



## Application for Works Approval

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

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**Works Approval Number** W6882/2024/1

**Applicant** BHP Nickel West Pty Ltd

**ACN** 004 184 598

**File number** DWER2024/000002

**Premises**

1. Kwinana Nickel Refinery  
Lot 89 on Deposited Plan 411084  
Patterson Road KWINANA BEACH WA 6167  
Certificate of Title Volume 2958 Folio 292
2. Baldivis Facility  
Lot 820 on Plan 77252  
Miller Road BALDIVIS WA 6171  
Certificate of Title Volume 2841 Folio 582

**Date of report** 12/06/2024

**Decision** Works approval granted

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## 1. Decision summary

This decision report documents the assessment of potential risks to the environment and public health from emissions and discharges during the construction works required to empty and reline Evaporation Cells (EC) EC 1, EC 2 and EC 3 at the Baldvis Facility portion of the premises. This includes a review of the regulatory controls applied to the ongoing operation of EC1, EC2 and EC 3 as provided for in Licence L8437/2010/3. As a result of this assessment, works approval W6882/2024/1 has been granted.

## 2. Scope of assessment

### 2.1 Regulatory framework

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

### 2.2 Application summary and overview of premises

On 29 December 2023, the applicant submitted an application for a works approval to the department under section 54 of the *Environmental Protection Act 1986* (EP Act).

The application is for the approval to reline the 3 process effluent ponds: Evaporation Cell (EC) 1, EC 2 and EC 3, while continuing to operate the refinery and while continuing to utilise these ponds for wastewater storage, evaporation and recycling back into the refinery.

In order to achieve this outcome, without causing a loss of process liquor holding capacity at the premises during the relining process, a staged balancing and removal of process liquor and process solids from each cell will occur. This will allow each evaporation cell a period of being out of service while the emptying and relining works are undertaken. To support this activity, BHP Nickel West Pty Ltd (the occupier) has undertaken to construct two chlorine brine storage tanks at the Kwinana Refinery to allow for storage of up to 110ML of process liquor (Works Approval W6788/2023/1) to accommodate the volumetric requirements of standard operating conditions. These tanks of 70 ML and 40 ML respectively allow sufficient additional capacity to carry out these works and also allow for containment of an unplanned process upset, should one occur. The largest pond EC3 has a capacity of approximately 100ML and the works contained within this approval are dependent and conditional upon the works under W6788/2023/1 being completed to the prescribed standards.

This application assesses:

- The emptying of liquor from EC1, EC2, EC3 and movement of liquor between EC ponds and the chlorine brine tanks at the Kwinana Refinery portion of the facility;
- Construction of an impermeable solids processing and drying pad at the Baldvis portion of the premises;
- Removal of solids from the existing ECs via a water based scouring system;
- Establishment of a solids screening area on the solids processing pad to remove crystalline nickel ammonium sulphate salts from the solid waste stream, which will be dried and transported back to the Kwinana Nickel Refinery for storage and or reprocessing
- The remaining solids will be temporarily stored in adjacent EC's and disposed of at a licenced waste facility prior at the completion of the Project.

- Establishment of a temporary contaminated materials lay down area and ancillary earth works
- Removal of existing liner system: primary liner, geonet and secondary liner;
- Installation of new dual liner system within EC1, EC2 and EC3 and connection to existing leak detection system and replacement of balance pipes
- Commissioning of EC1, EC2 and EC3
- Construction of 2-3 monitoring /recovery bores

## 2.3 Background

The Kwinana Nickel Refinery premises is separated into two main operational areas the Kwinana Nickel Refinery which is the primary prescribed category activities area, and the Baldvis Facility, a parcel of land which is 5.5km south-east of the Kwinana Nickel Refinery portion of the premises and contains a closed ammonia sulphate residue tailings storage facility (TSF), and three wastewater Evaporation Cells (EC), a staging pond tanks and a pumping station to support the return flow back to the refinery.

These two areas are joined by a utilities corridor where wastewater is conveyed between the refinery to the evaporation ponds; and contains necessary associated L8437/2010/3 (Date of Amendment 26/10/2022) infrastructure such as pumps and electrical line that support the conveyance of wastewater.

Wastewater is generated at the Kwinana Nickel Refinery as a biproduct of the nickel refining processes including leaching of nickel matte, copper boiling, nickel reduction, cobalt recovery, ammonium sulphate recovery and from the wastewater treatment plant that recycles water back into process operations at the refinery. Surplus effluents are volumetrically reduced through evaporation at the Baldvis Facility. These wastewaters are held in evaporation ponds 2 and 3 (EC 2 and EC 3 respectively).

The process effluent going into the ponds has extremely high total dissolved solids, which includes very high levels of ammonium sulphate, a range of metals including high levels of nickel, heavy metals such as copper and cobalt; and metalloids such as boron and silica. At very high concentrations ammonia sulphate can kill vegetation, acidify soils and mobilise soluble aluminium, reducing the availability of cations in the soil which can impact on the chemical and physical structure and function of soil. The metals and metalloid compounds in the effluent such as nickel, cobalt and copper and known to be toxic to aquatic freshwater and marine biota.

The application is to undertake construction works relating to the management of liquid wastes derived from Category 44: metal smelting or refining; Category 34: Oil or gas refining; and Category 31 Chemical manufacturing activities at the Baldvis portion of the premises. The premises is approximately 6km southeast of the Kwinana Nickel refinery portion of the premises. The infrastructure and equipment relating to the works activities has been considered in line with *Guideline: Risk Assessments* (DWER 2020) and are outlined in works approval W6882/2024/1.

### 2.3.1 Summary of current instruments

The refinery operates under *Environmental Protection Act* (EP Act) 1986 Licence L8437/2010/3. The premises is also undertaking construction works at the premises under three separate Works Approvals:

- W6117/2018/1 for construction of a powder leach nickel sulphate plant
- W6275/2019/1 for debottlenecking of production to increase production from 75ktpa to 90 ktpa

- W6788/2023/1 for the construction of two chlorine brine storage tanks
- W6882/2024/1 the current application to reline the evaporation cell ponds at the Baldivis Facility.

### 2.3.2 Recent amendment to Licence L8437/2010/3: Baldivis facility evaporation ponds

During 2022 the Kwinana Nickel Refinery Licence made application to amend Licence L8437/2010/3 to allow for the installation of evaporation units (Pitt- Boss) and evaporation Sprinklers on all three evaporation ponds (EC1, EC2 and EC3) (amendment date 26/10/2022). At the time of application, the Licence Holder advised that wastewater levels contained within the evaporation cells has been higher than anticipated over recent years on account of periods of high rainfall coinciding with “process upsets” which result in significant volumes of excess wastewater being disposed of within the wastewater pond system.

As part of the application a range of parameters were investigated including the integrity of the liners (condition 42).

### 2.3.3 Pond liner integrity assessment

On the 3 March 2023 DWER received correspondence from BHP Nickel West Pty Ltd in relation to Condition 42 (above) (DWER document DWERDT745550).:

1. Liner Integrity Assessment Technical Memorandum (Baldivis *Evaporation Cells – Primary Liner Assessment* (Golder, 2021)
2. *Report on Condition of Monitoring of Residual Lifetime Assessment of HDPE Geomembrane Liners* (Golder and Associates, 2021)
3. *Report on Condition of Monitoring of Residual Lifetime Assessment of LLDPE Geomembrane Liners* (Golder and Associates, 2021)

The report into the estimated residual lifespan of the *primary pond liner* which is a high density polyethylene (HDPE) liner with a nominal thickness of 2mm (see reference # 2. above) gave an estimated residual lifetime of 1-2 years based on the selection of 18 samples taken from anchor trenches, crests and internal slopes to not cause destruction of the liner. The samples were taken across all three EC ponds and 9 were submitted for testing. The results indicated that the primary liner which had been in service 28 years at the time the testing had an estimated maximum life of 1-2 years. Based on this information, the consultants for the liner integrity assessment provided a recommendation to the occupier to test the secondary liner as well (see technical memorandum as reference #1 above). It is noted that in between the primary and secondary liner is an underdrainage geonet system for the recovery of seepage.

The secondary liner, a geomembrane liner of 0.75mm thickness, was subsequently subject to a series of tests to determine the residual lifetime of the liner. This liner was also installed 28 years from the time of testing (which occurred in 2021) and it was determined that this liner, based on the samples subject to testing, was between 5-7 years; or 2-4 years from the current time. The samples taken were reported to have been sampled on or around July 2021. This information is provided in correspondence marked #3 above.

The occupier advised that the geo net underdrainage layer between the primary and secondary liner was working adequately and was sufficient to manage any seepage through the liner in the short term, and to enable construction works to be undertaken.

## 2.4 Proposed Works

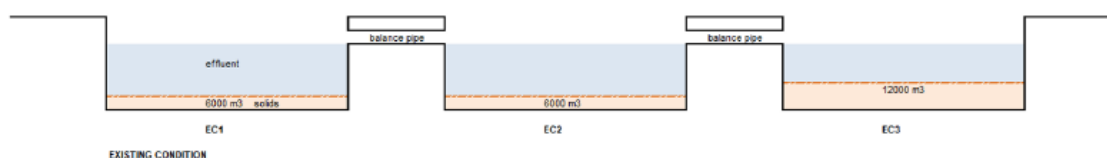
The construction works proposed to be undertaken as part of this works approval will be undertaken in a staged manner to enable the refinery to continue normal operations while undertaking the liner replacement works. To minimise discharges occurring from the works, each pond will be emptied and relined over the subsequent three summer periods, when rainfall is typically less, and where stormwater ingress and contamination with solids is less likely to occur.

### 2.4.1 Preparatory works

Prior to the relining works commencing, a series of enabling or preparatory works are listed below:

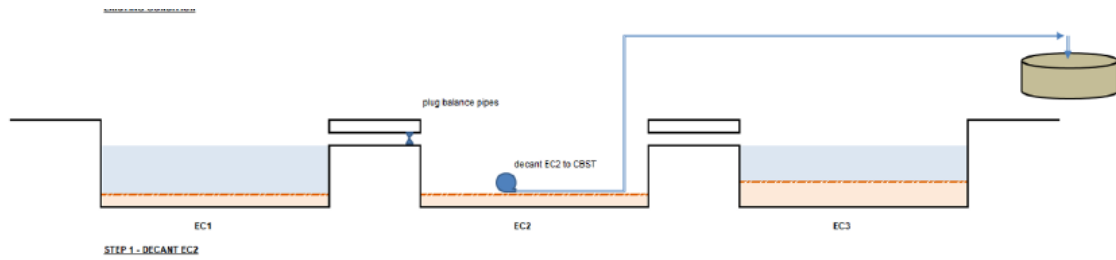
- Temporarily seal balance pipes;
- Construct an impermeable laydown area;
- Construct 3 x new monitoring/recovery bores in case of breach of liner;
- Removed nickel ammonium sulphate crystal layer from the top of the solids in the pond, screen these and dry them on the hard stand area prior to transport back to the refinery for storage and/or reprocessing;
- Remove solids and liquids from the Evaporation Ponds EC 1, EC 2 and EC 3;
- Isolation and removal of other pipework and pumping infrastructure for each pond prior to relining (seepage pipes);
- Reline the ponds, one at a time over three years (summer periods).

Figure 1 below shows that status of the three evaporation ponds prior to commencement of works. The first pond to be relined will be EC1. In order to empty this pond, all the liquor from EC2 will be conveyed to the Chlorine Brine Tanks within the Kwinana Refinery Premises (see Figure 2 below). The liquor from EC3 will also be pumped into the Chlorine Brine Tanks. The solids from EC1 will then be removed using the robotic dredge, initially removing the nickel ammonium sulphate crystalline layer, followed by the solids. The Nickel ammoniums sulphate salts will be relayed onto the lined hardstand area (the laydown area) where they will dried and bagged prior to transport back to the Refinery. The remaining solids will be pumped on into EC3, in the space that is made available by the transference of the liquid to the Chlorine Brine Tanks (see Figure 3 below). The effluent in EC1 will then be conveyed into EC2 leaving EC1 empty as shown in Figure 4 below.



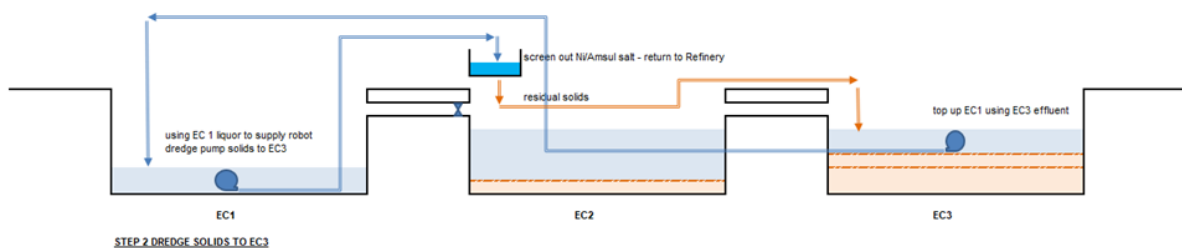
**Figure 1: The existing arrangement of solids and liquor in Evaporation Cells EC1, EC2 and EC3**

*Source: Adapted from Figure 4 Works Approval Application Supplementary Information (BHP NickelWest, 2023).*



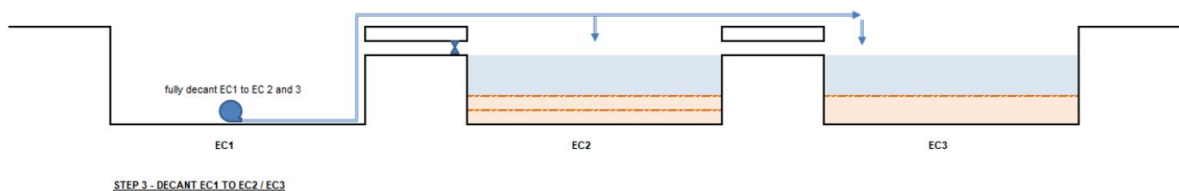
**Figure 2: Shows the isolation of the balance pipe, removal of effluent from EC2 to the chlorine brine tanks at the refinery.**

Source: Adapted from Figure 4 Works Approval Application Supplementary Information (BHP NickelWest, 2023).



**Figure 3: Shows the removal of solids from EC1 into EC3, and the screening and removal of nickel ammonium sulphate salts.**

Source: Adapted from Figure 4 Works Approval Application Supplementary Information (BHP NickelWest, 2023).



**Figure 4: This shows the emptying of liquor from EC1 by transference into EC2.**

Source: Adapted from Figure 4 Works Approval Application Supplementary Information (BHP NickelWest, 2023).

Once EC1 is emptied, the liner will be subject to a final clean. The primary liner, geonet drainage layer and the secondary liner will be removed and disposed of at a licensed waste facility. The substrate will be inspected and tested to ensure it meets the required specifications and reworked if necessary to ensure it is suitable prior to relining.

The residual solids within EC2 will be removed from this pond over a three-month period, dried and taken to a solid waste facility for disposal commencing in June 2024.

This process will repeat for each pond and relining works are anticipated to take effect over 2024-2025 for EC1; 2025-2026 for EC2 and 2026-2027 for EC3. The application states that once EC1 is relined it will be empty, and the effluent EC2 and EC3 will not be pumped back to the Chlorine Brine tanks at the refinery, instead the available space within EC1 will be used to accommodate the liquor.



## 2.4.2 Pond relining Works

The occupier plans to undertake the following works as part of the relining process:

- Roll and inspect the subgrade and assess if any areas are soft and need to be removed and repaired in order to meet the required specifications that allow for loading without causing damage to the liner (as detail in Table 5 of the Works Approval);
- Inspect the embankment stability. The external embankments are not expected to have any issue; there is some concern that the internal or shared embankments may be more vulnerable to destabilization while one pond is empty and adjacent to a filled pond. The factors of safety for the shared embankments do not meet the required factor of safety under saturated conditions and need careful control and monitoring during the works;
- Balance pipes will be replaced with new HDPE pipes and are required to be connected via a concrete batten system;
- Installation of two new outlet pipes for the seepage outlet system to the seepage collection sumps for each cell. These new pipes will be located inside the existing pipes to prevent disturbance to the down slope embankment walls;
- The liners (in ascending order):
  - 2mm thick polyethylene primary liner;
  - Geocomposite drain (flow net with conductive fabric layer that allows for a leak detection from the primary liner);
  - 2mm polyethylene secondary liner; and
  - Geosynthetic Clay Liner (GCL); and
  - subgrade.

The liners are considered critical infrastructure and subject to a rigorous Quality Assurance and Quality Control construction methods as defined by the designers specifications; which are contained within the *Baldivis Evaporation Cells – Relining Engineering and Design: Construction Quality Assurance Plan* (Golder, 2023).

## 2.5 Operational maintenance and surveillance plan

The occupier has identified a number of key risks to the success of the project that may impact on the environment and that could occur during the construction and commissioning phase under the works approval. An Operational, Maintenance and Surveillance Plan (OMSP) has been developed to oversee all of the activities during removal of the existing evaporation cell contents, removal of the existing liners and installation of the new liners, including the loss of containment from EC1, EC2, EC3 and the staging pond at the Baldivis facility during works.

The OMSP outlines key roles and responsibilities, processes and procedures to ensure the safe and efficient storage of process liquor and solids in accordance with design specifications of infrastructure, legislation applicable guidelines, codes of practice and stakeholder expectations. Of particular concern is the increased risk of leaks and discharges occurring during the pond emptying process as the primary liner is already past its predicted life of functionality. The management actions are especially important to mitigate against the risks of shared embankment failure; which has implications for potential loss of life.

### 2.5.1 Leak discharge control measures

The occupier initially provided information to the Department (correspondence date 19 May 2023 DWER document reference DWERDT781153) indicating that the Chlorine Brine Storage Tanks would need to be constructed before the Baldvis Facility ponds could be relined. This would allow to process effluent to be contained during the relining process. The application to reline the ponds acknowledges that the most probable cause of discharges occurring is during the evaporation cell emptying and liner removal stage as the aged liner may be damaged prior to being emptied, allowing the unrestricted seepage of liquor through the damaged liner. The occupier proposes the following controls to mitigate the risks of this happening (as detailed in the OMSP, 2023):

- Continuous monitoring of the seepage collection system;
- Weekly inspection of the evaporation cells liner and embankments for signs of faults or leakage;
- Monthly monitoring of the network groundwater bores surrounding the evaporation cells;
- Establishment of additional groundwater recovery bores down gradient of the evaporation cells, in order to intercept any incursion of evaporation cells liquors to groundwater in the event that a significant failure was to occur;
- Limiting movement and placement of equipment on liners;
- Development of work instructions to detail how repairs are to be undertaken for any leaking or damaged section of the liners (once and if identified);
- Resources to patch and repair liners kept on site in case they are required;
- Visual inspection of leak detection system flow rates to assist with early detection of faults; and
- Assessment of design capacity of current seepage system with a trigger level assigned to trigger action response plan to further investigations and implementation of additional measures to address an increase in seepage rates

*(adapted from correspondence dated 19 May 2023,)*

The existing leachate collection system has recently been upgraded (outside of this works approval) and now has a capacity to contain seepage from the primary liner of up to 3,456m<sup>3</sup> day (Section 3.1.3 Works Approval Application Supplementary Information (BHP Nickel West, 2023)). The base of each cell has two valleys which then have a minimum 1% slope gradient which intercepts and drains seepage to one of two seepage collection pits located along the western edge of each evaporation cell. The leakage is then pumped back pumped back into EC2.

Other measures include flow meters that monitor and measure the movement of effluent and liquors between the Kwinana and Baldvis Facilities; the monitoring of freeboard on EC1, EC2 and EC3 and the use of a water level meter on the staging pond; the monitoring of the phreatic surface in each embankment (5 in the external embankments for the evaporation cells; and 3 in the embankments of the staging pond);

### 2.5.2 Embankment Stability during relining

The occupier acknowledged there is a risk that the draw down of water that proceeds the relining works could cause or contribute to embankment instability if the embankments are saturated during the relining process through sloughing and erosion of the downstream embankment, especially the internal embankments (embankments of EC 2 which are situated in between EC 1 and EC3). For this reason, the relining works will occur during the dry season of the following three summer periods and take approximately 12 weeks to complete.

After removal of the primary and secondary liners (and geonet drainage system that lies between them); the subgrade soils will be inspected by a geotechnical engineer to assess if

areas within the foundation earth layer require repair. It is anticipated that some areas may require excavation, replacement and compaction.

An assessment of embankment stability was undertaken by Golder (2020b) and assessed against the ANCOLD and CDA (2013, 2014) guidelines. The risk of external embankment stability met the factor of safety requirements, however the shared embankments that lie between EC1 and EC2 and between EC2 and EC3 do not meet the minimum required factor of safety while one pond is empty and adjacent to a full pond. The occupier has developed a Trigger Action Response Plan to manage embankment stability. Should these internal embankments breach, the greatest impacts could potentially be a loss of life to staff employed to undertake the works. This risk to life is management under *Work Health and Safety Act 2020* and is not considered in this application. Should an internal embankment collapse, contamination to the subgrade would occur and this is considered in the risk assessment contained within this decision report.

## 2.6 Part IV of the EP Act

Ministerial Statement 377 was issued for the Baldivis Facility in 1995 as it was found the sulphate residue disposal dam was unlined, and a large plume was impacting ground water the site, and nearby surface water resources and impact areas included the Leda Nature Reserve and Lake Cooloongup. Under MS 377 the sulphate residue disposal dam was closed and three evaporation ponds and the staging pond were constructed at the facility. The Baldivis Facility is currently classified as Contaminated - Remediation Required.

On the 4 June 2019 the EPA Compliance Team advised Nickel West that Ministerial Statement 377 no longer applied to the facility and the contamination is now managed under the Contaminated Sites Act 2003. The ponds are now regulated under the Licence L8437/2010/3, although MS 377 is formally to be withdrawn.

## 3. Risk assessment

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

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

### 3.1 Source-pathways and receptors

#### 3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises construction and operation which have been considered in this decision report are detailed in Table 1 below. Table 1 also details the control measures the applicant has proposed to assist in controlling these emissions, where necessary.

**Table 1: Proposed applicant controls**

Emission	Sources	Potential pathways	Proposed controls
<b>Construction-</b>			
Dust	Transport, mixing, compaction of materials for the construction of the lay down area.  Vehicle movements  Dust lift off from dried solid wastes storage and handling prior to offsite disposal  Minor excavation of two sumps to construct the primary liner leakage system  Exposure of pond flow  Stockpiling of pond floor material is excavated  Civil works to create access road (including vegetation clearing)	Air/windborne pathway	<i>Removal of existing pond liners and construction of new pond liners</i>  The Baldivis Evaporation Cell – Relining Engineering and Design: Dust Management Plan (2023) will apply. The controls include: <ul style="list-style-type: none"> <li>• Water truck/cart available at all times to wet down areas prior to planned dust generating activities and when dust is visible</li> <li>• Minimise areas requiring vegetation clearing for access roads</li> <li>• Wet down construction areas prior to works</li> <li>• Cover or stabilize soil stockpiles and/or keep stock pile size small</li> <li>• Limit traffic speed on unsealed road</li> <li>• Monitor weather and adjust work schedule where possible to accommodate more favorable conditions for dust generating activities</li> <li>• If works are to continue during less favorable weather conditions ensure there are adequate resources available to manage dust through other control measures (such as dust suppression)</li> <li>• Installation of temporary fencing with dust shade cloth barrier around;</li> <li>• Stop work if dust management measures are not effective or if asbestos is encountered in the construction area and implement asbestos controls as necessary.</li> <li>•</li> </ul>

Emission	Sources	Potential pathways	Proposed controls
Noise	Mixing, compaction of materials for the construction of the lay down area Additional pumping activities Increased vehicular activities	Air/windborne pathway	<i>Removal of existing pond liners and construction of new pond liners</i> <ul style="list-style-type: none"> <li>• All works are planned to occur during normal daylight business hours;</li> <li>• Nighttime works may occur during to complete works prior to the onset of storm events and will comply with the Environmental Protection (Noise) Regulations 1997;</li> <li>• All onsite vehicles compliant with vehicle noise emission requirements;</li> <li>• Separation distances are such that any noise and vibration from construction works is sufficient; and</li> <li>• Construction works will occur over a short duration.</li> </ul>
Leachate/leakage  Effluent containing high levels of ammoniums sulphate, metals and metalloid compounds	Seepage through the base of the evaporation cell liners when emptying and removing liners;  Failure of Geonet drainage layer to capture seepage during works;  Complete failure of three-tiered liner system during works prior to emptying;  Rainfall during removal of contaminated liner	Direct discharge to soil, contamination of soil and infiltration to groundwater	<i>Removal of existing Liners</i> <ul style="list-style-type: none"> <li>• Continuous monitoring of the primary liner leachate collection system</li> <li>• Weekly inspection of the evaporation cells liner and embankments for signs of faults or seepage occurring</li> <li>• Monthly monitoring of the network groundwater bores surrounding the evaporation cells.</li> <li>• New groundwater monitoring bores and implementation of groundwater monitoring program</li> <li>• Establishment of additional recovery bores down gradient of the evaporation cells. Establishment of a groundwater monitoring program in order to intercept any incursion of liquor to groundwater in the event that a significant failure was to occur</li> <li>• limiting movement and placement of equipment on liners;</li> <li>• development of work instructions to detail how repairs are to be undertaken for any leaking or damaged section of the liners (once and if identified)</li> <li>• Resources to patch and repair</li> </ul>

Emission	Sources	Potential pathways	Proposed controls
			<p>liners kept on site in case they are required</p> <ul style="list-style-type: none"> <li>• Visual inspection of leak detection system and flow rates to assist with early detection of faults.</li> <li>• Assessment of design capacity of current leachate collection system with a trigger level assigned to trigger action response plan to further investigations and implementation of additional measures to address any increases in seepage rates</li> <li>• The existing leachate collection system has recently been upgraded and now has a capacity to contain seepage from the primary liner of up to 3,456m<sup>3</sup> day (outside of this works approval)</li> <li>• Mechanical seal to close the balance pipes between cells to ensure no transference of liquor occurs from one cell while another is in the process of being emptied and relined.</li> </ul> <p><i>Construction of new pond liners</i></p> <p>Construction of the new liners to comply with the technical specifications as detailed in:</p> <ul style="list-style-type: none"> <li>• <i>Baldivis Evaporation Cells: Relining Engineering and Design</i> (Golder, 2023)</li> <li>• <i>Baldivis Evaporation Cells- Relining Engineering and Design: Construction Quality Assurance Plan</i> (Golder, 2023)</li> <li>• <i>Water Quality Protection Note 26 (WQPN-26)</i> (Department of Water and Environmental Regulation, 2022)</li> <li>• <i>Australian National Committee on Large Dams (ANCOLD), Dam Safety Guidelines</i> (ANCOLD, 2012)</li> </ul> <p>And include the following design characteristics:</p> <ul style="list-style-type: none"> <li>• Lined to have an overall permeability of less than 1 x 10<sup>-9</sup> m/s;</li> <li>• Have groundwater clearance of</li> </ul>

Emission	Sources	Potential pathways	Proposed controls
			<p>more than 3m above the maximum height of the superficial aquifer;</p> <ul style="list-style-type: none"> <li>• Compaction testing of subgrade to meet the requirements of AS 1289.5.1.1;</li> <li>• Primary liner comprised of 2 mm thick polyethylene-based geomembrane liner;</li> <li>• Conductive geotextile layer installed to support Leak Detection Survey of the Primary Liner;</li> <li>• Polyethylene Geonet leachate collection layer installed between the primary and secondary liners;</li> <li>• Secondary liner: 2 mm thick polyethylene-based geomembrane liner and a Geosynthetic Clay Liner (GCL);</li> <li>• Anchor trench size is 0.6 m deep by 0.5 m wide;</li> <li>• The leakage outlet pipe to be below the floor level at the internal embankment toe;</li> <li>• Leakage pipe at liner connection to be concrete cased and welded to the HDPE plate to ensure it has a permeability of less than <math>1 \times 10^{-9}</math> m/s; and</li> <li>• All works subject independent quality control and quality assurance testing.</li> </ul> <p><i>Construction of laydown area</i></p> <ul style="list-style-type: none"> <li>• HDPE lined and to have a permeability of <math>1 \times 10^{-9}</math> m/s or less</li> <li>• 500mm earth bund;</li> <li>• 1% gradient draining seepage towards EC2; and</li> <li>• All works subject independent quality control and quality assurance testing</li> </ul>
<p>Discharge of solid/sediment from ponds to ground</p> <p>Crystalline Nickel Ammonium Sulphate</p>	<p>Solids removed from ponds via robotic scouring;</p> <p>Unplanned discharges via ruptured and broken</p>	<p>Direct discharge to soil, contamination of soil and infiltration to groundwater</p>	<p><i>Removal of existing Liners</i></p> <p>Liners will be cleaned after being emptied;</p> <p>Laydown area constructed to meet not less than <math>1 \times 10^{-9}</math> m/s permeability with bunds surrounding.</p> <p>Solid waste will be either transported back</p>



Emission	Sources	Potential pathways	Proposed controls
<p>Sludge containing high levels of ammoniums sulphate, metals and metalloid compounds</p>	<p>conveyance infrastructure including pipelines, pumps, valves</p> <p>Laydown area storage, drying and bagging, storage and handling prior to off site disposal</p>		<p>to the refinery for reprocessing (crystalline nickel ammonium sulphate) or transported off site for disposal at a licensed waste facility;</p> <p>All pipelines, valves and pumps are subject to daily visual monitoring;</p> <p>Pipelines transferring liquid between the evaporation ponds and the staging pond containing automatic shut off valves;</p> <p>Conveyance pipelines are attached to flow meters between the Baldvis Facility and the Kwinana Nickel Refinery;</p> <p>Pipelines within the EC pond footprint area drain towards the evaporation ponds; and</p> <p>Clean up spill management procedure in place: BHP Nickel West Spill Procedure (HSE-PRO-0025).</p>
<p>Effluent and solids</p> <p>Containing high levels of ammoniums sulphate, metals and metalloid compounds</p>	<p>Embankment failure</p> <p>Collapse of sharded embankment causing internal collapse between EC1 and EC2; or EC2 and EC3</p>	<p>Direct discharge to soil, contamination of soil and infiltration to groundwater</p>	<p><i>Removal of existing pond liners and construction of new pond liners</i></p> <p>The occupier has developed a <i>Trigger Action Response Plan</i> to manage embankment stability during these works. This includes careful monitoring of the following events, incident reporting and testing and training of emergency response procedure to maintain a state of response preparedness:</p> <ul style="list-style-type: none"> <li>• Groundwater bores;</li> <li>• Standpipe piezometers;</li> <li>• Instrumentation accuracy; functionality</li> <li>• Rainfall;</li> <li>• Seismic events;</li> <li>• Seepage;</li> <li>• Crest settlement/deformation;</li> <li>• Cracks in embankments;</li> <li>• Slough/slumps in embankments;</li> <li>• Freeboard;</li> <li>• Embankment erosion; and</li> <li>• Pipeline failure.</li> </ul> <p>All works subject independent quality control and quality assurance testing</p>
	<p>Rupture spills and leaks from</p>		<p><i>Removal of existing pond liners and</i></p>



Emission	Sources	Potential pathways	Proposed controls
	wastewater delivery lines		<p><i>construction of new pond liners</i></p> <p>All pipelines, valves and pumps are subject to daily visual monitoring;</p> <p>Pipelines transferring liquid between the evaporation ponds and the staging pond containing automatic shut off valves</p> <p>Conveyance pipelines are attached to flow meters between the Baldivis Facility and the Kwinana Nickel Refinery</p> <p>Pipelines within the EC pond footprint area drain towards the evaporation ponds.</p> <p>Clean up spill management procedure in place: BHP Nickel West Spill Procedure (HSE-PRO-0025).</p> <p>All works subject independent quality control and quality assurance testing</p>
	Run off from laydown area		<ul style="list-style-type: none"> <li>• HDPE lined and to have a permeability of <math>1 \times 10^{-9}</math> m/s or less</li> <li>• 500mm earth bund</li> <li>• 1% gradient draining seepage towards EC2</li> <li>• All works subject independent quality control and quality assurance testing</li> </ul>
Odour	<p>Exposure of solids previously contained in an anoxic environment exposed to ambient air and drying on the laydown area;</p> <p>Solids scouring for the removal of solids has the potential to generate highly odourous liquor stream.</p>	Air/windborne pathway	<p><i>Removal of existing Liners</i></p> <p>The occupier has not proposed any controls to manage odour; and.</p> <p>The separation distance to residential receptors and the short duration of works are the primary odour control mechanisms.</p>
<b>Operation</b>			
Leachate	Seepage of contaminants through the liner base causing	Direct discharge to soil, infiltration to groundwater	Ponds to be double lined with a conductive leachate detection layer and a geonet drainage removal system between the primary and secondary liner giving the

Emission	Sources	Potential pathways	Proposed controls
	groundwater contamination and mounding		<p>ponds an overall permeability of <math>1 \times 10^{-9}</math> m/s or less;</p> <p>Gradient of 1% or more of base of pond to ensure drainage of leachate towards the internal embankment valley drain and leachate outlet pipe to ensure seepage is collected and conveyed to leachate sump;</p> <p>Monitoring of leachate collection sump for volumetric inflow;</p> <p>Use of piezometers on the external embankment to detect seepage (moisture content);</p> <p>Groundwater monitoring bores to detect leakage reaching the underlying groundwater;</p> <p>Site has developed a Trigger Action Response Plan to assess and manage any seepage that is detected;</p> <p>Groundwater recovery bores to recover contaminated groundwater should seepage occur and impacts on groundwater quality be observed; and</p> <p>Leachate sump volumes monitored.</p>
Liquor overflow through over topping	Overtopping due to excess loading of heavy rainfall events	Overland flow, direct discharge to soil, infiltration to groundwater	<p>Maintenance of operational freeboard of a minimum value of 670mm below the embankment crest level ;</p> <p>Balance pipes to convey liquor between cells;</p> <p>Ability to transfer liquor back to refinery;</p> <p>Evaporation sprinklers;</p> <p>Pitt boss units; and</p> <p>Recording of rainfall and evaporation-monthly basis to ensure capacity during peak rainfall</p>
Wastewater delivery line ruptures spills leaks, pump and valve failure			<p>All pipelines, valves and pumps are subject to daily visual monitoring;</p> <p>Pipelines transferring liquid between the evaporation ponds and the staging pond containing automatic shut off valves;</p> <p>Conveyance pipelines are attached to flow meters between the Baldvis Facility and the Kwinana Nickel Refinery;</p> <p>Pipelines within the EC pond footprint area drain towards the evaporation ponds; and</p> <p>Clean up spill management procedure in place: BHP Nickel West Spill Procedure</p>

Emission	Sources	Potential pathways	Proposed controls
			(HSE-PRO-0025).
Embankment failure	Direct discharge and overland flow to nearby land and water	Overland flow Direct discharge to soil, contamination of soil and infiltration to groundwater	The occupier has developed a <i>Trigger Action Response Plan</i> to manage embankment stability during these works. This includes careful monitoring of the following events, incident reporting and testing and training of emergency response procedure to maintain a state of response preparedness: <ul style="list-style-type: none"> <li>• Groundwater bores;</li> <li>• Standpipe piezometers;</li> <li>• Instrumentation accuracy and functionality;</li> <li>• Rainfall;</li> <li>• Seismic events;</li> <li>• Seepage;</li> <li>• Crest settlement/deformation;</li> <li>• Cracks in embankments;</li> <li>• Slough/slumps in embankments;</li> <li>• Freeboard;</li> <li>• Embankment erosion; and</li> <li>• Pipeline failure</li> </ul>

### 3.1.2 Receptors

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

Table 2 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 2: Sensitive human and environmental receptors and distance from prescribed activity**

Human receptors	Distance from prescribed activity
Nearest residential dwellings	670m south of ponds are residential dwellings on Kerosene Lane, Baldivis 1.7m east on Lumbar Way Baldivis 1.5km north on Ebrington Road, Wellard-
Environmental receptors	Distance from prescribed activity
Lake Cooalongup	1.2km east from ponds and 650m east from

	staging pond
<p>Groundwater</p> <p>Located within the: Stakehill Ground water area proclaimed under the <i>Rights in Water and Irrigation Act 1914</i></p> <p>Superficial aquifer is approximately 13m below the base of the evaporation Ponds EC1, EC, and EC3 at -0.51 and 1.95mAHD</p> <p>Water is fresh to brackish with TDS from 1,00mg/L to 1,500mg/L and to the west of the premises TDS is 1,500mg/L to 12,000mg/L</p>	<p>Superficial aquifer flows from the premises towards lake Coo loongup approximately 13m below the inferred base of the evaporation ponds.</p>
Leda Nature Reserve	150m north of ponds
Environmentally Sensitive Areas	<ul style="list-style-type: none"> <li>• Most of the Baldvis Facility premises, including the ponds is within the ESA buffer area applied to adjacent Threatened Ecological Communities (TEC's).</li> <li>• All of premises within Schedule 1 clearing area</li> </ul>
<p>Threatened Ecological Communities (TEC's)</p> <ul style="list-style-type: none"> <li>• Woodlands over sedgeland in Holocene dune swales in Swan Coastal Plain</li> <li>• Tuart <i>Eucalyptus gomphocephala</i> woodlands of the swan coastal plain</li> <li>• Southern <i>eucalyptus gomphocephala</i> and <i>Agonis flexuosa</i> woodlands</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	<p>Within 200m-2km there are TEC's to the north, south and east of the premises boundary</p>
<p>Threatened fauna</p> <p>There are various birds species that are found within proximity to the ponds including members of the Scolopacidae family (shorebirds) and Cacatuidae family (black cockatoos).</p>	<p>Various distances within 2km of premises boundary</p>

## 3.2 Risk ratings

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

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

Additional regulatory controls may be imposed where the applicant's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 3.

Works approval W6882/2024.2 that accompanies this decision report authorises construction and commissioning of the evaporation ponds EC1, EC2, EC3 and a laydown area. The conditions in the issued works approval, as outlined in Table 3 have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

A licence exists that authorise emissions associated with the ongoing operation of the EC ponds. A risk assessment for the operational phase has been included in this decision report, however licence conditions are subject to review, at completion of the works and may require the submission of an application to amend the licence and will not be finalised until the department assesses any licence application received (to change freeboard limits on the ponds for example)..

**Table 3: Risk assessment of potential emissions and discharges from the premises during construction and operation**

Risk events					Risk rating <sup>1</sup> C = consequence L = likelihood	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
<b>Construction</b>								
Transport mixing and compaction of materials for the laydown area vehicle movements, dust lift off from dried solids, storage and handling minor excavation within ponds if required Stockpiling of pond soils Civil works and vegetation clearing to create access roads	Dust: 1) from uncontaminated construction and ambient soils; and 2) pond derived dust from substrate excavation, sludge and screened crystalline nickel ammonium sulphate	<b>Pathway:</b> Air / windborne pathway causing <b>Impact:</b> impacts to health and amenity	Residential receptors located: 1) 670m south of ponds on Kerosene Lane, Baldivis 2) 1.7m east on Lumbar Way Baldivis 3) 1.5km north on Ebrington Road, Wellard	Refer to Section 3.1	C = Slight L = Unlikely <b>Low Risk</b>	Y	Condition 1 standard construction requirements Condition 11 standard compliance reporting requirement Condition 12 standard complaints reporting	N/A
	Noise			Refer to Section 3.1	C = Slight L = Unlikely <b>Low Risk</b>	Y	Condition 1 standard construction requirements Condition 11 standard compliance reporting requirement Condition 12 standard complaints reporting	N/A

Risk events					Risk rating <sup>1</sup> C = consequence L = likelihood	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
<p>Seepage from damage to liners during emptying and removal of liners</p> <p>Failure of Geonet drainage layer to capture seepage during works;</p> <p>Complete failure of three-tiered liner system during works prior to emptying;</p> <p>Rainfall during removal of contaminated liner</p>	Leachate containing high levels of ammonium sulphate, metals and metalloid compounds	<p><b>Pathway:</b></p> <p>Direct discharge to soil, contamination of soil and infiltration to groundwater</p> <p><b>Impact:</b></p> <p>Localised soil contamination</p> <p>Deterioration of groundwater quality and beneficial use of groundwater</p> <p>Longer term impacts on groundwater dependent deep rooted vegetation within the Threatened Ecological Community (TEC) in Leda Reserve and Lake Coo loongup Reserve</p> <p>Longer term impacts to water quality in nearby Lake Coo loongup</p> <p>Longer term impacts on threatened wetland dependent fauna</p>	<p>Soil groundwater</p> <p>Nearby surface water receptor Lake Coo loongup</p> <p>Leda nature Reserve and other nearby TEC vegetation</p> <p>Threatened wetland dependent fauna</p>	Refer to Section 3.1	<p>C = Moderate</p> <p>L = Possible</p> <p><b>Medium Risk</b></p>	Y	<p>Condition 1 &amp; 7 standard critical containment infrastructure construction requirements</p> <p>Condition 2 &amp; 8 standard quality control and quality assurance conditions</p> <p>Condition 9 &amp; 10 standard critical containment infrastructure reporting conditions</p> <p>Condition 3 to oversea removal of liners, solids and liquids from existing ponds without causing discharges to the environment</p> <p>Condition 11 standard compliance reporting requirement</p>	<p>Condition 6 groundwater monitoring condition to verify that leachate is not impacting the superficial groundwater table, and if it is, to serve as a recovery bores.</p> <p>This was proposed by the proponents however is considered suitable for conditioning by the Delegated Officer to ensure sampling is undertaken according to established groundwater monitoring protocol under AS/NZS 5667.1 and AS/NZS 5667.11</p>

Risk events					Risk rating <sup>1</sup> C = consequence L = likelihood	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
<p>Solids removed from ponds via robotic scouring;</p> <p>Unplanned discharges via ruptured and broken conveyance infrastructure including pipelines, pumps, valves</p> <p>Laydown area storage, drying and bagging, storage and handling prior to off site disposal</p>	<p>Discharge of solid/sediment from ponds to ground:</p> <p>1) Crystalline Nickel Ammonium Sulphate</p> <p>2) Sludge containing high levels of ammoniums sulphate, metals and metalloids compounds</p>	<p><b>Pathway:</b></p> <p>Overland flow through contact with incidental rainfall</p> <p>Direct discharge to soil, contamination of soil and infiltration to groundwater</p> <p><b>Impact:</b></p> <p>Soil contamination</p> <p>Seepage through soil profile causing deterioration of groundwater quality and beneficial use of groundwater</p> <p>Longer term impacts on groundwater dependent deep rooted vegetation within the Threatened Ecological Community (TEC) in Leda Reserve and Lake Coo loongup Reserve</p> <p>Longer term impacts to water quality in nearby Lake Coo loongup</p> <p>Longer term impacts on threatened wetland dependent fauna</p>	<p>Soil groundwater</p> <p>Nearby surface water receptor Lake Coo loongup</p> <p>Threatened Ecological Community (TEC) vegetation health</p> <p>Threatened wetland dependent fauna</p>	<p>Refer to Section 3.1</p>	<p>C = Moderate</p> <p>L = Possible</p> <p><b>Medium Risk</b></p>	<p>Y</p>	<p>Condition 1 standard critical containment infrastructure construction requirements</p> <p>Condition 2 standard quality control and quality assurance conditions</p> <p>Condition 9 &amp; 10 standard critical containment infrastructure reporting conditions</p> <p>Condition 3 to oversea removal of liners, solids and liquids from existing ponds without causing discharges to the environment</p> <p>Condition 11 standard compliance reporting requirement</p>	<p>N/A</p>



<p>Embankment failure</p> <p>Collapse of shared embankment causing internal collapse between EC1 and EC2; or EC2 and EC3</p>	<p>Effluent and solids</p> <p>Containing high levels of ammoniums sulphate, metals and metalloid compounds</p>	<p><b>Pathway:</b> Overland flow</p> <p>Direct discharge and inundation of soil</p> <p>Covering and smothering of vegetation</p> <p>Contamination of soil and infiltration to groundwater and to groundwater dependent wetland</p> <p><b>Impact:</b></p> <p>Soil contamination</p> <p>Seepage through soil profile causing deterioration of groundwater quality and beneficial use of groundwater dependent deep-rooted vegetation within the Threatened Ecological Community (TEC) in Leda Reserve and Lake Cooloongup Reserve</p> <p>Impacts to water quality in nearby Lake Cooloongup</p> <p>Impacts on threatened wetland dependent fauna through declining water quality</p> <p>Vegetation smothering and death</p> <p>Inundation of nearby Leda Nature Reserve and Lake Cooloongup Reserve causing threatened fauna deaths directly or indirectly through loss of habitat</p>	<p>Soil</p> <p>groundwater</p> <p>Nearby surface water receptor Lake Cooloongup</p> <p>Leda Nature Reserve</p> <p>Threatened Ecological Community (TEC) vegetation health</p> <p>Threatened wetland dependent fauna</p>	<p>Refer to Section 3.1</p>	<p>C = Major</p> <p>L = unlikely</p> <p><b>Medium Risk</b></p>	<p>Y</p>	<p>The stability assessment contained within the application form considers there is a low risk of external embankment failure under a range of operating conditions. Should internal embankment failure occur the OPSM and TARP and existing measures are considered adequate to manage this from an environmental discharges perspective.</p> <p>These include:</p> <p>Condition 1 standard critical containment infrastructure construction requirements</p> <p>Condition 2 standard quality control and quality assurance conditions</p> <p>Condition 9 &amp; 10 standard critical containment infrastructure reporting conditions</p> <p>Condition 6 groundwater monitoring condition to verify that leachate is not impacting the superficial groundwater table, and if it is, to serve as a recovery bores.</p>	<p>N/A</p>
<p>Rupture spills and leaks from</p>	<p>Effluent and solids</p>	<p><b>Pathway:</b> Overland flow</p>	<p>Soil</p>	<p>Refer to Section</p>	<p>C = Minor</p>	<p>Y</p>	<p>Condition 1 &amp; 7 standard critical</p>	<p>N/A</p>

Risk events					Risk rating <sup>1</sup> C = consequence L = likelihood	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
wastewater delivery lines	Containing high levels of ammoniums sulphate, metals and metalloid compounds	<p>Direct discharge to soil contamination of soil and infiltration to groundwater and to groundwater dependent wetland</p> <p><b>Impact:</b> Deterioration of groundwater quality and beneficial use of groundwater Longer term impacts on groundwater dependent vegetation within the Threatened Ecological Community (TEC) in Leda Reserve and Lake Cooloongup Reserve Longer term impacts to water quality in nearby Lake Cooloongup Longer term impacts on threatened wetland dependent fauna</p>	<p>groundwater</p> <p>Nearby surface water receptor Lake Cooloongup</p> <p>Threatened Ecological Community (TEC) vegetation health</p> <p>Threatened wetland dependent fauna</p>	3.1	L = Possible <b>Medium Risk</b>	Y	<p>containment infrastructure construction requirements</p> <p>Condition 2 &amp; 8 standard quality control and quality assurance conditions</p> <p>Condition 9 &amp; 10 standard critical containment infrastructure reporting conditions</p> <p>Condition 3 to oversea removal of liners, solids and liquids from existing ponds without causing discharges to the environment</p> <p>Condition 11 standard compliance reporting requirement</p>	N/A
Run off from laydown area				Refer to Section 3.1	C = Minor L = Possible <b>Medium Risk</b>			
Exposure of solids previously contained in an anoxic environment exposed to ambient air and drying on the laydown area; Solids scouring for the removal of solids has the potential to generate highly odourous liquor stream.	Odour	<p><b>Pathway:</b> Air / windborne pathway causing</p> <p><b>Impact:</b> impacts to health and amenity</p>	<p>Residential receptors located:</p> <p>1) 670m south of ponds on Kerosene Lane, Baldivis</p> <p>2) 1.7m east on Lumbar Way Baldivis</p> <p>3) 1.5km north on Ebrington Road, Wellard</p>	Refer to Section 3.1	C = Slight L = Unlikely <b>Low Risk</b>	No specific controls provided	N/A	N/A

Risk events					Risk rating <sup>1</sup> C = consequence L = likelihood	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
<b>Operation</b>								
Seepage of contaminants through the liner base causing groundwater contamination and mounding	Leachate containing high levels of ammonium sulphate, metals and metalloid compounds	<p><b>Pathway:</b> Direct discharge to soil, contamination of soil and infiltration to groundwater</p> <p><b>Impact:</b> Localised soil contamination Deterioration of groundwater quality and beneficial use of groundwater Longer term impacts on groundwater dependent deep rooted vegetation within the Threatened Ecological Community (TEC) in Leda Reserve and Lake Cooloongup Reserve Longer term impacts to water quality in nearby Lake Cooloongup Longer term impacts on threatened wetland dependent fauna</p>	Soil groundwater Nearby surface water receptor Lake Cooloongup Leda nature Reserve and other nearby TEC vegetation Threatened wetland dependent fauna	Refer to Section 3.1	C = Moderate L = Unlikely <b>Medium Risk</b>	Y	<p>Condition 1 &amp; 7 standard critical containment infrastructure construction requirements</p> <p>Condition 2 &amp; 8 standard quality control and quality assurance conditions</p> <p>Condition 9 &amp; 10 standard critical containment infrastructure reporting conditions</p> <p>Condition 3 to oversea removal of liners, solids and liquids from existing ponds without causing discharges to the environment</p> <p>Condition 11 standard compliance reporting requirement</p>	N/A
Overtopping due to excess loading of heavy rainfall events	Leachate containing high levels of ammonium sulphate, metals and metalloid compounds	<p><b>Pathway:</b> Overland flow Direct discharge to soil, contamination of soil and infiltration to groundwater</p> <p><b>Impact:</b></p>		Refer to Section 3.1	C = Moderate L = Unlikely <b>Medium Risk</b>	Y	N/A	The operating freeboard in condition 35 will be amended on the Operating Licence following completion of the Works from 467 mm to 670mm

Risk events					Risk rating <sup>1</sup> C = consequence L = likelihood	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
Wastewater delivery line ruptures spills leaks, pump and valve failure	Effluent and solids Containing high levels of ammoniums sulphate, metals and metalloid compounds	Localised soil contamination  Deterioration of groundwater quality and beneficial use of groundwater  Longer term Impacts on groundwater dependent deep rooted vegetation within the Threatened Ecological Community (TEC) in Leda Reserve and Lake Cooloongup Reserve  Longer term Impacts to water quality in nearby Lake Cooloongup  Longer term Impacts on threatened wetland dependent fauna	Soil groundwater Nearby surface water receptor Lake Cooloongup Leda nature Reserve and other nearby TEC vegetation Threatened wetland dependent fauna	Refer to Section 3.1	C = Moderate L = Unlikely <b>Medium Risk</b>	Y	Condition 1 & 7 standard critical containment infrastructure construction requirements  Condition 2 & 8 standard quality control and quality assurance conditions  Condition 9 & 10 standard critical containment infrastructure reporting conditions  Condition3 to oversea removal of liners, solids and liquids from existing ponds without causing discharges to the environment  Condition 11 standard compliance reporting requirement	N/A

Risk events					Risk rating <sup>1</sup> C = consequence L = likelihood	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
Embankment failure	Effluent and solids Containing high levels of ammoniums sulphate, metals and metalloid compounds	<p><b>Pathway:</b> Overland flow</p> <p>Direct discharge and inundation of soil</p> <p>Covering and smothering of vegetation</p> <p>Contamination of soil and infiltration to groundwater and to groundwater dependent wetland</p> <p><b>Impact:</b></p> <p>Soil contamination</p> <p>Seepage through soil profile causing deterioration of groundwater quality and beneficial use of groundwater dependent deep-rooted vegetation within the Threatened Ecological Community (TEC) in Leda Reserve and Lake Cooloongup Reserve</p> <p>Impacts to water quality in nearby Lake Cooloongup</p> <p>Impacts on threatened wetland dependent fauna through declining water quality</p> <p>Vegetation smothering and death</p> <p>Inundation of nearby Leda Nature Reserve and Lake Cooloongup Reserve causing threatened fauna deaths directly or indirectly through loss of habitat</p>	<p>Soil</p> <p>groundwater</p> <p>Nearby surface water receptor</p> <p>Lake Cooloongup</p> <p>Leda Nature Reserve</p> <p>Threatened Ecological Community (TEC) vegetation health</p> <p>Threatened wetland dependent fauna</p>	Refer to Section 3.1	C = Major L = Rare <b>Low Risk</b>	Y	<p>The stability assessment contained within the application form considers there is a low risk of external embankment failure under a range of operating conditions. Should internal embankment failure occur the OPSM and TARP and existing measures are considered adequate to manage this from an environmental discharges perspective.</p> <p>No works will be undertaken to the external embankments</p>	N/A

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

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

## 4. Consultation

Table 4 provides a summary of the consultation undertaken by the department.

**Table 4: Consultation**

Consultation method	Comments received	Department response
Application advertised on the department's website on 12 February 2024	None received	N/A
Applicant was provided with draft documents on 19/04/2024	8 May 2024 and 29 May 2024	See Appendix 1

## 5. Decision

The Delegated Officer has determined, subject to regulatory controls outlined in Table 1, that the relining works for the evaporation ponds EC1, EC2 and EC3 and the construction of a new laydown area does not represent an unacceptable risk to human health or the environment, such that the works are necessary to prevent discharges from the ponds from occurring to the environment.

The applicants proposed containment infrastructure (evaporation pond) design controls will be conditioned in the works approval to manage the risk associated with the release of process liquor high levels of ammonium sulphate, metals and metalloid compounds to the environment. These controls align with the ANCOLD guidelines (ANCOLD, 2012), WQPN 26 (2022) and include installation of a triple lining system, comprised of a primary, secondary and under drainage system, to prevent seepage. Compliance reporting conditions will ensure all infrastructure is installed and constricted as per the specified design requirements. IN addition, general reporting, record keeping and administration requirements will be conditioned to ensure compliance with the works approval.

Time limited operations are not considered relevant to this application as the ponds are already approved for use under operational Licence Licence L8437/2010/3. Upon completion of the works approval the new operational freeboard limit of 670mm will be applied to these ponds.

## 6. Conclusion

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

## References

1. Australian National Committee on Large Dams (ANCOLD), Dam Safety Guidelines (ANCOLD, 2012)
2. BHP Nickel West (2023) Baldvis Facility Operations, Surveillance and Maintenance Manual (OSMP);
3. BHP Nickel West Spill Procedure (HSE-PRO-0025)..
4. BHP Nickel West (2023) Works Approval Application Supplementary Information Baldvis Evaporation Cells Relining Project

5. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
6. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Environmental Siting*, Perth, Western Australia.
7. DWER 2020, *Guideline: Risk Assessments*, Perth, Western Australia.
8. Golder (2023) Baldvis Liner Replacement Project: Groundwater Monitoring Program BHP Nickel West
9. Golder (2023) Baldvis Evaporation Cells – Relining Engineering and Design *Construction Quality Assurance Plan (Golder 2023)*.
10. *Golder (2023) BHP Nickel West Pty Ltd Baldvis Evaporation Cells Relining Design (2023)*.
11. *Water Quality Protection Note 26 (WQPN-26) (Department of Water and Environmental Regulation, 2022)*

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

Condition	Summary of applicant's comment	Department's response
1	<p>Applicant requests that the reference to and reporting requirements associated with Critical Containment Infrastructure (CCI) be removed from Condition 1.</p> <p>The laydown area construction referenced in Table 1 does not meet the definition of CCI, as it is not designed to 'contain' waste. The laydown area is a temporary staging area, constructed to prevent any contamination to the surrounding environment during the removal and transfer of materials out of the evaporation cells.</p>	<p>Wording of condition changed to remove reference to critical containment infrastructure.</p>
Condition 1 Table 1	<p>It is proposed that the laydown area be constructed in two separate location over consecutive periods. Firstly, the laydown area is to be constructed adjacent to Evaporation Cell (EC) 2 whilst EC 1 is being relined. Once the relining of EC 1 is complete, the laydown area will be deconstructed and moved to a location adjacent to EC 1 to allow for the relining of EC 2. The laydown area will remain adjacent to EC1 whilst EC2 and EC3 are being relined. The proposed construction methodology is the same for both locations.</p> <p>The requirement for two laydown area locations has arisen post the submission of the original application. NiW requests that the approval be updated to include the two proposed location as shown in revised Figure 4 (23-Q01-43190-C.21184-2000-100), attached.</p>	<p>Figure 4 has been updated to reflect this change and shows revised drawings 23-Q01-43190-C.21184-2000-100 Rev 3.</p> <p>Update wording throughout the document to reference the laydown area being able to be situated in locations adjacent EC1 or EC2.</p>
Condition 1 Table 1 (b) and (d)	<p>Whilst clean fill is proposed to be used for the bottom layer of the laydown area, below the liner. NiW proposes to utilise existing embankment capping material from the internal embankments of the evaporation cells for the construction of the top layer of the laydown area (i.e. above the HDPE liner). The internal embankment capping material is to be removed as part of the relining process. Due to it being placed on top of the laydown area</p>	<p>The condition 1 (b) has not been changed as requested as it relates to subgrade materials only. What is proposed by Nickel West is consistent with this part of condition.</p> <p>Condition 1 (d) changed to a more outcome focused condition:" Aggregate must be size graded before use so as to not cause damage to the liner or build up of sedimentation within the subgrade</p>



Condition	Summary of applicant's comment	Department's response
	<p>liner and draining back towards the EC 2, any potential contamination will be contained. The Licence Holder requested that the following condition be amended from:</p> <p style="padding-left: 40px;">(d) Aggregate must be size graded so as to not cause damage to the liner grading requirements:</p> <p style="padding-left: 80px;">a. no aggregate greater than 53.0 mm; b. no more than 5% below 13.2 mm; and c. 2% less than 4.75 mm.</p> <p>To Aggregate must be of a suitable quality and composition as to not damage the liner or cause sedimentation.</p>	<p>The quality aspect of the proposed condition not accepted as this is adequately covered by condition 1(b).</p>
<p>Condition 1 Table 1 h)</p>	<p>Nickel West requested change from: "Laydown area floor to be constructed with a minimum fall of 1% towards evaporation cell 2 " to reflect a proposed change in construction plans to allow laydowns area to be constructed in two potential locations now (alongside evaporation cell 2 as originally planned and also evaporation cell 1).</p>	<p>Wording changed to include reference to evaporation cell 1 and evaporation cell 2</p>
<p>Condition 1 Table 1 i)</p>	<p>The laydown area is to be constructed east of the evaporation cells. The laydown area is proposed to drain into the evaporation cell to the 'west'. The earth bunds are intended to prevent any material or surface water run off discharging into the surrounding environment. The intent of the earth bunds are not to 'store' water or create freeboard. Nickel West request that the reference to freeboard is removed from this condition.</p>	<p>Proposed condition wording accepted</p> <p>The change to remove reference of the freeboard does not alter the outcome of the condition</p>
<p>Condition 1 Table 1 j)</p>	<p>The laydown area is proposed to be constructed in two potential locations. Please amend the wording to consider both possible locations.</p>	<p>Wording changed to include reference to evaporation Cell 1 and Evaporation Cell 2</p>
<p>Condition 1 Table 1 q)</p>	<p>Nickel West requested the minimum overlap distance be amended to 75mm as this is the standard achievable minimum distance in Australia.</p>	<p>Change made as requested</p>

Condition	Summary of applicant's comment	Department's response
Condition 1 Table 1 r)	Leak detection survey to be carried out following installation. The laydown area is a structure that is designed for the temporary storage of solids and machinery during phases of the relining project. It is not intended to hold any volume of liquor. As such, Nickel West is not proposing to undertake a full Construction Quality Assurance plan for this area Nickel West requests that this condition be removed.	Requested change made
Condition 1 Table 1 (t)	The liner must extend into evaporation cell 2 to allow run off to flow into this cell	Wording changed to include reference to evaporation cell 1 and evaporation cell 2
Condition 2 (Deleted)	Nickel West requested that the requirement to undertake a construction quality assurance plan for the laydown area be removed. The laydown area is not considered to be CCI and as such the environmental compliance auditing and reporting requirements under Condition 11 are considered sufficient to demonstrate construction compliance.	Condition removed as requested as the Delegated Officer considers the now two impermanent laydown areas will be used over a short duration only, and the Works Approval Holder is still required to meet construction requirements.
Condition 3 (Now condition 2) Table 2 items 1	As per all conveyancing pipework, the Pit Boss and evaporation sprinklers and associated pipes will all be flushed (within the EC's), cleaned of all solids and emptied within the existing evaporation cells prior to being transported to the existing unlined laydown area. The installation, operation and maintenance of the existing Pit Boss and Sprinkler system is managed in accordance with Prescribed Premises Operating Licence L8437/2010/3 and existing Nickel West procedures. Nickel West requested the removal of conditions relating to the removal of Pit Boss, Sprinklers and related pipework from this approval.	Requested change partially accepted. The sub condition is not removed. The pit Boss Units and the Sprinklers are likely to be contaminated with process water prior to decommissioning of works and the Delegated Officer considers it is appropriate they be required to be cleaned prior to being placed on an unsealed laydown area. This condition is changed to reflect this.
Condition 3 (Now condition 2) Table 2 item 2	All other pipework and infrastructure (Item 2) requiring removal to allow for the relining works will be relocated to an existing unlined laydown area within the Baldivis facility. The existing laydown area	Requested change partially accepted. The Delegated Officer considers it is appropriate the infrastructure be required to be cleaned prior to being

Condition	Summary of applicant's comment	Department's response
	is currently used to store clean materials and vehicles as required during maintenance activities. All items will be flushed, cleaned of all solids and emptied within the existing evaporation cells prior to being transported to the existing unlined laydown area. As the equipment is empty and thoroughly cleaned it poses low environmental risk to the environment surrounding the existing unlined laydown area.	placed on an unsealed laydown area. This condition is changed to reflect this.
Condition 3 (Now condition 2) Table 2 items 3 j) Now sub condition 2(g)	All dredge hoses and connection points shall float on to avoid contact with liner;	Change made
Condition 3 Table 2 items 3 (m) Now condition 2(j))	Solids are made up of a 20mm – 100mm 'crust' of ammonium sulphate / nickel double salts overlying a thicker (nominal 600mm) softer silty organic / wind blown debris layer. A belt screen will be used to segregate the salts content into a sealed containment system, the underflow of diluted silty material will be pumped into either EC2 or EC3.	Condition changed to include screening method.  Solids to be conveyed to the laydown area where they are screened via a belt screener to segregate salt content into a sealed containment system. The under flow of gross solids will be pumped into an adjacent EC.
Condition 3 Table 2 items 3 n)  (Condition removed)	Refer to above response for the current plan for solids and salts removal.  The methodology for the long-term disposal of the gross solids has not yet been defined.	Removed as answered sub condition 2(j)
Condition 3, Table 2 items 4 r) Now condition 2 (n)	Pipelines associated with the evaporation cell subject to relining drain back towards the evaporation cell being relined, or evaporation cell 2. Pipelines contained within the evaporation cells will drain towards the evaporation cells however pipelines connecting the evaporation cells to the staging pond will drain back to the staging pond due to the change in elevation	Condition wording amended as requested:
Condition 5 Table 4 Now Condition 4	Proposed groundwater monitoring locations, as shown on the submitted groundwater monitoring plan (appendix 7 of supporting document) are as follows:	Change made

Condition	Summary of applicant's comment	Department's response
	BAL-2209-08 BAL-2209-07 BAL-2209-06 BAL-2209-05 <b>BAL-288-01</b> BAL-2209-01 has not been proposed to be monitored. Nickel West requests that the table be amended to detail the above list of bores ( <b>BAL-288-01 replaces BAL-2209-01</b> ).	
Condition 6 Table 5 Item 1 g). Now condition 5 (g)	Secondary liner: Geosynthetic Composite Liner (GCL), polyethylene geo membrane and two cushion geotextile cushion layers;  (g) c. two layers of a polypropylene or polyester cushion/protection geotextile layer.  The two layers of the polypropylene or polyester cushion/protection geotextile layer at the sumps and over the panel drains, not over the entirety of the cell. Suggest removing reference to the two layers of cushion geotextile layers from this section and include in the requirements for the leachate collection layer requirements	Item removed. (g) c
Condition 6 Table 5 Item 1 , Infrastructure location and specifications Column	Liner Panel arrangement shown in Figures 9, 10 and 11 of Schedule 1 The liner panel arrangement shown in Figures 9, 10 and 11 of Schedule 1 are indicative only, minor changes may be present during construction due to conditions encountered. As such Nickel West requests that the word indicative be included in the condition wording.	Proposed condition change rejected.  There is capacity to provide immaterial changes to work in the works approval construction compliance documentation (Condition 7,8,9, 10 and 11). If significant changes are proposed
Condition 6 Table 5, Item 1, J) Now condition 5 (j)	Nickel West requested the minimum overlap distance be amended to 75mm as this is the standard achievable minimum distance in Australia.	Change made
Condition 6 Table 5, Item 1, k)	Nickel West requested this item to be removed from the secondary liner section and be included in the Leakage/leachate collection layer section of Table 5, items m) to t).	Change made

Condition	Summary of applicant's comment	Department's response
Now condition 5 (n)		
Condition 6 Table 5, Item 1, m) Now Condition 5	(m) A cushion Geotextile layer to be installed above the secondary liner and beneath the primary liner; As detailed above the cushion geotextile layer is to be installed over the panel drains, not over the entirety of the cell. Nickel West requested the condition wording be amended	Condition wording amended:
Condition 6 Table 5, Item 1, n) Now Condition 5 (m)	(n) The leakage outlet pipe to be the 0.4 m below the floor level at the internal embankment toe; Nickel West requested that this condition be removed as the depth is dependent on tying into existing constructed elements which will only be known once the liners have been removed	Partial acceptance of change. Sub-condition is amended to remove reference to distance of 0.4m.
Condition 6 Table 5, Item 1, p) Now Condition 5	(p) Leakage pipe at liner connection interval to be concrete cased and welded to the HDPE plate to ensure a permeability of less than $1 \times 10^{-9}$ m/s; Nickel West requested clarification of the meaning of the word interval in this condition or removal of the word 'interval' from this condition	Change made
Condition 6 Table 5, item 1, aa) Now Condition 5 (aa)	(aa) Panels of the liner should be overlapped by a minimum of 100mm, prior to heat welding; and As per previous comments please ensure that all condition reference weld overlap as minimum of 75mm.	Change made
Condition 6 Table 5 Item 1 ff) Now Condition 5	ff) Anchor trenches to be capped with gravel and a geotextile and moisture barrier Anchor trenches on the dividing embankments comply with requirements of item 1 ff)(refer Schedule 1 Figure 12), however the anchor trenches on the external embankments do not have capping (refer Schedule 1 Figure 13). Proposed condition wording:	Change made.

Condition	Summary of applicant's comment	Department's response
	Anchor trenches <b>on shared embankments</b> to be capped with gravel and a geotextile and moisture barrier	
Condition 6 Table 5 Item 1 gg)  Condition removed	gg) The moisture barrier shall extend for a depth of at least 10mm This requirement is not detailed within the design report or drawings.	Condition removed
Condition 6 Table 5 Item 1 hh)  Now Condition 5 (hh)	Reference to 300mm of surface material above the liners was an error. Please refer to the attached amended drawing 23-Q02-43158-C.21184-2000-100 which references a minimum of 150mm of surface material reinstated above the liners.	Condition amended
Condition 6 <b>Table 5 Item 1 oo)</b> Now Condition 5	The reference to batter is incorrect, the correct wording is Batten Bar. Nickel West requested the condition is updated to reflect this correction.	Change made.
Condition 8 Now Condition 7	Due to the complexity and detail required in critical containment report, Nickel West requests that the reporting timeframe be extended from 30 calendar days to 60 Calendar Days As discussed above, Nickel West requested that the laydown area be exempt from CCI reporting and thus removed from this condition.	Change made.  The requirements to report on non-critical containment infrastructure construction and alterations is added to Condition 10
Condition 8 and 9 Now condition 7 and 8	Reference to requirements of CCI reporting for the laydown area As discussed above, Nickel West requested that the contaminated laydown area (conditioned under Condition 1) be removed from the requirements of critical containment reporting	Change made.
Condition 11 Now Condition 10	Nickel West requested that the reference to groundwater wells be removed.	The change has not been made. The wording of the condition has been altered to include the requirement of items of infrastructure constructed and installed. The

Condition	Summary of applicant's comment	Department's response
		bore construction information is required to understand what part of the aquifer the bores are sampling groundwater from.
Condition 12 Now Condition 11	Nickel West requested a change to the reporting period from every two months to quarterly, and to submit the results as detailed in Condition 4 only	The changes are partially accepted. The changes to submission of monitoring is made, the requirement to provide summary information in each report remains
Schedule 1 Maps	Schedule 1 contains two Figures titled Figure 4 Nickel West requested that figure numbers are amended so that only one Figure 4 is listed in Schedule 1	Schedule 1 numbering changed to include only one Figure 4
Schedule 2: CQA Testing Table 5	Table 5: GCL CQA Testing The draft testing requirements in the works approval do not align with those proposed in WSP Technical Specification PS134615-006-R. Nickel West requested that Table 5 be replaced with <i>Table 3 Geosynthetic clay liner properties and minimum testing frequency</i> as provided.	Change made
Schedule 2: CQA Testing Table 6	Table 6: HDPE Geomembrane The draft testing requirements in the works approval do not align with those proposed in WSP Technical Specification PS134615-006-R. Nickel West requested that Table 6 be replaced with <i>Table 4 Secondary liner (HDPE Geomembrane) – Primary liner properties and minimum testing frequencies</i> as provided.	Change made
Schedule 2: CQA Testing Table 7	Table 7: Geotextile CQA Testing The draft testing requirements in the works approval do not align with those proposed in WSP Technical Specification PS134615-006-R. Nickel West requested that Table 7 be replaced with <i>Table 5 Required properties and testing frequencies Cushion geotextile</i> as provided.	Change made

Condition	Summary of applicant's comment	Department's response
Decision Report Section 2.2, page 1	The solids will not be dried prior to being stored in the EC.	Change made to remove the reference to drying prior to storage
Decision Report Section 2.3 page 2	EC1 is not a separate system, NiW requests that the following sentence be removed.  Evaporation pond 1 (EC 1) is managed as an isolated cell and contains excess concentrate from the reverse osmosis plant and process effluent.	Change made
Decision Report Section 2.4.1, Page 5 Figure 1,2, 3 and 4	NiW proposed minor changes to the sequence of emptying the evaporation cells for the relining and solids removal. Those changes include: <ul style="list-style-type: none"> <li>• Figure 2 -Liquor will be pumped from both EC 2 and EC3 into the CBS tanks located at the Kwinana Nickel Refinery</li> <li>• Figure 3 – Solids removed from EC1 will now be stored in EC3</li> </ul>	Figures have not been amended however change is referenced ion the Decision Report text
Decision Report Section 2.4.2, page 6	Request to remove reference of the geotextile cushion layer to liner between the whole of evaporation cell footprint	Change made
Decision Report Section 2.4.2, page 6	Nickel West requested that the word manufacturers is changed to designers	Change made
Decision Report Section 3.1.1 Table 1 Proposed controls	DWER sought clarification regarding whether native vegetation clearing was proposed to occur or not. Nickel West confirmed that no clearing of native vegetation is proposed under this application	Highlighted question in text removed.
Decision Report Page 12 proposed controls	Leakage pipe at liner connection interval to be concrete cased and welded to the HDPE plate to ensure it has a permeability of less than $1 \times 10^{-9}$ m/s; and Nickel West requested the word 'interval' be removed as it is not required in this description.	Change made
Decision Report Page 12 proposed controls	Nickel West requested the comment that the leakage outlet pipe to be the 0.4 m below the floor level at the internal embankment toe be changed as 0.4m cannot be confirmed until the existing liner is removed.	Change made
Decision Report Page 15 proposed controls	Nickel West requested change of the description of the drain from toe to valley drain be made.	Change made



Condition	Summary of applicant's comment	Department's response
Decision Report Page 15 proposed controls	Nickel West requested geotextile cushion layer Use of piezometers on the external embankment to detect seepage in moisture content in the embankments;	Partially accepted.
Decision Report Page 15 proposed controls	Nickel West requested Toes drains within the internal embankment to facilitate collection of leachate to be removed as this is incorrect	Change made
Decision Report Page 15 proposed controls	Nickel West requested change to the proposed freeboard Maintenance of operational freeboard of a minimum value of 670mm below the embankment crest level to reflect the freeboard level in the Licence of 467mm.	This is not accepted. The reduced freeboard was only applied to the evaporation cells as a short term measure until the ponds were relined. There has also been evidence of wave action overflow since the reduced freeboard was applied to the Licence, indicating this is not an appropriate freeboard.