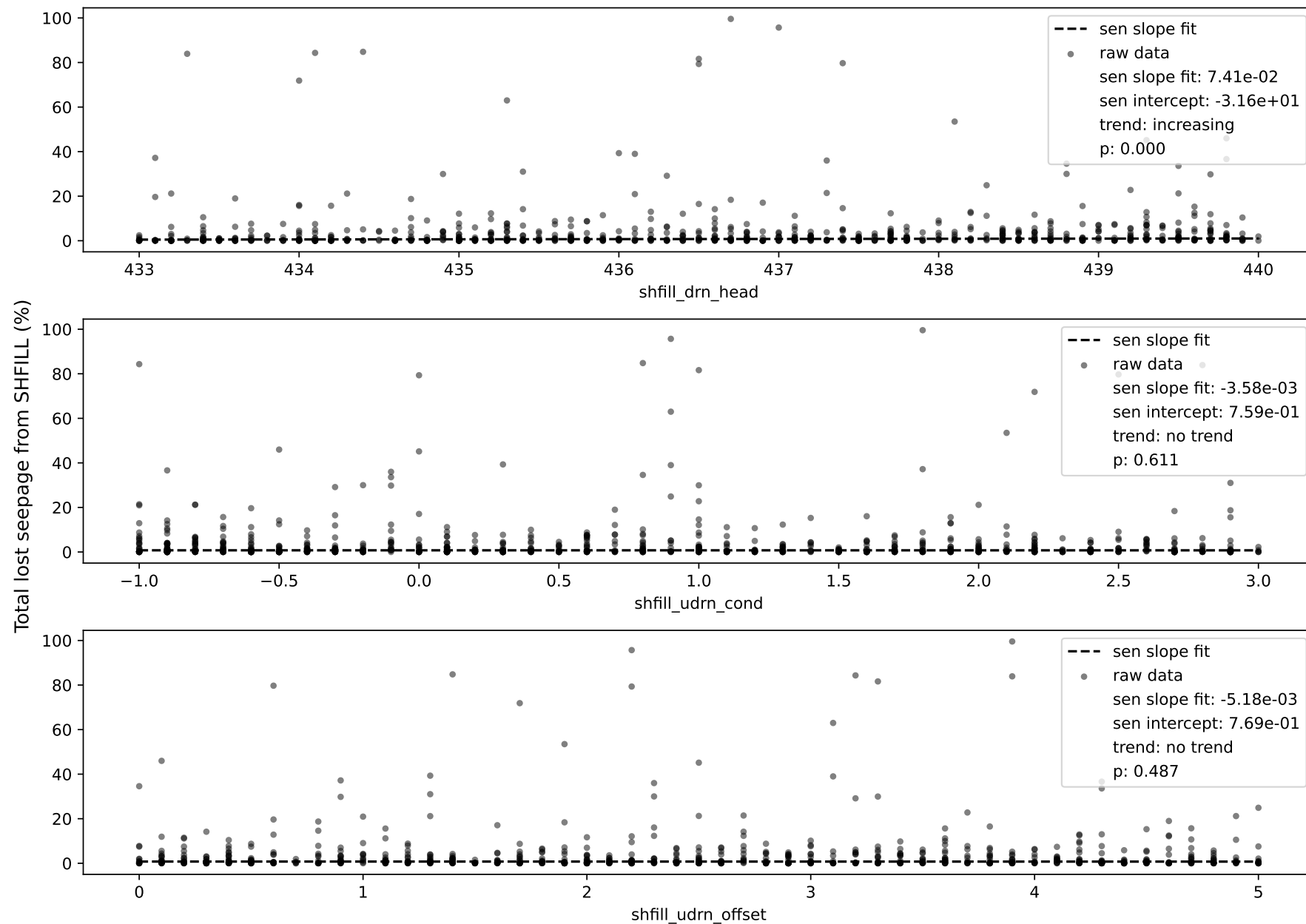
Further Morgan (2026) suggests that the large reduction of seepage from the raw suite to the final suite is indicative of a true risk. We disagree and have provided detailed rationale for the filtering undertaken. For instance the high values of lost seepage from the TSF occurred when excess recharge lead to groundwater heads far in excess of the top of the Tailings Storage Facility - Dam. This is not plausible. Those high levels of recharge would be refused and instead form surface runoff to the TSF wetland. The commonly used generalised likelihood uncertainty estimation (GLUE) approach involves randomly drawing parameter sets then filtering those parameter sets for acceptable behaviour to produce a posterior distribution. Here we use the GLUE approach, but with a deliberate bias towards over-prediction of lost seepage.



10 Impacts of Reduced Under Drainage Performance

Multiple concerns were raised regarding the potential for additional seepage under less than optimal under drainage performance. First, we must note that the aforementioned failure of the underdrainage system, to our knowledge, only refers to the explicit underdrainage in the TSF. It is not clear that the other drainage systems (E.g., SHFILL, SHELF) are subject to the same failure mechanism. Our analysis suggested that sufficiently draining the SHFILL is an essential mechanism to reduce the likelihood of lost seepage. We explicitly included DRN cells to represent this drainage system, but we have not assessed the design requirements. It may be possible to meet these requirements with a higher hydraulic conductivity material base rather than explicit underdrainage, which would likely be much more robust. The purpose of the SHFILL “under” drainage is to ensure that discharge from the deep system that is predicted in this area would not cause a build up of water and potential discharge along the edges of the SHFILL or into the redirected Shepherds Creek. In our assessment of the TSF underdrainage, we did not find a significant impact of the potential drainage extensions (or the inclusion of underdrainage at all) on the predicted lost seepage from this component. The main predictor of lost seepage from the TSF were heads in the TSF in excess of the land surface, which then caused seepage to bypass the collection system. These high heads were driven by high recharge parametrisation paired with low hydraulic conductivity of the TSF material. This suggests that excess recharge would be refused and such high heads are unlikely to occur in practice.

Some responses suggested that we did not conduct any assessment of the failure of the underdrainage system. This is incorrect. While we did not explicitly model scenarios where the underdrainage systems had reduced performance, we did include a number of parameters to represent less efficient underdrainage systems. These include the variable conductance of the underdrains and the variable inverts of the underdrains and other drainage systems (e.g., SHELF drains). [Morgan \(2026\)](#) correctly identified these simulations, but requested further presentation of the results. The effects of underdrainage extent (and thus performance) on the TSF is already present in figure 8.3 of the modelling report, which we will not re-produce here. [Figure 10.1](#) shows the Mann Kendall trends of the relationship between the lost seepage from the SHFILL and the invert level of the SHFILL drain at the Shepherds Creek Valley Fill - Seepage Dam (`shfill_drn_head`), and the hydraulic conductivity and invert levels of the SHFILL underdrains (`shfill_udrn_cond` and `shfill_udrn_offset`). There is no trend between the lost seepage and the underdrain hydraulic conductivity or invert offset, suggesting that even at reduced performance the underdrainage system is still effective at reducing the likelihood of lost seepage. There is an increasing trend against the invert level of the SHFILL drain, but this relationship is very small (Sen Slope of 0.07% increase in lost seepage per 1 m increase in invert level). The SHFILL drain invert is a very aggressive structural sensitivity parameter. These results further confirm that an assessment of the reduced performance of the underdrainage system is not likely to significantly affect the predicted lost seepage from the SHFILL.



11 Lost Seepage Pathway

Multiple concerns were raised regarding the potential for lost seepage to bypass the monitoring point in Shepherds Creek (SCO1). There also appears to be a conflation between seepage missed by SCO1 and seepage that is not detected by the monitoring network. Our work specifically assumes that the monitoring network includes surface water observations (e.g., at SCO1) and groundwater observations in the alluvium, colluvium and weathered schist in the lower Shepherds Creek Gorge. We agree with the submitters that seepage that bypasses the primary collection system may bypass SCO1, which is why a groundwater monitoring network in the lower Shepherds Creek Gorge is essential. The constrained topography of the gorge provides a natural monitoring point, which will minimise the potential for seepage to bypass the monitoring network.

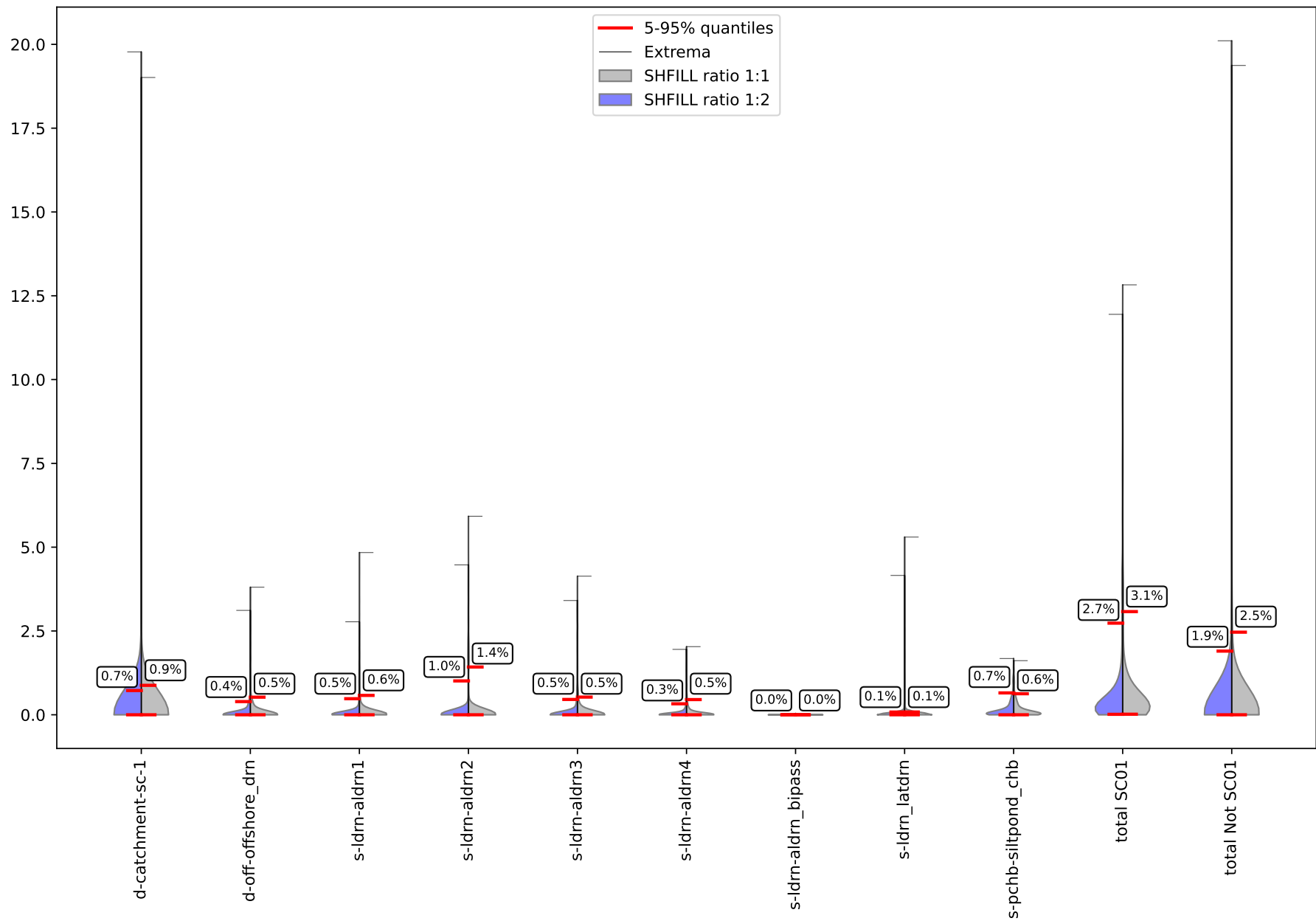
The model is designed to differentiate between seepage discharged to SCO1 and adjacent groundwater, and seepage that discharges via the deeper fresh schist pathways. The model is not capable of differentiating between seepage that discharges to SCO1 and seepage that flows through the alluvium, colluvium, and weathered schist under SCO1. Specifically, we characterise the lost seepage which will not be detected by the monitoring network as seepage that discharges to either the OFFSHORE zone or to the following deep model DRN zones (see [Figure 11.2](#)):

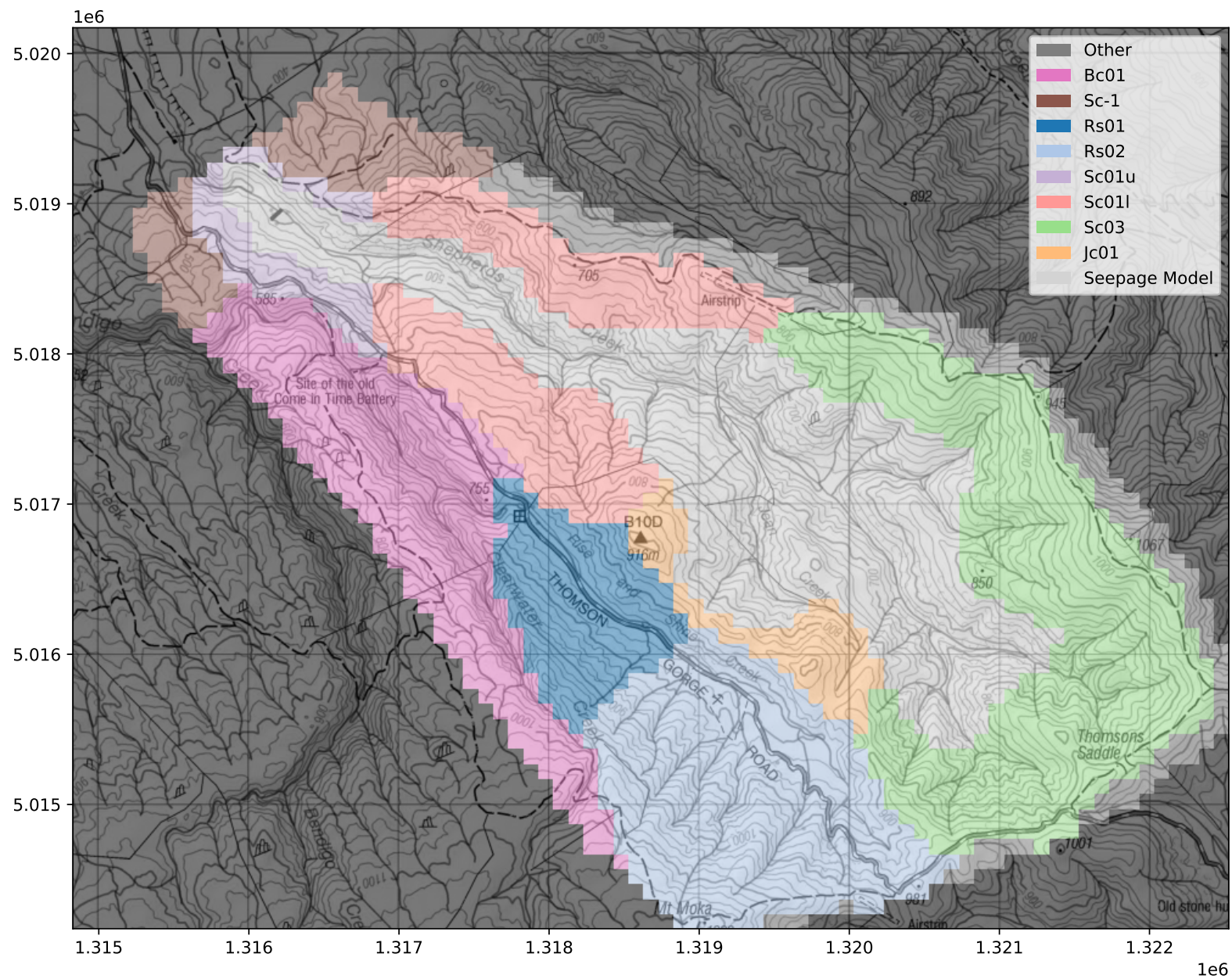
- BcO1
- Sc-1
- RSO1
- RSO2
- SCO1u
- Other

To provide more clarity on the lost seepage pathways, we can undertake an assessment of the partitioning of total lost seepage between the seepage that discharges to SCO1 and adjacent groundwater, and seepage that discharges to the deeper fresh schist pathways. The total lost seepage percentage is defined as:

$$\text{Percentage Mass Flux} = \frac{sr_{TSF} + sr_{SHELF} + sr_{SHFILL} \times r}{st_{TSF} + st_{SHELF} + st_{SHFILL} \times r} \times 100 \quad (11.1)$$

Where sr is the lost seepage to the receptor (e.g., to the OFFSHORE zone), st is the total seepage mass from the component, and r is the source concentration ratio of the SHFILL relative to the TSF and SHELF. Note that the mass loading of the SHFILL is expected to be lower than the TSF and SHELF due to the lower sulphur content of the material in the SHFILL ([Weber, 2025](#)). Here we present the results for a source concentration ratio of 1:1 and 1:2, SHFILL:TSF/SHELF as a sensitivity analysis. The results are presented in [Figure 11.1](#). Depending on the assumed ratio of SHFILL to TSF and SHELF contaminant mass production, the largest individual receptors of lost seepage in the model are the surface drains outside of Shepherds Creek, the second surface drain set in the seepage model, and the SiltPond. When accumulated to the total which would be detected by SCO1 and which would not be detected by SCO1, the models predict up to 3.1% lost seepage detectable by SCO1 and up to 2.5% lost seepage not detected. Note that these figures are not additive (e.g., total lost seepage is not $5.6 = 3 + 2.5$) as each member of the ensemble must be added individually before calculating the relevant percentiles.





12 Impacts of Lost Seepage on the Lindis River

Greer (2026) raised concerns regarding the potential impacts of lost seepage on the Lindis River. Contaminant loading to the Lindis River was beyond the scope of our modelling work, which was focused on a relative assessment of the potential for seepage, not the total mass flux. We are not in a position to comment on the mass balance component of Greer (2026), but we do note a potential overestimate of the percentage of lost seepage in the assessment. Our analysis predicted the fractional lost seepage for each of the components of the mine site. It appears that Greer (2026) has summed the lost seepage at the 95th percentile for each component. This is not a valid approach as it assumes that the model parameters that yield very high seepage for one component (e.g., the TSF) are the same model parameters that yield very high seepage for another component (e.g., the SHFILL). Additionally, the source concentration of the different components are likely to vary. In particular, the SHFILL is made of much lower sulphur content material than the TSF and SHELF (Weber, 2025). It is beyond our scope to determine the relative source concentrations of the different components. However, to better support a discussion of the total lost seepage, we have compiled a total lost seepage assuming that the SHFILL has a source concentration ratio relative to the TSF and SHELF of 1:1, 3:4, 1:2, and 1:4. Here the percentage mass flux for each component is defined by:

$$\text{Percentage Mass Flux} = \frac{sr_{TSF} + sr_{SHELF} + sr_{SHFILL} \times r}{st_{TSF} + st_{SHELF} + st_{SHFILL} \times r} \times 100 \quad (12.1)$$

Where sr is the lost seepage to the receptor (e.g., to the OFFSHORE zone), st is the total seepage mass from the component, and r is the source concentration ratio of the SHFILL relative to the TSF and SHELF. These results are presented in Figure 12.1. Further details on the apportionment between “total SCO1” and “total not SCO1” are presented in Section 11. Greer (2026) raises concerns that “A bypass rate of less than 4% would ensure that dissolved arsenic, zinc and antimony concentrations in the Lindis River do not increase above the ANZG 95% species protection threshold at MALF” and “A 3% seepage bypass rate at MALF is predicted to result in the ANZG (2018) 99% species protection threshold for dissolved zinc being exceeded” Greer (2026) considers the impacts of higher percentages of lost seepage (8% and 10%), which our model does not predict. Our results suggest that depending on the relative contribution of the SHFILL relative to the TSF and SHELF, the 95th percentile of the total lost seepage is very unlikely to be in excess of 5.4% with a large portion of this being discoverable by the monitoring network (e.g., SCO1 and adjacent groundwater). Note that most model realisations suggest that lost seepage will be far less than 3%. As shown in Section 9, the stochastic suite is biased towards higher rates of lost seepage, so the 95th percentile is likely to be a very conservative estimate of the potential for lost seepage. Further investigation of the model suite could refine the potential for lost seepage, but this was not possible within the time constraints of the modelling work and this response. Based on the results of our modelling, our experience with this model and the simplifying assumptions therein, and the conservative nature of the stochastic suite, we suggest that reaching the 95th percentile of lost seepage is very unlikely to occur. Table 12.1 presents the 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles of the total lost seepage for the different source concentration ratios. Even at the 90th percentile and an assumed SHFILL source concentration ratio of 1:1, the total lost seepage is unlikely to exceed 2% which is lower than species protection thresholds raised in Greer (2026). The significant difference between the 90th and 95th percentiles is indicative of the impact of extreme outliers in the posterior distribution. Further investigation of these outliers could provide insight into the very unlikely and possibly implausible conditions that yield these extreme values in the model, but this was not possible within the time constraints of the modelling work and this response.

Table 12.1: Percentiles of total lost seepage (%) for different SHFILL ratios

percentile	Pathway	SHF 1:1	SHF 3:4	SHF 1:2	SHF 1:4
5.00	Total	0.02	0.02	0.02	0.01
5.00	SCo1	0.02	0.01	0.01	0.01
5.00	Not SCo1	0.00	0.00	0.00	0.00
10.00	Total	0.05	0.05	0.04	0.03
10.00	SCo1	0.04	0.04	0.03	0.02
10.00	Not SCo1	0.00	0.00	0.00	0.00
25.00	Total	0.12	0.11	0.10	0.08
25.00	SCo1	0.10	0.09	0.08	0.07
25.00	Not SCo1	0.00	0.00	0.00	0.00
50.00	Total	0.31	0.28	0.26	0.21
50.00	SCo1	0.25	0.23	0.20	0.16
50.00	Not SCo1	0.00	0.00	0.00	0.00
75.00	Total	0.74	0.70	0.62	0.54
75.00	SCo1	0.58	0.52	0.49	0.46
75.00	Not SCo1	0.08	0.07	0.06	0.05
90.00	Total	1.93	1.83	1.74	1.55
90.00	SCo1	1.23	1.19	1.16	1.13
90.00	Not SCo1	0.56	0.51	0.44	0.41
95.00	Total	5.37	4.19	3.36	2.83
95.00	SCo1	3.08	2.81	2.73	2.18
95.00	Not SCo1	2.46	2.22	1.90	1.58

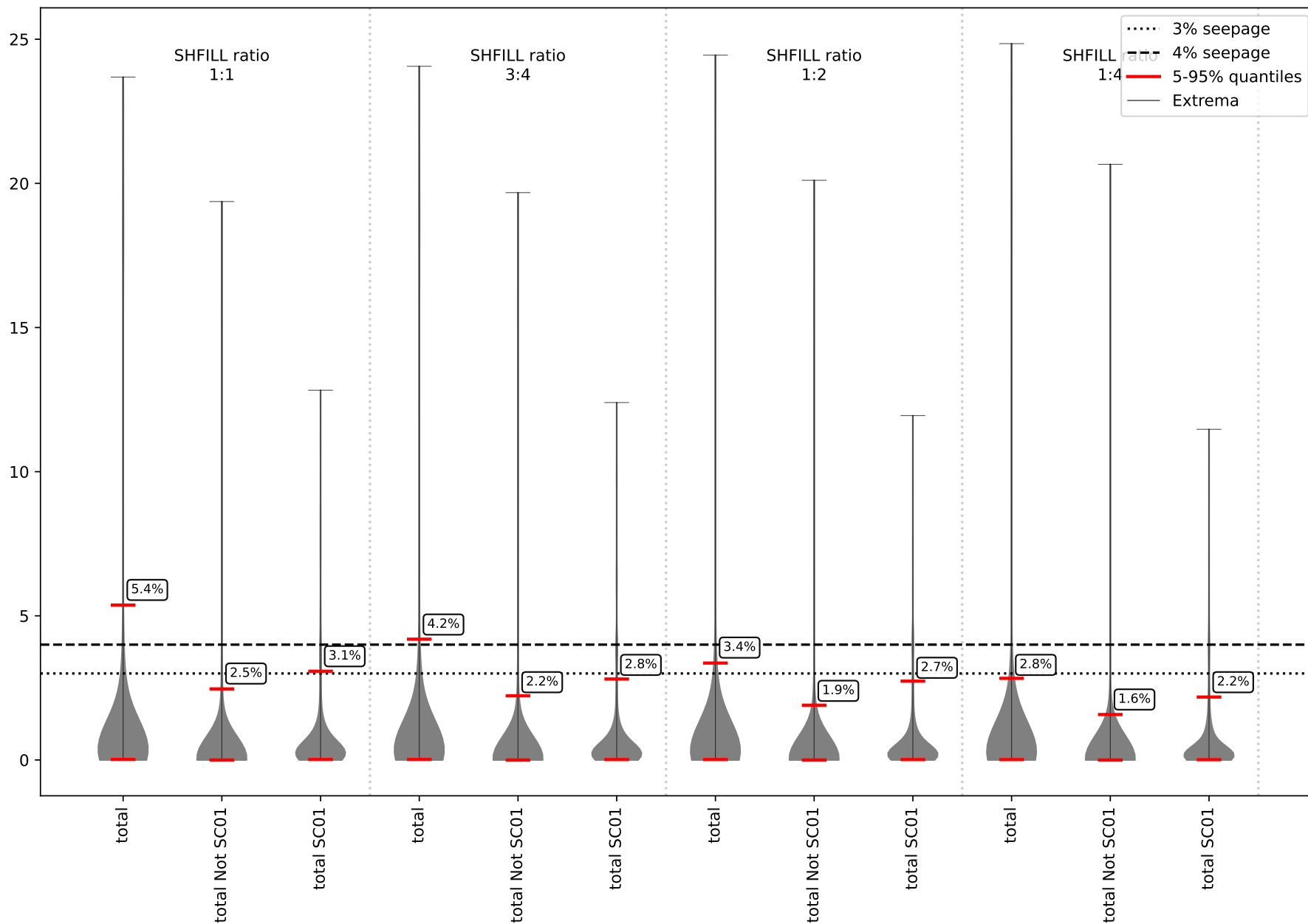


Figure 12.1: Total lost seepage percentage

Total is all seepage lost to the surface drains, OFFSHORE zone, and SiltPond. Not SC01 refers to the lost seepage to the OFFSHORE, and drainage systems that may not be captured by SC01 or nearby groundwater (e.g., d-catchment-sc-1). SC01 refers to the other lost seepage, which will likely be captured by SC01 or adjacent groundwater. See [Section 11](#) for further details.

Definitions and Abbreviations

DRN Drain Boundary Condition

OFFSHORE “Offshore” boundary to allow for seepage to flow out of the model domain

QALCL Quaternary Alluvium and Colluvium

RAS Rise and Shine deposit

SHELF Shepherds Creek Engineered Landform

SHFILL Shepherds Creek Valley Fill

SiltPond Shepherds Creek Silt Pond

SUMP Shepherds Creek Engineered Landform Seepage Collection Sump

TSF Tailings Storage Facility

VWP Vibrating Wire Piezometer

References

- Badenhop, A. (2026). Technical Review: Fast-Track Bendigo Ophir Mine. Technical Report 25080B. [1](#), [7](#)
- Burgess, R. (2026). BOGP Groundwater Site Investigation Memorandum. Technical Report J-H-NZO238-010-M-Revo. [1](#), [2](#), [6](#)
- Dumont, M. H., Cleary, C., Rekker, J., and Durney, P. (2025). Groundwater modelling analysis for mining bendigo ophir gold deposit. Report Z24002.m1.1, Kōmanawa Solutions Ltd. [4](#)
- Greer, M. (2026). Bendigo-Ophir Gold Project Fast-track Approval: Review of applicant's response to the Expert Panel's 11th request for further information. [1](#), [12](#), [12](#)
- McDonald, S. (2026). Planning Memorandum – Substantive Groundwater and Surface Water Issues Arising from Responses to RFI 11. [1](#)
- Morgan, L. (2026). SUPPLEMENTARY STATEMENT OF EVIDENCE OF DR LEANNE MORGAN GROUNDWATER HYDROLOGY RESPONSE TO RFI 11. [1](#), [6](#), [7](#), [9](#), [10](#)
- Rekker, J. (2025). Bendigo - Ophir Gold Mine Project – Surface Water & Catchment Existing Environment & Effects Assessment. Technical Report Z24002BOG-2, Kōmanawa Solutions Ltd. [4](#)
- Rekker, J. and Dumont, M. H. (2025). Bendigo – Ophir Gold Mine Project – Groundwater Existing Environment & Effects Assessment. Technical Report Z24002BOG-1, Komanawa Solutions Ltd. [4](#)
- Weber, P. (2025). Mine Impacted Water Overview Report. Technical Report J-NZO488-001-R-Revo, Mine Waste Management. [4](#), [11](#), [12](#)
- Webster Brown, J. G. (2026). SUPPLEMENTARY STATEMENT OF EVIDENCE OF PROFESSOR JENNIFER WEBSTER-BROWN RESPONSE TO RFI11 INFORMATION – WATER QUALITY. [1](#)