Decision Report

Review of Existing Licence

Division 3, Part V *Environmental Protection Act 1986*

Licence Number	L7404/1999/9
Applicant	Australian Nickel Investments Pty Ltd
ACN	119 599 323
File Number	DER2015/002781
Premises	Cosmos Nickel Operations Goldfields Highway SIR SAMUEL WA 6437 SHIRE OF LEONORA Legal description – Mining tenements M36/127 and M36/371 and part of M36/180 and M36/349
Date of Report	17 January 2019
Status of Report	Final

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1. Definitions of terms and acronyms

In this Decision Report, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
ACN	Australian Company Number
AHD	Australian Height Datum
Amended Licence	refers to EP Act licence L7404/1999/9, to be amended to reflect the changes as determined by the Delegated Officer and documented in this Decision Report
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
Decision Report	refers to this document
Delegated Officer	an officer under section 20 of the EP Act
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)
GL	Gigalitre, a unit of volume equivalent to 10^9 litres
hypersaline	salinity levels > 35,000 mg/L (greater than seawater)
Licence Holder	Australian Nickel Investments Pty Ltd
m^3	cubic metres
mbgl	metres below ground level
Mining Act	*Mining Act 1978* (WA)
Mtpa	million tonnes per annum
Occupier	has the same meaning given to that term under the EP Act.
Prescribed Premises	has the same meaning given to that term under the EP Act
Premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report
Primary Activities	as defined in Schedule 2 of the Amended Licence
Risk Event	As described in *Guidance Statement: Risk Assessment*
RIWI Act	*Rights in Water and Irrigation Act 1914* (WA)
TSF	Tailings Storage Facility
WMP	Water Management Pond

2. Purpose and scope of assessment

Australian Nickel Investments Pty Ltd (the Licence Holder) is preparing to resume underground mining at the Cosmos Nickel Operations. DWER has recently granted several amendment notices regarding initial works to dewater the Cosmos pit and underground, and the construction of additional dewatering infrastructure that is required for managing the predicted dewatering requirements during reopening of the mine and subsequent operations.

This Decision Report sets out the Delegated Officer's assessment of risks to public health and the environment that may arise from emissions and discharges during the recommencement of dewatering operations at the Premises.

3. Background

Cosmos Nickel Operations is a former nickel mining and processing venture located near Leinster, approximately 370 km north-west of Kalgoorlie. It was established in 1998 by Jubilee Mines NL (Jubilee) and in 2007 was sold to Xstrata Australasia Nickel Operations Pty Ltd (XNAO), who subsequently became a subsidiary of Anglo-Swiss multinational Glencore plc (Glencore).

During active operations, the project consisted of two underground mining operations, Cosmos and Prospero, and an ore processing facility. Historically high dewatering rates (around 50 to 60 L/s) were required to maintain dry conditions during mining (GRM, 2016b), with mine dewater managed using a number of pit storages and water management ponds.

Following exhaustion of the Prospero ore body in 2012, Glencore placed the project into care and maintenance and allowed the Cosmos pit and underground operation to flood.

The Licence Holder acquired the project in September 2015 as a 100% owned subsidiary of Western Areas Ltd, and EP Act licence L7404 was subsequently transferred in November 2015. As part of the transfer, licence conditions relating to the tailings storage facility (TSF), water management ponds, mine voids and the waste dump dam were removed to reflect the non-operational status.

As the new owner, the Licence Holder is preparing to recommission the project and target a series of orebodies comprising the 'Alec Mairs' and 'Odysseus' deposits, which lie around 1 km below surface and below the now flooded Cosmos pit and underground.

Construction of an eighth water management pond (WMP8), which is necessary for managing dewatering requirements during operations, was completed in November 2018. Glencore had previously obtained a works approval and clearing permit to construct this pond; however these approvals expired in 2014 and 2016, respectively. Construction of an additional, ninth, water management pond was also completed in December 2018.

The Existing Licence is subject to five Primary Activities; three of which are directly related to the mining and processing of nickel ore (categories 5, 6 and 52) and two which relate to the on-site worker's accommodation camp (categories 85 and 89).

The full category descriptions as defined in Schedule 1 of the EP Regulations are presented in Table 2 and how they relate to current activities at the Premises.

Table 2: Prescribed Premises Categories

Classification of Premises	Description	Current approved production capacity (from Existing Licence)	Proposed production capacity
Category 5	Processing or beneficiation of metallic or non-metallic ore: premises on which– (a) metallic or non-metallic ore is crushed, ground, milled or otherwise processed; or (b) tailings from metallic or non-metallic ore are reprocessed; or (c) tailings or residue from metallic or non-metallic ore are discharged into a containment cell or dam.	50,000 tonnes per annual period	Not subject to this assessment
Category 6	Mine dewatering: premises on which water is extracted and discharged into the environment to allow mining of ore.	50,000 tonnes per annual period	3,000,000,000 tonnes per annual period

Category 52	Electric power generation: premises on which electrical power is generated using a fuel.	10 MW in aggregate using diesel fuel	Not subject to this assessment
Category 85	Sewage facility: premises– (a) on which sewage is treated (excluding septic tanks); or (b) from which treated sewage is discharged onto land or into waters.	90 m^3 per day	18 m^3 per day
Category 89	Putrescible landfill site: premises on which waste is accepted for burial.	500 tonnes per annual period	Not subject to this assessment

3.2 Application details

The Licence Holder proposes to dewater approximately 1.4 gigalitres (GL) of hypersaline water currently held in storage in the Cosmos pit and underground, and recommence dewatering operations. The documents and information submitted to DWER for assessment of this proposal are listed in Table 3.

Table 3: Documents and information submitted for assessment

Document/information description	Author	Date/version
Cosmos Nickel Operation – Water Management Pond Groundwater Modelling	Groundwater Resource Management (GRM, 2016a)	J160017R01 final December 2016
Stygofauna Risk Assessment for Cosmos Mine	Bennelongia Environmental Consultants	Final report November 2016
Memo: Cosmos Nickel Water Balance Model Update	Groundwater Resource Management (GRM, 2016c)	6 December 2016
Cosmos Nickel Project – 2016 Annual Audit and Review of Tailings Storage Facility	Coffey Services Australia (Coffey, 2016)	29 November 2016
Cosmos Nickel Project – Technical Documentation in support of a Mining Proposal application for construction of Water Management Pond 8	Golder Associates (Golder Associates, 2016)	1665217-002-R-Rev1 December 2016
Cosmos Nickel Operation – Water Management Plan	Groundwater Resource Management (GRM, 2016b)	J160018R01 November 2016
Cosmos Nickel Operation – Construction and Operation of Water Management Pond 9	Clark Lindbeck & Associates Pty Ltd (Clark Lindbeck, 2017)	July 2017

The development sequence includes dewatering of the flooded mine, followed by underground development and refurbishment. Recommissioning of the processing facilities and infrastructure was completed in 2018, with ore production expected to recommence in September 2020.

As operations progress, ongoing dewatering will be required to manage groundwater inflows during mining. The proposed dewatering rates are:

- 2018 – 2.6 GL;
- 2019/2020 – 1.6 GL; and
- 2021 onwards – 1.3 GL.

Key findings:

1. The Existing Licence references a number of Primary Activities that are not subject to current operations, including category 5 (processing or beneficiation of ore), category 52 (electric power generation), category 85 (sewage facility) and category 89 (putrescible landfill).
2. Although the infrastructure exists on the Premises, these activities are not currently being undertaken or will be operating below the prescribed threshold during recommissioning of the project's mine water management system.
3. The Delegated Officer has determined the Amended Licence will reflect only the activities that are being conducted on the Premises.
4. A separate amendment application will be required prior to the recommencement of full operation at the Premises, which will enable the Delegated Officer to conduct an assessment of these activities in accordance with DWER's current regulatory framework.

4. Overview of the Cosmos Nickel Operations

4.1 Operational Aspects

The operational aspects discussed below relate to the recommissioning the project's existing mine water management system (category 6: mine dewatering).

The Cosmos Nickel Concentrator, power station and mine camp sewage facility will remain in care and maintenance during the initial recommissioning works[1]. The mine camp landfill will continue to operate, but below the prescribed threshold. These activities have not been assessed in accordance with DWER's current regulatory framework.

4.1.1 Dewatering strategy

Mining is proposed via underground declines to a depth of more than 1,000 metres below ground level (mbgl) and dewatering of surrounding aquifers to a depth around 1,100 m will be required. During active mining and processing the dewatering discharge will be primarily used in processing and for dust suppression.

The dewatering strategy proposed involves disposal of excess mine water via evaporation/ seepage in a series of infrastructures comprising:

- WMP1 – WMP5: a series of five ponds located east of the Cosmos pit constructed in the late 1990s. The ponds are linked by a common wall and trend north-south, operating as a cascading system, whereby mine water is discharged into the upper pond (WMP1) before overflowing into consecutive downstream ponds via purpose-built spillways. The external embankments are lined to remove lateral seepage and surface breakout; however the floors are unsealed which allows vertical seepage to the underlying groundwater;
- WMP6 & WMP7: two ponds located north of the TSF and WMP1 – WMP5. The ponds share a common wall to manage the natural gradient (WMP6 has a perimeter embankment 2 m higher than WMP 7). Similar to WMP1 – WMP5, the embankments are fitted with a synthetic liner and the floors are unsealed;
- WMP8: a newly constructed pond located north of WMP6 & WMP7, which shares a common wall. The embankment is lined with a synthetic liner to limit lateral seepage;
- WMP9: a new standalone pond constructed south of WMP1 – WMP5. Similar to WMP8, the embankment is lined with a synthetic liner to limit lateral seepage;
- Orleans mine pit: an abandoned mine pit located 2.7 km south of the Cosmos pit. It was previously used to store dewatering effluent from the Prospero pit; and

[1] To avoid recommissioning the existing 400-man sewage facility, a smaller, package treatment plant has been installed to service the smaller number of workers (<75) to be housed on-site during initial recommissioning works.

- Waste Dump Dam: a HDPE lined containment dam located on the Cosmos waste rock dump. The liner is in need of refurbishment prior to use.

The Licence Holder is actively investigating additional options for disposal of excess mine water, including storage in four existing pits on third-party tenements and re-injection into groundwater aquifers. The impacts of these options are not considered as part of this assessment.

4.1.2 Previous dewatering operations

Previous operation of the dewatering strategy was subject to the following licence conditions:

- A freeboard limit of 300 mm on the water management ponds;
- A minimum groundwater level depth around the ponds of 4 m;
- A groundwater target depth of 6 m, which if exceeded required the development and implementation of a groundwater recovery programme; and
- A freeboard limit of 200 mm on the pit storages.

A total of 22 groundwater monitoring bores were installed around the water management ponds and TSF to measure groundwater depths. Ten of these bores were designated as 'compliance bores' and used to identify exceedances of the groundwater target/limit.

The Delegated Officer notes there were a number of exceedances of the groundwater target and limit during the previous operation, which was managed using a series of recovery bores installed in target areas where unacceptable mounding was identified, and a recovery trench was constructed along the eastern boundary of WMP1 – WMP5.

4.1.3 Mine water management pond performance

The Licence Holder has completed a review of available groundwater monitoring data in order to assess the sustainability of the ponds both during operations and mine closure. The review indicated that during operation of the TSF and water management ponds, there was significant seepage to the surrounding groundwater system, causing mounding and an increase in groundwater levels to within 6 m of the surface. The most severe impacts were observed at WMP7 and east of the TSF, where exceedances of the 4 m limit were recorded. The bores in these areas are located in an area the Licence Holder believes to have high soil permeabilities, possibly associated with an alluvial channel.

Exceedances were largely managed during the last year of the previous operation using recovery bores, although the 6 m water depth target continued to be exceeded. No information is available as to whether there was any vegetation impacts associated with the exceedances.

Drawdown from dewatering the Cosmos pit extended under WMP1 – WMP5 and around the southern and western sides of the TSF, which negated mounding from pond and TSF seepages. The Licence Holder expects this trend to continue once dewatering of the pit and Cosmos underground is re-established

A comparative review of historical records and recent groundwater monitoring undertaken by the Licence Holder in 2016 shows a dissipation of the groundwater level mound around WMP6 & WMP7 following cessation of operations in 2012, indicating that groundwater levels are likely to eventually return to pre-mining conditions over time.

4.1.4 Works to existing infrastructure

The Licence Holder conducted a geotechnical assessment of the existing dewatering infrastructure and the following works were completed in October 2018 to ensure the existing infrastructures are fit-for-purpose:

- WMP1 – WMP5
  - Repairs to damage on upstream batters at water inlets and other places along the perimeter embankment;
  - Reinstatement of the synthetic liners on the upstream batters;

- Inspection of the geotextile membrane under the synthetic liner and replacement where required;
- Cleaning of the spillways through the common walls;
- Relining of those areas of the upstream batter;

- WMP6 & WMP7
  - Minor repairs to the synthetic liner on perimeter embankment of damage to upstream batter at water inlets and other places along the perimeter embankment;

- Waste Dump Dam
  - Refurbishment of the synthetic liner.

4.1.5 WMP8 & WMP9

WMP8 & WMP9 were approved for construction in July 2017 and September 2017, respectively, and both were completed in November 2018 and December 2018, respectively. The design for both is consistent with the existing water management ponds, in that the embankments are constructed of locally available clayey soils, the upstream faces lined with a geomembrane and synthetic liner, and both anchored into the existing ferricrete.

Both have 3 cells within each pond to minimise the maximum embankment height required to achieve the maximum evaporative area.

The pond floors are clay lined to minimise seepage, although some seepage is expected. Embankments are constructed of compacted clay, which is expected to reduce the likelihood and quantity of seepage being released through the more permeable layers encountered in the upper zone of the soil profile.

The operating criteria is consistent with the existing ponds, in that a freeboard of 0.5 m will be maintained, which results in an average pond depth of approx. 3 m.

For WMP8, six additional monitoring bores and four additional recovery bores were constructed adjacent to the pond (MB23 – MB28; RB27 – R31). For WMP9, an additional six groundwater monitoring bores have been constructed around the pond perimeter, which can be converted into recovery bores, if required. All bores are located at a 50 m setback from the pond embankments.

4.1.6 Pipeline from Cosmos to Orleans open pits

A new 280 mm diameter HDPE dewatering pipeline between the Cosmos and Orleans open pits was constructed in September 2018 (Amendment Notice 3). The pipeline route follows an existing track between the pits, which allows for visual monitoring of leaks and ruptures. Discharge into the Orleans pit commenced in September 2018.

4.2 Infrastructure

The existing infrastructure at the Premises, as it relates to Category 6 activities, is detailed in Table 4 and with reference to the site layout (attached in the Existing Licence).

Table 4: Cosmos mine dewatering infrastructure

Infrastructure	
Prescribed Activity Category 6	
Up to 3 gigalitres (GL) per year of hypersaline groundwater will be abstracted and discharged across the project water management facilities.	
1	Water Management Ponds (WMPs) 1 – 5: cascading series of ponds located east of the Cosmos pit, linked by a common wall. External embankments are lined to prevent lateral seepage, pond floors are unlined
2	WMP6 & 7: two ponds located north of WMPs 1 – 5 as separate adjoining cells
3	WMP8: newly constructed pond which shares a common wall with WMP6 & 7

Infrastructure	
4	WMP9: newly constructed pond located south of the existing WMPs
5	Waste Dump Dam: fully lined storage pond located on the Cosmos pit waste rock dump
6	Abandoned Orleans mine pit, previously used to manage discharge from the Prospero mine pit
7	Dewatering discharge pipeline network

4.3 Exclusions to the Premises

Abstraction of groundwater (mine dewatering) has been excluded, as this activity is regulated by DWER under the *Rights in Water and Irrigation Act 1914* (RIWI Act).

5. Legislative context

5.1 Part IV of the EP Act

The Cosmos project has not been assessed by the Environmental Protection Authority and there is no Ministerial Statement directly related to its operation.

5.2 Other relevant approvals

5.2.1 *Mining Act 1978* (WA)

With the exception of land alienated before 1 January 1899, all minerals[2] are the property of the Crown, and a mining title must be obtained from the Department of Mines, Industry Regulation and Safety (DMIRS) before ground disturbing exploration activities or any mining operations may be undertaken (DMP, 2015b).

The Licence Holder has an approved Mining Proposal (Reg ID 31746) for the original WMP8 proposal under the Mining Act. Addendums for amendments to the Mining Proposal have been approved for the following:

- February 2017 – changes to the approved WMP8 design (increase in wall height to 4 m; Reg ID 62549);
- September 2017 – construction of WMP9 (Reg ID 68665); and
- July 2018 – construction of the Cosmos to Orleans dewatering pipeline (Reg ID 74187).

DMIRS also administer the *Mines Safety and Inspection Act 1994*, with respect to the standards of occupational safety and health. The Resources Safety Division administers occupational health (OSH) legislation for mining operations, and safety legislation and the licensing regime for dangerous goods, including regulation of the State's major hazard facilities. This includes the requirement to lodge and have approved a Project Management Plan, reviewing structural designs and specifications of tailings storage facilities and other engineered mine-related infrastructure, etc.

Mine Closure Plan

All tenements that have an approved Mining Proposal on them must also have an approved Mine Closure Plan (MCP) that has been prepared in accordance with the "Guidelines for Preparing Mine Closure Plans" (DMP, 2015a).

DMIRS has approved a MCP (Registration ID: 62572; Strategen Environmental, 2016) for the project, which identifies the WMPs as a 'medium residual risk' to achieving site closure aims. The next revision of the MCP is scheduled for December 2019.

[2] When occurring on private land, the following are not considered minerals for the purposes of the Mining Act: limestone, rock, gravel, shale, sand and clay (excluding oil shale, mineral sands, silica or garnet sand, kaolin, bentonite, attapulgite and montmorillonite).

5.2.2 *Rights in Water and Irrigation Act 1914* (WA)

The Licence Holder holds the following Groundwater Licences (GWL) and Agreements to take water under the RIWI Act:

- GWL 110790(6) for the abstraction of up to 3 GL per year for the purposes of dust suppression, dewatering and mineral ore processing;
- GWL 151861(3) for the abstraction of up to 0.099 GL per year for the purposes of mineral ore processing and rehabilitation; and
- AGR 172361(1) for the abstraction of up to 1.5 GL per year for mining camp purposes.

5.2.3 Planning approvals

The Shire of Leonora has advised that planning approval is not required for the proposal.

5.3 Part V of the EP Act

5.3.1 Applicable regulations, standards and guidelines

The overarching legislative framework of this assessment is the EP Act and EP Regulations.

The guidance statements which inform this assessment are listed in Appendix 1.

5.3.2 Works approval and licence history

Table 5: Works approval and licence history

Instrument	Issued	Nature and extent of works approval, licence or amendment
L7404/1999/8	24/07/2008	Licence reissued for 5 years. Issued to Sir Samuel Mines N.L.
W4521/2009/1	02/06/2009	Works Approval to construct pipeline to allow for the short-term (6-9 months) disposal of dewatering effluent into the 'Bellevue Pits'. Occupier changed to Xstrata Nickel Australasia Operations Pty Ltd.
L7404/1999/8	12/11/2009	Licence amendment to authorise the 'Bellevue Pits' for disposal of dewater effluent. Premises boundary expanded to include tenement M36/25 on which the Bellevue Pits are located.
W4785/2010/1	09/12/2010	Works Approval for construction of a new industrial (inert) landfill facility on the Prospero Waste Rock Dump (WRD) No.2.
W4955/2011/1	01/07/2011	Works Approval for an upgrade of the worker's camp wastewater treatment plant.
L7404/1999/8	08/08/2011	Licence amendment to add the site's registered landfills (R1436 & R2070) onto the licence. Category 64 added.
L7404/1999/8	28/11/2011	Licence amendment to require the submission of a management plan regarding seepage from the TSF.
W5042/2011/1	25/11/2011	Works Approval for construction of an additional water management pond for storage of dewater from Cosmos dewatering operations.
W4853/2010/1	25/02/2011	Works Approval for encapsulation of evaporation pond salt sediment within the Cosmos underground WRD.
W4878/2011/1	12/05/2011	Works Approval for an upgrade of the Cosmos Nickel Concentrator (CNC) to 460,000 tpa capacity.
W5111/2011/1	12/04/2012	Works Approval for expansion of the TSF (TSF3) following the CNC upgrade.
W5294/2012/1	21/01/2013	Works Approval to upgrade the CNC to 750,000 tpa capacity.
L7404/1999/8	14/02/2013	Licence amendment following compliance inspection. Changes made to update licence conditions. Category 64 changed to 89.

L7404/1999/9	25/07/2013	Licence reissued for 3 years.
W5232/2012/1	22/10/2015	Works Approval for construction of a new industrial (inert) landfill facility on the Cosmos underground WRD.
L7404/1999/9	26/11/2015	Licence transferred to Australian Nickel Investments Pty Ltd. Licence format updated. Changes made to conditions to reflect the non-operational status. Tenements M36/24 and M36/25 removed from the premises description as these are not owned by Western Areas. Expiry extended to align with tenement M36/371.
L7404/1999/9	30/06/2017	Licence amendment to authorise recommencement of mine dewatering operations. Licence format updated.
L7404/1999/9	28/09/2017	Amendment Notice 1 – construction and operation of WMP9.
L7404/1999/9	21/11/2017	Amendment Notice 2 – temporary reduction in groundwater monitoring requirements during Stage 1 dewatering.
L7404/1999/9	13/09/2018	Amendment Notice 3 – construction of new dewatering pipeline from Cosmos to Orleans open pits.
L7404/1999/9	05/12/2018	Licence amendment to add WMP8 as an authorised discharge infrastructure and to consolidate all amendment notices.
L7404/1999/9	14/01/2019	Licence amendment to add WMP9 as an authorised discharge infrastructure.

5.3.3 Clearing of Native Vegetation

Clearing of native vegetation in Western Australia requires a clearing permit, unless exemptions apply. DWER is responsible for administering the native vegetation clearing provisions; however DMIRS has delegated authority under s20 of the EP Act to administer the clearing provisions for mining activities regulated under the Mining Act.

Clearing for WMP8

Up to 24.56 ha of native vegetation was cleared to facilitate the construction of WMP8. A clearing permit was granted for this area in 2011 (CPS 4520/1), shortly before the mine was placed into care and maintenance, and has since expired.

DMIRS re-assessed the environmental impacts for the clearing against the clearing principles contained in Schedule 5 of the EP Act and the proposed clearing was deemed unlikely to cause environmental harm. A new permit was subsequently issued on 10 November 2016 (CPS 7305/1).

Clearing for WMP9

Up to 64.05 ha of native vegetation was cleared to facilitate the construction of WMP9. On 2 March 2018 DMIRS approved an amendment to purpose clearing permit CPS 7914/2 held by the Licence Holder, to increase the area of approved clearing from 77 ha to 157 ha.

Clearing for the Cosmos-Orleans pipeline

Up to 2.5 ha of native vegetation was cleared to facilitate construction of the new dewatering pipeline between the Cosmos and Orleans open pits. The Licence Holder claimed an exemption from obtaining a clearing permit in this instance, on the grounds the clearing was less than 10 ha per tenement per year.

6. Modelling and monitoring data

6.1 Water balance model

A dynamic water balance model was developed for the project using the GoldSim systems modelling software, to assist in the management of mine water discharge. The initial model

was developed for Sir Samuel Mines in 2000 and the most recent iteration was completed by the Licence Holder in 2016 as part of pre-feasibility studies (GRM, 2016b).

The most recent updates have used a number of assumptions, including:

- A minimum freeboard in the WMPs of 0.5 m (based on updated DMP tenement conditions);
- A revision of the parameters for WMP8 to reflect changes in pond design from XNAO's approved design; and
- Further model development to enable flexible start dates for dewatering and commissioning of existing WMPs and new WMP8.

6.1.1 Modelling results

The model indicates that an eighth pond will be required to manage the initial high pumping rates of water stored in the Cosmos pit and underground. After this initial period (i.e. 12 – 14 months from commencement of dewatering), the Licence Holder expects that mine water discharge can be managed without using WMP8. Alternatively, the WMPs could be used in rotation to reduce mounding around the ponds.

Recent simulations indicate the water storage capacity of the existing mine water management system (including WMP8) will be exceeded if the Cosmos pit and underground are not drained by November 2018. This will require the commencement of dewatering in or before October 2017, or action is taken to reduce groundwater inflows to the AM6 and Odysseus return vent raise.

In the event that additional disposal capacity is required or increased dewatering rates are required, the Licence Holder also made provision for an additional, ninth pond (WMP9).

6.1.2 DWER technical review

DWER's review of the *Water Balance Modelling Report* and *Water Balance Update* provided as part of the Application identified that:

- As the evaporation rate of water decreases in a non-linear fashion with increasing salinity[3], increases in salinity of water pumped from the pit could significantly affect the time required to dispose of the water by evaporation. The evaporation rate of hypersaline water is also highly susceptible to small changes in relative humidity, wind speed, local topographic effects and pond construction;
- The groundwater modelling report suggests the local water balance model was calibrated using field observations, however no details were provided with respect to whether the effects of varying salinity, humidity and wind speed were adequately considered in the calibration process.
- Levy (2012) indicates the field calibration of local evaporation rates for hypersaline water is best managed by the installation of a small weather station near evaporation ponds to collect site-specific data on wind speed, temperature, solar radiation and relative humidity.

Key findings:

1. Due to the high salinity of the water, there is a risk that the rate at which water will be lost by evaporation from the water management ponds has been over-estimated.
2. Site-specific measurements of evaporation rates are required to ensure local factors are adequately considered in a water balance model for the site.

6.2 Hydrogeological model

A conceptual hydrogeological model has been developed for the WMPs and TSF, initially to manage groundwater seepage in areas where excessive mounding had been identified during the previous operation. The model has since been further developed and extended to include

[3] Levy, D.B., 2012. Predicting the effects of hypersalinity on evaporation rate and water quality in surface impoundments. *Proceedings of the Tailings and Mine Waste Conference, Keystone, Colorado, 14-17 October 2012*.

the catchment around the ponds, using the most recent information.

The revised model was used to develop a numerical groundwater flow and solute transport model using the MODFLOW and MT3DMS codes, respectively. It was used to simulate future operation of the WMPs and TSF and estimate impacts from seepage, including groundwater level mounding and development of a saline plume around the facilities, given the low groundwater flow environment.

6.2.1 Modelling results

The results indicate seepage during the operational phase will result in groundwater level mounding, particularly in areas where higher permeability conditions have been identified.

Remedial action will therefore be required to limit groundwater depths to within 6 m of the surface, which could be achieved with recovery bores and/or trenches (similar to the earlier operations). A total recovery pumping rate of about 310 m^3/d (3.6 L/s) is likely to be required to maintain groundwater depths below 6 m.

High salinity plumes will develop around the WMPs, in response to seepage impacts. The plumes are expected to be localised, extending a few tens of metres from the facilities.

The model indicated the groundwater levels and saline plume will return to background levels over time.

6.2.2 DWER technical review

DWER's review of the *Groundwater Modelling Report* (GRM, 2016) submitted for assessment identified that:

- The magnitude of the groundwater mounding that was simulated is considered to be plausible and is consistent with mounding that has been observed at similar mine sites in the region;
- The report suggests that groundwater mounding caused by seepage from the ponds can be controlled by installation of a number of recovery bores and trenches near the ponds which are pumped with a total abstraction rate of about 4 L/s. These bores would have to remain operational until the ponds are decommissioned to effectively protect vegetation from the effects of soil salinisation due to a rising water table;
- There are a number of practical difficulties of implementing the proposed strategy:
    - *the low hydraulic conductivity and heterogeneity of the regolith at the site.* The rising water table will create a perched aquifer in the weathered profile near the ponds; regolith materials within the weathered profile are likely to vary greatly in texture but will have a generally low hydraulic conductivity, which could make it difficult to construct recovery bores with sustainable high yields on pumping. A larger number of bores may therefore be required to achieve and maintain the target abstraction rate of 4 L/s; and
    - *difficulty in maintaining groundwater yields due to clogging of bores by iron and aluminum oxyhydroxide minerals*. Shallow groundwater near the ponds may contain elevated concentrations of dissolved iron and aluminum which could be precipitated and oxyhydroxide minerals on exposure to oxygen near pumped bores, that could cause progressive clogging of the screened intervals and reductions in pumping rates. Individual bores may therefore require frequent maintenance and redevelopment to maintain their yields.
- Geophysical investigations suggest that highly permeable regolith materials occur in the vicinity of WMPs 6 & 7; however additional geophysical and lithological information would be required to confirm this conclusion. Whether or not these highly permeable materials would be suitable targets for constructing groundwater recovery bores would depend on their lateral extent and the degree to which they are hydraulically interconnected with surrounding regolith materials. Bores constructed within localised lenses of permeable

materials may initially produce high yields, but pumping rates may rapidly decline as the lenses are dewatered and the rate of water input to these materials becomes controlled by the rate of leakage from the surrounding regolith;

- The modelling approach used to simulate solute transport of seepage from the WMPs has neglected the likely effect on groundwater flow of the large salinity contrast between water in the WMPs and natural groundwater. The extent to which hydrodynamic dispersion within the aquifer would allow mixing of solutes within the plume with brackish groundwater may therefore have been overestimated.

Key findings:

1. There may be practical difficulties in implementing a groundwater recovery scheme to control the mounding due to the generally low hydraulic conductivity of regolith materials and due to the risk of clogging of recovery bores and trenches by iron and aluminum oxyhydroxide minerals.
2. The plume from the TSF and WMPs is likely to be much narrower and contain much higher TDS levels on arrival at the Cosmos pit than indicated by the simulation in the model.

7. Consultation

In consideration of the distance to the nearest sensitive receptor (~5 km), the Delegated Officer did not identify any direct interest stakeholders in proximity to the proposal.

DWER identified five direct interest public authorities. The application was referred to DMIRS, the Department of Biodiversity, Conservation and Attractions (DBCA) and the Department of Aboriginal Affairs, in relation to the proposal to recommission dewatering operations. It was also referred to the Shire of Leonora in relation to planning approvals.

A summary of responses is provided in Table 6.

Table 6: Direct interest stakeholder submissions and DWER consideration

Comment	DWER consideration
Department of Mines, Industry Regulation and Safety	
No response received.	N/A
Department of Biodiversity, Conservation and Attractions	
The proposed activities are located in proximity to several Priority Ecological Communities in and around Lake Miranda, which contain unique assemblages of invertebrates within the groundwater calcretes. Based on the limited information provided, it is unlikely that drawdown from Cosmos will impact the PECs, and the potential for impacts should be able to be appropriately managed. The additional clearing for WMP8 falls outside of the management buffer for the Violet Range (Perseverance Greenstone Belt) vegetation complexes (banded ironstone) PEC and this is not likely to be impacted from the proposal.	Noted.
Department of Aboriginal Affairs	
There are no reported Aboriginal heritage sites within the area of the proposed WMP8; however there are a number of registered Aboriginal sites and other Aboriginal heritage places within the premises boundary. It is recommended the Applicant considers the DAA's *Aboriginal Heritage Due Diligence Guidelines* when planning specific developments associated with the proposal.	Noted.
Shire of Leonora	
The Shire advised it has no objection to the proposed works. Planning approval is not required.	Noted.

8. Location and siting

8.1 Siting context

The Premises is located in the Northern Goldfields, on the Norseman-Wiluna Greenstone Belt. The province is one of the State's main pastoral areas, and contains most of Australia's lode gold and nickel deposits.

8.2 Residential and sensitive premises

The distances to identified residential and sensitive receptors are detailed in Table 7.

Table 7: Receptors and distance from activity boundary

Residential and sensitive premises	Distance from Prescribed Premises
Yakabindie Pastoral Station (homestead)	Approx. 5 km NW of the Cosmos mine pit
BHP Leinster Nickel Mine	Approx. 25 km SSE of the Cosmos mine pit
Town of Leinster (pop. ~ 1,100)	Approx. 41 km SSE of the Cosmos mine pit

8.3 Specified ecosystems

Specified ecosystems are areas of high conservation value and special significance that may be impacted as a result of activities at or Emissions and Discharges from the Premises. The distances to specified ecosystems are shown in Table 8. Table 8 also identifies the distances to other relevant ecosystem values which do not fit the definition of a specified ecosystem.

The table has also been modified to align with the *Guidance Statement: Environmental Siting.*

Table 8: Environmental values

Specified ecosystems	Distance from the Premises
Ramsar Sites in Western Australia	Lake Ballard, approx. 190 km south of the Premises
Important wetlands – Western Australia	Lake Miranda, approx. 6 km south of the Henderson pit
Parks and Wildlife Managed Lands and Waters	Wanjarri Nature Reserve, approx. 11 km north-east of the Cosmos pit
Threatened Ecological Communities and Priority Ecological Communities	Priority 1 (P1) – Lake Miranda East Calcrete (potentially high stygofauna conservation values). Premises is located within and adjacent to the PEC buffer. The mapped boundary of the PEC is located approx. 5 km from the Cosmos pit. P1 – Violet Calcrete (potentially high stygofauna conservation values). Premises is located within and adjacent to the PEC buffer. The mapped boundary of the PEC is located approx. 3 km from the Cosmos pit. P1 – Lake Miranda West Calcrete (potentially high stygofauna conservation values). The mapped boundary of the PEC is located approx. 10 km from the Cosmos pit. P1 – Yakabindie Calcrete (potentially high stygofauna conservation values). The mapped boundary of the PEC is located approx. 5 km from the Cosmos pit.
Biological Component	**Distance from the Premises**
Threatened / Priority Flora	See section 8.4
Threatened / Priority Fauna	Lake Miranda, approx. 6 km south of the Henderson pit, may provide suitable habitat for a number of migratory bird species listed under international conventions

8.4 Native vegetation

8.4.1 Flora and vegetation surveys

Several flora and vegetation surveys have been conducted across the Cosmos tenements, with the most recent completed in 2011 on the proposed WMP8 area.

No Declared Threatened Flora species pursuant to the Wildlife Conservation Act or Priority Flora species as listed by DPaW were recorded within the survey area.

A total of 3 plant communities out of 15 communities that have been defined and mapped across the Premises occur within potential seepage boundaries of the WMPs and TSF. These include three Mulga, one *Acacia* woodland community and one shrubland community:

- Community A1 – Low Woodland of *Acacia aneura* var. *aneura* with *Acacia craspedocarpa* and *Acacia aneura* var. *macrocarpa, Acacia aneura* var. *fuliginea* and *Santalum spicatum* over *Eremophila galeata*, *Eremophila spectabilis, Monachather paradoxus* and *Eragrostis eriopoda* on red loams and sandy loams along drainage lines;
- Community A2 - Low Open Woodland of *Acacia aneura* var. *macrocarpa* and *Acacia aneura* var. *aneura* over *Eremophila galeata*, *Eremophila spectabilis, Eremophila latrobei* subsp. *latrobei, Senna artemisioides* subsp. *helmsii* x *oligophylla* and *Eragrostis eriopoda* on sandy loam gravels, often covered by a stony mantle of quartz and dolerite;
- Community S7 - Open Shrubland of *Eremophila galeata* and *Acacia tetragonophylla* with occasional emergent *Acacia aneura* var. *aneura* over *Senna artemisioides* subsp. *helmsii* x *oligophylla* and *Solanum lasiophyllum* on shallow red loams with an extensive stony mantle of dolerite or quartz.

The survey area occurs on the Laverton land system encompassing banded ironstone hills where a recognised Priority Ecological Community (PEC) has been located. None of the recognised communities identified during recent surveys were associated with this PEC.

8.5 Surface hydrology

Surface water drainage is generally to the south towards Lake Miranda. A series of small drainage lines trend east and south-east from rocky hills to the west, joining a main north-south drainage line known as Freshwater Creek.

Minor drainage lines are defined and well vegetated in the steeper hill slopes to the west and north of Cosmos, becoming less defined towards the south. Further to the south, drainage lines are poorly defined and less densely vegetated, with flows toward the south and south-east. The creek enters Lake Miranda approx. 6 km south of the Henderson pit.

The Premises is not within a Surface Water Proclamation Area. The distances to surface waters are shown in Table 9.

Table 9: Surface waters

Surface water	Distance from Premises	Environmental Value
Freshwater Creek	Flows north-south adjacent to the eastern flank of the WMPs Several smaller drainage lines around key site infrastructure are diverted to this creek Enters Lake Miranda approx. 6 km south of the Henderson pit	The low annual rainfall is highly episodic and has contributed to unique surface hydrological sequences supporting flora and faunal communities within the riparian zone Water is not suitable as potable water or for industrial use
Lake Miranda	Approx. 6 km south of the Henderson pit	Historically influenced by mining dewatering discharge Ephemeral waterbody that provides an important refuge for aquatic biota and may

		support a diverse range of organisms during flooding

8.6 Groundwater and water sources

8.6.1 Hydrogeology

Information on hydrogeology and groundwater resources below has been summarised from GRM (2016a; 2016b; 2016c).

The geology of the site generally comprises bedrock on the northern, eastern and western surface water catchment boundaries, and colluvium and alluvium overlying saprolite and saprock in the centre of the domain and along the down-gradient southern boundary. Higher permeability alluvial channel deposits occur along or close to ephemeral creek lines. Groundwater flows are south towards Lake Miranda, which forms a regional groundwater sink. Groundwater levels are primarily sustained by rainfall recharge.

The pre-mining groundwater levels in the area of the Cosmos underground were about 15 – 20 mbgl, equivalent to ~460 mRL. Groundwater levels in the vicinity of the mining operations have been influenced by pit and underground mine dewatering activities, which has led to the development of an extensive groundwater drawdown cone around the Cosmos pit. The drawdown currently extends more than 1.4 km north of the pit and acts as a local groundwater sink affecting much of the site.

On a catchment scale, hydrogeological units comprise the following:

- Bedrock – forms the ridges along the catchment divides and underlies saprolite and saprock over the remainder of the domain. Has generally low permeability and is considered an aquitard, however high secondary permeability zones, mostly associated with faults or joints, can occur and form discrete fractured rock aquifers. High yielding fractured rock aquifers have been identified in the Cosmos pit and underground mines, which resulted in large inflows during previous mining operations.
- Saprolite – comprises sandy and gravelly silt and clay formed from weathered bedrock. In the northern part of the domain (north of WMP1) the unit has low permeability, with slightly higher permeabilities identified throughout the southern part of the domain. Is considered an aquitard across the domain with highly variable thickness, but averages about 25 m.
- Saprock – forms a think transition zone between fresh and weathered rock. Has moderate permeability and commonly associated with minor groundwater intersects, forming a conduit for groundwater propagating drawdown impacts from the Cosmos pit and under-draining the overlying saprolite.
- Alluvial channel deposits – occur across the domain, comprising silt and sand with moderately high permeabilities. A linear feature has been identified extending south from the southern corner of WMP7, trending east of the TSF and WMP1 – WMP5, and a second area of high permeability has been identified around the south-west corner of WMP6. These are likely to constitute preferential pathway zones which resulted in localised groundwater mounding around WMP6 & WMP7 during previous mining operations.

8.6.2 Groundwater

During open pit and underground mining, groundwater occurrences have generally been associated with the following aquifers:

- vugs and cavities within the ultramafic caprock (generally above 410 mRL);
- the transition zone between fresh and weathered rocks; and
- fractures and lithological contacts within the fresh bedrock (away from these discrete zones the permeability is typically very low).

The distances to groundwater and water sources are shown in Table 10.

Table 10: Groundwater and water sources

Groundwater and water sources	Distance from Premises	Environmental Value
Public Drinking Water Source Areas	Nil	N/A
Major waterbodies	See section 7.5	
Groundwater	Pre-mining groundwater levels in the area of the ponds have not been documented, however are thought to be about 15 mbgl. Dewatering activities at the Cosmos pit and underground has resulted in a drawdown cone which extends approx. 1.4 km north of the pit, forming a capture zone around almost the entire upper catchment (including the area beneath the water management ponds and TSF). There are 5 registered bores within 3 km radius of the mine. The closest is Williams Well located adjacent to WMP2 and is no longer operational. The remaining 4 are unsuccessful groundwater exploration holes that were installed in 1988 and are no longer being used.	The natural groundwater is non-potable, with salinity ranging from 900 to 3,000 mg/L TDS. Potable water is drawn from the Yakabindie borefield and treated via reverse osmosis. The salinity of groundwater deeper in the profile is hypersaline, with available monitoring data indicating the salinity of water stored in the ponds ranging from 90,000 to 300,000 mg/L TDS.

8.7 Meteorology

Climate statistics for the local area are provided below. The rainfall and temperature graph presented in Figure 2 is from observations at Leinster Airport, approximately 30 km south of the site (BoM, 2017).

8.7.1 Regional climatic aspects

Cosmos is located within the Murchison bioregion, which has a semi-arid to arid climate with hot, dry summers and cool to mild winters.

The area is influenced by the more consistent winter rainfall pattern of the State's south-west region and variable summer rainfall, being dependent upon thunderstorm activity and rain-bearing depressions formed in the wake of tropical cyclones, which is typical of the State's northern regions.

8.7.2 Rainfall and temperature

According to the Köppen-Geiger climate classification system, Leinster is considered a hot desert climate, with virtually no rainfall during the year. The average temperature is 20.3 °C and annual average rainfall 223 mm.

Rainfall is the lowest in September, with an average of 8 mm. Most of the precipitation falls in January and February, averaging 38 mm.

January is the warmest month of the year, with an average of 29.2 °C. July is the coldest month, with temperatures averaging 11.3 °C.

There is a difference of 19 mm of precipitation between the driest and wettest months. Throughout the year, temperatures can vary by 17.9 °C.

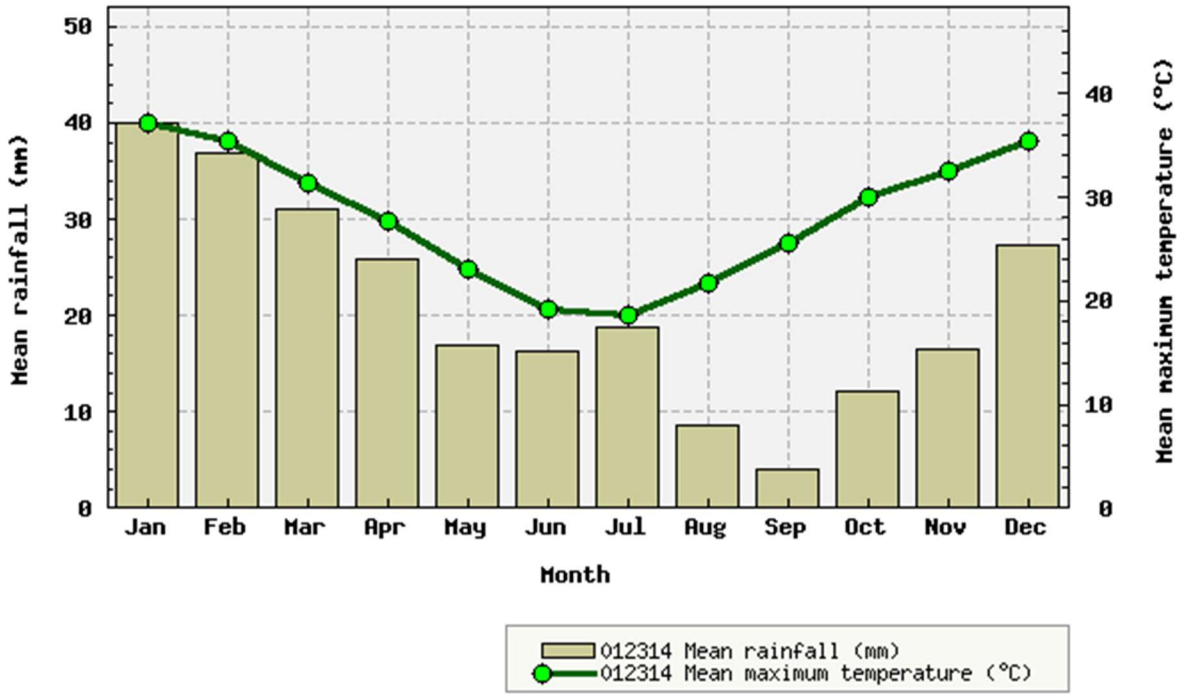

Figure 1: Average rainfall and maximum temperature for Leinster Airport 1994 – 2017

9. Risk assessment

9.1 Determination of emission, pathway and receptor

In undertaking its risk assessment, DWER will identify all potential emissions pathways and potential receptors to establish whether there is a Risk Event which requires detailed risk assessment.

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. Where there is no actual or likely pathway and/or no receptor, the emission will be screened out and will not be considered as a Risk Event. In addition, where an emission has an actual or likely pathway and a receptor which may be adversely impacted, but that emission is regulated through other mechanisms such as Part IV of the EP Act, that emission will not be risk assessed further and will be screened out through Table 11.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Table 11 below.

Table 11: Identification of emissions, pathway and receptors during dewatering operations

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
Category 6: Mine dewatering: **Initial draining of Cosmos pit and underground**	Abstraction resulting in drawdown of groundwater levels	None	Groundwater dependent ecosystems, subterranean fauna	Abstraction of groundwater	Reduction in groundwater availability for dependent flora/ fauna values	No	Not within scope of Part V of the EP Act. Regulated under the RIWI Act
	Discharge to WMPs	Seepage, hypersaline water to groundwater	Native vegetation within area of influence of WMPs. Groundwater	Direct discharge	Groundwater mounding	Yes	See Section 8.4
					Groundwater contamination	No	Groundwater quality is poor (hypersaline) with no beneficial uses
	Dewatering pipeline	Rupture of pipeline causing hypersaline water discharge to land	Soil and vegetation adjacent to pipeline alignment		Soil contamination inhibiting vegetation growth and survival	Yes	See Section 8.5
Category 6: Mine dewatering: **Dewatering operations during mining**	Abstraction resulting in drawdown of groundwater levels	None	Groundwater dependent vegetation, subterranean fauna	Abstraction of groundwater	Reduction in groundwater availability for dependent flora/ fauna values	No	Not within scope of Part V of the EP Act. Regulated under the RIWI Act
	Discharge to WMPs	Seepage, hypersaline water to groundwater	Groundwater and native vegetation within area of influence of WMPs	Direct discharge	Groundwater mounding	Yes	See Section 8.4
					Groundwater contamination	No	Groundwater quality is poor (hypersaline) with no beneficial uses
	Dewatering pipeline	Rupture of pipeline causing hypersaline water discharge to land	Native vegetation adjacent to pipeline alignment		Soil contamination inhibiting vegetation growth and survival	Yes	See Section 8.5
	Orleans Pit, WMPs overtopping	Overtopping causing hypersaline water discharge to land	Native vegetation adjacent to pit/WMPs		Soil contamination inhibiting vegetation growth and survival	Yes	

9.2 Consequence and likelihood of risk events

A risk rating will be determined for risk events in accordance with the risk rating matrix set out in Table 12 below.

Table 12: Risk rating matrix

Likelihood	Consequence				
	Slight	Minor	Moderate	Major	Severe
Almost certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Medium	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

DWER will undertake an assessment of the consequence and likelihood of the Risk Event in accordance with Table 13 below.

Table 13: Risk criteria table

Likelihood		**Consequence**		
The following criteria has been used to determine the likelihood of the Risk Event occurring.		**The following criteria has been used to determine the consequences of a Risk Event occurring:**		
			Environment	**Public health* and amenity (such as air and water quality, noise, and odour)**
Almost Certain	The risk event is expected to occur in most circumstances	Severe	• **onsite impacts**: catastrophic • **offsite impacts local scale**: high level or above • **offsite impacts wider scale:** mid-level or above • Mid to long-term or permanent impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are significantly exceeded	• Loss of life • **Adverse health effects:** high level or ongoing medical treatment • Specific Consequence Criteria (for public health) are significantly exceeded • **Local scale impacts:** permanent loss of amenity
Likely	The risk event will probably occur in most circumstances	Major	• **onsite impacts**: high level • **offsite impacts local scale**: mid-level • **offsite impacts wider scale**: low level • Short-term impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are exceeded	• **Adverse health effects:** mid-level or frequent medical treatment • Specific Consequence Criteria (for public health) are exceeded • **Local scale impacts**: high level impact to amenity
Possible	The risk event could occur at some time	Moderate	• **onsite impacts**: mid-level • **offsite impacts local scale**: low level • **offsite impacts wider scale**: minimal • Specific Consequence Criteria (for environment) are at risk of not being met	• **Adverse health effects:** low level or occasional medical treatment • Specific Consequence Criteria (for public health) are at risk of not being met • **Local scale impacts:** mid-level impact to amenity
Unlikely	The risk event will probably not occur in most circumstances	Minor	• **onsite impacts**: low level • **offsite impacts local scale**: minimal • **offsite impacts wider scale**: not detectable • Specific Consequence Criteria (for environment) likely to be met	• Specific Consequence Criteria (for public health) are likely to be met • **Local scale impacts:** low level impact to amenity
Rare	The risk event may only occur in exceptional circumstances	Slight	• **onsite impact**: minimal • Specific Consequence Criteria (for environment) met	• **Local scale**: minimal to amenity • Specific Consequence Criteria (for public health) met

^ Determination of areas of high conservation value or special significance should be informed by the *Guidance Statement: Environmental Siting.*

* In applying public health criteria, DWER may have regard to the Department of Health's *Health Risk Assessment (Scoping) Guidelines.*

"onsite" means within the Prescribed Premises boundary.

9.3 Acceptability and treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk treatment in Table 14 below:

Table 14: Risk treatment table

Rating of Risk Event	Acceptability	Treatment
Extreme	Unacceptable.	Risk Event will not be tolerated. DWER may refuse application.
High	May be acceptable. Subject to multiple regulatory controls.	Risk Event may be tolerated and may be subject to multiple regulatory controls. This may include both outcome-based and management conditions.
Medium	Acceptable, generally subject to regulatory controls.	Risk Event is tolerable and is likely to be subject to some regulatory controls. A preference for outcome-based conditions where practical and appropriate will be applied.
Low	Acceptable, generally not controlled.	Risk Event is acceptable and will generally not be subject to regulatory controls.

9.4 Risk Assessment – Groundwater mounding

9.4.1 Description of risk event

Seepage or leakage of hypersaline water from the water management ponds through the base of the pond to groundwater, causing adverse health effects to native vegetation from a rising saline water table.

9.4.2 Identification and general characterisation of emission

The predictive groundwater modelling simulation indicates that seepage during the operational phase will result in groundwater level mounding, particularly in areas where higher permeability conditions have been identified:

- Groundwater levels could rise to within 4 m of ground surface around WMP's 6 to 8 and around the TSF (seepage ~1,000 mm/yr);
- Groundwater levels are predicted to increase to levels close to ground surface (i.e. within 4 m) at bores located close to the TSF, bores located within the higher permeability area south-west of WMP6, and bores located within the alluvial channel deposits south of WMP7 and east of the TSF;
- Groundwater levels are predicted to reach the ground surface at bores next to the toe of the TSF and on the south-western toe of WMP7; and
- Mounding of groundwater levels in bores south of the water management ponds and TSF are predicted to be influenced (i.e. offset) by groundwater drawdown.

Seepage from previous operation of the water management ponds has caused localised groundwater mounding in the north, around WMP6 & WMP7 and in the northern part of the TSF. In a number of monitoring bores, groundwater levels have risen to within 6 m of the ground surface, exceeding the performance target set in previous Part V licences.

The most severe impacts were observed at WMP7 and east of the TSF in an area known to have high permeabilities, possibly associated with an alluvial channel that is thought to underlie the south-eastern corner of WMP7 and extending southwards paralleling the eastern boundary of WMP1 – WMP5.

High salinity groundwater plumes will develop around the water management ponds and TSF in response to seepage impacts. Available monitoring data indicates the salinity of water stored ranges from 90,000 to 300,000 mg/L Total Dissolved Solids (TDS), with a mean

concentration of 220,000 mg/L TDS. This compares with the natural groundwater salinity which ranges from 900 to 3,000 mg/L TDS.

9.4.3 Description of potential adverse impact from the emission

Rising groundwater levels may adversely affect native vegetation within the mounding zone of influence through 1) saturation of the root zone, and 2) accumulation of salts within the root zone. Impacts resulting from this may lead to:

- Decline of plant health;
- Plant death;
- Significant alteration beyond natural variation to the vegetation community; and/or
- Death of keystone plant species.

9.4.4 Criteria for assessment

In the absence of site-specific hydrogeological assessment that identifies the vegetation type occurring within the water management pond and TSF mounding impact zone and expected root zone depths for those vegetation species, the Delegated Officer has determined to adopt a conservative approach in assessing the potential impacts from groundwater mounding at the site. The approach is based on DWER's experience in regulating the impacts of mounding of saline groundwater from gold and nickel mining operations in the region, whereby a maximum 4 mbgl separation is imposed to protect the root zone of native vegetation typical of the Northern Goldfields.

9.4.5 Licence Holder controls

The main control proposed by the Licence Holder to manage seepage and groundwater mounding is groundwater recovery using the existing recovery bore network and trenches.

Predictive simulations over the operational phase incorporating recovery bores indicates a total recovery pumping rate of about 310 m^3/d (3.6 L/s) is required to maintain groundwater depths ≥ 6 mbgl.

The simulated recovery bore locations include the existing recovery bore network, expanded to include additional bores on the western side of the TSF and around WMP8. The final locations of new recovery bores will be determined based on future monitoring results where these identify rising groundwater levels above the management trigger level (6 mbgl).

A summary of the controls is set out in Table 15 below.

Table 15: Licence Holder's proposed controls for groundwater mounding

Aspect	Control
Receptor Management Strategy	Discharge will be distributed based upon a set of priority comprising (from highest to lowest): Orleans pit, WMP1, 2, 3, 4, 5, the Waste Dump Dam, WMP6, 7, 8, 9. This sequence is selected to minimise the use of WMP6 and 7, which are known the be prone to seepage and mounding
	Monitoring bore network comprising 22 bores installed around the WMPs and TSF to measure groundwater depths
Groundwater Management Plan	Use of existing recovery bore network where SWL reaches 6 mbgl
	Installation of additional recovery bores (RB27 – RB30) located adjacent to the proposed WMP design
	Rotation of discharge points to control mounding
	A trigger depth of 6 m to identify unacceptable impacts when action is required
Contingency	If the groundwater monitoring indicates unacceptable impacts: - Undertake an investigation to establish the likely cause of the impacts

	and assess the options available to mitigate against the impact; - In the event of an exceedance of the 6 m trigger, undertake a review of the groundwater flow model to identify appropriate remedial actions, including a revision of the recovery bore abstraction rates; - Implement the remedial action and report on its effectiveness in the annual groundwater monitoring report and AER; and - Should the remedial actions provide ineffective in addressing the problem, then discharge to the receptor will be suspended until alternative solutions can be found and implemented.

9.4.6 Key findings

The Delegated Officer has reviewed the information regarding the risk of groundwater mounding and has found:

1. The magnitude of groundwater mounding that has been simulated near the water management ponds by modelling is considered to be plausible, and active management interventions are required in some parts of the mine site to effectively protect native vegetation from the effects of a rising saline water table.
2. The management interventions proposed by the Licence Holder appear to rely solely on a groundwater recovery scheme to control the level of mounding caused by seepage from the ponds.
3. The *Applicant Groundwater Modelling Report* indicates that a total abstraction rate of about 4 L/s is required; however there are potentially a number of practical difficulties in implementing this strategy (i.e. to maintain the required abstraction rate of 4 L/s), and that the salinity of water in the Cosmos pit may increase more rapidly over time than predicted by the model.

9.4.7 Consequence

If groundwater mounding of hypersaline groundwater extends to within 4 mbgl in the area of influence around the water management ponds, then the Delegated Officer has determined that the impact on native vegetation will be a high level of on-site impacts, particularly if it results in significant alteration beyond natural variation to the vegetation community and/or death of keystone plant species. Therefore, the Delegated Officer considers the consequence of groundwater mounding to be **Major**.

9.4.8 Likelihood of Risk Event

The Delegated Officer has determined that the likelihood of impacts to native vegetation from the effects of a rising saline water table could possibly occur at some time. Therefore, the Delegated Officer considers the likelihood of impacts to native vegetation from groundwater mounding to be **Possible**.

9.4.9 Overall rating of groundwater mounding

The Delegated Officer has compared the consequence and likelihood ratings described above with the Risk Rating Matrix and determined that the overall rating for the risk of groundwater mounding is **High**.

9.5 Risk Assessment – Dewatering pipeline failure

9.5.1 Description of risk event

Spills or leaks of hypersaline water from the Cosmos mine pit/water management ponds through pipeline ruptures/overtopping to the ground, causing adverse health effects to native vegetation from soil salinisation.

9.5.2 Identification and general characterisation of emission

Dewatering will be required initially to remove approximately 1.4 GL of water currently held in storage in the Cosmos pit and underground, and then throughout the duration of the life-of-mine to maintain dry conditions during underground mining.

Mine dewatering will be achieved via a series of underground pumps, pipelines and transfer stations. Pipelines will be a mixture of the existing buried HDPE pipelines that were used during the previous operation, and additional new pipelines where required, such as pipelines to service WMP8. There is approximately 4 km of dual pipelines that run north of the Cosmos pit to the water management ponds, and an additional 5 km of dual pipeline that runs south to the Orleans pit.

As discussed in Section 8.4, available monitoring data indicates the salinity of water stored in the water management ponds ranges from 90,000 to 300,000 mg/L TDS, with a mean concentration of 220,000 mg/L TDS. The water being transferred from the pit and underground to the dewatering discharge infrastructures is therefore hypersaline. (Hypersaline water contains significant concentrations of sodium chloride or other salts, with saline levels surpassing that of ocean water, i.e. ≥50,000 mg/L TDS).

9.5.3 Description of potential adverse impact from the emission

Releases of hypersaline water can impact on surface vegetation (see Section 9.4), salinize soils, increase soil erosion and potentially contaminate local surface waters and groundwaters.

Evidence of environmental impacts from hypersaline water spills have been observed at several mine sites in the Goldfields, where large scale vegetation deaths were evident. DWER has recently prosecuted companies for hypersaline spills that resulted in vegetation deaths at mines in Widgiemooltha and the Chinchester Ranges.

9.5.4 Criteria for assessment

The Australian Water Quality Guidelines for Fresh and Marine Water Quality 2000 (ANZECC & ARMCANZ, 2000) provide freshwater and marine water trigger values at various levels of species protection. These guidelines also apply to livestock drinking water (Volume 1, Chapter 4) which would be the most relevant criteria for this assessment.

9.5.5 Licence Holder controls

To prevent spills of hypersaline water and to protect soil and vegetation, the Licence Holder proposes the following controls:

- Pipelines will be fitted with pressure transmitters at both ends of the pipeline with alarms to indicate variation in flow pressure;
- Pipelines will be located in bunded trenches to contain potential spills;
- Sumps will be constructed at low points (where required) to collect potential spills;
- Daily inspections of the dewatering pipeline network will be conducted;
- Ponds are designed to retain a 1:100 year ARI return period, 72 hour rainfall event above the operational freeboard; and
- Crest of the embankment will be graded inwards to drain water into the WMP and prevent the transport of contaminants to the environment.

9.5.6 Key findings

The Delegated Officer has reviewed the information regarding the risk of pipeline failure/overtopping of containment infrastructure and has found:

1. There is potential for vegetation to be damaged due to release of hypersaline mine water from a pipeline failure, or overtopping of a water management pond.
2. The risk is mitigated by the controls proposed by the Licence Holder.

9.5.7 Consequence

If spills or leaks of hypersaline water from pipelines and/or water management ponds occur, then the Delegated Officer has determined that the impact on native vegetation will be a long-term impact at a local scale, particularly if it results in vegetation deaths or alteration beyond natural variation to the vegetation community. Therefore, the Delegated Officer considers the consequence of groundwater mounding to be **Moderate**.

9.5.8 Likelihood of Risk Event

The Delegated Officer has determined that the likelihood of impacts to native vegetation from the effects of a hypersaline mine water spill could possibly occur at some time. Therefore, the Delegated Officer considers the likelihood of impacts to native vegetation from leaks or spills of hypersaline water to be **Possible**.

9.5.9 Overall rating of dewatering pipeline failure

The Delegated Officer has compared the consequence and likelihood ratings described above with the Risk Rating Matrix and determined that the overall rating for the risk of pipeline ruptures and/or pond overtopping is **Medium**.

9.6 Summary of acceptability and treatment of Risk Events

A summary of the risk assessment and the acceptability or unacceptability of the risk events set out above, with the appropriate treatment and control, are set out in Table 16 below. Controls are described further in section 1.

Table 16: Risk assessment summary

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)	Resulting regulatory controls
	Emission	**Source**	**Pathway/ Receptor (Impact)**				
1.	Groundwater mounding, caused by seepage	WMPs	Seepage through the base of the pond to groundwater causing impacts to native vegetation	Continuous groundwater recovery Rotate discharge points Monitoring of groundwater levels and quality Contingency actions upon reaching trigger values	Major consequence Possible **High risk**	Acceptable subject to proponent controls conditioned and outcomes-based controls	Licence to specify: - Annual water balance to be prepared; - Groundwater action criteria to be imposed on monitoring bores; - Groundwater mounding limit to be imposed; - Contingency measures in place; - Reporting and notification of exceedances; - Assessment of native vegetation condition
2.	Pipeline ruptures, overtopping of containment infrastructure	Dewatering water from Cosmos mine pit	Direct discharge to the environment causing impacts to native vegetation	Pipelines fitted with pressure sensors Secondary containment Daily inspections	Moderate consequence Possible **Medium risk**	Acceptable subject to outcomes-based controls	Licence to specify: - Minimum freeboard requirements on ponds and pits; - Pond embankments to be lined to prevent erosion from wave action; - Daily inspections for freeboard and integrity; - Pipelines to contain telemetry/pressure sensor systems and secondary containment

10. Regulatory controls

A summary of regulatory controls determined to be appropriate for the Risk Event is set out in Table 16. The risks are set out in the assessment in section 9 and the controls are detailed in this section. DWER will determine controls having regard to the adequacy of controls proposed by the Applicant. The conditions of the Licence will be set to give effect to the determined regulatory controls.

10.1 Licence controls

10.1.1 Authorised emissions

A requirement has been imposed (Amended licence condition 1) to specify the authorised location(s) for disposal of mine dewatering water and indirect emissions to groundwater (i.e. seepage).

Note: *The requirements specified in Table 2 of the Licence generally replicate the details provided in the Mining Proposal for the Premises.*

Grounds: *DWER's risk assessment is based on the disposal of dewatering water in locations other than those specified has not been risk assessed, and the defence provisions of s. 74, 74A and 74B would therefore not apply.*

10.1.2 Specified infrastructure and equipment controls

The following environmental controls, infrastructure and equipment should be maintained and operated to manage the risk of impacts to native vegetation from accidental releases, spills or leaks of hypersaline water from pipelines and/or water management ponds (Amended Licence conditions 2 and 3):

- Operational freeboard of 0.5 m vertical distance on the last ponds (WMP5, WMP7 and WMPs 8 & 9 (Cell C)) and 2.0 m vertical distance below the lowest crest level at Orleans pit to be maintained at all times;
- WMP embankments to be lined with HDPE to prevent erosion of the batters from wave action during operation;
- Daily inspections of freeboard capacity and pipelines for visual integrity and leak assessment to be conducted, to enable early detection and proactive management; and
- Installation of industry standard safeguards for all pipelines carrying hypersaline water, such as the use of automatic cut-outs, secondary containment, or telemetry and pressure sensors to allow detection of leaks and failures.

Note: *The requirements specified above generally replicate the controls proposed by the Licence Holder in the documents submitted for assessment, and were considered by the Delegated Officer in determining the risk of impacts to native vegetation from accidental releases, spills or leaks of hypersaline mine water.*

Grounds: *A review of the water balance model for the Premises indicates there is a risk the evaporation rate has been over-estimated, which may result in the volume of water requiring disposal exceeding the capacity of the available discharge infrastructure. The Delegated Officer therefore considers the risk of overtopping to require a high level of control.*

Operational freeboard requirements, the use of safeguards for pipelines containing materials that could otherwise pose a risk to the environment, and conducting daily inspections of pipelines and containment infrastructure have been considered necessary by the Delegated Officer to minimise the risk of accidental releases, spills or leaks of hypersaline mine water from pipelines and/or overtopping of the water management ponds.

The Delegated Officer considers the freeboard requirement of 300 mm on the water management ponds, as specified on the previous licence, to be insufficient to mitigate

potential overflow from wave action and storm events. A 500 mm freeboard is consistent with updated tenement conditions approved by DMIRS.

10.1.3 Specified actions

The following actions have been specified to limit the extent of groundwater mounding caused by seepage from the water management ponds (Amended Licence conditions 4, 10 11, 12 and 13):

- Preparation of an annual water balance, utilising data gathered under other conditions of the licence, to demonstrate the volume of mine water abstracted, where it has been discharged, and incorporating site-specific rainfall and evaporation data;
- A groundwater action criteria has been specified for all bores as part of the ambient groundwater monitoring suite (Condition 9), where upon monitoring results indicating the standing water level has exceeded 6 mbgl, an investigation is conducted to determine the likely cause of the exceedance and assess the available options to mitigate the impact;
- Undertake a review of the groundwater flow model to identify remedial actions, including a revision of the recovery bore abstraction rates;
- Implement the remedial action(s);
- A contingency measure where all discharges to the location are suspended should the remedial actions taken be ineffective, until an alternative solution is found and implemented;
- A groundwater level limit of 4 mbgl has been specified for all bores, and is not be exceeded; and
- Notify the CEO of an exceedance of the groundwater level limit.

Note: *The requirements specified above generally replicate the management measures proposed by the Licence Holder in the 'Receptor Management Strategy' of the Water Management Plan for the Premises, which includes distributing discharge of mine water upon a set priority to minimise the use of WMP6 and WMP7 (which are known to be prone to seepage and mounding).*

The Delegated Officer has considered the implementation of this strategy in determining the risk of groundwater mounding caused by seepage from the water management ponds, and considers WMP6 and WMP7 should be phased out over time by the Licence Holder as a primary discharge location.

Grounds: *A key finding of the groundwater mounding risk assessment is there may be a number of constraints on implementing the proposed groundwater recovery strategy at the site, and that more recovery bores may be required in order to maintain the target abstraction rate of 4 L/s. The Delegated Officer therefore considers this to increase the risk of groundwater mounding and a higher level of control is required.*

The groundwater modelling results indicate that seepage from the water management ponds will result in groundwater level mounding, particularly in areas where higher permeability conditions have been identified, i.e. WMP6 and WMP7. This is consistent with previous operation of the water management ponds, which required continuous operation of a groundwater recovery system to minimise the impacts from seepage. The Delegated Officer notes there were continued exceedances of the 6 mbgl target despite operation of the recovery system.

The Delegated Officer has considered the management strategy proposed by the Licence Holder and has determined to impose outcome-based conditions (i.e. groundwater level action criteria, groundwater level limit) opposed to prescribing specifics of the groundwater recovery system through the licence. The groundwater action criterion of 6 mbgl and the groundwater limit of 4 mbgl are conservative figures that have been imposed in the absence of site-specific information on root zone depths. These figures are based on DWER observations in

protecting shallow rooted native vegetation of the Murchison bioregion. Reporting to the CEO on a quarterly basis a summary of exceedances of the action criteria provides DWER with a mechanism to be informed of issues and to respond within a shorter timeframe than if the summary was reported annually. The requirement to investigate the cause of an exceedance and document remedial actions will provide assurance that proactive management is being undertaken.

The Delegated Officer notes the Licence Holder is actively investigating additional disposal options (most likely another mine pit, or construction of a new, ninth water management pond). However the option of reducing the dewatering rate, which will impact upon the project timing, may be considered should the risk of groundwater mounding become unacceptable.

10.1.4 Emission monitoring and reporting

Conditions requiring monitoring of the mine water discharge have been included in the Amended Licence (Conditions 5, 6, 7 and 8):

- Specifying the minimum monitoring requirements, i.e. the minimum requirements for sampling and analysis, minimum timeframes for sampling frequency and calibration requirements for instruments used by the Licence Holder (Conditions 5, 6 and 7 - also applies to ambient environmental monitoring, see Section 10.1.5);
- Monitoring of the mine water being discharged from the Cosmos pit, volume and quality (physical parameters and major ions);
- Monitoring of the mine water discharged to the discharge infrastructure, volume and quality (physical parameters, metals and metalloids, cyanide); and
- Submission of the monitoring results on an annual basis to the CEO.

Note: *The requirements specified above generally replicate the monitoring strategy proposed by the Licence Holder, and were considered by the Delegated Officer in determining the risk of impacts from dewatering activities.*

Grounds: *Monitoring of the mine water discharge is required for the purpose of informing the Delegated Officer of the quantity and quality of mine water being discharged, and for comparison to ambient (background) levels as a source, to enable potential contamination plumes to be defined with a greater level of confidence*.

10.1.5 Ambient environmental monitoring and reporting

Monitoring of local ambient groundwater conditions has been specified in the Amended Licence (Condition 9):

- Monitoring of specified bores in the vicinity of the water management ponds for mounding impacts, including weekly sampling of the standing water level, and annual sampling of water quality (physical parameters and metals);
- Monitoring of specified bores in the vicinity of the TSF for mounding and water quality impacts, including monthly sampling of the standing water level, and quarterly sampling of water quality;
- An annual assessment of native vegetation within the mounding zone of influence of the water management ponds; and
- Annual submission of the monitoring data and vegetation assessment to the CEO.

Note: *The requirements specified above generally replicate the controls proposed by the Licence Holder in the Application, and were considered by the Delegated Officer in determining the risk of impacts from groundwater mounding.*

Grounds: *Groundwater monitoring during the previous operation indicates excessive levels of seepage and groundwater mounding in some parts of the mine, requiring implementation of an active groundwater recovery strategy to limit the extent of mounding to protect native vegetation from the effects of a rising saline water table. The Licence Holder has proposed the same approach in managing the ponds.*

In view of this, together with the risk of the volume of mine water exceeding the capacity of the available discharge infrastructure, the Delegated Officer considers the risk of groundwater mounding to require a high level of control.

The Delegated Officer has therefore determined that monitoring of ambient groundwater conditions is critical for providing assurance over the effectiveness of the groundwater management strategy at the site. This includes weekly monitoring of the standing water level in bores in proximity to the water management ponds (monthly in bores in the vicinity of the TSF), which will enable early detection and proactive management of changes to water table levels and groundwater quality caused by seepage from the water management ponds.

An assessment of native vegetation within the mounding zone of influence of the water management ponds has also been deemed necessary by the Delegated Officer, in order to monitor potential changes in the condition of native vegetation that may be attributed to groundwater mounding on the site. The assessment must be conducted during the principal growing season (August to November) by a suitably qualified botanist. The Delegated Officer expects the botanist to be experienced in flora of the Murchison IBRA region.

10.1.6 Record-keeping

A number of conditions have been applied to the Amended Licence (Conditions 14 – 20) to prescribe the minimum record keeping requirements. They relate to the standards for book-keeping, the requirement to implement a suitable complaints management procedure, the requirement to submit an annual Compliance Report and an annual environmental report, and the requirement to produce records to the CEO upon request.

Grounds: *The requirements specified above are necessary to demonstrate compliance with other requirements of the Amended Licence.*

11. Determination of Licence conditions

The conditions in the issued Licence in Attachment 1 have been determined in accordance with the *Guidance Statement: Setting Conditions*.

The *Guidance Statement: Licence Duration* has been applied and the issued licence expiry has been set to align with expiry of tenement M36/371 (03/03/2020).

12. Applicant's comments

The Applicant was provided with the draft Decision Report and draft Amended Licence on 10 January 2019 and made no additional comments.

13. Conclusion

This assessment of the risks of activities on the Premises has been undertaken with due consideration of a number of factors, including the key documents and policies specified in this Decision Report (summarised in Appendix 1).

Based on this assessment, it has been determined that the Amended Licence will be granted subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

Tim Gentle
MANAGER RESOURCE INDUSTRIES
Delegated Officer
under section 20 of the *Environmental Protection Act 1986* (WA)

Appendix 1: Key documents

	Document title	In text ref	Availability
1.	Clark Lindbeck and Associates (December 2016) *Cosmos Nickel Project: Operating Licence Amendment Supporting Document*. Prepared for Australian Nickel Investments	Clark Lindbeck, 2016	DWER records
2.	Groundwater Resource Management (November 2016) *Cosmos Nickel Operation: Water Management Plan*. Report prepared for Western Areas Ltd	GRM, 2016a	DWER records (A1340061)
3.	Groundwater Resource Management (December 2016) *Cosmos Nickel Operation: Water Management Pond Groundwater Modelling*. Report prepared for Western Areas Ltd	GRM, 2016b	DWER records (A1340056)
4.	Groundwater Resource Management (December 2016). Memo: *Cosmos Nickel Water Balance Update*. Memo prepared for Western Areas Ltd	GRM, 2016c	DWER records (A1340058)
5.	Golder Associates (December 2016) *Cosmos Nickel Project: Technical documentation in support of a mining proposal application for construction of water management pond 8*. Report prepared for Western Areas Ltd	Golder Associates, 2016	DWER records (A1744788)
6.	Coffey Services Australia Pty Ltd (November 2016). *Cosmos Nickel Project – 2016 Annual Audit and Review of Tailings Storage Facility*. Report prepared for Western Areas Ltd	Coffey, 2016	DWER records (A1744791)
7.	Clark Lindbeck and Associates (July 2017). *Construction and Operation of Water Management Pond 9*. Report prepared for Australia Nickel Investments Pty Ltd	Clark Lindbeck, 2017	DWER records (A1518882)
8.	DWER Technical Advice: Cosmos Nickel Project – Management of pit dewatering and the disposal of hypersaline water (May 2017)	DER, 2017	DWER internal records
9.	Climate Data Online, Bureau of Meteorology. Leinster Airport 1994 – 2017	BOM, 2017	accessed at: www.bom.gov.au/climate/data
10.	ANZECC & ARMCANZ (2000), Australian and New Zealand Guidelines of Fresh and Marine Water Quality	ANZECC, 2000	accessed at: www.environment.gov.au
11.	Strategen, December 2016. *Cosmos Nickel Project – Mine Closure Plan*. Plan prepared for Western Areas Limited	Strategen, 2016	accessed at: minedexext.dmp.wa.gov.au
12.	Levy, D.B., 2012. Predicting the effects of hypersalinity on evaporation rate and water quality in surface impoundments. *Proceedings of the Tailings and Mine Waste Conference, Keystone, Colorado, 14-17 October 2012*.	Levy, 2012	accessed at: http://www.axis-geochemical.com/uploads/3/7/7/1/3771458/1_surface_impoundment_hypersalinity_2012.pdf
13.	DMP, May 2015. *Guidelines for Preparing Mine*	DMP, 2015a	accessed at:

	Closure Plans. Department of Mines and Petroleum, Perth.		www.dmp.wa.gov.au
14.	DMP, October 2015. *Mining Act Guidelines – Basic Provisions*. Department of Mines and Petroleum, Perth.	DMP, 2015b	
15.	Department of Water (February 2006) *Water Quality Protection Note 30: Groundwater monitoring bores*	DoW, 2006	accessed at: www.dwer.wa.gov.au
16.	DER, July 2015. *Guidance Statement: Regulatory principles.* Department of Environment Regulation, Perth.	DER, 2015a	
17.	DER, October 2015. *Guidance Statement: Setting Conditions.* Department of Environment Regulation, Perth.	DER, 2015b	
18.	DER, November 2016. *Guidance Statement: Environmental Siting*. Department of Environment Regulation, Perth.	DER, 2016	
19.	DER, February 2017. *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth.	DER, 2017a	
20.	DER, February 2017. *Guidance Statement: Decision Making*. Department of Environment Regulation, Perth.	DER, 2017b	

Attachment 1: Amended Licence L7404