APPLICATION
PROPOSED ACTIVITIES TSF3
WORKS APPROVAL

DATE: 27 DECEMBER 2023

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EXECUTIVE SUMMARY

This application seeks approval for the construction and operation of the Cosmos Tailings Storage Facility expansion (TSF3), located within the Cosmos Nickel Operation in Western Australia. TSF3 is designed as an unlined facility, with reliance on a 4m thick ferrecrete layer to act as a natural liner, ensuring the safe containment of tailings.

Design and Safety Assurance

Design studies conducted for TSF3 have rigorously evaluated its capacity to withstand extreme environmental conditions. Key findings and assurances include:

- TSF3 can safely withstand a 48-hour Probable Maximum Precipitation (PMP) event, exceeding the Department of Mines, Industry Regulation and Safety's design storm event requirements.
- A comprehensive dam break assessment has been conducted to assess potential consequences in the event of a dam failure.
- Safety measures in design include a minimum 6-meter crest width for embankments, safety bunds, wearing courses on embankment crests, and erosion protection measures.
- Compliance with Australian codes and guidelines underscores the commitment to safety, environmental responsibility, and adherence to established industry standards throughout the design approval process.

Seepage Management

Seepage rates have been thoroughly assessed, considering scenarios with and without a drainage system. The drainage system consists of finger drains and toe drains, strategically placed to mitigate potential saturation near the embankments, especially during upstream raise construction.

Operational Plan

The operation of TSF3 will align with established procedures for TSF1, ensuring consistency and adherence to safety protocols. An updated Emergency Action Plan will incorporate TSF3 after its commissioning.

Supernatant Water Management

Efficient removal of supernatant water will be achieved using a floating pump located at the decant pond, strategically positioned near the shared internal wall between TSF1 and TSF3. Control of the decant pond's position will be managed through spigots placed around the facility's perimeter.

Erosion Control

To minimize erosion of embankment slopes and reduce the risk of embankment failure or sediment loss into the environment, the crest of the perimeter embankment will be constructed with an inwardly graded crossfall of 2%, directing rainfall toward the TSF3 basin.

Tailings Characteristics

Tailings testing from a blended sample has been conducted to understand the characteristics of materials to be stored in TSF3. These tests provide essential information for safe tailings management within the facility, ensuring environmental compliance and stability. The findings suggest that the tailings are stable, unlikely to generate acidic conditions, and do not contain elevated levels of harmful elements.

Groundwater Impact Assessment

The likelihood of vertical seepage creating a groundwater mounding impact is assessed as low. Monitoring and recovery measures, such as intercepting and recovering seepage water, are in place to manage potential impacts on receptors, including terrestrial ecological communities, water bodies, and human populations. Among the various scenarios considered, Scenario 07, which involves the removal of Water Management Pond 8 (WMP8), stands out as the most environmentally beneficial option. This scenario addresses historical high seepage issues by eliminating the problematic pond. It also deactivates Water Management Pond 1 (WMP1) and focuses on the management of TSF1, TSF3, and Water Management Ponds 6-7 (WMP6-7). Scenario 07 suggests the addition of two recovery bores to manage groundwater levels effectively, thereby safeguarding the environment. IGO will re-equip available recovery bores for appropriate mounding control however, IGO expects that an additional recovery bore will not be necessary based on the proposed location (adjacent to WMP6/7) being presently cleared and devoid of vegetation. To ensure the implementation of appropriate management strategies to meet licensing obligating, IGO will maintain ongoing monitoring and assessment of the recovery situation.

Surface Water Management

A comprehensive hydrological study has been conducted to assess surface water flow processes. Design considerations include culverts and erosion protection measures to safeguard on-site assets. It's important to note that this surface water infrastructure has already been installed at the Cosmos mining project. By having this infrastructure in place, the project is well-prepared to handle extreme weather events, prevent erosion, and protect the surrounding environment.

Conclusion

This application for Cosmos Tailings Storage Facility Expansion (TSF3) demonstrates a commitment to environmental responsibility, safety, and adherence to rigorous design and regulatory standards. The reliance on a natural ferrecrete layer, thorough design studies, seepage management, and comprehensive operational plans ensure the safe and sustainable management of tailings within TSF3. Approval of this application will support the continued responsible growth of the Cosmos Nickel Operation while safeguarding the surrounding environment and communities.

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1.2 Project Description

IGO is seeking approval to construct an unlined Tailings Storage Facility (TSF3) abutting the south of the existing TSF1 over the disused Water Management Pond 1 (WMP1). The proposed TSF will provide additional storage for tailings materials and greater access to TSF1 for paste production used for backfilling activities. TSF2 was originally constructed adjacent to TSF1 and was subsequently incorporated into the footprint of TSF1. As such, the new TSF is labelled TSF3.

1.3 Application Type and Scope

This application is for a Works Approval and is solely for:

- the starter embankment of TSF3 (RL 484m); and
- the first raise of TSF3 to elevation RL 486.5m.

Upon obtaining the facility's operational license, subsequent amendments will be applied to accommodate the construction of an additional three 2.5m lifts to RL 494m as per the full technical specification report for the expansion. This phased approach was established in collaboration with the DWER during the scoping meeting. It was designed to align the starter embankment and first raise with the maximum allowable timeframe for a works approval being 5 years.

This streamlined approach ensures that the necessary approvals are obtained promptly for the initial construction phases, with a clear plan for addressing subsequent phases in compliance with regulatory timelines.

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2. TAILINGS STORAGE FACILITY DETAILS

2.1 Location

The proposed TSF expansion (TSF3) for the Cosmos Nickel Operation is located on tenement M36/371 within the Shire of Leonora. Cosmos is located approximately 37km north of Leinster and can be accessed via the Goldfields Highway. Nearby mining operations include the Bellevue Gold Mine to the south and Kathleen Valley Lithium mine to the north.

2.2 Design and Engineering

Golders prepared a design report for the proponent, IGO Ltd, with the purpose of updating previous studies conducted in 2018 for the expansion of the existing tailings storage facility (TSF1) at the Cosmos Nickel Operation. The expansion is necessitated by the need to provide Life of Mine storage for tailings generated at Cosmos from November 2023 to January 2037. While adequate storage capacity exists within the existing TSF (TSF1), IGO is considering an expansion of the facility to accommodate the proposed plant throughput and extended mine life. The expansion will be developed on already cleared land and take over the footprint of Water Management Pond 1 (WMP1). The footprint of TSF3 is maximum 16Ha.

The expansion plan entails the construction of an additional one cell TSF, referred to as TSF3, adjacent to TSF1. This expansion will involve the creation of earth fill starter embankments between TSF1 and WMP1, along with raising the wall height of WMP1 to reduced level (RL) 484 m Australian Height Datum (AHD). Additionally, a decant water collection facility will be established adjacent to the southern wall of TSF1 to manage supernatant water recovery from TSF3. The wall raises for TSF3 will be implemented using the upstream construction method, similar to the practices employed for TSF1, incrementally increasing storage capacity up to a maximum elevation of RL 494 m AHD for TSF 3, which the full design is approximately 15 meters above natural ground. Information relating to staging and storage capacity, as well as starter embankments and raises is provided in Table 2.

Table 2 – Tailings Checklist Part 3 Required Information

Category	Item	Information
Staging and Storage Capacity	Expected crest elevation	15 m
	Tailings storage area	9.3 ha
	Tailings storage volume	~1.0 × 106 m3
	Cumulative storage volume (m^3) for the starter embankment(s) and raise(s)	~1.0 × 106 m3
Starter embankments and raises	General approach (upstream, centreline, downstream)	Upstream
	Maximum raise height	2.5 m

Category	Item	Information
	Materials properties, and availability.	Northern embankment of WMP1 and clayey material from the foundation between TSF1 and WMP1. Supplementary material will be obtained from the borrow area situated to the east of the site.

The proposed timeline outlines the commencement of TSF3 construction in July 2025, with the facility scheduled for commissioning in December 2025. Design studies conducted for TSF3 have indicated that it can safely withstand a 48-hour probable maximum precipitation (PMP) event without overtopping, exceeding the Department of Mines, Industry Regulation and Safety's design storm event requirements. Furthermore, the design maintains a satisfactory factor of safety for the outer perimeter embankments and the dividing wall between TSF 1 and TSF 3 under various conditions. Seepage rates have been assessed, accounting for scenarios with and without a drainage system, which represents a small fraction of the total inflow.

The operation of TSF3 will align with previous operating procedures for TSF1, and the Emergency Action Plan currently in place for TSF1 will be updated to incorporate TSF3 after the facility's commissioning.

The design report (Appendix 4) includes detailed design information for TSF3.

2.3 Construction and Operational Details

The proposed expansion of the Cosmos TSF involves the construction of TSF3, an unlined TSF cell positioned adjacent to the existing TSF1. The construction and operation of TSF3 will adhere to established best practices and methodologies, with a primary focus on ensuring the safety, efficiency, and environmental responsibility of the facility.

2.3.1 Construction and Raise Methodology

Raises to TSF3 will be executed using the proven upstream construction method, a technique successfully employed during the development of TSF1. This method involves the controlled deposition of tailings, ensuring a systematic and secure rise in embankment height. By carefully managing the rate of rise and tailings deposition, the construction team will facilitate the construction of future embankment raises on previously deposited tailings. This approach optimizes space utilization and contributes to the facility's long-term stability.

2.3.2 Construction Phases

The construction of TSF3 can be divided into several key phases:

- **Removal and Utilization of WMP1 Northern Embankment:** The northern embankment of Water Management Pond 1 (WMP1) will be removed and repurposed as a protective layer for the clayey materials in the starter embankment, serving as the upstream zone.
- **Starter Embankment Construction:** A compacted starter embankment will be constructed between the existing TSF1 and WMP1. This starter embankment will initially elevate to a height of up to 4 meters above the surrounding ground level.

Simultaneously, the embankment of WMP 1 will be raised to elevation RL 484 meters Australian Height Datum (AHD).

- **Raising of Existing WMP1 Embankments:** The elevation of the existing WMP1 embankments will be increased to RL 484 meters AHD, aligning with the overall design.
- **Material Sourcing:** Material for the starter embankment and raised portions of existing embankments will predominantly be sourced from the northern embankment of WMP1 and clayey material from the foundation between TSF1 and WMP1. Supplementary material will be obtained from the borrow area situated to the east of the site.

2.3.3 Embankment Geometry

The typical embankment geometry of the perimeter embankment of each upstream raise is generally as follows:

- **Compacted tailings upstream batter:** 1V:2H
- **Compacted tailings downstream batter:** 1V:3H (downstream batter of starter embankment will be 1V:3H)
- **Crest width (overall including safety bund):** 6 meters
- **Main embankment zone:** compacted tailings
- **Downstream cover zone:** loose waste rock (max. 300 mm, ~5% fines)

2.3.4 Tailings Deposition and Decant Return

Tailings slurry will be discharged into TSF3 from spigot off-takes installed in the tailings distribution pipelines, located at the upstream crests of the perimeter embankments of the TSF (except the northern embankment), consistent with previous operations at TSF1. The spigots will be opened sequentially around the facility with the aim of allowing an even beach to develop and maintaining the decant pond around the decant tower.

Consistent with TSF1, the deposition method will allow the tailings on the beach to dry through evaporation, before being covered with freshly deposited wet tailings. This sub-aerial deposition method will improve consolidation of the tailings and subsequent tailings strength, which facilitates the upstream construction method. Establishment of a continuous tailings beach will be accomplished through deposition of tailings from the TSF3 starter embankment to be constructed between TSF1 and WMP1 and WMP1 raised embankment.

Proposed tailings delivery and return water pipelines are provided in Attachment 2. This shows their location in relation to the tailing's storage facilities. Connectivity will be from the processing plant to the TSF and vice versa.

2.3.5 Water Management – Decant System

Supernatant water will be efficiently removed from the facility using a floating pump located at the decant pond, which is strategically positioned near the shared internal wall between TSF 1 and TSF 3. The control of the decant pond's position will be managed by the careful operation of spigots positioned around the facility's perimeter. Typically, this control involves a systematic deposit of tailings in cycles around the TSF, with adjustments made as needed to maintain the desired pond location. To ensure effective segregation of tailings across the beaches, tailings will be discharged at a low velocity, forming shallow braided streams.

The proposed floating pump will be housed within a floating "Turret" intake system, designed with minimal draft requirements, enabling it to operate efficiently with a small volume of water on the tailings' surface. Access to the pump will be facilitated through a ramp originating from the crest of TSF 1's southern embankment. The pump will be tethered using a steel cable, offering flexibility to adjust its location and, if necessary, to move it to the eastern flank for maintenance purposes.

Controlling incidental rainfall runoff on TSF3 is of utmost importance to minimize erosion of the embankment slopes and reduce the risk of embankment failure or sediment loss into the environment. To address this concern, the crest of the perimeter embankment will be constructed with an inwardly graded crossfall of 2%, directing rainfall toward the TSF3 basin.

Throughout facility operations, the expectation is that groundwater mounding will remain beneath TSF3. Nevertheless, the presence of the Cosmos pit as a groundwater sink exerts influence over groundwater movement throughout the site. Consequently, it is foreseen that seepage discharge from TSF3 will flow toward the pit. Hydrological modelling indicates that the pit will exert flow well past operations and will serve as a sink post closure.

This operational approach is designed to efficiently manage supernatant water, control rainfall runoff, and account for groundwater dynamics to ensure the safe and sustainable operation of the facility.

Underdrainage System

To mitigate potential issues related to tailings saturation near the TSF embankments, especially during upstream raise construction, an underdrainage system is proposed. This system primarily includes the following components:

- **Finger drains:** These are slotted subsoil drains (such as MegafloTM 170 or equivalent) wrapped with BidimTM geotextile material. They extend 20 meters from the upstream embankment's toe towards the decant area, with a 20-meter interval between each finger drain.
- **Toe drain:** These are slotted subsoil drains (such as MegafloTM 300 or equivalent) wrapped with BidimTM geotextile material. These drains run along the upstream toe of the embankments and are connected to the finger drains.

The drainage from the finger drains is channelled to a collection sump through a collection pipe installed beneath the tailings. These pipes, likely made of HDPE, will be appropriately sized to accommodate the expected inflow rate and will have a 1% grade directing flow towards the decant tower. This underdrainage system is designed to prevent the adverse effects of elevated phreatic surfaces and lateral seepage during the construction of the starter embankment.

2.3.6 Continued Raising of TSF3

Continued raising of TSF3 using the upstream construction method will be based on the assumption that the tailings will achieve an average dry tailings density of 1.5 t/m3. The sequence of development for TSF3 starter embankment and additional raises is summarised as follows:

- Clearing of Unsuitable Material
- Exposing Ferricrete Surface
- Geomembrane Liner Removal
- Removal of Gravel/Waste Rock
- WPM 1 Embankment Crest Starting Surface Condition
- Construction of Access Ramp

- Work Method Statement (WMS) for Compaction (Starter Embankment)
- WMS for Compaction (Embankment Raises and Decant Access Ramp)
- Compliance Testing (Starter Embankment and Decant Access Ramp)
- Construction of Starter Embankment
- Construction of Decant Access Ramp
- Erosion Protection (Waste Rock) on Starter Embankment Downstream Slope
- Underdrainage System Pipe Installation with Geotextile
- WMS for Excavation of Tailings Material
- Compliance Testing (Embankment Raises)
- Construction of Embankment Raise with Tailings Material

The above steps will be reviewed by IGO's principal representative and will be supported by documentation that includes compaction test results and surveys where required. This process is to ensure that the construction and operation of TSF3 will adhere to best practices and regulatory standards while maximizing efficiency and safety. Further details on hold points are provided in Section 4 of the design report (Appendix 4).

3. ENVIRONMENTAL IMPACT ASSESSMENT

3.1 Environmental Impact Statement

The project was assessed for potential impacts with regards to air quality, water resources, soil, wildlife, vegetation, noise, and cultural heritage. Key findings include:

- **Air Quality:** Negligible impact on air quality.
- **Groundwater:** Noticeable effect on groundwater levels and quality.
- **Vegetation and Wildlife:** Possible harm to local plants or animals.
- **Soils:** Potential impact on local soils.
- **Surface Water:** Minor influence on surface water flows.
- **Cultural Heritage:** No harm to cultural heritage sites.
- **Noise:** No expected noise disruption.

3.2 Environmental Investigations

Several investigations were conducted to support the proposal. These include:

- Tailings Characterisation
- Hydrogeological Conceptual Model
- Geotechnical and Seepage Investigation
- Surface Water Model

3.2.1 Tailings Characterisation

Tailings testing from a blended sample generated from the flotation of Odysseus ores (laboratory metallurgical test work) was conducted to understand the characteristics of the materials to be stored in the TSFs. The tests covered various aspects, including the physical properties, settling behaviour, drying effects, consolidation properties, and strength behaviour of the tailings. A summary is provided in Table 3 and the assessment report provided as Appendix 4.

These tests provide essential information for the safe storage and management of the tailings within the TSFs, ensuring environmental compliance and stability. The results suggest that the tailings should not pose environmental concerns during management and TSF operation. IGO intends to undertake further testing of the ex-mill stream following commissioning of the mill to confirm initial findings.

Table 3 – Tailings Characterisation Results Summary

Item	Result
Tailings Source	Odysseus Orebody
Blending and Ratios	No blending of tailings. Single tails stream to TSF.
Number of samples taken relative to the volume/throughput	36 samples taken per 12-hour shift from MSA sample cutter.
Process chemicals used	Frother DSF002A, Flocculant Magnafloc 800HP, Carboxymethyl Cellulose (CMC)
Water Sources and Inputs to System	Cosmos mine dewater is utilised as the source water for processing and sourced from WMP9. Decant water is recycled back into the system. Extended water analysis for WMP9 is presented as Appendix 8. Decant water is yet to be tested (processing plant commissioned in late November 2023)
Wet/Dry Tailings	Tailings are wet and will be pumped as a slurry.
Physical Characteristics	The tailings were classified as Sandy Clay based on classification testing.
Settling Test	The tailings settle to 90% of their density in about 0.3 days. The final settled density is approximately 1.178 t/m³.
Air Drying Test	The maximum air-dry density of the tailings is 1.63 t/m³. Shrinkage limit is achieved at 16 days.
Consolidation Testing	The coefficient of consolidation (Cv) varies between 100 and 400 for relevant design stresses. Dry density ranges from 1.51 t/m³ to 1.79 t/m³ for different vertical effective stresses. Hydraulic conductivity is approximately 5 × 10-8 m/s.

Item	Result
CSL Triaxial Testing	Critical friction angle is estimated at around 33.5°. Peak and residual undrained shear strength ratios vary between 0.1 and 0.28. Tailings may exhibit brittle failure.
Monotonic and Cyclic Shear Testing	Results from monotonic direct simple shear (MDSS) and cyclic direct simple shear (CDSS) testing are available. These tests help understand the behavior of tailings under shear forces.
Geochemical Characterization	The tailings are classified as Non-Acid Forming (NAF) based on Acid-Base Chemistry testing. This classification is based on the presence of "trace-sulphides," primarily pyrrhotites and pentlandites, which are minerals that can potentially generate acidity under certain conditions. However, in this case, these trace sulphides are found within an "olivine/serpentine-enriched" gangue. The presence of olivines and serpentines in the gangue is significant because these minerals are typically associated with alkaline or non-acidic conditions. They can neutralize any acidity that might be generated by the trace sulphides, thus preventing the tailings from becoming acidic. Major/Minor elements are similar to soil, regolith, and bedrock compositions in non-mineralized terrain. Modest enrichments in Ni, Cr, and Mo, typical of tailings-solids from ultramafic-ore nickel operations in Western Australia. This implies that these enrichments are not exceptionally high or extreme. Instead, they are within a reasonable or expected range, especially when considering tailings derived from ultramafic ores. Mineral composition is predominantly olivines and serpentines (lizardites). Minor presence of chlorites, vermiculites, Cr-magnetites, and chromites. Traces of pyrrhotites and pentlandites.
Naturally occurring radioactive materials (NORMs)	No NORMs
Erosive, sodic and/or dispersive materials	Comprehensive testing and assessments for particle size distribution, salinity/sodicity, dispersion, erosion, and field observations are planned. These tests and assessments are scheduled to be conducted (processing plant commissioned December 2023) as part of our ongoing environmental monitoring and risk assessment program.
Fibrous minerals	Yes – likely to contain fibrous materials.
Characteristics of Embankment Materials	Clay and clayey gravel.

3.2.2 Conceptual Hydrogeological Model

A high-level quantitative model of potential source-pathway-receptor associated with the proposed new tailings storage facility (TSFs) has been completed (Appendix 5). The proposed new TSF (TSF 3) will be an extension of the pre-existing TSF, which is located within a designated terrestrial groundwater-dependent ecosystem of low to moderate potential (GDE Atlas national assessment). This area is considered the primary area of concern by Golders regarding potential environmental receptors and is described within Section 7.3 of Attachment 7 - Location and Sitting of the works approval application.

Based on environmental assessments conducted at other similar mine sites in the area, nitrate, salinity (as measured by total dissolved solids – TDS), metals (aluminium, boron, cadmium, copper, manganese, nickel, zinc), and chloride have been identified as specific contaminants of concern within the tailings concerning potential environmental receptors.

Pathways

The likely pathways by which contaminants can reach shallow alluvial deposits and the deeper saprolite aquifer are as follows:

- Groundwater flow through the shallow perched aquifers
- Surface water flow through runoff and the alluvium
- Seepage from TSFs into deeper groundwater (aquifers).

Site Layout and Infrastructure

At the Cosmos site, mine dewatering volumes are currently managed by a series of nine (9) large surface water management ponds (WMP1-9) and one operational TSF (TSF1). The proposed TSF extension (TSF3) will increase the footprint of the current TSF and overlap onto the location of the existing WMP1.

License Requirements

Management of groundwater (including monitoring, extraction, and disposal) is regulated by the Groundwater Licensing Operating System (GLOS) and the Cosmos Prescribed Premises Licence L7404/1999/9. These measures encompass groundwater monitoring and the establishment of a network of groundwater recovery bores and the implementation of seepage interception and recovery trenches.

Regional Hydrology

A complex arrangement of colluvium, alluvium, and sheet wash material is present across the site, providing evidence for a dynamic depositional environment within the superficial units. The presence of these geological features matters because they can significantly influence the environmental and hydrogeological dynamics of the site, which in turn can impact the success of mining or construction projects and the protection of local ecosystems and water resources.

Local Hydrogeology

Borehole logs and the refined groundwater model have provided a reasonable understanding of the hydrogeological conditions at the site. The unconsolidated material covering much of the site comprises a layer of recent deposits (granular and of variable permeability) up to 5 m thick overlaying a slightly thicker (6–11 m – increasing in thickness to the south) unit of weathered saprolite. This tells us that there are two layers of earth materials at the site. The upper layer, recent deposits, is relatively thin (up to 5 meters thick) and contains a mix of small particles, with varying levels of water flow capacity. Below this, there is a thicker layer known as weathered saprolite, which has been weathered by natural processes and becomes more substantial as you go south on the site.

Potential Impact

The likelihood of potential vertical seepage creating a groundwater mounding impact resulting in a breach of environmental license conditions is assessed as low. The outputs of the recently developed numerical groundwater model indicated that seepage from TSF3 creates a negligible increase in groundwater levels beneath the TSF, with the majority of groundwater impacts influenced by discharge into the adjacent water management ponds (WMP6-8), particularly WMP8.

Receptors

Groundwater drawdown or mounding associated with the proposed project has the potential to affect various receptors, such as terrestrial ecological communities, Lake Miranda (a saline playa), humans (especially pastoral stations and indigenous communities), other aquatic receptors such as riparian habitat containing groundwater-dependent vegetation, macrophytes, algae, and cyanobacteria, as well as micro-invertebrates and amphibians and reptiles.

Mine Dewatering

Due to mining operations, including dewatering, the groundwater levels in the region have been impacted. There is a noticeable area where groundwater levels have gone down due to mining activities around the Cosmos pit. However, in some areas, such as around certain water management ponds (WMPs), mining operations have led to rising groundwater levels, causing local issues. To manage this, a system of recovery bores and trenches has been set up to control and mitigate the effects.

The key impacts identified from mining activities, particularly dewatering operations, on the local groundwater system in the Cosmos mine area include:

- **Drawdown Cone Formation:** The dewatering operations around the Cosmos pit have led to the formation of an extensive drawdown cone, which extends over a considerable distance from the pit. This drawdown cone represents a significant impact on the local groundwater system.
- **Groundwater Mounding:** Historical operations of water management ponds (WMP6-8) and the tailings storage facility (TSF1) have caused groundwater seepage and mounding, leading to local rises in groundwater levels. This mounding can have implications for native vegetation and water quality in the region.

To manage these implications, IGO undertake the following:

- **Recovery Measures:** To address rising groundwater levels and seepage issues, a system of recovery bores and trenches has been implemented to intercept and recover seepage water from specific areas, such as WMP6-8 and TSF1. However, periodic instances of water depth exceeding target levels have been observed in the past, indicating the need for continued management and monitoring.
- **Predictive Water Balance:** This is a proactive approach that benefits IGO by improving water resource management, ensuring compliance, reducing risks, and promoting sustainable and responsible mining practices.
- **Groundwater Monitoring:** This a critical component of responsible mine dewatering and it helps protect water resources, ensures compliance with regulations, and supports environmental stewardship and community engagement. By providing

essential data, groundwater monitoring plays a central role in sustainable and environmentally conscious mining practices.

Predictive Groundwater Levels and Seepage Rate Simulations

In the Golders study, groundwater modelling was conducted to predict groundwater conditions over an 11-year period (2023–2034) to assess the impacts of mining activities at the Cosmos Nickel Operation on groundwater. Various scenarios were evaluated to understand groundwater dynamics and make informed decisions. The following was also considered during the assessment:

- Effectiveness of Existing Dewatering Infrastructure
- Trigger Level Breach Analysis (6 mbgl)
- Impact of TSF3 Expansion and WMPs Utilization

Here are the key scenarios and their implications:

- **Scenario 01: Base Case (All Ponds in Use)** - This scenario represents standard mining operations. It shows that additional recovery bores are needed in the north to manage elevated groundwater levels.
- **Scenario 02: WMP1 Removal (Excluding TSF3 Seepage Increase)** - Removing WMP1 without considering TSF3's impact suggests that additional recovery bores are required in the north to address elevated groundwater levels.
- **Scenario 03: WMP1 Removal (Including TSF3 Seepage Increase)** - Removing WMP1 while considering TSF3's influence indicates that additional recovery bores are needed in the north and central regions to manage rising groundwater levels.
- **Scenario 04: WMP8 Removal (Seepage Mitigation)** - Removing WMP8 suggests that no new recovery bores are needed, as the remaining ponds can handle groundwater levels effectively.
- **Scenario 05: Reduced Conductance of WMP8** - Lowering the conductance of WMP8 indicates that no new recovery bores are needed, and WMP8 can effectively manage groundwater levels.
- **Scenario 06: Worst Case (Maximum Pond Capacity)**- This worst-case scenario shows challenges in the north and central regions, where additional recovery bores are required to manage elevated groundwater levels.
- **Scenario 07: TSF1 and TSF3 On, and WMP8 Off** - Operating TSF1 and TSF3 while removing WMP1 and WMP8 suggests the need for two additional recovery bores in the north to address groundwater mounding around WMP6-7.

In summary, WMP8 Removal stands out as the most environmentally beneficial option because it directly addresses historical high seepage issues by eliminating the problematic pond. By deactivating WMP1 and WMP8 and focusing on TSF1, TSF3, and WMP6-7 i.e., Scenario 07 which aims to minimize the associated environmental impact. It suggests two additional recovery bores to manage groundwater levels, which can help safeguard the environment. This is the scenario that IGO intends to proceed with. IGO will re-equip available recovery bores for appropriate mounding control however, IGO expects that an additional recovery bore will not be necessary based on the proposed location (adjacent to WMP6/7) being presently cleared and devoid of vegetation. To ensure the implementation of appropriate management strategies to meet licensing obligating, IGO will maintain ongoing monitoring and assessment of the recovery situation.

3.2.3 Geotechnical and Seepage Assessment

Golders geotechnical investigation (Appendix 6) compiled a comprehensive overview of the findings and assessments conducted to evaluate the site's geotechnical characteristics. The investigation comprised a detailed review of previous studies conducted in 2017, supplemented by additional investigations carried out from July 17 to 19, 2023.

The geotechnical investigations revealed that the TSF expansion area and proposed borrow area primarily consist of silty SAND (SM) to silty sandy GRAVEL (GM), with a thin soil horizon overlying rock-strength ferricrete. These findings align with the published geological conditions, indicating loose to medium dense foundation conditions. Notably, the ferricrete layer is approximately 4 meters thick overlying saprolite material. The ferricrete layer, being a hardpan formation, exhibits relatively low permeability due to the iron minerals binding the particles tightly, resulting in a compact, less porous material. Essentially, it serves as a natural liner as seen at WMP1-5 and WMP9.

Laboratory tests provided further insights into the foundation soils, indicating an average particle density of approximately 2.75 t/m3 and non-plastic characteristics based on Atterberg Limits tests. Particle Size Distribution (PSD) classified the foundation soils as Silty Sand (SM) with non-plastic fines and fine to coarse grained gravel. Standard compaction tests yielded Standard Maximum Dry Density (SMDD) values of around 2.30 t/m3 for foundation material and approximately 1.40 t/m3 for borrow material. However, the presence of particles over 19 mm necessitated the consideration of relative density for compaction control.

Permeability tests estimated the coefficient of permeability for foundation samples collected at 95% SMDD, indicating permeability levels typical of Silty Sand, ranging from 1 × 10-8 to 5 × 10-10 m/s. Consolidated drained triaxial testing provided effective stress parameters applicable to dilative materials, with results detailed in the report.

This provides a deep understanding of the ground conditions at the site, which is crucial for construction of the project. By understanding the soil composition and its properties, engineers have made informed decisions on the design which helps ensure that these activities can be carried out without compromising safety or causing environmental harm.

Golders seepage assessment of TSF3 aimed to estimate water leakage through its base, to determine the water level within, and assess the benefits of using an underdrainage system. They also considered the potential impact of nearby groundwater. Using SEEP/W software, Golders created a 2D model covering TSF3's central area to just beyond its outer wall. They accounted for various soil layers, tailings types, and operational conditions. However, it's important to note that their model simplifications and exclusions may lead to results that are indicative rather than precise. Nevertheless, their findings suggest that implementing the underdrainage system can significantly lower water levels within TSF3, reducing the risk of groundwater interaction due to dewatering efforts. Additionally, they estimated seepage rates during and after operation, with the drainage system potentially reducing total seepage by approximately 10%. Around 7% of inflowing water may be lost to seepage. Most importantly, Golders assessment indicates that majority of seepage moves vertically rather than horizontally in the upper 6 meters of the ground beneath TSF3.

Managing seepage through an underground drainage system will involve the controlled collection and removal of water that permeates through the ground within the TSF. It includes the installation of collection pipes (facilitating the flow of seepage water to the decant pond), monitoring and maintenance for system effectiveness, compliance with environmental regulations, and the mitigation of environmental risks. This ensures that seepage is safely managed, minimizing potential harm to groundwater and surface water while safeguarding the integrity of the TSF structure.

Furthermore, the assessment of near surface seepage indicated that the phreatic surface would remain within the tailings stack and foundation materials beneath the TSF, with most seepage expected to flow vertically. A minor fraction, accounting for less than 6% of the overall seepage, is expected to move laterally within the near-surface materials. This fraction will be collected at designated points and reintroduced into the site's water management system to be reused in the operational water cycle.

3.2.4 Surface Water Model

Groundwater Resource Management (GRM) conducted a comprehensive hydrological study (Appendix 7) to evaluate the potential ramifications of the expansion on surface water flow processes at Cosmos. This study encompassed an assessment of the effects arising from the extended development of underground operations, the introduction of new infrastructure such as water management ponds, waste rock dumps, a mine shaft, and additional facilities, as well as an examination of the proposed expansion of the TSF.

The existing surface water control measures at Cosmos were designed by Dames and Moore in 1999 and include flood protection bunding, runoff diversion drains, and culverts. GRM assessed the conditions of these measures and their hydraulic capacity.

The objectives of the study were to evaluate the hydrological changes due to the new infrastructure for various storm events during operational and post-closure stages. This assessment includes flood extent, peak discharge rates, and flow velocities.

The scope of work involved delineating surface water catchments, conducting a hydraulic analysis, assessing the impact of Probable Maximum Precipitation, generating inundation maps, and designing mitigation measures. GRM determined design storm events for different annual exceedance probabilities and proposed mitigation measures as needed.

Surface Model Development

Pertaining to model development, a hydrological study was undertaken to delineate the surface water catchment based on supplied topographic data. The catchment, which encompasses an area of approximately 42.1 square kilometres, displays varying elevations and drainage patterns. The study incorporated both existing and anticipated future infrastructure.

For the design of storm events, a range of Annual Exceedance Probabilities (AEPs) was adopted,

A 2D hydrological model was formulated using HEC-RAS software, comprising two sets of models for the existing and proposed infrastructure. The model encompassed elements such as computational mesh, roughness coefficients, outflow boundary conditions, and equations for simulating flow. The simulation period spanned 9 hours to allow for complete stormwater dispersion, and the model incorporated both pre-existing and planned hydrological structures. Default program settings and tolerances were applied throughout, except where otherwise specified for specific requirements and complexities.

Proposed Surface Water Management Infrastructure

In assessing the hydrological aspects, the HEC-RAS hydrological model becomes an essential tool. This model allows for the estimation of peak discharge, particularly for storm events with various Annual Exceedance Probabilities (AEPs), ranging from the 50% AEP to the 1% AEP rainfall event. However, it's notable that the model encountered challenges in accurately predicting peak discharge for high-frequency storm events due to specific topographic complexities within the catchment area. Adjustments were made to infiltration losses to enhance the model's performance for lower-frequency storm events. Nevertheless, these adjustments led to an overestimation of peak runoff for low-frequency events, including the 1% AEP (100-year ARI) event.

As an integral component of the comprehensive plan for Cosmos, the report delineates critical design considerations for surface water infrastructure. Notably, the selection of the design storm event is the 1% AEP event, a prudent choice in alignment with the long-term demands of the mining project. This culminates in the design of culverts, a pivotal feature characterized by corrugated metal pipes (CMP) with a diameter of 1050 mm. The report furnishes detailed specifications for the roadside drain and advocates the application of rip-rap lining to bolster erosion protection during significant storm events, in strict accordance with the well-established guidelines of Main Roads of Western Australia (2006). It is noteworthy that this infrastructure has been implemented to safeguard other on-site assets.

Additional Flows to the Existing Pit Diversion Drain for Tailings Storage Facility

The existing conditions involve the southern catchment directing flows into the existing waste rock diversion drain, which subsequently diverts these flows north around the waste rock dump. With the construction of the proposed infrastructure, there will be an alteration in these flow patterns that could affect the tailings storage facility. The southern culverts and diversion drain will be instrumental in redirecting flows into the existing diversion drain located south of the pit, necessitating a careful assessment of the existing diversion drain's capacity.

To address this, calculations of freeboard requirements were conducted using the HEC-RAS model for both the 1% AEP event and the existing conditions, based on survey data. The presence of a bund formed from excavated material downstream of the drain was observed, potentially acting as a barrier to surface runoff reaching the open pit. The report indicates that the existing diversion drain must be capable of handling both the existing catchment flows and the additional runoff from the southern catchment effectively.

In anticipation of increased flows from the southern catchment, the HEC-RAS model suggests a potential rise of approximately 0.2 meters in peak water levels within the drain. Nevertheless, the conclusion reached is that the existing southern drain possesses adequate capacity to accommodate the additional runoff from the southern catchment.

Summary of Model Results

The model results indicate that during heavy rainfall events, certain areas on the site could experience flooding, with water levels potentially exceeding 1 meter in depth. However, it's important to note that what may appear as flooding in some areas is primarily a result of rain filling up low-lying spots due to uneven terrain, rather than extensive runoff along drainage channels.

The primary area prone to flooding is situated to the west of the site along a prominent north-south drainage system, particularly during less frequent, higher-intensity storms. The proposed water infrastructure plans show promise in preventing flooding in specific regions, including the upstream sides of the planned road realignment and the waste rock dump (north-west of the TSF).

Importantly, there are minimal differences in flooding extents between the existing and proposed infrastructure scenarios. While maximum flow velocities are generally low, there are localized areas, such as near the waste dump, where higher velocities could lead to erosion and necessitate protective measures like rip-rap lining.

Overall, the peak water flow rates vary significantly, from 1.3 to 56.7 cubic meters per second, depending on the storm's intensity. With the new infrastructure plans considering the upper end of this range, it will ensure comprehensive flood protection.

In conclusion, the hydrological model results affirm that the proposed future infrastructure will have minimal impact on the surface water drainage patterns. Recommendations for surface water drainage infrastructure have already been installed at the project to further mitigate flooding effects and protect site assets. Notably, the primary drainage channel situated to the west of the site remains largely unaffected by the planned infrastructure enhancements.

4. COMPLIANCE AND SAFETY

4.1 Compliance with Regulatory Standards

In the pursuit of design approval for Cosmos, strict adherence to Australian regulatory standards is paramount. The design and approval process takes into account several key Australian codes and guidelines, ensuring compliance and adherence to industry best practices. These include:

- **Australian National Committee on Large Dams (ANCOLD, 2019)** – Guidelines on Tailings Dams: This comprehensive set of guidelines encompasses various aspects of tailings dams, covering planning, design, construction, operation, and closure. Compliance with these guidelines is integral to the design approval process.
- **Department of Mines, Industry Regulation and Safety (DMIRS, 2013)** – Code of Practice for Tailings Storage Facilities: This code of practice provides essential guidance on tailings storage facility management, offering a framework for ensuring safety, environmental protection, and regulatory compliance throughout the facility's lifecycle.
- **Department of Mines, Industry Regulation and Safety (DMIRS, 2015a)** – Guide to Departmental Requirements for the Management and Closure of Tailings Storage Facilities (TSFs): This guide delineates specific departmental requirements for managing and closing tailings storage facilities. It serves as a crucial reference point for compliance in these critical aspects of facility operation.
- **Department of Mines, Industry Regulation and Safety (DMIRS, 2015b)** – Guide to the Preparation of a Design Report for Tailings Storage Facilities (TSFs): This guide outlines the necessary procedures and components for preparing a design report tailored to tailings storage facilities. It provides a structured approach to document preparation and submission, aligning with regulatory standards.

Compliance with these Australian codes and guidelines underscores the commitment to safety, environmental responsibility, and adherence to established industry standards throughout the design approval process for Cosmos.

4.2 Safety Measures

The proposed TSF 3 is categorized as a 'Category 1, Medium Hazard' according to the code of practice set by DMIRS (Department of Mines, Industry Regulation and Safety), and it is classified as 'High B' based on the ANCOLD (Australian National Committee on Large Dams) guidelines, with an assumed 'Major' severity level. A comprehensive dam break assessment has been conducted to evaluate the potential consequences of a dam failure.

A Fault Mode & Effects Analysis (FMEA) was conducted in alignment with AS/NZS 3931:1998 to assess potential failure mechanisms and their consequences for the TSF expansion. Various failure modes were identified, including overtopping of perimeter walls, embankment slope failures, erosion, piping erosion, and foundation failure. Each failure mode was assessed separately, considering triggers, impact, risk categories, and potential for catastrophic outcomes. While 29 potential failure modes were identified, 24 were considered credible, with 15 posing major consequences. Risk ratings were assigned, and it was concluded that all credible, catastrophic failure modes had a 'Medium' risk rating, indicating no immediate need for additional risk mitigation measures.

Additionally, a Dam Break Assessment (DBA) was performed to estimate the volume of tailings and potential runout extents in the event of a dam failure. The worst-case scenario identified potential impacts downstream, including a population at risk (PAR) of 53 and a potential loss of life (PLL) of 4. The DBA findings are included in Appendix E of the Design Report.

Regarding Safety in Design, several safety features were outlined, including a minimum 6 m crest width for TSF embankments, safety bunds, wearing courses on embankment crests, and safety measures for vehicular access and erosion protection. These measures are intended to enhance safety during TSF operations.

5. RISK ASSESSMENT AND MANAGEMENT

5.1 Risk Assessment

A Risk Assessment was conducted for the proposed facility to support the DWER application. This has been provided as Appendix 1.

5.2 Risk Management

IGO have assessed the risks of emissions from the project and identified potential source, pathway and impact to receptors in accordance with the *Guideline: Risk Assessments (DWER 2020).* The risk criteria (likelihood and consequence) are shown in Table 4. The risk rating matrix (Table 5) was used to determine the acceptability and treatments for each risk event, including proposed outcome-based controls for risk events rated ‘medium’ and above.

Table 4 – Risk Criteria

Consequence		
The department will use the following criteria to assess the consequences of a risk event occurring:		
	Environment	Public health* and amenity (such as air and water quality, noise and odour)
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**
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**
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**
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**
Slight	• Onsite impact: **minimal** • **Specific Consequence Criteria (for environment) met**	• Local scale: **minimal impacts to amenity** • **Specific Consequence Criteria (for public health) criteria met**

Likelihood	
The department will use the following criteria to assess the likelihood of a risk event occurring.	
Almost certain	**The risk event is expected to occur in most circumstances**
Likely	**The risk event will probably occur in most circumstances**
Possible	**The risk event could occur at some time**
Unlikely	**The risk event will probably not occur in most circumstances**
Rare	**The risk event may only occur in exceptional circumstances**

Table 5 – 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

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. The risk has been determined in consideration of the sensitive receptors and environmental setting (Table 7). For risks identified, a summary of impacts and mitigation measures are detailed below.

Further details on risk assessment methodology and register of scenarios is included in Attachment 1. Key emissions, pathways and controls are detailed below.

5.3 Emissions and Potential Pathways

The key emissions, potential pathways and proposed controls associated with the construction and operation are detailed in Table 6 below. Emissions arising from the infrastructure (under normal and unforeseen operation) and any potential failures/spills have been determined in the assessment. To identify pathways/receptors we considered the site's topography, separation and environmental siting factors to determine how emission may impact on a receptor. Examples of controls considered include, siting of infrastructure, design and construction specifications, emission controls/limits, monitoring, operational/maintenance procedures and volume/scale limits.

Table 6 – Emissions, Pathways and Controls

Emission	Sources	Potential Pathways	Proposed Controls
Contaminated stormwater and sedimentation	TSF3 dam surface embankments	Storm event resulting in runoff Direct discharge to land and infiltration to soil, vegetation and ephemeral creek	Rock armouring on outer embankments Toe-drains and safety bunds Surface water diversion Surface water management plan Surface water assessments Daily inspections Annual soil and vegetation monitoring downstream of TSF3
Overtopping of TSF embankments resulting in	TSF3	Direct discharge to land and infiltration to	Design for PMP events >500mm freeboard Tailings deposition modelling

tailings release or dam failure		soil, vegetation and ephemeral creek	48-hour PMP event modelling Dam-break assessment Geotechnical investigations Design compliant with Australian codes and guidelines Piezometers Daily inspections Annual geotechnical audit Emergency action plan Embankments (6m crest width) and safety bunds
Tailings decant water (hypersaline water and reagents) – no cyanide.	TSF3 decant pond	Birds or wildlife ingesting TSF 3 decant water (high salinity, reagents and elevated metal/metalloid concentrations)	Daily inspections Low-toxicity processing chemicals Hypersaline water not used for drinking (birds and bats will not drink >50K mg/L))
Rupture of pipelines causing tailings / decant water to discharge to land.	Tailings and return water pipelines from the plant to TSF3	Land: Direct discharge to land	Daily inspections pipelines Engineering designs and sign-off Leak detection and alarm Burial of pipes at road crossings Inductions and training Construction within designated pipeline corridor Survey pickup of pipelines Preventative maintenance schedule Flow meters and water balance
Seepage of leachate from base and walls	Tailings slurry and decant water within TSF3	Seepage through base and/or embankments of TSF into groundwater, vegetation and adjacent ephemeral creek	Separation distance from groundwater receptors (groundwater dependent ecosystems or registered third-party groundwater users) and Lake Miranda. Seepage Recovery bores Monitoring bores – weekly Under drainage seepage recovery system Maintenance inspections Geotechnical design Groundwater and Seepage modelling report Vegetation monitoring Water Balance Decant return to plant Groundwater quality program (quarterly) in accordance with L7404. Groundwater level monitoring and trigger levels in accordance with L7404. Continue operation of existing active recovery bores and additional bores in accordance with groundwater seepage modelling report (WSP, 2023)
Dust	Construction earthworks and	Air: Transport and dispersion	Tailings will be kept at a slurry density of between 45% to 60% solids. This wet state will minimise dust lift off during operation of TSF3.

	lift off from tailings surface	of particles (fugitive dust)	Rotation of spigot points around the TSF to maintain damp breaches will occur during operations if dust lift off is observed. Where saline water is used for dust suppression, all reasonable measures must be taken to avoid detrimental impacts to surrounding environmental receptors. Dust monitoring (ambient) – Quarterly
Noise	Heavy machinery, construction noise and vehicle movements.	Air / windborne pathway	None proposed due to separation distance to nearest human receptor. All mining operations comply with Environmental Protection Act (Noise) Regulations 1997. TSF3 is located within existing active mining area.
Hydrocarbon leaks and spills	Maintenance activities. Oil / fuel leaks from mobile plant during construction and operations	Infiltration Overland flow via stormwater	Hydrocarbons/chemicals stored on impervious bunds and spill kits available to mobile plant and vehicles. Soil contaminated by hydrocarbons will be treated in-situ, at the bioremediation pad or transported offsite to a controlled waste licensed facility for treatment.

5.4 Receptors

In accordance with the *Guideline: Risk Assessment (DWER 2020)*, IGO has excluded internal employees, visitors, and contractors from this risk assessment (i.e. mine village and administration buildings). Protection of these parties involves different exposure risks and prevention strategies provided for under other state legislation. Table 7 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 TSF3 (*Guideline: Environmental Siting (DWER 2020)*).

Table 7 – Potential Receptors (human, environmental, groundwater & water)

Receptor	Distance from proposed works and activity
Human Receptors	
Yakabindie Pastoral Station (Homestead)	Approximately 5.5km northwest of proposed TSF3. Intermittently occupied, during pastoral activities (mustering).
Town of Leinster	42 km southeast of proposed TSF3. Not considered a receptor.
Bellevue Gold Mine	Approximately 4.3 km southwest of proposed TSF3.
Cosmos Mining Operation (IGO)	TSF3 is within the Cosmos mine operational area. The Cosmos mine village is located 1.6km northwest of proposed TSF3. Not considered as relevant to risk assessment (*Guideline: Risk Assessment (DWER 2020)*).
Environmental Receptors	
Threatened and Priority Ecological Communities (TEC/PEC) – *Biodiversity Conservation Act 2016.*	TSF3 is located adjacent to (but outside buffer) of **Priority 1 Ecological Community - Violet Range** (Perseverance Greenstone Belt) vegetation complexes (banded ironstone formation). Clearing for mining is listed as a threat for the Violet Range PEC, however TSF3 does not require any clearing. **Lake Miranda East Calcrete PEC (P1)** is located 3.7 km southeast of proposed TSF3. Hydrological changes associated with mining is listed as a threat, however the separation distance is beyond potential pathway. **Yakabindie Calcrete PEC (P1)** is located 4.8 km west of proposed TSF3. Hydrological changes associated with mining is listed as a threat, however the separation distance is beyond potential pathway. TEC/PEC listed under *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* are not considered a receptor (00's Km from the nearest).
Environmentally Sensitive Areas	Wanjarri Wildlife Sanctuary is located 15km northeast of proposed TSF3.
Priority Flora - *Biodiversity Conservation Act 2016.*	*Grevillea inconspicua* (P4) located approximately 9km northwest of proposed TSF3. The habitat not synonymous with the preferred vegetation for *Grevillea inconspicua*. The site is described as 'cleared/disturbed', part of an active mine footprint. Surface runoff and seepage will need to be controlled to avoid potential impact to native vegetation and fauna habitat outside the active/cleared mining footprint, adjacent to proposed TSF3.
Priority Fauna - - *Biodiversity Conservation Act 2016*	*Dasycercus blythi* (brush-tailed mulgara) (P4) has been recorded (2004) 8.6km northeast of proposed TSF3. *Kwonkan moriartii* (Moriarty's trapdoor spider) (P2) has been recorded (1962) 11.2 km north of TSF3. The site is described as 'cleared/disturbed', part of an active mine footprint, with negligible value or impact to regional terrestrial fauna habitats. Also, the fauna records are quite dated, between 20 to 60 years ago.

Hydrology	Lake Miranda is located 5 km south of TSF3, however the separation distance is beyond potential pathway. Yakabindie borefield (IGO/BHP) is located 10km east of TSF3. An ephemeral flowing drainage channel is located approximately 200m east of the proposed TSF3 location terminating at Lake Miranda. The creek flows as sheet wash during significant local rainfall events. Surface runoff and seepage will need to be controlled to avoid potential impact to this ephemeral creek.
Heritage	TSF3 is located 1km west of the nearest registered heritage site buffer boundary (Nantanantakukura).

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