



## Application for Licence Amendment

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

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<b>Licence Number</b>	L8731/2013/1
<b>Licence Holder</b>	Santos WA Energy Limited
<b>ACN</b>	009 301 964
<b>File Number</b>	DER2016/001677-1
<b>Premises</b>	Devil Creek Gas Plant Forty Mile Beach Road MARDIE WA 6714  Legal description - Lots 5001 and 5002 on Deposited Plan 53412, Lot 5008 on Deposited Plan 53413 Certificate of Title Volume 3154 Folios 221, 222 and 228 As defined by the premises map in Schedule 1
<b>Date of Report</b>	16 August 2023
<b>Decision</b>	Revised licence granted

**Amine Fisher**  
**A/Manager Process Industries**

an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

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## 1. Decision summary

Licence L8731/2013/1 is held by Santos WA Energy Limited (licence holder) for the Devil Creek Gas Plant (the premises), located at Lots 5001, 5002 and 5008, Forty Mile Beach Road, Mardie, Western Australia.

This Amendment Report documents the assessment of potential risks to the environment and public health from proposed changes to the emissions and discharges during the operation of the Premises. As a result of this assessment, revised Licence L8731/2013/1 has been granted.

## 2. Scope of assessment

### 2.1 Regulatory framework

In completing the assessment documented in this Amendment Report, the department has considered and given due regard to its Regulatory Framework and relevant policy documents which are available at [DWER Regulatory documents | Western Australian Government \(www.wa.gov.au\)](https://www.wa.gov.au).

### 2.2 Application summary

On 5 May 2023, the licence holder submitted an application to the department to amend Licence L8731/2013/1 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act).

Licence L8731/2013/1 was amended 6 January 2023 to temporarily reduce the freeboard of the evaporation ponds from 800mm to 500mm. The temporary freeboard reduction was requested due to the evaporation ponds receiving an increased volume of produced water as production rates at the DCGP increased in order to meet the states gas supply needs (at the time) and the Reindeer Reservoir nearing end of life resulting in increased produced water volumes. A further amendment was granted on 10 February 2023 to extend the allowance for the ponds to operate at the reduced freeboard until 14 August 2023.

The following amendments are being sought by the licence holder to provide ongoing additional capacity for produced water disposal on the premises:

- a permanent reduction of the freeboard requirement specified on the licence for the premises evaporation ponds (E1-E4) to 500mm; and
- establishment of a fifth evaporation pond by refurbishing an existing decommissioned water storage pond located adjacent to the existing evaporation ponds into a lined pond; and
- update the premises maps to make minor corrections by removing the reference to the decommissioned ground flare and update infrastructure labels.

### 2.3 Part IV of the EP Act

The Devil Creek Development Project was assessed under Part IV of the EP Act (EPA Report 1307) and is subject to conditions of Ministerial Statement 795 (MS 795).

The Ministerial Statement conditions do not specify requirements relating to operation of the ponds.

## 2.4 Application details

### 2.4.1 Existing premises and evaporation ponds

The premises is located approximately 65 km southwest of Karratha. The gas plant processes gas and liquids from the Reindeer gas field which are transported onshore from an offshore platform to produce natural gas for the domestic market and condensate. The premises has four high density polyethylene (HDPE) lined evaporation ponds for disposal of wastewater produced on the premises and from the adjacent Devil Creek Accommodation Village also operated by the licence holder (L8413/2010/2).

The evaporation ponds primarily receive produced water recovered from the gas during processing. Prior to disposal to the ponds produced water undergoes treatment via hydrocyclones and a stripping column designed to reduce hydrocarbon content to 30 mg/L. The treatment system is sized to handle 76 m<sup>3</sup>/hr. The ponds also receive treated wastewater from the accommodation village (average of 1.69 m<sup>3</sup>/hr), the premises sewage treatment system (<0.5 m<sup>3</sup>/day) and the Contaminated Stormwater Pond (estimated to occur 1-2 times per year if the pond reaches capacity with a total inflow based on the pond capacity approximately 3,660 m<sup>3</sup>). Water quality for water disposed to the ponds is typically of elevated conductivity and nitrogen, with some residual hydrocarbons present.

Each pond is approximately 130 m by 130 m, has been excavated to a depth of approximately 1.6 m and has constructed embankments of approximately 0.8 m above ground level (total pond depth is 2.4 m). The ponds are lined with 1.5 mm HDPE overlaying a cushion geotextile and a 300 mm compacted clay layer. Annual groundwater monitoring is undertaken in accordance with the existing licence at four monitoring wells located in the four corners of the evaporation pond area.

The ponds were designed and constructed with a freeboard of 800 mm (equivalent to the embankments) which includes an allowance of 300 mm to account for a 1 in 100 year, 24 hour ARI rainfall event and an additional 500 mm. The total capacity of each pond inclusive of the current freeboard is 25,000 m<sup>3</sup>. The operational capacity of the ponds reduces over time as evaporation efficiency reduced as salinity increases. A series of groundwater monitoring wells are installed and monitored around the pond area perimeter to aid in detection of leaks.

In March 2023 a leak was discovered in the liner of evaporation pond 3. The leak corresponded with an increase in salinity in monitoring bore MW2. Production was suspended upon the discovery of the leak. A tear in the liner of pond 3 was identified and repaired by divers on 30 April 2023 and production at Devil Creek recommenced on 2 May 2023. The area of the four ponds was reported by the licence holder to the department as a known or suspected contaminated site following discovery of the leak and was subsequently classified as *Possibly contaminated - investigation required* (DMO 4009) on 22 June 2023.

The licence holder engaged engineering consultants Fyfe Pty Ltd to assess the evaporation ponds stability under static load cases. The primary purpose of the study was to determine whether the pond's stability would be affected by the proposed reduction in the freeboard under static conditions (Fyfe 2023). Available drawings and geotechnical studies for the ponds were reviewed to develop a geotechnical model of the as constructed ponds. The model was used to conduct analysis of a variety of load scenarios for the ponds for differing soil behaviors together with existing freeboard (800 mm), reduced freeboard (500 mm), 200 mm freeboard due to a maximum estimated rainfall event of 300 mm. A total of 12 different scenarios were modelled.

The study concluded that for all analysis cases under static load pond stability will not be affected by the proposed permanent reduction in freeboard. Further conclusions of the study included that there should not be a rapid reduction in water level in the pond (i.e. pumping out) while the soil is saturated to avoid failure of the slope and this must be avoided during and after heavy or prolonged rainfall events. The study also indicated that given the small size of

the ponds formation of wind waves is considered unlikely as a significant fetch length is typically required to allow these to develop during extreme weather events.

### 2.4.2 Proposed works

During construction of the gas plant a temporary lined water storage pond was established on an area of approximately 1.2 ha immediately adjacent to the evaporation ponds for dust suppression post construction. Following its use, the pond was decommissioned through removal and disposal of the liner. The licence holder proposes to undertake works to repurpose this area as an evaporation pond approximately 120 m long, by 90 m wide and 2.7 m deep. When operated with a freeboard of 500 mm the pond will have a storage volume of approximately 23,500 m<sup>3</sup>. The proposed works include the following.

- Clearing of regrowth vegetation and minor civil works to remove objects such as roots and stones that may damage the pond liner.
- Cut and fill earthworks to establish pond embankments and floor. Embankments will be built to a height of approximately 0.5 m above the existing ground level. Existing slopes will be trimmed to 1V:2H batters and the in-situ clayey silt floor will be compacted in a 300 mm thick layer to 95% maximum dry density (MDD) with moisture content of 0-3% of optimum moisture content (OMC) (secondary liner with permeability <math>1 \times 10^{-9}</math> metres per second).
- Lining with a 1.0 mm HDPE geomembrane with heat welded joints overlying a geotextile underlain by a drainage monitoring layer made of blue metal and three Megaflow® pipes draining to an inspection pipe. Liner specifications will be in accordance with the *Water Quality Protection Note No.26 – Liners for containing pollutants, using synthetic membranes* (Department of Water 2013).
- Establishment of an above ground pipeline (where practical, if needing to cross Forty Mine Beach Road this section will be underground) between the produced water treatment system and new pond.
- Establishment of a perimeter fence around the pond to prevent terrestrial fauna access.

### 2.4.3 Climate information

The premises is located in the Pilbara region of Western Australia which is characterised by very hot summers, mild winters and low and variable rainfall. From late spring to early autumn (November–April) is the region's wet season which is characterised by hot temperatures (daily maximum temperatures averaging 36–37 °C) and the majority of the annual rainfall occurring. Wet season rains are associated with the Australian monsoon and occasional tropical cyclones. Tropical cyclones cause the most extreme rainfall events and generate 25–34% of the total annual rainfall near the Pilbara coast. Hot, dry and sunny conditions mean the Pilbara is also subject to very high evaporative demand (Sudmeyer 2016).

A summary of historical rainfall and evaporation data from the Bureau of Meteorology (BOM) Dampier Salt weather station (005061) (closest station) is provided in Table 1. Highest rainfalls occur in the first quarter of the year.

**Table 1. BOM Dampier Salt weather station 005061 monthly climate statistics (all years of data 1969-2023)**

Month	Average monthly rainfall (mm)	Highest monthly rainfall (mm)	Decile 9 monthly rainfall (mm)	Highest daily rainfall (mm)	Mean monthly evaporation (mm) (extrapolated from daily)
January	34.9	200.2	107.6	195.0	335
February	71.5	366.5	210.1	208.0	277
March	44.8	287.5	97.0	140.0	310
April	18.1	124.7	57.9	98.2	270
May	33.4	199.3	102.9	120.6	217
June	35.1	236.6	74.8	75.2	177
July	11.9	85.7	42.6	63.6	186
August	3.9	33.7	17.1	27.6	223
September	1.6	18.5	6.7	18.3	267
October	0.7	16.0	1.2	16.0	332
November	1.2	40.0	1.1	40.0	354
December	13.1	138.0	38.5	104.0	363

The existing ponds were designed with a freeboard based on a 100-year Average Recurrence Interval (ARI) 24-hour rainfall event of 346 mm which was derived from parameters obtained from Volume 2.0 of the *Australian Rainfall and Runoff Guidelines* (1998) for the Karratha Aero weather station. To demonstrate the suitability of the proposed 500 mm freeboard for the existing and new ponds, the licence holder provided updated rainfall intensity duration data for the location of the premises (latitude: -20.9067 and longitude: 116.42). The information was derived from the *Design Rainfall Data System* (Bureau of Meteorology 2016) and the new edition of the *Australia Rainfall and Runoff Guidelines* (Commonwealth of Australia 2016). Relevant rainfall events based on this data are listed below.

- 1% (24-hour) Annual Exceedance Probability (AEP) rainfall event = 285 mm (~100-year ARI).
- 0.05% (24-hour) AEP rainfall event = 500 mm (~2000-year ARI).
- 1% (72-hour) AEP rainfall event = 366 mm (~100-year ARI).
- 0.2% (72-hour) AEP rainfall event = 498 mm (~500-year ARI).

The licence holder considers permanent operation of the evaporation ponds with a 500 mm freeboard, without implementing additional inspection and weather monitoring controls specified in Table 1.3.2 of the existing licence, does not present an unacceptable risk of overtopping and associated impacts. This is due to the freeboard being sufficient to accommodate significant rainfall events inclusive of the highest recorded daily rainfall in the surrounding area which was 364 mm recorded on 10 February 1995 at the Mardie weather station (005008).

## 2.4.4 Water balance

Water breakthrough in the Reindeer reservoir in later 2022 resulted in the produced water production volume increasing from an average of 20-30 m<sup>3</sup>/hour to approximately 60 m<sup>3</sup>/hour. The licence holder conducted a high-level water balance (Table 2) based on evaporation, rainfall, and pond reserve to demonstrate that water storage is a limiting factor for premises production, and the need for additional storage capacity on the premises in order to continue production.

When the production rate of the plant is at its minimum (40 TJ), produced water is discharged to the evaporation ponds at an estimated rate of 13.25 m<sup>3</sup>/hr. The water balance shows that there is pond reserve for 11 months of the year at this production rate. When the production rate of the plant is at its maximum (200 TJ), produced water is discharged to the evaporation ponds at an estimated rate of 59.6 m<sup>3</sup>/hr. The water balance shows that there is no pond reserve in any months at this rate. The water balance illustrates that plant production rate is inhibited by the pond's ability to accept produced water (while maintaining the 500 mm freeboard).

**Table 2. Pond reserve capacity for produced water inflow water balance (with 500 mm freeboard and additional fifth evaporation pond) (Santos 2023)**

Month	Evaporation	Rainfall	Pond Reserve		
	mm/month	mm/month	E1 – E4 (m <sup>3</sup> /hr)	E7 (m <sup>3</sup> /hr)	Combined (m <sup>3</sup> /hr)
January	334.8	35.5	21.8	4.3	26.2
February	277.2	71.9	15.8	3.3	19.1
March	310	44.1	19.0	3.9	22.9
April	270	18.4	18.5	3.8	22.3
May	217	33.4	12.1	2.7	14.8
June	177	35.1	9.0	2.1	11.1
July	186	11.9	11.3	2.5	13.8
August	223.2	3.9	15.1	3.2	18.3
September	267	1.6	19.7	4.0	23.7
October	331.7	0.7	24.5	4.8	29.3
November	354	1.2	27.3	5.3	32.6
December	362.7	12.9	26.1	5.1	31.1
Annual	3,310.6	287.3	-	-	-

*Pond reserve is based on a pond area of 62,500 m<sup>2</sup>*

*Includes 80 kL day combined inflow from sources other than produced water.*

*Mean monthly rainfall and evaporation sourced from Dampier Salt (site number: 005061) (BOM, 2023)*

*Evaporation rate may not be representative of the produced water due to high salt content.*

## 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 Amendment Report are detailed in Table 3 below. Table 3 also details the proposed control measures the licence holder has proposed to assist in controlling these emissions, where necessary.

**Table 3: Licence holder controls**

Emission	Sources	Potential pathways	Proposed controls
Dust	Earthworks to establish a fifth evaporation pond.	Air/windborne pathway	Dust suppression will be used if required.
Contaminated water (elevated salinity, hydrocarbons and nutrients)	Storage of treated produced water and wastewater within evaporation ponds	Loss of containment from overtopping or wall failure discharging to ground leading to overland flow and/or infiltration	Minimum top of embankment freeboard of 500mm will be maintained. Visible freeboard markers will be maintained on the pond walls at a depth of 500 mm below the top of embankment.
		Seepage/infiltration from pond embankments and/or floor	Existing ponds have a 1.5 mm HDPE liners installed over a cushion geotextile and compacted clay horizon. New pond Pond surface will cleared of vegetation, stones >25mm and other objects that may damage the liner prior to lining. Pond will be lined in accordance with <i>Water Quality Protection Note No.26</i> with a 1.0 mm thick HDPE geomembrane, underlain by geotextile and a drainage monitoring layer comprising blue metal and three megaflow pipes with an inspection pipe, and a 300mm clay floor. The 300 mm in-situ clay floor will be compacted to 95% MDD with moisture content of 0-3% of OMC and permeability <1x10 <sup>-9</sup> metres per second). Annual groundwater monitoring in accordance with existing licence. Pond base will be 7 m above the maximum wet season water table.
		Ingestion of or contact with contaminated water by fauna	A perimeter fence is installed around the evaporation ponds to prevent terrestrial fauna access.



### 3.1.2 Receptors

In accordance with the *Guideline: Risk assessments* (DWER 2020), the delegated officer has excluded employees, visitors and contractors of the licence holder's from its assessment. Protection of these parties often involves different exposure risks and prevention strategies, and is provided for under other state legislation. For this reason the Devil Creek Accommodation Village located approximately 1km from the evaporation ponds, is not considered a sensitive receptors for the purposes of this assessment.

Table 4 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)).

**Table 4: Sensitive human and environmental receptors and distance from prescribed activity**

Human receptors	Distance from prescribed activity
Gnoorea point campground	9.8 km from boundary of premises
Environmental receptors	Distance from prescribed activity
Groundwater	Base of proposed evaporation pond will be approximately 7 metres above the maximum wet season water table. Groundwater flow is in a north westerly direction.
Threatened ecological community Horse flat land system of the Roebourne Plain; priority 3.	Surrounding land.
Minor watercourses	~ 300-800 m north and west of the ponds
Devil Creek	600 m east of the ponds

### 3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for those emission sources which are proposed to change 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 licence holder 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 licence holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the licence holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 5.

The Revised Licence L8731/2013/1 that accompanies this Amendment Report authorises emissions associated with the operation of the Premises.

The conditions in the Revised Licence have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

**Table 5. Risk assessment of potential emissions and discharges from the Premises during construction, commissioning and operation**

Risk Event					Risk rating <sup>1</sup>	Licence holder's controls sufficient?	Conditions <sup>2</sup> of licence	Reasoning
Source/ Activities	Potential emission	Potential pathways and impact	Receptors	Licence holder's controls	C = consequence L = likelihood			
<b>Construction</b>								
Earthworks to establish a fifth evaporation pond.	Dust	Air/windborne pathway causing vegetation smothering in surrounding area and impact to vegetation health	Vegetation within P3 ecological community in surrounding area	Dust suppression if required.	C = Minor L = Rare <b>Low Risk</b>	NA	NA	The construction works are not expected to generate significant dust emissions. The general provisions of the EP Act are considered sufficient in regulating dust emissions.
<b>Operation</b>								
Storage and disposal of treated produced formation water, treated hydrocarbon contaminated water from the Contaminated Water Pond and treated sewage in five evaporation ponds (E1-E4 and proposed E7), with a reduced freeboard (500 mm).	Contaminated wastewater (hydrocarbons, nutrients and elevated salinity)	Direct discharge to ground due to overtopping or embankment failure of the ponds which may result in soil contamination, flooding and runoff toward surrounding seasonal drainage watercourses potentially impacting the health of the watercourse and vegetation.	Minor watercourses ~ 300-800 m north and west of the ponds Devil Creek 600 m east of the ponds Vegetation within P3 ecological community Groundwater ~ 7 m bgl	Refer to Section 3.1	C = Moderate L = Rare <b>Medium Risk</b>	Y	Conditions 1.3.1 and 1.3.2	During the Pilbara wet season, the region is subject to higher rainfall and potentially to cyclonic activity and tropical lows with associated heavy rainfall and flooding which presents an increased risk of overtopping. The delegated officer noted that the proposed 500 mm freeboard includes sufficient allowance to contain 1% AEP 24 hour and 72 hour rainfall events with additional capacity of 315 mm and 134 mm remaining respectively, and is also sufficient to contain the maximum recorded daily rainfall in the area of 364 mm with remaining capacity (section 2.4.3). Additionally, the highest monthly rainfall for the Dampier Salt weather station is also well within the proposed freeboard (366.5 mm). The stability assessment for the ponds indicates that stability of the ponds will not be impacted by operating at a reduced freeboard, including when a rainfall event of 300 mm above the freeboard is considered.  Given the above the delegated officer considered the proposed permanent freeboard reduction does not present an unacceptable risk of impact to receptors. The delegated officer reviewed the additional operational controls which were applied in the licence when the freeboard was temporarily reduced to 500 mm to determine whether to retain the requirements. Given the licence holder demonstrated the reduced freeboard is sufficient to contain 1% AEP rainfall events up to 72 hours, weather monitoring requirements were removed. The delegated officer did however consider it necessary to retain requirements for monitoring and/or inspection to ensure the required freeboard is maintained and seepage or integrity issues are identified in a timely manner.
		Direct discharge to ground due to seepage and infiltration to groundwater	Vegetation within P3 ecological community Groundwater ~ 7 m bgl	Refer to Section 3.1	C = Moderate L = Unlikely <b>Medium Risk</b>	Y	Conditions 1.3.1, 1.3.2, 1.4.1, 3.4.1 and 4.2.1	The licence holder has proposed to construct the additional evaporation pond in a similar manner to the existing evaporation ponds with a primary geomembrane liner, underlain by geotextile, on a compacted foundation. The new pond will also have an underdrainage/monitoring layer. The proposed lining system is considered sufficient to mitigate the risk of seepage impacts therefore the proposed design/construction requirements have been specified in the works approval.  The delegated officer gave consideration to the need to establish additional groundwater monitoring wells at the new evaporation pond for seepage detection. Given the pond will have an underdrainage/monitoring layer with inspection pipes, and based on groundwater flow detection, monitoring wells at the existing ponds E1-E4 are likely to be in the flow path to detect seepage from the new pond, the delegated officer considered additional groundwater monitoring locations would not be required but included a requirement for weekly monitoring of the underdrainage inspection pipes to ensure seepage is detected in a timely manner if it occurs.  The Delegated Officer had regard to the liner damage (subsequently

Risk Event					Risk rating <sup>1</sup> C = consequence L = likelihood	Licence holder's controls sufficient?	Conditions <sup>2</sup> of licence	Reasoning
Source/ Activities	Potential emission	Potential pathways and impact	Receptors	Licence holder's controls				
								repaired) which occurred in pond 3. It is considered a matter of coincidence that the failure appears to have aligned closely with the annual groundwater monitoring event therefore impact was observable in the monitoring results, illustrating the importance of adequate monitoring frequency where it is the primary means of detecting seepage. Given the existing ponds have not been constructed with an underdrainage/monitoring layer (as proposed for the additional pond), the delegated officer has increased the groundwater monitoring frequency for electrical conductivity to monthly, with an associated reportable event criteria, for the monitoring bores to ensure timely detection of leaks if they occur.
		Ingestion of, or contact with, contaminated water leading to fauna illness. Drowning	Fauna in the surrounding area	Refer to Section 3.1	C = Minor L = Rare <b>Low Risk</b>	Y	1.4.1	The delegated officer considered that given the ponds are/will be fenced and within an active operation terrestrial fauna are unlikely to access them. Given the water stored within the ponds has been treated resulting in water with elevated salinity but minimal residual contaminants, it is unlikely to be ingested in sufficient quantities to cause illness. Fencing of the ponds is considered sufficient control and visual inspections of the pond will allow for identification of any affected fauna.

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

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

Note 3: Conditions 1.4.2-1.4.3 are department imposed conditions required for compliance reporting.

## 4. Consultation

Table 6 provides a summary of the consultation undertaken by the department.

**Table 6: Consultation**

Consultation method	Comments received	Department response
Local Government Authority advised of proposal 24 May 2024	<p>The City of Karratha replied on the 9 June 2023 and commented that:</p> <ul style="list-style-type: none"> <li>the City's Environmental Health Department support the permanent reduction of the existing four evaporation ponds freeboard from 800mm to 500mm, on the basis that the fifth evaporation pond (E7) is constructed.; and</li> <li>an Application for Development Approval will be required to be submitted for the construction of the fifth evaporation pond. A development application for the fifth evaporation pond has not been received by the City to date.</li> </ul>	The delegated officer noted that the licence holder provided a copy of the development approval for the evaporation pond (DA23-094) received from the City of Karratha on 15 August 2023.
Department of Mines, Industry Regulation and Safety (DMIRS) advised of proposal 24 May 2023	DMIRS replied on 7 July 2023 advising that the proposed amendment is not expected to impact the operation of pipeline and the management and control of dangerous goods.	The delegated officer noted this advice.
Licence holder was provided with draft amendment on 26 July 2023	<p>Licence holder replied on 11 August 2023</p> <p>Refer to Appendix 1</p>	Refer to Appendix 1

## 5. Decision

The delegated officer has assessed the proposal to permanently reduce the minimum operational freeboard of the premises evaporation ponds from 800mm to 500mm and determined that it does not represent an unreasonable risk to public health or the environment. In coming to this conclusion the delegated officer has considered the following points:

- the freeboard is sufficient to contain extreme rainfall events with additional capacity;
- the freeboard is sufficient to contain the maximum recorded daily rainfall in the area of 364 mm with remaining capacity, and;
- the stability assessment for the ponds indicates a reduced freeboard will not impact pond stability.

To ensure the specified freeboard is monitored and maintained on the evaporation ponds the delegated officer considered it necessary to retain a requirement for monitoring of pond water levels.

The delegated officer also considered the risk to public health and the environment of construction and operation of an additional evaporation pond (E7) and concluded that it does not represent an unacceptable risk. In coming to this conclusion the delegated officer has considered the following points:

- the pond will provide additional capacity for disposal of produced water on the premises, which will reduce the need to curtail production from the plant to maintain pond freeboard;
- the pond will be established in a previously disturbed area which has been used for water storage in the past;
- the pond has been designed in a similar manner to the existing evaporation ponds with an appropriate synthetic lining system, underlain by compacted in-situ materials to prevent seepage of contained water;
- the pond has been designed with an underdrainage/monitoring layer which will enable early detection of seepage if it occurs through the primary HDPE liner; and
- application of the same freeboard requirements and operational controls as the existing evaporation ponds.

The delegated officer also had regard to a failure of pond liner having occurred recently. The failure preceded annual groundwater monitoring which detected changes in groundwater quality indicative of impact from contaminated water seepage from the pond. To ensure groundwater monitoring enables timely identification of potential leaks the delegated officer determined to increase the frequency of groundwater monitoring for electrical conductivity from annual to monthly with a reportable event criterion of 10,000  $\mu\text{S}/\text{cm}$  and associated management actions in the event of an exceedance.

## 6. Conclusion

Based on the assessment in this Amendment Report, the delegated officer has determined that a Revised Licence will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

### 6.1 Summary of amendments

Table 7 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the Revised Licence as part of the amendment process.

**Table 7: Summary of licence amendments**

Condition no.	Proposed amendments
1.1.2	Included definitions for MDD, OMC, quarterly and suitably qualified engineer.
1.3.1	Amendment of the specified freeboard from 800 mm to 500 mm and inclusion of the new evaporation pond.
1.3.2	Reworded to operational requirements and retained requirements relating to monitoring of water levels. Included an additional requirement for inspection for seepage through the inspection pipe on the new evaporation pond. Deleted meteorological monitoring requirements.
1.4.1	Specified construction requirements for the new evaporation pond aligned with the licence holder's proposed design/construction details.
1.4.2-1.4.3	Compliance reporting requirements for the new evaporation pond.
3.4.1	Revised monitoring frequency for electrical conductivity from annual to monthly.
3.4.2	New management condition to be undertaken in the event of a exceedance of reportable event criteria for ambient groundwater monitoring.
4.2.1	Included a requirement for a summary of pond inspections to be included in the Annual Environmental Report

<b>Condition no.</b>	<b>Proposed amendments</b>
4.3.1	Removed the requirement for monthly reporting of pond water levels and inspections.
Schedule 1	Figures 1-3 replaced with updated maps and Figure 4 included showing design detail of the new evaporation pond.

## References

1. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
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## Appendix 1: Summary of licence holder's comments on risk assessment and draft conditions

Condition	Summary of licence holder's comment	Department's response
1.3.2	<p>Under Table 1.3.2, bullet point 4: Santos proposes to amend '<i>Visual inspections of the water levels....</i>' to '<i>Monitoring of the water levels....</i>'</p> <p>This amendment will allow for flexibility (and redundancy) in undertaking the pond water level checks accounting for personnel/ equipment availability and weather variability. Methodologies used to monitor the pond water levels may include the use of remote systems and manual in-situ measurement/ observations.</p>	<p>The delegated officer agrees to modify the requirements to reflect the requested change as it achieves the same objective of ensuring regular pond level checks occur.</p>
1.3.2 and 3.4.1	<p>Santos proposed two different options in lieu of the proposed increased ambient groundwater quality monitoring frequency of quarterly which are both intended to achieve the principle of early detection.</p> <p><b>Option 1:</b></p> <p>Santos proposes a new bullet point within Table 1.3.2 with the following text:</p> <p><i>"Monthly monitoring of electrical conductivity parameter at all monitoring wells MW-1 to MW-8 shall be undertaken. If the monitored Electrical Conductivity levels exceed historical variation levels, ambient groundwater quality monitoring shall be undertaken within 4 weeks. The scope of ambient groundwater quality monitoring shall be equivalent to the annual ambient groundwater quality monitoring as shown in Table 3.4.1."</i></p> <p>Santos proposes that for Option 1 the frequency of the ambient groundwater quality monitoring described in Table 3.4.1 is reverted to Annual instead of Quarterly</p> <p>Santos proposes this amendment given that the produced water stored within the Evaporations Ponds has a significantly higher Electrical</p>	<p>The delegated officer considers that option 1 will address the environmental risk of seepage/leaks from the evaporation ponds. However, the suggested wording of the condition is not sufficiently clear and enforceable. The delegated officer has determined to revert to annual groundwater monitoring for detailed parameters and require monthly monitoring of EC as well as adopt a reportable value criterion for EC so that elevated levels are investigated and reported appropriately.</p> <p>An examination of historical values shows that normal data is below 6,000 <math>\mu\text{S}/\text{cm}</math> and mostly below 5,000 <math>\mu\text{S}/\text{cm}</math> with two exception of 8,505 for MW-2 in 2021 and 42,400 <math>\mu\text{S}/\text{cm}</math> for MW-2 in 2023. The second of these two outliers was associated with a leak.</p> <p>The delegated officer has therefore determined that the reportable value criterion should be 10,000 <math>\mu\text{S}/\text{cm}</math>. Condition 3.4.1 has been amended to include the reportable event criteria and condition 3.4.2 added to specify management actions in the event of an exceedance.</p>

Condition	Summary of licence holder's comment	Department's response
	<p>Conductivity, as well as specific indicator elevated contaminants of concern such as Boron. A monthly in-situ EC monitoring program results in a shorter period between monitoring events and will enable earlier detection in the unlikely event of future leaks. The follow up ambient groundwater monitoring and sampling in event of increased EC reading will assist with identification of potential contaminants of concern and leak source.</p> <p><b>Option 2:</b></p> <p>Under Table 1.3.2, Santos proposes a new bullet point with the following text:</p> <p><i>“Quarterly monitoring of ambient groundwater quality at all monitoring wells MW-1 to MW-8 shall be undertaken. Parameters to be sampled during the Quarterly monitoring to be limited to the following:</i></p> <ul style="list-style-type: none"> <li>• <i>Physical parameters (i.e. pH, Electrical Conductivity &amp; Dissolved Oxygen);</i></li> <li>• <i>Ammonia;</i></li> <li>• <i>Boron; and</i></li> <li>• <i>Total Recoverable Hydrocarbons.</i></li> </ul> <p><i>If the monitored levels of any of the above parameters exceed historical variations, ambient groundwater quality monitoring shall be undertaken. The scope of the ambient groundwater quality monitoring shall be equivalent to the annual ambient groundwater quality monitoring as shown in Table 3.4.1.”</i></p> <p>For Option 2 Santos propose an additional line is added to include for quarterly monitoring of the above parameter suite.</p> <p>Santos proposes this amendment given that the produced water stored within the Evaporations Ponds has a significantly higher Electrical Conductivity, as well as specific indicator elevated contaminants of concern such as Boron. A targeted groundwater quality monitoring program will enable a shorter lab turnaround time which may potentially allow for earlier intervention in the unlikely event of leaks in the future.</p>	