Government of Western Australia
Department of Water and Environmental Regulation

Decision Report

Application for Works Approval

Part V Division 3 of the *Environmental Protection Act 1986*

Works Approval Number	W6922/2024/1
Applicant	Golden Grove Operations Pty Ltd
ACN	114868325
File number	DER2024/000124
Premises	Golden Grove Mine Mining Tenement M59/92 YALGOO WA 6635 As defined by the premises maps attached to the issued works approval
Date of report	24/07/2024 (FINAL)
Decision	Works approval granted

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1. Decision summary

This decision report documents the assessment of potential risks to the environment and public health from emissions and discharges during the construction and operation of the premises. As a result of this assessment, works approval W6922/2024/1 has been granted.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this decision report, the Department of Water and Environmental Regulation (the department; DWER) has considered and given due regard to its regulatory framework and relevant policy documents which are available at https://dwer.wa.gov.au/regulatory-documents.

2.2 Application summary and overview of premises

On 21 March 2024, Golden Grove Operations Pty Ltd (the applicant) applied to DWER for a works approval under section 54 of the *Environmental Protection Act 1986* (EP Act).

The application relates to the construction and installation of mine dewatering infrastructure and equipment (Category 6 – Mine dewatering) and the construction of an inert landfill (Category 63 – Inert landfill site) at the Golden Grove Mine (the premises). The premises is approximately 60 km south-east of Yalgoo. A summary of respective design capacities is listed below:

- Category 6 Mine dewatering, design capacity of 750,000 tonnes per annual period; and
- Category 63 Class 1 inert landfill, design capacity of 5,000 tonnes per annual period.

Time-limited operations will occur under the works approval.

Once construction works, compliance certification and DWER sign-off has been completed, the operational aspects from the works approval will be transitioned onto Licence L9423/2024/1 which is in place for the Scuddles & Gossan Hill Mine. These changes will be progressed via a separate licence amendment application.

2.2.1 Overview of Gossan Valley Project

The premises will be mined for base metals from three deposits Gossan Valley, Grassi and Felix (collectively referred to as the Gossan Valley Project (GVP)). The site has not previously been mined and currently the only existing infrastructure are two production bores constructed in 2020 for the site's groundwater assessment. The surrounding stations are ex-leasehold which have been destocked.

The premises is 7 km south of the Gossan Hill Mine currently operated by the applicant under Licence L9423/2024/1. This proximity allows for the use of existing utilities and infrastructure at the Gossan Hill Mine to be extended to support the premises, including high voltage power lines, pipelines and roads. Where facilities or infrastructure cannot be extended, new infrastructure will be constructed, including offices and crib rooms; workshops and laydowns; ventilation rises and escapeways; landfill; explosives magazine; generators; and fuel facility etc.

The applicant estimates about an eight-year mine life at a steady rate of 0.5 Mtpa, totalling 4.1 Mt of ore over the life of mine. The ore will be accessed via an underground mine which will be safely accessed by a box-cut 36 m in depth at the surface. At the surface near the box-cut, a run-of-mine (ROM) (or mine-ore-pad (MOP)) with a spoon drain will be constructed for trucks to stockpile ore. Here, road trains will collect stockpiled ore and haul to the Gossan Hill MOP (on Licence L9423/2024/1), where the ore will be transferred to an overland conveyor and transported to the Scuddles processing facility.

Mine waste will be stored on a waste rock dump (WRD) to the west of the landfill which will be managed by the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS). The WRD will not be considered any further in this assessment.

2.2.2 Mine dewatering activities

The applicant is proposing to abstract the lower most 9 m of the box-cut and underground mine to facilitate safe access to the underground mine at GVP. Dewatering the underground mine will occur both underground and at the surface generally using the following approach:

- Ongoing pumping from production bore GVW007P pumping 12 to 15 L/s (1,296 kL/day), location about 100 m behind the box-cut;
- Deployment of 8-20kW Flygt pumps that will feed directly into either a sump or a ~55kW GE084 mono pump hopper (or similar pump mounted on a skid for ease of relocation);
- Primary pumping stations constructed at various areas of the underground mine as it is developed including towards the upper portion of the Gossan Valley South and Grassi orebodies. These will be suitability sized excavations with appropriate LOM ground support. A concrete floor together with concrete plinths shall house the permanent mono pumps:
    - Gossan Valley South will have 2 x GE084 (or similar) mono pumps feeding a rising main to the surface and then around to the incoming dam;
    - Grassi will have 2 x GE086 (or similar) mono pumps feeding the Grassi decline, up through the portal and around to the incoming dam;
    - Both of these pump selections considered locations, head, frictions losses, etc will be able to pump a nominal 14 L/s; and
- Ventilation rises as appropriate.

Dewater from underground mining will be pumped to a settling dam, compartmentalised into two sections with a connecting spillway. Sediment laden dewatering water will be pumped into the ‘inflow dam’ where it will be allowed to settle, and the sediment free water left to overflow across the spillway into the ‘outflow dam’. Water from the outflow dam will be reticulated to relevant areas, as required – back to the underground, workshop/washdown pad and to the processing plant. The dams will be HDPE lined to prevent seepage.

Approximately 750,000 tonnes per annum of water will be abstracted at a rate of about 50 kL per day.

2.2.3 Dewatering dams – inflow and outflow

Process overview:

The application states two dams (‘Inflow’ and ‘Outflow’) will be constructed in the northwest corner of the Project. The designated location has been chosen based on the intended use of the water through the workshop and washdown pad, and back underground.

The inflow dam will collect water from dewatering of the box-cut and underground mine, treated water from the oil water separator at the washdown pad (which also treats excess water captured at the workshop) and the concentrated reject from the reverse osmosis plant. The treatment quality of the oil water separator and the reverse osmosis plant are as follows:

- The oil water separator is expected to treat water with an expected influent range up to 6000 ppm of total petroleum hydrocarbons (TPH) and reduce TPH to <30 ppm (effluent range; and
- Approximately 3.15 ML of brine will be produced per annum which equates to 0.08% of the total amount water generated per annum. The ratio of brine to potable water

produced will be 2:1 (i.e. for every 3 litres of water, 2 litres is brine and 1 litre is potable use water). The combined salinity levels of water directed to the inflow/outflow dams will only be marginally affected based on the minor volume of brine produced overall to abstracted water (0.08%).

The intent of the inflow dam is to provide time for sediment to settle out of the incoming water streams. The outflow dam will collect water from the inflow dam via a spillway and ready for redistribution across the premises. Water from production bore GCW007P will also be pumped to the outflow dam. Collected water is pumped back to the underground mine, workshop, washdown bay and to a standpipe for use in dust suppression. Any remaining excess water will be pumped back to the Processing Plant for treatment and use in processing.

The applicant has indicated that there is the potential for the excess water from the outflow dam to be sent to the Golden Grove Processing Plant; of which used process water is stored in evaporation ponds at Gossan Hill for eventual discharge into Lake Wownaminya as per Licence L9423/2024/1 (Condition 21 and 27). Lake Wownaminya is an extensive ephemeral salt lake system located approximately 27 km north of Golden Grove operations. Licence L9423/2024/1 includes requirements for monitoring water quality and water quality discharge limits to the Lake (metals, total recoverable hydrocarbons, pH, Sulphate, total acidity, total suspended solids).

Figure 1 below provides a schematic of the operational surface water flows between site infrastructure. A breakdown of the estimated usage of mine water during the construction and operation phases are shown in Table 1 below.

Table 1: Water balance of mine water

Description	Construction phase		Operational phase	
	Rate (L/s)	Volume (MLpa)	Rate (L/s)	Volume (MLpa)
	Pits/bores			
Production bore GWV007P	15.0	4,730.4	12.0	3,784.3
Rainfall input into the box-cut	0.0	0.0	0.00000012	3.6
Steady inflow to GV Box-cut	0.0	0.0	0.0	0.0
Potable Feed from bore GWV007P	0.0	0.0	0.015	4.73
Spent (Brine) - 2:1 ratio	0.0	0.0	0.01	3.15
Potable Use -1:2 ratio	0.0	0.0	0.005	1.58
	Surface			
Surface dust suppression	-1.4	-441.5	-4.3	-1,368.8[1]
Site construction	-6.0	-1,892.2	0.0	0.0
Other surface use	-1.0	-315.4	-1.0	-315.4
Evaporation from 'In-flow and Out-flow' dams	-0.06	-18.6	-0.06	-18.6
	Underground Mine			
Underground mine feed	0.0	0.0	-6.0	-1,892.2
Mine losses	0.0	0.0	-2.0	-630.7
Underground mine discharge	0.0	0.0	14.0	4,415.0
	Dewatering balance			
Balance (pumped back into the Gossan Hill Mill (processing plant) / water storage)	6.5	2,062.8[2]	12.6	3,986.9[2]

Note 1: Includes Standpipe flow rate of 50 L/s; watercart capacity of 50,000 L (10 loads per day = 0.5 ML) and dust suppression 75% of the year.
Note 2: Sub-volumes to be discharged to Lake Wownaminya – construction phase ~124ML/annum; and operational phase ~ 239 ML/ annum.

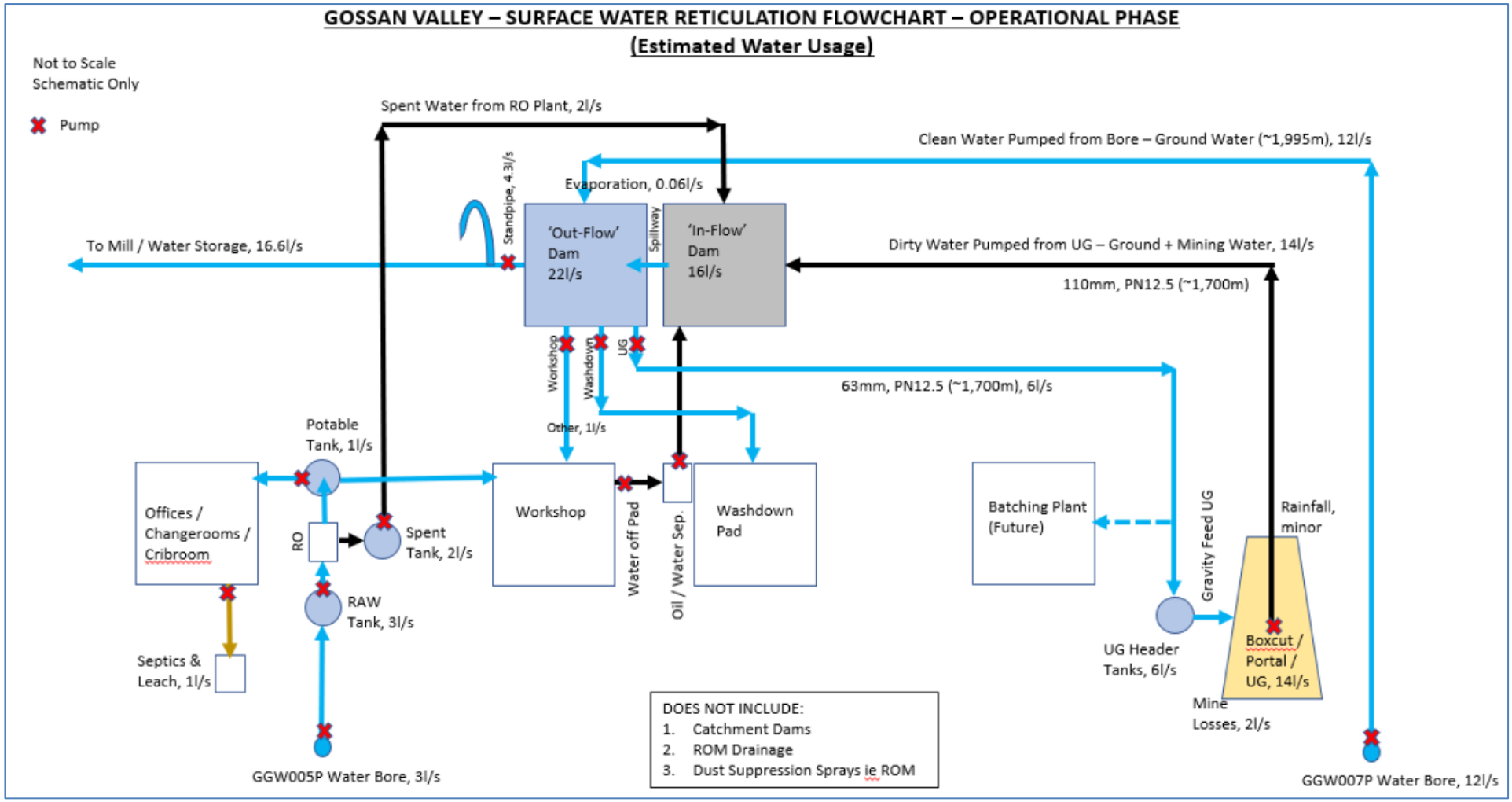

Figure 1: Schematic of dewatering flow (source – Golden Grove Operations Pty Ltd. 2024, Response document to 21-day package)

Dam design and construction:

Material for the construction of the dam walls will be sourced from a combination of borrow pits and underground mining waste. All material will be trucked in, with preconditioning, placement and rolling occurring in 300 mm increments. Once a full height of 3.0 m is reached, an excavator will trim the excess material to the designed 45º batter angle. The inside base of the dams will be rolled to ensure no rocks, sticks or sharp items are present that could potentially impact the integrity of the liner. The dams will then be lined with a 1.5 mm HDPE liner with an underlay beneath. The liner edge will be placed in an excavated tie-in trench that will then be backfilled and compacted.

The application states that each dam will be 60 m x 60 m in dimension with an internal batter of 45º, resulting in a total capacity of 9,747 m^3 for each dam. With the implementation of a freeboard for each dam the operating capacity of each dam is 7,980 m^3 (inflow – 500mm freeboard) and 6,272 m^3 (outflow – 1000 mm freeboard), respectively. Telemetry will be installed to provide continuous monitoring of the freeboard level within the dam and to direct the input volumes from the pumps.

A centralised main HDPE outlet pipe (250 mm diameter) will be attached to the dam wall and fitted with isolation valving and numerous manifolds connecting various pumps. Water from this outlet will be pumped to the underground header tankers, the workshop, the standpipe and the Gossan Hill processing plant. All pumps will be skid mounted coupled to electric motors rated and sized for operation in high ambient temperatures. Skids will be heavy duty galvanised units with a roof to provide weather protection. Matched to each pump will be appropriate isolation valves, check valves, pressure gauges and flow meters. A water distribution summary is presented in Figure 2 below.

The outflow dam is required to have the larger freeboard to ensure there is capacity to receive input from the underground mine in the event the pump which directs water to the Gossan Valley Processing Plant fails and requires repairs taking up to 4 days. During this time production bore GVW007P will be switched off leaving about 8 L/s incoming from the underground mine allowing mine activities to continue to operate. In this scenario, an operational freeboard of 330 mm across both dams will be adopted to prevent overtopping.

The dams will be fenced to prevent entry by livestock and native fauna and will be fitted with two fauna egress mats in the dam corners.

Pump	Flow (L/s)	Estimated Head Pressure	Pump Type	Pump kW
Underground Tank Supply	3	2 m Head pressure (tank inlet) + 38 m (friction loss) + 10m Factor = **50 m**	Vertical Multistage Pump	3
Workshop Tank Supply Pump	7	2 m Head pressure (tank inlet) + 35 m (friction loss) + 10m Factor = **47 m**	Vertical Multistage Pump	5.5
Standpipe Pump System	50	6 m Head pressure (tank inlet) + 7 m (friction loss) + 10m Factor = **13 m**	End Suction Centrifugal Pump	11
Excess Water Pump System	15	160 m Head pressure (tank inlet) + 30 m (friction loss) + 10m Factor = **200 m**	Vertical Multistage Pump	30

Figure 2: Water distribution summary (source – Golden Grove Operations Pty Ltd. 2024, Application Supporting Document)

2.2.4 Characteristics of mine dewater

Groundwater quality

Groundwater field investigations for the premises commenced 9 January 2020. Samples of the pumped groundwater were taken at the end of each pumping test to characterise base groundwater quality.

Analysis of the samples demonstrates that the groundwater quality is near neutral to weakly alkaline (pH 7.10 to 7.84); fresh to brackish (706 to 3,470 mg/L total dissolved solids (TDS)); slightly hard to very hard (113 to 609 mg/L (as $CaCO_3$)); dominated by sodium and chloride ions; has a low nutrient content; and does not contain detectable hydrocarbons at the four sites tested for these parameters.

Dissolved zinc was detectable at all sites and other trace metals (cadmium, chromium, copper, iron, manganese, nickel and selenium) at some sites. All detectible dissolved metals were below licence groundwater limits for Licence L9423/2024/1 for the Scuddles & Gossan Hill Mine. Major and trace ions across all sites were below the respective groundwater and surface water limits specified in Licence L9423/2024/1.

Baseline groundwater quality at the premises has been compared to the Scuddles and Gossan Hill Mine and found the premises is of generally better quality than was abstracted in the initial years of mining at Gossan Hill and Scuddles. Particularly, the TDS are lower, and average pH and concentrations area similar. This means groundwater at the Premises has not been affected by reduced water quality and increased TDS levels observed by dewatering and TSF activities at Gossan Hill and Scuddles Mine.

The applicant has proposed a groundwater monitoring programme as follows:

- Assess the water quality of inflows and outflows and ensure suitability for re-use in intended applications.
- Observe the quality of excess water being transferred into the Golden grove process circuit;
- Record the rate of abstraction and how the aquifer responds to refine hydraulic interconnections and catchment recharge rates;
- Determine the aquifer response to abstraction to forecast operational risks to the projects water management processes; and
- Observe the levels and quality of groundwater in potential seepage zones at the MOP pad, WRD and TSF to provide a pre-emptive tool for minimising impacts to the groundwater resource.

Groundwater monitoring is recommended to extend the baseline dataset during the construction phase, detect whether changes during operations are within expected ranges, and inform the basis of design for mine closure planning. The recommended monitoring programme is focussed on areas where changes are predicted to be larger and may affect water management practices over the life of the project.

Of the areas that form the monitoring program, DWER will require groundwater monitoring results to be provided from the monitoring wells around the dams and ROM pad. Water quality of both dams and the groundwater among the infrastructure area will be monitored in line with the Gossan Valley Monitoring Plan.

2.2.5 Class 1 Inert Landfill

A Class 1 inert landfill comprised of a single open trench will be excavated over a four month period concurrent with the mining of the box-cut. Caprock will be ripped in areas where mobile equipment are capable otherwise blasting may be required. Excavated material will mostly be

hauled and stored at the WRD, with some material used in the construction of other surface infrastructure. A perimeter safety and wind bund will also be progressively constructed around the trench.

The landfill will be progressively backfilled with inert waste starting from a managed tip head. Once an area is filled, the waste will be compacted and covered in NAF fresh rock, which becomes the new tip head location. Inert waste will include vent bags, concrete residue and clean plastic containers.

Groundwater monitoring bores closest to the landfill measured depth to groundwater ranging between 26 m and 44 m below ground level (mBGL), therefore the base of the landfill to the top of the groundwater has a vertical separation distance greater than 3 metres.

2.2.6 Reverse Osmosis Plant

A reverse osmosis plant (RO plant) will be located on the eastern side of the office complex and raw water will be supplied from bore GVW005P via a HDPE pipeline. The final design of the RO plant has yet to be finalised however it will likely comprise:

- Raw water supplied from bore GVW005P via a HPDE pipeline;
- An RO Plant will be contained in a 6m sea-container;
- Six (6) x 15,000L poly water tanks;
    - Two tanks inter-connected for raw brackish water, fitted with a float valve;
    - A pump from the two ‘brackish water’ tanks will feed the RO plant. This in turn will supply RO water to three (3) RO water tanks inter-connected to reticulate through the offices via a suitable pressure pump including redundancy and associated plumbing to supply adequate water especially during peak times;
    - The sixth water tank will store the concentrated reject water (Brine). A float system will activate a pump that will pump the brine water to the dams.

2.3 Mining Proposal

The applicant has confirmed they have submitted an application for a new Mining Proposal (MP) to DEMIRS and is currently under assessment as REG ID 124003. The Mining Proposal for Gossan Valley is not a revised proposal but a standalone document. In section 2.3.4 of this MP it states that excess water from the clean dam will be transferred to the Mill which indicates that it will be entering the process circuit from which any excess treated water will be discharged to Lake Wownaminya in accordance with Licence L9423/2024/1.

Excess water from the Gossan Valley Clean dam is transported to the mill via the GVW007 production bore pipeline which was approved under Mining Proposal REG ID 120689. The only addition to the approved system is the clean dam acting as a distribution point between the production bore and the mill which is being assessed under MP REG ID 124003.

2.4 Native Vegetation Clearing Permit

On 19 December 2020, CPS 9046/1 was granted under section 51E of the *Environmental Protection Act 1986* to clear no more than 109.82 hectares of native vegetation over four mining tenements, which includes Mining Lease 59/92. The area approved for clearing covers the infrastructure and pipeline and transport corridor proposed at the premises.

2.5 Groundwater licence

On 13 December 2023, Ground Water Licence 209427(1) was granted under the *Rights in Water and Irrigation Act 1914*. This allows abstraction for up to 500,000 kl per annum from bore

GVW007P.

The applicant will submit an amendment for GWL103574(8) to include bore GVW005P. GWL103574(8) allows abstraction for up to 3.51 GL of groundwater per annum.

3. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guideline: Risk Assessments* (DWER 2020).

To establish a risk event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises construction and operation which have been considered in this decision report are detailed in

Table 2 below.

Table 2 also details the control measures the applicant has proposed to assist in controlling these emissions, where necessary.

Table 2: Proposed applicant controls

Emission	Sources	Potential pathways	Proposed controls
Construction			
Dust	Vehicle movement on unsealed roads, earthworks, construction and potential blasting	Air / windborne pathway	• Land disturbance will be kept to the minimum necessary for development of the project within the Premises; • Water cart dust suppression, with increased suppression in windy conditions; • Earth works stopped during high winds; • Vehicle traffic confined to designated roads and tracks; and • Occupational hygiene requirements for dust will be complied with in operational areas.
Hydrocarbons	Mechanical failure of vehicle and equipment used for earthworks and construction.	Spills from equipment failure seeping through the ground into the groundwater	• Any spills that do occur will be managed in accordance with existing Golden Grove spill management procedures; and • Only a single excavator is required for the works and only for a period of 4 months, reducing the risk of this type of spill.
Operation			

Emission	Sources	Potential pathways	Proposed controls
Dust	Ore stockpiling on ROM/MOP	Air/windborne pathway	• Land disturbance will be kept to the minimum necessary for development of the project within the Premises; • Water cart dust suppression, with increased suppression in windy conditions; • Earth works stopped during high winds; • Vehicle traffic confined to designated roads and tracks; and • Occupational hygiene requirements for dust will be complied with in operational areas.
Brackish water from dewatering combined with treated water from the oily water separator and concentrated reject from the Reverse Osmosis plant.	Dam and/or pump failure	Leaks/ seepage	• Dams are HDPE lined (1.5mm); • As part of constructing the dams, the inside base will be rolled prior to lining to ensure no rocks, sticks or sharp items are present that could potentially impact the integrity of the liner; and • Groundwater monitoring programme.
		Overtopping	• Inflow dam 'spills' into the Outflow dam by design; • In situ telemetry providing continuous monitoring of freeboard level; • Operational freeboard to be implemented at respective dams. • Daily inspection of dams to ensure specified freeboards are maintained; • Ability to pump excess water to the Gossan Hill mill (processing plant) to prevent overflows; and • Groundwater monitoring programme.
	Pipeline failure	Leaks and bursts	• Pipelines laid within existing roadside drains; • Remote monitoring of pipelines via installed telemetry; and • Weekly in-field inspections of pipelines.
	Discharge to Lake Wownaminya via the Scuddles & Gossan Hill Mine.	Direct discharge	• Groundwater quality assessment conducted (Appendix A); • Prioritize re-use of water at Gossan Valley Project (underground) to reduce volume of excess water sent to the Gossan Hill mill (processing plant); and • Monitoring of discharge water quality as per existing Licence L8593/2011/2

Emission	Sources	Potential pathways	Proposed controls
			conditions.
Windblown waste	Tipping activities and active tip-face at the landfill	Air/windborne pathway	• Wind bund installed to prevent incidence of windblown waste leaving landfill footprint; and • Progressive covering of waste with a minimum of 1 m of Non-acid-forming (NAF) fresh rock.
Landfill leachate	Landfill	Seepage to groundwater	• Only inert waste to be disposed of at the landfill (in accordance with the Landfill Waste Classifications and Waste Definitions 1996); • Base of landfill trench minimum 3 m above groundwater level; • Used IBCs that cannot be returned to the supplier for recycling should be thoroughly rinsed and crushed prior to placement in the landfill; • Waste to be sorted to divert recyclable and hazardous waste streams to appropriate facilities; • Volumes of waste to be recorded; and • NAF fresh rock used to cover waste.

3.1.2 Receptors

In accordance with the *Guideline: Risk Assessment* (DWER 2020), the Delegated Officer has excluded the applicant's employees, visitors, and contractors from its assessment. Protection of these parties often involves different exposure risks and prevention strategies, and is provided for under other state legislation.

Table 3 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental Siting* (DWER 2020)). Figure 3 and Figure 4 below show the closest receptors to the disturbance envelope.

Table 3: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors	Distance from prescribed activity
No residential or sensitive premises within 5 km	
Aboriginal Heritage - Warriedar Station	Warriedar Station heritage area located approximately 3 km south east of the landfill. The site is listed for: Artefacts / Scatter, Ceremonial, Grinding Patches / Grooves, Historical, Rockshelter, Arch Deposit, Camp, Natural Feature, and Ochre. **Not a residence.**
Aboriginal Heritage - Mougooderra Hills	A heritage site located within the Minjar and Chulaar Hills vegetation complexes (banded ironstone formation) Priority 1 TEC. It is approximately 3.9 km south west from the landfill and dams and 3.3

	km from the premises boundary.
Accommodation Village - DC Mines Pty Ltd	DC Mines accommodation village is about 7.5 km east of the landfill. **Ruled out as more than 5 km away.**
Environmental receptors	**Distance from prescribed activity**
Native vegetation	Immediately surrounding the infrastructure within and adjacent to the Premises boundary. The Golden Grove site is located within the Yalgoo biogeographic subregion, which is characterised by open woodlands (principally Callitris, *Eucalyptus salubris*, Mulga and Bowgada) and scrubs on earth or sandy earth plains (CALM 2002). The subregion represents the boundary between the Murchison and Southwestern bioregions with features of both bioregions represented in the Yalgoo subregion. The premises overlays the following three systems: Rainbow System (270Rb): Hardpan plains supporting mulga tall shrublands. Watson System (270Wa): Hills, rises and gravelly plains on sedimentary rocks supporting bowgada shrublands with non-halophytic undershrubs. Tealtoo System (270Te): Level to gently undulating loamy plains with fine ironstone gravel mantles supporting dense acacia shrublands.
Significant fauna	*Leipoa ocellata* (Malleefowl) Vulnerable under the EPBC Act and BC Act, has had evidence of its presence recorded within the Premises boundary from the following: • Scats (2 records); • Tracks (12 records); • Foraging evidence (6 records (2 within the mine development envelope (MDE))); and Mounds (11, two of which were previously known (2 are within the MDE)). **No impact expected.**
Underlying groundwater - East Murchison and Gascoyne Groundwater Area	The dams and landfill overlay the East Murchison Groundwater Area and are approximately 450m east of the Gascoyne Groundwater Area. Groundwater level monitoring from the groundwater assessment was generally greater than 15 mbgl, with depths ranging from 7.38 mbgl to 43.79 mbgl. Depth to groundwater of bores proximal to the landfill site ranged from 26 m to 44 m. The premises is sited over poorly hydraulically conductive poorly fractured caprock and extensively weathered clay over with one main regionally extensive aquifer. The aquifer associated with base of the weathered zone is regionally extensive but varies considerably in depth, thickness and hydraulic properties. The most permeable and high yielding zones are fractured rock and marginal contacts of intrusive dolerite. Several deep fault zones of fresh bedrock are unlikely to yield much water unless fractures prove to be permeable. Recharge of the aquifer is slow and only notable when rains are about 50 mm or more over one or successive days. Groundwater tend to flows from recharge zones in higher topographical areas where the saprolite is thinner and gravity feed down to low lying areas. Salinity is

	higher at these recharge areas and fresher down gradient.
Threatened and priority flora	Threatened *Stylidium scintillans* and Priority 3 *Grevillea globose*, *Calotis* sp. Perrinvale Station, Drummondita fulva and *Micromyrtus trudgenii*, and controlled species *Santalum spicatum* (Sandalwood) are recognised under the WA Biodiversity Conservation Act 2016 (BC Act) and are scattered all throughout the premises boundary.
Minor surface water lines	Unnamed and minor surface water lines between 900 m and 1.6 km from the dams and landfill.
PEC - Priority 1 Minjar and Chulaar Hills vegetation complexes (banded ironstone formation)	Minjar and Chulaar Hills vegetation complexes (banded ironstone formation) Priority 1 PEC is approximately 2.6 km and 2.8 km southwest of the landfill and dams respectively. The buffer zone extends out by 500 m but does not overlap the Premises Boundary.
Thundelarra Conservation Park	5.8 km east of the dams and landfill. **Ruled out due to distance more than 5 km away.**
Surface water bodies	Unnamed surface water body 6.9 and 6.75 km east of the dams and landfill respectively. Not a permanent water body due to evaporation rates exceeding rainfall rates. **Ruled out due to distance more than 5 km away.**

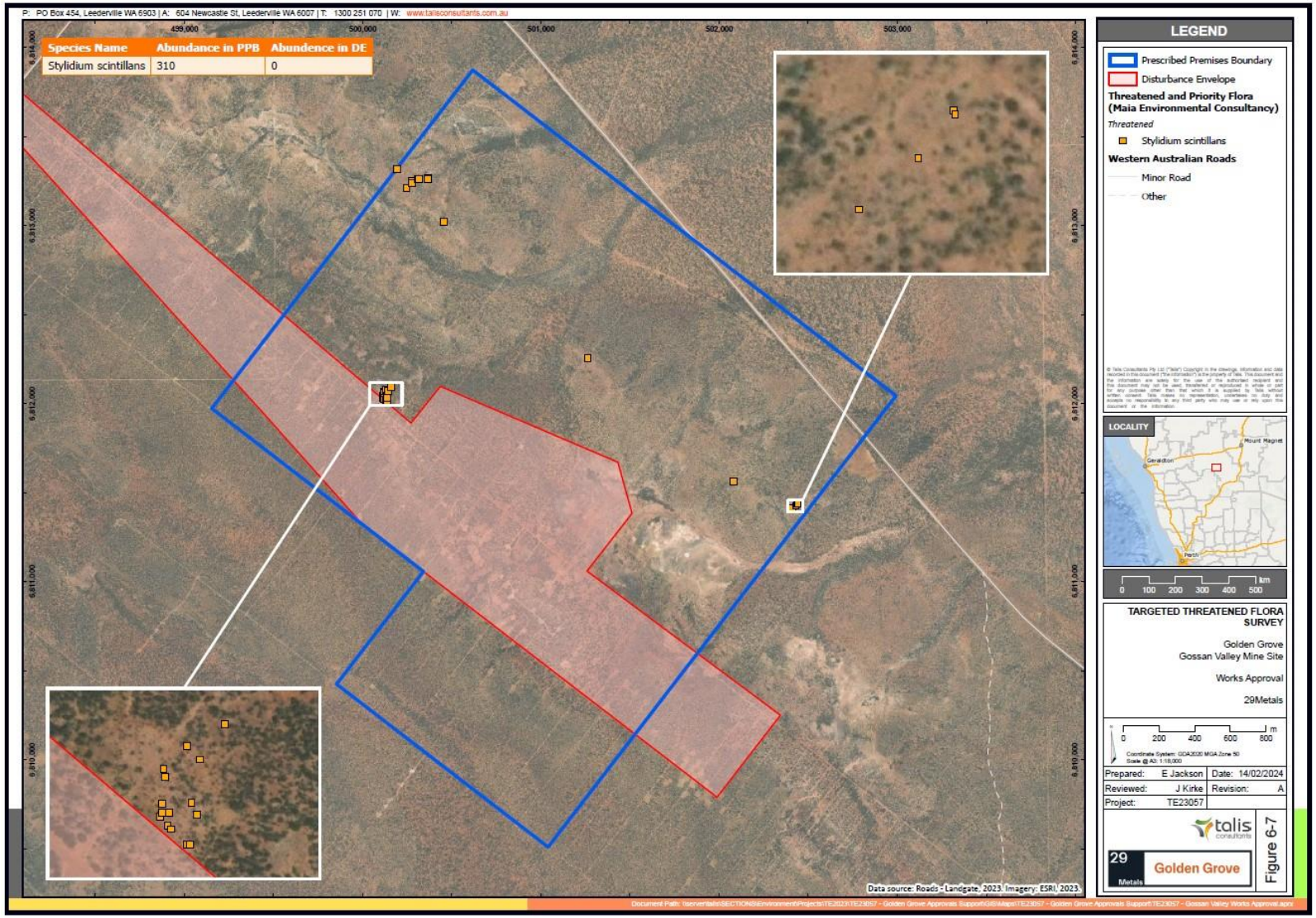

Figure 3: Threatened flora receptors

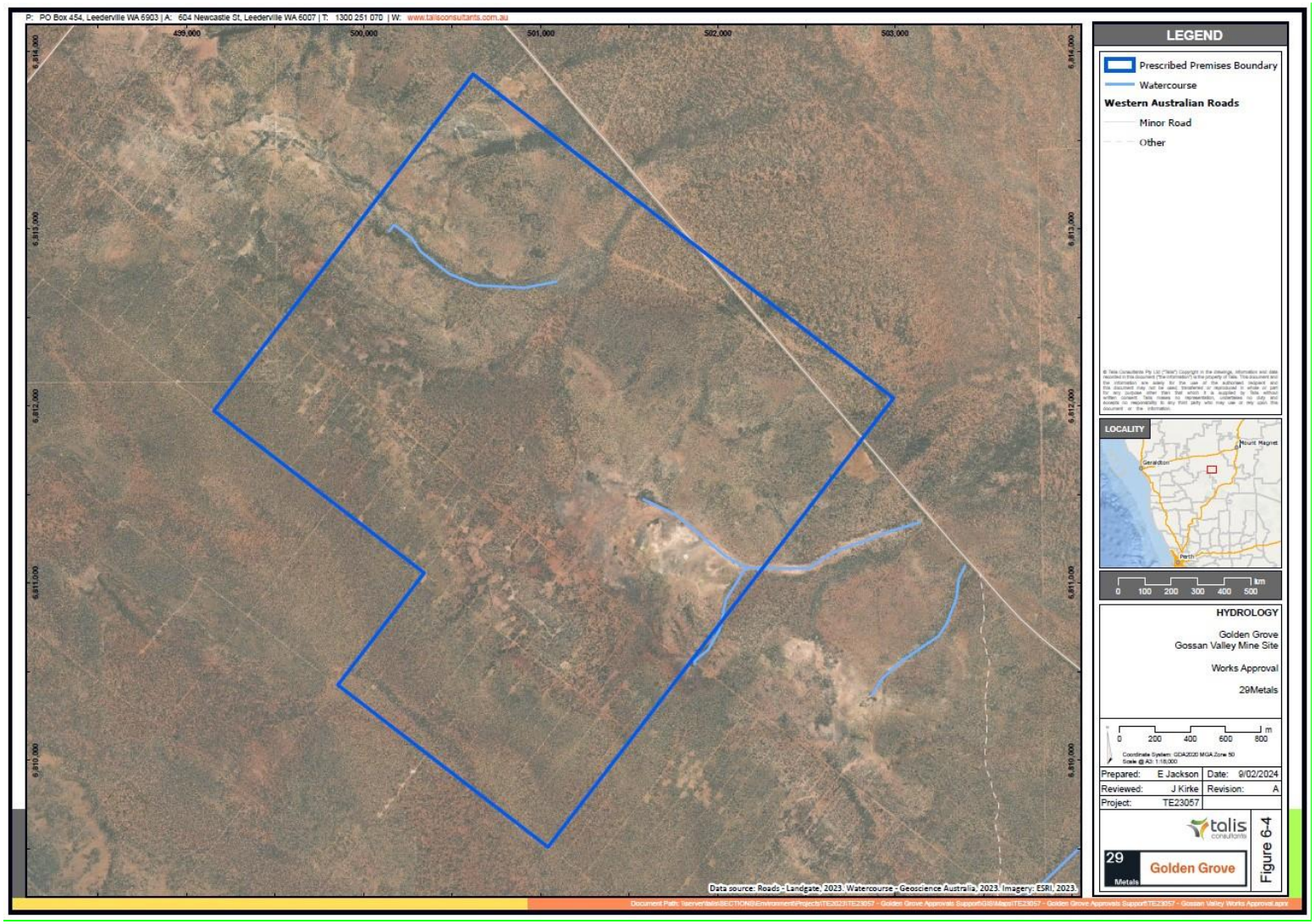

Figure 4: Surface water receptors

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for each identified emission source and takes into account potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are in-complete they have not been considered further in the risk assessment.

Where the applicant has proposed mitigation measures/controls (as detailed in Section 3.1), these have been considered when determining the final risk rating. Where the delegated officer considers the applicant's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the works approval as regulatory controls.

Additional regulatory controls may be imposed where the applicant's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 4.

Works approval W6922/2024/1 that accompanies this decision report authorises construction and time-limited operations. The conditions in the issued works approval, as outlined in Table 4 have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

A licence is required following the time-limited operational phase authorised under the works approval to authorise emissions associated with the ongoing operation of the premises i.e. mine dewatering and landfill activities. A risk assessment for the operational phase has been included in this decision report, however licence conditions will not be finalised until the department assesses the licence application.

Table 4: Risk assessment of potential emissions and discharges from the premises during construction and operation

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls / DWER comments
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Construction								
Vehicle movement on unsealed roads, earthworks, construction and potential blasting	Dust	Air / windborne pathway causing impacts to amenity, photosynthesis and increased sedimentation	Native vegetation Threatened and priority flora Warriedar Station TEC & Mougooderra Hills Minor surface water lines	Refer to Section 3.1	C = Slight L = Unlikely **Low Risk**	Y	Condition 8 and 9	Condition 8 – specifies that water from the Outflow Dam can be used for dust suppression activities. Condition 9 – specifies that water used for suppression is to be applied in a manner that does not impact native vegetation or the environment.
Operation (including time-limited-operations operations)								
Dam and/or pump failure	Brackish mine water	Seepage	Native vegetation Threatened and priority flora Minor surface water lines	Refer to Section 3.1	C = Minor L = Rare **Low Risk**	Y	Condition 1, 2, 8 and 10	Condition 1 – installation and maintenance of a liner implemented to manage seepage. Condition 2 – construction of monitoring wells to monitor changes in groundwater quality around infrastructure. Condition 8 – general operational requirements. Condition 10– environmental monitoring requirements.
		Overtopping		Refer to Section 3.1	C = Minor L = Rare	Y	Condition 8 and 10	Condition 8 – specifies a minimum operational freeboard for respective

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls / DWER comments
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
					Low Risk			dams Condition 10 – environmental monitoring requirements
Pipeline failure		Leaks and bursts		Refer to Section 3.1	C = Slight L = Unlikely **Low Risk**	Y	Condition 1 and 8	Condition 1 and 8 – pipeline installation and maintenance requirements designed to reduce potential of environmental discharge.
Surplus discharge to Lake Wownaminya		Direct discharge	Lake Wownaminya Groundwater	Refer to Section 3.1	C = Slight L = Rare **Low Risk**	Y	Condition 8	Condition 8 – specifies that surplus water sent to Lake Wownaminya is subject to water quality conditions of licence L9423/2024/1,
Tipping and storage at the landfill	Windblown waste	Air/windborne pathway causing impacts to amenity	Native vegetation Threatened and priority flora	Refer to Section 3.1	C = Slight L = Rare **Low Risk**	Y	Condition 1 and 8	Condition 1 – specifies the construction of a perimeter safety and wind bund to prevent windblown waste leaving the landfill. Condition 8 – includes operational requirement to retrieve windblown waste at least weekly and return to the landfill
	Landfill leachate	Seepage to land and underlying groundwater	Underlying groundwater (depth ranges from 26 - 44 mBGL)	Refer to Section 3.1	C = Slight L = Rare **Low Risk**	Y	Condition 1 and 8	Inert landfill – risks of leachate to groundwater are therefore minor.

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk Assessments* (DWER 2020).

Note 2: Proposed applicant controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

4. Consultation

Table 5 provides a summary of the consultation undertaken by the department.

Table 5: Consultation

Consultation method	Comments received	Department response
Application advertised on the department's website on 18 April 24	None received	N/A
Shire of Yalgoo advised of proposal on 30 April 24	None received	N/A
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) advised of proposal 30 April 24	None received	N/A
Applicant was provided with draft documents on 10 June 2024.	Comments and additional information were received on 2 July 2024 – refer to Appendix 1	Refer to Appendix 1

5. Conclusion

Based on the assessment in this decision report, the delegated officer has determined that a works approval will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

References

1. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
2. Department of Water and Environmental Regulation (DWER) 2016, Proposed Amendment report L8593/2011/1 Golden Grove Operations Pty Ltd, Perth, Western Australia, 25 August 2016
3. DWER 2020, *Guideline: Environmental Siting*, Perth, Western Australia.
4. DWER 2020, *Guideline: Risk Assessments*, Perth, Western Australia.
5. DWER 2020, *Clearing Permit 9046/1*, Perth, Western Australia.
6. DWER 2023, Amendment report L8593/2011/1 Golden Grove Operations Pty Ltd, Joondalup, Western Australia, 4 May 2023
7. DWER 2023, *Licence to take water GWL209427(1) Instrument Report*, Joondalup, Western Australia, 13 December 2023.
8. Golden Grove Operations Pty Ltd, 2024, Works Approval Application (DWERVT13704~85).
9. Golden Grove Operations Pty Ltd, 2024, Supporting Documentation (DWERVT13704~85).
10. JBS&G 2023, Annual Environment Report 2022 - Licence L8593/2011/2, Subiaco, Western Australia

Appendix 1: Summary of applicant's comments on risk assessment and draft conditions

Section / Condition	Department comment	Summary of applicant's comment	Department's response
	Decision report		
2.2.2 Overview of mine dewatering activities	1. Applicant to clarify how the underground mine is to be dewatered. What infrastructure and equipment will be used and where will it be deployed/installed. The Gossan Valley Project Groundwater Assessment (AECOM, 9 October 2020) states that abstraction (using pumps) from a box-cut sump at a rate of approximately 50kL/day from the lowermost 9m of the box-cut will be required however, no information is presented in the Application Supporting Document to confirm the approach.	Site is out to tender for these works thus specific details can't be provided. Generally, the system will include but not limited to: 1. The underground will employ Flygt pumps (8-20kW) that will feed either a sump or a mono pump hopper directly. 2. If a travelling mono is used, it will be ~55kW GE084 (or similar pump mounted on a skid for ease of relocation. 3. Two primary pump stations shall be constructed towards the up portion of the Gossan Valley South and Grassi orebodies. These will be suitability sized excavations with appropriate LOM ground support. A concrete floor together with concrete plinths shall house the permanent mono pumps. i. Gossan Valley South will be 2 x GE084 (or similar) mono pumps feeding a rising main to the surface and then around to the incoming dam. ii. Grassi will have 2 x GE086 (or similar) mono pumps feeding the Grassi decline, up through the portal and around to the incoming dam. **Both of these pump selections considered locations, head, frictions losses, etc will be able to pump a nominal 14 l/s.** Similar primary pump stations shall be constructed at various areas of the underground mine as it is developed.	Information added to section 2.2.2 of the Decision Report and included in Condition 1, Table 1 of the Works Approval.
	2. Applicant to clarify after the 9 m of the box cut is dewatered, whether dewatering of the underground mines are included in the 750,000 tpa calculations. The Gossan Valley Project Groundwater Assessment (AECOM, 9 October 2020) states that dewatering will likely be required for vent shafts where they intersect with saprock	Yes the underground mine volume is included in the 750,000 tpa calculations. Further to the response in point 1, sumps generally align above each other, drain holes will be bored to help manage water ultimate to a sump and the	

Section / Condition	Department comment	Summary of applicant's comment	Department's response
	aquifer and that underground sumps and pumps could be used to extract water and that opportunities exist to use bores to extract water. Further, it states that deep permeable fractures could yield high short-term inflows of groundwater. No information is presented in the Application Supporting Document to confirm the dewatering approach for these sections of the underground mine.	pump system. Currently an approved production bore, GVW007P has been operational since the later part of Q1, 2024 and currently abstracting ~15 l/s. This bore is located ~100m behind the box-cut location. Ventilation rises are still being finalized. A geotechnical drilling campaign commenced 3 June 2024 which includes drilling down the centre of each ventilation rise. This will help determine the best construction methodology (including ongoing water management), more up to date water table levels and the lithology that the raises will ultimately be excavated through.	
2.2.3 Dewatering dams – inflow and outflow	3. What is the design performance of the oily water separator for total recoverable hydrocarbons and other potential contaminants of concern?	This is out for final design but an indicative unit is a Cleanawater TS5000 SS oil water separator. From their webpage/brochure, the expected performance is: i. Typical TPH Influent < 5000-6000ppm ii. Typical TPH Discharge (treated) < 30ppm	Information added to section 2.2.3 of the Decision Report. 'The Gossan Valley – Surface water flow chart – Operational phase (Estimated water usage)' has replaced the diagram of the dewatering dams as Figure 1.
	4. How much concentrated brine is expected to be discharged into the inflow dam per discharge event and per annual period? What dilution ratio expected? How saline is the outflow water expected to be? It is noted that water may be used for dust suppression purposes within the GVP, this information is required to determine the extent of potential environmental impacts from reuse options and to facilitate the risk assessment process.	There is currently a confidential tender process underway for the supply and installation of the office/changeroom complex. Included in this scope of works is to supply and install and appropriated sized RO plant through a reputable supplier. On initial scoping, and in the included Table 1, it is expected that the brine ratio will be 2:1 (i.e. for every 3 litres of water, 2 litres is brine and 1 litre is Potable use water). Using this ratio, approximately 3.15ML of brine will be generated annually. This represents ~ 0.08% of total water per annum and thus salinity will only be marginally affected. Until the specific unit is designed and chosen, site does not have any other information to go off at present.	
	5. Applicant to provide a breakdown of expected volumes (estimates) to be used within the GVP for dust suppression above ground and underground, underground for other uses, within the washdown pad, at the workshop etc. (estimates only).	See the included Table 1 estimated volumes per annum. The table outline 3 phases. i. Phase 1 (Prod bore only) ii. Phase 2 (Construction) iii. Phase 3 (Operational)	Information added to section 2.2.3 of the Decision Report.

Section / Condition	Department comment	Summary of applicant's comment	Department's response
		As far as practicable – rainfall, evaporation, RO spent, dust suppression, UG usage, UG dewatering and excess water have be considered.	
	6. Applicant to clarify how much surplus water discharge is anticipated to go to the Gossan Mill Processing Plant, evaporation ponds and Lake Wownaminya under Licence L9423/2024/1 (estimates only).	As per Table 1, the expected surplus of water from Gossan Valley to the Mill is: i. Phase 1 (Prod bore only) ~4,730 ML / annum ii. Phase 2 (Construction) ~2,063 ML / annum iii. Phase 3 (Operational) ~3,987 ML / annum Of the above volumes the following amounts of water from Gossan valley is estimated to be discharge to Lake Wownaminya: i. Phase 1 (Prod bore only) ~284 ML / annum ii. Phase 2 (Construction) ~124 ML / annum iii. Phase 3 (Operational) ~239 ML / annum	
	7. How much freeboard will remain if 4 days' worth of mine dewater is stored in the outflow dam? i.e. what operational freeboard will be maintained in consideration of this scenario.	The original concept for the dams had to consider a reasonable period of time that the pumps may have been u/s. We assumed 7 days capacity when we designed the dams and considered the freeboard amounts. The justification for the two different freeboards for the dams (inflow is 500mm and outflow is 1000mm). If the main outlet pump / line to the mill fails, we can turn off GVW007P production bore. U/G will still be able to operate with water coming from the dam to U/G + UG dewatering. This will still result in a ~8 l/s +ve input into the inflow dam. The outflow dam will continue to increase volume first up to the spillway (~2.5 days) and then both dams will increase simultaneously to dam crest (absolute capacity) in another ~4.5 days. This allows for a lot of unplanned downtime and associated repairs to get the pump system up and running. To answer the question, at 4 days, the approximate freeboard between both dams is 330mm.	Information added to section 2.2.3 of the Decision Report and Condition 8, Table 3 of the Works Approval.
2.2.4 Characteristics of mine dewater	8. The Department considers that an appropriate water quality monitoring program should be implemented at the premises and included in works approval conditions. Please confirm details of a monitoring program for: (a) raw mine dewater being fed to the inflow dam; (b) water quality of water being pumped out of the outflow dam for reuse; and (c) surrounding groundwater quality for the	A draft water quality monitoring plan is provided in attachment 1. This plan was developed from the recommended monitoring plan provided in the AECOM (2020) Gossan Valley Groundwater Assessment report. Some of the monitoring locations were reconfigured to suit the final mine layout. This plan is intended to be revised and finalised once all regulatory approval have been received and the program will then be included in the	Well installation requirements added to Condition 2 and 3 of the Works Approval. Water quality

Section / Condition	Department comment	Summary of applicant's comment	Department's response
	underground mine voids being dewatered. Please provide relevant details of site monitoring locations/infrastructure and related plans depicting this information for licensing purposes.	Golden Grove EMS for implementation.	monitoring has been added to Condition 10, Table 4 of the Works Approval.
2.2.6 Reverse Osmosis Plant	9. This appears to be a directly related activity – further information is required including details on site location, operational overview and plant design capacity. Irrespective of this plant being relatively small scale it is linked to other project aspects (as noted above) and therefore it will need to be captured in the assessment.	As mentioned in point 4 above, the design and capacity of the RO plant is yet to be finalised. Its location and general layout concept is portrayed in Figure 1 and will located on the eastern side of the planned office complex. An overview of the system: 1. Raw water supplied from bore GVW005P via a HPDE pipeline. 2. An RO Plant will be contained in a 6m sea-container. 3. There will six (6) x 15,000l poly water tanks. i. Two (2) tanks inter-connected for initial 'brackish water' which will have a float valve connected. ii. A pump from the two 'brackish water' tanks will feed the RO plant. This in turn will supply RO water to three (3) RO water tanks inter-connected to reticulate through the offices via a suitable pressure pump including redundancy and associated plumbing to supply adequate water especially during peak times. iii. The sixth water tank will store the concentrated reject water (Brine). A float system will activate a pump that will pump the brine water to the dams. The whole system will be included into the existing site 'Potable Water Management Plan'. Figure 3 is a screen shot of the index of the plan noting the 'potable water quality monitoring.' To complete the water balance, a septic and leach drain system has been approved by the Government of Western Australia, Department of Health 'Approval to Construct or Install an Apparatus for the treatment of Sewage'. Approval No: 52.24 granted 4th April 2024. This will be located on the western side to the office complex.	Information added to section 2.2.6 of the Decision Report and Condition 1, Table 1 of the Works Approval.
2.3.1 Mining Proposal	10. Applicant to confirm if the revised Mining Proposal application will cover the Gossan Valley Project and Scuddles & Gossan Hill Mine, where surplus dewater from the GVP may be discharged to	The Mining Proposal for Gossan Valley is not a revised proposal but a standalone document. This has been submitted to DEMIRS and is currently under assessment as REG ID 124003. In section 2.3.4 of this MP it states	Information added to section 2.3 of the Decision

Section / Condition	Department comment	Summary of applicant's comment	Department's response
	the evaporation ponds covered under Licence L9423/2024/1.	that excess water from the clean dam will be transferred to the Mill which indicates that it will be entering the process circuit from which any excess treated water will be discharged to Lake Wownaminya in accordance with Licence L9423/2024/1. Excess water from the Gossan Valley Clean dam is transported to the mill via the GVW007 production bore pipeline which was approved under Mining Proposal REG ID 120689. The only addition to the approved system is the clean dam acting as a distribution point between the production bore and the mill which is being assessed under MP REG ID 124003.	Report.