GRANTS LITHIUM PROJECT

Environmental Impact Statement

Appendix O

Construction/operations phase environmental risk register

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Environmental Factor	Hazard/Aspect	Incident/event	Description of Impact	Assumptions	L*	C*	IR*	Summary of Controls	L*	C*	RR*	Cumulative impacts	Certainty - Info Gaps
01 Terrestrial Flora and Fauna	001 Site clearing and preparation	Removal of vegetation	Loss of sensitive vegetation types	• No sensitive vegetation types within direct disturbance footprint. Indirect impacts to mangroves and riparian rainforest associated with reduced flows addressed separately.				**Not assessed communities not present**				None	High. Confirmed by field survey.
01 Terrestrial Flora and Fauna	001 Site clearing and preparation	Noise emissions from machinery and equipment	Reduced habitat quality for fauna due to disturbance	• No sensitive habitats in proximity to mine site (i.e. wetlands, roost sites). • Blasting will occur 3 times per week. • Machinery and equipment operations 24 hours .	2	1	**1 - Low**	• Blasting Management Plan to address safety issues. No specific environmental controls identified.	2	1	**1 - Low**	Unlikely. Low RR.	High. No sensitive receptors. Confirmed by field survey.
01 Terrestrial Flora and Fauna	001 Site clearing and preparation	Removal of vegetation	Loss of habitat for fauna	• Mine site disturbance envelope is 145ha. • Disturbance will occur in Eucalyptus woodland habitats with no significant biodiversity value. • Habitat well represented in surrounding areas and no other industrial development that would deter use of these habitats.	2	1	**1 - Low**	• Vegetation Clearing Procedure includes controls for marking of clearing boundaries, topsoil removal and storage, vegetation disposal and erosion and sediment control to further minimise impact.	2	1	**1 - Low**	Unlikely. Low RR.	High. Confirmed by field survey.
01 Terrestrial Flora and Fauna	001 Site clearing and preparation	Uncontrolled bushfire caused by operation of equipment or burning of stockpiled vegetation	Reduced habitat quality due to loss of understorey	• Site surveys found pre-development habitats heavily impacted by fire. • No significant habitat or threatened species values present in surrounding areas that would be impacted by a bushfire event.	2	2	**1 - Low**	• Vegetation Clearing Procedure includes controls for minimising fire risk during clearing and disposal of vegetation. • EMP includes first response capability to be provided onsite. • Bushfire response to be addressed in site Emergency Management Plans.	2	2	**1 - Low**	Unlikely. Low RR.	High. Current fire history and impacts confirmed by field survey. Risk occurs over a very short period of time.
01 Terrestrial Flora and Fauna	001 Site clearing and preparation	Dust emissions caused by operation of machinery and equipment	Reduced habitat quality due to smothering of plants with dust	• No sensitive habitats in proximity to mine site (i.e. wetlands, roost sites). • Airborne dust deposition anticipated to occur within a short distance around the disturbance footprint and will be within the boundary of ML.	3	2	**2 - Medium**	• Dust suppression will be undertaken using water carts and application of polymer products. • Water supply for dust management included in project planning - accounts for about one-third of the mine site water requirements. • ESCP addresses stabilisation of cleared areas to prevent wind erosion, which will minimise dust emissions.	2	2	**1 - Low**	Unlikely. Low RR.	Moderate. RR dependent of effective dust management. Experience on other mine sites shows that dust emissions are often significant.
01 Terrestrial Flora and Fauna	001 Site clearing and preparation	Removal of vegetation	Loss of Typhonium praetermissum habitat	• Targeted surveys in suitable habitats within the project footprint did not locate the species. • Some modelled areas of potential habitat have not been surveyed. These areas occur within the pit shell. • Because surveys can only be done in Jan-Mar a precautionary approach applied an assumption made that species could occur. • A regional assessment of the impact of removing plants has been prepared to consider the worst-case scenario.	3	2	**2 - Medium**	• None identified. The constrained nature of the mine site means there is no options to avoid plants if they were located within the disturbance envelope. The regional assessment indicates that if Typhonium plants were to occur within the disturbance footprint, their removal would not constitute a significant impact on the regional population. • The areas of modelled suitable habitat will be surveyed in Jan/Feb 2019 and results provided in the MMP. If plants are identified, each will be recorded and data provided to the NT Herbarium to contribute to refinement of the modelling.	2	2	**1 - Low**	Unlikely. Low RR.	High. Assessment uses worst-case scenario that species is present and is based on modelling of species occurrence provided by NT Herbarium.
01 Terrestrial Flora and Fauna	001 Site clearing and preparation	Weed introduction and spread by machinery and equipment	Reduced habitat quality due to competition with native species and increased bushfires	• Project area has low levels of existing weed infestation. • Construction materials will be sourced on site (no import of fill). • Gamba Grass and Mission Grass are key weeds of concern and are prevalent on mine/extractive sites in the region.	4	3	**3 - High**	• EMP includes controls for plant and equipment hygiene, weed survey and control.	3	3	**3 - High**	Possible. There is some potential for cumulative impacts associated with proliferation of weed infestations and increase bushfires associated with future lithium mining proposals on Core's EL's.	High. Current weed status of project area confirmed by field survey. Weeds still a moderate risk based on experience at other mine sites in the NT.
01 Terrestrial Flora and Fauna	001 Site clearing and preparation	Removal of vegetation	Loss of Stylidium ensatum habitat	• Targeted surveys in suitable habitats within and downstream of the project footprint did not locate the species.				**Not assessed because species not present**				None	High. Confirmed by field survey.
01 Terrestrial Flora and Fauna	002 Construction of mine site infrastructure	Infrastructure/materials/ equipment brought to site	Introduction of invasive pest species that are not already present in the area (i.e. ants and mosquitos)	• Infrastructure will be trucked from interstate. • Invasive ants and mosquitos could be hidden and transported onto site. • Origin of materials currently unknown.	3	4	**3 - High**	• EMP includes inspection procedures for all loads arriving on site. • Response and control in consultation with DPIR.	1	4	**2 - Medium**	Unlikely. Response plans would eradicate the pest.	Moderate. Likelihood of materials harbouring ant and mosquito pests depends on origin. Risk to be re-assessed as part of MMP once original of materials is known.

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01 Terrestrial Flora and Fauna	002 Construction of mine site infrastructure	Material (sand, rock, clay) imported from off-site	Introduction and spread of weeds	• Current plan is for materials to be sourced on-site from overburden material. Some importation of sand and rock materials required. • Experience on other projects in the region shows that importation of material is a key source of weed introduction and spread. • Gamba Grass and Mission Grass are prevalent in the region but not on the mine site. • No sensitive habitats.	4	3	3 - High	• Off-site sources to be declared weed free • Implementation of weed management as detailed in EMP.	3	3	3 - High	Possible. There is some potential for cumulative impacts associated with proliferation of weed infestations and increase bushfires associated with future lithium mining proposals on Core's EL's.	Moderate. Materials balance yet to be completed. If material to be imported, then risk would need to be re-assessed as part of MMP.
01 Terrestrial Flora and Fauna	003 Water supply and use	Observation Hill Dam decreases flow volumes downstream to Charlotte River	Loss of Stylidium ensatum habitat downstream	• Targeted surveys in suitable habitats within and downstream of the project footprint did not locate the species. • Possibility that occurrence was not detected. • If species was present, modelled reduction in flow is unlikely to affect species distribution.	1	2	1 - Low	Low IR, none required.	1	2	1 - Low	Unlikely. Low RR.	High. Confirmed by field survey.
01 Terrestrial Flora and Fauna	003 Water supply and use	Observation Hill Dam decreases flow volumes downstream to Charlotte River	Loss of sensitive riparian / wetland vegetation due to reduction in flows	• NT Water Allocation Planning Framework contingent allocation for environmental and public benefit is 80%. • No public benefit water uses in catchment. • Riparian rainforest along drainages downstream of dam may be sensitive to reduced flows. • The modelled reduction in flows at the outlet to Charlotte River is up to 2.6% in February.	2	2	1 - Low	• Mine site design amended to incorporate additional storages (MWD 1 & 2) so that TSF decant and pit dewatering can be used as the primary project water supply. • Dam sizes have will be designed based on the minimum requirement to achieve a sustainable water supply for the project. • Minor reduction in flow is a residual impact associated with the project.	2	2	1 - Low	Unlikely. Low RR.	High. Site is located high in catchment - even if pump rate from dams were to increase, downstream impact to flows would not significantly change.
01 Terrestrial Flora and Fauna	003 Water supply and use	Inundation of dam footprints	Loss of flora/fauna habitat	• Obs Hill Dam inundation footprint 20ha. • Mine Site Dam inundation footprint 19ha. • No significant habitats or sensitive vegetation types present. • Habitat well represented in surrounding areas and no other industrial development that would deter use of these habitats.	2	1	1 - Low	• Dam sizes have will be designed based on the minimum requirement to achieve a sustainable water supply for the project. • Some loss of habitat is a residual impact associated with the project.	2	1	1 - Low	Unlikely. Low RR.	High. Confirmed by field survey.
01 Terrestrial Flora and Fauna	003 Water supply and use	Mine Site Dam reduces flows downstream to West Arm	Loss of sensitive riparian / wetland vegetation or mangroves due to reduction in flows	• NT Water Allocation Planning Framework contingent allocation for environmental and public benefit is 80%. • No significant or sensitive water dependent environmental values in ephemeral drainages upstream of saltwater influence, where modelled flow reduction is up to 46% during the early wet season. • Hinterland mangroves 1.7km downstream closest sensitive receptor. • Combined impact of the mine site and dam could reduce flows into the upper mangroves of West Arm by 16-20 % in the early wet season months Nov-early Jan, dropping to between 1% and 7% for the remainder of the wet season.	2	3	2 - Medium	• Mine site design amended to incorporate additional storages (MWD 1 & 2) so that TSF decant and pit dewatering can be used as the primary project water supply. • Required capacity of mine site dam reduced to 310ML in feasibility design phase. • Dam sizes have will be designed based on the minimum requirement to achieve a sustainable water supply for the project. • Minor reduction in flow is a residual impact associated with the project.	2	3	2 - Medium	Unlikely. No other users in catchment.	Moderate. Capacity of dam required for supplementary supply to be confirmed through detailed design. Current predicted reduction in flow is worst-case i.e. risk will decrease.
01 Terrestrial Flora and Fauna	004 Mining and ore processing	Noise emissions from drill/blast and mining operations	Avoidance of mine site and immediate surrounds by native fauna	• No sensitive habitats in proximity to mine site (i.e. wetlands, roost sites). • Blasting will occur 3 times per week. • Machinery and equipment operations 24 hours .	2	1	1 - Low	• Blasting Management Plan to address safety issues. No specific environmental controls identified.	2	1	1 - Low	Unlikely. Low RR.	High. No sensitive receptors. Confirmed by field survey.
01 Terrestrial Flora and Fauna	004 Mining and ore processing	Dust emissions from materials handling, stockpiling and truck movements	Reduced habitat quality due to smothering of plants with dust	• No sensitive habitats in proximity to mine site (i.e. wetlands, roost sites). • Airborne dust deposition anticipated to occur within a short distance around the disturbance footprint and will be within the boundary of ML.	3	2	2 - Medium	• Dust suppression will be undertaken using water carts and application of polymer products. • ESCP to include best-practice dust management in accordance with IECA Guidelines. • Water supply for dust management included in project planning - accounts for about one-third of the mine site water requirements.	2	2	1 - Low	Unlikely. Low RR.	High. No sensitive receptors. Confirmed by field survey.
01 Terrestrial Flora and Fauna	005 Waste rock, rejects and tailings disposal	Wildlife interaction with tailings	Death of individual animals affects environmental values	• TSF co-located in WRD - machinery movements likely to deter fauna from area. • Operations will be 24 hours/day. • Characterisation work indicates no chemical contaminants of concern will be present in the tailings.	2	1	1 - Low	• Low IR. TSF cells will be monitored as part of operational requirements. If fauna are found to be attracted to area, measures to address this new risk would be developed in future revisions of the MMP.	2	1	1 - Low	Unlikely. Low RR.	High. Inherent risk is low due to inert nature of tailings.

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01 Terrestrial Flora and Fauna	006 Haulage of ore to Darwin Port	Haul trucks hitting animals on the road	Death of individual animals affects environmental values	• Ten return truck movements per day - not a significant increase in existing traffic. • Haul operations in day time hours only.	2	1	**1 - Low**	• Low IR. Speed limits on trucks will further limit potential impacts.	2	1	**1 - Low**	Unlikely. Low RR.	High. Low traffic volumes species at risk mainly macropods, which are not threatened.
01 Terrestrial Flora and Fauna	009 Non-ore waste management	Waste storage areas attract pest species such as cats, rats, dingoes	Increased predation/competition with native wildlife	• Putrescible waste will be stored onsite in skip bins between each removal. • Site will be active 24hrs/day	3	1	**1 - Low**	• Waste will be storage in designated covered bins. Waste will be regularly removed from site by a licensed contractor. • Vermin control will be implemented if vermin detected. • Refer EMP.	2	1	**1 - Low**	Unlikely. Low RR.	High. Covered waste storage known to be effective in treating risk.
02 Terrestrial Environmental Quality	001 Site clearing and preparation	Inappropriate topsoil removal and storage	Loss of soil structure and seedbank	• Top 20cm of topsoil will be stripped and stored to the north-west of the WRD. • Topsoil will be stored for 1-3 years for use in rehabilitation. • Soil characterisation indicates naturally poor growth medium.	4	3	**3 - High**	• Vegetation Clearing Procedure includes procedures for topsoil removal and storage. • Rehabilitation trials will be conducted during rehab of the WRD annulus planned for end of year 1. • Mine Closure Plan includes monitoring of initial rehabilitation success and rectification works.	2	3	**2 - Medium**	Possible. The risk land and soils associated with rehabilitation failure increases with disturbance area. Future mining activities could therefore contribute to cumulative impacts.	Moderate. Experience on other mine sites indicates lack of suitable growth medium is a key cause of rehabilitation failure. Rehabilitation trials required to inform methods and likely outcomes.
02 Terrestrial Environmental Quality	002 Construction of mine site infrastructure	Disturbance of soils and alteration of surface water flows	Soil erosion due to increased runoff from cleared/hardened areas	• Access track into site crosses drainage line - culvert crossing to be constructed. • Bund to be constructed to divert surface water around mine site - increased flow to the ephemeral drainage line to the south. • Only erosion of inundation bund and WRD annulus would impact on surrounding environment as the rest of the site is bunded. • Construction will occur during the dry season.	4	3	**3 - High**	• ESCP includes controls for stabilisation of cleared areas. • Stormwater drains will divert flows to sediment dams for treatment prior to discharge off-site. • ESCP includes design specifications for culverts and sediment dams.	3	2	**2 - Medium**	Unlikely. Soil erosion impacts are localised. Minimal existing disturbance.	Moderate-High. RR is dependent on effective implementation of controls. Experience on other mine sites shows that erosion and sediment control targets are regularly not achieved.
02 Terrestrial Environmental Quality	003 Water supply and use	Disturbance of soils and alteration of surface water flows by dam wall and spillway	Erosion of stream banks downstream of dam walls/spillways	• Spillway modelled to overflow during January of an average wet season. • Hydrographs show event based overflows in Jan/Feb and continuous overflow in Feb/Mar and event based again through late Mar into early Apr. • Dam wall and spillway design yet to be completed but will be in accordance with ANCOLD guidelines.	3	2	**2 - Medium**	• Dam wall and spillway to include erosion controls as per ESCP. • Dam wall and spillway design to reference ANCOLD guidelines.	2	2	**1 - Low**	Unlikely. Minimal existing or future potential disturbance in catchment.	Moderate. Dam wall design and geotechnical report inclusive of soil tests and consequence assessment pending.
02 Terrestrial Environmental Quality	003 Water supply and use	Disturbance of soils and alteration of surface water flows by construction of water pipeline	Soil erosion due to alteration of surface water flow paths	• Water pipeline traverses some short sections of broad drainages and steep slopes with increased erosion risk. • Pipeline will be buried.	3	2	**2 - Medium**	• Clearing Procedure includes specific controls for minimising soil disturbance and alteration of flows along the water pipeline corridor. • Erosion and sediment controls to be installed in accordance with ESCP.	2	2	**1 - Low**	Unlikely. Soil erosion impacts are localised. Minimal existing disturbance.	Moderate-High. RR is dependent on effective implementation of controls. Experience on other mine sites shows that erosion and sediment control targets are regularly not achieved.
02 Terrestrial Environmental Quality	005 Waste rock, rejects and tailings disposal	Acid Mine Drainage from WRD/TSF	Contamination of land and soils	• Materials characterisation (EcOz/Pendragon 2018) indicates waste rock and tailings is geochemically benign - AMD is unlikely	1	3	**1 - Low**	• On-going operational waste and tailings characterisation to confirm material characteristics. • TSF is lined with low permeability material that will minimise infiltration and release of contaminants.	1	2	**1 - Low**	Unlikely. Low RR.	High. Materials characterisation undertaken in accordance with guidelines.
02 Terrestrial Environmental Quality	005 Waste rock, rejects and tailings disposal	Construction of WRD landform	Soil erosion due to run-off from WRD annulus	• WRD annulus will be exposed to a single wet season, with rehabilitation planned around end of year 1 mining activities. • Materials characterisation (EcOz/Pendragon 2018) indicates some shallow weathered strata (10-15 mbgl) may be prone to slaking with some dispersion.	4	3	**3 - High**	• WRD annulus to be constructed of competent waste material. • Geotechnical testing program to be undertaken to define materials characteristics, sources and treatments for WRD and TSF construction and rehabilitation. • WRD Annulus to be rehabilitated in year 1. Rehabilitation trials and monitoring with remedial works as required. • Rehabilitation success to be monitored and supplementary work undertaken as required. Refer Mine Closure Plan.	3	3	**3 - High**	Unlikely. Soil erosion impacts are localised. Minimal existing disturbance. Minimal existing or future potential disturbance in catchment.	Low. Final landform/drainage design pending. RR dependent of rehabilitation success.

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02 Terrestrial Environmental Quality	007 Storage and handling of hazardous materials	Spills and leaks from fuel storages	Contamination of soils by hydrocarbons	• Fuel storage and handling in accordance with AS1940. • Volumes stored on site are relatively small.	3	1	**1 - Low**	• EMP includes monitoring of fuel storages for leaks/spills and spill response procedures. • Contaminated soils will be excavated and remediated on site.	3	1	**1 - Low**	Unlikely. Low RR.	High. Inherent risk is low due to design, which is standard practice.
03 Inland Water Environmental Quality	001 Site clearing and preparation	Erosion (wind/water) due to disturbance and exposure of ground surface	Increased turbidity in watercourses that flow into West Arm affects environmental values and/or other users	• Clearing will occur during the dry season. • Exposed surfaces of the inundation bund and WRD annulus will be susceptible to erosion during first rains. • Minor ephemeral drainage lines are the receiving waters. • Baseline water quality monitoring indicates wet season flows have low levels of turbidity.	3	3	**3 - High**	• Erosion and Sediment Control Plan includes methods for stabilising cleared areas and controls for minimising off-site movement of sediments. • Water quality monitoring addressed in Water Management Plan. • Review of ESCP implementation if elevated turbidity recorded.	2	3	**2 - Medium**	Unlikely. Low RR.	Moderate. Dependent on effective stabilisation of cleared areas, which can be difficult to achieve in the Top End. Detailed ESCP will be submitted with MMP.
03 Inland Water Environmental Quality	003 Water supply and use	Overflow of Raw Water or Process Water Dams	Increased turbidity in watercourses that flow into West Arm affects environmental values and/or other users	• Raw Water Dam designed to be continuously pumped to processing circuit and dust suppression. • Process Water Dam designed to receive pit dewatering and TSF decant and be continuously pumped to processing circuit. • Dam overflows would be contained within the mine site by drainage channels and the diversion bund.	2	2	**1 - Low**	• Dam sizing and design criteria to provide contingency storage for wet weather events. • As a contingency, excess water can be directed to the pit and/or TSF.	2	2	**1 - Low**	Unlikely. Low RR.	Moderate. Dam designs and operational requirements pending.
03 Inland Water Environmental Quality	003 Water supply and use	Erosion of stream banks downstream of dam walls/spillways	Increased turbidity in receiving waters downstream of dams affects environmental values and/or other users	• Spillway modelled to overflow during January of an average wet season. • Hydrographs show event based overflows in Jan/Feb and continuous overflow in Feb/Mar and event based again through late Mar into early Apr. • Dam wall and spillway design yet to be completed but will be in accordance with ANCOLD guidelines. • Watercourses are ephemeral - no significant aquatic or riparian habitats downstream.	3	2	**2 - Medium**	• Dam wall and spillway to include erosion controls as per ESCP. • Dam wall and spillway design to reference ANCOLD guidelines.	2	1	**1 - Low**	Unlikely. Low RR.	Moderate. Dam wall and spillway design pending. Geotechnical report inclusive of soil tests and consequence assessment pending.
03 Inland Water Environmental Quality	003 Water supply and use	Discharge of excess water in wet season	Poor water quality in watercourses discharging to West Arm affects environmental values	• Discharge water is groundwater dewatered from pit and therefore water quality is expected to be similar to the groundwater aquifer. • Arsenic and phosphorous is naturally elevated in the groundwater, but not in surface water. • Discharge required in wet season months of Dec to May i.e. peak flows - maximum dilution. • Water will be stored in separate storage to process water. • Sediments are also a contaminant of concern.	3	3	**3 - High**	• Discharge timing and volumes to be authorised by Waste Discharge Licence. • Discharge monitoring and reporting addressed in Water Management Plan.	2	3	**2 - Medium**	Unlikely. No other discharges in catchment.	Moderate. Discharge regime based on feasibility stage mine design. To be confirmed and authorised by WDL.
03 Inland Water Environmental Quality	004 Mining and ore processing	Contamination of pit in-flows due to exposure to PAF and/or other contaminants in pit walls	Poor water quality in groundwater aquifer affects environmental values and/or other users	• Waste characterisation (EcOz/Pendragon 2018) does not identify any significant PAF material occurrences within the pit shell. • Process water could be redirected to the pit in the event of extreme flood events but will not contain contaminants of concern. • Groundwater flows will be towards the pit and therefore water quality in the pit will not influence groundwater in the surrounding aquifer.	1	3	**1 - Low**	• Operational characterisation of pit wall lithologies and water quality. Refer Water Management Plan. • Pit is dewatered to process water dam where water quality will be tested and (if required) treated prior to use of water in processing/dust suppression.	1	2	**1 - Low**	Unlikely. Low RR.	Moderate. Further characterisation of pit wall lithologies and water during operations to confirm status.
03 Inland Water Environmental Quality	004 Mining and ore processing	Rainfall onto mine site produces sediment and/or contaminated runoff that is released off-site	Poor water quality downstream of mine site affects environmental values and/or other users	• Ore and rejects characterisation indicates material is inert and gravel like and therefore will not leach contaminants of concern. Fine sediments key contaminant of concern. • Stockpile areas are located within the area enclosed by the inundation bund and WRD, so no direct flow path to the environment. • Run-off directed to stormwater drains and sediment dams, for treatment prior to release off-site.	3	2	**2 - Medium**	• Sediment dams to be designed and operated in accordance with ESCP. • Water treated with flocculent and tested to achieve water quality criteria prior to release. • Water Management Plan includes a surface water monitoring program to detect changes in water quality with corrective actions implemented as required.	2	2	**1 - Low**	Unlikely. Low RR.	Moderate. Sediment dam designs and operational requirements pending.

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03 Inland Water Environmental Quality	005 Waste rock, rejects and tailings disposal	Seepage of water from WRD/TSF to groundwater aquifer	Poor water quality in groundwater aquifer affects environmental values and/or other users	• Waste characterisation (EcOz/Pendragon 2018) does not identify any AMD potential. • Tailings characterisation indicates the material is inert with no chemical contaminants. Fine sediments is the only contaminant of concern. • Groundwater flow direction under TSF is towards the pit. • Pit void is classified as a groundwater sink, so movement of contaminants into groundwater not expected to occur. • No groundwater users within 12km of site.	2	3	**2 - Medium**	• On-going operational materials and tailings characterisation program. • TSF foundation to be constructed from low permeability material, rolled and compacted. • TSF design incorporates underdrainage system. • TSF to be capped at closure and encased within WRD. • Monitoring of water quality in pit and monitoring bores with corrective actions implemented as required.	2	2	**1 - Low**	Unlikely. Low RR.	Moderate. Characterisation work indicates no source of chemical contaminants. TSF designs available to inform risk assessment. No sensitive receptors.
03 Inland Water Environmental Quality	005 Waste rock, rejects and tailings disposal	Release of sediment and/or contaminated water/tailings from WRD/TSF into surface water	Poor water quality in surface watercourses that flow into West Arm affects environmental values	• Tailings characterisation indicates the material is inert with no chemical contaminants. Fine sediments is the only contaminant of concern. • Tailings to be placed in TSF constructed in centre of the WRD and will be surrounded by competent waste rock. • Dam failure and environmental spill consequence categories assessed according to ANCOLD guidelines. Spillway sized to accommodate 0.1%AEP flood event. Design Storage Allowance prior to spilling set at 1%AEP, 72hours flood event. • In the event of TSF failure/overtopping, the WRD annulus provides for secondary containment. • Run-off from landform is intercepted by stormwater drains and directed to sediment dams.	2	3	**2 - Medium**	• Dam failure and environmental spill consequence categories assessed according to ANCOLD guidelines. Spillway sized to accommodate 0.1%AEP flood event. Design Storage Allowance prior to spilling set at 1%AEP, 72hours flood event. • Tailings characteristics TBC during trial plant testing. • In the event that the TSF's are at risk of overtopping, the open pit provides for contingency storage. • Water Management Plan includes a surface water monitoring program to detect changes in water quality with corrective actions implemented as required.	2	3	**2 - Medium**	Unlikely. No other land use in catchment.	Moderate.Characterisation work indicates no source of chemical contaminants. TSF designs available to inform risk assessment.
03 Inland Water Environmental Quality	005 Waste rock, rejects and tailings disposal	Erosion of WRD annulus	Increased turbidity in surface watercourses that flow into West Arm affects environmental values	• Run-off from landform is intercepted by stormwater drains and directed to sediment dams. • WRD annulus will be exposed to a single wet season, with rehabilitation planned around end of year 1 mining activities.	3	3	**3 - High**	• WRD annulus to be constructed of competent waste material. • Dispersive waste will be dumped in the centre of the centre of the WRD. • Implement ESCP. • Rehabilitation success to be monitored and supplementary work undertaken as required. Refer Mine Closure Plan.	2	3	**2 - Medium**	Unlikely. Exceedances likely to be sporadic - not sustained. Minimal existing disturbance. Minimal existing or future potential disturbance in catchment.	Low. Final landform/drainage design pending. RR dependent of rehabilitation success.
03 Inland Water Environmental Quality	007 Storage and handling of hazardous materials	Leaks and spills from diesel fuel storage areas entering groundwater	Hydrocarbon contamination of aquifer affects environmental values and/or other users	• Above-ground fuel storage tanks used over short life of mine - lowers risk associated with diffuse pollution over time. • Fuel storage and handling in designated areas and accordance with AS1940. • Groundwater aquifer is shallow but transmissivity is low. • During mining, groundwater beneath the mine site will flow towards the pit. • No GDE's or other users in proximity to site.	2	2	**1 - Low**	• Surround storage areas for fuels and oils with an impervious bund that contains 120% of the largest container stored in the bund – as per AS1940 • Refuel vehicles within bunded areas • Make available spill containment equipment kits at the works area that are adequately-sized to manage the volume of fuels that could be spilled • Water Management Plan addresses monitoring of water quality in sediment dams and pit and implementation of corrective actions if hydrocarbons are detected.	1	2	**1 - Low**	Unlikely. Low RR.	High. Compliance with AS for storage and handling is established as an effective risk treatment.
03 Inland Water Environmental Quality	007 Storage and handling of hazardous materials	Leaks and spills from diesel fuel storage areas entering surface water	Hydrocarbon contamination of downstream ephemeral watercourses that flow into West Arm	• Above-ground fuel storage tanks used over short life of mine - lowers risk associated with diffuse pollution over time. • Fuel storage and handling in designated areas and accordance with AS1940. • Diversion bund around site provides added barrier to movement of spills off site by surface water flows.	2	3	**2 - Medium**	• Surround storage areas for fuels and oils with an impervious bund that contains 120% of the largest container stored in the bund – as per AS1940 • Refuel vehicles within bunded areas • Make available spill containment equipment kits at the works area that are adequately-sized to manage the volume of fuels that could be spilled • Water Management Plan addresses monitoring of water quality in sediment dams and pit and implementation of corrective actions if hydrocarbons are detected.	1	2	**1 - Low**	Unlikely. Low RR.	High. Compliance with AS for storage and handling is established as an effective risk treatment.
03 Inland Water Environmental Quality	008 Non-ore waste management	Leaks from septic system into groundwater	Bacterial contamination of groundwater beneath the site affects environmental values and/or other users	• Capacity based on max 64 staff onsite will be less than 2,000l/day. • On-site waste water system will be installed by a licensed plumber in accordance with NT Code of Practice for onsite wastewater management. • Groundwater aquifer is shallow but transmissivity is low. During mining, groundwater beneath the mine site will flow towards the pit.	2	2	**1 - Low**	• Spill response procedures in EMP	2	1	**1 - Low**	Unlikely. Low RR.	High. NT Code of Practice is proven effective measure to treat risks associated with on-site wastewater treatment and disposal.

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03 Inland Water Environmental Quality	008 Non-ore waste management	Leaks from septic system into surface water	Bacterial contamination of surface water flows affects environmental values	• Capacity based on max 64 staff onsite will be less than 2,000l/day. • On-site waste water system will be installed by a licensed plumber in accordance with NT Code of Practice for onsite wastewater management. • Diversion bund around site provides added barrier to movement of spills off site by surface water flows.	2	2	**1 - Low**	• Spill response procedures in EMP	2	1	**1 - Low**	Unlikely. Low RR.	High. NT Code of Practice is proven effective measure to treat risks associated with on-site wastewater treatment and disposal.
03 Inland Water Environmental Quality	008 Non-ore waste management	Hazardous waste storage areas do not have adequate containment	Contamination of surface water and/or groundwater affects environmental values and/or other users	•Waste produced on site will comprise waste oils/lubricants, batteries, tyres. • Any release of contaminants to ground would either seep to groundwater, which flows towards the pit, or enter the on-site stormwater management system that is direct to the sediment dams.	3	2	**2 - Medium**	• Use, handle, store and dispose of all hazardous materials in accordance with the Dangerous Goods Act and the Waste Management and Pollution Control Act • Locate chemical and hazardous goods storage areas no less than 50 m from any areas of concentrated water flow, flood and poorly-drained areas • Make available spill containment equipment kits at the works area that are adequately-sized to manage the volume of hazardous materials stored within the works areas • Water Management Plan addresses monitoring of water quality in sediment dams and pit and implementation of corrective actions if contaminants are detected.	2	1	**1 - Low**	Unlikely. Low RR.	High. RR dependent on design and operation of as constructed stage areas; however, volumes of materials to be stored are relatively small.
04 Hydrological processes	002 Construction of mine site infrastructure	Alteration of surface water flows and discharges	Reduced flows affects environmental values	• Mine site infrastructure will change stream lines in the upper catchment. • No significant or sensitive water dependent environmental values in ephemeral drainages upstream of saltwater influence, where modelled flow reduction is up to 46% during the early wet season. • Combined impact of the mine site and dam could reduce flows into the upper mangroves of West Arm by 16-20 % in the early wet season months Nov-early Jan, dropping to between 1% and 7% for the remainder of the wet season.	2	3	**2 - Medium**	• Mine site design revised to include sediment dams that provide for treatment and discharge of stormwater.	2	3	**2 - Medium**	Unlikely. No other users.	Moderate. Modelling based on feasibility stage mine site designs. To be revised for detailed design.
04 Hydrological processes	003 Water supply and use	Dam wall failure Mine Site Dam	Downstream flooding in West Arm catchment	• Due to the proximity of the dam to the Cox Peninsula Road, the Population At Risk (PAR) has been assessed as 1 – 10. • Consequence Category as 'Significant'. • Spillway has been designed to pass a 0.1% AEP flood event.	2	3	**2 - Medium**	• Dam design in accordance with ANCOLD Guidelines	1	2	**1 - Low**	Unlikely. Low RR.	Moderate. Final designs pending.
04 Hydrological processes	003 Water supply and use	Dam wall failure Observation Hill Dam	Downstream flooding in Bynoe catchment	• Population At Risk (PAR) has been assessed as 1 – 10. • Consequence Category as 'Significant'. • Spillway has been designed to pass a 0.1% AEP flood event.	2	3	**2 - Medium**	• Dam design in accordance with ANCOLD Guidelines	1	2	**1 - Low**	Unlikely. Low RR.	Moderate. Final designs pending.
04 Hydrological processes	003 Water supply and use	Harvesting of surface water flows to fill OHD	Reduced flows downstream to Charlotte River affects environmental values	• NT Water Allocation Planning Framework contingent allocation for environmental and public benefit is 80%. • No public benefit water uses in catchment. • Riparian rainforest along drainages downstream of dam may be sensitive to reduced flows.	2	3	**2 - Medium**	• Mine site design amended to incorporate additional storages (MWD 1 & 2) so that TSF decant and pit dewatering can be used as the primary project water supply. • Dam sizes have will be designed based on the minimum requirement to achieve a sustainable water supply for the project. • Some reduction in flow is a residual impact associated with the project.	2	3	**2 - Medium**	Possible. Development of open pit mine at BP33 will also affect flows in the Charlotte River catchment.	High. Site is located high in catchment - even if pump rate from dams were to increase, downstream impact to flows would not significantly change.
04 Hydrological processes	003 Water supply and use	Operational efficiencies not achieved resulting in increased project water requirements	Additional extraction of water from dams decreases downstream flows more than predicted	• Conservative approach applied to modelling with pump rate based on entire mine site supply coming from a single source. • Site water balance prepared for feasibility stage design indicates pit dewatering expected to supply most of the site water requirements. Obs Hill Dam could provide all of the projects make-up water needs; however, mine site dam proposed as a contingency supply option. • Any additional supply requirement is not likely to be of a magnitude that would increase the modelled reduction of flows.	2	2	**1 - Low**	• The DMS processing facility recycles and re-uses water at a number of points within the circuit. • An operational efficiencies statement was prepared for the current water management system design. The statement indicates re-use efficiency of 39%. • Water re-use will be monitored and adjustments made where required to maximise efficiencies	1	2	**1 - Low**	Unlikely. Low RR.	High. Conservative approach to modelling used - risk not dependent on achieving a high level of operational efficiency.

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04 Hydrological processes	003 Water supply and use	Discharge of excess water in wet season	Increased flows downstream into West Arm affects environmental values	• The site water account predicts discharge requirement during Dec to Mar each year. • Discharge is driven by groundwater inflows to pit. • Model parameter estimation was undertaken in accordance with best practice guidelines (Barnett et al, 2008). The model is deemed to meet the requirements of a Class 2 model and is suitable for providing estimates of dewatering requirements for mines and the associated impacts.	3	2	**2 - Medium**	• Mine site design amended to incorporate additional storage (MWD2) for dewatering of pit inflows so that discharge required in wet season only. • Discharge timing and volumes to be authorised by Waste Discharge Licence. • Discharge monitoring and reporting addressed in Water Management Plan.	3	1	**1 - Low**	Unlikely. Low RR.	Moderate. Discharge regime based on feasibility stage mine design and inputs from Class2 groundwater model. To be confirmed and authorised by WDL.
04 Hydrological processes	003 Water supply and use	Harvesting of surface water flows to fill Mine Site Dam	Reduced flows downstream into West Arm affects environmental values	• NT Water Allocation Planning Framework contingent allocation for environmental and public benefit is 80%. • No significant or sensitive water dependent environmental values in ephemeral drainages upstream of saltwater influence, where modelled flow reduction is <45% during the early wet season. • Hinterland mangroves 1.7km downstream closest sensitive receptor. • Combined impact of the mine site and dam could reduce flows into the upper mangroves of West Arm by 16-20 % in the early wet season months Nov-early Jan, dropping to between 1% and 7% for the remainder of the wet season.	2	3	**2 - Medium**	• Mine site design amended to incorporate additional storages (MWD 1 & 2) so that TSF decant and pit dewatering can be used as the primary project water supply. • Required capacity of mine site dam reduced to 310ML in feasibility design phase. • Dam sizes have will be designed based on the minimum requirement to achieve a sustainable water supply for the project. • Minor reduction in flow is a residual impact associated with the project.	2	3	**2 - Medium**	Unlikely. No other users in catchment.	Moderate. Capacity of dam required for supplementary supply to be confirmed through detailed design. Current predicted reduction in flow is worst-case i.e. risk will decrease.
04 Hydrological processes	004 Mining and ore processing	Groundwater inflows to pit	Drawdown of groundwater levels in aquifer affects environmental values and/or other users	• Groundwater inflows to pit modelled over life of mine. Model deemed to meet the requirements of a Class 2 model (Barnett et al 2008) and is suitable for providing estimates of mine dewatering requirements. • End of mining drawdown cone modelled to extend 1 km from the pit. • No GDE's present in area. Drawdown modelling indicates impact will not affect discharge to ephemeral watercourses. • No other users within 12km of site.	2	2	**1 - Low**	• None identified as inherent risk is low. • Groundwater levels will be monitored during operations and post-closure. Refer Water Management Plan.	2	2	**1 - Low**	Unlikely. Low RR.	High. Inherent risk is low due to absence of GDE's and other user and drawdown will occur over a limited area.
04 Hydrological processes	005 Waste rock, rejects and tailings disposal	Aquifer recharge from TSF cells	Localised mounding of groundwater	• Groundwater flow direction in area of TSF will be towards the pit void. • Modelled drawdown cone covers area beneath WRD/TSF landform.	2	2	**1 - Low**	• TSF foundation to be constructed from low permeability material, rolled and compacted. • TSF design incorporates underdrainage system. • TSF to be capped at closure and encased within WRD. • Groundwater monitoring program to detect changes in groundwater levels around site. Refer Water Management Plan.	1	2	**1 - Low**	Unlikely. Low RR.	High. TSF design provided. Based on modelling, informed by baseline groundwater monitoring.
05 Air quality and GHG	001 Site clearing and preparation	Removal of vegetation	Release of GHG	• Proposal will result in direct loss of 181ha of native vegetation. • Cleared vegetation will be disposed of by burning stockpiles.	5	1	**2 - Medium**	• GHG emissions calculated at 0.4% of NT total emissions. 80% of emissions will occur in first year. • Reporting of GHG emissions will be required in year 1. • Maintain records of GHG emissions so that reporting requirements can be met.	5	1	**2 - Medium**	Unlikely. Low emissions contribution.	High. Emissions calculated in accordance with prescribed methods.
05 Air quality and GHG	004 Mining and ore processing	Exhaust emissions and diesel fuel consumption	Release of GHG	• Small vehicle and equipment fleet. • Relatively short mine life. • Short haul distance. • Powered by onsite diesel generators.	5	1	**2 - Medium**	• GHG emissions calculated at 0.4% of NT total emissions. 80% of emissions will occur in first year. • Reporting of GHG emissions will be required in year 1. • Maintain records of GHG emissions so that reporting requirements can be met.	5	1	**2 - Medium**	Unlikely. Low emissions contribution.	High. Emissions calculated in accordance with prescribed methods.
05 Air quality and GHG	004 Mining and ore processing	Dust emissions	Nuisance and/or public health effects	• Mine site is remote from sensitive receptors. • Dust deposition expected to occur within the ML. • Cox Peninsula Road 500m away is a sensitive receptor.	3	3	**3 - High**	• Dust suppression will be undertaken using water carts and application of polymer products. • Water supply for dust management included in project planning - accounts for one-third of the mine site water requirements. • Visual monitoring of dust emissions outside of the disturbance footprint with additional dust management if dust is visible on Cox Peninsula Road.	2	2	**1 - Low**	Unlikely. Low RR.	Moderate. RR is dependent on effective dust control. Experience on other mine sites indicates that this is regularly not achieved and dust is an ongoing issue.

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05 Air quality and GHG	006 Haulage of ore to Darwin Port	Exhaust emissions and diesel fuel consumption	Release of GHG	• 10 return truck movements per day; 177km round trip. • Relatively short mine life and short haul distance.	5	1	**2 - Medium**	• GHG emissions calculated at 0.4% of NT total emissions. 80% of emissions will occur in first year. • Reporting of GHG emissions will be required in year 1. • Maintain records of GHG emissions so that reporting requirements can be met.	5	1	**2 - Medium**	Unlikely. Low emissions contribution.	High. Emissions calculated in accordance with prescribed methods.
05 Air quality and GHG	006 Haulage of ore to Darwin Port	Dust emissions from haul trucks	Nuisance and/or public health effects	• Haul route passes sensitive receptors including Berry Springs Primary School, houses and businesses. • Product is coarse. • Dust does not contain any contaminants of concern.	2	2	**1 - Low**	• Loads will be covered. • Complaints procedures established.	1	1	**1 - Low**	Unlikely. Low RR.	High. Loads will be covered.
05 Air quality and GHG	011 Power generation and use	Exhaust emissions and diesel fuel consumption	Release of GHG	• Small vehicle and equipment fleet. • Relatively short mine life. • Short haul distance. • Powered by onsite diesel generators.	5	1	**2 - Medium**	• GHG emissions calculated at 0.4% of NT total emissions. 80% of emissions will occur in first year. • Reporting of GHG emissions will be required in year 1. • Maintain records of GHG emissions so that reporting requirements can be met.	5	1	**2 - Medium**	Unlikely. Low emissions contribution.	High. Emissions calculated in accordance with prescribed methods.

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