Environmental Management Plan

West Angelas Iron Ore Project

RTIO-HSE-0311343

Robe River Mining Co. Pty. Ltd.

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April 2018

Rio Tinto

Disclaimer and Limitation

This Environmental Management Plan has been prepared by Rio Tinto's Iron Ore group (Rio Tinto), on behalf of Robe River Mining Co. Pty. Ltd. (the Proponent), specifically for the West Angelas Iron Ore Project. Neither the report nor its contents may be referred to without the express approval of Rio Tinto, unless the report has been released for referral and assessment of proposals.

Document Status					
Rev	Author	Reviewer/s	Date	Approved for Issue	
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3	Rio Tinto		April 2018	OEPA	April 2018

SUMMARY

This West Angelas Iron Ore Project (West Angelas Project) Environmental Management Plan (EMP) is submitted by Rio Tinto on behalf of Robe River Mining Co. Pty. Ltd. (the Proponent) in accordance with condition 5 of MS xxxx. Table S 1 below presents the environmental criteria to measure achievement of the environmental outcome that must be met through implementation of this EMP.

Table S 1: Environmental criteria to measure achievement of environmental outcome

Proposal title	West Angelas Iron Ore Project
Proponent	Robe River Mining Co. Pty. Ltd.
Ministerial Statement	MS xxxx
Purpose of this EMP	This EMP fulfils the requirements of conditions 6, 7 and 8 of MS xxxx.
Hydrological Processes and Flora and Vegetation – Dewatering, surface water discharge and riparian vegetation **EPA Objective:** *To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.*	
Condition environmental outcome	• The Proponent shall ensure that there is no irreversible impact, as a result of the proponent's dewatering activities, to potentially groundwater dependent vegetation within Karijini National Park. • The Proponent shall ensure that there is no irreversible impact, as a result of the discharge of surplus water, to the health of riparian vegetation of Turee Creek East.
Trigger criteria	Potential GDE within Karijini National Park: 1. The mean vegetation index for the upper canopy (*E. victrix* / *E. camaldulensis*) declines >2 standard deviations (SD) from baseline[1].
	Surface water discharge and riparian vegetation: 2. Surface water discharge reaches within 2 km of the boundary of Karijini National Park (as measured along the creek channel/s) under natural no-flow conditions. 3. Significant upward trend (25%) in number of introduced species relative to baseline.
Threshold criteria	Potential GDE within Karijini National Park: 1. The mean vegetation index for the upper canopy (*E. victrix* / *E. camaldulensis*) declines >2SD from baseline over two consecutive monitoring events.

[1] Baseline surveys of the Potential GDE are still to be undertaken therefore the response in natural variation is not yet fully understood.

	Surface water discharge and riparian vegetation: 2. Surface water discharge reaches the boundary of Karijini National Park under natural no-flow conditions. 3. Significant upward trend (40%) in number of introduced species with a notable decline (40%) in native species richness compared to baseline.
Flora and Vegetation – West Angelas Cracking Clay Priority Ecological Communities **EPA Objective:** *To maintain representation, diversity, viability and ecological function at the species, population and community level.*	
Condition environmental outcome	• The Proponent shall ensure that there is no disturbance to the West Angelas Cracking Clay Priority Ecological Community (PEC-2015-5). • The Proponent shall ensure no more than 20 ha of disturbance to other representations of the West Angelas Cracking Clay Priority Ecological Community.
Trigger criteria	1. Disturbance (direct or indirect) within 100 m of West Angelas Cracking Clay Priority Ecological Community (mapped representation PEC-2015-5). 2. Disturbance within other representations of West Angelas Cracking Clay PEC exceeds 15.5 ha.
Threshold criteria	1. Disturbance (direct or indirect) within the West Angelas Cracking Clay Priority Ecological Community (mapped representation PEC-2015-5). 2. Disturbance within other representations of West Angelas Cracking Clay PEC exceeds 20 ha.
Terrestrial Fauna – Conservation significant fauna species; Ghost Bat (*Macroderma gigas*) **EPA Objective:** *To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.*	
Condition environmental outcome	• The Proponent shall ensure that there is no disturbance to the Ghost Bat roost (Cave AA1). • The Proponent shall minimise disturbance to other Ghost Bat roosts (Caves A1, A2, L2 and L3).
Trigger criteria	1. Disturbance within 150 m of Ghost Bat roost (Cave AA1). 2. Vibration levels exceed 40mm/s peak particle velocity (Cave AA1) or 75mm/s peak particle velocity (Caves A1, A2, L2 and L3).
Threshold criteria	1. Disturbance within 100 m of Ghost Bat roost (Cave AA1). 2. Significant damage to Ghost Bat roosts (Caves AA1, A1, A2, L2 and L3). 3. Permanent Ghost Bat abandonment of caves.

Corporate endorsement

I hereby certify that to the best of my knowledge, the provisions within this West Angelas Environmental Management Plan are true and correct and address the legal requirements of MS xxxx.

Name: **Signed:**

Designation: GM, West Angelas and Robe Valley **Date:**

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1. CONTEXT, SCOPE AND RATIONALE

1.1 West Angelas Project

The Proponent (Robe River Mining Co. Pty. Ltd.) manages and operates the West Angelas Project, as approved by MS 970 and MS 1015, under Part IV of the *Environmental Protection Act 1986* (EP Act).

The West Angelas Project is located approximately 130 km northwest of Newman in the Pilbara region of Western Australia on Mineral Lease 248SA (ML248SA) which was granted in 1976 under the *Iron Ore (Robe River) Agreement Act 1964 (WA)* (Figure 1-1). The West Angelas Project consists of the following (as depicted in Figure 1-2):

- Open cut above and below water table (AWT and BWT) mining of iron ore from deposits A, A west, B, C, D, E, F and G by conventional drill, blast, and load and haul techniques.
- Ore processing in central processing facilities.
- Surface waste dumps which are used in backfilling of the mine pits as far as practicable.
- Infrastructure including but not limited to the following:
    - Dewatering and surplus water management infrastructure, including the Turee Creek B borefield which provides potable water to the mine and camp facilities (and, when required, water for operational purposes) and the mine dewatering borefield which dewaters the ore bodies to allow below water table mining. Dewatering water is used onsite in the first instance to supply water for operational purposes. Surplus dewatering water, exceeding the operational requirement, is discharged to a local ephemeral tributary of Turee Creek East.
    - Surface water management infrastructure, including diversions to direct surface water flows around deposits.
    - Linear infrastructure, including the 413 km rail network which transports processed ore approximately to port facilities located at Cape Lambert, the Turee Creek B borefield, pipeline and powerline and the 35 km mine access road which links the mine with the Great Northern Highway.
    - Support facilities, including the accommodation village which is located approximately 9 km west of the mine.

1.2 Key Environmental Factors

Management of the following key aspects of the West Angelas Project are incorporated in this Environmental Management Plan (EMP):

- Hydrological processes – dewatering of groundwater; surface discharge of surplus dewatered water; and riparian vegetation.
- Flora and vegetation – the West Angelas Cracking Clay Priority Ecological Community (PEC).
- Terrestrial Fauna – conservation significant fauna species (Ghost Bat).

This EMP will be implemented subject to approval by the EPA and will replace the existing approved management plan associated with the West Angelas Project (RTIO-HSE-0210871, November 2013).

This EMP has been developed in accordance with the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016 and Environmental Impact Assessment (Divisions 1 and 2) Procedures Manual 2016.*

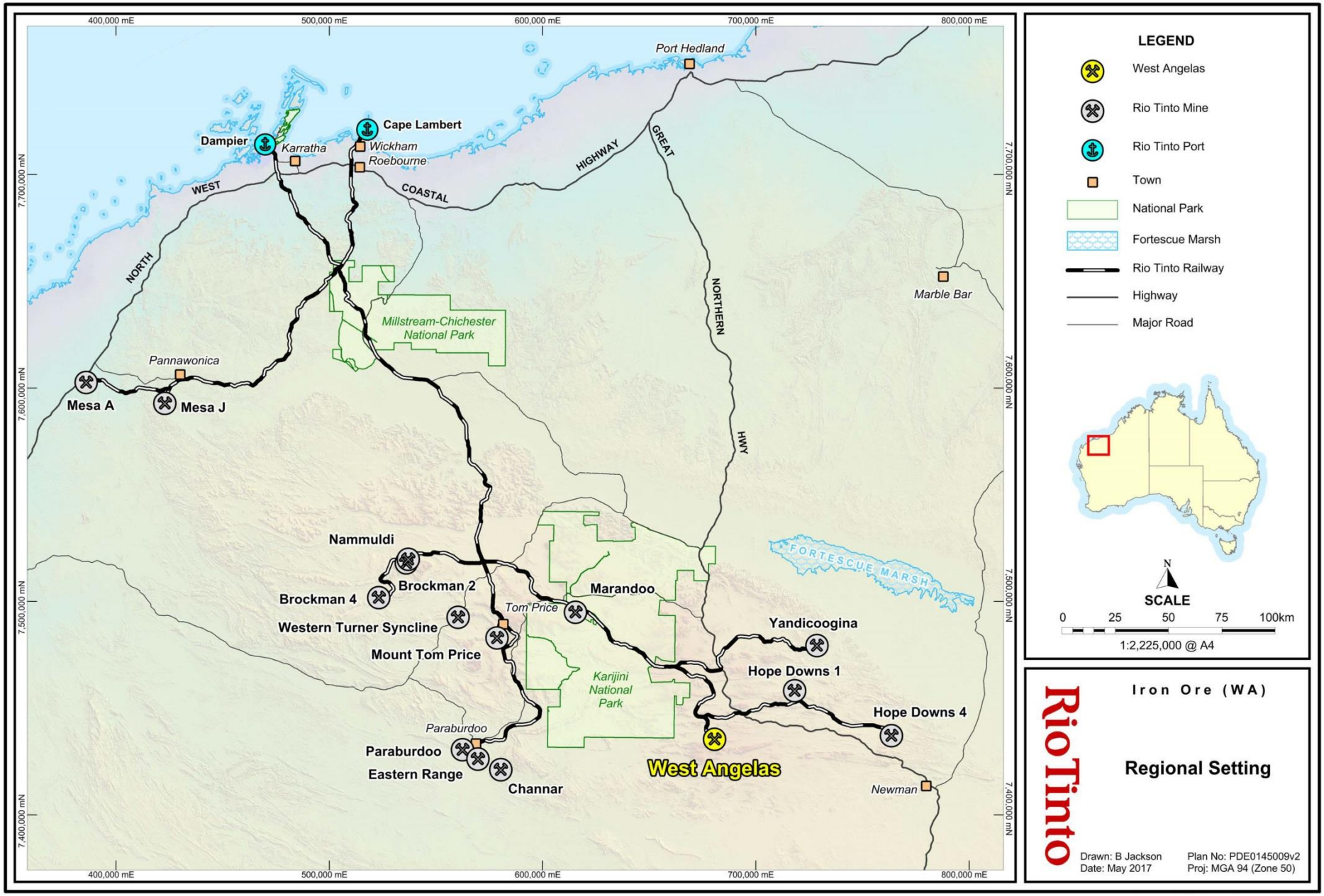

Figure 1-1: Regional Setting of the West Angelas Iron Ore Project

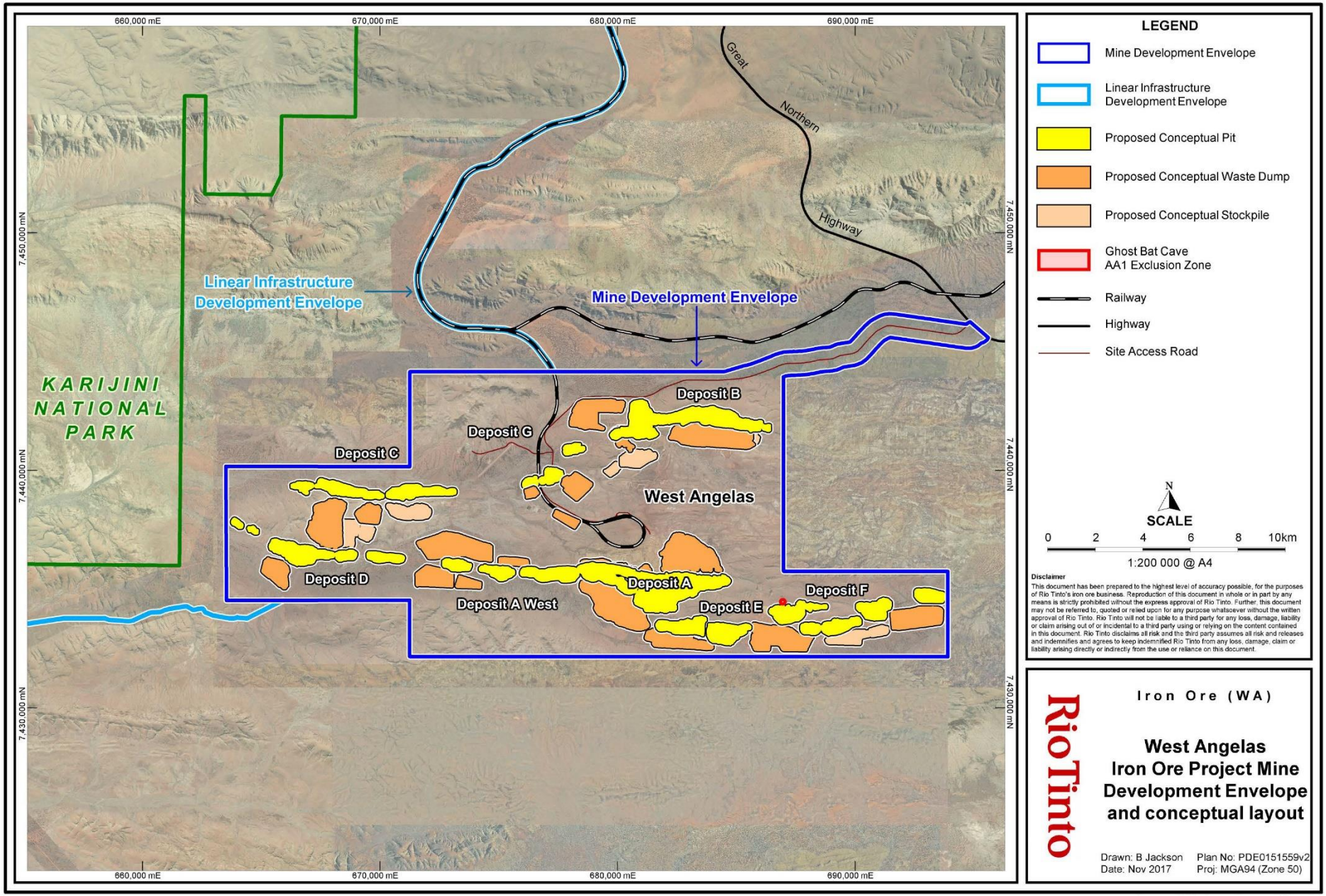

Figure 1-2: West Angelas Iron Ore Project Mine Development Envelope and conceptual layout

1.3 Condition Requirements

The proposed conditions and the associated proposed environmental objectives for the West Angelas Project are detailed below in Table 1-1.

Table 1-1: Proponent proposed condition for the West Angelas Project

Condition	
5	**Condition Environmental Management Plans**
5-1	The proponent shall prepare and implement a Condition Environmental Management Plan to the satisfaction of the CEO. This plan shall demonstrate that the **environmental outcomes** specified in in condition 6-1, condition 7-1 and condition 8-1 will be met.
5-2	The Condition Environmental Management Plan shall: (1) specify the environmental outcomes to be achieved, as specified in condition 5-1; (2) specify trigger criteria that must provide an early warning that the threshold criteria may not be met; (3) specify threshold criteria to demonstrate compliance with the environmental outcomes specified in condition 5-1. Exceedance of the threshold criteria represents non-compliance with these conditions; (4) specify monitoring to determine if trigger criteria and threshold criteria are exceeded; (5) specify trigger level actions to be implemented in the event that trigger criteria have been exceeded; (6) specify threshold contingency actions to be implemented in the event that threshold criteria are exceeded; and (7) provide the format and timing for the reporting of monitoring results against trigger and threshold criteria to demonstrate that condition 5-1 has been met over the reporting period in the Compliance Assessment Report required by condition 3-6.
5-3	After receiving notice in writing from the CEO that the Condition Environmental Management Plan satisfies the requirements of condition 5-2 the proponent shall: (1) implement the Condition Environmental Management Plan, or any subsequent approved versions; and (2) continue to implement the Condition Environmental Management Plan until the CEO has confirmed by notice in writing that the proponent has demonstrated the objectives specified in condition 5-1 have been met.
5-4	In the event that the monitoring indicates an exceedance of the threshold criteria specified in the Condition Environmental Management Plans, the proponent shall: (1) report the exceedance in writing to the CEO within seven (7) days of the exceedance being identified; (2) implement the threshold level contingency actions specified in the Condition Environmental Management Plans within 24 hours and continue implementation of those actions until the CEO has confirmed by notice in writing that it has been demonstrated that the threshold criteria are being met and the implementation of the threshold contingency actions is no longer required; (3) investigate to determine the cause of the threshold criteria being exceeded; (4) investigate to provide information for the CEO to determine potential environmental harm that occurred due to the threshold criteria being exceeded; and (5) provide a report to the CEO within twenty one (21) days of the exceedance being reported as required by condition 5-6(1). The report shall include; a. details of threshold contingency actions implemented;

Condition	
	b. the effectiveness of the threshold contingency actions implemented, against the threshold criteria; c. the findings of the investigations required by condition 5-5(3) and 5-5(4); d. measures to prevent the threshold criteria being exceeded in the future; e. measures to prevent, control or abate the environmental harm which may have occurred; and f. justification of the threshold remaining, or being adjusted based on better understanding, demonstrating that outcomes would continue to be met.
5-5	The proponent: (1) may review and revise the Condition Environmental Management Plan, or (2) shall review and revise the Condition Environmental Management Plan as and when directed by the CEO.
6	**Hydrological Processes and Flora and Vegetation – Dewatering, discharge and riparian vegetation**
6-1	The proponent shall manage implementation of the Proposal to meet the following environmental outcomes: (1) The proponent shall ensure that there is no irreversible impact, as a result of the proponent's dewatering activities, to groundwater dependant vegetation within Karijini National Park. (2) The proponent shall ensure that there is no irreversible impact, as a result of the proponent's discharge of surplus water, to the health of riparian vegetation of Turee Creek East.
7	**Flora and Vegetation – Conservation significant vegetation communities; West Angelas Cracking Clay Priority Ecological Communities**
7-1	The proponent shall manage implementation of the Proposal to meet the following environmental outcomes: (1) The proponent shall ensure that there is no disturbance to the West Angelas Cracking Clay Priority Ecological Community (PEC-2015-5). (2) The proponent shall ensure no more than 20 ha of disturbance to other representations of the West Angelas Cracking Clay Priority Ecological Community.
8	**Terrestrial Fauna – Conservation significant fauna species; Ghost Bat (*Macroderma gigas*)**
8-1	The proponent shall manage the implementation of the Proposal to meet the following environmental outcomes: (1) The proponent shall ensure that there is no disturbance to the Ghost Bat roost; Cave AA1. (2) The proponent shall minimise disturbance to other Ghost Bat roosts; Caves A1, A2, L2 and L3.

1.4 Rationale and Approach

This EMP addresses environmental factors (and relevant environmental objectives) which were determined by the EPA as being relevant to the appropriate management of dewatering, surface water discharge, conservation significant vegetation communities and fauna species associated with the West Angelas Project. The EMP achieves this by:

- Identifying the environmental criteria that the Proponent will use to monitor performance of the measures proposed to address the requirements of condition 5 of MS xxxx for the West Angelas Project.
- Defining the management actions that the Proponent will take in response to monitoring results.

Results of baseline surveys, monitoring and a number of assumptions and uncertainties inform the management approach for meeting the condition environmental outcomes stated in conditions 6, 7, and 8 of MS xxxx.

The identified trigger criteria, threshold criteria, trigger level actions and threshold contingency actions are aligned with the overall management approach.

Monitoring data is used to evaluate compliance with the trigger and threshold criteria to achieve the relevant condition environmental outcomes.

1.4.1 Survey and Study Findings

a) Potential GDE within Karijini National Park

An ecological assessment has been undertaken to determine the presence of any potentially Groundwater Dependent Species and Groundwater Dependent Vegetation likely to represent a potential Groundwater Dependent Ecosystem (GDE).

Three common Pilbara species are known to be groundwater dependant (phreatophytic): *Melaleuca argentea* (obligate phreatophyte)*; Eucalyptus camaldulensis* subsp. *refulgens* (facultative phreatophyte); and *E. victrix* (facultative phreatophyte or vadophyte). Riparian vegetation along Turee Creek East supports two of these species: *E victrix* and *E. camaldulensis*.

Melaleuca argentea and other moisture indicating or mesic species such as *Melaleuca glomerata, Melaleuca bracteata* and *Acacia ampliceps* which often indicate shallow groundwater were not recorded in the survey area. Semi-mesic species like *Acacia pyrifolia* and *Androcalva luteiflora* were recorded but these species are common in creeks in the Pilbara and are not generally recognised as dependent on or indicative of shallow groundwater.

E. victrix were common at variable densities within riparian vegetation communities of Turee Creek East. However, groundwater elevation beneath the riparian vegetation communities of Turee Creek East within the West Angelas area is typically between 20m and 70m bgl, and therefore inaccessible to *E. victrix* such that the potential for groundwater dependence is considered 'negligible'.

Groundwater elevation below the riparian vegetation communities of Turee Creek East within Karijini National Park is typically between 2 m and 6.5 m bgl, and therefore accessible to riparian vegetation such that the potential for groundwater dependence is elevated.

Approximately 22 ha of relatively dense riparian vegetation within Karijini National Park was found to contain *E. victrix* (the C3B community) at densities which could indicate the potential for groundwater dependence. Based on the stand density, approximately 22 ha of relatively dense riparian vegetation communities of Turee Creek East within Karijini

National Park (the C3B community) is assumed to represent a potential GDE, considered to be at 'low to medium' risk of impact as a result of groundwater drawdown (Figure 1-3).

Approximately 4.8 ha of riparian vegetation within Karijini National Park is co-dominated by *E. victrix* and *E. camaldulensis* (the C2B community) at densities which could indicate the potential for groundwater dependence. Based on the structure and stand density, approximately 4.2 ha of relatively dense riparian vegetation communities of Turee Creek East within Karijini National Park (the C2B community) is assumed to represent a potential GDE considered to be at 'medium' risk of impact as a result of groundwater drawdown (Figure 1-3). Approximately 0.6 ha of the C2B community is considered to be at 'low' risk of impact as groundwater drawdown is expected to be limited beneath this community.

The Proponent proposes to monitor the health of potentially groundwater dependant species; *E. victrix* and *E. camaldulensis,* within Karijini National Park at 'low' to 'medium' risk of impact as a result of groundwater drawdown utilising Digital Multi Spectral Imagery (DMSI) to ensure there are no significant changes to health beyond natural variation.

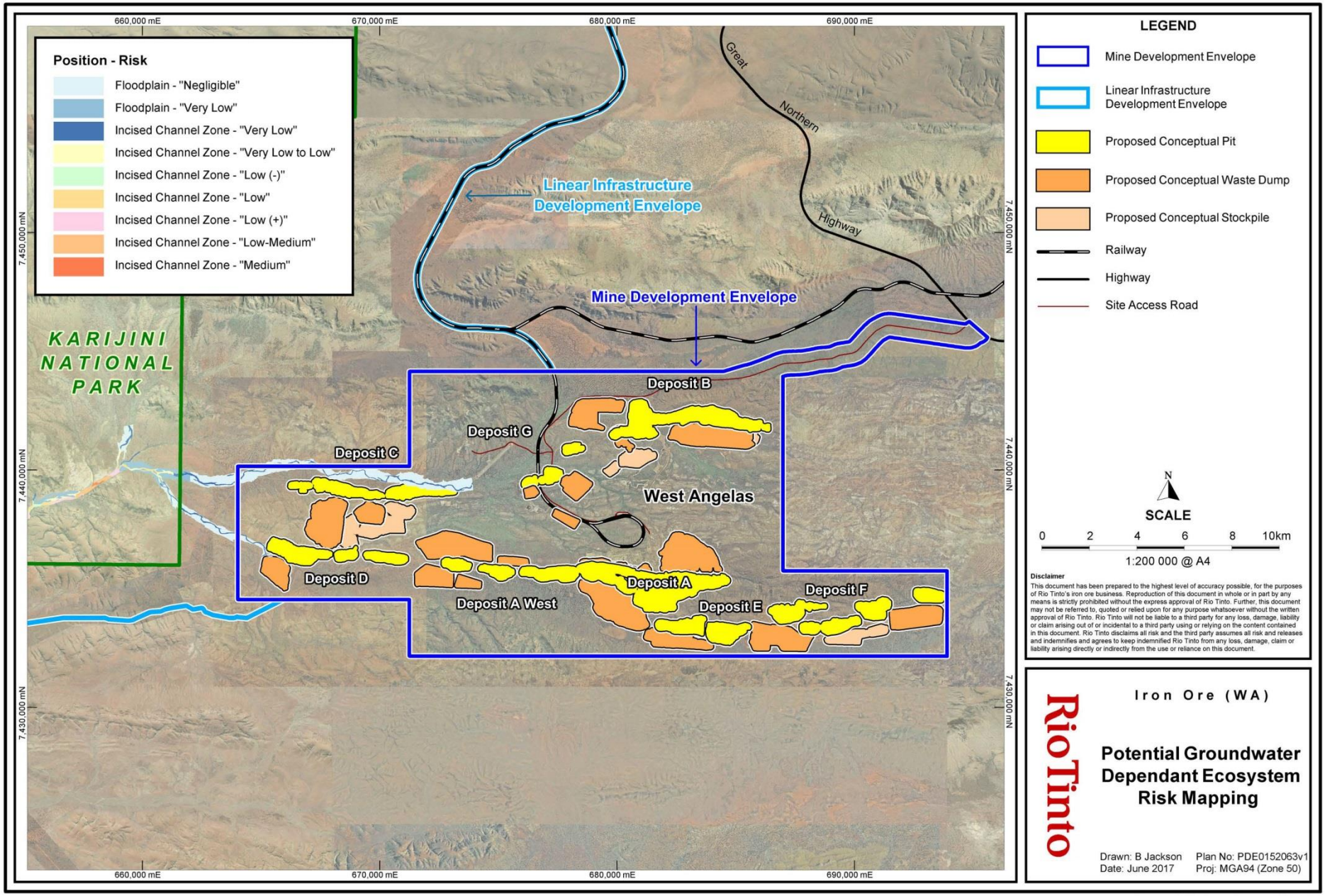

Figure 1-3: Potential groundwater dependant ecosystem risk mapping

b) Surface water discharge

The West Angelas Project is located in the upper reaches of the Turee Creek Catchment immediately west of the regional catchment divide separating Ashburton River catchment from the Fortescue River catchment. The regional Turee Creek Catchment is approximately 7,400 km^2. The upper catchment has a complex drainage pattern characterised by intermittent flow and infrequent wide-spread flooding, depending on the occurrence of high intensity rainfall events.

Turee Creek, an ephemeral tributary of the Ashburton River, represents the most significant named watercourse in the region.

The east branch of Turee Creek (Turee Creek East) is an ephemeral watercourse which flows depending on the occurrence of high intensity rainfall events, typical of Pilbara watercourses. Turee Creek East flows generally westward across the West Angelas Project, continuing west south-westerly through Karijini National Park , before merging with Turee Creek (Turee Creek merges with the Hardey River, which flows into the Ashburton River). Immediately upstream of the confluence with Turee Creek, Turee Creek East has a catchment area of approximately 2,050 km^2.

West Angelas has historically been considered a water neutral site; whereby operational water demand is roughly equivalent to dewatering requirements. As below water table resources are developed, dewatering volumes are expected to exceed operational water demand. Dewatering water is used onsite in the first instance to supply water to meet operational water demand. Any surplus dewatering water, exceeding the operational requirement is discharged into a local ephemeral tributary of Turee Creek East.

The cumulative balance of surplus dewatering water from Deposits B, C and D requiring management is up to approximately 12 GL/a. Based on discharge of up to 12 GL/a, the maximum surface discharge extent is modelled to extend up to 22 km (as measured along the creek channel/s). Figure 1-4 presents the modelled extent of surface water discharge. The surface discharge extent will not extend as far as Karijini National Park.

The banks of Turee Creek East are fringed by scattered trees and shrubs (mostly *Acacia* spp. with a few patchily distributed *E. victrix* trees).

An extensive baseline riparian vegetation monitoring program was established in 2011. Vegetation community structure, species diversity, cover and abundance have been monitored annually at 48 permanent quadrats across eight transect test sites. This EMP proposes a more targeted monitoring program with riparian monitoring only being undertaken at sites within the actual surface discharge extent within the relevant reporting period (and control sites to contextualise any trends).

The structure, cover and health of both native and introduced species within the surface discharge extent will be recorded during riparian vegetation monitoring surveys.

Discharge is expected to result in inevitable changes to the structure, cover and health riparian vegetation within the surface discharge extent including the following:

- changes in riparian vegetation community structure;
- changes in the health of the dominant riparian tree species *E. victrix* and *E. camaldulensis* (if present), which may include:
    - declining health (decreasing biomass / abundance and / or cover) or death of species susceptible to waterlogging stress (*E. victrix*); and
    - increasing biomass / abundance and / or cover or artificial recruitment of species tolerant to waterlogging (*E. camaldulensis*).

- establishment or increasing biomass / abundance and / or cover of other species which are tolerant to waterlogging (particularly sedges and rushes); and
- enhanced potential for weed ingress / proliferation.

It is expected that species which are currently present but not yet detected in baseline surveys, due to low abundance and / or cover, are likely to be detected during future surveys as their abundance and / or cover increases commensurate to water availability.

Vegetation cover in areas downstream of the surface discharge extent may also increase due to a larger upstream source of seed, which is mobilised during rainfall-induced flow events, though it is unknown whether the recruitment in ephemeral reaches are driven by seed supply or water availability.

Despite the expected changes the structure, cover and health of riparian vegetation communities (both native and introduced species) within the extent of surface water discharge, the health of the riparian vegetation can be maintained by monitoring the relationship between native and introduced taxa. Increased cover of introduced species as a result of perennial hydrologic regime is likely to be mirrored by native species, and hence seedbank for recruitment will be maintained, minimising the risk of future loss of native vegetation at the cessation of discharge. Accordingly, trends in the presence of native species throughout the surface discharge extent shall be analysed in parallel to the presence of introduced species, to detect any threats which weeds may pose to native vegetation. The presence of introduced species will be monitored in isolation as an early warning indicator, though the threshold criteria take into account the balance of all species, to ensure that the increased productivity as a result of perennial water supply is not misinterpreted as a negative impact to the health of riparian vegetation.

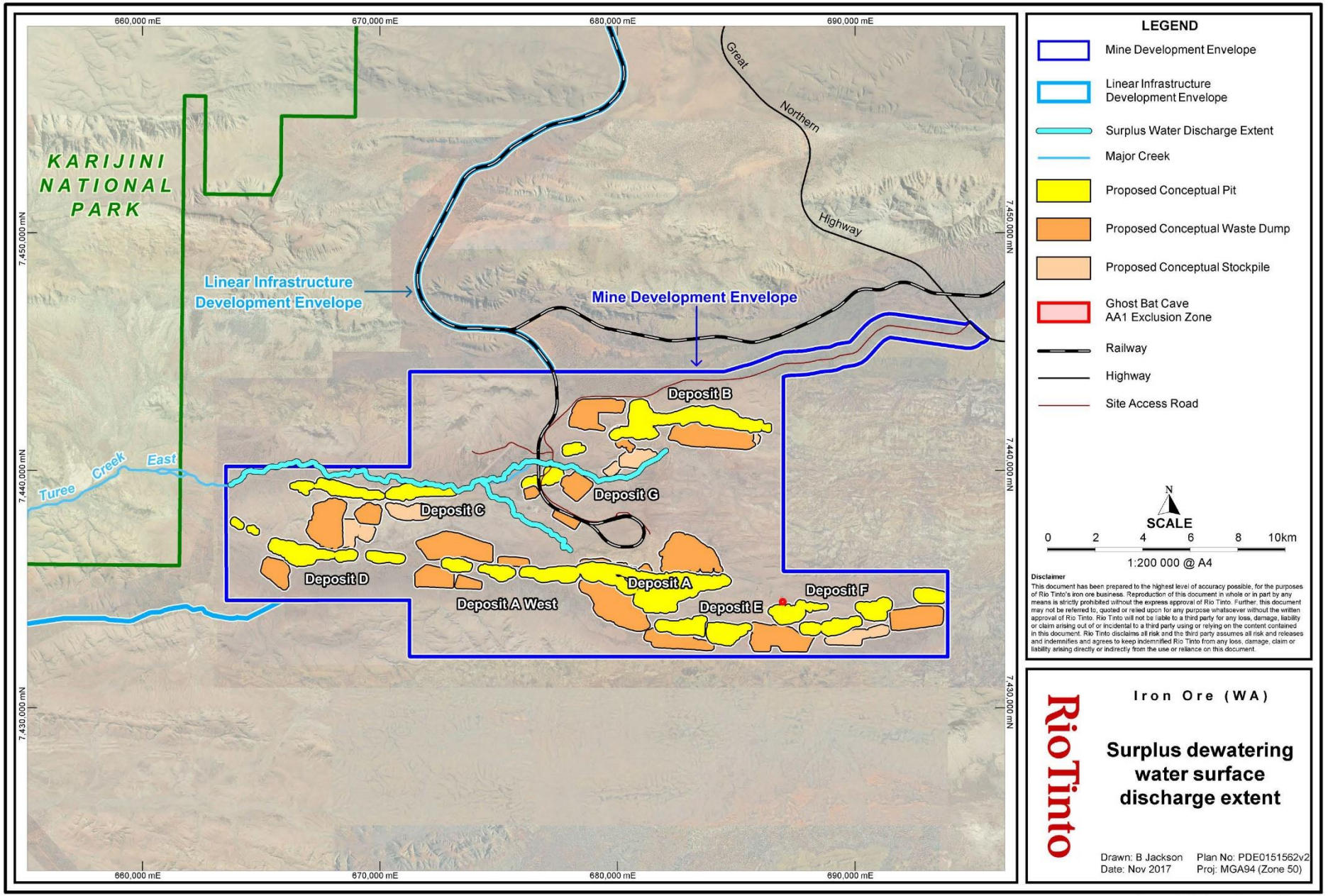

Figure 1-4: Surplus dewatering water surface discharge extent

c) Flora and Vegetation

Several ecosystems are considered locally significant in relation to the West Angelas Project, including:

- The Priority 1 West Angelas Cracking Clay Priority Ecological Community (PEC) occurs extensively within the West Angelas region with approximately 440 ha of this community mapped. Figure 1-5 depicts the extent of mapped PECs within the West Angelas Mine Development Envelope.

  These communities are considered significant because they are relatively uncommon in the Pilbara and because they are in very good condition, attributed to the absence of historic cattle grazing. This community is defined as 'open tussock grasslands of *Astrebla pectinata*, *A*. *elymoides*, *Aristida latifolia* in combination with *Astrebla squarrosa* and low scattered shrubs of *Sida fibulifera*, on basalt derived cracking-clay loam depressions and flowlines'.

  One representation of the PEC (mapped as PEC-2015-5) located within the Development Envelope is considered to be a particularly good representation of the community and thought to be one of the largest representations in the West Angelas region (approximately 230 ha; although similar sized representations may be present elsewhere in the Pilbara). Based on this, formal protection via MS XXXX has been afforded to this mapped representation. Significant proportions of the remainder of the community are considered to be representations of 'other' less significant grassland communities. These 'other' representations are either more marginal or consist of substantial areas of mosaic-type clay flat community assemblages interspersed with sections of cracking clays and, in some areas, contain species slightly different to those listed in the PEC description (including *A. elymoides*, with absence of *A. squarrosa*). Approximately 15.5 ha of an 'other' representation of the PEC overlies Deposit D, therefore, avoidance is not possible. A further 4.5 ha of the PEC may be potentially indirectly disturbed.

  Threats to this community include: clearing for mining; changes in hydrological regimes; changes in fire regimes and weed invasion.

- Communities which are characterised by mulga species are common in the West Angelas region. Only groved Mulga communities are considered significant, deemed to be an '*ecosystem at risk*' (Kendrick 2003).

  The formation of a mosaic pattern of mulga groves with relatively bare areas in between (intergroves) and the retention of mulga groves is directly dependent upon patterns of surface water (sheet) flows. Groved mulga communities are susceptible to shadowing effects when sheet flow is disrupted or water logging effects when sheet flow is concentrated within the landscape.

  These communities occur relatively extensively throughout the Hamersley Ranges however, groved mulga communities in the West Angelas region are in very good condition, attributed to the absence of historic cattle grazing.

  Threats to groved Mulga communities include: clearing for mining; changes in fire regimes; grazing and trampling; and weed ingress, particularly by Ruby Dock. These communities are also sensitive to changes to the hydrological regime.

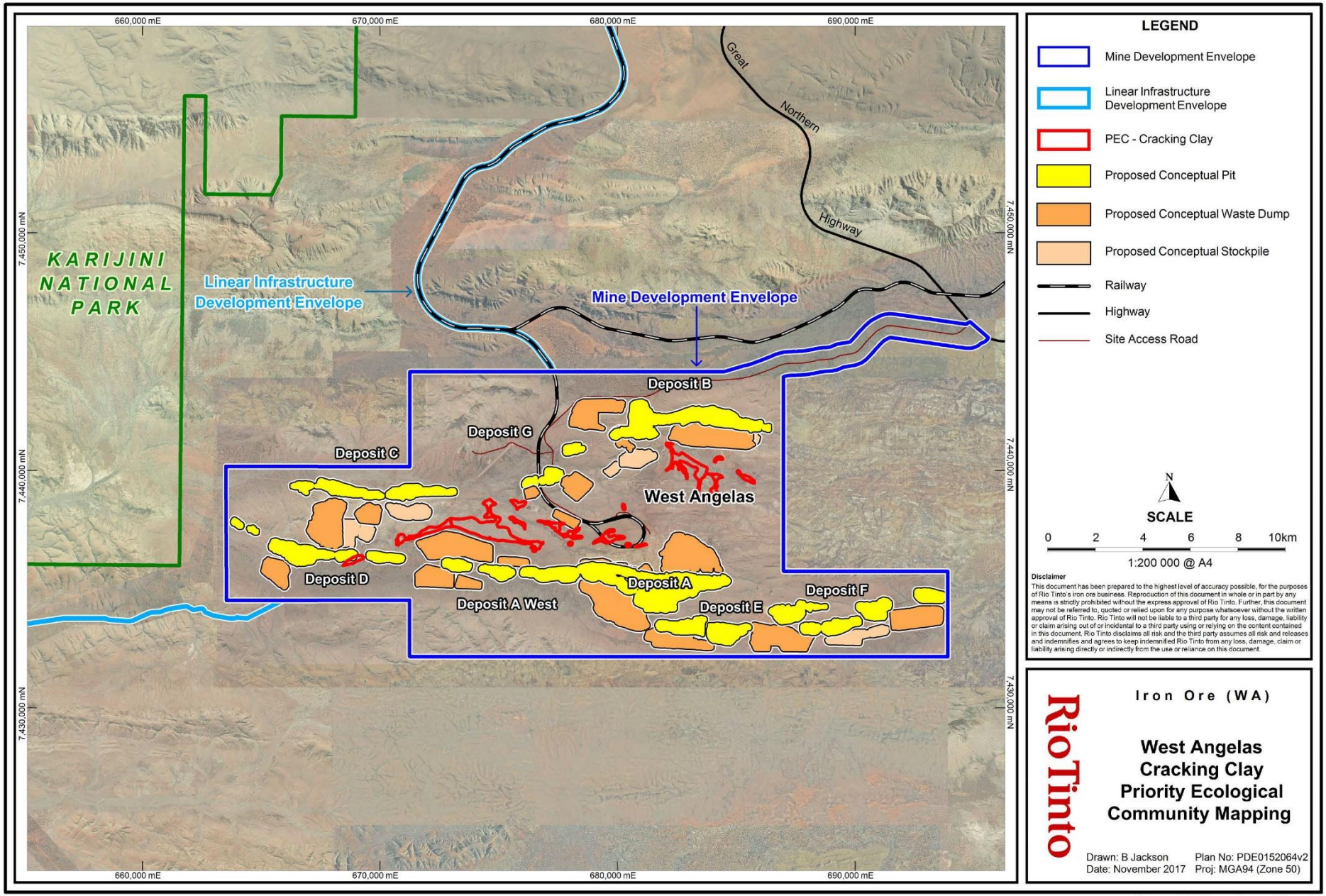

Figure 1-5: West Angelas Cracking Clay Priority Ecological Community mapping

d) Terrestrial Fauna

West Angelas is acknowledged to support diverse fauna for its size due to the great diversity of habitats it provides.

A total of nine broad-scale habitats have been identified within the West Angelas area: 'footslope or plain'; 'hilltop, hillslope; ridge or cliff'; 'mixed Acacia woodland'; 'mulga woodland'; 'mesa top'; 'cracking clay'; 'major gorge and gully'; 'major drainage'; and 'cleared area'. Most of these habitats are considered to be of low conservation significance, representing units that are relatively common in the region. However, the 'mulga woodland' and 'cracking clay' habitats are considered to be of moderate conservation significance.

In addition to these habitats of elevated conservation significance, caves that are utilised by ghost bats for roosting or foraging represent significant habitat features.

Ghost bats are known to require a number of suitable caves throughout their home ranges (i.e. night / feeding roosts for feeding throughout the duration of the night, day roosts for resting and maternity roosts). The presence of day roosts and / or maternity roosts in an area is considered the most important indicator of habitat for ghost bats, and these caves are generally the primary focus of conservation and / or monitoring (Department of Environment 2015 in Biologic 2016).

The first sightings of ghost bats in the West Angelas region were documented in 1978 (Integrated Environmental Services 1979). Monitoring surveys were undertaken between 1997 and 2003 and then annually since 2012 (except for 2016).

Ghost bats have been recorded roosting in five caves within from 'gorge and gully' habitat in the West Angelas region; four roosts: Caves A1, A2, L2 and L3 to the north of Deposit B and one cave to the north of Deposit F; Cave AA1 (Figure 1-6). The monitoring surveys identified a pattern of consistent intermittent use of the monitoring caves by Ghost bats:

Cave A1 has consistently shown evidence of recent ghost bat use throughout all surveys and is classified as a day roost. Owing to its high ongoing record of use, the possibility of it being a maternity roost is difficult to rule out; therefore it is considered of moderate to high importance to the Ghost Bat population.

Cave A2 has shown evidence of recent ghost bat use during three out of four years of monitoring (no evidence of Ghost Bat use recorded during the 2014 survey however, scats were recorded during the 2015 survey) and is a feeding / night roost. Despite its relatively frequent use, this cave's relatively open, shallow structure would limit its use as a day roost or maternity roost, therefore it is considered of moderate importance to the local ghost bat population.

Cave L2 has only shown reliable evidence of recent ghost bat use once (scats recorded in 1998) and potential evidence of a Ghost Bat call in 2015 and is classified as a feeding / night roost. This cave's collapsed entrance and relatively open, shallow structure would limit its use as a day roost or maternity roost, therefore it is considered only of low to moderate importance to the local Ghost Bat population.

Cave L3 has shown evidence of recent Ghost Bat use during all surveys except for 2014 (no evidence of Ghost Bat use recorded during the 2014 survey however, scats were recorded during the 2015 survey) and is classified as a potential day roost. Owing to its relatively frequent use and the larger size and structure of this cave (particularly the presence of deeper rear passages), it is also difficult to rule out the cave's potential as a maternity roost, therefore it is considered to be of moderate to high importance to the local Ghost Bat population.

Cave AA1 has shown evidence of recent Ghost Bat use or presence throughout all surveys and is considered to have the highest conservation value of all the caves in the West Angelas region because it is a suspected maternity roost (Biologic 2016), in 1997/98 a

female was captured that was considered to be pregnant. Maternity roosts are uncommon with only eleven recorded in the Pilbara bioregion and therefore, Cave AA1 is also considered to have regional significance. A 100m exclusion zone has been, and will continue to be, maintained, preventing direct or indirect disturbance to Cave AA1.

Foraging habitat favoured by the Ghost Bat is diverse. This carnivorous predator typically requires a relatively large foraging area (usually containing riparian vegetation), within 2 km of day roosts for hunting of small mammals, birds, reptiles and insects that are common and widespread in the Pilbara.

Recognised threats to the Ghost Bat include loss of roosting and foraging habitat, either directly (removal of roosts or vegetation during clearing) or indirectly as a result of mining (noise and / or vibrations resulting in damage to roosts or abandonment, and degradation of foraging habitat from dust deposition or weed incursion).

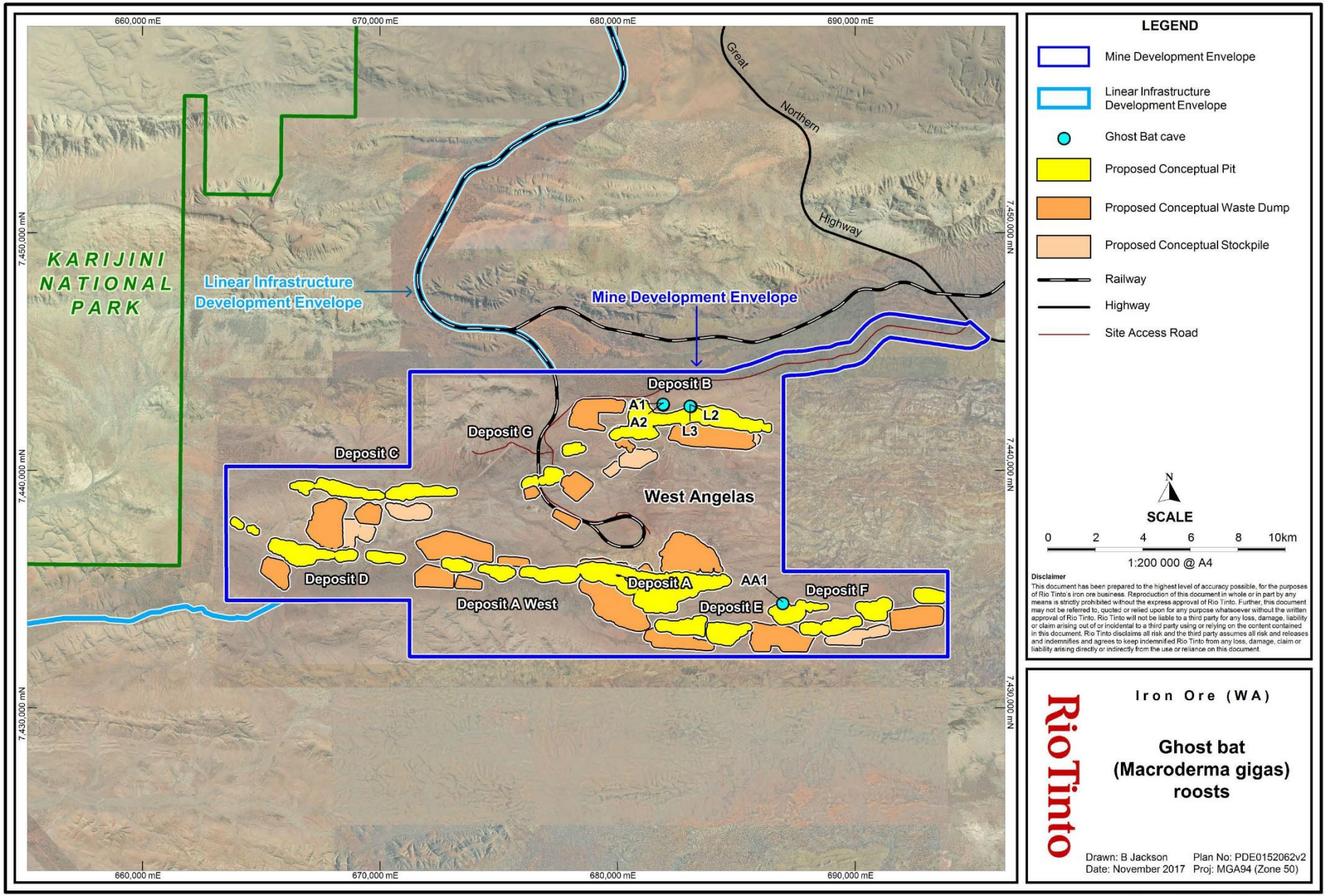

Figure 1-6: Ghost Bat (*Macroderma gigas*) roosts

1.4.2 Key Assumptions and Uncertainties

The key assumptions relating to this EMP are:

- Turee Creek East and its tributaries are ephemeral and thus dry for most of the year. Based on modelling, it is predicted that permanent surface water flows from discharge of surplus water (assuming no natural flows at time of discharge) may reach within 2 km of the boundary of Karijini National Park (as measured along the creek channel/s).
- Prolonged / permanent inundation of ephemeral creeks as a result of discharge is expected to result in inevitable changes to riparian vegetation community structure, the health of the dominant riparian tree species *E. victrix* and *E. camaldulensis* and establishment or increasing abundance of other species which are tolerant to waterlogging.

  Riparian ecosystems are characterised by the presence of phreatophytic species. Three common Pilbara species are known to be phreatophytic: *M. argentea* (obligate phreatophyte)*, E. camaldulensis* (facultative phreatophyte) and *E. victrix* (facultative phreatophyte or vadophyte).

  Riparian vegetation along Turee Creek East supports two of these species: *E. victrix* and potentially *E. camaldulensis*. *M. argentea* is not present along Turee Creek East.

  M. argentea, which most often occurs in permanently inundated pools and springs, are adapted to a perennial hydrologic regime. *E. victrix* and *E. camaldulensis* are adapted to an ephemeral hydrologic regime. Trees are subjected to flooding following high intensity rainfall events and then potentially waterlogging for several months afterwards. These eucalypt species are also able to tolerate extended periods of draught.

  These characteristics influence the patterning and abundance of these species within the creek system and also their response to impacts such as dewatering and discharge. For example, dewatering may have a significant impact on the health of *M. argentea* but not at all on *E. victrix* or *E. camaldulensis*. Discharge creates a perennial hydrologic regime which may favour *M. argentea*, resulting in increased recruitment but may have a significant impact on the health of *E. victrix* and *E. camaldulensis*.

  Given the absence of *M. argentea* Turee Creek East, *E. victrix* and *E. camaldulensis* will be treated as a functional group for detecting impact to riparian trees.

  After cessation of discharge, riparian vegetation is expected to gradually revert to a pre-impact condition (e.g. structural composition, functional behaviour, habitat elements and recruitment dynamics).
- Baseline weed surveys will provide a representative weed species inventory as well as collect abundance and distribution data.
- Weed distribution and abundance in the Pilbara fluctuates considerably depending on seasonal conditions. The Proponent assumes that the seasonal conditions during the baseline weed survey will be typical, where rainfall is sufficient to trigger weed germination and growth. However, a level of uncertainty exists when comparing monitoring results to baseline i.e. determining whether changes in weed distribution and abundance may be due to seasonal variances rather than attributable to the West Angelas Project or effectiveness of control actions.
- Due to the presence of dormant seeds, weeds are expected to persist over a number of years irrespective of control actions.

- A 100 m exclusion zone around Cave AA1 and controlled blasting and vibration monitoring will be undertaken for blasts located within 300 meters all Ghost Bat roosting habitats will protect the roosting habitat for this species.
- Protection of roosting habitat for species of conservation significance will enable the persistence of these species.

1.4.3 Management Approach

This EMP has been developed to address the key environmental factors (and relevant EPA environmental objective) of Hydrological Processes, Flora and Vegetation, and Terrestrial Fauna and the specific outcomes stated in condition 6, 7 and 8 of MS xxxx.

Weeds within the West Angelas Development Envelopes are managed through a comprehensive annual weed control program, completed between April and October. Weed control measures include the use of both selective and non-selective herbicides. In some cases, physical removal of weeds is undertaken where appropriate.

This EMP includes the trigger and threshold criteria and associated management contingency actions that the Proponent will undertake if the environmental outcomes are exceeded.

1.4.4 Rationale for choice of provisions

Environmental criteria have been developed based on consideration of:

- threatening processes and risks associated with each environmental factor
- the availability of suitable monitoring methods; and
- relevance to the condition environmental outcomes sought for each environmental factor.

The specific trigger and threshold criteria and actions defined in Table 2-1 have been chosen as they provide a basis for detecting and avoiding or otherwise managing potential impacts, such that the condition environmental outcomes stated in conditions 6, 7 and 8 of MS xxxx can be achieved.

The potential for the trigger criteria to be detected due to natural variability in vegetation communities must be accounted for in the management response. Therefore, exceedance of the trigger criteria will not be treated as a non-compliance to the condition environmental objectives.

The potential for the threshold criteria to be detected due to natural variability in vegetation communities must also be accounted for in the management response.

Exceedance of the threshold criteria will be treated as a non-compliance of the West Angelas Project to the environmental objective if the exceedance is attributable to the West Angelas Project.

2. EMP PROVISIONS

This section of the EMP identifies the legal provisions that the Proponent will implement to ensure that the environmental outcomes of conditions 6, 7 and 8 are met during implementation of the West Angelas project.

It identifies the environmental criteria that will be used to measure performance and monitoring that will be undertaken in relation to these environmental criteria. Finally, it defines the response actions (trigger level and contingency actions) that will be undertaken if the environmental criteria are exceeded. Table 2-1 details the provisions of this EMP.

2.1 Outcomes

- No irreversible impact to potentially groundwater dependant vegetation within Karijini National Park.
- No irreversible impact to the health of riparian vegetation of Turee Creek East.
- No disturbance to the West Angelas Cracking Clay PEC (mapped representation PEC-2015-5).
- Minimise disturbance to other mapped representations of the West Angelas Cracking Clay PEC.
- No disturbance to the Ghost Bat roost (Cave AA1).
- Minimise disturbance to other Ghost Bat roosts (Caves A1, A2, L2 and L3).

2.2 Performance Indicators (Environmental Criteria)

Two levels of criteria, which vary in function, have been developed for this EMP.

2.2.1 Trigger Level Criteria

Trigger criteria measures are set at a conservative level to ensure management actions are implemented well in advance of the environmental objective being compromised. Thus, trigger criteria are set at a level below the threshold criteria to signal the need to focus and investigate and where applicable, mitigate the impact further or increase the level of protection or rehabilitation.

Potential GDE within Karijini National Park:

1. The mean vegetation index for the upper canopy (*E. vitrix / E. camuldulensis*) declines >2SD from baseline.

Surface water discharge and riparian vegetation:

2. Surface water discharge reaches within 2 km from the boundary of Karijini National Park (as measured along the creek channel/s) under natural no-flow conditions.
3. Significant upward trend (25%) in number of introduced species relative to baseline.

West Angelas Cracking Clay PEC:

4. Disturbance (direct or indirect) within 100 m of West Angelas Cracking Clay Priority Ecological Community (mapped representation PEC-2015-5).
5. Disturbance to other representations of West Angelas Cracking Clay PEC exceeds 15.5 ha.

Ghost Bat:

6. Disturbance is within 150 m of Ghost Bat roost (Cave AA1).

7. Vibration levels exceed 40 mm/s peak particle velocity (Cave AA1) or 75 mm/s peak particle velocity (Caves A1, A2, L2 and L3).

2.2.2 Threshold Level Criteria

Threshold criteria measures are framed to measure achievement of the environmental objective. A failure to meet the threshold criterion, if deemed attributable to the implementation of the West Angelas Project, signals that the environmental objective is not being met.

Potential GDE within Karijini National Park:

1. The mean vegetation index for the upper canopy (*E. vitrix / E. camaldulensis*) declines >2SD from baseline over two consecutive monitoring events.

Surface water discharge and riparian vegetation:

2. Surface water discharge reaches the boundary of Karijini National Park under natural no flow conditions.
3. Significant upward trend (40%) in number of introduced species with a notable decline (40%) in native species richness compared to baseline.

West Angelas Cracking Clay PEC:

4. Disturbance (direct or indirect) within West Angelas Cracking Clay PEC (mapped representation PEC-2015-5).
5. Disturbance to other representations of West Angelas Cracking Clay PEC exceeds 20 ha.

Ghost Bat:

6. Disturbance within 100 m of Ghost Bat roost (Cave AA1).
7. Significant damage to Ghost Bat roosts (Caves AA1, A1, A2, L2 and L3).
8. Permanent Ghost Bat abandonment of caves.

2.3 Response Actions

The Proponent has developed a number of trigger level actions that would be implemented if the associated trigger criterion signals the need to increase mitigation or protection (Table 2-1). These trigger level actions will be implemented by the Proponent to mitigate and manage impacts so they once again will meet trigger and safeguard the threshold criteria.

The Proponent has developed a number of threshold contingency actions that would be implemented if the associated threshold criterion signals that the environmental outcome is exceeded (Table 2-1). The threshold contingency actions will be implemented to manage aspects of the proposal and achieve the condition environmental outcome and manage the impact to below threshold and trigger criteria again and hence bring the Proponent back into compliance.

2.4 Monitoring

The purpose of monitoring is to inform, through the environmental criteria, if the conditioned environmental outcome is being achieved and when trigger level actions or threshold contingency actions will be implemented.

Monitoring provisions for each environmental factor and how these will determine performance against the environmental criteria are presented in Table 2-1.

Missed monitoring events will not be treated as a non-compliance as long as the Proponent can validate that the required environmental outcome has still be achieved, for example

through the use of alternative data to assess performance against the environmental criteria.

a) Potentially Groundwater Dependent Vegetation Monitoring

Approximately 4.2 ha of the riparian vegetation of Turee Creek East, within Karijini National Park, is co-dominated by *E. victrix* and *E. camaldulensis* at elevated densities and is assumed to represent a potential GDE considered to be at 'medium' risk of impact as a result of groundwater drawdown.

Whilst it's inherently difficult to interpolate the local groundwater table elevation from limited data, and hence to predict the groundwater dependence of local eucalypt assemblages, monitoring the cover and health of the upper canopy may provide an indicator of stress related to groundwater drawdown and reduced water availability.

Digital Multi-Spectral Imagery (DMSI) has been selected as an appropriate monitoring technique, to examine the spectral vegetation index of the upper canopy. Vegetation indices provide a representation of the cover and photosynthetic vigour of vegetation, by assessing the ratio of red and near-infra red radiation wavelengths. Changes to spectral vegetation can provide a meaningful indication of condition and stress.

Prior to groundwater drawdown extending beneath the potential GDE within Karijini National Park, remote sensing will collect DMSI over the area from which a baseline vegetation index will be established.

Changes to the vegetation index of the canopy for both *E. camaldulensis* and *E. victrix* within the potential GDE within Karijini National Park will be monitored over time, concurrently with groundwater elevation observations. A two standard deviation (2SD) change from baseline is the same approach used for other monitoring programs in the East Pilbara.

As detailed in Table 2-1, part of the actions to complete in response to exceeding the trigger criteria will be field-based observations of the community within Karijini National Park.

b) Riparian Vegetation Monitoring

Monitoring of diversity, cover and abundance of both native and introduced species within riparian vegetation of Turee Creek East has been undertaken annually since 2011.

The condition, cover and health of riparian vegetation within the observed surface water discharge extent shall continue to be monitored annually by qualitative in-field assessment.

Whilst it's predicted that increased water availability may increase the biomass / abundance and / or cover of other species which are tolerant to waterlogging (including weeds) within the surface discharge extent, the triggers have been selected to ensure that during times of discharge, weed coverage does not cause a reduction of native species diversity or cover. It's also noted that once discharge ceases, the trigger would effectively ensure that the ratio of native and introduced species coverage is maintained, which aligns with the environmental outcome of condition 6.

c) West Angelas Cracking Clay PEC Monitoring:

Annual land clearing reconciliation shall be compared against West Angelas Cracking Clay PEC mapping.

d) Blast Vibration Prediction and Monitoring:

Blast vibration shall be predicted using a 'scaled distance' blast vibration model for every blast within 300m of Caves AA1, A1, A2, L2 and L3. Blasts shall not proceed where predicted blast vibration exceeds criteria to ensure that the caves are protected from significant damage.

Blast vibration monitoring shall be implemented for all blasts within 300m of Caves AA1, A1, A2, L2 and L3 to confirm blast vibration predictions are met, to ensure that blast vibration does not exceed criteria and that the caves are protected from significant damage.

A set of photographs shall be prepared as reference for damage assessment. Quarterly visual inspection shall identify any significant damage (change from reference). Additional visual inspection shall be required where blast vibration levels exceed criteria.

e) Ghost Bat Presence / Absence Monitoring:

Monitoring of Ghost Bat presence / absence within Caves AA1, A1, A2, L2 and L3 has been undertaken annually since 2012.

The use of a monitoring cave by Ghost Bats shall continue to be confirmed annually by a visual sighting and / or the presence of scats and / or middens. The Ghost Bat is distinctive in being very much larger than any other cave dwelling bat in the region, and is easily identified. Scats and middens are also distinctive for this species.

Sheets of black cotton shall be placed on scat piles or middens and shall be searched for fresh scat material. Presence of scats or middens on the sheets indicates use of the caves by Ghost Bats over a known time period, and enables acquisition of scat samples should further studies be undertaken (e.g. pregnancy detection and dietary analysis).

Categorisation of each of the monitoring caves shall be reassessed based on the results of the most recent survey, and where appropriate shall be re-categorised using the following definitions:

- Feeding Cave / Night Roost – no individuals, only a small number of scats observed.
- Feeding Cave / Possible Day Roost – no individuals, large scat piles observed.
- Day Roost – individuals are or have been observed within a cave during the day. The cave can be visually inspected for the presence of juveniles, no juveniles are observed.
- Day Roost / Possible Maternity Roost – individuals are observed within a cave during the day but flush or hide before a full inspection of individuals possibly carrying juveniles can be made.
- Maternity Roost – juveniles are observed attached to females within a cave. (Note that all maternity roosts are day roosts, but not all day roosts are maternity roosts).

The use of a monitoring cave by Ghost Bats can also be confirmed by remote detection. Ultrasonic bat detectors, recording continuously, shall be placed in the entrance of all monitoring caves. Ultrasonic bat detectors contain omnidirectional microphones and record calls (including inaudible calls, which are often made by Ghost Bats when exiting caves, thus providing an additional method of detecting this species) in high quality audio formats. Digital cameras, taking photos at 30 minute intervals, shall also be placed at locations with scat piles, facing towards the roof to visually detect Ghost Bats returning to roosts.

Table 2-1: West Angelas EMP Provisions

EPA objectives:

- To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.
- To maintain representation, diversity, viability and ecological function at the species, population and community level.

Outcomes:

- No irreversible impact to potentially groundwater dependent vegetation within Karijini National Park.
- No irreversible impact to the health of riparian vegetation of Turee Creek East.
- No disturbance (direct or indirect) to the West Angelas Cracking Clay Priority Ecological Community (mapped representation PEC-2015-5).
- Minimise disturbance (direct or indirect) to other representations of the West Angelas Cracking Clay Priority Ecological Community.
- No disturbance (direct or indirect) to the Ghost Bat roost (Cave AA1).
- Minimise disturbance (direct or indirect) to other Ghost Bat roosts (Caves A1, A2, L2 and L3).
- Avoid the use of barbed wire in the Proposal area, except where there is a statutory requirement to do so, to minimise the impact of barbed wire on Ghost Bats.

Key environmental values: Karijini National Park, Turee Creek East, West Angelas Cracking Clay PEC, riparian vegetation, Ghost Bats.

Key impacts and risks: potential adverse impacts on riparian vegetation, conservation significant vegetation and conservation significant fauna species as a result of clearing, dewatering, surface water discharge, and blasting and loss of habitat.

Environmental criteria	Response Actions	Monitoring	Reporting
Hydrological Processes – Potential GDE within Karijini National Park			
Trigger criterion: 1. The mean vegetation index for the upper canopy (*E. victrix / E. camaldulensis*) declines >2SD from baseline.	• Review reference sites data to ascertain if change has also occurred at reference sites. • Review degree of exposure of impacted sites relative to dewatering via review of: site specific observations; dewatering volumes and extent; hydrogeological model and other natural factors (i.e. seasonal rainfall data) to determine if attributable to implementation of the project. • Complete in-field inspection of the area.	Annual assessment of vegetation condition using DMSI at established monitoring regions containing *E. victrix* and *E. camaldulensis* within Karijini National Park along with suitable reference site/s (Figure 1-3).	• The environmental outcome will be reported against the trigger criteria for each calendar year by 30 April in the ACAR for MS xxxx. • If trigger criterion was exceeded during the reporting period, the ACAR will include a description of the effectiveness of trigger level.

Environmental criteria	Response Actions	Monitoring	Reporting
Threshold criterion: 1. The mean vegetation index for the upper canopy (*E. victrix / E. camaldulensis*) declines >2SD from baseline over two consecutive monitoring events.	As for trigger criteria with addition of the following: • Notify the OEPA within 7 days of that non-compliance being known. • Within 21 days of confirmation of this threshold criteria being exceeded, provide a report to the OEPA in accordance with Ministerial Condition. If threshold criteria exceedance is considered likely to be due to discharge, report to include proposed remedial action/s identified during trigger investigations. • Implement remedial action/s (e.g. local recirculation of groundwater and/ or aquifer reinjection), as agreed with the OEPA. • Submit a report to the OEPA within 12 months after the notification, detailing the: o Effectiveness of contingency actions implemented. o Analysis of trends. o Schedule for ongoing reporting.	• Annual assessment of vegetation condition using DMSI at established monitoring regions containing *E. victrix* and *E. camaldulensis* within Karijini National Park along with suitable reference site/s (Figure 1-3). • Assessment of condition and cover of understorey flora. • Quarterly groundwater levels, physiochemical and hydrochemical parameters.	• Notify the OPEA within 7 days of that non-compliance being known with a report provided within 21 days. • The environmental outcome will be reported against the threshold criterion for each calendar year in the ACAR. The ACAR will include a description of the effectiveness of threshold contingency actions that have been implemented to manage the potential impact, as well as a summary of analysis of trends.

Environmental criteria	Response Actions	Monitoring	Reporting
Surface water discharge – riparian vegetation			

Trigger criterion:
1. Surface water discharge reaches within 2 km of the boundary of Karijini National Park (as measured along the creek channel/s) under natural no-flow conditions.
2. Significant upward trend (25%) in number of introduced species relative to baseline.
	• Review correlative environmental parameters, including discharge volumes and extent; hydrological model; and other natural factors (i.e. seasonal rainfall data etc.) to determine if permanent surface water flow beyond 2 km of the boundary of Karijini National Park / significant upward trend in number of introduced species is attributable to implementation of the project.
	• If other causal environmental factors for permanent surface water flow beyond 2 km of the boundary of Karijini National Park / significant upward trend in number of introduced species (other than discharge) cannot be identified:
	  • undertake expanded on-ground assessment (if appropriate, expand the extent and frequency of permanent surface water flow monitoring, expand the extent of riparian vegetation monitoring to include reference sites).
	  • investigate potential remediation strategies (e.g. modified surplus water management strategy, discharge regime or alternative discharge location, weed control).
		• Monthly permanent surface water flow at established monitoring point along the proposed surface water discharge extent (Figure 1-4).
		• Annual condition, cover and health of riparian vegetation within the observed (or predicted) surface water discharge extent (Figure 1-4).
			• The environmental outcome will be reported against the trigger criteria for each calendar year by 30 April in the ACAR for MS xxxx.
			• If trigger criterion was exceeded during the reporting period, the ACAR will include a description of the effectiveness of trigger level.

Threshold criterion: 1. Surface water discharge reaches the boundary of Karijini National Park under natural no-flow conditions. 2. Significant upward trend (40%) in number of introduced species with a notable decline (40%) in	As for trigger criteria with addition of the following: • Notify the OEPA within 7 days of that non-compliance being known. • Within 21 days of confirmation of this threshold criteria being exceeded, provide a report to the OEPA in accordance with Ministerial Condition.	• Monthly permanent surface water flow at established monitoring point along the proposed surface water discharge extent (Figure 1-4). • Annual condition, cover and health of riparian vegetation within the observed (or predicted) surface	• Notify the OPEA within 7 days of that non-compliance being known with a report provided within 21 days. • The environmental outcome will be reported against the threshold criterion for each calendar year in the ACAR. The ACAR will include a description

Environmental criteria	Response Actions	Monitoring	Reporting
native species richness compared to baseline.	If threshold criteria exceedance is considered likely to be due to discharge, report to include proposed remedial action/s identified during trigger investigations. • Implement remedial action/s (e.g. modified surplus water management strategy, discharge regime or alternative discharge location, weed control), as agreed with the OEPA. • Submit a report to the OEPA within 12 months after the notification, detailing the: o Effectiveness of contingency actions implemented. o Analysis of trends. o Schedule for ongoing reporting.	water discharge extent (Figure 1-4).	of the effectiveness of threshold contingency actions that have been implemented to manage the potential impact, as well as a summary of analysis of trends.

Environmental criteria	Response Actions	Monitoring	Reporting
Flora and Vegetation - West Angelas Cracking Clay PEC			

Trigger criterion:
1. Disturbance (direct or indirect) within 100 m of West Angelas Cracking Clay PEC (mapped representation PEC-2015-5).
2. Disturbance within other representations of West Angelas Cracking Clay PEC exceeds 15.5 ha.
	• Complete hydrological assessment to determine whether the disturbance will impact surface water drainage to the West Angelas Cracking Clay PEC.
	• Review mine plan to ensure:
	  ○ Disturbance will not occur within West Angelas Cracking Clay PEC (PEC-2015-5); and
	  ○ Disturbance within other representations of West Angelas Cracking Clay PEC will not exceed 20 ha.
	• Investigate potential remediation strategies.
		• Annual land clearing reconciliation against West Angelas Cracking Clay PEC mapping (Figure 1-5).	• The environmental outcome will be reported against the trigger criteria for each calendar year by 30 April in the ACAR for MS xxxx.
			• If trigger criterion was exceeded during the reporting period, the annual report will include a description of the effectiveness of trigger level.

Threshold criterion:
1. Disturbance (direct or indirect) within the West Angelas Cracking Clay PEC (mapped representation PEC-2015-5).
2. Disturbance within other representations of West Angelas Cracking Clay PEC exceeds 20 ha.
	As for trigger criteria with addition of the following:
	• Notify the OEPA within 7 days of that non-compliance being known.
	• Within 21 days of confirmation of this threshold criteria being exceeded, provide a report to the OEPA in accordance with Ministerial Condition.
	If threshold criteria exceedance is considered likely to be due to operations, report to include proposed remedial action/s identified during trigger investigations.
	• Implement remedial action/s, as agreed with the OEPA.
	• Submit a report to the OEPA within 12 months after the notification, detailing the:
	  ○ Effectiveness of contingency actions implemented.
	  ○ Schedule for ongoing reporting.
		• Annual land clearing reconciliation against West Angelas Cracking Clay PEC mapping (Figure 1-5).	• Notify the OPEA within 7 days of that non-compliance being known with a report provided within 21 days.
			• The environmental outcome will be reported against the threshold criterion for each calendar year in the ACAR. If the threshold criterion was exceeded during the reporting period, the ACAR will include a description of the effectiveness of threshold contingency actions that have been implemented to manage the potential impact, as well as a summary of analysis of trends.

Environmental criteria	Response Actions	Monitoring	Reporting
Terrestrial fauna – Ghost Bat			
Trigger criterion: 1. Disturbance within 150 m of Ghost Bat roost (Cave AA1). 2. Vibration levels exceed 40mm/s peak particle velocity (Cave AA1) or 75mm/s peak particle velocity (Caves A1, A2, L2 and L3).	• Complete in-field inspection of the area. • Review site specific observations; clearing extent; blast vibration predictions / blast vibration monitoring levels; and other natural factors (i.e. seasonal rainfall data etc.) to determine if disturbance / significant damage is attributable to implementation of the project. • If other causal environmental factors for disturbance / significant damage cannot be identified, undertake expanded on-ground assessment (if appropriate, expand the frequency of monitoring). • Investigate potential remediation strategies (such as modified blast management strategy).	• Annual land clearing reconciliation against Ghost Bat roost, Cave AA1 Exclusion Zone (Figure 1-6). • Blast vibration monitoring for all blasts within 300m of Caves AA1, A1, A2, L2 and L3 (Figure 1-6). • Quarterly visual inspection where blast vibration levels exceed criteria. • Annual assessment of presence / absence of evidence of Ghost Bat use within Caves AA1, A1, A2, L2 and L3 (Figure 1-6).	• The environmental outcome will be reported against the trigger criteria for each calendar year by 30 April in the ACAR for MS xxxx. • If trigger criterion was exceeded during the reporting period, the annual report will include a description of the effectiveness of trigger level.
Threshold criterion: 1. Disturbance within 100 m of Ghost Bat roost (Cave AA1). 2. Significant damage to Ghost Bat roosts (Caves AA1, A1, A2, L2 and L3). 3. Permanent Ghost Bat abandonment of caves.	As for trigger criteria with addition of the following: • Notify the OEPA within 7 days of that non-compliance being known. • Within 21 days of confirmation of this threshold criteria being exceeded, provide a report to the OEPA in accordance with Ministerial Condition. If threshold criteria exceedance is considered likely to be due to operations, report to include proposed remedial action/s identified during trigger investigations. • Implement remedial action/s, as agreed with the OEPA. • Submit a report to the OEPA within 12 months after the notification, detailing the: ○ Effectiveness of contingency actions implemented. ○ Analysis of trends. ○ Schedule for ongoing reporting.	• Annual land clearing reconciliation. • Blast vibration monitoring for all blasts within 300m of Caves AA1, A1, A2, L2 and L3 (Figure 1-6). • Quarterly visual inspection where blast vibration levels exceed criteria. • Annual assessment of presence / absence of evidence of Ghost Bat use within Caves AA1, A1, A2, L2 and L3 (Figure 1-6).	• Notify the OPEA within 7 days of that non-compliance being known with a report provided within 21 days. • The environmental outcome will be reported against the threshold criterion for each calendar year in the ACAR. If the threshold criterion was exceeded during the reporting period, the ACAR will include a description of the effectiveness of threshold contingency actions that have been implemented to manage the potential impact, as well as a summary of analysis of trends.

2.5 Reporting

The environmental outcome will be reported against trigger and threshold criteria (Table 2-2) for each calendar year in the Annual Compliance Assessment Report (ACAR) for the West Angelas Project against MS xxxx.

The annual report will also include a summary of analysis of monitoring data to facilitate adaptive management.

In the event that trigger and threshold criteria are exceeded during the reporting period, the annual report will include a description of the effectiveness of any management contingency actions that have been implemented to manage the impact.

Table 2-2: West Angelas Environmental Management Plan Reporting Table

Key environmental factor: Conservation significant vegetation, riparian vegetation and conservation significant terrestrial fauna	
Condition environmental outcome, trigger and threshold criteria as per MS xxxx	**Reporting periods 1 January-31 December**
Trigger criteria:	**Status report:** Environmental outcome achieved Environmental outcome not achieved
1. The mean vegetation index for the upper canopy *(E. victrix / E. camaldulensis*) declines >2SD from baseline.	
2. Surface water discharge reaches within 2 km from the boundary of Karijini National Park (as measured along the creek channel/s) under natural no-flow conditions.	
3. Significant upward trend (25%) in number of introduced species relative to baseline.	
4. Disturbance (direct or indirect) within 100 m of West Angelas Cracking Clay Priority Ecological Community (mapped representation PEC-2015-5).	
5. Disturbance (direct or indirect) to other representations of West Angelas Cracking Clay PEC exceeds 15.5 ha.	
6. Disturbance within 150 m of Ghost Bat roost (Cave AA1).	
7. Vibration levels exceed 25mm/s peak particle velocity (Cave AA1) or 50mm/s peak particle velocity (Caves A1, A2, L2 and L3).	
Threshold criteria:	**Status report:** Environmental outcome achieved Environmental outcome not achieved
1. The mean vegetation index for the upper canopy (E. victrix / E. camaldulensis) declines >2SD from baseline over two consecutive monitoring events.	
2. Surface water discharge reaches the boundary of Karijini National Park under natural no-flow conditions.	
3. Significant upward trend (40%) in number of introduced species with a notable decline (40%) in native species richness compared to baseline.	
4. Disturbance (direct or indirect) within the West Angelas Cracking Clay PEC (mapped representation PEC-2015-5).	
5. Disturbance (direct or indirect) to other representations of West Angelas Cracking Clay PEC exceeds 20 ha.	
6. Disturbance within 100 m of Ghost Bat roost (Cave AA1).	
7. Significant damage to Ghost Bat roosts (Caves AA1, A1, A2, L2 and L3).	
8. Permanent Ghost Bat abandonment of caves.	

3. ADAPTIVE MANAGEMENT AND REVIEW OF THIS EMP

The Proponent will implement adaptive management to learn from the implementation of mitigation measures, monitoring and evaluation against trigger and threshold criteria, to more effectively meet the conditioned environmental outcome.

The following approach will apply:

- Monitoring data will be systematically evaluated and compared to baseline and reference site data on a regular basis in a process of adaptive management to verify whether riparian vegetation responses to the impact are the same or similar to predictions.
- The effectiveness and relevance of trigger level and threshold contingency actions will be evaluated on an annual basis to determine if any changes to management actions are required.
- Increased understanding of the hydrological and ecohydrological regimes based on additional internal and external studies will be incorporated into the monitoring and management approach when newer relevant information becomes available and where applicable.

This EMP will also be reviewed annually to ensure it is consistent with and informed by existing strategies and licences, including (but not limited to) the following:

- Licence L7774/2000, issued under Part V of the EP Act for processing of ore, dewatering (discharge), screening, power generation, sewage facility, landfill and bulk storage of chemicals;
- Groundwater Licence GWL98740, issued under the RiWI Act for abstraction of 5,380,000 kL from the mine for dewatering and water supply purposes;
- Groundwater Licence GWL103136, issued under the RiWI Act for abstraction of 3,102,500 kL from the Turee B Borefield for water supply purposes;
- West Angelas Operations Groundwater Operating Strategy; and
- West Angelas Turee B Borefield Groundwater Operating Strategy.

4. STAKEHOLDER CONSULTATION

Consistent with the EPA's expectations for this EMP to align with the principles of EIA, the Proponent consulted with stakeholders, including but not limited to the Department of Park and Wildlife, OEPA, and the Department of Water during the environmental impact assessment of the West Angelas Deposits C, D and G Project (2017) and the information is captured in the supporting Environmental Review Document.

Any additional consultation regarding this EMP will be captured in subsequent revisions.

5. REFERENCES

Biologic Environmental Survey (Biologic) 2016, West Angelas Iron Ore Mine – Deposit B and F Ghost Bat Monitoring 2015, unpublished report prepared for Rio Tinto Iron Ore by Biologic, Perth

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EPA 2015, Environmental Assessment Guideline for Preparation of Management Plans (EAG 17), Environmental Protection Authority, Perth

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