

# **Karara Mining Limited Operating Strategy**

## **Yandanooka Borefield – Parmelia Aquifer**

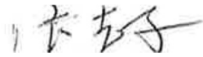
**at Lot 117 on Plan 202782 and Lot 146 on Plan  
203646**

**Water used at G59/38, L59/99**

**Karara Iron Ore Project**

*"I understand that the commitments given in the attached operating strategy are a condition of the groundwater licences for the Parmelia Aquifer at the Yandanooka borefield and that a breach of a commitment or any licence condition may be an infringement of the Rights in Water and Irrigation Act 1914"*

Person legally responsible for water licence:



Date: 11 March 2020

Printed name: Zhiqian Zhang, Manager KML Processing

Approved by delegated authority:



Date: 19/3/2020

# **Karara Mining Limited**

## **Groundwater Licence Operating Strategy**

### **Yandanooka borefield – Parmelia Aquifer**

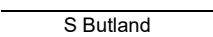
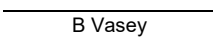
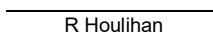
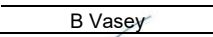
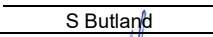
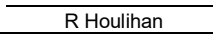


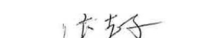
### **Karara Iron Ore Project**

CORP-EN-REP-1077

11<sup>th</sup> March 2020

## SYNOPSIS

This document presents the Groundwater Licence Operating Strategy for the Karara Iron Ore Project. This document has been prepared for submission to the Department of Water and Environmental Regulation.

CORP-EN-REP-1077 – KARARA MINING LIMITED					
REV	DESCRIPTION	TECH	REVIEW	APPROVED	DATE
A	Initial Issue	 S Butland	 B Vasey	 R Houlihan	24-May-2016
1	Issued for Use	 B Vasey	 S Butland	 R Houlihan	28-July-2017
2	Issued for Use	 C Noble	 T Ennis John	 Z Zhang	11-Mar-2020

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## 1 INTRODUCTION

Karara Mining Limited (KML) is the operating company for Anshan Iron and Steel (Ansteel), owners of the Karara Iron Ore Project (the Project) which is located approximately 90 km east of the town of Morawa and 220 km inland from the port of Geraldton, Mid-West Gascoyne, Western Australia (Figure 1).

### 1.1 Abbreviations

A list of the terms referred to in this report is detailed in Table 1.

**Table 1: Abbreviations**

Term	Description
CAW	Construct and Alter Well licence
DWER	Department of Water and Environmental Regulation
GDE	Groundwater Dependent Ecosystem
GLOS	Groundwater Licence Operating Strategy
GWL	Groundwater Licence
KML	Karara Mining Limited
mbtoc	Metres below top of collar
SRMS	Scaled Root Mean Square
TEC	Threatened Ecological Community
the Project	Karara Iron Ore Project

### 1.2 Background

Construction of the borefield was completed in September 2010 by Connector Drilling Ltd under the supervision of Rockwater Pty Ltd. Water is transferred from the Yandanooka borefield via the raw water pipeline, which was commissioned in August 2012.

Groundwater abstraction commenced at Yandanooka in 2011. Water is used for magnetite ore processing and a potable supply for the Project. The borefield is situated on the Bundanoon and Mullaloo properties, located west of Yandanooka along the Yandanooka East road. Groundwater is abstracted from the Leederville-Parmelia aquifer, located within the Mingenew groundwater sub-area of the Arrowsmith Proclamation Area. Water is abstracted

**KARARA MINING LIMITED  
YANDANOOKA GROUNDWATER LICENCE OPERATING STRATEGY  
KARARA IRON ORE PROJECT**

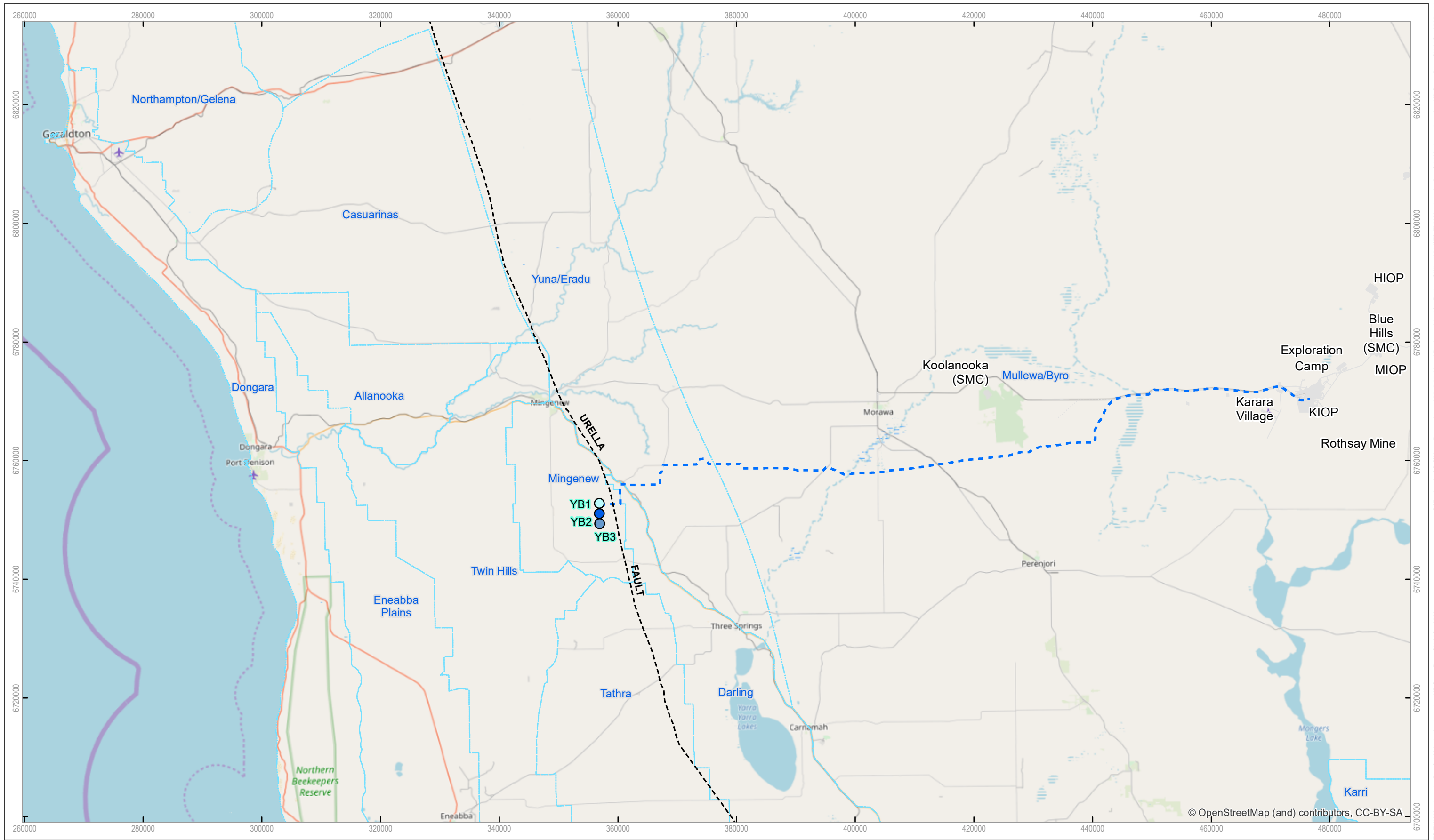
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under 5C Licences GWL170861 and GWL (TBC) issued by the Department of Water and Environmental Regulation (DWER).

This Groundwater Licence Operating Strategy (GLOS) supersedes the previous versions dated 26<sup>th</sup> August 2011 and 28<sup>th</sup> July 2017 for GWL170861. It has been updated primarily to:

- a) Reflect an increased entitlement of 5.4GL/yr
- b) Update the monitoring program and contingency plans.

Further updates to this GLOS will be in accordance with any approved changes required by the DWER, or as a result of a significant change to the development and operation of the Project.



19 February 2020  
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Figure 1  
**Yandanooka Borefield Location Setting (GWL 170861)**

- Legend**
- YB1
  - YB2
  - YB3
  - Urella Fault
  - Raw Water Pipeline
  - Current Mining Proposal Area
  - - - Ground Water Sub Areas

NORTH

0 20  
kilometres

1:600,000  
GDA 1994 MGA Zone 50

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## 2 ADMINISTRATIVE REQUIREMENTS

The required administrative arrangements to ensure compliance with this operating strategy are outlined below in Table 2. Scheduled reporting requirements will be prepared in accordance with the department’s Operational Policy 5.12 “*Hydrogeological Reporting Associated with a Groundwater licence*” (DWER, 2009). These reporting requirements are outlined in Table 3.

**Table 2: Administrative Requirements**

Details	Administrative Arrangement
Licensee	Karara Mining Limited
Address	Level 8, London House, 216 St Georges Terrace, Perth WA PO Box 7200, Cloisters Square WA 6850
Phone	(08) 6298 1888
Borefield name	Yandanooka
Borefield location	Lot 117 on Survey Plan P202782 (Certificate of Title 1323-591) Lot 146 on Survey Plan P203646 (Certificate of Title 1188-209)
Strategy duration	5 years
Review date	June 2024
Water year	1st July to 30 <sup>th</sup> June
Position responsible for implementing operating strategy	Zhiqian Zhang Manager Production Karara Mining Limited <a href="mailto:Zhiqian.Zhang@kararamining.com.au">Zhiqian.Zhang@kararamining.com.au</a>
General Contact	Trevor Ennis-John Principal Advisor Approvals and Compliance <a href="mailto:Trevor.Ennis-John@kararamining.com.au">Trevor.Ennis-John@kararamining.com.au</a>
Technical Contact	Craig Noble Superintendent Water Management <a href="mailto:Craig.Noble@kararamining.com.au">Craig.Noble@kararamining.com.au</a>

**Table 3: Scheduled Reporting Requirements**

Frequency	Requirements
Annual	<p>Submission of the annual groundwater report. The report shall include, as a minimum, the following:</p> <ul style="list-style-type: none"> <li>• All required monitoring data as outlined in this document, including groundwater levels, water quality and abstraction volumes;</li> <li>• An assessment of water levels against model predictions as agreed with the DWER;</li> <li>• A retrospective water balance for the operation;</li> <li>• An assessment of the borefield operation compliance with the Groundwater Licence Operating Strategy commitments;</li> <li>• An assessment of the borefield operation compliance with the Groundwater Licence (GWL) terms and conditions; and</li> <li>• Any proposed changes to the groundwater management.</li> </ul> <p>The annual groundwater report shall be submitted within three months of the completion of the water year.</p>
Triennial	<p>Triennial Aquifer Review will be submitted in place of the Annual Aquifer Review discussing the data for the previous three year period. The Triennial Aquifer Review shall include:</p> <ul style="list-style-type: none"> <li>• Long term trends for monitoring data, including groundwater levels, water quality and abstraction data;</li> <li>• An assessment of water levels against model predictions as agreed with the DWER;</li> <li>• A retrospective water balance for the operation;</li> <li>• An assessment of the borefield operation compliance with the Groundwater Licence Operating Strategy commitments;</li> <li>• An assessment of the borefield operation compliance with the Groundwater Licence (GWL) terms and conditions; and</li> <li>• Any proposed changes to the groundwater management.</li> </ul> <p>Triennial Aquifer Review shall be submitted within 3 months of the completion of the relevant water year (the next being in 2020).</p>

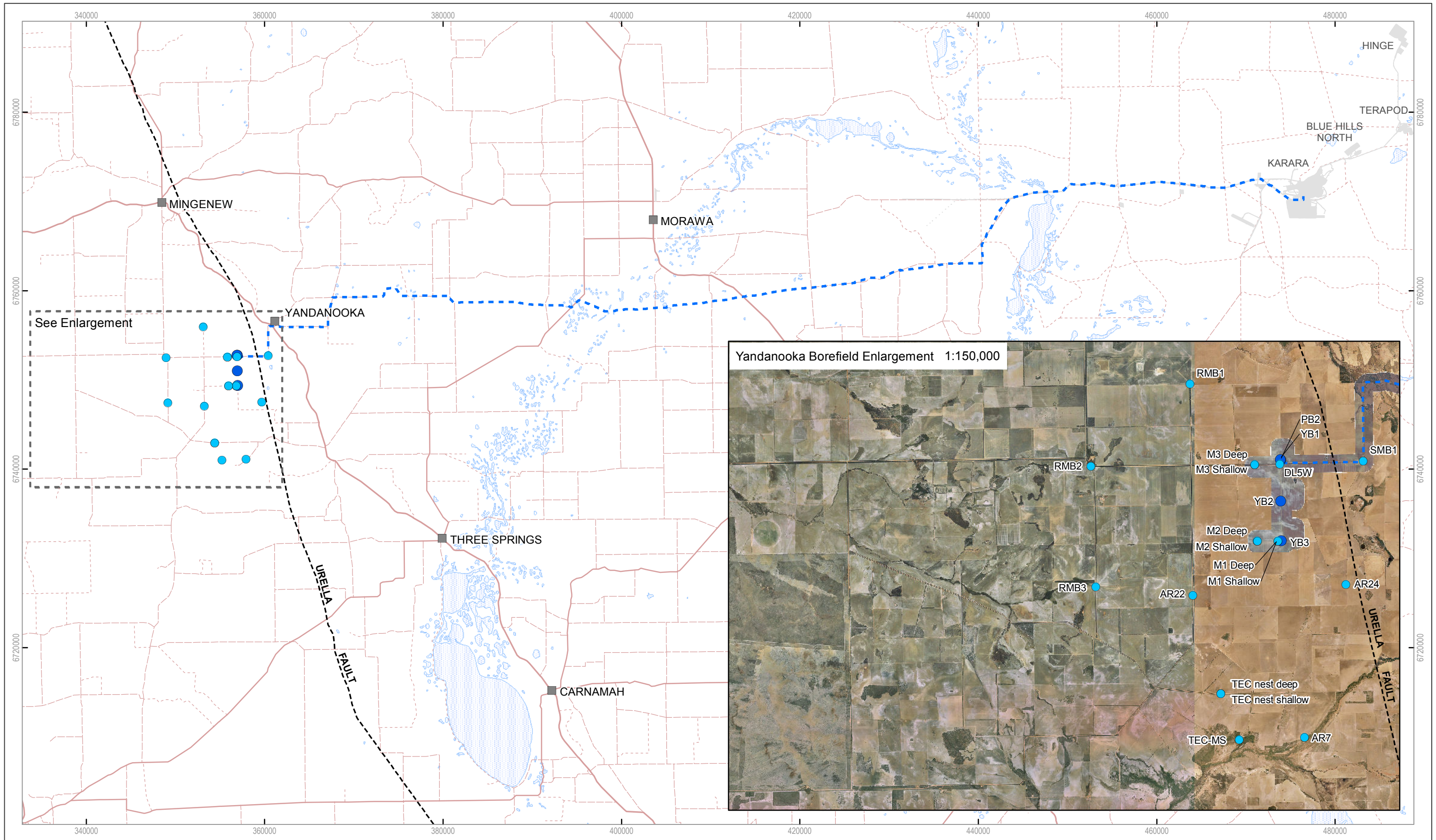
### **3 SCHEME DESCRIPTION**

The Yandanooka borefield consists of four production bores constructed under licenses CAW171228(1) and CAW1712214(1) and 16 monitoring points located at various sites within the Parmelia Aquifer and east of the Urella Fault. Each production bore was drilled and constructed by Connector Drilling Pty Ltd under the supervision of Rockwater Pty Ltd between August, 2007 and November, 2010. Bore details are outlined in Table 4.

**Table 4: Summary of Production Bore and Monitoring Bore Network**

Bore ID	mE (GDA94_50)	mN (GDA94_50)	ToC * (mAHD)	Casing DN (mm)	Cased Depth (mBGL)	Screened Interval (mBGL)	Aquifer	Purpose	Comment
AR22	353254.55	6747057.47	267.66	100	82	65.8-82	Parmelia	Monitoring	Water Corporation bore, Arrowsmith River
AR24	359688.95	6747510.15	287.59	100	96	89.9-96	Parmelia	Monitoring	Water Corporation bore, Arrowsmith River
DL5W	356904.86	6752565.69	299.69	100	108	102-108	Parmelia	Monitoring	DWER bore, Dongara line series. Next to YB1
M1 Deep	356835.22	6749333.75	299.72	50	177	141-177	Parmelia	Monitoring	West of YB3
M1 Shallow	356839.42	6749333.92	299.58	50	84	72-84	Parmelia	Monitoring	West of YB3
M2 Deep	355962.42	6749323.15	300.92	50	162	126-162	Parmelia	Monitoring	West of YB3
M2 Shallow	355965.72	6749323.15	300.94	50	90	78-90	Parmelia	Monitoring	West of YB3
M3 Deep	355856.07	6752541.31	307.94	50	152	116-152	Parmelia	Monitoring	West of YB1
M3 Shallow	355851.33	6752541.23	307.88	50	90	78-90	Parmelia	Monitoring	West of YB1
RMB1	353133.52	6755929.43	296.75	100	94	82-94	Parmelia	Monitoring	North of borefield
RMB2	348974.99	6752473.31	252.79	100	80	68-80	Parmelia	Monitoring	West of M3
RMB3	349174.85	6747413.74	239.13	100	64	48-58	Parmelia	Monitoring	West of M2
SMB1	360416.06	6752696.58	281.17	100	18	82-94	Parmelia	Monitoring	East of Urella fault
TEC-Deep	354427.78	6742916.11	265.69	100	150	138-150	Parmelia	Monitoring	Threatened Ecological Community bore
TEC-MS	355212.67	6740982.28	209.19	100	3.5	0.5-3.5	Parmelia	Monitoring	Threatened Ecological Community bore
TEC-Shallow	354428.92	6742916.92	265.74	100	64	52-64	Parmelia	Monitoring	Threatened Ecological Community bore
PB2	356947.02	6752741.13	297.70	206	201.5	99-199	Parmelia	Production	Production bore (Standby)
YB1	356937.34	6752754.24	297.66	203	197.8	100-197.8	Parmelia	Production	Production bore
YB2	356952.61	6751020.52	301.02	203	237	127.2-237	Parmelia	Production	Production bore
YB3	356971.91	6749349.80	299.29	203	197.5	112-197.5	Parmelia	Production	Production bore

*\* Bores were re-surveyed by HDT Surveys in December 2018, using RTK method*



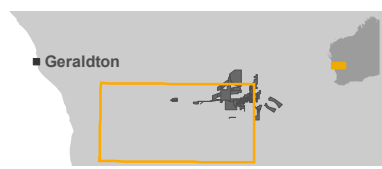
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Figure 2  
**Production and Monitoring Bore Locations (GWL 170861)**

**Legend**

- Locality
- Production Bore
- Monitoring Bore
- - - Urella Fault
- - - Raw Water Pipeline
- Current Mining Proposal Area
- Waterbody
- Principal Road
- Secondary Road
- - - Minor Road
- - - Track

NORTH  
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 kilometres  
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 GDA 1994 MGA Zone 50



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## **3.1 Conveyance System**

The conveyance system is designed to store and then transfer water from the Yandanooka borefield 150 km to the Karara beneficiation plant and raw water tanks at both the plant site and the Karara Village. The conveyance system consists of the following infrastructure.

### **3.1.1 Bulk Flow Conveyance Pipeline**

A bulk flow conveyance pipeline was constructed and commissioned in August 2011 to transport bore water from the Yandanooka borefield to the Karara site. The pipeline is constructed of 560 mm cement lined steel pipe. One pumping station is located at the Yandanooka borefield, to move the water from the storage tanks at the borefield to the Karara mine site.

### **3.1.2 Water Storage Facilities**

Water storage occurs at both the borefield and at the mine site.

Water is pumped from the bores directly to two 500 kL tanks located at the Yandanooka borefield. Each tank is fully enclosed to prevent evaporative loss and contamination of the water supply. From this source, the water is pumped to the mine site via the pump station.

At the beneficiation plant, raw water is firstly stored in two raw water tanks with excess water being diverted to the raw water storage dam. The raw water dam has a capacity of 24,360 kL and is fully lined. The raw water dam will hold approximately two days operational water supply.

## **3.2 Water Supply System**

Water supply for processing is sourced from the raw water tanks and transferred to the magnetite processing plant. Excess water from the thickening process is captured in the process water dam which has an approximate capacity of 45,000 kL. Once captured, the processed water is returned to the process water tanks where it can be utilised again in the beneficiation plant.

A number of features have been included in the beneficiation plant design to reduce water losses primarily within the dry tailings. These include tailings thickeners, dewatering screens and pressure filters. Due to limitations of the pressure filters, KML also operates both wet concentrate and wet tailings facilities. Water from these facilities is decanted and pumped back

to the process water dam for reuse in the processing circuit. Final moisture levels in the filtered tailings and concentrate are approximately 15% and 9% respectively.

### **3.3 Karara Village and Karara Site Potable Water System**

Abstracted water is pumped into a single 1,440 kL raw water tank located at the Karara Village and one 200 kL raw water tank located within the mine site. The purpose of the raw water tanks are to act as storage contingency in the event that supply from the borefield is temporarily interrupted. The raw water tanks will hold approximately two days operational water supply. At the village, raw water passes through a sand filter, an ultra violet (UV) treatment system and a chlorination system, prior to storage in the 1,440 kL potable water storage tank. At the mine site the raw water is passed through a UV system and is chlorinated prior to storage in two 300 kL potable water storage tanks. Due to the untreated quality of this water, desalination is not required at either location.

## 4 IDENTIFYING AND MANAGING IMPACTS

*Table 5: Summary of Potential Issues and Management*

Issue	Management Objective	Measurement	Management Response
The potential to adversely impact groundwater quality within the Leederville-Parmelia aquifer	Prevent significant changes to the quality of the aquifer as a result of abstraction	Salinity measurements monthly in operational production bores and M1, M2 and M3 deep and shallow	As per Section 6 of this document
Potential impacts to other users within the Leederville-Parmelia aquifer	Prevent significant changes to groundwater levels as a result of abstraction	Water levels measured and compared against model predictions as agreed with the DWER	As per Section 6 of this document
Potential impacts to Groundwater Dependent Ecosystems (GDE's) and Threatened Ecological Communities (TEC's) within the Leederville-Parmelia aquifer	Prevent significant changes to groundwater levels as a result of abstraction	Water levels measured in TEC-MS bore to be above 1.7 mbtoc.  Water levels measured and compared against model predictions as agreed with the DWER	As per Section 6 of this document

## 5 MONITORING REQUIREMENTS

The purpose of the monitoring program is to:

- Monitor for changes in water level and water quality resulting from groundwater abstraction at the Yandanooka Borefield on the Leederville-Parmelia Aquifer, other local aquifer users and the local GDEs and TECs;
- Validate the groundwater model predictions focusing on the impacts resulting from groundwater abstraction; and
- Verify abstraction volumes as per the annual water entitlement outlined in the Licence to Take Water granted by the Minister under Section 5C of the Rights in Water and Irrigation Act 1914.

Table 6, Table 7 and Table 8 provide a summary of the monitoring commitments for water use, water level monitoring and water quality monitoring.

All abstraction bores will be monitored through KMLs SCADA operating system but will also be verified by field readings each month. This allows KML to assess water abstraction rates against the water delivered at the processing plant and pump station, allowing early detection of discrepancies in flow rates. Flow meters located throughout the water delivery and distribution network are installed in accordance with the DWER Guidelines for Water Meter Installation (DWER, 2009). Flow meters on bores will be tested for accuracy and validated in-situ by a KML instrument technician every three years with data included in the Triennial Aquifer review with the next due by the 30<sup>th</sup> September, 2020.

**Table 6: Summary of Water Use Measurement**

Draw point	Meter Make	Meter Serial Number	Monitoring Frequency
YB1	Siemens	823301D221	Monthly
YB2	Siemens	822001D221	Monthly
YB3	Siemens	822101D221	Monthly
PB2	Siemens	822201D221	Monthly

**Table 7: Summary of Water Level Monitoring**

Bore ID	Monitoring Frequency
M1, M2, M3 Deep, M3 Shallow and DL5W	Monthly
TEC-MS and TEC-Deep, TEC-Shallow	Monthly
SMB1, RMB1, RMB2 and RMB3	Monthly
AR22 and AR24	Monthly

**Table 8: Summary of Water Quality Monitoring**

Bore ID	Parameter Monitored	Monitoring Frequency
YB1, YB2, YB3 and PB2	Major component analysis	Annually every June on operational bores only
YB1, YB2, YB3 and PB2	EC	Monthly
M1 Deep, M1 Shallow, M2 Deep, M2 Shallow, M3 Deep, M3 Shallow, TEC-Deep, TEC-Shallow, DL5W, SMB1, RMB1, RMB2, RMB3, AR22, AR24	EC	Monthly
TEC-MS	EC, pH and Redox	Monthly

## 5.1 Model Validation

KML, in consultation with the DWER, is committed to a continuous improvement process for the groundwater model. As such, KML will update the groundwater model with a target completion date of 6 months from the receipt of clear modelling objectives from the DWER and formal agreement on a suitable modelling approach. Following improvements to the model being completed, an approach to assess observed water levels against modelled water levels will then be agreed and adopted.

## 6 IMPACT MANAGEMENT AND CONTINGENCY PLANS

Groundwater abstraction at the Yandanooka borefield is operated in a way to prevent or minimise any potential for environmental impacts. A significant reduction in groundwater levels has the potential to impact on Groundwater Dependent Ecosystems (GDE's), Threatened Ecological Communities (TEC's) and other groundwater receptors by potentially lowering the groundwater levels and deleteriously affecting the groundwater quality. Works that have been conducted by KML to monitor these potential impacts include;

- Installation of monitoring bores adjacent to production bores, regionally and adjacent to identified GDEs and TECs;
- Proactively monitoring groundwater levels, groundwater quality and abstraction data; and
- Undertaking a detailed groundwater model to identify the potential impact on GDEs, TECs and other groundwater users.

### 6.1 Groundwater Levels – TEC-MS

Groundwater levels at TEC-MS will be monitored monthly and compared to a trigger level of 1.7 mbtoc, each time the groundwater level is measured and recorded. If this depth to groundwater is exceeded, the bore will be re-measured to validate, and if an exceedance is confirmed the DWER will be notified within 2 weeks. KML will carry out a hydrogeological assessment within 4 weeks of notifying the DWER (6 weeks after identifying the exceedance), with the objective to determine if any changes to abstraction patterns or other factors may have affected groundwater levels. If the cause for the exceedance is identified as being directly attributable to KML's abstraction, KML will liaise with the DWER within 2 weeks of completing the hydrogeological assessment to determine appropriate responses including any need for remedial actions.

### 6.2 Groundwater Salinity - TEC-MS, TEC-Deep and TEC-Shallow

Salinity values (measured as Electrical Conductivity, EC) are collected from each monitoring location as described in Table 8, and will be compared to historical trends to determine if there are significant salinity changes at each location.

Salinity trigger levels will be applied to monitoring bores TEC-MS, TEC-Deep and TEC-Shallow. An "indicator" level has been applied of 3000  $\mu\text{S}/\text{cm}$  and an "investigation" level of 4000  $\mu\text{S}/\text{cm}$  has been applied.

If the “indicator” level is exceeded for any sample in either of these bores, then:

- a) KML will immediately check sampling methodology and resample to validate accuracy of the initial reading;
- b) If the sample is confirmed to exceed the indicator level, is not an outlier and forms part of an increasing trend, then KML will complete an assessment of regional salinity trends within 30 days;
- c) If the increasing trend can be directly attributed to borefield abstraction, then KML will determine and implement measures to reduce its impacts on increasing salinity, such as constructing of additional bores, reducing abstraction and/or changing the abstraction regime.

If the “investigation” level is exceeded on any one sampling month the following actions would be undertaken;

- a) KML will immediately check sampling methodology and resample to validate accuracy of the initial reading;
- b) If the sample is confirmed to exceed the investigation level, is not an outlier and forms part of an increasing trend, then KML will complete an assessment of regional salinity trends;
- c) If the upward trend can be directly attributed to borefield abstraction, and remedial measures outlined above have been actioned with no reduction in the increasing salinity trend, then the following options would be discussed with the DWER;
  - (1) Reduce or stop abstraction until groundwater quality returns below threshold value.
  - (2) Find alternative water supplies

### **6.3 Groundwater Salinity - Other**

Salinity measurements as EC will be compared to historical monitoring trends each time the groundwater quality is measured and recorded (i.e. monthly);

If any of the monitoring bore salinity levels are trending in a continual upward direction (4 or more successive increases not determined to be outliers), KML will carry out a hydrogeological assessment with the objective to determine if any changes to abstraction patterns or other factors may have affected regional salinity increases.

If the cause for the exceedance is identified to be directly attributed to KML's abstraction, KML will liaise with the DWER within 2 weeks of completing of the hydrogeological assessment to determine appropriate remedial actions.

#### **6.4 Unexpected Aquifer Response to Other Users**

If a landholder within the Mingenew subarea reports that their groundwater supply has been affected, KML will provide all available data to the DWER, including groundwater levels, groundwater quality and daily abstraction rates.

Following the data review by the DWER, if it is identified that KML's abstraction is resulting in the degradation of a surrounding landholder's groundwater supply, KML and the DWER shall develop a remedial management plan. The plan shall detail measures to ensure a water supply for the affected landholder.

#### **6.5 Damaged or Broken Pipe**

- In the event of minor damage to the main Karara pipeline any leak will be controlled by temporary bunding, and the pipeline would be repaired as soon as possible;
- In the event of a major leak on the Karara pipeline, KML will inform the DWER and the borefield would be shut down until repairs are completed; and
- The details of any damage to the pipeline will be included in the annual monitoring report.

#### **6.6 Bore or Pump Failure**

- In the event of a bore or pump failing, the standby bore may be used.
- If two or more failures occur at the same time, individual bore pumping rates will be increased provided the increase is within the capacity of the pumps and drawdowns in the bores would not be excessive.
- If individual bore pumping rates cannot be increased the quantity of groundwater pumped from the borefield would be reduced until the bores or pumps are replaced.
- Any changes to abstraction will be described in the annual monitoring report.

## **7 WATER USE EFFICIENCY**

KML is committed to developing and submitting an Advanced Water Conservation and Efficiency Plan (WCEP) to the DWER by April 30<sup>th</sup> 2020, replacing the previous WCEP (KML, 2012). Once completed, KML will comply with the commitments listed in the Advanced WCEP.

## 8 SUMMARY OF COMMITMENTS

*Table 9: Summary of Commitments*

<b>Commitment</b>	<b>Due date</b>
Submit to the DWER Geraldton office a Groundwater Monitoring Review every three years commencing 2020, alternatively a Groundwater Monitoring Summary every year commencing 2021	30 Sept annually
Reports will be prepared in accordance with the DWER Operational policy 5.12 'Hydrogeological reporting associated with a groundwater well licence'	Ongoing
The DWER Geraldton office will be notified in writing should the observed groundwater level fall below the 1.7m threshold for TEC-MS	Ongoing
The DWER Geraldton office will be notified in writing should salinity in either TEC-MS, TEC-Deep and TEC-Shallow exceed the "investigation" level of 4000 $\mu$ S/cm and can be attributed to KML's abstraction	Ongoing
The DWER Geraldton office will be notified in writing of any unexpected salinity increases 6.3	Ongoing
The DWER Geraldton office will be notified in writing of any damaged or broken pipe leading to a major loss of water and the borefield would be shut down until repairs are completed	Ongoing

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