Government of Western Australia
Department of Water and Environmental Regulation

Decision Report

Application for Works Approval

Division 3, Part V *Environmental Protection Act 1986*

Licence Number	W6220/2019/1
Applicant	BHP Billiton Nickel West Pty Ltd
ACN	ACN 004 184 598
File Number	DER2018/001687
Premises	Leinster Nickel Operation Mineral Lease ML255SA and Mining Tenement M36/230
Date of Report	7/03/2019
Status of Report	Final

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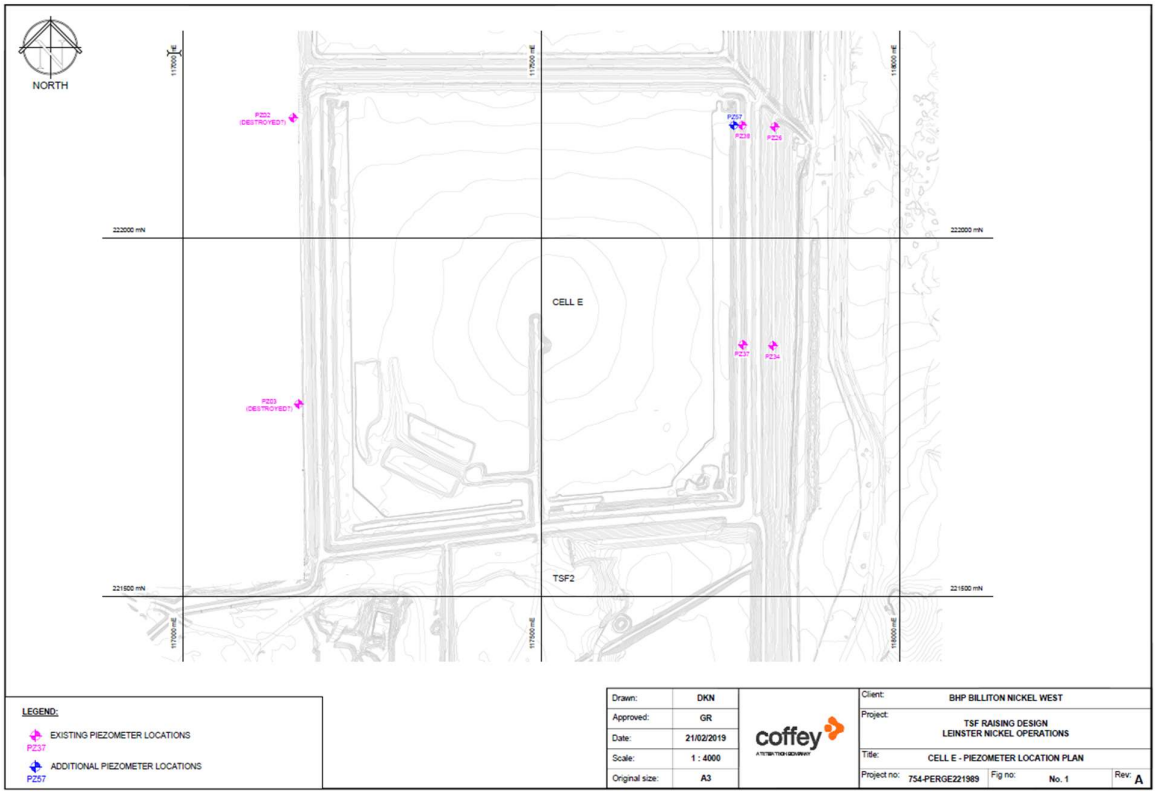


1. Definitions of terms and acronyms

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

Table 1: Definitions

Term	Definition
ACN	Australian Company Number
AER	Annual Environment 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.
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DWER	Department of Water and Environmental Regulation As of 1 July 2017, the Department of Environment Regulation (DER), the Office of the Environmental Protection Authority (OEPA) and the Department of Water (DoW) amalgamated to form the Department of Water and Environmental Regulation (DWER). DWER was established under section 35 of the *Public Sector Management Act 1994* and is responsible for the administration of the *Environmental Protection Act 1986* along with other legislation.
EP Act	*Environmental Protection Act 1986* (WA)
Existing Licence	L4612/1989/11
Licence Holder	BHP Billiton Nickel West Pty Ltd (NiW)
NiW	The Licence Holder; BHP Billiton Nickel West Pty Ltd
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
Risk Event	As described in *Guidance Statement: Risk Assessment*
RL	Reduced level, a relative measurement of vertical distance between an assumed survey height reference point, and other survey data points
TFS	Tailings Storage Facility

2. Purpose and scope of assessment

The purpose of this assessment is for the issue of a Works Approval for the upstream construction of a 2m embankment raise for Tailings Storage Facility (TSF) 3 Cell E.

This Decision Report assesses emissions and discharges associated with the construction and operation of the TSF3 Cell E embankment raise from RL 10545.5 to a final height of RL 10547.5m. TSF 3 is an above ground paddock style compound with a footprint of approximately 185Ha and is divided into Cells AB; Cells CD and Cell E. Cell E is approximately 55Ha in area and is situated approximately 2.5km north of the nickel concentrator plant. The risk of emissions and discharges from the broader Nickel West Leinster Operations are not within the scope of this assessment and are subject to the conditions of the existing Licence L4612/1989/11.

This assessment has resulted in the Department of Water and Environmental Regulation (DWER) issuing Works Approval W6620/2019/1 (Issued Works Approval) which is contained in Attachment 1. The decision to grant this Works Approval is consistent with the Department of Water and Environmental Regulation's (DWER) Guidance Statement: Risk Assessment (DER,2017) and Guidance Statement: Decision making (DER,2017).

2.1 Application details

Table 2 lists the documents submitted during the assessment process.

Table 2: Documents and information submitted during the assessment process

Document/information description	Date received
Application form dated 13 December 2013, including; • Nickel West Leinster (L4612/1989/11). Works Approval Application Supplementary Information: TSF 3 Cell E Raise to RL 10547.5m	13 December 2018
Supporting documentation: • Email Correspondence: Leinster Works Approval Application for Additional Information (Annette Latto: 7 February 2019) • Leinster Nickel Mine: Dam Safety Review of Tailings Storage Facilities, Golder Associates Pty Ltd (Golder, 2018) • Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Facility Emergency Procedures Management Plan (NiW, 2016a) • Leinster Nickel Operation Tailings Management Master Plan Description of Existing Facilities (NiW, 2016b) • Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Facility Emergency Procedures Management Plan (NiW, 2016c) • Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Facility Monitoring Plan (NiW, 2013) • Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Facility Operating Manual (NiW, 2016d) • Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Facility Risk Management Plan (NiW, 2016e) • Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Facility Roles and Responsibilities (NiW, 2016f) • Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Water Management Plan (NiW, 2016g) • Leinster Nickel TSF3 Cell E Raise to RL 10,547.5m (FY19): Scope of Works & Earthworks Specification (Coffey, 2018) • Tailings Storage Facility – Emergency Response Plan (NiW, 2018b)	7 February 2019

3. Background

The premises is situated approximately 370km north east of Kalgoorlie and approximately nine kilometers east of the Leinster township on Mineral Lease 255SA. BHP Billiton Nickel West Pty Ltd (NiW) processes sulphide ore to produce nickel concentrate which is then transported via rail to the Kalgoorlie Nickel Smelter for smelting (L8653/2012/2). The site is authorized to processes up to 3,600,000 tonnes of ore annually and during the 2017-2018 annual period approximately 2,250,000 tonnes of tailings were produced requiring on site disposal to both TSF2 and TSF3. The TSF Cell 3E has a footprint of approximately 33Ha and through this amendment will be raised to approximately 20m above ground level. The current

embankment raise will allow for the storage of an additional 0.98 million tonnes of tailings and extend the operational life of TSF3 Cell E by a further five to nine months.

4. Overview of Premises

4.1 Operational aspects

Through this Works Approval the occupier intends to use borrow material to raise the embankment of TSF Cell 3E by two meters to RL 10547.5m using the upstream method of construction for tailings storage facilities (ANCOLD, 2012). A two meter raise of associated infrastructure such as the internal causeway, decant structures, drainage lines, and electrical and pumping infrastructure will also occur. Some modification to external drainage lines to divert storm water away from the new TSF embankment raise is also included in the proposal.

The embankments of the new raise will be constructed using borrow material and mine waste be sourced from various parts of the premises including the Rocky's Reward Waste Dump, the stockpiles near Perseverance Mine (which contain pre-crushed and screened material) and Tailings from Cell 3 E. The materials will be tested to ensure it meets specified performance criteria within tolerance limits such as sieve size, plasticity index, liquidity, moisture content. Suitable materials will compacted to the specified compacted dry density ration limit for that material type and any that do not meet specifications will be disposed of at a designated spoil area (Coffey, 2018).

Tailings will be disposed along the perimeter embankment through sub-aerially rotating spigots, situated approximately 40m apart. Deposition will be managed to form a thin beach layer adjacent to the perimeter embankment and a natural decline towards the centrally located decant tower. The decant well will pump and transfer the decant liquor to the return water pond located to the north of TSF Cell 3 AB via a return water line that transects the northern west side of Cell 3E (Coffey, 2018). A total operation freeboard of 300mm will be maintained at all times allowing for a 1 in 100-year Annual Recurrence Interval (ARI) rainfall event of 2.7mm/hour over a 72 hour period (NiW, 2016g).

31 piezometers exist along the embankments of TSF 2 and TSF 3 to assist with the monitoring and management of the phreatic surface within the TSF (NiW, 2016b).

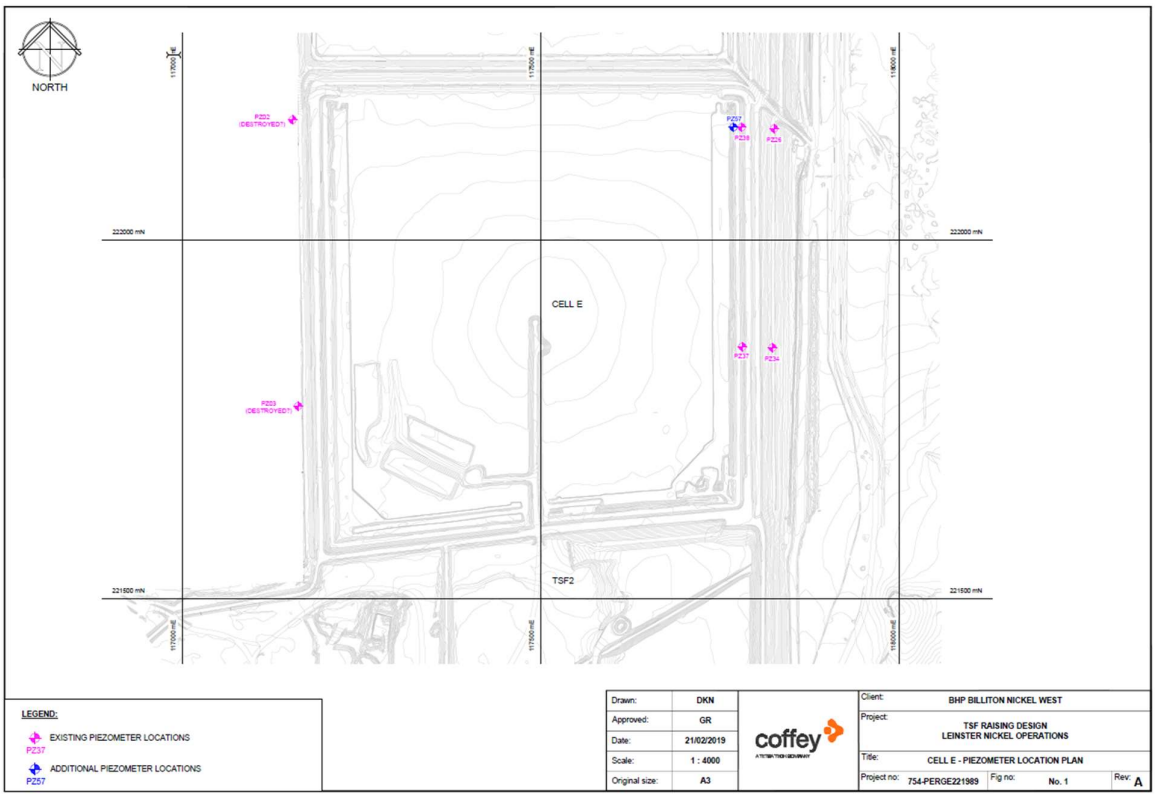
A system of seepage trenches, cut off trenches are used to limit the movement of seepage to groundwater where it may impact on groundwater and impact on vegetation within proximity of TSF 3 Cell E. Groundwater recovery bores are used to recover seepage surrounding the TSF and to ensure groundwater mounding does not impact on the root zone of plants species within 6m of the ground surface (NiW, 2016b).

The TSF 3 Cell E infrastructure, as it relates to Category 5 activities, is detailed in Table 3 and with reference to the Site Plan (attached in Attachment 1).

Table 3: Leinster Nickel Operations TSF3 Cell E embankment raise infrastructure

	Infrastructure	Site Plan Reference
	Prescribed Activity Category 5	
Nickel West processes nickel sulphide ore to produce nickel concentrate. Ore treatment involves crushing and grinding with water and then chemicals are added as the floatation part of the processes to separate and suspend the nickel in solution. The primary chemical additive is sodium ethyl xanthate, and also includes a flocculent, copper sulphate and guar. Tailings resulting from this process are discharged as a slurry to the paddock style TSF's located approximately 2.5km north of the plant.		
1	TSF embankments • Phased removal of TSF3 Cell E tailings delivery lines and associated infrastructure •Phased bulk earthworks constructions of embankment lift of Cell TSF3 Cell E to RL 10547.5m •Embankments are to be constructed using in-situ soils and mine waste from a nearby waste dump (name), rolled and compacted to a minimum 95% of standard Maximum Dry Density and placed within a moisture content tolerance of within 2% (+/-) of its optimum moisture •Reinstallation of TSF3 Cell E tailings delivery lines and associated infrastructure; •Peizometers placed in array locations around the external perimeter embankment as shown in Figure 1 to monitor the phreatic surface within the deposition mass. Constructed to allow for minimum total freeboard of 300mm from the top of the tailings beach to the embankment crest	
2	<u>TSF decant tower</u> •The centrally located decant tower and causeway will be raised to RL 10 547.5m Recycled decant water will be recycled back into processing plant via the return water pond located to the north of TSF 3	
3	<u>TSF pipelines</u> •Will be contained within bunded open trenches to contain leaks and spillages from pipe burst events Will be fitted with automatic leak detection and shut off systems to minimise discharge and allow for maintenance and recovery of materials	
4	<u>Tailings deposition</u> •Embankment perimeter wall fitted with a tailings deposition main ring that contains multiple spigot attachment valves located at nominal 40m intervals; •Multiple spigots used to discharge tailings sub-aerially on the upstream edge of the perimeter embankment; cycling between TSF Cells to facilitate thin layer and consolidation of tailings; •Tailings discharge at low velocity and spigot locations changed periodically to maximise tailings beach consolidation around the edge of the TSF and minimise the size and location of the decant pond towards the centre of the cell; Tailings deposition will be managed to contain rainfall associated with a 1 in 100 year, 72 hour duration Average Recurrence Interval rainfall event.	

Figure 1: Cell E Peizometer Location Plan



Source: Email from NiW dated 25/2/2019; DWER record A1768195

4.2 Other relevant approvals

The key regulatory control over the Leinster Nickel Operations comes from the *Nickel (Agnew) Agreement Act 1974 (WA)* which was ratified by parliament as a State Agreement as a major resources project for mining and mining related activities. The premises is wholly situated within State Agreement Act mining lease ML255SA and the site is not subject to a mining proposal under *Mining Act 1978*.

Although not subject to a Mining proposal; NiW have submitted a dam safety review of the tailings storage facilities at the Leinster Nickel Operations as part of this application. The review was conducted by a third party Engineering consultant in accordance with the specifications of ANCOLD (2012) and identifies the status of critical controls is compliant for TSF incident management, TSF escalation and response plan, TSF operations, TSF construction. Limited data is available for TSF design in relation to the TSF foundations and risk based design due to the age of the facility. The Works Approval Holder has undertaken a geotechnical investigations and a dam break assessment to address the deficiencies in historical TSF design and construction practices (Golder, 2018).

BHP Billiton Nickel West Pty Ltd also have obtained the following approvals as outlined in Table 4.

Table 4: Relevant approvals

Legislation	Number	Approval
Nickel (Agnew) Agreement Act 1974 (WA)	-	Legal contract between the State of Western Australia and the proponent to develop a major nickel project within the boundary of Western Australia.
Environmental Protection Act 1986	CPS 2222/4	To clear up to 400Ha of land within the prescribed premises boundary
Environmental Protection Act 1986	L4612/1989/11	To undertake the mining and processing of ore; mine dewatering, used tyre storage, landfilling of waste and treatment of sewage.
Rights in Water and Irrigation Act 1914	GWL58111(5)	To take water for mining and processing activities from the Mid-Gum Pool and Alans Pool paleochanel aquifer
	GWL63834(4)	To take potable water from the combined fractured rock west and fractured rock aquifer
	GWL66248(5)	To take water for dewatering purposes from the combined fractured rock west and fractured rock aquifer

4.3 Part V of the EP Act

Table 5 summarises the works approval and licence history for the premises.

Table 5: Works approval and licence history

Instrument	Issued	Nature and extent of works approval, licence or amendment
L4612/1989/11	29/04/2016	The Licence duration extended from 18 October 2018 to 18 October 2030 by Amendment Notice.
L4612/1989/11	15/12/2016	Amendment Notice 1 to authorise construction and operation of a replacement waste water treatment plant.
L4612/1989/11	22/08/2017	Amendment Notice 2 to authorise embankment raise to TSF3 Cell CD to RL 10,556.5m
L4612/1989/11	20/03/2018	Amendment Notice 3 to authorise embankment raise to TSF3 Cell AB to RL 10,556.5m
L4612/1989/11	30/01/2019	Amendment Notice 4 to authorise construction and operation of the Venus paste plant.
W6620/2019/1	7/03/2019	For TSF3 Cell E embankment raise from RL 10545.5 to a final height of RL 10547.5m

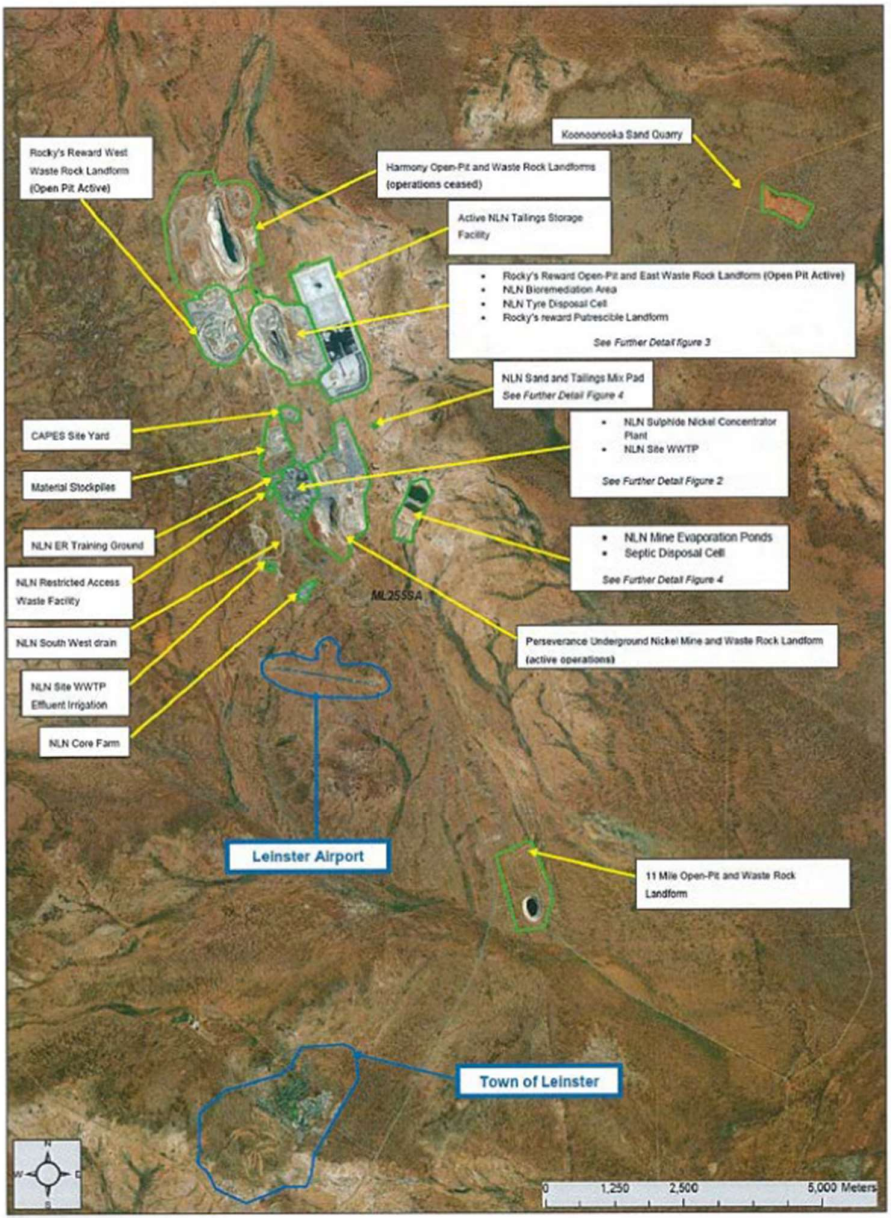
5. Location and receptors

Table 6 below lists the relevant sensitive land uses in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 6: Receptors and distance from activity boundary

Residential and sensitive premises	Distance from Prescribed Premises
Town of Leinster	12 km (to the south–west) of TSF3 as shown in Figure 2.

Figure 2: Location of Town of Leinster with respect to the Leinster Nickel Operations



Source: Current Amendment Application Form (NiW, 2018)

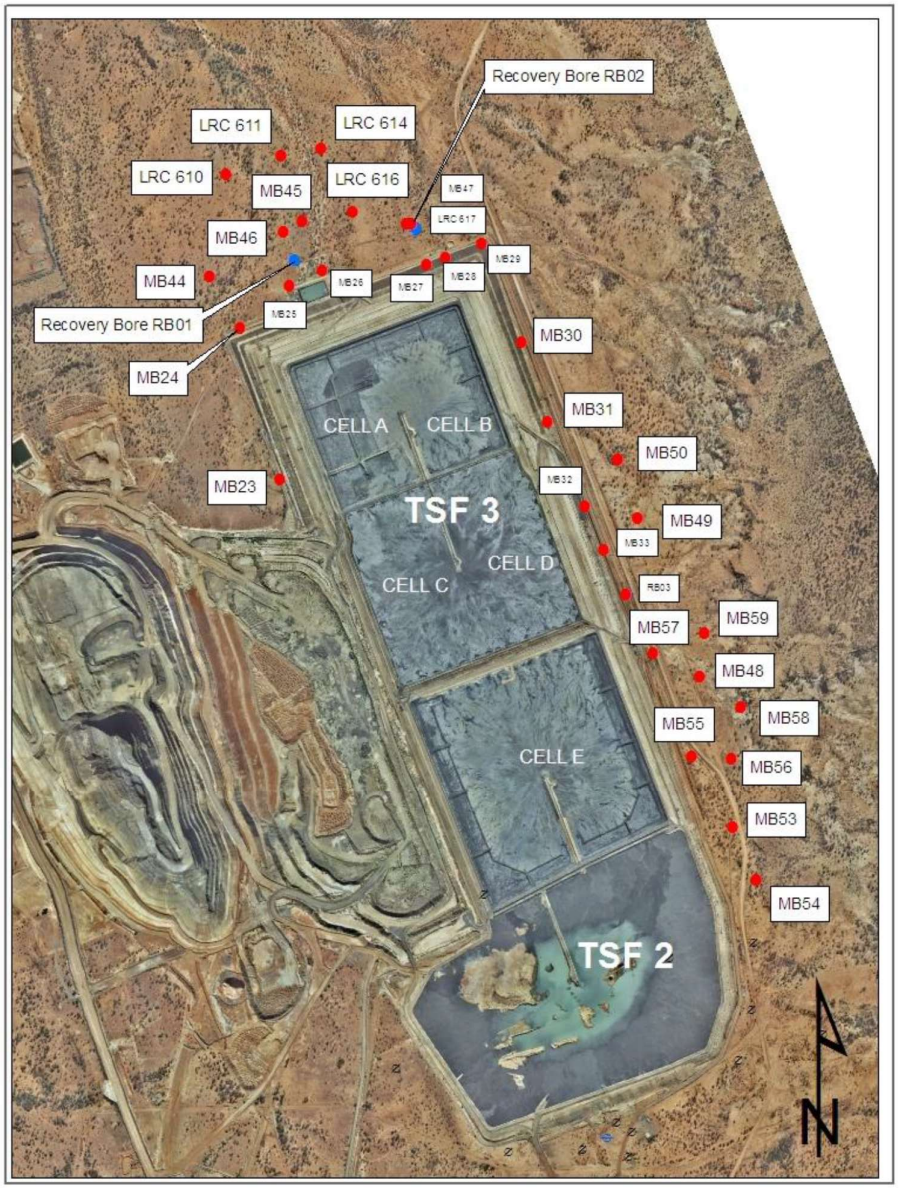
Table 7 below lists the nearest environmental receptors to the TSF.

Table 7: Environmental receptors and distance from activity boundary

Environmental receptors	Distance from Prescribed Premises
11 mile (potable) borefield	5 km (~12 km south of TSF3)
McArthurs (historical pastoral) Bore	5 km to the north
Priority flora	Surrounding TSF2 and TSF3 as shown in Figure 4.

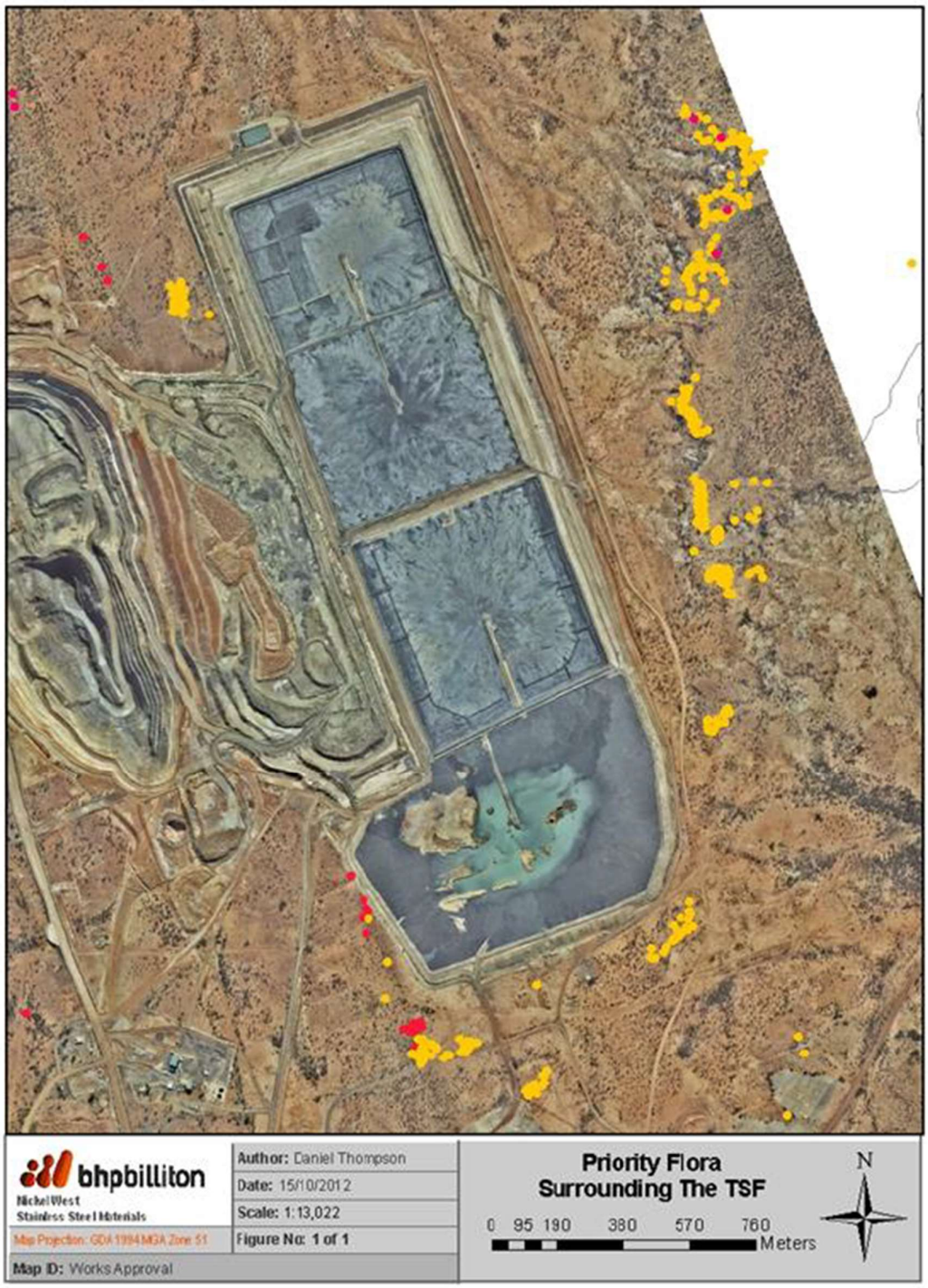
Figure 3 below details the location of groundwater water monitoring an recovery bore surrounding TSF 2 and TSF 3.

Figure 3: Groundwater Monitoring and recovery bores in relation to TSF2 and TSF3



Source: Amendment Application Form For Cell Raise TSF3 Cell CD (NiW, 2017)

Figure 4: Location of Priority Flora in relation to TSF 2 and TSF3



Source: Amendment Application Form For Cell Raise TSF3 Cell CD (NiW, 2017

5.1 Local Hydrogeology

The TSFs are located on a regional catchment divide at a ground elevation of 520m AHD, more than 10km from significant aquifers (valley fill alluvial groundwater systems including 11 Mile Potable borefield). Drilling programs in 1991 – 1992, prior to construction of TSF3, encountered no underlying groundwater systems. In 1996 three years post operation of TSF3, a section of deep weathered fractured bedrock running north – south under TSF2 was detected, with seepage consequently expected to run north-south with spread to east and west less (Berry 2017).

Immediately underlying the TSFs is alluvial soil, of moderate permeability to a depth of less than 5m, overlying low permeability saprolitic clay. Highly weathered granite extends to 20-30m deep and pre-development static water levels were at this level (~490 m AHD). The only natural groundwater occurrences were minor and discontinuous zones associated with bedrock fractures (Berry 2017).

The tailings seepage salinity of 15,000 mg/L is distinct from the salinity of local groundwater. The seepage is also chemically distinct with elevated arsenic, magnesium, nickel and sulfate concentrations (Berry 2017). Vertical seepage from the TSF has mounded in the previously unsaturated materials and this water has a slight tendency to migrate laterally through low permeability geology which were previously unsaturated.

A ground conductivity survey in 2007 provided evidence of the extent of impact from seepage over the 15 year operating period 1993 – 2007. Areas of elevated conductivity are indicative of seepage impact, with the area most affected being to the north and south of the TSFs (Berry 2017). Limited lateral seepage to the east was observed.

There are a number of minor non-perennial watercourses, or drainage lines within the vicinity of the of the premises and these flow towards the Lake Miranda and Lake Raeside salt lake systems following heavy rainfall. Rainfall is sporadic and although the annual average is 274mm per annum, up to 100mm can fall within a 24 hour period. These Salt lake systems are over 15km away from the premises boundary.

6. Risk assessment

6.1 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 13.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Tables 8 and 9 below.

Table 8. Identification of emissions, pathway and receptors during construction

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
Construction, mobilisation and positioning of infrastructure associated	Vehicle movements on unsealed access roads	Noise	No residences or other sensitive receptors within 12km of TSF3	Air / wind dispersion	Amenity impacts	No	The Delegated Officer Considers the distance is sufficient between the construction area and residential dwellings to manage potential impacts. The Noise Regulations apply

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
with TSF3 Cell E raise		Dust		Air / wind dispersion	Amenity Impacts Deposition which may harm plants by reducing photosynthesis and plant respiration	No	The Delegated Officer Considers the distance is sufficient between the construction area and residential dwellings to manage potential impacts No impacts evident on native vegetation from existing vehicle activities. The Works Approval Holder is required to undertake the works in accordance with the application supporting documentation and includes a commitment to undertake regular wetting of work areas to control dust (Coffey, 2018).t Works approval holder controls are considered adequate to manage dust from construction activities and include the use water carts on roads
	Earthworks for construction of new TSF raise and associated infrasructure	Noise	No residences or other sensitive receptors within 12km of TSF3 Nearby native vegetation	Air / wind dispersion	Amenity impacts	No	The Delegated Officer Considers the distance is sufficient between the construction area and residential dwellings to manage potential impacts. The Noise Regulations apply

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
			including priority flora				
		Dust			Amenity impacts Deposition which may hard plants by reducing photosynthesis and plant respiration	No	The Delegated Officer Considers the distance is sufficient between the construction area and residential dwellings to manage potential impacts Delegated Officer Considers impacts on priority flora from particulate dust to be insignificant and unlikely to occur due to short duration of works. The Works Approval Holder is required to undertake the works in accordance with the application supporting documentation and these includes a commitment to undertake regular wetting of earthen work areas and use of spray carts to control dust (Coffey, 2018).t Vegetation monitoring occurs near TSF 2 and TSF3 under Licence Condition W10 and is undertaken annually and no declines in vegetation health has been observed from either TSF seepage or due to previous TSF embankment raise events. No further assessment.
		Sediment/soil	Nearby native vegetation including priority flora	Storm water runoff	Partial burial of vegetation	No	The Delegated Officer considers the impacts on vegetation to be insignificant and unlikely to occur. Rainfall is generally low, and should a high rainfall event occur during the short construction phase cut off trenches will drain and contain sediment, protecting nearby vegetation (Coffey, 2018). No further assessment
		Hydrocarbons	Soil and vegetation	Direct discharge/ stormwater	Soil contamination inhibiting vegetation growth and survival	No	Spills resulting from earthworks are unlikely to occur and impacts from potential events will be insignificant due to small volumes and spill response procedure (Coffey, 2018).

Table 9: Identification of emissions, pathway and receptors during operation

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**		
Tailings deposition into TSF3 Cell embankment raise RL 10547.5m	Tailings surface	Dust	No residences or other sensitive receptors within 12km of TSF3	Air/ wind dispersion	Human health and amenity	No	There will be no overall change in the risk of dust emissions from the Tailings dam surface associated with the current embankment raise. The Delegated Officer Considers the distance is sufficient between the construction area and residential dwellings to manage potential impacts Existing Licence Condition A1(a) requires the Works Approval holder to prevent and minimise the generation of dust for open areas, such as the TSF surface area. No further assessment.
	Tailings delivery and return water pipelines	Rupture of pipelines causing tailings discharge to land	Native vegetation and soil adjacent to tailings pipelines	Direct discharge	Soil contamination inhibiting vegetation growth and survival	Yes	The risk of pipeline, drain and pump failures associated with Cell 3E embankment raise is assessed in Section 6.4 of this report. .
	Seepage	Leachate	Soil and groundwater	Direct discharge	Groundwater mounding Groundwater contamination	Yes	The risk of increase seepage through the base of the TSF3 Cell E is considered in the the detailed risk assessment contained in Section 6.5 of this report
	Overtopping of TSF3 Cell E	Tailings release	Native vegetation and soils	Overtopping of supernatant and/or tailings during extreme rainfall event or over filling of the TSF cell	Soil contamination. Impacts to terrestrial vegetation and ecosystems. Seepage leading to groundwater contamination	Yes	The risk of overtopping due to excess loading or overtopping due to heavy rainfall events associated with Cell 3E embankment raise is detailing in Section 6.6 of this report.

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Stormwater runoff	Stormwater contaminated with tailings and tailing liquor	Soil and vegetation within the stormwater catchment area	Sheet runoff and infiltration	Soil contamination inhibiting vegetation growth and survival	Yes	The risks associated with uncontrolled stormwater runoff and flooding is covered in Section 6.7 of this report
	Contact by wildlife Facility is fenced to prevent access by large animals	Birds exposed to potentially hazardous/ toxic materials from the surface of the TSF	Birdlife	Direct contact and ingestion of water elevated levels of metals/ metalloid contaminants; dermal contact and ingestion of aquatic organisms.	Reduced health and potentially soft tissue damage (eyes, digestive tract) cause by ingestion and contact with tailings liquor and contaminated organisms.	No	There will be no overall change in the risk of harm to birds associated with the current TSF3 Cell E embankment raise. Boundary fencing separates the mine site infrastructure from pastoral activities, preventing access by livestock and kangaroos. Bird deaths have not been encountered on the TSF's to date, but any occurrences associated with the TSF's would be reported. No further assessment required.

6.2 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 10 below.

Table 10: 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 11 below.

Table 11: 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.

6.3 Acceptability and treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk treatment Table 12 below:

Table 12: 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.

6.4 TSF3 Cell E tailings delivery and return water pipeline failure

6.4.1 Risk assessment

There is potential for the discharge of tailings slurry and return water to the environment through pipelines failing, bursting or leaking.

Tailings slurry and decant water contain soluble metals and metalloids (other chemicals) which are toxic to vegetation and fauna.

The discharge of tailings and decant water may cause vegetation and faunal death through contact with soft tissues such as through absorption or ingestion. Discharges of significant quantities tailings and return water may cause contaminants to seep into the soil profile and in significant quantities impact on the roots of deep rooted vegetation such as tree species and diminish ambient groundwater quality.

The relevant land and groundwater criteria include for discharges is the Guidelines for fresh and Marine Waters (ANZECC and ARMCANZ, 2000), and the National Environmental Protection (Assessment of Site Contamination) Measure (NEPC, 2013) for soil and groundwater.

The application states that the TSF has been designed in accordance with the Code of practice: tailings storage facilities in Western Australia (DMP, 2013) and the Guidelines on Tailings Dams Planning, Design, Construction, Operation and Closure (ANCOLD, 2012) Leakage and failure of tailings and decant water pipelines will be managed through the use of an automatic leak and flow rate detection system, shut off valves, a standby pump, regular inspections, regular maintenance and the containment of of pipelines in open trenches (if not

buried). An Operating Manual has been provided for the Leinster Nicklel Operations TSF's and includes inspection of tailings and decant lines during each shift, twice daily (NiW, 2016d). The Delegated Officer has considered the location of TSF3 Cell E, the composition of tailings and decant water and that the priority flora (within 200m of TSF3) are separated by a cut off trench and located upslope of the TSF and determined that a tailings spillage would result in low level on site impacts. Therefore, the Delegated Officer considers the consequence to be **minor.**

The Delegated Officer has considered the infrastructure requirements for the TSF3 Cell E pipelines (tailings and return water) on the Existing Licence, distance to sensitive and priority flora; the impermeable nature of the insitu soils and determined that the environmental impact from a tailings/decant liquor spill to the environment will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of the consequence occurring to be **unlikely**.

The overall rating for the risk of tailing and decant water spill through leaks, pipeline failure or rupture events during operation is **medium** and acceptable subject to regulatory controls.

6.4.2 Regulatory Controls

The Delegated Officer considers the following conditions are sufficient for managing the risks associated with a TSF Cell E pipeline failure, following construction:

- Existing Licence Condition W1(a) requires all tailings delivery and return water lines to be managed to prevent damage to vegetation, surface or groundwater resources.
- Exisiting Licence Condition W17(a) requires all pipelines containing saline or alkaline constituents (including tailings and return water lines) to be buried or sites within appropriately bunded facilities.
- Existing Licence Condition W17(b) requires the aboveground tailings and return water delivery lines (and secondary containment infrastructure) to drain towards catch pits to allow for containment of any spills. The pipelines are required to be fitted with a leak detection and automatic shut off system in the case of burst events.
- Exisiting Licence Condition W16(a) requires 12 hourly visual inspection of tailings delivery lines, return water lines and Condition W16(b) requires a log book to be kept and available for inspection.

6.5 Seepage

6.5.1 Risk assessment

Groundwater in the area is naturally saline and the only beneficial use of the water in the area is as a process water supply for the processing of ore in mining operations. The current embankment raise has the potential to cause an increase in seepage from the base of the TSF3 Cell E liner and this could contribute to increased groundwater contamination and mounding beneath the TSF3 Cell E. There is limited design and construction data available for the starter embankment of this TSF cell so the permeability of the base of the cell as constructed in uncertain (Golder, 2018) and monitoring data and indicates that seepage is occurring from this cell (AER, 2018). Baseline groundwater beneath TSF3 footprint area was observed at approximately 30mbgl prior to development (Berry, 2017) and water had recently been identified to between 1.7- 11.3mbgl (AER, 2018).

Post development, the depth to ground water varies around the TSF's as a whole; and rising groundwater has been observed to coincide with deposition into the TSF's which is currently between 1.6mbgl immediately adjacent to Cell E (MB57) and west of the toe drain; and rises

to between 6.7mbgl (MB5) and 11.3mbgl (MB58) east of the TSFs Cell E with 50-100m east (AER, 2018). The natural ground elevation rises to the east and less permeable geology combine to be protective of deep rooted vegetation species, as the seepage is toxic to vegetation and as the root zone which generally extends to a maximum of 6m below the ground surface. So while the current embankment raise has the potential to further elevate groundwater however this is not expected to impact on the growth of priority vegetation to the east of the TSF3 Cell E.

The relevant land and groundwater criteria include for discharges within the 6m root zone of vegetation is the Guidelines for fresh and marine waters (ANZECC and ARMCANZ, 2000), and the National Environmental Protection (Assessment of Site Contamination) Measure (NEPC, 2013) for soil and groundwater.

To reduce the risk of seepage the following considerations have been incorporated into the TSF3 Cell E design:

- The use of low permeability compacted materials with specified performance criteria for the embankment raise materials;
- Construction of a cut off trench beneath and in the centerline of the external perimeter embankment to a depth where low permeability materials are encountered (Golder, 20-18). This will act as a hydraulic barrier and prevent horizontal flow of seepage from within the TSF to the external environment;
- Piezometer arrays will be constructed along the perimeter embankments to allow for early detection of seepage within the embankments;
- Decant structures to maximize the recovery of process water in each cell.
- Tailings discharge conducted in a manner that ensures process water is constantly positioned around the central decant structure ensuring ponding is kept away from the perimeter embankments;
- Groundwater regularly monitored; and
- Regular inspection and maintenance of the TSF and associated infrastructure as stated in the TSF Operating Manual (Coffey, 2018)

The Delegated Officer has considered the sitting of TSF3 Cell E and the low permeability soils within that location, the poor groundwater quality and distance to groundwater and determined that low-level on site impacts will result from basal discharge from the TSF liner. Therefore, the Delegated Officer considers the consequence to be **minor**.

The Delegated Officer has considered the the design and construction standards of TSF3 Cell E embankment raise, the operational procedures for management of TSF3 Cell E, and the natural low permeability of the *insitu* soils and determined that the impacts of seepage will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of the consequence occurring is **unlikely**.

The Delegated Officer considers the overall rating for the risk of seepage from TSF3 Cell E during operation is **moderate**, and acceptable subject to regulatory controls.

6.5.2 Regulatory Controls

The Delegated Officer Considers the following conditions are suitable for managing the risks associated with seepage following construction of TSF Cell E embankment raise to RL 10547.5m:

- Existing Conditions W5, W6(a),W6(b) and W6(c) for the installation, maintenance and monitoring of groundwater wells and recovery bores for the purpose of monitoring and recovering seepage in the vicinity of the TSF's
- Existing Condition W16 for this inspection of the TSF's 12 hourly and to note the ponding of decant within the TSF cells, seepage on the embankment walls and tailings deposition.

6.6 Overtopping of TSF3 Cell E

6.6.1 Risk assessment

Overtopping of TSF3 Cell E can occur if deposition into the cell exceeds the holding capacities or as a result of a significant rainfall event, or a combination of both of these events. In the instance of an overtopping event, tailings slurry and decant water contain soluble metals and metalloids and other chemicals which are toxic vegetation and fauna would be discharged to the environment leading to soil contamination and possibly impacts to terrestrial ecosystems, such as plant and animal deaths. Large discharge volumes or discharge over sustained periods could result in eventual groundwater contamination.

The risks of an overtopping event would be assessed against relevant land and groundwater criteria include the Guidelines for fresh and marine waters (ANZECC and ARMCANZ, 2000), and the National Environmental Protection (Assessment of Site Contamination) Measure (NEPC, 2013) for soil and groundwater.

The design and operation standard for TSF's is the *Guidelines on Tailings Dams Planning, Design, Construction, Operation and Closure* (ANCOLD, 2012) and the *Code of practice: tailings storage facilities in Western Australia* (DMP, 2013). The Code requires a minimum operational freeboard of 300mm to be maintained as well as a 200mm tailings beach freeboard (a total of 500mm). A combined freeboard of 500mm will be maintained at all times during normal operations which is easily able to accommodate rainfall from a 1 in 72 hour ARI event (194.4mm) which is predicted to result in an addition 300,000m3 across all TSF2 and TSF3 cells which will take approximately 30 days to be returned back to the processing plant (NiW, 2016g).

The method of tailings deposition will create a depressed truncated prism over the area of TSF3 Cell E to ensure drying of the tailings and to facilitate removal of decant water. The depressed area will also allow for the temporary storage of volumes of stormwater away from the perimeter embankments where it can impact on stability. The Tailings Storage Water Management Plant (NiW,2016g) allows for up to 30 days for removing excess water from the TSF3 Cell E following an extreme rainfall event. The primary control mechanisms for preventing overtopping are the design specifications, the Operating Manual (NiW, 2016d) which includes freeboard markers, routine inspections (twice daily), regular maintenance, and minimising the size and extent of the centrally located decant pond and by ensuring maximum water is returned to the processing plant area. The design features include cut off tranches adjacent to the upstream edges, a sloped embankment crest, rocks on the outer embankment for erosion control and operation of a central decant tower.

If an overtopping event occurs, the Delegated Officer has determined that the impact of tailings and decant water discharge will have will have mid-level onsite impacts. Therefore, the Delegated Officer considers the consequence of an overtopping event to be **moderate.**

The Delegated Officer has considered the controls in place for TSF3 Cell E including embankment freeboard, capacity to accommodate a 1 in 100 years 72 hour rainfall event, design and infrastructure requirements as well as operational procedures as specified in the

operations manual and determined that while overtopping of TSF3 Cell E will only occur in exceptional circumstances, impacts could occur if overtopping occurs. Therefore, the Delegated Officer considers the likelihood of the consequence occurring to be **possible**.

The overall rating for the risk of overtopping of TSF3 Cell E on environmental receptors during operation is **medium** and acceptable subject to regulatory controls.

6.6.2 Regulatory Controls

The Delegated Officer Considers the following conditions are suitable for managing the risks associated with overtopping of TSF3 Cell E:

- Existing Licence Condition W15 requires the maintenance of a 300mm freeboard within all TSF cells to accommodate extreme rainfall events and over topping. The Leinster Nickel Mine: Dam Safety Review of Tailings Storage Facilities (Golder, 2018) notes that the current operational contingency freeboard is actually 500mm, as per the Code of practice: tailings storage facilities in Western Australia (DMP, 2013) and the Licence condition should be updated to reflect this best practice value;
- Exisiting Licence Condition W16(a) for 12 hourly visual inspections of the the TSF's including for ponding on the surface, the internal embankment freeboard.

6.7 Stormwater runoff

6.7.1 Risk assessment

Stormwater runoff from TSF3 Cell embankments has the potential to become contaminated with sediments from tailings slurry, decant liquor, hydrocarbons, heavy metals, metalloids and hazardous chemicals and wastes during operation. Soluble metals and metalloids can form metal complexes which are toxic and highly soluble in water. This can lead to contamination of land through direct contact and infiltration into soils. Soil contamination may inhibit vegetation growth and cause health impacts to fauna and through bioaccumulation in the food chain.

Prolonged stormwater contact with TSF embankments can also act to destabilise the embankments through the swelling and subsequent shrinkage of pore spaces when the embankments construction materials become saturated, then dry after the wet period ends. Stormwater events, through poor management of saturation within the embankments, can also cause erosions to poorly designed and constructed embankments. Both erosion and prolonged contact with stormwater have the ability to contribute to dam break events where the contents of the TSF are discharged to the environment in an uncontrolled manner, often with significant and lasting effects spread over a wide geographical area.

The primary control mechanism for managing contaminated stormwater runoff is to limit contact of surface runoff with the TSF and associated infrastructure following extreme rainfall events. The flood modelling study indicates that incorporation of the following considerations into the design and operation of TSF2 will have the effect of isolating the TSF from flood conditions:

- Seepage trenches and toe drains around the external embankment perimeter TSF3 Cells;
- Stormwater diversion drains surrounding the TSF2 and TSF 3 to divert surface runoff from high intensity cyclonic rainfall events;
- Maintenance and cleaning debris out of drains and culvert where required to allow clear passage of storm water.

The Delegated Officer has considered the location of TSF3 Cell E within the catchment drainage areas, the possibility of severe weather events, the solubility and toxicity of potential contaminants and the existing drainage systems and around the TSFS Cell E and determined that storm water runoff from an extreme weather event could result in low-level on-site impacts. Therefore, the Delegated Officer the consequence to be **minor.**

The Delegated Officer has considered the infrastructure surrounding TSF3 Cell E including the toe drains and seepage trenches around the TSF2 embankment, and considers impacts from high intensity storm water runoff events will not occur in most instances. Therefore, the Delegated Officer considers the likelihood of the consequence occurring to be **unlikely**.

The overall rating of the risk of contaminated stormwater runoff from TSF 3 Cell E impacting on vegetation and contaminating soil to be **medium**, and acceptable subject to regulatory controls.

6.7.2 Regulatory Controls

The Delegated Officer considers the following condition is suitable for managing the risk associated with stormwater runoff and flood events:

- Existing Licence Condition W3 which required stormwater to be diverted away from areas adjacent to TSF's to minimise the threat of accidental loss of stored matter due to flooding or erosion.
- Exisiting Licence Condition W4 requires the installation and maintenance of perimeter drains downstream of the TSF which primarily for the collection and recovery of seepage or materials from a low level breach of the embankments; but that will also serve to collect contaminated stormwater.

7. Determination of Works Approval conditions

The conditions in the issued Works Approval can be found in Attachment 1. These have been determined in accordance with the Guidance Statement: Setting Conditions (DER, 2015).

The Guidance Statement Licence Duration has been applied and the issued works approval expires in three years from the date of issue. This duration allows the Works Approval Holder to meet anticipated timeframes for construction works and proposed commencement dates for deposition of tailings. The duration allows the Works Approval to remain valid for an additional two year period to accommodate unexpected delays.

Commissioning of the TSF3 Cell E can occur under the Works Approval following the submission of the engineering certification that ensure the works have been constructed in accordance with the requirements and specifications of the current works approval. The existing Licence Conditions are suitable to manage any emissions and discharges from the new embankment raise through this commissioning period.

8. Applicant's comments

The Applicant was provided with the draft Decision Report and draft issued Works Approval 19 February 2019. The Applicant provided minor editorial comments on 25 February 2019, an updated premises boundary map and piezometer location maps on 25 February 2019 which have been incorporated as appropriate. Not all editorial changes recommended to the wording of Works Approval Conditions have been incorporated.

9. Conclusion

This assessment of the risks of activities on the Premises has been undertaken with due consideration of a number of factors, including the documents and policies specified in this

Decision Report (summarised in Appendix 1). Based on this assessment it has been determined that the issues Works Approval will be granted subject to conditions commensurate with the determined controls, administration and reporting requirements.

Appendix 1: Key documents

	Document title	In text ref	Availability
1.	Licence L4612/1989/11 – Leinster Nickel Operations	L4612/1989/11	accessed at www.der.wa.gov.au
2.	Works Approval W6220/2019/1–TSF 3 Cell E embankment raise to RL 10547.5m	W6220/2019/1	DWER record A1748959
3.	Works Approval W5576/2013/1 – TSF 3 Cell E embankment raise to RL 10545.5m	W5576/2013/1	DWER record A1435498
4.	Works Approval application form for this works approval as received 13 December 2018:	NiW, 2018	DWER record A1748920
5.	TSF Cells CD Lift by 2.5m to RL 10,556.5m Nickel West leinster DER Licence L4612/1989/11	NiW, 2017	DWER record A1435498
6.	Email Correspondence: Leinster Works Approval Application for Additional Information (Annette Latto: 7 February 2019)	Latto, 2019	DWER record A1764327
7.	Email Correspondence: Response to draft conditions W6220/2019/1 BHP Billiton Nickel West Pty Ltd Nickel West Leinster Nickel (Annette Latto: 25 February 2019)	Latto, 2019a	DWER record A1768195
8.	Berry K (2017) Nickel West Leinster Assessment of Groundwater Characteristics, April 2017.	Berry, 2017	DWER record A1435498 (Appendix 2)
9.	Nickel West Leinster 2017/2018 Annual Environmental Report for L4612/1989/11 and L6606/1995/9	AER, 2018	DWER record A1734084
10.	Leinster Nickel Mine: Dam Safety Review of Tailings Storage Facilities, Golder Associates Pty Ltd	Golder, 2018	DWER record A1764265
11.	Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Facility Emergency Procedures	NiW, 2016a	DWER record A1764256

	Management Plan		
12.	Leinster Nickel Operation Tailings Management Master Plan Description of Existing Facilities	NiW, 2016b	DWER record A1764267
13.	Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Facility Licensing Plan	NiW, 2016c	DWER record A1764262
14.	Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Facility Monitoring Plan	NiW, 2013	DWER record A1764263
15.	Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Facility Operating Manual	NiW, 2016d	DWER record A1764266
16.	Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Facility Risk Management Plan	NiW, 2016e	DWER record A1764258
17.	Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Facility Roles and Responsibilities	NiW, 2016f	DWER record A1764268
18.	Leinster Nickel Operation Tailings Management Master Plan Tailings Storage Water Management Plan	NiW, 2016g	DWER record A1764264
19.	Leinster Nickel TSF3 Cell E Raise to RL 10,547.5m (FY19): Scope of Works & Earthworks Specification	Coffey, 2018	DWER record A1764327
20.	Tailings Storage Facility – Emergency Response Plan	NiW, 2018b	DWER record A1764327

Attachment 1: Issued Works Approval W6220/2019/1