

Memorandum

Date 28 September 2022 **Pages** 10
Attention Paul Ryall
Company R W Corkery and Co
Job No. 1356-07-D2
Subject Bowdens Silver Water Balance
Impact of May 2022 amendment to Harvestable Rights Order on water supply reliability

Dear Paul,

In February 2022 WRM prepared an Updated Surface Water Assessment supporting the Water Supply Amendment Report for the Bowdens Silver Project.

During assessment of the Project, DPE requested information on the implications of a recent amendment to the Harvestable Rights Order for the project water supply. The request is outlined below:

In May 2022 the Harvestable Rights Orders were amended with a provision that disallows water to be moved from harvestable rights dams to excluded works or other dams in the landholding. Please provide consideration of the implications of this amendment to the project, noting that Bowdens Silver was proposing to transfer water between water storages.

This memo outlines the results of additional water balance modelling to assess the change to the site water balance with the system modified to comply with the above amendment.

Modifications to the water balance model

During preparation of the surface water assessment, a site water balance model was developed for the Project using the GoldSim software. The site water balance model was modified for this assessment as follows:

- the water management system was modified to remove the 130 ML Clean Turkeys Nest dam - which was planned as a collection point for water captured in the Harvestable Rights Dams around the project. In the revised system, water supplies would be either drawn directly from these dams (for dust suppression use) - or transferred to the process plant.
- the climate data was updated to include rainfall and evaporation estimates from the period after December 2018. The data was sourced from the SILO database (as per the original assessment).

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Climate data changes

SILO regularly reviews and updates data processing methods and inputs. Since the generation of the Project's original dataset, there have been three material updates. These included two updates (8 July 2020 and 15 June 2022) that incorporated revised BoM data and one (25 September 2019) that addressed an interpolation error in rainfall data for the period 1 January 2017 to 24 September 2019. The resultant changes to the mean annual rainfall and evaporation are summarised in Table 1 below.

Table 1 Effect of SILO data updates on climate averages

	Original surface water assessment	September 2022	Increase
Average annual rainfall (mm)	672	699	4.0%
Average annual Morton's lake evaporation (mm)	1,347	1,320	-2.0%
Average annual Morton's wet ET (mm)	1,325	1,298	-2.0%
Average annual pan evaporation (mm)	1,517	1,412	-6.9%

Effect of climate data changes on modelled runoff

The increases in catchment runoff resulting from the changes to the climate data are summarised in Table 2 below.

Table 2 Effect of SILO data updates on average annual runoff (mm/a)

Scenario	Parameter	Dry Tailings Beach (TSF)	Natural/Undisturbed	Roads/Hardstand/Pits	Waste Rock Emplacement	Rehabilitation	Lined
Low Runoff	Original runoff	210.8	15.9	156.2	14.8	14.8	275.5
	Updated runoff	228.0	19.9	171.1	18.7	18.7	294.7
	Change	8.2%	25.4%	9.5%	26.0%	26.0%	7.0%
Base Case	Original runoff	300.0	30.7	179.1	17.8	17.8	300.0
	Updated runoff	320.0	35.5	194.8	22.1	22.1	320.0
	Change	6.7%	15.7%	8.8%	24.0%	24.0%	6.7%
High Runoff	Original runoff	300.0	53.5	249.1	89.2	89.2	403.8
	Updated runoff	320.0	61.0	267.4	99.8	99.8	426.4
	Change	6.7%	14.0%	7.3%	11.8%	11.8%	5.6%

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Results

The results of the revised modelling are summarised in the following pages - the key modelling outcomes presented in the Updated Surface Water Assessment are reproduced along with the revised versions of the following outputs:

- Table 5.5 Average Annual Site Water Balance - Years 1 to 14
- Table 5.8 Project volumetric water supply reliability
- Figure 5.3 Average Annual Main Water Source Inflows
- Figure 5.4 Modelled Open Cut Pit Water Inventory
- Figure 5.5 TSF Water Inventory
- Figure 5.6 TSF Water Levels
- Table 5.11 Average Annual Site Water Balance - Years 1 to 14 - Low Runoff Scenario
- Table 5.12 Average Annual Site Water Balance - Years 1 to 14 - High Runoff Scenario
- Table 5.13 Average Annual Site Water Balance - Years 1 to 14 - Low Groundwater Inflow Scenario

In summary - the average annual water balance shows that the change to the clean water harvesting system significantly reduces the portion of clean water runoff that can be harvested. However, this represents only a small component of total site water supply.

The latest update of the model climate data increased the average volume of runoff generated by the site catchments. As a result, the reliability of water supply is marginally higher under this revised assessment.

The increased runoff would lead to an increased likelihood of overflow from the sediment dams (especially under the high runoff scenario). For the purpose of this water balance model update, it was assumed that pump station and dam capacities would be increased during detailed design to avoid sediment dam overflows under historical climate conditions.

The increased wet-period runoff results in increased total volumes accumulating in the TSF and open cut pit. However, the additional runoff would be able to be accommodated in these storages without changes to their design capacities.

For and on behalf of

WRM Water & Environment Pty Ltd



Michael Batchelor

Director

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Table 5.5a
Average Annual Site Water Balance – Years 1 to 14 - Amendment Report

Item	Inflow	Outflow
	ML/a	ML/a
Rainfall and runoff	856	
Net groundwater inflows to open cut pit	431	
Advanced dewatering	380	
Clean water harvesting	40	
Ore moisture	83	
Retained tailings moisture		1 142
Evaporation		448
Dust suppression demands supplied		131
Concentrate moisture		6*
Other plant losses		20
Dam overflows		0
Annual increase in stored volume		43*
Total	1 789	1 789

Table 5.5b
Average Annual Site Water Balance – Years 1 to 14 - Revised

Item	Inflow	Outflow
	ML/a	ML/a
Rainfall and runoff	924	
Net groundwater inflows to open cut pit	431	
Advanced dewatering	380	
Clean water harvesting	27	
Ore moisture	83	
Retained tailings moisture		1 143
Evaporation		477
Dust suppression demands supplied		128
Concentrate moisture		6
Other plant losses		19
Dam overflows		0
Annual increase in stored volume		72
Total	1 844	1 844

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Table 5.8a
Project volumetric water supply reliability - Amendment Report

Demand	Volumetric water supply reliability	
	Average	Lowest
Processing plant	99.4%	94.5%
Dust suppression	99.8%	99.5%

Table 5.8b
Project volumetric water supply reliability - Revised

Demand	Volumetric water supply reliability	
	Average	Lowest
Processing plant	99.6%	96.3%
Dust suppression	99.8%	99.5%

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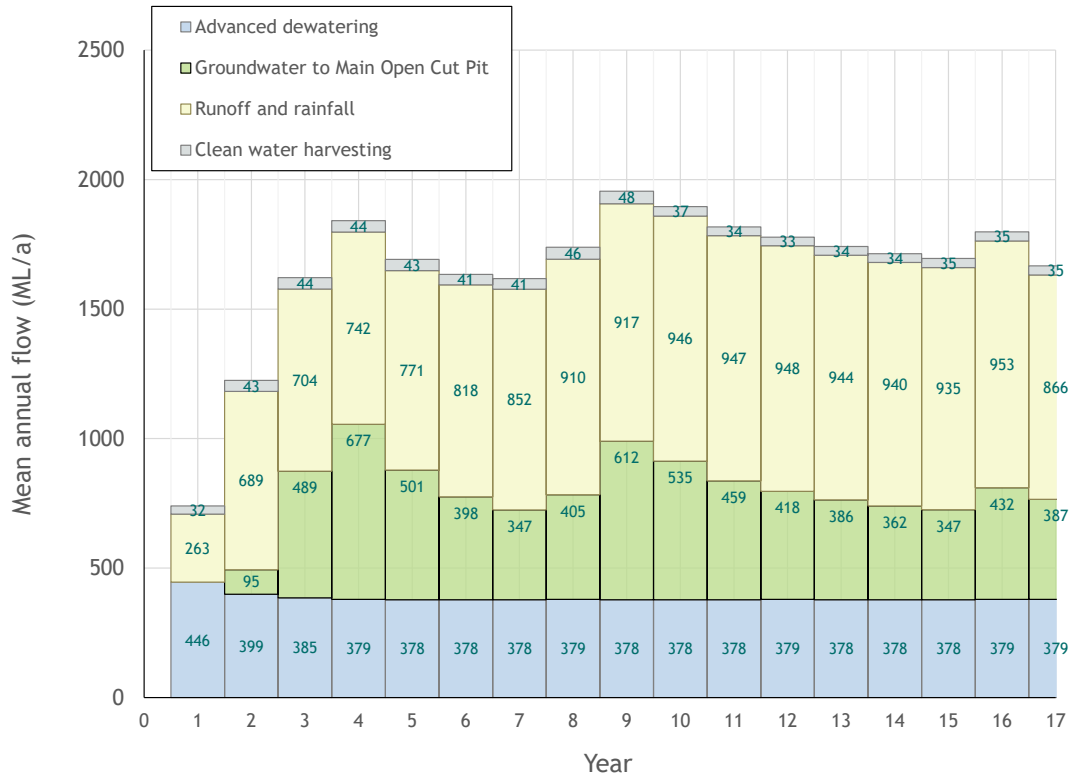


Figure 5.3a Average Annual Main Water Source Inflows - Amendment Report

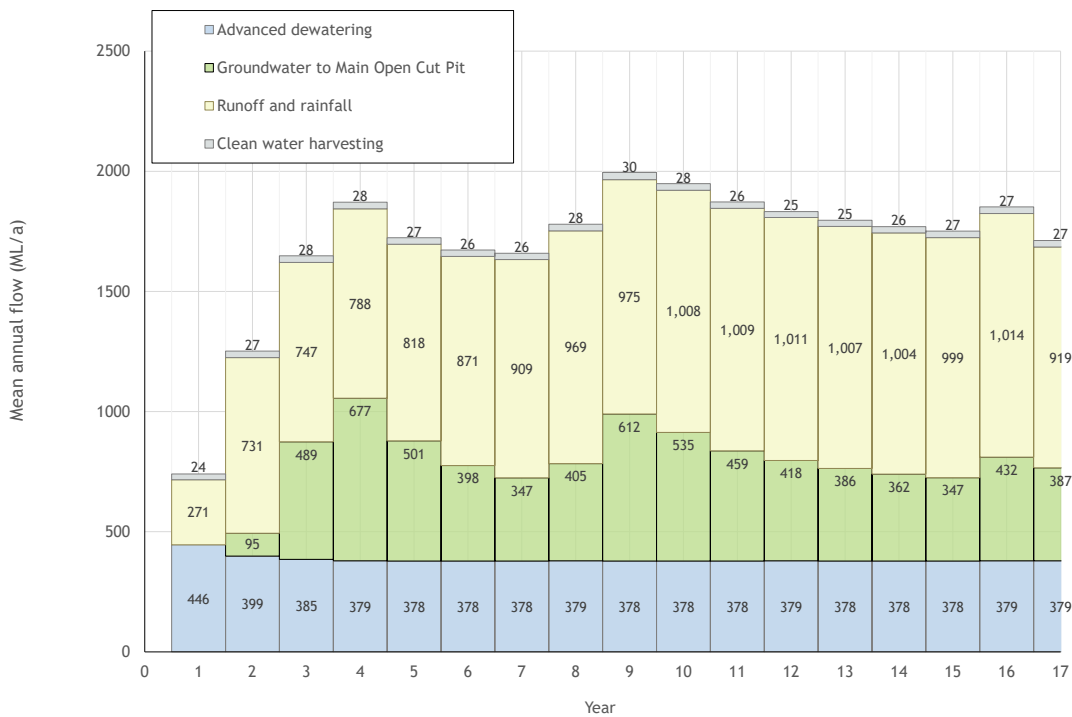
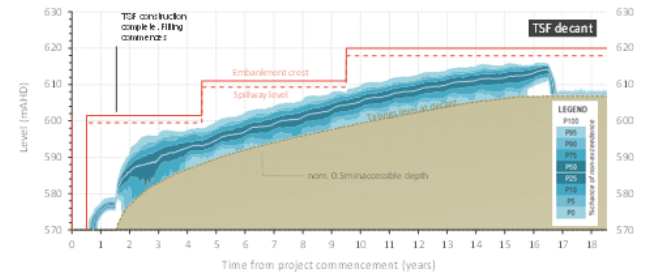
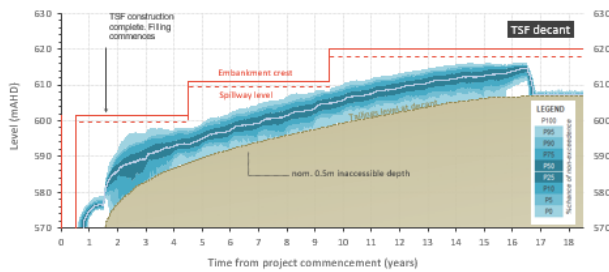
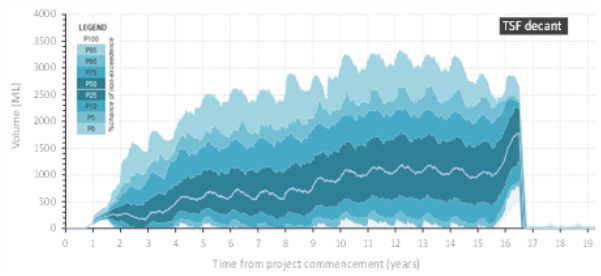
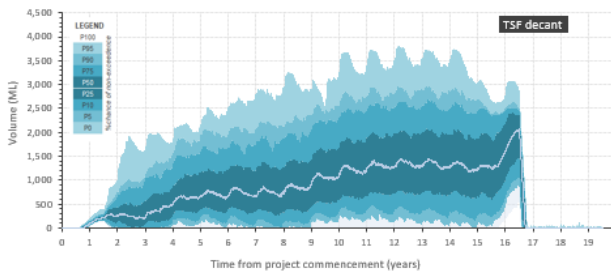
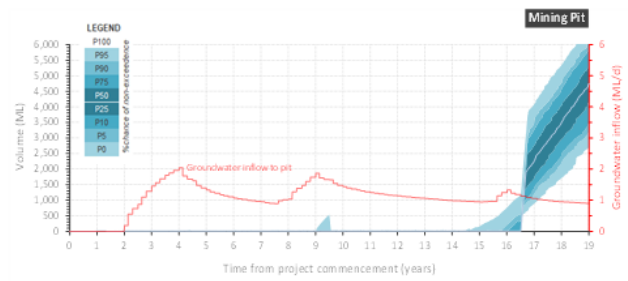
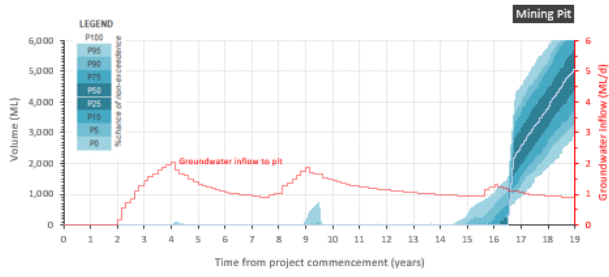


Figure 5.3b Average Annual Main Water Source Inflows - Revised

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Revised (from top):

Open cut pit water inventory

TSF water inventory

TSF water levels

Amendment Report (from top):

Open cut pit water inventory

TSF water inventory

TSF water levels

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Table 5.9a
Average Annual Site Water Balance – Years 1 to 14 – Low Runoff Scenario
- Amendment Report

Item	Inflow	Outflow
	ML/a	ML/a
Rainfall and runoff	740	
Net groundwater inflows to open cut pit	431	
Advanced dewatering	380	
Clean water harvesting	22	
Ore moisture	82	
Retained tailings moisture		1 129
Evaporation		356
Dust suppression demands supplied		131
Concentrate moisture		6*
Other plant losses		19
Dam overflows		0
Annual increase in stored volume		14*
Total	1 655	1 655

Table 5.9b
Average Annual Site Water Balance – Years 1 to 14 – Low Runoff Scenario
- Revised

Item	Inflow	Outflow
	ML/a	ML/a
Rainfall and runoff	804	
Net groundwater inflows to open cut pit	431	
Advanced dewatering	380	
Clean water harvesting	7	
Ore moisture	83	
Retained tailings moisture		1 139
Evaporation		374
Dust suppression demands supplied		128
Concentrate moisture		6
Other plant losses		19
Dam overflows		0
Annual increase in stored volume		39
Total	1 705	1 705

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Table 5.10a
Average Annual Site Water Balance – Years 1 to 14 – High Runoff Scenario
- Amendment Report

Item	Inflow	Outflow
	ML/a	ML/a
Rainfall and runoff	1 109	
Net groundwater inflows to open cut pit	431	
Advanced dewatering	380	
Clean water harvesting	58	
Ore moisture	83	
Retained tailings moisture		1 146
Evaporation		614
Dust suppression demands supplied		132
Concentrate moisture		6*
Other plant losses		20
Dam overflows		0
Annual increase in stored volume		143*
Total	2 061	2 061

Table 5.10b
Average Annual Site Water Balance – Years 1 to 14 – High Runoff Scenario
- Revised

Item	Inflow	Outflow
	ML/a	ML/a
Rainfall and runoff	1 183	
Net groundwater inflows to open cut pit	431	
Advanced dewatering	380	
Clean water harvesting	25	
Ore moisture	83	
Retained tailings moisture		1 147
Evaporation		619
Dust suppression demands supplied		128
Concentrate moisture		6
Other plant losses		20
Dam overflows*		0*
Annual increase in stored volume		182
Total	2 102	2 102

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Table 5.11a Average Annual Site Water Balance – Years 1 to 14 – Low Groundwater Inflow Scenario - Amendment Report

Item	Inflow	Outflow
	ML/a	ML/a
Rainfall and runoff	811	
Net groundwater inflows to open cut pit	215	
Advanced dewatering	190	
Clean water harvesting	40	
Ore moisture	71	
Retained tailings moisture ¹		979*
Evaporation		211
Dust suppression demands supplied		119
Concentrate moisture		5*
Other plant losses		18*
Dam overflows		0
Annual increase in stored volume		-4*
Total	1 327	1 327
¹ Note that limited water supply would constrain production by approximately 15% on average under this scenario		

Table 5.11b Average Annual Site Water Balance – Years 1 to 14 – Low Groundwater Inflow Scenario - Revised

Item	Inflow	Outflow
	ML/a	ML/a
Rainfall and runoff	873	
Net groundwater inflows to open cut pit	215	
Advanced dewatering	190	
Clean water harvesting	27	
Ore moisture	73	
Retained tailings moisture ¹		1 010
Evaporation		223
Dust suppression demands supplied		116
Concentrate moisture		5
Other plant losses		18
Dam overflows		0
Annual increase in stored volume		6
Total	1 378	1 378
¹ Note that limited water supply would constrain production by approximately 12% on average under this scenario		