Government of Western Australia
Department of Water and Environmental Regulation

Amendment Notice 2

Licence Number	L8721/2013/1
Licensee	Karara Mining Limited
ACN	070 871 831
File Number:	2012/008499
Premises	Karara Minesite Beneficiation Plant M59/644, M59/645, G59/38 and L59/99 PERENJORI WA 6620
Date of Amendment	08/01/2018

Amendment

The Chief Executive Officer (CEO) of the Department of Water and Environmental Regulation (DWER) has amended the above Licence in accordance with section 59 of the *Environmental Protection Act 1986* as set out in this Amendment Notice. This Amendment Notice constitutes written notice of the amendment in accordance with section 59B(9) of the EP Act.

Date signed: 8 January 2018

Alana Kidd

Manager Licensing – Resource Industries

an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

Definitions and interpretation

Definitions

In this Amendment Notice, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
ACN	Australian Company Number
AHD	Australian Height Datum
ARI	average recurrence interval
BIF	Banded Iron Formation
Category/ Categories/ Cat.	categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
Delegated Officer	an officer under section 20 of the EP Act
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DBCA	Department of Biodiversity, Conservation and Attractions
DER	Department of Environment Regulation As of 1 July 2017, the Department of Environment Regulation (DER), the Office of the Environmental Protection Authority (OEPA) and the Department of Water (DoW) amalgamated to form the Department of Water and Environmental Regulation (DWER).
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environmental Regulation As of 1 July 2017, the Department of Environment Regulation (DER), the Office of the Environmental Protection Authority (OEPA) and the Department of Water (DoW) amalgamated to form the Department of Water and Environmental Regulation (DWER). DWER was established under section 35 of the *Public Sector Management Act 1994* and is responsible for the administration of the *Environmental Protection Act 1986* along with other legislation.
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)
EP (UD) Regulations	*Environmental Protection (Unauthorised Discharges) Regulations*

	2004
HDPE	High Density Polyethylene
KML	Karara Mining Limited
Licensee	Karara Mining Limited
Mm^3	Million cubic metres
Minister	the Minister responsible for the EP Act and associated regulations
MS	Ministerial Statement
mbgl	metres below ground level
Mm^3	million cubic metres
Noise Regulations	*Environmental Protection (Noise) Regulations 1997* (WA)
Prescribed Premises	has the same meaning given to that term under the EP Act.
Premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report.
PEC	Priority Ecological Community
RIWI Act	*Rights in Water and Irrigation Act 1914*
Risk Event	as described in *Guidance Statement: Risk Assessment*
TDS	Total Dissolved Solids
TSF	Tailings Storage Facility

Amendment Notice

This amendment is made pursuant to section 59 of the **EP Act** to amend the Licence issued under the EP Act for a **prescribed premises** as set out below. This notice of amendment is given under section 59B(9) of the EP Act.

This notice is limited only to an amendment relating to **Category** 5 infrastructure and operation. No changes to the aspects of the Licence relating to categories 54 or 64 have been requested by the Licensee.

The following guidance statements have informed the decision made on this amendment:

- *Guidance Statement: Setting Conditions* (October 2015)
- *Guidance Statement: Decision Making* (February 2017)
- *Guidance Statement: Risk Assessment* (February 2017)
- *Guidance Statement: Environmental Siting* (November 2016)

Amendment description

On 10 April 2017, the **Licensee**, Karara Mining Limited (**KML**) submitted an application to the former Department of Environment Regulation (**DER**) for an amendment to the Karara Minesite Beneficiation Plant (Karara Minesite) licence L8721/2013/1 to allow for the construction of Tailings Storage Facility (**TSF**) 2A and TSF 2B within the TSF landform footprint (located as shown below in Figure 1).

On 4 December 2017, KML requested that the amendment application be revised to only include TSF 2A, to ensure consistency with the application Reg. Id 70406 received by the Department of Mines, Industry Regulation and Safety (**DMIRS**) on 25 October 2017. Therefore, this Amendment Notice includes assessment and conditions for construction and operation of TSF 2A only.

Background

The ore processing/beneficiation plant at the Karara Minesite consists of a crushing plant (primary and secondary crushing), screens, magnetic separation, thickeners and filter plants, and a TSF for deposition of wet and dry tailings. The final process product is magnetite concentrate.

Disposal of tailings was originally intended to be via dry-stacked tailings material over a TSF footprint of 450 ha using a radial stacker pattern. However, operational constraints restricted the tailings filtration circuit of the processing plant, resulting in limitations in the total volume of dry tails that the plant can produce.

To alleviate this constraint, a temporary wet tails TSF 1 was constructed within the larger dry TSF landform area for disposal of tailings with a moisture content of more than 20% (Figure 1). Stormwater runoff and seepage from the TSF landform reports to a retention pond, with water reused in the process plant or for dust suppression.

KML proposes to construct an additional wet TSF cell, named TSF 2A, within the TSF landform area. Figure 1 shows the location and general layout of TSF 2A.

The following background information is derived from the Application documents and the report submitted for the original works approval W4615/2009/1,*Geochemical characterisation of process – tailings samples*, Graeme Campbell & Associates Pty, May 2007 (GCA, 2007).

Tailings slurry characteristics

The tailings slurry is thickened at the process plant to between 55% and 60% (w/w) solids. A design value of 55% solids was adopted for the TSF 2A design.

Tailings geochemistry (from GCA, 2007)

KML commissioned Graeme Campbell & Associates Pty Ltd (GCA) in 2007 to conduct geochemical testing on process-tailings samples. Tests for characterisation of acid-base properties were undertaken, comprising acid neutralization capacity; pH buffering; net acid generation and mineralogy assessment. Although pyrrhotite was identified as a "trace-component", the Sulphide-S contents of the samples were less than 0.2%. GCA concluded that net acid generation test results confirm that the tailings sample are non-acid forming with pH results from 7.8 to 8.4, and combined tailings product would therefore also be non-acid forming.

Elemental compositions of the tailings samples were found to contain low levels of leachable salts and were slightly enriched with respect to arsenic and selenium.

GCA concluded that the material did not represent a significant risk of leaching under neutral pH conditions and the tailings were essentially "barren" materials. DWER notes however, the tailings liquors are alkaline and leaching may not necessarily occur at neutral pH.

TSF 2A - embankments

The design is for a single stage embankment with net operational storage capacity of 12 million cubic metres (**Mm^3**) tails material placed as slurry with a solids content of approximately 55 - 65%. This is estimated to provide about 4.3 years of tailings deposition.

The top of the embankment elevations will vary from RL 344.0 to RL 345.25 m **AHD**. The maximum embankment height will be up to 24 m at the deepest section at the east of the facility.

The central core of the embankments will be constructed of compacted dry tailings (permeability 10^{-8} m/s). The TSF foundation is colluvium soil (silty sand) to 1 m soil overlying 5 m of weathered rock, overlying granite rock. A summary of the TSF 2A foundation and embankment material and permeability is shown below (from Wave, 2015).

Material Type	Permeability (m/s)	K_x/K_y
Foundation - Soil	1.0×10^{-7}	1
Foundation - Weathered Rock	1.0×10^{-8}	1
Embankment Fill - Colluvium	1.0×10^{-8}	1
Embankment - Compacted Tailings	3.0×10^{-8}	1
Embankment - Mine Waste	5.0×10^{-4}	1
Hydraulically Deposited Tailings	1.0×10^{-7}	1

Seepage will be directed to a Seepage Collection Sump located on the east side of TSF 2A (see Figure 1 below).

A key trench will be constructed along the footprint of the southern embankment and one third section of the eastern embankment for collection of seepage and on to the Seepage Collection Sump (Figure 2 below).

The northern section and two thirds of the eastern section embankment footprints (total 1.8 km) will be constructed of mine waste (permeability 5.0×10^{-4} m/s) to a thickness of 3.0 m. This zone will function as a drainage layer to allow under seepage to drain towards the downstream side for collection by a toe drain and on to the Seepage Collection Sump (Figure 2).

Under normal operating conditions, the seepage rate is estimated to be less than 5 m^3/day. Maximum seepage (when decant is at maximum operating size) is modelled at 15 m^3/day from the eastern and northern embankments. Seepage analysis indicated low under-seepage volumes from TSF 2A due to:

- the TSF foundation is on weathered rock (low permeability);
- high evaporation (net positive for 7 months of the year);
- the decant pond will be located far from the perimeter; and
- given the decant is operated such that low pond levels are maintained.

Seepage water in the sump will be pumped back to the plant for reuse or directly to the operating wet cell TSF storage area.

Four piezometers will be installed in the embankments to monitor the phreatic surface through the embankment.

Tailings management

Tailings will be delivered by four 250 mm **HDPE** and Victaulic jointed steel lines, with subaerial deposition by spigots a maximum 7 m apart on perimeter embankments. Subaerial deposition will facilitate evaporation from the beached tailings surface and allow control of discharge points to force the decanted liquor to the required pond area for immediate pump back to the process plant, to minimise the size of the decant pond.

A decant collection chamber with pontoon mounted pump will be located near the centre of TSF 2A (Figure 1).

Tailings pipelines are within earthen bunds to contain spills.

Stormwater management

TSF 2A has been designed and sized to accommodate storage of at least a 1:100 year, 72 hour **ARI** rainfall event and a total freeboard of 500mm, for anticipated tailings deposit tonnages/volumes (Wave, 2017 and Application documents - copy of KML response to query from DMIRS).

Stormwater from the current embankments of the TSF (dry stack, and wet cell TSF 1) are collected by drains at the base of the embankments and flow by gravity to a Retention Pond. Water is retained in the retention pond by an earthen wall approximately 4 m high.

Changes are proposed to the general arrangement of stormwater drainage from the TSF (dry stack and wet cells) as illustrated in Figure 3 below.

A Seepage Collection Sump will be constructed at the east embankment of TSF 2A, and stormwater from TSF 2A will report to the sump.

TSF 2A will be located within part of the current area of the Water Retention Pond (Figures 1 and 3) and the size of the retention pond area will be reduced as a consequence. Wave International (2017) undertook a review of the water balance of the runoff from the TSF and concluded that the remaining water retention basin is of sufficient volume to retain the storm event runoff from the TSF (dry stack and wet cells) and embankments for at least a 1 in 100 year, 72 hour ARI rain event.

KML also propose to construct a 1 m high bund within the retention pond area as a barrier north of TSF cell 2A to retain flows within the retention basin and minimise potential for flows to impact on the TSF 2A embankments (Figure 3) (Application documents – copy of response to query to KML from DMIRS).

Operating Manual

The existing TSF Operating Manual will be updated to include the TSF 2A wet cell immediately after construction and prior to operation. It is not expected to undergo significant changes, but will account for monitoring of piezometers, new locations of decant pumping systems and changes to storm water management and operation.

Figure 1: TSF 2A location and layout

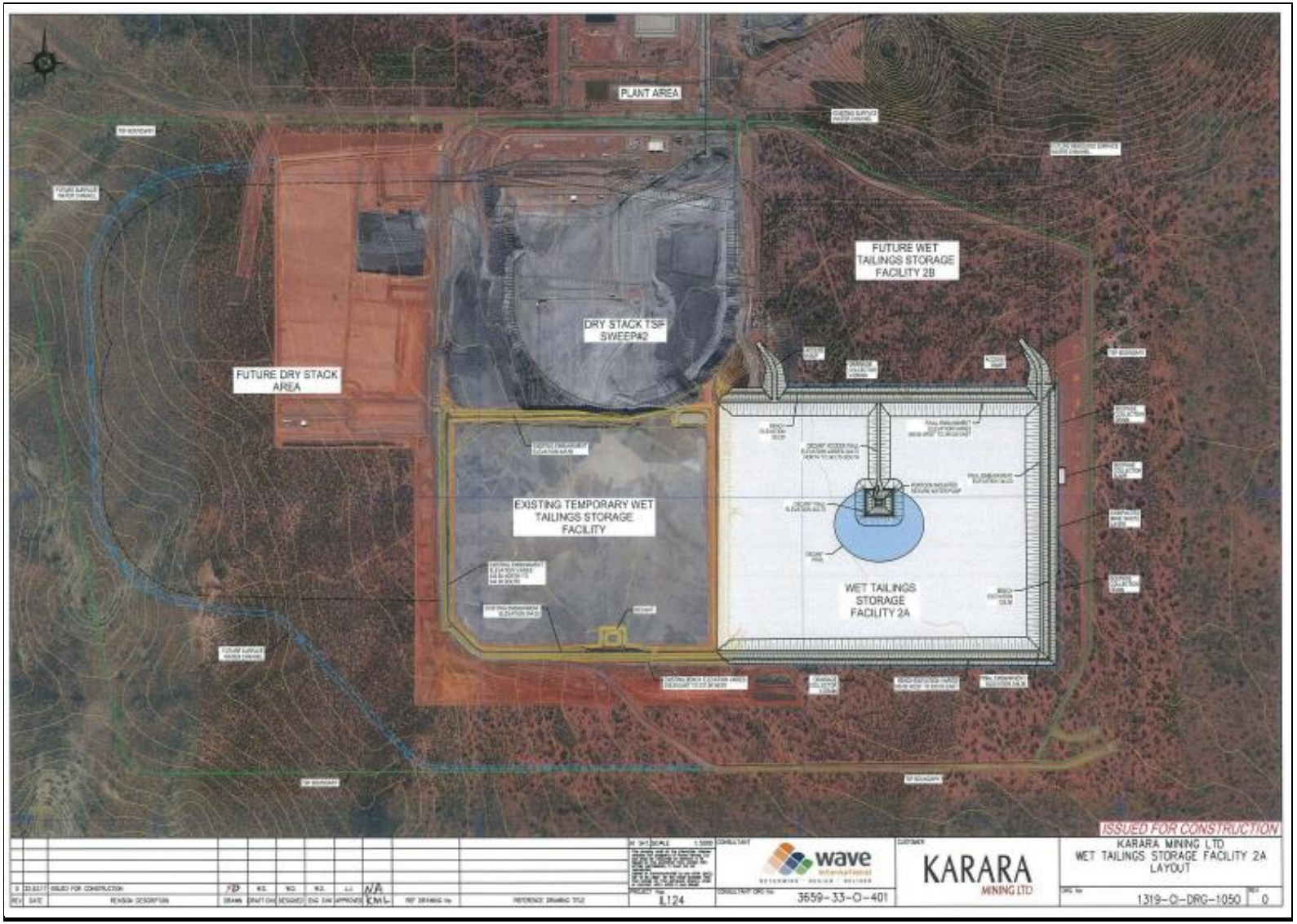

Figure 2: TSF 2A Earthworks – seepage collection drain

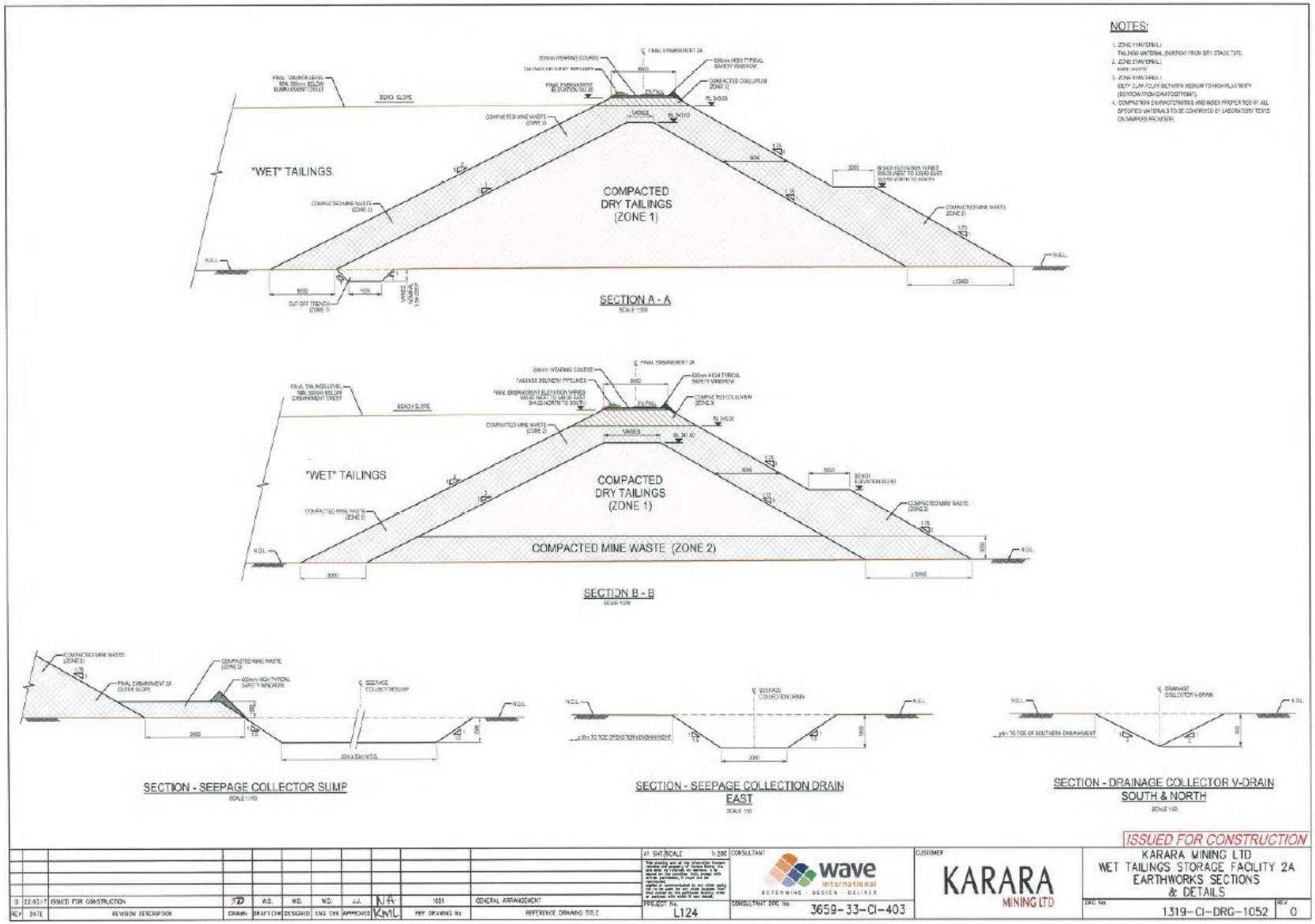

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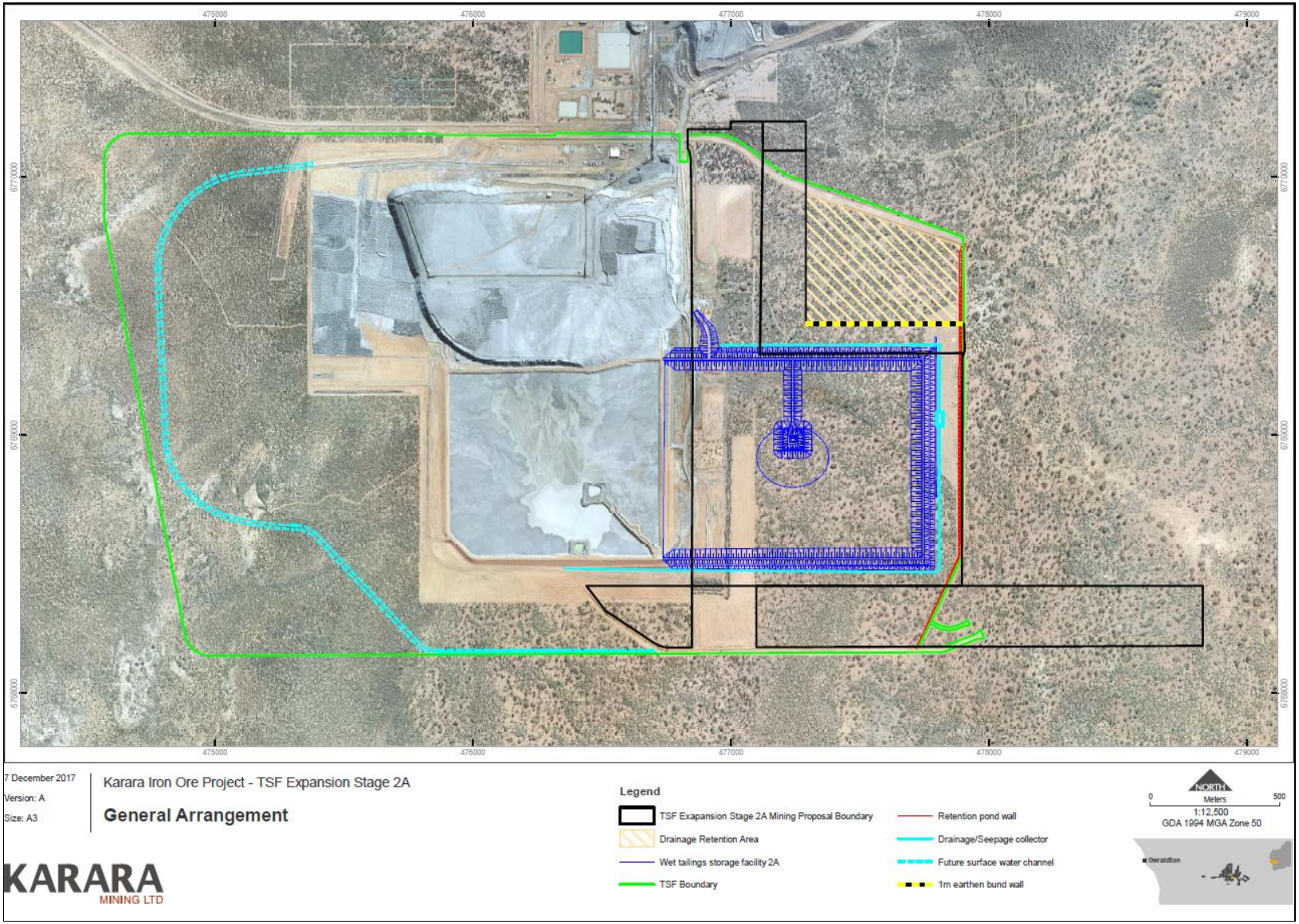
Figure 3: TSF 2A drainage and seepage collection



Licence: L8721/2013/1

Other approvals

Table 2 outlines other approvals relevant to this assessment.

Table 2: Relevant approvals

Legislation	Number	Approval summary relevant to this assessment
EP Act	**MS** 805	Approved 8 September 2009. Condition 6-5 requires the proponent to monitor impacts from mining and mining related activities due to: 1. dust; 2. saline water application for dust; 3. fire; and 4. feral species on the Blue Hills vegetation complex Priority Ecological Community (**PEC**) . Condition 6-6 requires proponent to immediately provide and implement a proposed management measures when outcome of minimizing disturbance or loss of the PEC. Attachment 4 replaced Attachment 3, 13 December 2017. Changes were made for "Inclusion of wet tailings cells within the final tailings storage facility landform, being a single dry stack tailings storage facility." Changes were incorporated into Table 2: Location and authorised extent of physical and operational elements of Attachment 4.
Environmental Protection and Biodiversity Conservation Act 1999	EPBC Approval Reference Number 2006/3017	Approved 29 October 2009
Rights in Water and Irrigation Act 1914 **(RIWI Act)**	GWL 158673	7 January 2011 Licence to abstract groundwater
Mining Act 1978	Reg. Id 24232	Approved 2 November 2009 Karara Iron Ore Project, Mining Proposal Years 1 to 6.
	Reg. Id 47541	Approved 19 June 2014 Interim Wet TSF Mining Proposal
	Reg. ID 56329.	Approved 22 October 2015 Mining Proposal – Wet tails expansion
	Reg. Id 70406	Received by DMIRS on 25/10/2017 – Approved 21 December 2017 TSF Expansion Stage 2A Mining Proposal

Amendment history

Table 3 provides the instrument log of the licences and works approvals related to L8721/2013/1 that have been issued since 10/12/2009.

Table 3: Instrument log

Instrument	Issued	Amendment
W4596/2009/1	10/12/2009	Works Approval - Karara Landfill Facility
W4615/2009/1	12/02/2010	Works Approval - Karara Minesite Beneficiation Plant
W4620/2009/1	05/03/2010	Works Approval – Waste Water Treatment Plant
L8486/2010/1	09/12/2010	Licence – Waste Water Treatment Plant
L8721/2013/1	16/05/2013	Licence - Karara Minesite Beneficiation Plant
L8721/2013/1	26/09/2013	Amendment Licence - Karara Minesite Beneficiation Plant
W5545/2013/1	20/01/2014	Works Approval – wet tailings TSF1
W5664/2014/1	11/07/2014	Works Approval – wet tailings TSF2 (Stage 1 and Stage 2) Note: Karara has advised this TSF infrastructure will not be constructed.
L8721/2013/1	11/11/2015	Amendment to include wet TSF1 and amalgamate L8486/2010/1 (WWTP) and include the Landfill.
W5545/2013/1	17/12/2015	Amendment for raise and extension of wet TSF1.
L8721/2013/1	29/04/2017	Notice of Amendment to extend licence expiry date to 19 May 2021
L8721/2013/1	30/06/2017	Amendment Notice #1 to include Phase 1 (raise) of TSF1, change the premises boundary and increase category 5 production capacity.
L8721/2013/1	08/01/2018	Amendment Notice # 2 for the construction of TSF 2A and TSF 2B.

Location and receptors

The Karara Minesite is located about 230 km east of Geraldton.

Table 4 below lists the sensitive land uses in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 4: Receptors and distance from activity boundary

Residential and sensitive premises	Distance from Prescribed Premises
Karara Homestead.	Approximately 7 km southwest of the TSF area.
Pastoral bores and wells associated with Karara Station - Mungada Bore and Van's Bore is still in use. (Information from Wave, 2017 and DWER's Water Information Database)	Variously on the premises and in local vicinity.

Table 5 below lists the environmental receptors in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 5: Environmental receptors and distance from activity

Environmental receptors	Distance from Prescribed Premises
Priority Ecological Community (Blue Hills vegetation complex).	Occurs on ridges. Found on the premises and in the local vicinity (Figure 4 below for buffered locations).
One DRF, 20 Priority Flora and four other taxa of conservation significance.	Occurs on the premises and in the local vicinity (Figure 5 below for buffered locations).
Three invertebrate and 15 vertebrate species of conservation significance.	Recorded during a fauna survey of the mine site, or are very likely to be present.
Flora and fauna	Close vicinity to TSF2 Infrastructure as shown in Figure 6
Department of Biodiversity, Conservation and Attractions **(DBCA)** managed land	The Premises is located entirely within the DBCA managed land.
RIWI Act proclaimed Area - Gascoyne Groundwater Area – Mullewa/Byro Sub Area.	The Premises is located within the Gascoyne Groundwater Area.
Inland water body (~ 86 ha)	700 m north east of the TSF area.
Minor unconnected non perennial watercourses	On the premises and local vicinity.

Topography and drainage

The magnetite deposit at Karara is a semi-arcuate ridge that is part of the Blue Hills Range formed by Banded Iron Formation (BIF). The ridge forms part of a catchment divide with most drainage to the west and south along weakly-defined ephemeral drainage lines that lead towards the Mongers Lake paleo-drainage; and with minor tributaries to the north (topographical contours shown in Figure 7 below).

The land at TSF 2A slopes west to east, with a 5 m difference in height between the western and eastern boundaries (Wave, 2017).

Hydrogeology

The hydrogeology of the region is described in the Geological Survey of Western Australia 1987 as “bedrock with no primary porosity or permeability” indicating that groundwater yields are likely to be very low and dependent on bedrock lithology, fracturing, weathering and local recharge conditions

Aquifers in and around the mine-site are mainly in fractured banded ironstone formation (BIF). Where these rocks are fractured or jointed, some minor perched aquifers within the BIF in the Mt Karara Ridge could exist. In the mine-site area, depth to the water table ranges between 2.7 to 24.4 mbgl dependent on changes in ground elevation (Wave, 2017).

There are four drainage depressions that collect surface water which are likely to have a shallow water table, approx. 5m from the surface (Wave, 2017).

Groundwater at Karara mine site is generally fresh to brackish near the water table, and is highly saline below depths between 500 and 100 m. Groundwater salinity at existing monitoring bores within the mine site area range from 600 to 81,000 mg/L Total Dissolved Solids (**TDS**). The groundwater is slightly acidic to slightly alkaline (pH 6.8 to 8.6) and is of a sodium chloride type, with proportionately high sulfate concentrations (Wave, 2017).

Wave International (2017) describes the foundation below TSF 2A as:

- Colluvium (silty sand) 1 m which will be removed under TSF 2A footprint on the southern and one third east embankments during construction, and remain under the northern side and two thirds of the eastern embankment;
- Weathered rock/ferricrete (up to 5 m) underlying the colluvium layer; over
- Granite rock.

Drill holes within the TSF footprint demonstrated a minimum depth to groundwater of 36 m. (source: email Karara 20/11/215).

Groundwater contours indicate groundwater flow from the TSF is in an easterly and southwesterly direction as shown in Figure 8 below.

Meteorology

The Karara area has a semi-arid climate with hot dry summers and cool, moderately wet winters.

Australian Bureau of Meteorology summary statistics from rainfall records (1928 – 2017) at Karara Station No. 010195 are listed below.

Summary statistics for all years Information about climate statistics

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	21.2	23.6	26.5	21.5	35.9	42.0	41.9	38.7	21.3	10.0	12.8	12.8	312.0
Lowest	0.0	0.0	0.0	0.0	1.2	0.5	2.0	9.0	1.0	0.0	0.0	0.0	150.1
5th %ile	0.0	0.0	0.3	0.2	2.6	5.8	9.2	11.8	4.2	0.5	0.1	0.0	190.8
10th %ile	0.0	0.0	0.7	0.8	4.7	13.1	15.0	14.9	6.5	1.3	1.4	0.0	208.7
Median	9.9	9.2	17.1	13.9	29.5	35.6	40.6	33.3	18.2	7.5	9.6	6.8	300.2
90th %ile	57.0	69.9	70.8	54.1	80.9	83.3	71.9	68.8	35.6	18.3	30.1	36.8	414.7
95th %ile	76.2	88.0	81.3	58.2	98.4	101.4	76.2	83.6	43.1	33.2	38.2	43.7	464.9
Highest	109.6	120.6	144.4	68.8	149.4	129.1	119.6	128.4	77.0	51.0	45.4	49.5	495.8

The average evaporation rate expected at the premises based on observations at nearby Morawa and Meekatharra weather stations, indicates that evaporation exceeds average rainfall in every month of the year.

Figure 4: Priority Ecological Community (buffered)

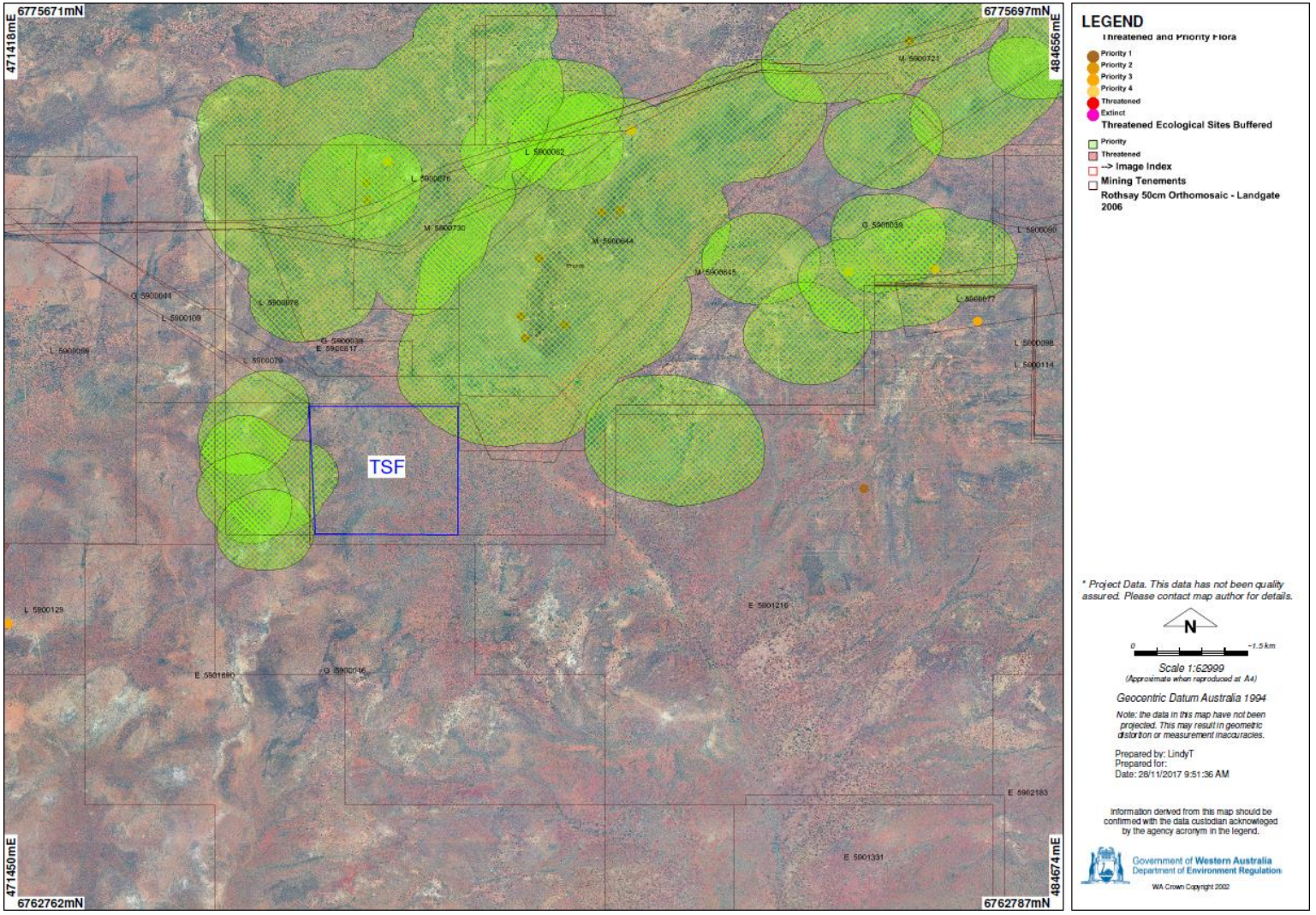


Figure 5: Priority flora

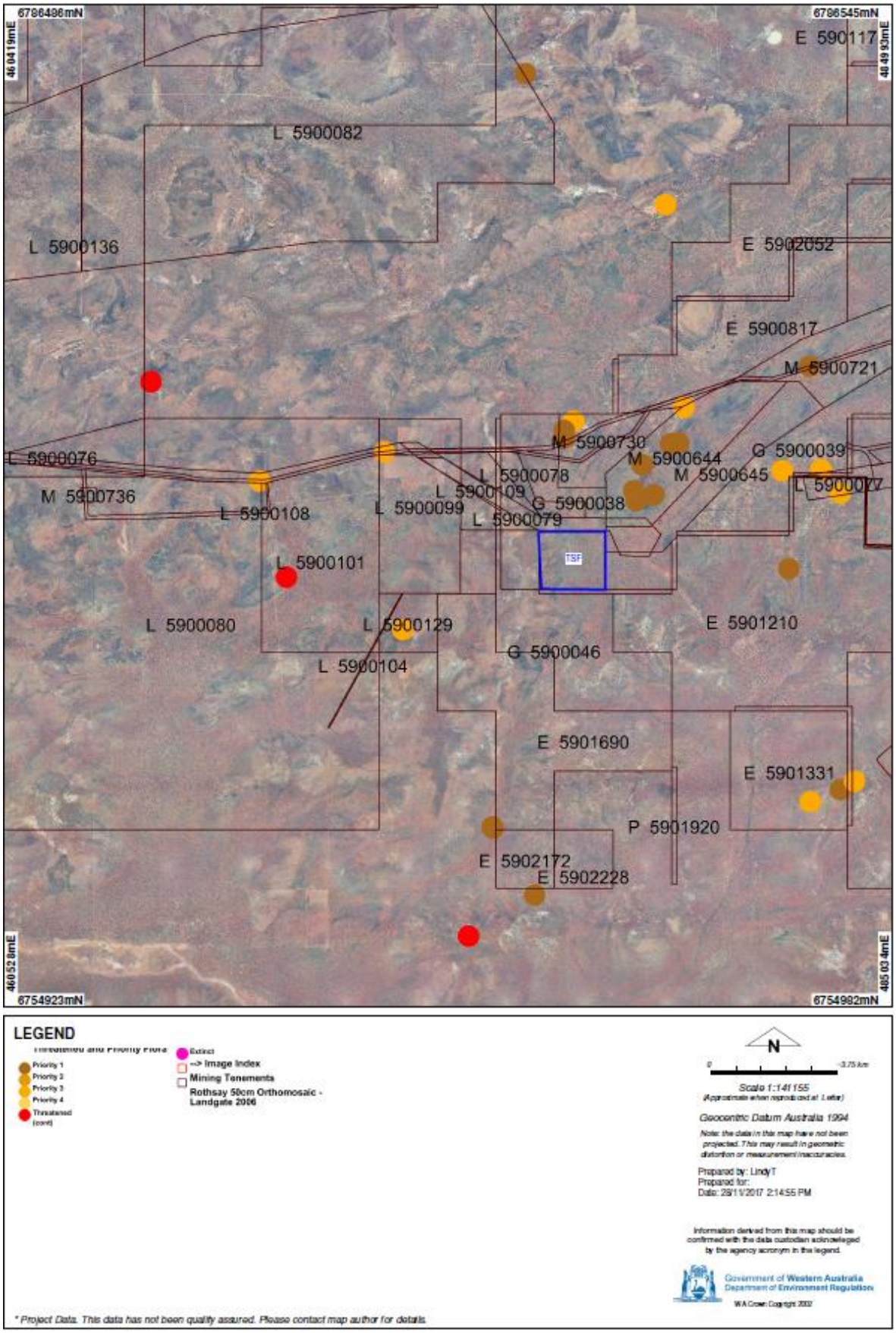


Figure 6: Fauna and vegetation in the immediate location of TSF 2 A and 2B

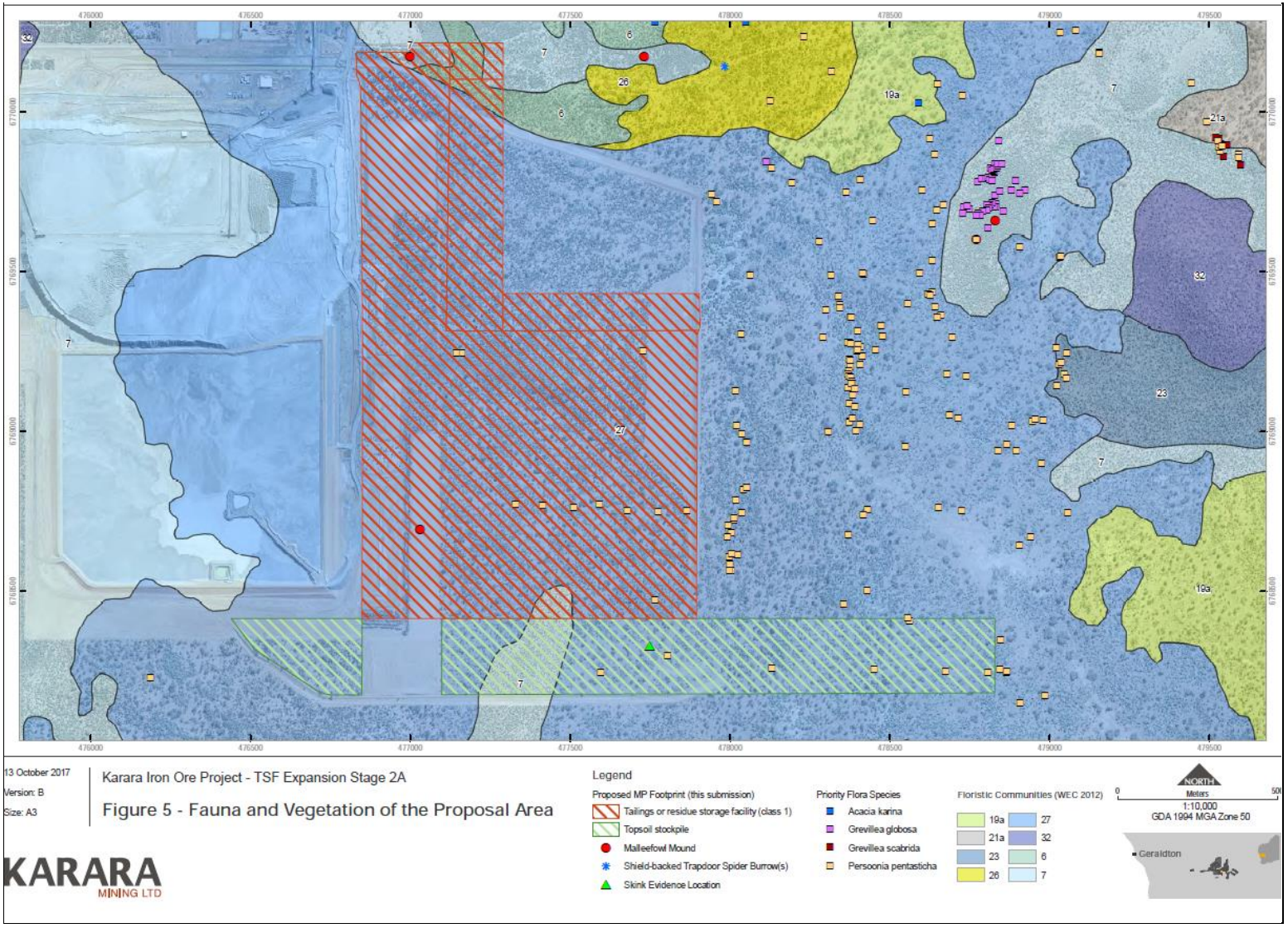


Figure 7: Topographic contours and priority flora

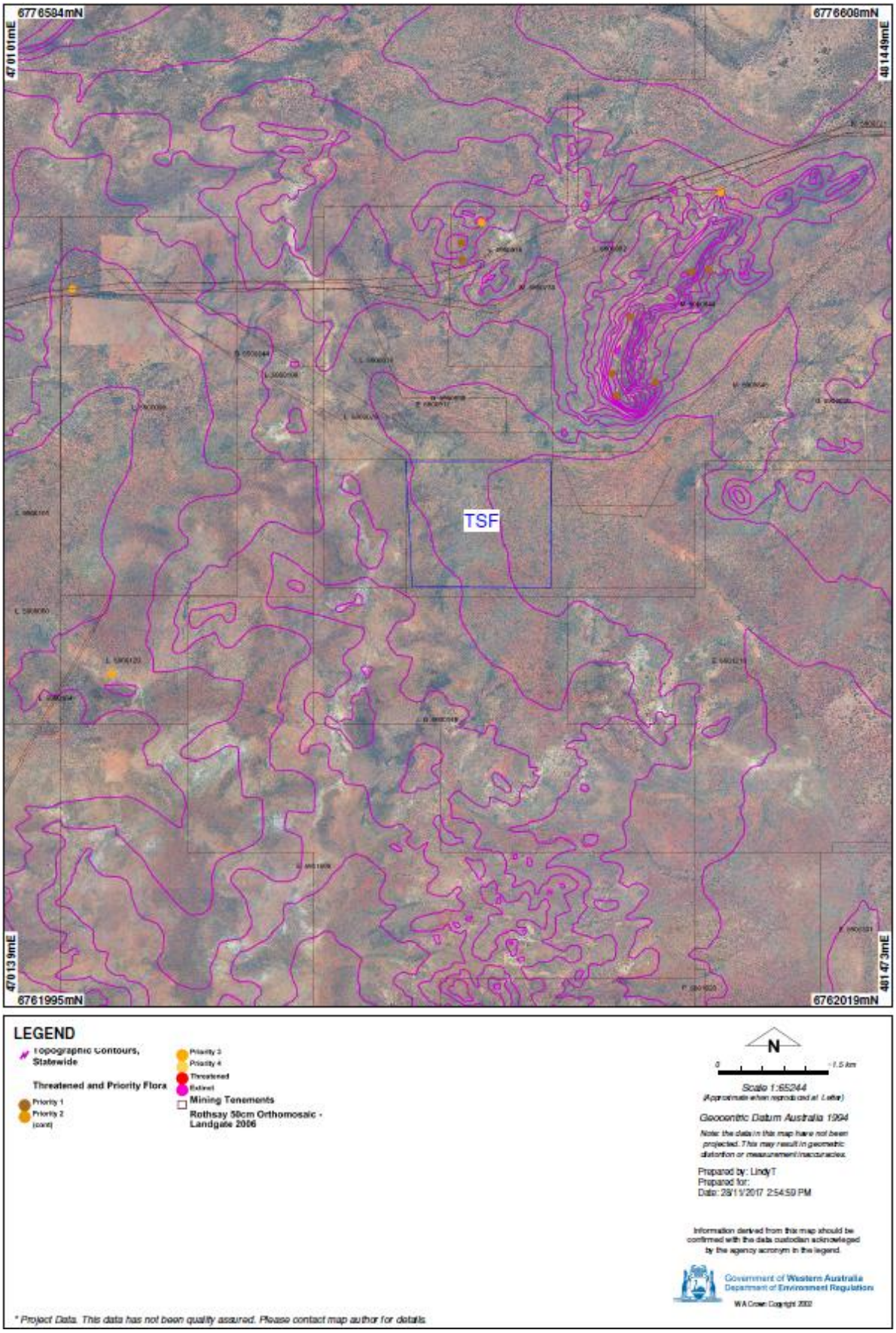
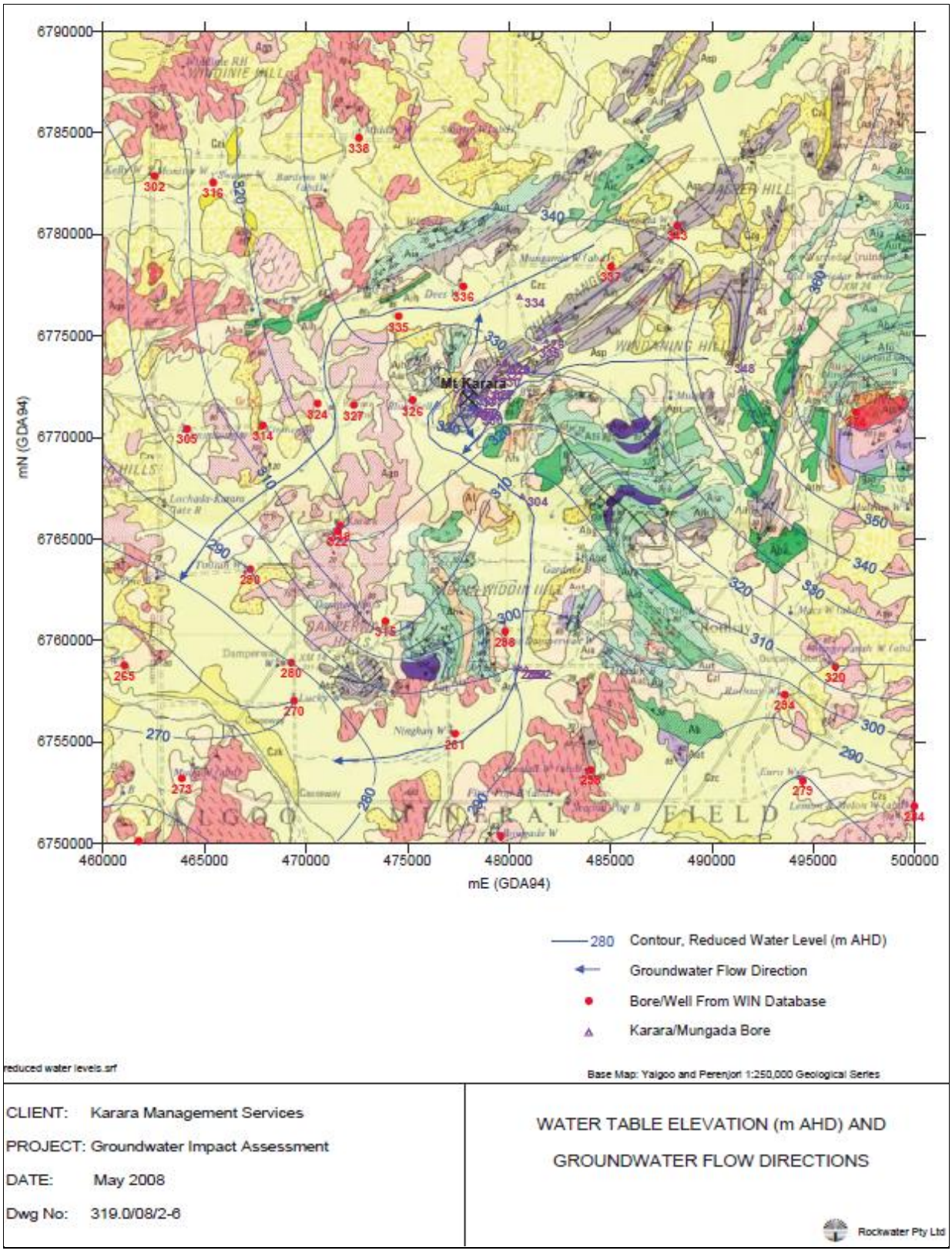


Figure 8: Water table elevation (m AHD) and groundwater flow directions



Risk assessment

Tables 6 and 7 below describe the Risk Events associated with the amendment consistent with the *Guidance Statement: Risk Assessments*, and Tables 8, 9 and 10 in Appendix 3.

Table 6: Risk assessment for proposed amendments during construction

Risk Event						Consequence rating	Likelihood rating	Risk	Reasoning
Source/Activities		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**				
Cat 5 Processing or beneficiation of metallic or non-metallic ore	Construction of TSF 2A	Dust associated with construction activities.	Karara Homestead ~ 7 km southwest of the TSF area.	Air/wind dispersion	Health and amenity impacts	**Slight**	**Unlikely**	**Low**	Given the separation distance from the nearest residence, the risk of impact is considered to be **Low**. No additional regulatory requirements are deemed to be required.
			Vegetation of conservation significance including a PEC located on the premises and in the local vicinity.	Air/wind dispersion	Smothering vegetation of conservation significance and a PEC, reducing extent and vitality.	**Moderate** Midlevel on site on site impacts Short term impact event during construction.	**Unlikely** The risk event is unlikely to occur in most circumstances (given controls in place)	**Medium**	Impact of dust on the PEC is required to be monitored under Part IV of the EP Act. (MS 805). The current licence condition 2.3.1 requires dust to be managed in accordance with the Karara Corporate Standard Environmental Plan – Dust Management Plan, Corp-EN-PLN-1010, June 2014. The Dust Management Plan has been updated and the licence will be amended to the latest version. No additional regulatory requirements are deemed to be required.
		Noise associated with construction activities.	Karara Homestead ~ 7 km southwest of the TSF area.	Air/wind dispersion	Health and amenity impacts	**Slight**	**Unlikely**	**Low**	Given the separation distance from the nearest sensitive land use, the risk of impact by noise is considered to be **Low**. Noise emissions are expected to comply with the **Noise Regulations**. No additional

									regulatory requirements are deemed to be required.
		Stormwater during heavy rainfall events carrying sediment laden water.	The nearest surface water body is ~ 700 m north of the TSF. Vegetation of conservation significance including a PEC and priority flora in the vicinity of the TSF	Land and water courses	Short term localized inundation with adverse impacts to health and survival of vegetation and increased sedimentation of surface water bodies.	**Minor** Low level on site impacts The PEC is located on ridges and impact event short - during construction.	**Rare** The risk event may only occur in exceptional circumstances	**Low**	Stormwater from within the TSF area will continue to be directed to the Retention Pond during construction. Given the short term nature of construction, and low average monthly rainfall in the area, the risk of impact is considered **Low**, and no additional regulatory requirements are deemed to be required.
		Hydrocarbon spill from construction machinery and storage.	Vegetation of conservation significance including a PEC and priority located on the premises.	Land	Localized soil contamination	**Minor** Low level on site impacts The PEC is located on ridges.	**Rare** The risk event may only occur in exceptional circumstances	**Low**	The Applicant's controls include: • Hydrocarbons stored in accordance with *Dangerous Goods Safety Act 2004*. • Spill equipment will be maintained at site and contaminated soil excavated and removed to the bioremediation facility or offsite. The general provisions of the EP Act and the *Environmental Protection (Unauthorised Discharges) Regulations 2004* apply and no additional regulatory requirements are deemed to be required.

Table 7: Risk assessment for proposed amendment during operation

Risk Event						Consequence rating	Likelihood rating	Risk	Reasoning and Delegated Officer's decision
Source/Activities		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**				
Cat 5 Processing or beneficiation of metallic or non-metallic ore	Tailings disposal and storage - TSF 2A	Tailings leachate - seepage through base of TSF.	Gascoyne Groundwater Area Pastoral bores and wells associated with Karara Station, two currently in use.	Seepage of tailings through soil profile and via fractures in underlying rock.	Contamination of groundwater	**Minor** Low level on site impacts	**Unlikely** The risk event will probably not occur in most circumstances, given the depth to groundwater and the permeability of the underlying granite rock.	**Medium**	Groundwater quality - able to be used for pastoral uses. Groundwater salinity within the vicinity of the mine ranges from 600 to 81,000 mg/L TDS. The tailings leachate was considered benign under neutral conditions (GSA, 2007). However, this test was conducted at neutral pH and may not be indicative of conditions experienced at site. It is noted that the tailings liquors are alkaline, so results from GCA 2007 are not sufficient. The Delegated Officer requires the applicant to complete US EPA LEAF test 1313 to assess the expected leachates (seepage) that may be derived from the tailings under a range of pHs, including the expected alkaline conditions. Depth to groundwater at the TSF is approximately 36 m. The TSF overlays 1 m soil, 5 m weathered rock, overlying granite rock. The Delegated Officer considers that monitoring bores should be constructed for 6 monthly monitoring to confirm seepage to groundwater is not occurring.
			Native vegetation (including DRF/ Priority taxa flora)	Seepage of tailings through soil profile causing	Inundation of vegetation root zones leading to vegetation	**Moderate** Mid-level on site impacts	**Possible** The risk event could occur at some time.	**Medium**	Priority flora and other native vegetation is located in the vicinity of the TSF (Figures 4, 5 and 6) Given the proximity of vegetation, the

				mounding above underlying rock	death, poor health				Delegated Officer considers that monitoring bores should be installed to enable monitoring to confirm inundation from seepage is not occurring.
		Tailings leachate seepage - embankments.	Vegetation of conservation significance including DRF and priority flora and a PEC	Land - flow path	Adverse impacts to the health and survival of a PEC, priority flora and other native vegetation (impact area limited to the seepage flow path).	**Moderate** Mid-level on site impacts	**Unlikely** The risk event will probably not occur in most circumstances, given the Applicant's controls	**Medium**	A PEC and priority flora and other native vegetation is located in the vicinity of the TEC, (Figures 4, 5 and 6). The PEC is located on ridges. Impact would be restricted to area of seepage around the TSF and seepage flow path (Figure 8). Applicant's controls include: • Core of embankments to be constructed from compacted dry tailings (permeability 3 x10^{-8}m/s). • A key trench will be constructed along the southern embankment and one third section of the eastern embankment footprints to allow seepage to be directed to the Seepage Collection Sump. • The northern section and the other two thirds of the eastern section embankment footprints, to be constructed to function as a drainage layer for seepage collection by a toe drain reporting to the Seepage Collection Sump. • Seepage will report to a Seepage Collection Sump. Collected water will be pumped for re-use. Detailed in *Background* section above. • Four piezometers will be installed in embankment walls to monitor the phreatic surface within the tailings. The embankment piezometers will assist in determining the location of

									the water table in the embankment (phreatic surface). • A floating pontoon mounted pump constructed near the centre of the TSF so that the decant pond is distanced from the embankments • Decant liquor pumped to the process plant via return pipeline. • Spigots, for subaerial deposition of tailings, located on perimeter of embankments at up to 70 m centres to facilitate evaporation of liquor. The Applicant's controls have contributed to lowering the risk and the Delegated Officer has therefore determined that these controls will be conditioned in the licence.
		Tailings – embankment failure and overflow	Karara Homestead ~ 7 km southwest of the TSF. Vegetation of conservation significance including priority flora and a PEC.	Land - flow path	Health and amenity Adverse impacts to the health and survival vegetation of conservation significance and a PEC.	Not assessed	Not assessed	Not assessed	Structural stability of TSF 2A is assessed, regulated and managed under the *Mining Act 1978,* which is administered by DMIRS. No additional regulatory requirements are deemed to be required.
		Tailings pond – overtopping due to overfilling or storm event.	Vegetation of conservation significance including priority flora and a PEC.	Land - flow path	Adverse impacts to the health and survival vegetation of conservation significance and a PEC in	**Moderate** Mid-level on site impacts	**Unlikely** The risk event will probably not occur in most circumstances, given the	**Medium**	A PEC and priority flora and other native vegetation is located in the vicinity of the TSF, (Figures 4, 5 and 6). The PEC occurs on ridges. Applicant's controls include: • TSFs sized to contain a 1:100 year,

					the path of the flow.		Applicant's controls		72 hour ARI rainfall event and 500 mm total freeboard, for planned storage amounts. • Supernatant water located around a decant water compartment, constructed of permeable rock fill decant walls. • Decant water recovered by a floating pontoon mounted pump and returned to the process plant. • Subaerial deposition of tailings via spigots located on perimeter embankments at up to 70 m centres, to facilitate evaporation and allow control of discharge points to force liquor to the decant pond area. • Minimum total freeboard of 500 mm maintained. The Applicant's controls have contributed to lowering the risk and the Delegated Officer has therefore determined that these controls will be conditioned in the licence.
		Tailings and return line spillage from pipeline failure.	Vegetation of conservation significance including priority flora and a PEC	Land - flow path	Adverse impacts to the health and survival of vegetation of conservation significance and a PEC.	**Moderate** Mid-level on site impacts	**Possible** The risk event could occur at some time	**Medium**	A PEC and priority flora and other native vegetation is located in the vicinity of the TSF, (Figures 4, 5 and 6). The PEC occurs on ridges. Applicant's controls include: • Tailings and return pipelines constructed of 250 mm HDPE lines. • Tailings and return pipelines inspected daily for leaks and spills. • Tailings and return pipelines sited within earthen bunds to contain

									spill. The Applicant's controls have contributed to lowering the risk and the Delegated Officer has therefore determined that these controls will be conditioned in the licence.
	Exposure of external surfaces of TSF	Stormwater during heavy rainfall events	Vegetation of conservation significance including priority flora and a PEC	Land - flow path	Adverse impacts to the health and survival of vegetation of conservation significance and a PEC.	**Moderate** Mid-level on site impacts (infrequent and short term event)	**Unlikely** The risk event will probably not occur in most circumstances given the applicant's controls.	**Medium**	A PEC and priority flora and other native vegetation is located in the vicinity of the TSF, (Figures 4, 5 and 6). The PEC occurs on ridges. Applicant's controls include: • Stormwater runoff from the TSF landform is directed by surface drains located at embankment perimeters to a Drainage Retention Area or Seepage Collection Sump sized to accommodate a 1 in 100 year 72 hour storm event. • The drainage retention area is bounded by earthen bunds 4 m high. • A 1 m high berm will be constructed at the Retention Pond north of TSF 2 to retain stormwater and protect TSF 2 embankments. The Applicant's controls have contributed to lowering the risk and the delegated Officer has therefore determined that these controls will be conditioned in the licence.
		Dust associated with drying of tailings surface.	Karara Homestead ~ 7 km southwest of the TSF.	Air/wind dispersion	Health and amenity impacts	**Slight**	**Rare**	**Low**	Given the separation distance from the nearest residence, the risk of impact is considered to be **low**. No additional regulatory requirements are deemed to be required.

			Vegetation of conservation significance including a PEC, on the premises and in the local vicinity.	Air/wind dispersion	Smothering vegetation of conservation significance reducing extent and vitality.	**Major** Ongoing impact to an area of high conservation value of significance	**Unlikely** The risk event is unlikely to occur in most circumstances (given controls in place)	**Medium**	Impacts of dust risk to the PEC is required to be monitored under Part IV of the EP Act (MS 805). The current licence condition 2.3.1 requires dust to be managed in accordance with the Karara Corporate Standard Environmental Plan – Dust Management Plan, Corp-EN-PLN-1010, June 2014. The Dust Management Plan has been updated to include additional dust management measures at the TSF as required following a DER inspection in April 2017, and the licence will be amended to the latest version. No additional regulatory requirements are deemed to be required.

Decision

Category 5 - Processing or beneficiation of metallic or non-metallic ore

The Delegated Officer has determined that the key potential emissions associated with the proposed TSF 2A are from tailings leachate seepage, overtopping of the TSF, pipeline spills, and tailings dust.

The Delegated Officer considers that the Applicant's controls which contributed to the determination of risk should be conditioned, in accordance with *Guidance Statement: Risk Assessments* (February 2017). The Delegated Officer has also determined that US EPA LEAF test 1313 should be conducted, and monitoring bores should be installed to enable groundwater monitoring. The assessment and determinations of conditions are set out in the risk assessment Table 7.

The Delegated Officer has determined that the construction and operation of the wet cell TSF 2A will not result in emissions which are unacceptable to public health or the environment.

Licensee comments

The Licensee was provided with the proposed Amendment Notice on 19 December 2017. Comments received from the Licensee have been considered by the Delegated Officer as shown in Appendix 2.

Amendment

1. The licence is amended by the deletion of the Definitions text as shown in strikethrough below and the insertion of the Definitions text as shown below in bold underline below.

'AHD' means Australian Height Datum

'ARI' means Average Recurrence Interval

'CEO' for the purposes of notification means:
Director General
Department Administering the *Environmental Protection Act 1986*
Locked Bag 33 Cloisters Square
PERTH WA 6850
~~info@der.wa.gov.au~~ **info-der@dwer.wa.gov.au**

'TSF' means Tailings Storage Facility

2. The Licence is amended by the insertion of the following Condition 1.3.7 as shown in bold underline below.

1.3.7 The Licensee shall ensure that the requirements as detailed in Table 1.3.6 are met during the construction of TSF 2A.

Table 1.3.6: Construction requirements		
Location	**Requirements**	**Location and construction details reference map**
TSF 2A	**Sized to contain a 1:100 year ARI, 72 hour rainfall event for net operational storage capacity of 12 million m^3.** **Top of the embankment elevations will vary from RL 344.0 to RL 345.25 m AHD.** **Core of embankments constructed with material with hydraulic conductivity of 1.0 x 10^{-8} m/s or less.** **A key trench constructed along the southern embankment and one third section of the eastern embankment footprints to allow seepage to be directed to the Seepage Collection Sump.** **The northern section and the other two thirds of the eastern section embankment footprints, constructed to function as a drainage layer for seepage collection by a toe drain reporting to the Seepage Collection Sump.** **Constructed so that seepage will drain to a Seepage Collection Sump.** **Four piezometers installed in each embankment wall.** **Tailings delivery pipelines constructed of 250 mm diameter HDPE and Victaulic jointed steel lines.** **Tailings return pipelines constructed of 250 mm diameter HDPE.** **Tailings delivery and return water pipelines and pumps bunded by earthen trenches.** **A floating pontoon mounted pump constructed near the centre of the TSF and so that decant water is able to be pumped to the process plant via return pipeline.** **Spigots, for subaerial deposition of tailings, located on perimeter of embankments at up to 70 m centres.**	**Schedule 1: Map 6: TSF 2A layout, and Map 7: Seepage Collection Sump**
Seepage Collection Sump	**Constructed so that water collected in the Seepage Collection Sump may be returned to the process plant or an operational wet TSF or reused as dust suppression.** **Constructed to accommodate a 1 in 100 year, 72**	**Schedule 1: Map 6: TSF 2A layout; and Map 7: Seepage Collection Sump**

	hour ARI rainfall event.	
Stormwater Drainage	**Constructed so that surface water runoff from the TSF dry stack is collected by surface drains at TSF perimeter embankments and reports to the Drainage Retention Area.** **Constructed so that surface water runoff from wet cells TSF 1 and TSF 2A is collected by surface drains at TSF perimeter embankments and reports to the Seepage Collection Sump.** **Constructed to accommodate at least a 1 in 100 year, 72 hour ARI rainfall event.** **Retention pond wall approximately 4 m high.** **Drainage Retention Area constructed with a 1 m high bund to contain flow of water north of TSF 2A.**	**Schedule 1: Map 8 TSF drainage and seepage plan**
TSF (dry stack and wet cells) groundwater monitoring bores	**At least two bores located to the east of the TSF (one bore in the natural surface drainage channel and the other within 50 m of the TSF) and two bores to the south of the TSF, to enable seepage from the TSF to be detected and monitored (indicative locations as shown in Map 6.** **Bore locations to be determined by use of existing geological and geophysical data or electromagnetic geophysical survey to ensure that the bores are located on structural features that are likely to be significant seepage pathways from the TSF.** **Final siting of monitoring wells determined under advice by an experienced hydrogeologist.** **Well installation and construction (including preparation of well construction logs) in accordance with the National Environmental Protection (Assessment of Site Contamination) Measure 1999 – Schedule B, Section 8.2.** **To be installed with three metre long screens placed across the top of the groundwater table.** **To be surveyed to allow the top of the bore casing and ground level to (Australian Height Datum) at each location to be accurately determined.**	**Schedule 1: Map 8: TSF drainage and seepage plan and indicative monitoring locations**

3. The Licence is amended by the insertion of the following Condition 1.3.8 as shown in bold underline below.

1.3.8 The Licensee shall conduct a US EPA LEAF (leaching etc.) test 1313 on tailings sample(s) and submit the results to the CEO within one month of the date of this amendment.

4. Condition 2.3.1 of the licence is amended by the deletion of the text as shown in strike through below and the insertion of the text as shown below in bold underline below.

2.3.1 The Licensee shall ensure dust emissions are managed in accordance with the

~~Karara Corporate Standard Environmental Plan – Dust Management Plan, Corp-EN-PLN-1010, 24 June 2014~~ **Karara Mining Limited Dust Management Plan, CORP-EN-PLN-1010, 21 June 2017.**

5. The Licence is amended by the insertion of the following condition 4.3.2 as shown in bold underline below.

4.3.2 The Licensee shall submit compliance documents to the CEO within one month following construction of the works outlined in this amendment.

6. The Licence is amended by the insertion of the following condition 4.3.3 as shown in bold underline below.

4.3.3 The compliance documents required by condition 4.3.2 shall:

(a) Certify that the works were constructed in accordance with the construction conditions of this amendment; and

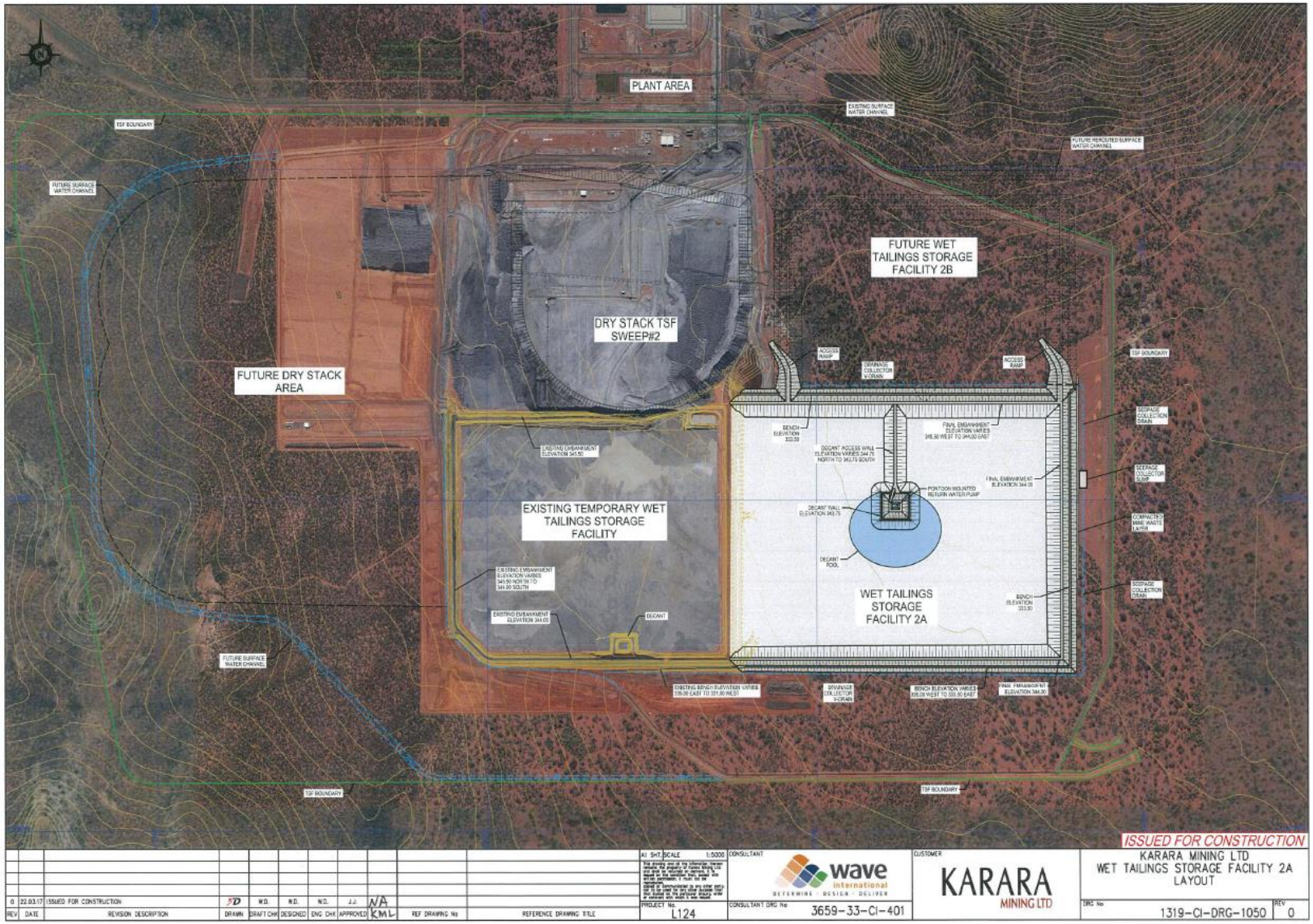
(b) Be signed by a qualified engineer and a person authorized to represent the Licensee and contain the printed name and position of that person within the company.

7. The Licence is amended by the addition of Map 6: TSF 2A layout, as shown below.

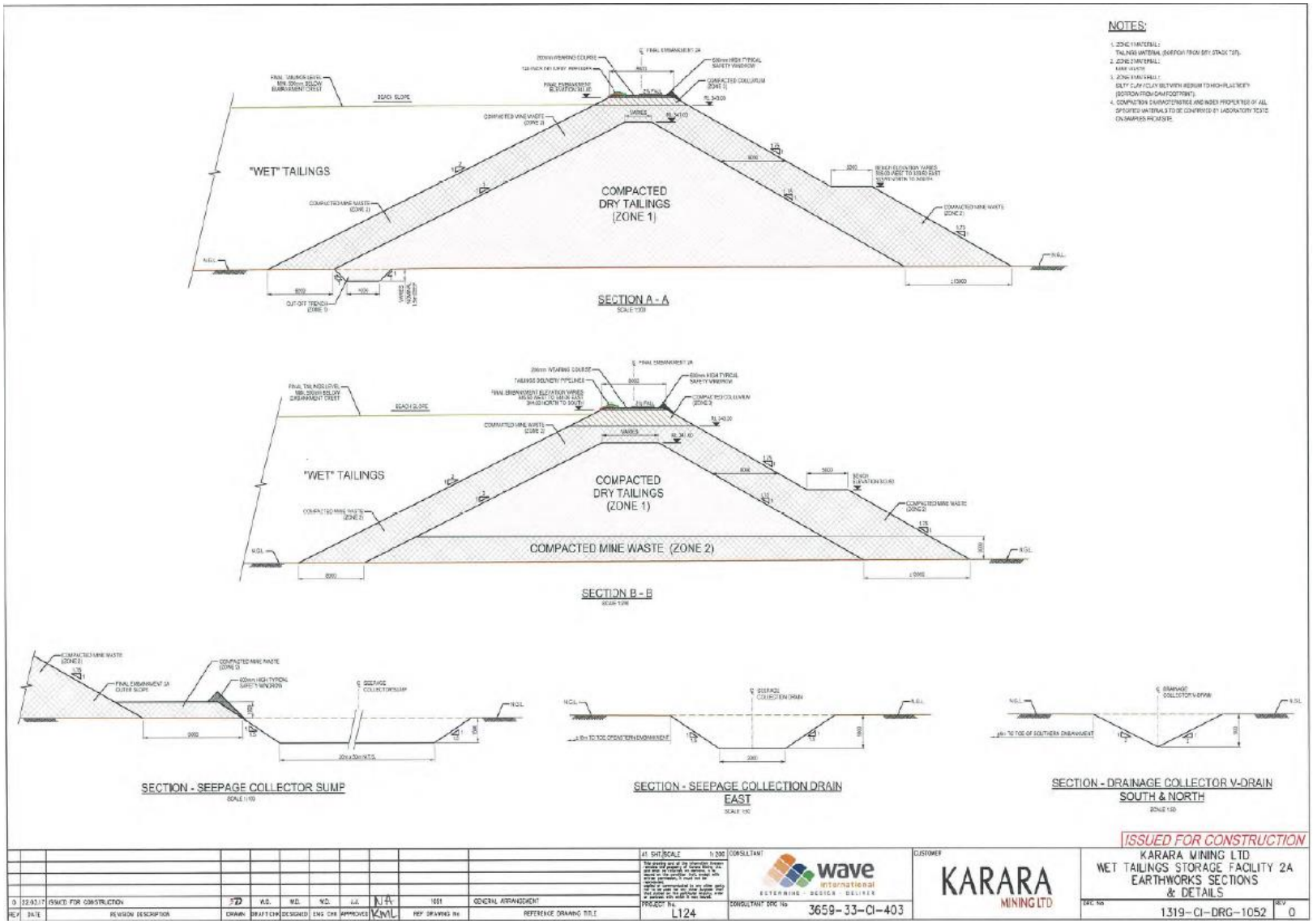
8. The Licence is amended by the addition of Map 7: Seepage Collection Sump, as shown below.

9. The Licence is amended by the addition of Map 8: TSF drainage and seepage plan and indicative monitoring locations, as shown below.

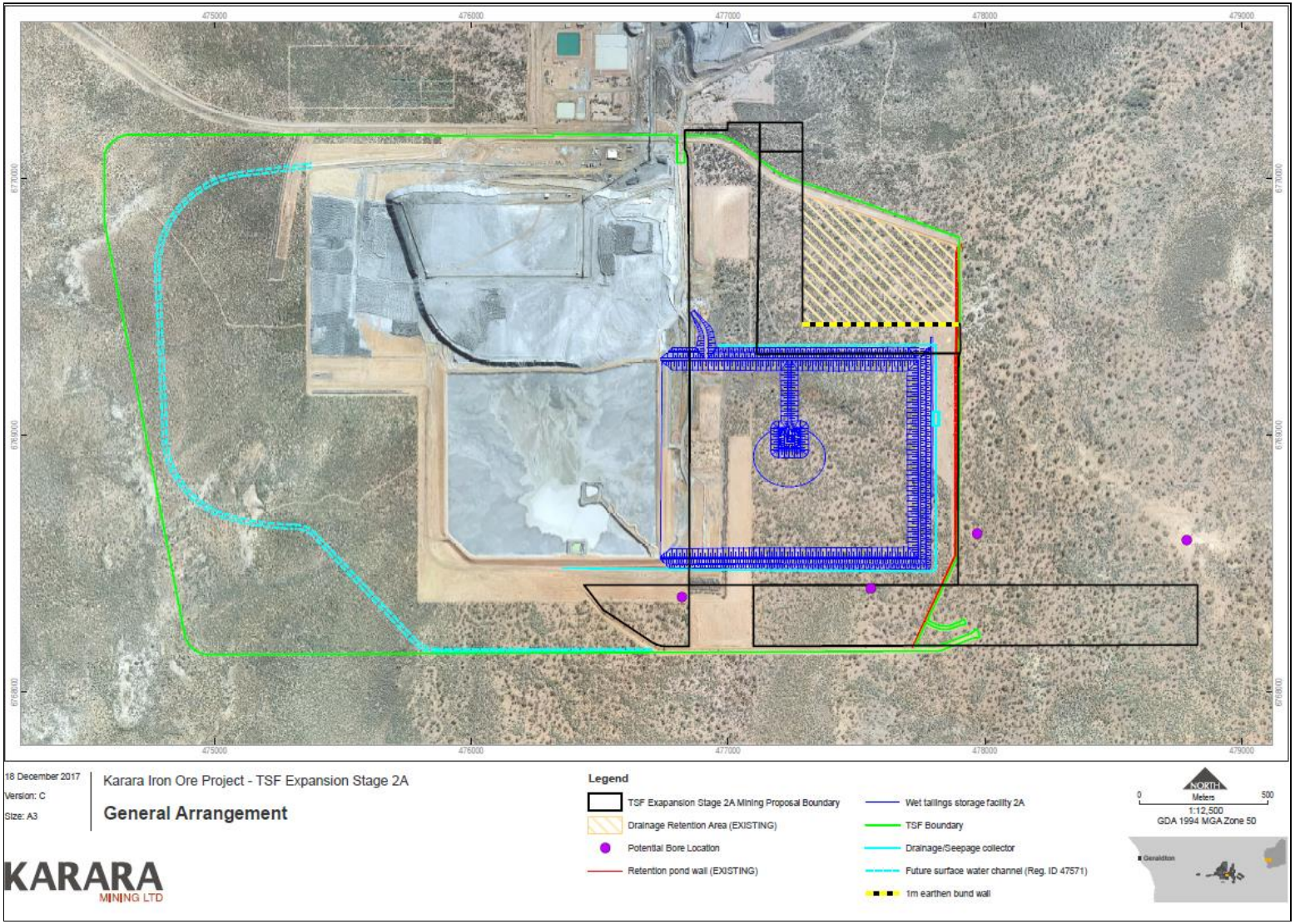
Map 6: TSF 2A layout



Map 7: Seepage Collection Sump



Map 8: TSF drainage and seepage plan and indicative monitoring locations



Appendix 1: Key documents

	Document title	In text ref	Availability
1	Application form and documents: works approval/licence received by DWER 10/04/2017.	Application documents	DWER records (CEO1159/17)
2	Application documents – further information received by DWER 4/12/2017.	Application documents	DWER records (A1574073)
3	Email: *Subject: FW: TSF bores.* From Rhys Houlihan, Karara Mining Limited, sent 20/11/2015 1:51 PM	Email Karara 20/11/2015	DWER records (A149959)
4	*Geochemical characterisation of process – tailings samples.* Unpublished report to Karara Management Services Pty Ltd, Job No 00624/2a, Graeme Campbell & Associates Pty, May 2007.	GCA, 2007	DWER records (A1499506)
5	*Guidance Statement: Regulatory principles.* Department of Environment Regulation, July 2015.	N/A	accessed at www.dwer.wa.gov.au
6	*Guidance Statement: Setting conditions.* Department of Environment Regulation, October 2015.		
7	*Guidance Statement: Risk Assessments*. Department of Environment Regulation, February 2017.		
8	*Guidance Statement: Decision Making*. Department of Environment Regulation, February 2017.		
9	*Guidance Statement: Environmental Siting* Department of Environment Regulation, *November 2016.*		
10	*Karara Mining Limited Dust Management Plan, CORP-EN-PLN-1010*, 21 June 2017	Dust MP	DWER records (A1575661)
11	*KML Mine Site Wet Tailings Storage Facility 2A and 2B Design Report*, Wave International, 3/04/2017	Wave, 2017	Part of Application documents - DWER records (CEO1159/17)
12	Licence L8721/2013/1	Existing Licence	accessed at www.dwer.wa.gov.au
13	Licence L8721/2013/1 Amendment Notice #1	Amendment Notice #1	accessed at www.dwer.wa.gov.au
14	Ministerial Statement 805	MS805	accessed at www.epa.wa.gov.au/
16	Ministerial Statement 895	MS895	accessed at www.epa.wa.gov.au
17	*Operating Manual for Wet Tailings Storage Facility,* Karara Mining Limited, March 2017	TSF Operating Manual	Part of Application documents - DWER records (CEO1159/17)

Appendix 3: Summary of Licence Holder comments

The Licensee was provided with the draft Amendment Notice on 19 December 2017 for review and comment. The Licensee responded on 22 December 2017. The following comments were received on the draft Amendment Notice.

Condition	Summary of Licence Holder comment	DWER response
1.3.7 **TSF (dry stack and wet cells) groundwater monitoring bores**	Karara understood the groundwater monitoring bores would be constructed at a depth to monitor seepage and potential impact in the surficial aquifer [i.e. be in the vicinity of 5 – 10m depth] because the primary risk identified is inundation of the water table. However, the condition requires construction to the aquifer underlying the TSF (approx. 36m depth). Karara requests confirmation of depth of bores required.	Leachate tests required by condition 1.3.8 will provide further information to determine if the leachate is benign or otherwise. Final siting and depth of the bores is to be determined under advice by a hydrologist to enable the detection of both vertical and horizontal seepage from the TSF, and hence any potential impacts from what are now wet tailings. Bores at depth will provide background levels.
	Clarification of proposed monitoring parameters requested.	To be finalised after completion of leach test results with opportunity for the Licensee to comment.

Appendix 3 – Risk Rating

A risk rating will be determined for risk events in accordance with the Risk Rating Matrix set out in Table 8 below.

Table 8: Risk Rating Matrix

Likelihood	Consequence				
	Slight	Minor	Moderate	Major	Severe
Almost Certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Medium	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

DWER will undertake an assessment of the consequence and likelihood of the Risk Event in accordance with Table 9 below.

Table 9: Risk Criteria Table

Likelihood		Consequence		
The following criteria has been used to determine the likelihood of the Risk Event occurring.		**The following criteria has been used to determine the consequences of a Risk Event occurring:**		
			Environment	**Public Health* and Amenity (such as air and water quality, noise, and odour)**
Almost Certain	The risk event is expected to occur in most circumstances	Severe	• **on-site impacts**: catastrophic • **off-site impacts local scale**: high level or above • **off-site impacts wider scale:** mid level or above • Mid to long term or permanent impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are significantly exceeded	• Loss of life • **Adverse health effects:** high level or ongoing medical treatment • Specific Consequence Criteria (for public health) are significantly exceeded • **Local scale impacts:** permanent loss of amenity
Likely	The risk event will probably occur in most circumstances	Major	• **on-site impacts**: high level • **off-site impacts local scale**: mid level • **off-site impacts wider scale**: low level • Short term impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are exceeded	• **Adverse health effects:** mid level or frequent medical treatment • Specific Consequence Criteria (for public health) are exceeded • **Local scale impacts**: high level impact to amenity
Possible	The risk event could occur at some time	Moderate	• **on-site impacts**: mid level • **off-site impacts local scale**: low level • **off-site impacts wider scale**: minimal • Specific Consequence Criteria (for environment) are at risk of not being met	• **Adverse health effects:** low level or occasional medical treatment • Specific Consequence Criteria (for public health) are at risk of not being met • **Local scale impacts:** mid level impact to amenity
Unlikely	The risk event will probably not occur in most circumstances	Minor	• **on-site impacts**: low level • **off-site impacts local scale**: minimal • **off-site impacts wider scale**: not detectable • Specific Consequence Criteria (for environment) likely to be met	• Specific Consequence Criteria (for public health) are likely to be met • **Local scale impacts:** low level impact to amenity
Rare	The risk event may only occur in exceptional circumstances	Slight	• **on-site impact**: minimal • Specific Consequence Criteria (for environment) met	• **Local scale**: minimal to amenity • Specific Consequence Criteria (for public health) met

^ Determination of areas of high conservation value or special significance should be informed by the *Guidance Statement: Environmental Siting.*

* In applying public health criteria, DER may have regard to the Department of Health's, *Health Risk Assessment (Scoping) Guidelines*

"on-site" means within the prescribed premises boundary.

Acceptability and Treatment of Risk Event

DER will determine the acceptability and treatment of Risk Events in accordance with the Risk Treatment Table below:

Table 9: Risk Treatment Table

Rating of Risk Event	Acceptability	Treatment
Extreme	Unacceptable.	Risk Event will not be tolerated. DER may refuse application.
High	May be acceptable. Subject to multiple regulatory controls.	Risk Event may be tolerated and may be subject to multiple regulatory controls. This may include both outcome-based and management conditions.
Medium	Acceptable, generally subject to regulatory controls.	Risk Event is tolerable and is likely to be subject to some regulatory controls. A preference for outcome-based conditions where practical and appropriate will be applied.
Low	Acceptable, generally not controlled	Risk Event is acceptable and will generally not be subject to regulatory controls.