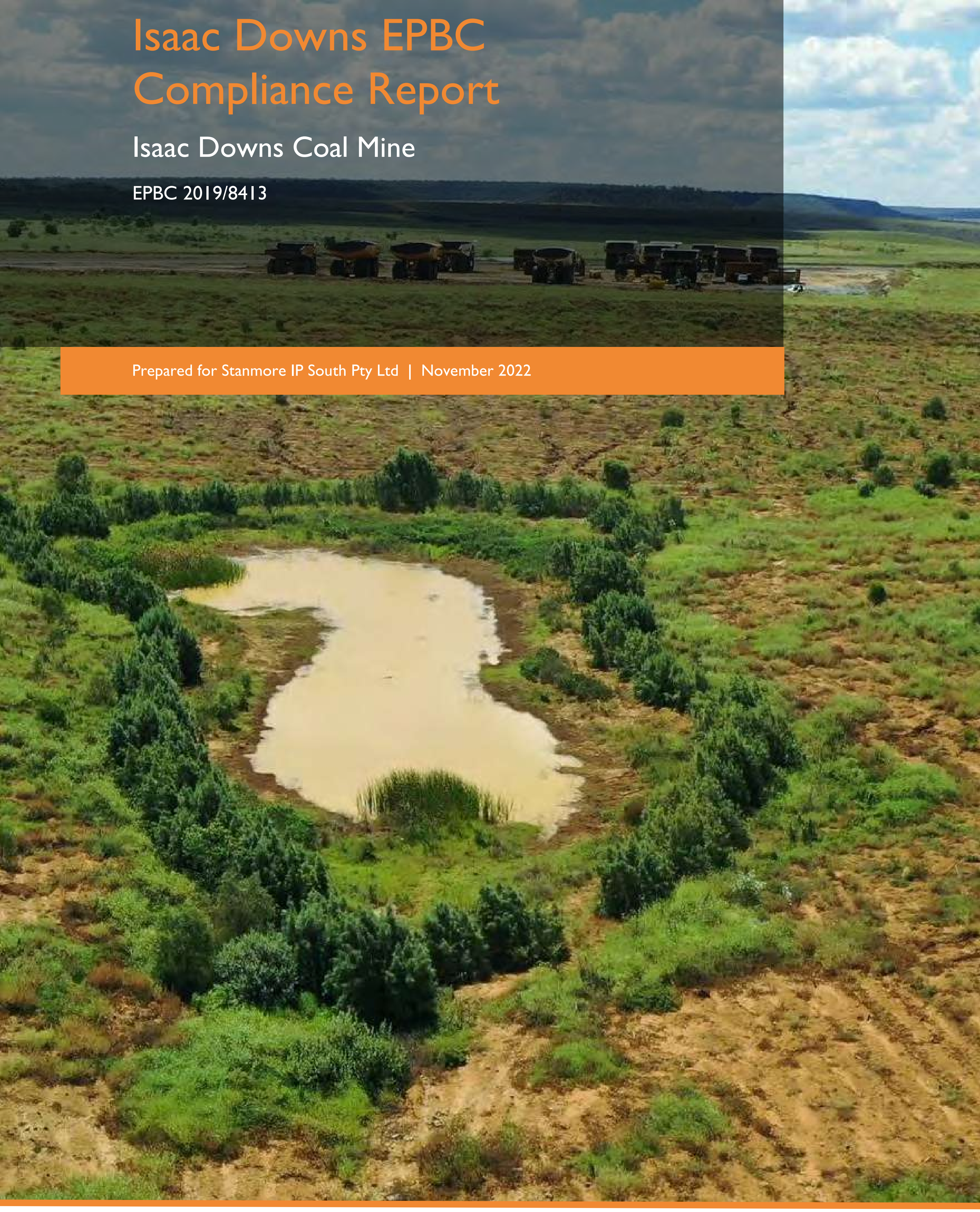
# Isaac Downs EPBC Compliance Report

## Isaac Downs Coal Mine

EPBC 2019/8413

Prepared for Stanmore IP South Pty Ltd | November 2022



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|---|---|
| Project number: | 22M029 |
| Document title: | Isaac Downs EPBC Compliance Report \| Isaac Downs Coal Mine |
| Revision: | V1-1 |
| Date: | 8 November 2022 |
| Client: | Stanmore IP South Pty Ltd |

| | |
|---|---|
| Project manager: | Justin Vohland |
| Author: | Anna Riddell / Justin Vohland |

| | | | |
|---|---|---|---|
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| Email: | jvohland@sgmenvironmental.com | | |

Honest | Trust | Innovation | Safety

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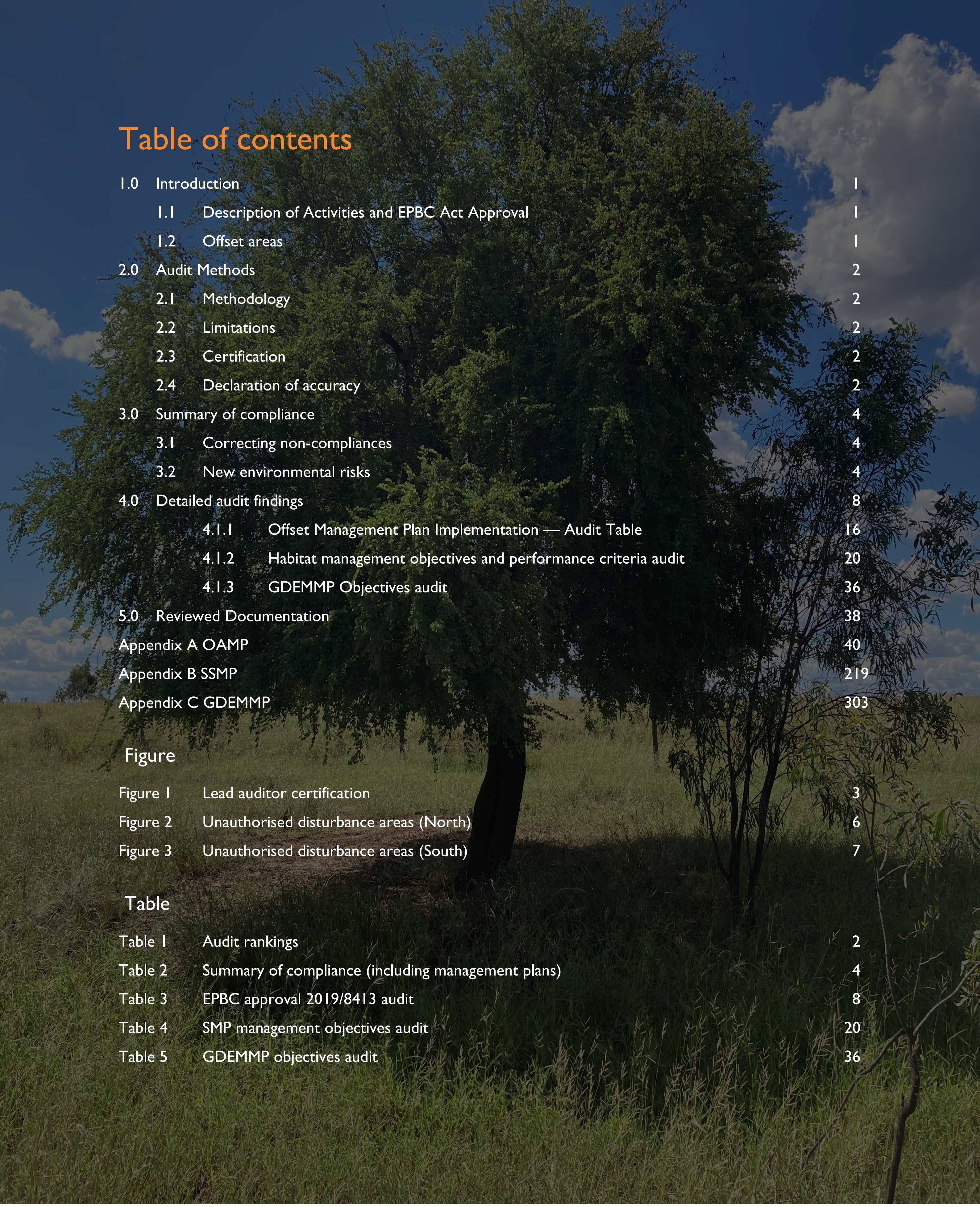
**Document history and status**

| Revision | Date | Description | By | Review | Approved |
|---|---|---|---|---|---|
| V0-1 | 02/11/22 | Final | A Riddell | J Vohland / D Mude | J Vohland/ D Mude |
| V1-1 | 08/11/22 | Revised | J Vohland | J Vohland / D Mude | J Vohland/ D Mude |



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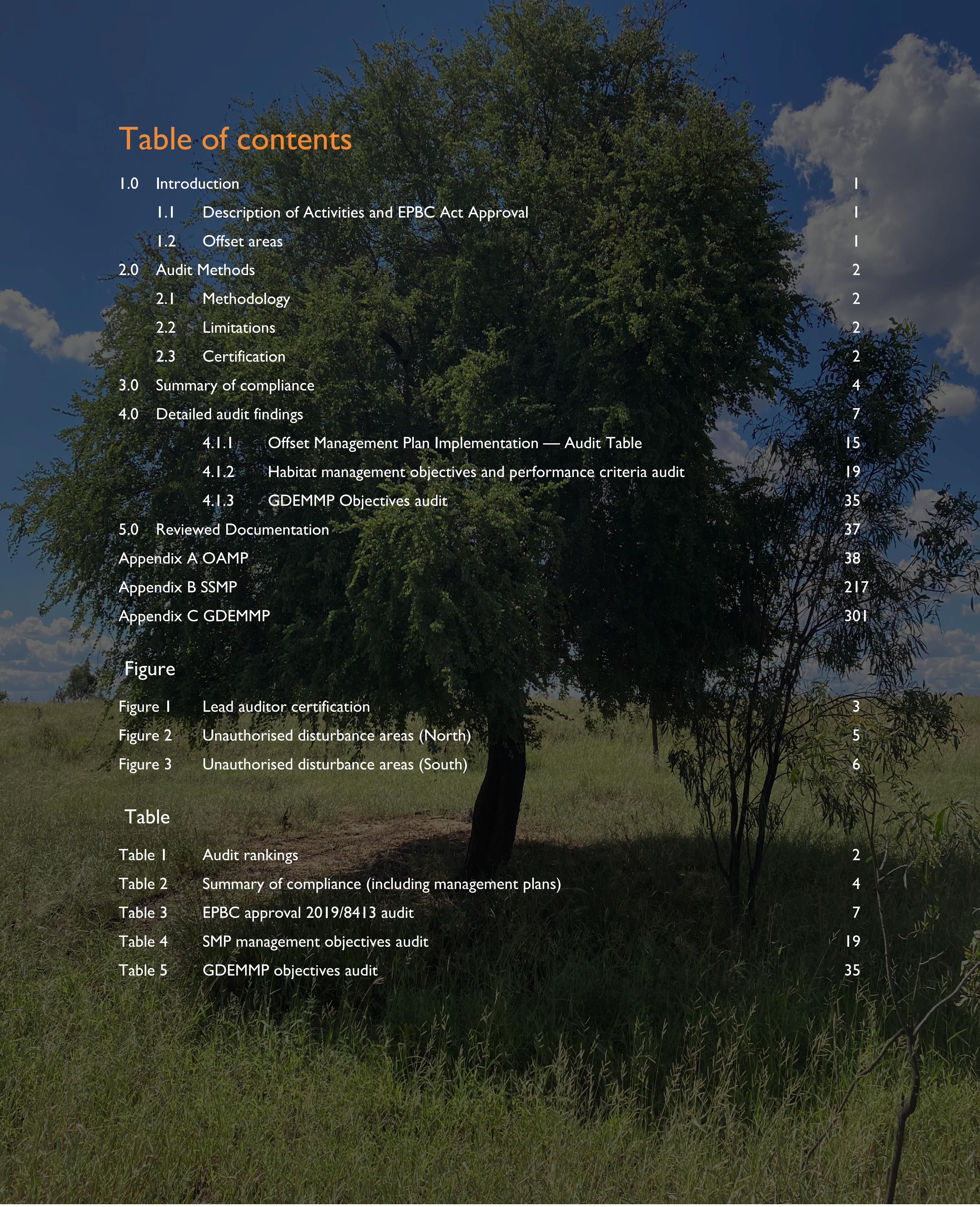

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# Important note about your report

This Report is provided for the exclusive use of the Client pursuant to the Scope of Works dated 16 May 2022, which requires us to provide Services relating to annual compliance reporting for Environmental Protection and Biodiversity Consecration approval.

This Report is provided to the Client on the terms and conditions set out in the Standard Terms of SGM Environmental (Mackay) Pty Limited (SGME, we, us or our).

We derive data in this Report from information (or confirmation of the absence thereof) sourced from the Client and their subcontractors, designated laboratories and / or information that has been made available in the public domain at the time or times outlined in this Report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the information and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this Report.

SGME has prepared this Report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to any applicable standards, guidelines, procedures and practices outlined in the Scope of Works as at the date of issue of this Report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this Report, to the extent permitted by law.

This Report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by SGME for use of any part of this Report in any other context.

Reporting of the Isaac Downs EPBC Compliance Report is based on a desktop assessment of data that has been measured by the client, their subcontractors and other third parties.

SGME does not accept any Liability whatsoever for, or in respect of, any use of, or reliance upon this Report by any person contrary to the above or our Standard Terms.

# 1.0 Introduction

Stanmore IP South Pty Ltd (Stanmore) engaged SGM Environmental (Mackay) Pty Ltd (SGME) to prepare the annual compliance report (the Report) for the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Approval for the Isaac Downs Project (EPBC 2019/8413).

The audit period is the 12-month period following commencement of the action being 9 August 2021 – 9 August 2022.

## 1.1 Description of Activities and EPBC Act Approval

The Isaac Downs Project is located 10 kilometres (km) south-east of Moranbah in central Queensland. The Project is approved by State and Commonwealth governments with residual impacts to Matters of National Environmental Significance (MNES) requiring offsets in accordance with the approval EPBC 2019/8413 issued on the 26 May 2021.

The approved action is:

"*To develop and operate an open cut coal mine and associated infrastructure approximately 10 km south-east of Moranbah, Queensland.*"

The approval contains requirements for offsets under the *EPBC Act Environmental Offsets Policy* (offset policy), including the development of an offset area management plan (OAMP), ornamental snake offset area management plan (OS-OAMP), significant species management plan (SSMP) and a groundwater dependent ecosystem management and monitoring plan (GDEMMP).

## 1.2 Offset areas

The requirements of the approval include two areas to offset impacts on habitat for the Koala (*Phascolarctos cinereus*), Greater Glider (*Petauroides Volans*), Squatter Pigeon (southern) (*Geophaps scripta scripta*) breeding habitat and foraging habitat and the Ornamental Snake (*Denisonia maculate*). Mt Spencer station (Lot 4 SP222438) has been selected as the location to meet the offset area required for the Koala, Greater Glider and Squatter pigeon. Nunbank Station (510 hectares (ha) within Lot 47 Plan LE167) was proposed as a location to meet the requirements for offsetting the impacts to the Ornamental Snake habitat. This area as not approved by the Department of Agriculture, Water and the Environment (DAWE). Work is continuing on a suitable offset area for the Ornamental Snake.

# 2.0 Audit Methods

**Table 1 Audit rankings**

| **Rankings** | **Description** |
|---|---|
| Compliant | Evidence or actions satisfy the requirements of the condition. |
| Non-Compliant | Evidence indicates that the requirements of the condition have not been met. |
| Not triggered | Condition has not been triggered during the audit period. |

## 2.1 Methodology

The audit was undertaken as a desktop assessment and a visit to Isaac Downs Mine on 31 October 2022.

## 2.2 Limitations

The report reflects the findings of the audit completed by desktop review of documentation supplied by Stanmore and questioning of Stanmore personnel.

## 2.3 Certification

The audit was conducted by Justin Vohland of SGME. Justin holds a Bachelor of Science (Environment) and a post graduate Diploma of Mining. He has worked within the mining industry for over twelve years in site management and consulting roles. Justin has conducted many formal and informal audits of mine sites in Australia and the United States over his career and is a qualified lead auditor (Figure 1). Given Justin's experience he is considered an appropriately qualified person to conduct audits.

## 2.4 Declaration of accuracy

A declaration of the accuracy of this compliance report is required to be signed by the approval holder.

*In making this declaration, I am aware that sections 490 and 491 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) make it an offence in certain circumstances to knowingly provide false or misleading information or documents. The offence is punishable on conviction by imprisonment or a fine, or both. I declare that all the information and documentation supporting this compliance report is true and correct in every particular. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.*

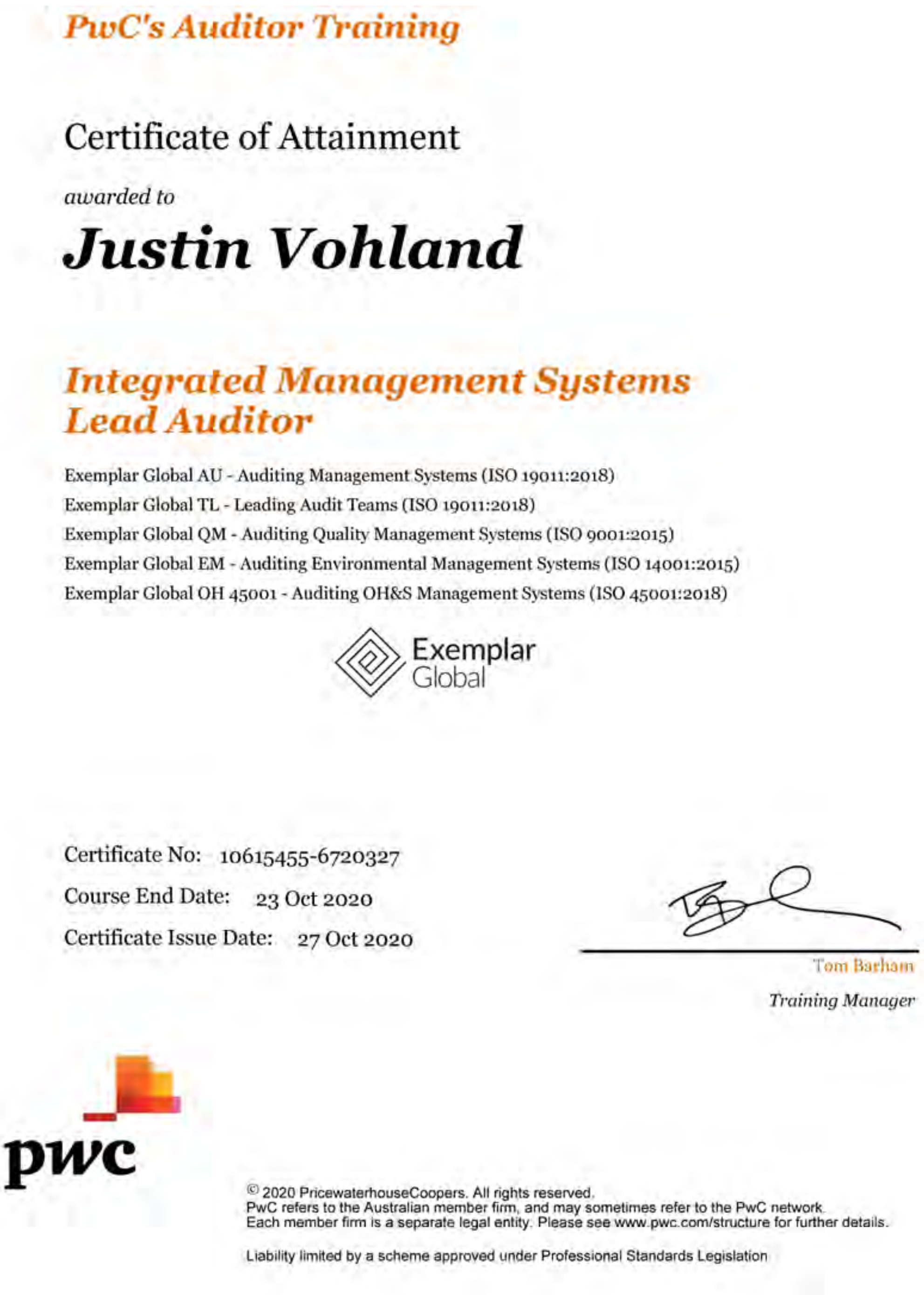
Signed ______________________________

Full name: Paddy Kearney

Position: General Manager Isaac Plains Complex

Organisation: Stanmore IP South Pty Ltd (ABN: 96 625 536 094)

Date: 9 November 2022



*PwC's Auditor Training*

Certificate of Attainment

*awarded to*

**Justin Vohland**

***Integrated Management Systems Lead Auditor***

Exemplar Global AU - Auditing Management Systems (ISO 19011:2018)
Exemplar Global TL - Leading Audit Teams (ISO 19011:2018)
Exemplar Global QM - Auditing Quality Management Systems (ISO 9001:2015)
Exemplar Global EM - Auditing Environmental Management Systems (ISO 14001:2015)
Exemplar Global OH 45001 - Auditing OH&S Management Systems (ISO 45001:2018)

Exemplar Global

Certificate No: 10615455-6720327
Course End Date: 23 Oct 2020
Certificate Issue Date: 27 Oct 2020

Tom Barham
*Training Manager*

pwc

**Figure 1 Lead auditor certification**

# 3.0 Summary of compliance

A summary of compliance is given in Table 2.

**Table 2 Summary of compliance (including management plans)**

| | Compliant | Non-compliant | Not triggered |
|---|---|---|---|
| Approval | 18 | 1[1] | 20 |
| Management plans | 15 | 1[1] | 6 |
| Total | 33 | 2 | 26 |

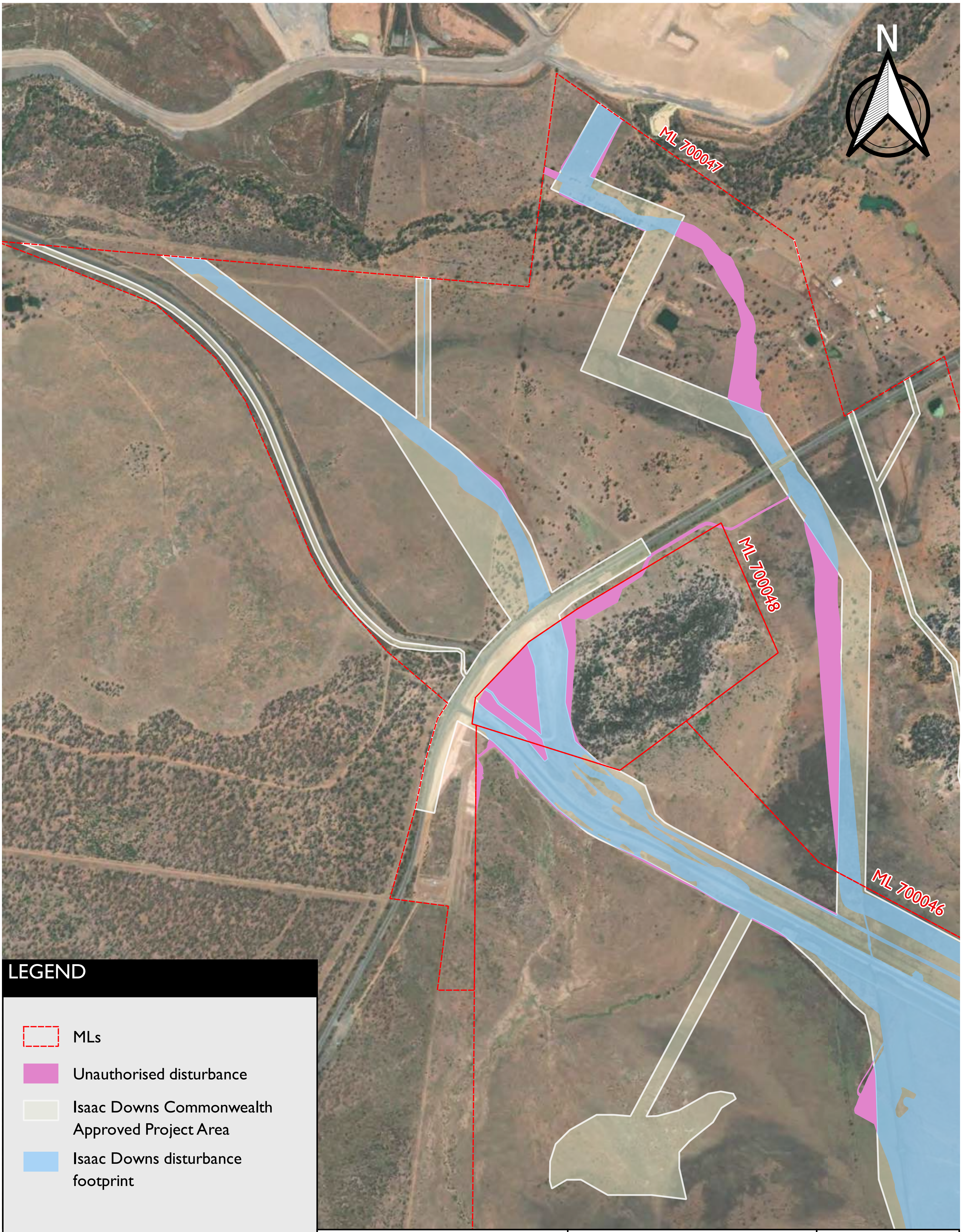
1. The non-compliance from the approval and management plans is the same incident being the clearing of land outside the permitted boundary.

## 3.1 Correcting non-compliances

A non-compliance with condition 1 (clearing outside of the approved area) was found during the audit. The non-compliance was reported to site personnel as part of the final version of the compliance report. The non-compliance will be reported to DAWE by site personnel as per condition 28. The nature, responsibility and timing of corrective actions will be determined following an investigation and liaison with DAWE.

## 3.2 New environmental risks

No new environmental risks have been identified during the audit. New or emerging risks will continue to be identified and managed as required.



## LEGEND

⬚ MLs

🟪 Unauthorised disturbance

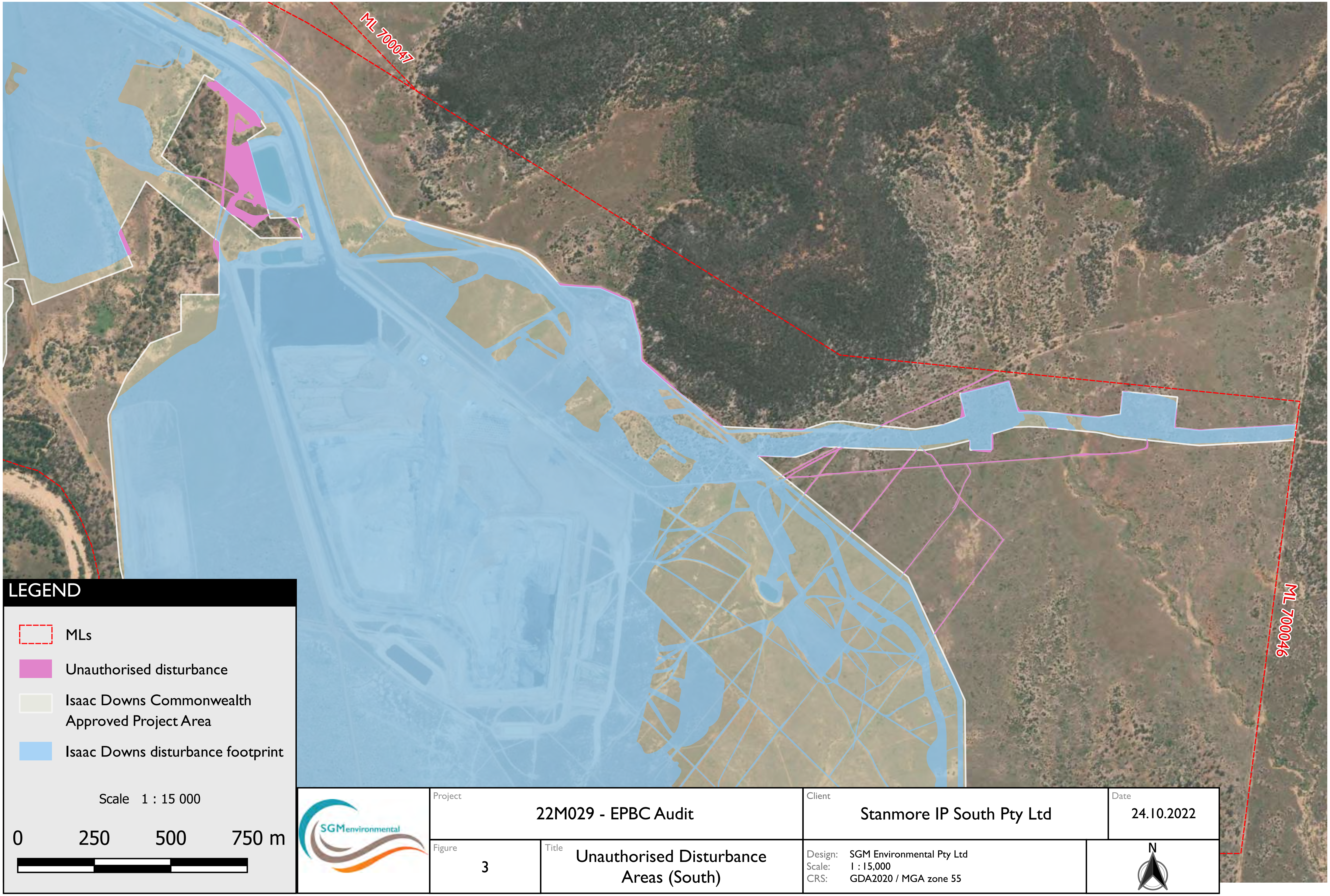
⬜ Isaac Downs Commonwealth Approved Project Area

🟦 Isaac Downs disturbance footprint

Scale 1 : 17 500

0 300 600 900 m

| | |
|---|---|
| Project | 22M029 - EPBC Audit |
| Client | Stanmore IP South Pty Ltd |
| Figure | 2 |
| Title | Unauthorised Disturbance Areas (North) |
| Design: | SGM Environmental Pty Ltd 03.11.2022 |
| Scale: | 1 : 17,500 |
| CRS: | GDA2020 / MGA zone 55 |



SGMenvironmental

| | | | |
|---|---|---|---|
| Project<br>22M029 - EPBC Audit | | Client<br>Stanmore IP South Pty Ltd | Date<br>24.10.2022 |
| Figure<br>3 | Title<br>Unauthorised Disturbance Areas (South) | Design: SGM Environmental Pty Ltd<br>Scale: 1 : 15,000<br>CRS: GDA2020 / MGA zone 55 | |

# 4.0 Detailed audit findings

**Table 3 EPBC approval 2019/8413 audit**

| Condition number | Condition | Findings | Compliance status |
|---|---|---|---|
| Part A | Conditions specific to the action | | |
| *Maximum impact limits* | | | |
| 1 | The approval holder must not impact beyond the limits of the Project area. | Total disturbance is 657.84 ha which is 519.03 ha below the total allowed under the approval.<br>Disturbance has occurred outside of the approved Project footprint. Disturbance outside the approved area is 27.0 ha. Of that area 1.26 ha is in MNES areas as shown in the below table.<br>**Species** – **Area (ha)**<br>Koala – 0.4<br>Squatter Pigeon (breeding) – 0.12<br>Squatter Pigeon (foraging) – 0.33<br>Greater Glider – 0.14<br>Ornamental Snake – 0.27<br>**Total** – **1.26**<br>The areas outside of approval limits are mostly associated with the dragline walk corridor and some infrastructure ie dams. The dragline walk corridor was altered to minimise disturbance to areas of established vegetation. The majority of the cleared area is existing grazing land. Rehabilitation has already been completed in most of these areas under the site *Erosion and Sediment Control Plan.*<br>Following notification of this non-compliance Stanmore will investigate the incident and liaise with DAWE on corrective actions.<br>**Evidence:** See Figure 2 and Figure 3 | Non-compliant |

<table>
<tr><th>Condition number</th><th>Condition</th><th>Findings</th><th>Compliance status</th></tr>
<tr><td>2</td><td>The approval holder must not impact more than:<br>a. 131.9 ha of Koala (<i>Phascolarctos cinereus</i>) habitat;<br>b. 120.9 ha of Greater Glider (<i>Petauroides volans</i>) habitat;<br>c. 66.6 ha of Squatter Pigeon (southern) (<i>Geophaps scripta scripta</i>) breeding habitat;<br>d. 55.5 ha or Squatter Pigeon (southern) (<i>Geophaps scripta scripta</i>) foraging habitat; and<br>e. 173.5 ha of Ornamental Snake (<i>Denisonia maculata</i>) habitat.</td><td>a. Compliant<br>b. Compliant<br>c. Compliant<br>d. Compliant<br>e. Compliant
<table>
<tr><th>Species</th><th>Permitted disturbance (ha)</th><th>Actual disturbance (ha)</th><th>Balance (ha)</th></tr>
<tr><td>Koala</td><td>131.9</td><td>24.45</td><td>107.45</td></tr>
<tr><td>Squatter Pigeon (breeding)</td><td>66.6</td><td>13.33</td><td>53.27</td></tr>
<tr><td>Squatter Pigeon (foraging)</td><td>55.5</td><td>9.16</td><td>46.34</td></tr>
<tr><td>Greater Glider</td><td>120.9</td><td>21.58</td><td>99.32</td></tr>
<tr><td>Ornamental Snake[1]</td><td>120</td><td>119.87</td><td>0.13</td></tr>
</table>
1. As per condition 5, only 120 ha of Ornamental Snake habitat may be cleared until the OS-AMP is approved by the Minister.<br><b>Evidence:</b> See table above.</td><td>Compliant</td></tr>
<tr><td colspan="4"><i>Environmental offset reports</i></td></tr>
<tr><td>3</td><td>To compensate for the impacts to habitat for listed threatened species up to the limits specified in condition 2.a to 2.d, the approval holder must, prior to the commencement of the action and for the duration of the approval, implement the Offset Area Management Plan (OAMP).</td><td>The OAMP was developed to support the referral of the Mine under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).<br><b>Evidence:</b> OAMP (2021), Offset Delivery Pan (ODP) (2021), Stanmore Offset Area July 1-September 30 2022 Activity Notes.</td><td>Compliant</td></tr>
<tr><td>4</td><td>To compensate for the impacts to Ornamental Snake (<i>Denisonia maculata</i>) habitat up to the limits specified in condition 2.e, the approval holder must submit an Ornamental Snake Offset Area Management Plan (OS-OAMP), prepared by a suitably qualified ecologist and consistent with the Environmental offsets policy, within 12 months of the date of the commencement of the action for the written approval of the Minister. The approval holder must implement the approved OS-OAMP, and provide written evidence to the department, within 6 months of the approval of the OS-OAMP.</td><td>The OS-OAMP was submitted to the department but it was not approved. Correspondence form DAWE on 17 June 2022 stated that Stanmore had fulfilled the obligation of submitting the OS-OAMP despite it not being approved as a suitable area.<br><b>Evidence:</b> OS-OAMP (2022), Confirmation with Stanmore representative: Richard Oldham.</td><td>Compliant</td></tr>
<tr><td>5</td><td>The approval holder must not impact more than 120 ha of Ornamental Snake (<i>Denisonia maculata</i>) habitat unless the OS- OAMP has been approved by the Minister in writing.</td><td>Total OS habitat disturbance 119.87 ha.<br><b>Evidence:</b> Observation of ID disturbance area mapping for the OS habitat. See Figure 2 and Figure 3.</td><td>Compliant</td></tr>
<tr><td>6</td><td>For every hectare of Ornamental Snake (<i>Denisonia maculata</i>) habitat impacted prior to approval of the OS-OAMP (ie prior clearance), the approval holder must provide an offset in addition to the offset for the total impact to Ornamental Snake (<i>Denisonia maculata</i>) habitat.<br>Note: Condition 6 requires the area of habitat to be input into the impact calculator of the Offsets assessments guide to be the total area of habitat impacted plus prior clearance (≤173.5 ha + prior clearance).</td><td>OS-OAMP was submitted but not approved by DAWE.<br><b>Evidence:</b> OS-OAMP (2022), Confirmation with Stanmore representative: Richard Oldham.</td><td>Not triggered</td></tr>
<tr><td colspan="4"><i>OS-OAMP</i></td></tr>
</table>

| Condition number | Condition | Findings | Compliance status |
|---|---|---|---|
| 7 | The approval holder must ensure the OS-OAMP required under condition 4 includes the following:<br>a. details to demonstrate how the offset(s) proposed compensates for the impacts to Ornamental Snake (*Denisonia maculata*) habitat and any prior clearance in accordance with the Environmental offsets policy;<br>b. a description of the offset(s), including location, size, condition, environmental values present and surrounding land uses;<br>c. relevant baseline data and other supporting evidence, including results from field validation surveys and quantifiable ecological data, that documents the presence or likely presence of the Ornamental Snake (*Denisonia maculata*) and the quality of the Ornamental Snake (*Denisonia maculata*) habitat within the offset area(s);<br>d. an assessment of the site habitat quality score(s);<br>e. details of how the offset area(s) will provide connectivity with other habitats and biodiversity corridors and/or will contribute to a larger strategic offset for the Ornamental Snake (*Denisonia maculata*);<br>f. a description and maps (including shapefiles) to clearly define the location and boundaries of the offset area(s), accompanied by the offset attributes (including physical address of the offset area(s), coordinates of the boundary points in decimal degrees and the size of the environmental offsets in hectares);<br>g. specific offset completion criteria derived from the site habitat quality score to demonstrate the improvement in the habitat quality score for Ornamental Snake in the offset area(s) over the period of effect of this approval;<br>h. details of the management actions (including timing, frequency, duration and method of outcome measurement), to be carried out to meet the offset completion criteria (the management actions proposed must be consistent with the Environmental management plan guidelines and the approved conservation advice);<br>i. interim performance targets that set targets at 5-yearly intervals for expected progress towards the completion criteria set in condition 7.g;<br>j. details of the nature, timing and frequency of monitoring to inform progress against achieving the interim performance targets (the frequency of monitoring must be sufficient to track progress towards each set of milestones, and sufficient to determine whether the offset area(s) is/are likely to achieve those milestones in adequate time to implement all necessary corrective actions);<br>k. timing for the implementation of corrective actions if monitoring activities indicate the interim performance targets have not been achieved;<br>l. a risk analysis and a risk management and mitigation strategy for all risks to the successful implementation of the OS-OAMP and timely achievement of the offset completion criteria, including for if the offset fails to achieve and maintain the completion criteria; and<br>m. the legal mechanism that will be used for legally securing the offset area(s), such that legal security remains in force over the offset area for at least the period of effect of this approval. | The OS-OAMP was submitted but not approved by DAWE.<br>**Evidence:** OS-OAMP (2022), Confirmation with Stanmore representative: Richard Oldham. | Not triggered |

| Condition number | Condition | Findings | Compliance status |
|---|---|---|---|
| 8 | Within 60 business days after the end of each 5-year period from the date of implementation of the OAMP, until the expiry of this approval, the approval holder must submit to the department, and publish on the website for the remainder of the period of the approval, a report that assesses progress towards achieving and maintaining the completion criteria specified in the OAMP and approved OS-OAMP. The report must:<br>a. detail performance achieved against all interim performance targets in the period since the date of implementation with more detail in respect of the period since the last report;<br>b. describe the results and effectiveness of all management actions implemented during the period the subject of that report;<br>c. include all monitoring results, including all confirmed sightings of listed threatened species in a format consistent with the Guidelines for biological survey and mapped data; and<br>d. detail any interim performance targets not met and describe all corrective actions taken and evaluate their effectiveness.<br>Once the completion criteria are achieved, they must be maintained by the approval holder for the remainder of the duration of this approval. | Not Triggered as the approval has been in effect for less than the 5-year implementation date.<br>OS-OAMP submitted but not approved by DAWE.<br>**Evidence:** Approval EPBC 2019-8413, OAMP (2021), OS-OAMP (2022), Confirmation with Stanmore representative: Richard Oldham. | Not triggered |
| 9 | Within 60 business days of the 20th anniversary of the date of implementation of the OAMP and the OS-OAMP, the approval holder must submit a report that provides evidence substantiating whether the offset area(s) has/have fully achieved and maintained the completion criteria. If all completion criteria have not been achieved within 20 years from the date of implementation of the OAMP and the OS-OAMP, the approval holder must provide, within 6 months, additional environmental offsets approved by the Minister in writing consistent with the Environmental offsets policy. | Not Triggered as the approval has been in effect for less than the 20-year implementation date.<br>**Evidence:** Approval EPBC 2019-8413. | Not triggered |
| *Legal securing of environmental offsets* | | | |
| 10 | The approval holder must legally secure the offset area(s) described in the OAMP and approved OS-OAMP within 12 months of the approval of the associated plan. The OAMP and approved OS-OAMP must be attached to the legal mechanism used to legally secure the associated offset area(s). | OAMP location secured.<br>OS-OAMP was not approved. Correspondence form DAWE on 17 June 2022 stated that Stanmore had fulfilled the obligation of submitting the OS-OAMP despite it not being approved as a suitable area.<br>**Evidence:** VDEC documents for OAMP (2022/000838), | Compliant |
| 11 | The approval holder must provide evidence to the department<br>within 5 business days of the legal mechanism being executed. | VDEC for OAMP location supplied.<br>**Evidence:** Email with VDEC documents sent to Michaela Ballard (DAWE) on the 26th May 2022. | Compliant |
| 12 | The legal mechanism used to legally secure the offset area(s) described in the OAMP and approved OS-OAMP must remain in force from the date of obtaining legal security and for at least the remaining period of effect of this approval. | Condition not triggered. | Not triggered |
| *Significant species management plan* | | | |
| 13 | The approval holder must implement the Significant Species Management Plan (SSMP) for the duration of mining activities. | A SSMP was prepared to support the referral for the ID project under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).<br>**Evidence:** Isaac Downs MNES SSMP. | Compliant |
| *Conservation of the Koala and Greater Glider in the Bowen Basin* | | | |

| Condition number | Condition | Findings | Compliance status |
|---|---|---|---|
| 14 | The approval holder must contribute a single payment equivalent to the value of $23,000 (GST exclusive and indexed in line with CPI on the date of this approval) to a program specified by the Minister in writing where the contribution will be used for the better protection and long-term conservation of the Koala (*Phascolarctos cinereus*) and Greater Glider (*Petauroides volans*) in the Bowen Basin. | Condition not triggered.<br>No program has been specified by the minister.<br>**Evidence:** Email chain between Stanmore and Vaughn Cox at DAWE. | Not triggered |
| 15 | Within 3 months of the date the Minister specifies the program described in condition 14, the approval holder must provide notice to the department, with documentary evidence, that the payment required under condition 14 has been made. | Condition not triggered. | Not triggered |
| *Groundwater dependent Ecosystems (GDEs)* | | | |
| 16 | The approval holder must implement the GDE Management and Monitoring Plan for at least the duration of this approval. | Plan implemented.<br>**Evidence:** GDEMMP Monitoring reports round 1-4 by 3d Environmental. | Compliant |
| 17 | The approval holder must submit a revised GDE Management and Monitoring Plan (GDEMMP) for the written approval of the Minister within 2.5 years from the date of this approval. The revised GDEMMP must be adjusted to include the raw baseline data and to set the trigger values and disturbance thresholds. The approval holder must implement the revised GDEMMP as approved by the Minister within 12 months of submitting to the Minister. | Condition not triggered for this audit period.<br>**Evidence:** Approval EPBC 2019-8413. | Not triggered |
| 18 | If the approval holder detects that a trigger value has been reached or exceeded, the approval holder must report this to the department within 5 business days of the detection. Unless evidence can be provided, to the Minister's satisfaction, that the trigger value exceedance is not attributable to mining activities, corrective actions must be implemented within 60 business days of the detection. | Condition not triggered for this audit period.<br>**Evidence:** Approval EPBC 2019-8413. | Not triggered |
| 19 | If corrective actions fail to halt or reverse impacts to GDEs within 24 months from the detection of a trigger level being reached or exceeded, and a disturbance threshold has been exceeded, the approval holder must submit a GDE Offset Strategy within 6 months for the written approval of the Minister. The approval holder must implement the approved GDE Offset Strategy within 12months of submitting to the Minister. | Condition not triggered for this audit period.<br>**Evidence:** Approval EPBC 2019-8413. | Not triggered |
| 20 | Provided no trigger value has been reached or exceeded under condition 18, resulting in the requirement for a GDE Offset Strategy under condition 19, the approval holder must, within 6 months of completing follow-up surveys, submit a report to the Minister that provides:<br>a. a summary memorandum detailing the current habitat quality score of the GDEs;<br>b. a comparison of the follow-up surveys to the baseline GDE dataset provided in the approved revised GDEMMP, to identify any significant departure from the habitat quality score and/or extent of GDEs when compared to these metrics prior to the commencement of the action; and<br>c. commitments to any future monitoring requirements. | Condition not triggered for this audit period.<br>**Evidence:** Approval EPBC 2019-8413. | Not triggered |
| Part B | Standard administrative conditions | | |
| *Notification of fate of the commencement of the action* | | | |
| 21 | The approval holder must notify the department in writing of the date of commencement of the action within 10 business days after the date of the commencement of the action. | **Evidence:** 9th August 2022 - Email from Stanmore personnel: Melanie Ballantine to Peter Blackwell (DAWE). Notification response from Michaela Ballard (DAWE). | Compliant |

| Condition number | Condition | Findings | Compliance status |
|---|---|---|---|
| 22 | If the commencement of the action does not occur within 5 years from the date of this approval, then the approval holder must not commence the action without the prior written agreement of the Minister. | Condition not triggered. Commencement occurred within 5 years. | Not triggered |
| *Compliance records* | | | |
| 23 | The approval holder must maintain accurate and complete compliance records. | **Evidence:** Review of Stanmore records for the Audit. | Compliant |
| 24 | If the department makes a request in writing, the approval holder must provide electronic copies of compliance records to the department within the timeframe specified in the request.<br>Note: Compliance records may be subject to audit by the department or an independent auditor in accordance with section 458 of the EPBC Act, and or used to verify compliance with the conditions. Summaries of the result of an audit may be published on the department's website or through the general media. | No request has been made as per advice from site personnel.<br>**Evidence:** Discussion with site personnel. | Compliant |
| *Submission and publications of plans* | | | |
| 25 | The approval holder must:<br>a. submit plans electronically to the department;<br>b. unless otherwise agreed to in writing by the Minister, publish each plan on the website within 20 business days of the date of:<br>i. this approval, if the approved version of the plan is specified in these conditions, or<br>ii. the date a plan has been approved by the Minister in writing, if the plan requires the approval of the Minister;<br>c. exclude or redact sensitive ecological data or commercial or personal data from plans published on the website or provided to a member of the public; and<br>d. keep plans published on the website until the end date of this approval. | a. Compliant<br>b. Compliant<br>c. Compliant<br>d. Compliant<br>**Evidence:**<br>a. Email correspondence showing submission of plans<br>b. Email correspondence confirming publishing of plans on the website<br>c. Reviewed published plans on website<br>d. Viewed published plans still on the website | Compliant |
| 26 | The approval holder must ensure that any monitoring data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under all plans is prepared in accordance with the Guidelines for biological survey and mapped data, or subsequent revision, and submitted electronically to the department in accordance with the requirements of those plans. | Monitoring data is collected in accordance with *Guidelines for biological survey and mapped data.*<br>**Evidence:** Review of monitoring reports states that data is prepared in accordance with the guideline. | Compliant |
| *Annual Compliance Reporting* | | | |

| Condition number | Condition | Findings | Compliance status |
|---|---|---|---|
| 27 | The approval holder must prepare a compliance report for each 12-month period following the date of commencement of the action, or otherwise in accordance with an annual date that has been agreed to in writing by the Minister. The approval holder must:<br>a. publish each compliance report on the website within 60 business days following the relevant 12-month period;<br>b. notify the department by email that a compliance report has been published on the website and provide the weblink for the compliance report within five business days of the date of publication;<br>c. keep all compliance reports publicly available on the website until this approval expires;<br>d. exclude or redact sensitive ecological data or commercial or personal data from compliance reports published on the website; and<br>e. where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the department within 5 business days of publication.<br>Note: Compliance reports may be published on the department's website. | a. Not triggered — this is the first compliance report;<br>b. Not triggered — this is the first compliance report;<br>c. Not triggered — as above;<br>d. Not triggered — as above; and<br>e. Not triggered — as above. | Not triggered |
| *Reporting non-compliance* | | | |
| 28 | The approval holder must notify the department in writing of any: incident; non-compliance with the conditions; or non-compliance with the commitments made in plans. The notification must be given as soon as practicable, and no later than two business days after becoming aware of the incident or non-compliance. The notification must specify:<br>a. any condition which is or may be in breach;<br>b. a short description of the incident and/or non-compliance; and<br>c. the location (including co-ordinates), date, and time of the incident and/or non-compliance. In the event the exact information cannot be provided, provide the best information available. | Condition not triggered during this audit period. Unauthorised clearing as per condition 1 is required to be reported however the obligation to notify falls outside the audit period. | Not triggered |
| 29 | The approval holder must provide to the department the details of any incident or non-compliance with the conditions or commitments made in plans as soon as practicable and no later<br>than 10 business days after becoming aware of the incident or non-compliance, specifying:<br>a. any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future;<br>b. the potential impacts of the incident or non-compliance; and<br>c. the method and timing of any remedial action that will be undertaken by the approval holder. | Condition not triggered during this audit period. | Not triggered |
| *Independent audit* | | | |
| 30 | The approval holder must ensure that independent audits of compliance with the conditions are conducted when requested in writing by the Minister. | Condition not triggered during this audit period.<br>**Evidence**: Confirmation with site personnel Dante Mude. | Not triggered |

| Condition number | Condition | Findings | Compliance status |
|---|---|---|---|
| 31 | For each independent audit, the approval holder must:<br>a. provide the name and qualifications of the independent auditor and the draft audit criteria to the department;<br>b. only commence the independent audit once the audit criteria have been approved in writing by the department; and<br>c. submit an audit report to the department within the timeframe specified in the approved audit criteria. | Condition not triggered during this audit period.<br>**Evidence:** Not required | Not triggered |
| 32 | The approval holder must publish the audit report on the website within 10 business days of receiving the department's approval of the audit report and keep the audit report published on the website until the end date of this approval. | Condition not triggered.<br>**Evidence:** Not required | Not triggered |
| *Revision of action management plan* | | | |
| 33 | The approval holder may, at any time, apply to the Minister for a variation to a plan approved by the Minister, or as subsequently revised in accordance with these conditions, by submitting an application in accordance with the requirements of section 143A of the EPBC Act. If the Minister approves a revised plan, the approval holder must then, from the date specified, implement the revised plan in place of the previous plan. | Condition not triggered during this audit period. | Not triggered |
| *Completion of action* | | | |
| 34 | Within 20 business days after the completion of the action, the approval holder must notify the department in writing and provide completion data. | Condition not triggered for this audit period. | Not triggered |

### 4.1.1 Offset Management Plan Implementation — Audit Table

| Habitat management objectives | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions | SGME comments | Compliance status |
|---|---|---|---|---|---|---|
| Habitat or vegetation loss through unplanned land clearing | • No unapproved and/or intentional clearing of vegetation within the offset area, except for clearing that is required for fencing, access, firebreaks or public safety.<br>• Signs and fences will be erected within three months of the offset being legally secured. They will be erected at all entrances and potential access points to the site identifying the area as an environmental offset and stating that access to the site is forbidden.<br>• Fences will be maintained to prevent unauthorised access, to minimise incursions by feral herbivores and to control stock presence<br>• Ecological thinning may be carried out, but only in accordance with the advice of a suitably qualified expert and only as approved by DAWE. | • Any activities that are in contravention of the Voluntary Declaration.<br>• Detection of damaged fences associated with vehicle access roads/tracks<br>• Detection of prohibited forestry operations, native timber harvesting or clearing outside of established access tracks, fire control lines and fence lines (existing infrastructure). | • Monitoring and inspections will monitor and document if there is evidence of recent forestry or timber harvesting activities or illegal clearing.<br>• Monitoring will also document vegetation clearing that has occurred for fire break, access road or fence line maintenance.<br>• Refer to Section 7.0 for detail on required monitoring.<br>• The annual compliance report will document any illegal/ unauthorised land clearing. | • Notify the Department within 10 business days of clearing<br>• Upon being notified or becoming aware of prohibited forestry operations, native timber harvesting or clearing outside of existing infrastructure, the landholder is to assess how unauthorised persons accessed the site<br>• Review existing access restrictions and inspect signage and offset area fencing within one fortnight of detection of the clearing.<br>• Corrective actions will be implemented immediately (eg the regeneration of those areas will be undertaken, and these areas added to the ongoing monitoring sites) and if appropriate the OAMP will be revised and updated if required.<br>• Any changes to the OAMP will be reported to the Minister for approval prior to changes in management. | No unplanned clearing has occurred in the audit period.<br>Details will be provided in the first OAMP monitoring report. | Compliant |

| Habitat management objectives | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions | SGME comments | Compliance status |
|---|---|---|---|---|---|---|
| Control invasive weed species to reduce impacts on MNES from an overdominance of non-native floristic abundance in the understorey. | • Access to the offset site will be restricted to authorised persons only.<br>• Weed management and weed hygiene restrictions will be implemented across the offset site to reduce the extent of existing weeds and to control the potential introduction of other exotic weed species.<br>• Weed hygiene and management will be undertaken in consultation with the landowner.<br>• Chemical and/or mechanical control of declared weed species will be undertaken in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets or other sources of information.<br>• Refer to Section 6.7 for further details on weed management. | • An increase in the average percent (%) cover score of weed species from baseline and/or previous monitoring events.<br>• Outbreak of infestations of weed species not previously recorded in the offset area during baseline and/or previous monitoring events.<br>• An increase in the presence of weeds (relative abundance and/or area of occurrence) as determined from photo monitoring results.<br>• An interim performance target is not attained, or a completion criterion is not attained and/or maintained. | • Monitoring of weeds and non-native plants will be undertaken during the habitat quality assessment surveys using the same methodology used to the baseline habitat quality as outlined Section 4.1 of this OAMP and EcoSM, 2020a, as well as incidental observations as part of routine management.<br>• The annual compliance report will document the presence of weeds, weed control measures and extent of weed cover during the reporting period, and the relevant responsive actions. | • Any increase in the relative abundance of invasive or other weed populations from those recorded during the baseline survey, or subsequent monitoring events will trigger the following corrective actions that must be undertaken:<br>– Review adherence to current weed hygiene procedures to ensure compliance and to update restrictions.<br>– Review timing and frequency of weed management measures, and implement alternative weed management timeframes.<br>– Investigate alternative weed management control actions (eg spot spraying and/or injection of herbicides) and implement.<br>– Undertake additional weed management measures until weed populations are reduced.<br>• Suitably qualified ecologist to review the OAMP within one month and update if required. | Annual OAMP compliance report not triggered.<br>Monitoring methodology for weeds provided in section 7.5 of the OAMP. | Not triggered |

| Habitat management objectives | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions | SGME comments | Compliance status |
|---|---|---|---|---|---|---|
| Strategic cattle grazing to reduce and manage understorey fuel loads and, native and non- native flora densities. | • Stock management will be undertaken in consultation with the landowner and as required to achieve the performance objectives and completion criteria.<br>• If and where new fencing is required to demarcate the offset area, ensure fencing is permanent and prohibit unintended grazing by cattle.<br>• Squatter Pigeon breeding period can vary depending on localised site conditions but generally peaks in the early to mid-dry season (May-July). Grazing will be excluded during the peak Squatter Pigeon breeding and egg laying periods in the early to mid-dry season. | • Livestock located in the offset areas outside of strategic grazing events.<br>• Livestock located in the offset areas during breeding season (May to and including July).<br>• Damaged fencing is observed<br>• Habitat Quality assessments indicate native grass groundcover is <30% or<br>• >55%.<br>• If ecological surveys indicate an extended or varied peak breeding period outside the early to mid-dry season. | • Regular inspections of the offset area will be undertaken during normal land management and farming practices to examine fence lines when stock are grazing in the offset area and/or adjacent to the offset area.<br>• Records will be kept of when and how many cattle graze in offset areas.<br>• Regular inspections will be undertaken to assess signs of overgrazing and pugging.<br>• Habitat quality assessments will be undertaken in accordance with this OAMP and will include assessment of percentage cover of native perennial grasses. | • Amend livestock management practices including amendment of stocking rates, and/or timing, and/or duration and/or frequency of strategic grazing events until native grass cover is >30% <55%.<br>• Repair offset area boundary fencing if damaged within one week of detection.<br>• Removing stock when excessive pugging or overgrazing is observed such that native grass cover is <30%.<br>• Remove stock from Squatter Pigeon breeding habitat where found to be grazing in Squatter Pigeon breeding season.<br>• Construct additional fencing if required.<br>• Should monitoring activities identify triggers for further action, the OAMP will be reviewed by a suitably qualified ecologist within one month and updated if required.<br>• Any corrective action identified will be implemented within 1 month of the OAMP being updated. | • Offset area is selectively grazed.<br>• Stock excluded May – July as per the *July 1 – September 30: 2022 Activity Notes*<br>• Fencing inspected as per quarterly activity notes | Compliant |
| Reduce the risk of unplanned fire causing adverse impacts to MNES by strategic fire management. | • Controlled burns will be undertaken in consultation with the landowner and in accordance with the recommended fire management guidelines for Regional Ecosystems and will involve a range of burn strategies including patchwork burns.<br>• Fire is to be excluded from the offset area except for planned and strategic burns as required to reduce understorey fuel loads having a detrimental impact on canopy tree recruitment and | • Unplanned fire within the offset area.<br>• Planned fires become out of control or the required burning regime is not achieved.<br>• Habitat Quality assessments indicate native grass groundcover is <30% or >55%. | • Fire breaks are to be inspected annually in September<br>• Visual inspection of signs of fire during routine land management and during the habitat quality assessments.<br>• Fuel loads will be monitored through monitoring of ground cover and to inform fire management strategies | • Occurrences of fire are to be recorded during the visual inspections undertaken during routine land management.<br>• If an uncontrolled bushfire has impacted the offset area (including if controlled burning becomes out of control), review the grazing management and fire management strategies and adherence to these strategies and exclude cattle for at least three months (depending on | No controlled burns were recorded in the audit period. Fire breaks are in place and inspected. | Not triggered |

| Habitat management objectives | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions | SGME comments | Compliance status |
|---|---|---|---|---|---|---|
| | establishment and to maintain existing fire breaks.<br>• Create firebreaks around the offset area boundary to minimise unplanned fire from adjacent lands.<br>• Firebreaks are to be co- located, where possible, with roads, fence lines and vehicle access tracks. No areas of MNES will be cleared unless necessary for safety management and without consideration to the impacts and Department requirements (ie habitat areas are not reduced). | | | conditions for re-growth). All fire breaks will be inspected, maintained, and repaired if required.<br>• To ensure compliance, with performance criteria, undertake remedial action including:<br>− Alteration to stocking rates, and/or duration and frequency of strategic grazing events; and/or<br>− Amendments to fire management practices as required including fire safety and containment management.<br>• Suitably qualified ecologist to review the OAMP within one month and update if required. | | |
| Habitat degradation and direct impact to MNES due to unauthorised access to offset site. | • All signs and fences will be erected within three months of the offset being legally secured.<br>• Signs will be erected at all entrances and potential access points to the site stating that access to the site is forbidden.<br>• Fences will be maintained to prevent unauthorised access, to minimise incursions by feral herbivores and to control stock presence. | • Evidence of unauthorised or unplanned access by persons, vehicles, and/or stock is detected during exclusion periods.<br>• Evidence of stock is detected at any point during exclusion times.<br>• Damage is detected to any fence or sign. | • Monitoring of fence lines will be undertaken by the Landholder or suitable qualified person appointed by the approval holder within 3 months of the offset area being legally secured and during quarterly inspections.<br>• Inspections will monitor and document damage or loss of signs and evidence of unauthorised access to the offset area. | • Upon being notified or becoming aware of prohibited access to the offset area, the approval holder is to reassess access protocols for any lessees etc., signage and general access within one fortnight.<br>• Damage to signage and fences will be repaired within one month of noting the damage.<br>• If there are areas that have been negatively impacted by unauthorised access, the regeneration of those areas will be undertaken, and these areas added to the ongoing monitoring sites.<br>• Signage will be repaired and maintained as required by the Landholder or suitable qualified person appointed by the approval holder. | No authorised access to the offset was recorded in the audit period. Signs and fencing were installed within three months of securing the offset. | Compliant |
| Offset fails to achieve the interim performance targets and completion criteria within the anticipated 5, 10, 15 and/or 20- year time intervals. | • All management actions outlined in this OAMP will be implemented to ensure that the interim performance targets and competition criteria are achieved. | • Interim performance targets are not achieved by year 5, 10 or 15.<br>• Completion criteria are not achieved by year 20. | • Habitat quality score assessments will be undertaken for each 5-year period, as a minimum.<br>• Monitoring of the offset area will be undertaken in accordance with | • Habitat quality score assessments will be interim performance targets or the completion criteria were not achieved within the specified timeframes. This investigation | Annual OAMP compliance report not triggered.<br>VDEC provided as evidence by Stanmore. | Not triggered |

| Habitat management objectives | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions | SGME comments | Compliance status |
|---|---|---|---|---|---|---|
|  | • The Voluntary Declaration under the VM Act will ensure that the landholder remains obliged to undertake active management of the offset until all completion criteria are achieved.<br>• Monitoring will continue for the life of the approval to ensure that completion criteria have been met and maintained. |  | the methods outlined in this OAMP.<br>• Monitoring results will be compared against the interim performance targets and completion criteria to assess progress of offset area in achieving the requirements of this OAMP. | must re- evaluate the suitability of the relevant management actions and identify appropriate corrective actions.<br>• As soon as practicable, and within six months of detection of the trigger, implement revised corrective actions. These may include (but not limited to):<br>• Increasing the frequency and intensity of pest animal and weed control measures or revising the type of measures to be implemented.<br>− Modify fire management measures, to better support enhancement of offset values.<br>− If the investigation outlined above requires changes to the management actions, then as soon as possible, and within six months of detection of the trigger, implement a revised<br>− OAMP, as approved by the Minister, incorporating those recommended changes.<br>• Additional offsets will need to be sought by the approval holder, and approved by the Minister, should the above corrective actions not be successful. |  |  |

### 4.1.2 Habitat management objectives and performance criteria audit

**Table 4 SMP management objectives audit**

| SMP management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions | SGME comments | Compliance status |
|---|---|---|---|---|---|---|---|
| Limit or avoid loss of MNES and/or<br>habitat for MNES. | • Clearing of habitat for MNES does not occur outside of the approved | • Infrastructure will be sited in accordance with the State and | • Clearing of MNES habitat exceeds the approved disturbance | • Fauna Spotter will monitor, and record | • Should clearing of habitat for MNES exceeds the approved disturbance | • This audit has identified unauthorised clearing has occurred at the Mine | Non-compliant |

| SMP management objectives | **Performance criteria** | **Management and mitigation measures** | **Trigger for further action** | **Monitoring** | **Corrective actions** | **SGME comments** | **Compliance status** |
|---|---|---|---|---|---|---|---|
|  | and proposed disturbance footprints.<br>• No net loss of habitat for the Koala and Greater Glider outside of the approved disturbance limits.<br>• No net loss of permanent water sources for the Squatter Pigeon outside of the approved disturbance limits.<br>• No net loss of habitat for the Squatter Pigeon outside of the approved disturbance limits.<br>• No net loss of Ornamental Snake foraging resources outside of the approved disturbance limits.<br>• No net loss of foraging habitat for the Black-faced Monarch and Satin Flycatcher outside of the approved disturbance limits.<br>• Rehabilitation of disturbed areas will be rehabilitated in accordance with the Project's Rehabilitation Management Plan. | Commonwealth approval conditions.<br>• Areas requiring vegetation removal will be clearly delineated to ensure disturbance to areas being retained is avoided. Limits of clearing are to be delineated using barricading or temporary fencing and signage prior to works commencing. Exclusion areas are to be clearly shown and labelled on all operational and management drawings and plans. GIS shapefiles will be provided to clearing personnel and/or contractors prior to the commencement of clearing operations.<br>• Where exclusion fencing is required, consideration shall be given to fauna movement, current land uses and worker safety requirements.<br>• Permanent water sources for retention such as farm dams outside of the disturbance limits will be clearly delineated and shown and labelled on all operational and management drawings and plans<br>• Avoid where possible and within the constraints of the mining schedule, impacting on MNES habitat during breeding periods through timing of clearing and creek disturbance activities to avoid the main breeding | limits in Table 1 of this SSMP and/or occurs outside of any approved disturbance limits.<br>• Disturbance to permanent water sources, which may provide habitat for Squatter Pigeons and Ornamental Snakes, outside of the disturbance areas.<br>• Rehabilitation and decommissioning fails to meet the objectives of the Rehabilitation Management Plan. | clearing activities and all fauna encountered.<br>• The Environmental Officer (EO) will monitor and record the total area of MNES habitat cleared every quarter and assess against the disturbance limits outlined in Table 1 of this SSMP.<br>• Auditing of the Permit to Disturb will be undertaken quarterly by the EO to ensure any disturbance has been undertaken in accordance with the requirements of the Permit to Disturb, this SSMP and approval conditions and to ensure no unauthorised disturbance has occurred.<br>• Rehabilitation monitoring will be undertaken in accordance with Rehabilitation Monitoring Plan that will be required by the final approval conditions. | limits in Table 1 of this SSMP and/or occurs outside of the Project footprint, clearing, works are to cease immediately, and DAWE notified of the incident within five business days. The incident will be recorded in the Project's environmental and incident reporting system register.<br>• Following clearing, the area will be assessed within 20 business days by a suitably qualified expert with corrective actions provided to the DAWE via a Corrective Action Contingency Plan.<br>• The Plan will include a schedule to implement the corrective actions.<br>• Should rehabilitation and decommissioning fail to meet the objectives, completion criteria and schedule of the Rehabilitation Management Plan, the reasons of the failure will be investigated.<br>• Corrective Actions:<br>• The Corrective Actions identified in the Corrective Action Contingency Plan and approved by DAWE will be implemented and may include additional rehabilitation or offsets or provision of additional permanent water sources for the Squatter Pigeon and/or Ornamental Snake prey.<br>• Within 20 business days of a rehabilitation trigger being activated, a Contingency Plan will be | for MNES habitat as shown in Figure 2 and Figure 3.<br>• No net loss of habitat has occurred.<br>• Management and corrective actions are to be available for entry into the following audit period compliance report. |  |

| SMP management objectives | **Performance criteria** | **Management and mitigation measures** | **Trigger for further action** | **Monitoring** | **Corrective actions** | **SGME comments** | **Compliance status** |
|---|---|---|---|---|---|---|---|
|  |  | season of impacted MNES (ie mid dry season to wet season for Squatter Pigeon.<br>• Prior to entry to the Project area, all site personnel including contractors shall be made aware via toolbox talks and site information sheets, of the sensitive environs they will be working in and around and be advised of specific limitations to construction works being undertaken in or adjacent to threatened fauna habitat. All staff and contractors will be required to report sightings of relevant fauna in the activity area to the EO immediately.<br>• An internal 'Permit to Disturb' system will be used by the EO to ensure that all clearing activities are authorised prior to disturbance. Conditions listed in the Permit to Disturb must be implemented.<br>• The EO or delegate will routinely inspect the disturbance limit boundaries to ensure that no clearing or disturbance of vegetation or habitat beyond the approved limits has taken place.<br>• Temporary stockpile sites for soil and equipment, access routes, laydown areas and other associated infrastructure will, as afar as reasonably practical, be located in cleared areas and will |  |  | developed by a suitably qualified expert to address the reason for the failure and identify appropriate Corrective Actions. |  |  |

| SMP management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions | SGME comments | Compliance status |
|---|---|---|---|---|---|---|---|
| | | not be situated in areas of MNES habitat.<br>• Prior to construction activities commencing, signage, including speed limits, will be erected in the vicinity of exclusion areas to warn of the potential presence of threatened fauna in the area.<br>• Pre-clearance surveys will be undertaken by a suitably qualified ecologist using approved State and Commonwealth survey guidelines within 48 hours before clearing activities commencing.<br>• The pre-clearance survey will be undertaken in order to:<br>• Record the location of all hollow bearing trees, log piles and nest using a GPS. Features of tree hollows (diameter, number and whether active/inactive) should be recorded in the Environmental Diary/Register; and<br>• Relocate all captured non-breeding animals to suitable habitat adjacent to the disturbance area and within the Project Area.<br>• A Fauna Spotter will be present for all clearing activities and will conduct a walk- through survey prior to commencement of clearing and prior to clearing works each day to check vegetation and other fauna habitats.<br>• The Fauna Spotter will reinspect the area of | | | | | |

| SMP management objectives | **Performance criteria** | **Management and mitigation measures** | **Trigger for further action** | **Monitoring** | **Corrective actions** | **SGME comments** | **Compliance status** |
|---|---|---|---|---|---|---|---|
| | | cleared vegetation immediately after clearing to locate any potentially injured fauna that should then be taken to a wildlife carer or veterinarian.<br>• Vegetation clearing will be undertaken progressively and trees will be felled in the direction of the clearance zone to avoid impacts to adjoining retained vegetation and habitat.<br>• Hollow bearing trees will be clearly flagged and surrounding vegetation removed with the hollow bearing tree left standing for at least one night to encourage fauna to relocate of its own accord. Hollow bearing trees will be inspected to determine if hollows are occupied.<br>• If after one night the resident fauna have not moved on, the hollow entrance will be blocked with a towel or similar and the hollow removed by cutting below the hollow section. The hollow with the animal inside will then be installed in nearby similar and adjoining vegetation to be retained at a similar height and orientation with the entrance unblocked at dusk.<br>• If the procedure described above is not possible for any reason, hollow-bearing trees will be felled using a tree grab or similar that can | | | | | |

| SMP management objectives | **Performance criteria** | **Management and mitigation measures** | **Trigger for further action** | **Monitoring** | **Corrective actions** | **SGME comments** | **Compliance status** |
|---|---|---|---|---|---|---|---|
|  |  | remove the tree in a controlled fashion. If possible and safe to do so, hollow trees will be felled at dusk to allow fauna the opportunity to disperse during their normal activity period. These trees will be felled away from hollow openings. The tree will be knocked at the base several times prior to felling to encourage fauna to relocate of their own accord. Once the tree is felled, it will be inspected for any fauna and any injured fauna rescued and taken to a wildlife carer or veterinarian.<br>• Any fauna that is captured will be relocated into the adjacent habitat at least 200 m from the clearing area if clearing works are yet to be completed.<br>• Where threatened fauna is identified and delaying the clearing of area is not feasible, (ie the clearing is critical to the activity schedule), a 50 m exclusion zone will be established and the area must not be disturbed for a minimum of 24 hours while clearing is undertaken around the exclusion zone. After 24 hours, a Fauna Spotter/Catcher may relocate the breeding animal to suitable habitat at least 200 m away from the disturbance area. Where survival of young or eggs is unlikely as a result of the disturbance, these are to be handed |  |  |  |  |  |

| SMP management objectives | **Performance criteria** | **Management and mitigation measures** | **Trigger for further action** | **Monitoring** | **Corrective actions** | **SGME comments** | **Compliance status** |
|---|---|---|---|---|---|---|---|
| | | over to a previously identified wildlife carer or veterinarian. | | | | | |
| Prevent habitat degradation and a decline in habitat values within habitat adjacent to that within the Project area (ie habitat not proposed to be cleared for the Project or previously approved mining activities at IPC). | • Maintain habitat quality within the retained MNES habitat in relation to baseline habitat quality scores outlined in EcoSM, 2020).<br>• Rehabilitation of disturbed areas will be rehabilitated in accordance with the Project's Rehabilitation Management Plan. | • Areas of MNES habitat adjacent to the disturbance footprint and within mining leases, will be clearly delineated and shown and labelled on all operational and management drawings and plans. GIS shapefiles will be provided to clearing personnel and/or contractors prior to the commencement of clearing operations.<br>• Site access is only to occur along designated site access tracks. No unauthorised access is permitted.<br>• Prior to commencement of the action signage, including speed limits, will be erected to warn of the potential presence of threatened fauna in the area.<br>• Posters will be developed and displayed in meeting areas that reminds staff and contractors about the MNES present in the Project area.<br>• Prior to entry to the Project area, all site personnel including contractors shall be made aware via toolbox talks and site information sheets, of the sensitive environs they will be working in and around and be advised of specific limitations to construction and/or operational works being undertaken in or | • The habitat quality score in areas of retained MNES are not maintained (eg habitat falls below the baseline habitat quality score). | • Habitat quality assessments will be integrated with the existing IPM monitoring program. Specific ID monitoring will be undertaken every two (2) years in retained vegetation that provides habitat for MNES. Monitoring will be undertaken in accordance with the Commonwealth survey guidelines and the State guidelines guide for determining terrestrial habitat quality. | • Where inadvertent disturbance to MNES habitat occurs, an investigation will be undertaken.<br>• Should a decline in the habitat quality scores be observed, the cause will be investigated, and a Corrective Actions Contingency Plan will be developed by a suitably qualified ecologist within 20 business days of the decline being detected. The Plan will include appropriate corrective actions and an implementation schedule for those actions. The DAWE will be notified within 20 business days of the decline in habitat quality.<br><br>Corrective Actions:<br>• Corrective actions identified in the Plan will be implemented within 30 days of the trigger being detected. Depending on the cause of the decline in habitat quality scores, potential corrective actions may include:<br>− Rehabilitation of MNES habitat.<br>− Additional environmental awareness training to workers regarding MNES.<br>− Increasing pest animal and weed control measures or revising the type of | • This audit has identified unauthorised clearing has occurred at the Mine for MNES habitat as shown in Figure 2 and Figure 3.<br>• Management and corrective actions are to be available for entry into the following audit period compliance report.<br>• Monitoring has not been triggered to determine the state of remaining MNES habitat condition. | Not triggered |

| SMP management objectives | **Performance criteria** | **Management and mitigation measures** | **Trigger for further action** | **Monitoring** | **Corrective actions** | **SGME comments** | **Compliance status** |
|---|---|---|---|---|---|---|---|
| | | adjacent to threatened fauna habitat.<br>• All staff and contractors will be required to report sightings of MNES fauna to the EO immediately where tree hollows that are suspected as being used by Greater Gliders are identified from within the disturbance area, they are to be salvaged to the greatest extent possible and relocated within retained vegetation. As far as practical, the site of the relocation is to be within retained vegetation and replicate the height and orientation of the original breeding or nesting structure. Sections of hollow branch or log will be secured in the new location by mechanical means deemed appropriate by the Fauna Spotter/Catcher (eg bolts, metal bands). Relocation is to be undertaken under the supervision of a spotter/catcher.<br>• Selected trees and/or logs will be salvaged and reused as fauna habitat to enhance retained vegetation habitat values (Riparian areas). Trees and other habitat features to be salvaged will be identified and flagged by the Fauna Spotter/Catcher during the walk- through survey and/or clearance activities.<br>• If an occupied tree hollow cannot be | | | measures implemented.<br>– Increasing the frequency of dust suppression techniques.<br>– Repair fences if damaged, or installation of new fencing.<br>• Provision of additional offsets if required. | | |

| SMP management objectives | **Performance criteria** | **Management and mitigation measures** | **Trigger for further action** | **Monitoring** | **Corrective actions** | **SGME comments** | **Compliance status** |
|---|---|---|---|---|---|---|---|
| | | relocated the breeding habitat should be replaced nearby and in retained vegetation (but at least 200 m away from the disturbance area) in undisturbed habitat, with an artificial nesting structure at a ratio of 1:1 using current best practice nest box design.<br>• Implementation of dust suppression techniques in accordance with the Dust Management Plan and the CMSHA and the CMSHR.<br>• Maintenance of existing fences.<br>• Maintenance of existing water management infrastructure and erosion and sediment control devices.<br>• Pest animals and weeds will be managed in accordance with the Project's Weed and Pest Management Plan.<br>• Light spill we be directed to the open cut pits to minimise light spill.<br>• The use of low wattage lighting with list spill guards. | | | | | |
| Minimise risk of weed introduction and/or the spread of existing weed species in habitat area for MNES. | • No new weed species are established in areas of MNES habitat areas based on baseline data.<br>• Spreading of weeds does not occur as in areas of retained MNES habitat compared to baseline habitat quality surveys. | • Weeds will be managed in accordance with the existing Project's Weed and Pest Management Plan.<br>• The Plan includes the following:<br>– A site induction program that provides weed management information to staff, contractors and visitors. | • An increase in the average percent (%) cover score of weed species from baseline and/or previous monitoring events.<br>• Detection of weed species not previously recorded in the Project area during baseline and/or previous monitoring events. | • Monitoring of weeds outside of the disturbance areas will be undertaken during the habitat quality assessment surveys.<br>• Monitoring will be undertaken every two years (refer to Section 6.1.3). | • Should an increase in weed cover or presence of new weed species be observed, an investigation will be undertaken to determine the cause. This will involve reviewing adherence to the Weed and Pest Management Plan and an assessment of the distribution of weeds within the Project area in relation to baseline to determine | • Monitoring has not been triggered to determine the state of remaining MNES habitat condition including the presence of weed species. | Not triggered |

| SMP management objectives | **Performance criteria** | **Management and mitigation measures** | **Trigger for further action** | **Monitoring** | **Corrective actions** | **SGME comments** | **Compliance status** |
|---|---|---|---|---|---|---|---|
|  |  | − Detailed control measures aimed at eradicating where possible, or otherwise reducing the extent of weeds in accordance with the Queensland Department of Agriculture and Fisheries (DAF) guidelines and the requirements of the Biosecurity Act 2014.<br>− Weed washdown procedures for all vehicles brought to site that will be traveling beyond the site office carpark.<br>− Targeted weed control measures within the Project area. |  |  | the cause of the incursions.<br>• From the investigation, a Corrective Action Contingency Plan will be developed by a suitably qualified ecologist within 20 business days of the trigger being detected. The Contingency Plan will include appropriate corrective actions and an implementation schedule for those corrective actions.<br>Corrective Actions:<br>− Corrective actions identified in the contingency plan will be implemented within 30 days of the trigger being detected.<br>− Potential corrective actions may include:<br>− Increasing the frequency and/or duration of weed control efforts.<br>− Investigating and/or implementing alternate weed management control actions. Amending weed hygiene practices.<br>− Updating the Weed and Pest Management Plan. |  |  |
| Reduce habitat degradation and potential predation on MNES by pest animals. | • No new pest animal species are established in areas of MNES habitat in comparison to baseline data.<br>• Reduction in pest animal numbers in areas of habitat for MNES to below baseline levels. | • Pest animals will be managed in accordance with the ID Weed and Pest Management Plan.<br>• The Weed and Pest Management Plan will include requirements for: | • Observed increase in sightings/signs and/or the relative abundance of pest animals in areas of retained MNES habitat above baseline levels.<br>• Direct observation or signs of, a pest animal not identified as | • Monitoring of weeds outside of the disturbance areas will be undertaken during the habitat quality assessment surveys.<br>• Monitoring will be undertaken every two | • Should evidence of pest animals show an increase compared to baseline, undertake an investigation to assess possible reasons for the increase (eg inappropriate waste | • Monitoring has not been triggered to determine the state of remaining MNES habitat condition including the presence of pest species. | Not triggered |

| SMP management objectives | **Performance criteria** | **Management and mitigation measures** | **Trigger for further action** | **Monitoring** | **Corrective actions** | **SGME comments** | **Compliance status** |
|---|---|---|---|---|---|---|---|
|  |  | – Appropriate waste management and waste disposal.<br>– A reporting framework to ensure sightings of pest animals are recorded.<br>– Site inductions to include information on pest animals including control requirements, importance of appropriate waste management and reporting requirements when pest animals are observed within the Project area during construction and operation activities.<br>– Control of pest animals.<br>• Pest management actions outlined in the Weed and Pest Management Plan will primarily focus on those pest animals identified within the Project area and include Cane Toads, Feral Cats, Wild Dogs, House Mice and European Rabbits and that have a potential to impact on MNES and their habitat. Additional pests will be included as necessary if identified as occurring within the Project area during the habitat quality monitoring program (European Foxes and Feral Pigs).<br>• Pest management will include a range of best management practice actions including shooting, trapping, | occurring within the Project area during the baseline surveys. | years (refer to Section 6.1.4). | management leading to increased pest animals).<br>• Should predation of MNES be observed undertake an investigation to assess possible reasons for the incident(s).<br>• Review adherence to the Project's Weed and Pest Management Plan.<br>• From the investigation, a Corrective Actions Contingency Plan will be developed by a suitably qualified ecologist within 20 business days of the trigger being detected. The Contingency Plan will include appropriate corrective actions and an implementation schedule for those corrective actions.<br>Corrective Actions:<br>• Corrective actions identified in the contingency plan will be implemented within 30 days of the trigger being detected.<br>• Potential corrective actions may include:<br>– Increasing the frequency and/or duration of pest animal control efforts.<br>– Investigating and/or implementing alternate pest animal control methods in consultation with Queensland Department of Agriculture and Fisheries (DAF).<br>– Updating the exiting Weed and Pest |  |  |

| SMP management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions | SGME comments | Compliance status |
|---|---|---|---|---|---|---|---|
| | | fencing and baiting in and will be undertaken in accordance with site safety and health requirements, and DAF guidelines and the requirements of the Biosecurity Act 2014 and as permitted under the SHMS. | | | Management Plan to include new species where relevant. | | |
| Minimise impact of dust deposition on habitat for MNES during construction and operation of the Project. | • Dust deposition does not exceed 120 mg per square metre per day, averaged over one month when measured at any sensitive receptor<br>• Dust is monitored in accordance with the ID Dust Management Plan. | • Dust suppression will be undertaken in accordance with the Dust Management Plan and include the following actions:<br>− Staging vegetation clearing to minimise areas of disturbed and bare ground.<br>− Progressively rehabilitating disturbed areas.<br>− Removal and dumping of overburden as soon as reasonably practical following blasting activities<br>− Regular watering of haul roads and access tracks in accordance with the CMSHR.<br>− Dust suppression spraying of stockpiles.<br>− Limiting grading and/or dozing in high dust generating areas.<br>− Limiting overburden drilling.<br>− Enforcing speed limits in accordance with the requirements of the CMSHA and CMSHR. | • Dust deposition levels exceed 120 mg per square metre per day when averaged over one month at sensitive receptors.<br>• Visual inspections of vegetation adjacent to the disturbance areas show visible signs of dust deposition. | • Monitoring of dust deposition will be undertaken in accordance with EA approval conditions and the Project's Dust Management Plan.<br>• Existing monitoring includes visual inspections of vegetation adjacent to the disturbance areas. | • If dust deposition monitoring exceeds the trigger value of 120 mg per square metre averaged over one month, Stanmore must investigate whether the exceedance is a result of Project activities and notify the administering authority within seven days of the exceedance occurring.<br>• Should an exceedance of dust deposition levels be attributed to Project activities Stanmore will implement dust abatement measures.<br>Corrective Actions:<br>• Corrective actions identified in the Dust Management plan will be implemented within 10 days of the trigger being detected. | No exceedances of dust trigger values for the reporting period. Two complaints were lodged due to dust however follow up monitoring showed no exceedances at monitoring points.<br>Confirmation with site personnel: Dante Mude and review of the incident register. | Compliant |

| SMP management objectives | **Performance criteria** | **Management and mitigation measures** | **Trigger for further action** | **Monitoring** | **Corrective actions** | **SGME comments** | **Compliance status** |
|---|---|---|---|---|---|---|---|
| Minimise noise and vibration impact in areas of MNES habitat. | • When measured, noise and vibration levels at sensitive receptors do not exceed the general criteria set out in the ID Management Plan. | • Regularly maintaining and servicing all plant equipment to minimise machinery noise.<br>• All engine covers will be kept closed while equipment is operating.<br>• Blasting will only occur between 9am and 7pm. | • When measured at sensitive receptors noise and vibration levels exceed criteria set out in the approval conditions.<br>• When blasting occurs outside of the approved blast times. | • Noise and vibration monitoring will be undertaken in accordance with monitoring requirements set out in the approval conditions. | • If noise and vibration monitoring exceed the trigger values outlined, Stanmore must investigate whether the exceedances are the result of the mining activities and notify the administering authority within seven days of the exceedance occurring.<br>• Should exceedance levels be attributed to mining activities, noise and vibration abatement measures will be implemented.<br>Corrective Actions:<br>• Corrective actions identified during investigations will be implemented within 10 days of the trigger being detected. | No exceedances of noise and vibration trigger values during reporting period.<br>Confirmation with site personnel: Dante Mude and review of the incident register. | Compliant |
| Minimise degradation of habitat for MNES from an increased risk of fire due resulting from Project activities. | • No uncontrolled fires within the Project area resulting from Project related activities. | • Fire management for coal mining operations in Queensland is governed by the CMSHA and the CMSHR with the CMSHR prescribing management of fires for coal mines.<br>• Section 37 of the CMSHR prescribes that the coal mines Safety and Health Management System (SHMS) must include standard operating procedures for action to be taken when a fire is discovered at the mine.<br>• Buffers will be maintained around potential ignition sources such as plant and machinery, haul roads and mine infrastructure areas. | • An uncontrolled fire occurs within the Project area that is due to mining activities.<br>• Weed cover exceeds baseline levels and groundcover biomass (eg vegetation) exceeds benchmark levels. | • Compliance with the SHMS will be monitored in accordance with the requirements of the CMSHA and CMSHR.<br>• Monitoring of biomass (groundcover including organic litter) for fire management will be undertaken during the habitat quality assessments that will occur every two (2) years thereafter (refer to Section 6.1.2). | • Should an uncontrolled fire occur within the Project area, the existing IPM Emergency Response Plan will be enacted. Should any corrective actions and changes to fire management be required, they will be done in accordance with the CMSHA and CMSHR and incorporated into the SHMS.<br>• Should biomass monitoring indicate that there is a risk of an uncontrolled fire occurring, biomass control measures will be assessed by a suitably qualified ecologist within 20 business days and Corrective Actions suggested. Biomass control measures aimed | No uncontrolled fires at the Mine during the reporting period. Confirmation with site personnel: Dante Mude. | Compliant |

| SMP management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions | SGME comments | Compliance status |
|---|---|---|---|---|---|---|---|
| | | • Prior to site entry, all relevant site personnel, including contractors, will be made aware of fire safety and risks.<br>• Fuel loads will be minimised and managed through the weed control measures outlined in the ID Weed and Pest Management Plan. | | | at reducing fuel loads may include controlled burns, strategic grazing or modified weed management measures.<br>Corrective Actions:<br>• Any corrective actions identified will be implemented within 30 days of the trigger being detected. | | |
| Minimise alteration of Squatter Pigeon and Ornamental Snake habitat from changes to water quality and hydraulic activity. | • Water quality is maintained within the ID Project area and does not exceed the receiving waters trigger levels at downstream monitoring sites listed in the IPM Receiving Environment Monitoring Program which will be updated to include the ID Project.<br>• Water quality monitoring is undertaken in accordance with the ID Receiving Environment Monitoring Program.<br>• Erosion and sediment control is undertaken in accordance with the Erosion and Sediment Control Plan (ESCP).<br>• Maintain riparians habitat quality scores within the retained MNES habitat in relation to baseline habitat quality scores | • Site stormwater management will be undertaken in accordance with the management plans and programs required by the approval conditions including a REMP.<br>• The site specific WMP, REMP and ESCP as well as other water management requirements as outlined in the approval conditions.<br>• Required management plans will be implemented with the aim of minimising alterations to receiving environment water quality erosion, minimising mobilisation of sediments and minimising erosion related disturbances to the current hydrological regime.<br>• The maintenance and cleaning of any vehicles, plant or equipment must not be carried out in areas from which contaminants can be released into any receiving waters.<br>• Spillage of wastes, contaminants or other | • Water quality monitoring exceeds the approved receiving environment trigger levels outlined in the approval conditions and.<br>• Visual inspections of water management infrastructure show signs of failure.<br>• The habitat quality score in areas of retained riparian vegetation are not maintained (eg habitat falls below the baseline habitat quality score). | • Water quality monitoring will be undertaken in accordance with the approval conditions and REMP.<br>• Monitoring of the effectiveness of the erosion and sediment control devices and water management infrastructure will be undertaken in accordance with approval conditions.<br>• Habitat quality assessments will be undertaken every two (2) years in retained vegetation that provides habitat for MNES. | • If water quality characteristics of the downstream monitoring point exceed those trigger levels outlined in the final EA, and these levels are higher than upstream monitoring locations, Stanmore must investigate the exceedance and the potential for environmental harm and provide a written report to the administering authority as part of the Project's Annual Return.<br>• Should an exceedance of water quality trigger levels be attributed to Project activities, an assessment on the effectiveness of the WMP and REMP will be undertaken and appropriate Corrective Actions included in Plan revisions and the Annual reports in accordance with approval conditions.<br>• Should a decline in the riparian habitat quality scores be observed, the cause will be investigated, and a Corrective Actions Contingency Plan will be developed by a suitably qualified ecologist within | • No exceedances of trigger levels in the receiving environment at the Mine for reporting period.<br>• Implementation of the REMP observed at the Mine during auditor site visit.<br>• Implementation of the ESCP observed at the Mine during auditor site visit.<br>• Cleaning of vehicles is currently undertaken at Isaac Plains Coal Mine. | Compliant |

| SMP management objectives | **Performance criteria** | **Management and mitigation measures** | **Trigger for further action** | **Monitoring** | **Corrective actions** | **SGME comments** | **Compliance status** |
|---|---|---|---|---|---|---|---|
| | | materials must be cleaned up as quickly as practicable to minimise the release of wastes, contaminants or materials to any stormwater drainage system or receiving waters. | | | 20 business days of the decline being detected. The Plan will include appropriate corrective actions and an implementation schedule for those actions. The DAWE will be notified within 20 business days of the decline in habitat quality. | | |
| Minimise potential for mortality or injury to MNES from Project activities (eg habitat clearing, vehicle strikes etc). | • No mortality or injury to MNES as a result of Project activities (eg from clearing activities, vehicle strikes etc). | • Environmental awareness training will be provided to all workers as part of site induction and will include specific topics on MNES, risks and protective measures, and identification of the MNES.<br>• Pre-clearance surveys will be undertaken within 48 hours prior to clearing activities to assess the presence of MNES within the disturbance area to be cleared.<br>• At least one qualified Fauna Spotter/Catcher will be present during clearing activities.<br>• A wildlife carer will be called to collect any injured fauna.<br>• Speed limits of 60 km/hr will be set and enforced on all internal roads including haul roads, with the exception of creek crossings at night which will have 40 km/he limits.<br>• Vehicles must abide by vehicle speed limits and access to any restricted areas or exclusion zones must be limited to | Injury or mortality to an MNES | • All personnel will be required to be report any interactions between vehicles and/or /machinery and MNES in the Project area.<br>• Visual observations during normal working hours.<br>• Incidental observations during habitat quality assessments. | • Should an injury to, or mortality of, an MNES, an investigation will be undertaken to ascertain the cause of the injury or mortality.<br>• Should the injury or mortality be attributed to mining activities, a Contingency Plan will be developed by a suitably qualified ecologist within 20 business days and will include Corrective Actions and an implementation schedule for the Corrective Actions.<br>Corrective Actions:<br>• Corrective actions identified in the contingency plan will be implemented within 30 days of the trigger being detected. | • This audit has identified unauthorised clearing has occurred at the Mine for MNES habitat as shown in Figure 2 and Figure 3. The area of MNES cleared was minimal and less than the total allowed clearance for the activity ie total disturbance is below the allowed limit however clearing has occurred outside of the assigned footprint.<br>• Management and corrective actions are to be available for entry into the following audit period compliance report.<br>• Review of incident register showed no reports of vehicle and MNES species interaction. | Complaint |

| SMP management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions | SGME comments | Compliance status |
|---|---|---|---|---|---|---|---|
| | | critical site-specific activities to minimise threats to MNES.<br>• All injured fauna encountered during the construction and operation of the activity will be taken to a wildlife carer/facility or veterinarian within 24 hours.<br>• Where injured fauna is encountered, and it is unsafe to handle the animals, the following should be undertaken<br>• The location of the injured animal will be identified so it can be located again<br>• The species of animal will be identified if possible and its sex and approximate size determined<br>• The type of injury sustained will be identified if possible<br>• The EO shall immediately contact Queensland's Department of<br>• Environment and Science (DES) and report the animal and arrange for its capture and transportation to a wildlife carer or veterinarian. | | | | | |

### 4.1.3 GDEMMP Objectives audit

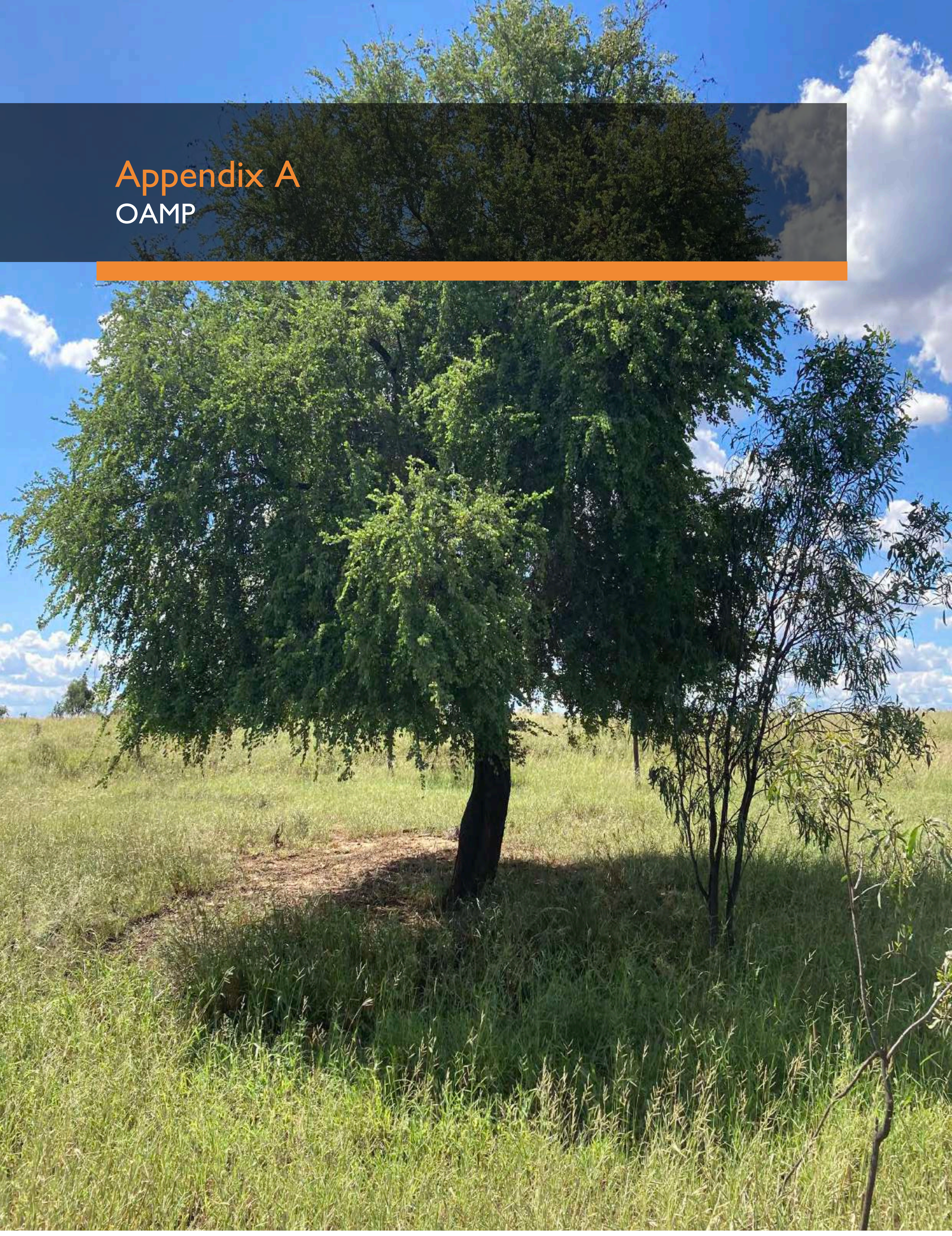
**Table 5 GDEMMP objectives audit**

| Objective | SGME Comments | Compliance status |
|---|---|---|
| Characterise GDEs that are likely to be impacted by the ID Project in terms of ecological function, interaction with surface water and interaction with groundwater as presented in 3d Environmental (2020a). | Section 4 of the plan outlines GDE area 1 & 2 associated with Mine. Figure 8 shows the location of both areas. | Compliant |
| Provide a synopsis of the potential risks to GDE integrity posed by mining activities associated with the ID Project. | Section 5 of the plan details the major risks to the GDE's. Table 1 provides the ranking for the likelihood of impact to GDE health according to GDE risk categories. Figure 10 shows the locations of potential impact. | Compliant |
| Identify biophysical parameters that can be applied to the monitoring of GDE function that can be repeated objectively and consistently throughout the life of the ID Project to measure GDE health. | Table 2 (Assessment methods that will be applied during GDE monitoring) shows the assessment methods to be utilised for GDE monitoring. Evidence of the implementation of monitoring methods have been observed in the *GDEMMP baseline event monitoring reports 1-4. Details of the baseline monitoring plan are available in Appendix F of the GDEEMMP plan* | Compliant |
| Describe the most appropriate actions to measure changes to biophysical function of GDEs that may indicate a decline in GDE health and provide a statistically robust framework that can demonstrate whether impacts to GDEs are associated with mining activities rather than natural variation. | Section 7 of the plan provides the details of the approach to monitoring and management of the GDEs. The section outlines the decision to collect data over a 2-year period to account for seasonal variability. | Compliant |

| Objective | SGME Comments | Compliance status |
|---|---|---|
| Develop triggers that may be used to initiate the application of corrective actions, which can be refined over time as monitoring data is collected. | Section 10 of the plan describes the steps to develop triggers/trigger limits to initiate corrective actions. Recommendations will be made in a *GDE baseline assessment interpretive report* following the collation of data from the baseline study. | Compliant |
| Develop a suite of corrective actions that may be applied to ameliorate impacts to GDEs and prevent or repair declining GDE health. | Section 11 of the plan provides the details for potential corrective actions and the adaptive measurement of the GDEs. The section outlines the treatment of affected vegetation through restoration of moisture supply or infill planting. | Compliant |
| Develop disturbance thresholds and offset requirements should corrective actions not be successful. | Section 11.4 describes the steps to consider biodiversity offsets if mitigation measures are unsuccessful and degradation of GDEs can be attributed to operations at the Mine. | Compliant |

# 5.0 Reviewed Documentation

- Isaac Downs Offset Area Management Plan: EPBC2019/8413 prepared by Base Consulting Group;
- Isaac Downs Ornamental Snake Area Management Plan: EPBC2019/8413 prepared by Base Consulting Group;
- Isaac Downs — MNES Significant Species Management Plan prepared by Base Consulting Group;
- Groundwater Dependent Ecosystem (GDE) Management and Monitoring Plan – Isaac Downs Project prepared by 3D Environmental;
- Stanmore Offset Area July–September 2022 Delivery Notes;
- Stanmore email correspondence;
- 2019-8413 Approval notice variation;
- GDE Baseline monitoring reports 1–4 prepared by 3d Environmental;
- Voluntary declaration documents: Mt Spencer Station (EPBC2019/8413);
- Annual Compliance Report Guidelines 2014 by the Australian Government Department of the Environment;
- Stanmore Offset Area 1,2 & 3 - Lot 4 Mt Spencer Station April 1 – June 30: 2022 Activity Notes; and
- Stanmore Offset Area 1,2 & 3 - Lot 4 Mt Spencer Station July 1 – September 30: 2022 Activity Notes.



# Appendix A
## OAMP

# Isaac Downs - Offset Area Management Plan: EPBC 2019/8413

## Stanmore IP South Pty Ltd

| | |
|---|---|
| Client | Stanmore IP Coal |
| Reference | J0053 |

## Document Control

| | |
|---|---|
| **Title** | Isaac Plains East Extension Offset Area Management Plan |
| **Job Number** | J0053 |
| **Client** | Stanmore IP South Pty Ltd |

## Document Issue

| **Issue** | **Date** | **Prepared By** | **Reviewed/Approved By** |
|---|---|---|---|
| REV A: CLIENT REVIEW 1 | 26/03/2021 | Craig Streatfeild/Isaac Witten | Craig Streatfeild/Richard Oldham |
| REV B: CLIENT REVIEW 2 | 26/03/2021 | Craig Streatfeild | Richard Oldham |
| REV O: DAWE SUBMISSION | 9/04/2021 | Craig Streatfeild | Richard Oldham |
| REV O1: REVISED VERSION FOR DAWE COMMENT | 26/11/2021 | Craig Streatfeild/Brandon Hourigan | Richard Oldham |
| REV O2: DAWE RESPONSE | 7/12/2021 | Craig Streatfeild/Brandon Hourigan | Richard Oldham |
| REV O3: FINAL DAWE RESPONSE | 14/12/2021 | Craig Streatfeild/Brandon Hourigan | Richard Oldham |

# Table of Contents

# Approval Holder Declaration

I declare that:

1. To the best of my knowledge, all the information contained in, or accompanying this Biodiversity Offset Management Plan that was supplied by the proponent is complete, current and correct.

2. I am duly authorised to sign this declaration on behalf of the approval holder.

3. I am aware that:

a. Section 490 of *the Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading.

b. Section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* where the person knows the information or document is false or misleading.

c. The above offences are punishable on conviction by imprisonment, a fine or both.

Signed: ______________________

Full name: Jon Romcke

Organisation: Stanmore IP South Pty Ltd

Date: 17/12/21

# Abbreviations

| Abbreviation | Description |
|---|---|
| ABN | Australian Business Number |
| ACN | Australian Corporation Number |
| BPA | Biodiversity Planning Assessment |
| BVG | Broad Vegetation Group |
| DAF | Department of Agriculture and Fisheries |
| DAWE | Department of Agriculture, Water and the Environment |
| DBH | Diameter at Breast Height |
| DEHP | Department of Environment and Heritage Protection |
| DES | Department of Environment and Science |
| DEWHA | Department of Environment, Heritage, Water and The Arts |
| DNRME | Department of Natural Resources, Mines and Energy |
| DNR | Department of Natural Resources |
| DoE | Department of Environment |
| DoEE | Department of The Environment and Energy |
| EDL | Ecologically Dominant Layer |
| EO Act | Environmental Offsets Act 2014 |
| EPBC Act | Environment Protection and Biodiversity Conservation Act 1999 |
| ha | Hectares |
| km | Kilometres |
| MNES | Matters of National Environmental Significance |
| m | Metres |
| NC Act | Nature Conservation Act 1992 |
| OAMP | Offset Area Management Plan |
| RE | Regional Ecosystem |
| SPRAT | Species Profile and Threats Database |
| VM Act | Vegetation Management Act 1999 |

# 1.0 Introduction

Base Consulting Group (Base) was commissioned by Stanmore IP South Pty Ltd (Stanmore) to prepare this Offset Area Management Plan (OAMP) to address potential offset obligations for impacts to listed Commonwealth fauna species from operations at the proposed Isaac Downs (ID) Project (the Project). This OAMP has been prepared to support a referral for the Project under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). DAWE notified Stanmore that the Project would be a controlled action and assessed via the bilateral agreement with Queensland on 14 May 2019 (EPBC: 2019/8413). An environmental impact statement (EIS) Assessment Report, under the Queensland *Environmental Protection Act 1994* (EP Act) was issued on 03/03/2021, completing the assessment process for the EIS subject to the bilateral agreement.

Stanmore IP Coal Pty Ltd (IP Coal), a separate subsidiary of Stanmore, operates the Isaac Plains Mine (IPM) (Refer to Figure 2) on granted mining lease (ML) 70342, ML 700016, ML 700017, ML 700018 and ML 700019, subject to an existing environmental authority (EA). These mining leases encompass the Isaac Plains East (IPE) and Isaac Plains East Extension (IPEE) mining areas and are located immediately to the north of the ID Project.

As part of the Stanmore's existing IPE and IPEE projects and to address the Commonwealth's requirements, OAMPs were developed and approved for the same property (Mt Spencer station) as proposed for this OAMP. The ID OAMP (version provided to the Department of Agriculture, Water and Environment (DAWE) on 09/04/2021) was approved as part of the approval for the ID Project by DAWE on 26/05/2021. The shape of the approved offset area at Mt Spencer station has been amended to reflect the practical realities of fence line installation.

The previously mapped fence line with the adjacent State Forest has been amended which removed approximately 124 ha within the existing offset area. Therefore, the existing offset area boundary required amending to accommodate an additional 124 ha which has been added to the south-western boundary. This version of the OAMP outlines the modified offsets area and the revised habitat quality scores for the revised offsets area. The additional area was previously surveyed during the habitat quality assessments undertaken in July and October 2020. No changes to the habitat quality score or the previously approved offset area of 610 ha has occurred.

The OAMP includes habitat mapping, habitat quality scores and the locations of the observed MNES that require offsetting within the revised offset area of 610 ha within Lot 4 SP277438. Management actions, performance criteria and competition criteria for the offset area are also outlined and remained unchanged from the previously approved OAMP.

## 1.1 Background

The Project is located approximately 10 km south-east of Moranbah township in central Queensland (refer to Figure 1). ML applications 700046, 700047 and 700048 have been made for the Project. The Project MLs and EA will extend over parts of MDL 137, EPC 755, EPC 728 and EPC 548 and the Project area is shown on Figure 2.

The Project involves the following components:

- Open cut metallurgical coal mine;
- In-pit and out of pit spoil dumps;
- Flood protection levee;
- Mine infrastructure area (MIA);
- Water management infrastructure including mine water dam, sediment dams and clean water diversion;

- Access road from the Peak Downs Highway;
- Linear infrastructure corridors to connect the Project to the existing Isaac Plains Mine on ML 70342 (Figure 2) with a ROM coal haul road, power supply and water pipelines (linear infrastructure); and
- Use of existing Isaac Plains Mine CHPP, tailings management systems, and train load out facility.

## 1.2 Report Scope and Purpose

The ID Project is immediately south of the previously approved IPE and IPEE projects. The assessment of significance of residual impacts (prepared for the Project EIS) for the ID Project (EcoSM, 2020a; b) identified that the MNES for which offsets are likely required are the same as those required for the IPE and IPEE projects (Koala, Greater Glider and Squatter Pigeon).

The purpose of this OAMP is to offset significant residual impacts to the Koala, Greater Glider and Squatter Pigeon (breeding and foraging habitat) for the Project. This OAMP proposes to legally secure offset areas within Mt Spencer Station (Figure 3) as an offset for residual impacts to 131.9 ha of Koala habitat, 120.9 of Greater Glider habitat and 122.1 of Squatter Pigeon habitat (comprising 66.6 ha of breeding habitat and 55.5 ha of foraging habitat) (refer to Table 1). While this OAMP focuses on offsetting the ID Project, the proposed offsets area is part of a larger strategic offset area within Lot 4SP277438 which in turn, is part of the wider Mt Spencer Station (Figure 3). This larger approximately 3000ha strategic offsets area also provides offsets for impacts to the Koala, Greater Glider and Squatter Pigeon for the IPE and IPEE Projects (Figure 3).

Although significant impacts requiring offsets are likely to occur for the Ornamental Snake, Mt Spencer Station and Lot 4SP222438 does not contain the request habitat to offset these matters. As such, any required offsets for the Ornamental Snake will be addressed in a separate OAMP.

Stanmore's IPEE project was approved by DAWE in December 2020 (EPBC 2019/8548) and the IPEE approval included approval of an OAMP. The IPEE offset area is in the north and north-west portion of Lot 4SP277438. Immediately south of and adjoining the IPEE offset area is the proposed IPE offset area and the IPE offsets management plan is currently being assessed by DAWE. The ID offset area adjoins the IPE offsets area and extends to the south, south-east of the IPE offsets boundary into the central part of Lot 4SP277438.

This OAMP proposes ongoing management and monitoring of the offset area to satisfy the requirements of the Commonwealth's Offset Policy and expected approval conditions. In accordance with the Commonwealth Offset Policy, management of the offset area in accordance with this plan is for a 20 year period.

**Table 1 MNES impacted by the Project for which offsets will be delivered**

| MNES | EPBC Act status | Impact area requiring offsets (ha) | Required offset area (ha) |
|---|---|---|---|
| Koala *(Phascolarctos cinereus)* | Vulnerable | 131.9 | 610 |
| Greater Glider *(Petauroides volans)* | Vulnerable | 120.9 | 560 |
| Squatter Pigeon (Southern) *(Geophaps scripta scripta)* | Vulnerable | Breeding (66.6)<br>Foraging (55.5)<br>Total 122.1 ha | 565 |

Detailed ecological field investigations of the impact area have been undertaken to support the ID approvals process (i.e. as part of the approved EIS). As part of these investigations, habitat quality assessments were undertaken to inform the offset requirements for the ID Project.

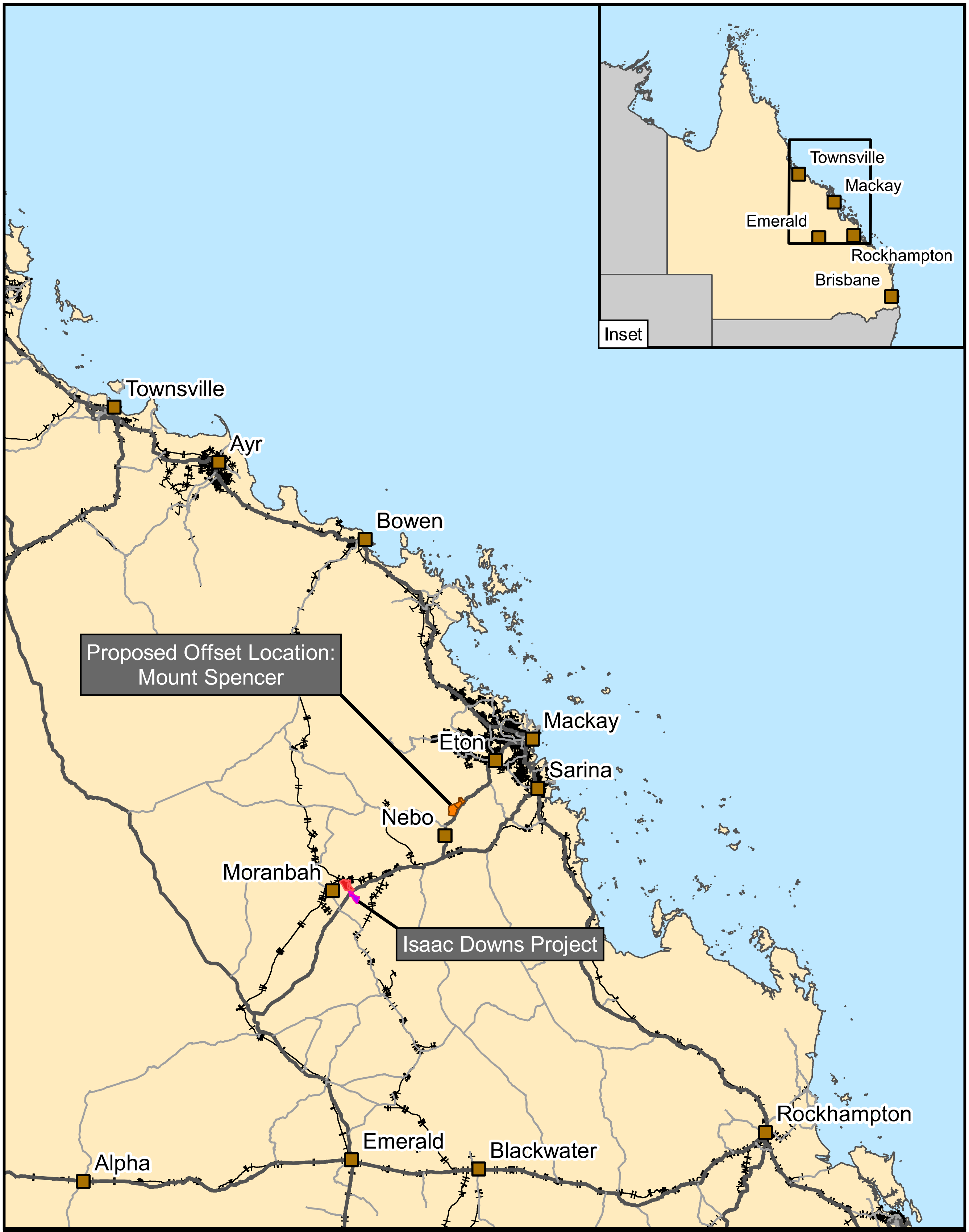


Figure 1: Mount Spencer - Offset Site Context

0 25 50 75 km

Scale @ A3: 1 : 2500000
Date: 05/03/2021
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Natural Resource and Mines) 2021;

Legend

- 🟫 Towns
- Highways
- Roads
- ⊢ Rail Network
- 🟧 Mount Spencer (Lot 4SP277438)
- 🟥 Isaac Plains East
- 🟪 Isaac Downs

BASE/

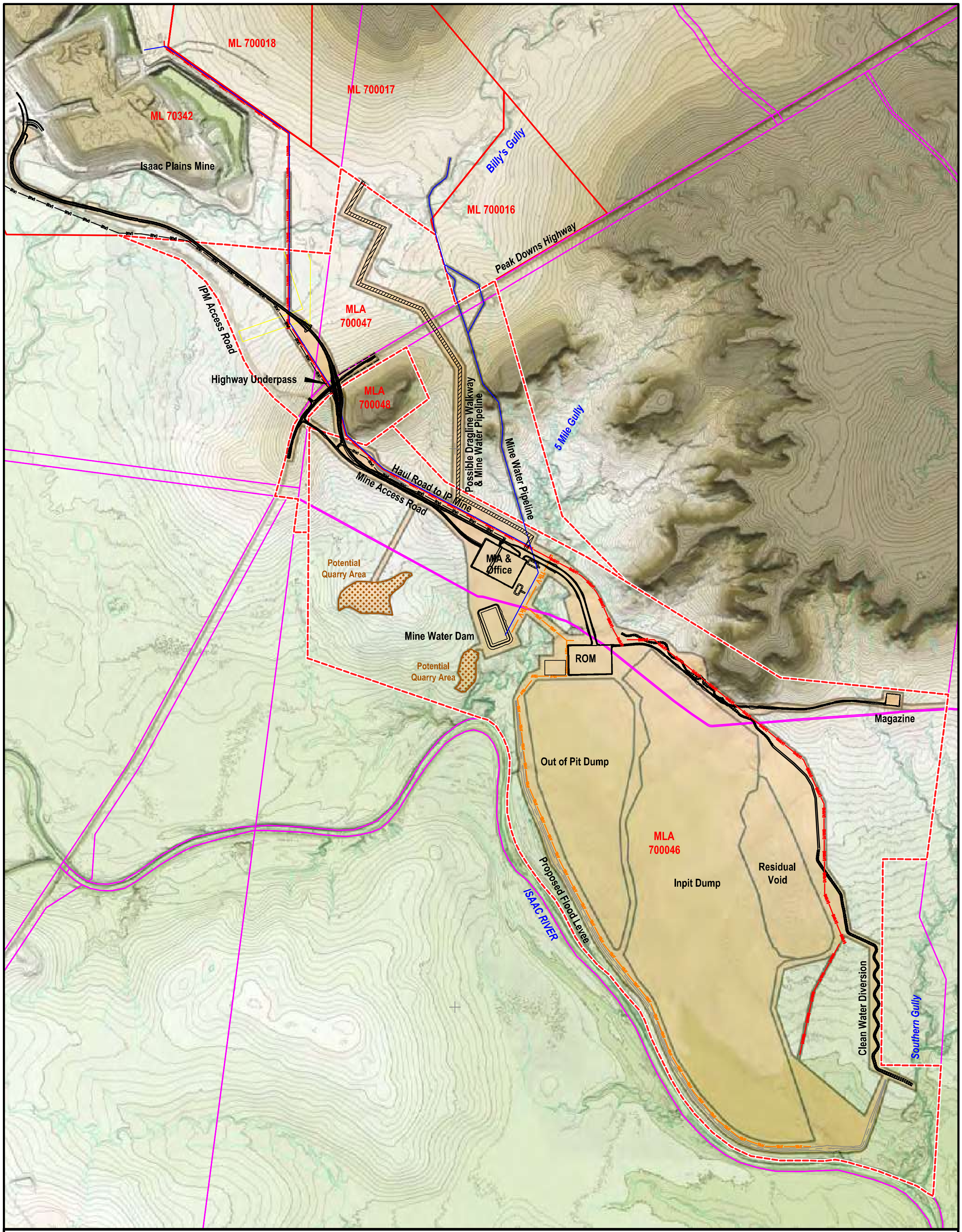


Figure 2: Project Setting

0 1 2 km

Scale @ A3: 1 : 75000
Date: 07/12/2021
Drawn: Brandon Hourigan

DATA SOURCE:
QSPATIAL 2021;
The State of Queensland (Department of Resources) 2021; Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, DATSIP

🟥 Mine Lease
🟥 Isaac Downs Project MLAs
🟧 Project Footprint
— Topography 1m Contours
— Drainage
— Cadastral Boundary

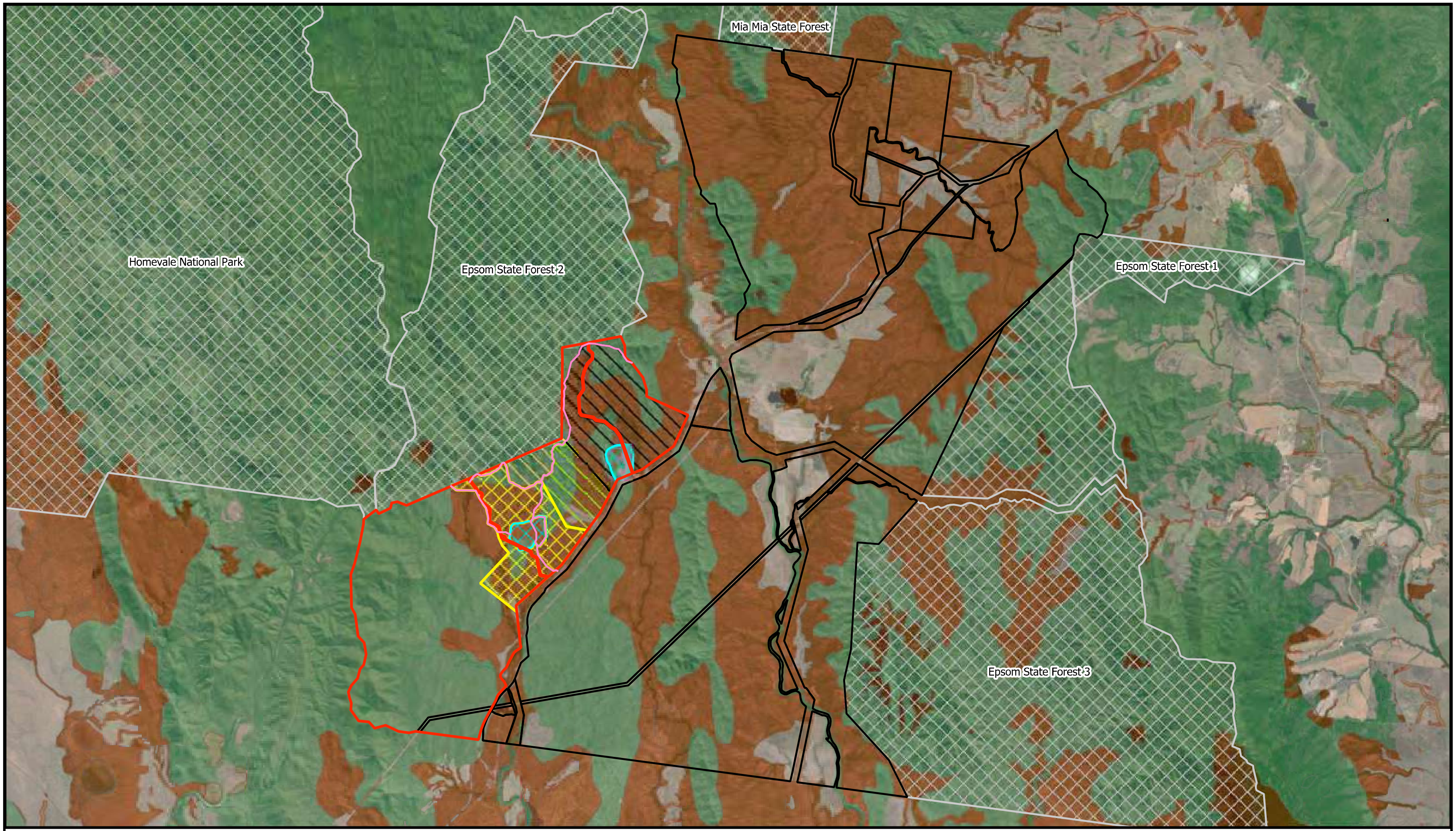


Figure 3: Mount Spencer Station with Existing Offset Areas

**Legend**

- — Existing Fenceline
- ☐ Lot 4SP277438
- ☐ Mount Spencer Station
- ☒ Protected Areas
- ☐ Holding Yards
- ▨ IPEE Offset Area
- ▨ IPE Offset Area
- ☒ Proposed ID Offset Area
- ▨ Removed ID Offset Area

**Regional Ecosystem Mapping**

- 🟧 Category A or B: Of Concern
- 🟩 Category A or B: Least Concern
- 🟧 Category C or R: Of Concern
- 🟩 Category C or R: Least Concern
- Non-remnant

Scale @ A3: 1 : 110000
Date: 23/11/2021
Drawn: Josh T

DATA SOURCE:
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Resources) 2021; Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

BASE/

# 2.0 Regulatory Framework

## 2.1 *Environment Protection and Biodiversity Conservation Act 1999* – Commonwealth

The EPBC Act is the Commonwealth Government's principal piece of environmental legislation and is administered by the DAWE. The EPBC Act is designed to protect MNES, which include threatened species of flora and fauna, threatened ecological communities (TECs), migratory species as well as other protected matters. The Act includes EPBC categories of threat for threatened flora and fauna, identifies key threatening processes to their survival and provides for the preparation of recovery plans for threatened flora and fauna.

Approval is required under the EPBC Act for any action (development) that has the potential to significantly impact MNES. Proponents of projects that are likely to have a significant impact refer the project to the DAWE for a determination on whether the proposed activity requires assessment under the EPBC Act via a controlled action, and if so, the level of assessment required. For controlled actions, five different levels of assessment are possible and include assessment based on information provided in the referral, assessment by preliminary documentation, assessment by an Environmental Impact Statement (EIS), assessment by a Public Environment Report (PER) and assessment by public enquiry.

The ID Project was determined by DAWE determined be a controlled action on 14 May 2019 and assessed via an EIS under the under bilateral agreement between the Commonwealth and the Queensland Governments. Although there were no specific requirements for an OAMP to being developed during the EIS assessment phase, it was noted that an OAMP would need to be provided and approved prior to significant impacts occurring to MNES. Therefore, and as the strategic offset area has already been identified, an OAMP was prepared as part of the EIS assessment and approval phase of the Project and was approved on 26/05/2021.

Under the *Environment Protection and Biodiversity Conservation 1999* (EPBC Act) Environmental Offsets Policy, offsets are required where a residual impact is likely to occur after avoidance, mitigation and management measures have been undertaken. For this project, offsets for residual impacts are to be legally secured for the MNES (Table 1).

## 2.2 Policy Principles

The EPBC Act Environmental Offsets Policy (October 2012), has five key aims that involve:

- Ensuring the use of offsets are efficient, effective, timely, transparent and scientifically robust;
- Providing all stakeholders with greater certainty on how offsets are determined and provided;
- Delivering improved environmental outcomes;
- Outlining the appropriate nature and scale of offsets; and
- Providing guidance on acceptable offsets and their delivery.

The Policy also provides eight key principles that are applied in determining the suitability of offsets as follows. These principles are addressed in further detail in Section 4.7.

- Deliver an overall conservation outcome that improves or maintains the viability of the MNES in question;

- Be primarily built around direct offsets but may also include other compensatory measures;
- Be in proportion to the level of statutory protection that applies to the MNES;
- Be of a size and scale proportionate to the residual impacts on the protected matter;
- Account for and manage the risks of the offset not succeeding;
- Be additional to what is already required under law or regulations;
- Be efficient, effective, timely, transparent, scientifically robust and reasonable; and
- Have transparent governance arrangements including management actions, monitoring and auditing.

Lot 4SP277438 which is part of Mt Spencer Station, has approximately 4700 ha of remnant vegetation that has the potential to provide offsets for impacts to the MNES. Further, Mt Spencer Station (inclusive of Lot 4) covers 22,712 ha which includes approximately 20,190 ha of remnant vegetation that has the potential to provide offsets for impacts to the MNES.

The identified 610 ha offset area, to which this OAMP applies, is located on the central section of the property and immediately to the south, south-east of the IPE offsets area. The identified offset area has the potential to provide offsets that offer additional environmental values over and above those required (Figure 3). Offsets for all three MNES have been co-located within the 610 ha Koala offset area and it is the intent of Stanmore to manage the total offset area as a whole, rather than as a piecemeal approach by implementing different management actions for the IPEE, IPE and ID Project.

# 3.0 Biodiversity Values Requiring Offsets

To support the Project's State and Commonwealth approvals process, detailed ecological surveys and assessments have been undertaken across the ID project area and include studies undertaken as part of the IPE EIS approval process in 2018 and 2019 (EcoSM 2020b). As well as collecting data to assess the significance of impacts to MNES, surveys also involved habitat quality assessments for the Koala, Greater Glider and Squatter Pigeon. Habitat quality assessments are discussed further in Section 4.1 and Section 4.2. A detailed ecological assessment report by Ecological Survey and Management, 2020 (EcoSM, 2020b) that includes all surveys and assessments undertaken to date is included in Appendix 10 of the amended EIS (AEIS)[1] and a Biodiversity Offsets Strategy is included in Appendix 12 of the AEIS.

Collectively, these surveys and assessments were undertaken, in order to:

- Determine the presence/absence of listed flora and fauna species within the Project area;
- Assess the vegetation characteristics and the presence of ecological communities within the Project area;
- Describe the likely adverse impacts on MNES within the Project area;
- Describe measures that would be implemented to avoid and mitigate impacts on those MNES; and

Assess the baseline habitat quality of the impact area for the MNES requiring offsets.

This section provides a summary of the ecological assessments undertaken to determine the likelihood of occurrence of fauna MNES to occur or potentially occur, within the ID project area and to assess the potential impacts to those MNES.

## 3.1 Impact Assessment Ecological Survey Effort

A variety of flora and fauna survey methods were used to detect MNES during the assessment surveys (EcoSM, 2020b). The detailed ecological assessment to support the initial ID EPBC referral incorporated a dry season and a wet season fauna and flora survey. The dry season surveys were conducted over nine days in late-September and early October 2018 with the wet season surveys undertaken over eight days in late February and early March 2019 (EcoSM, 2020b). Flora surveys were undertaken in accordance with the Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 3.2 (Nelder et al., 2012).

Assessment sites were undertaken across the entire Project area and included both vegetation assessment sites and photo monitoring points within each vegetation community type as outlined below.

Numbers in parentheses indicates the number of sites that fall within the ID project footprint:

- 208 vegetation assessment sites in total comprising;
  - 38 detailed secondary sites
  - 48 tertiary sites

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[1] The AEIS includes updates in response to submissions on the EIS and is the final document provided to the Department of Environment and Science prior to the issue of the EIS Assessment Report by DES on 03/03/2021.

  - 74 modified quaternary sites
  - 48 photo monitoring sites
  - Targeted flora surveys
  - Random traverses

At 30 secondary sites detailed plots were installed and vegetation condition data collected in accordance with the Department and Environment and Science's (DES) '*Guide to determining terrestrial habitat quality, V1.2' (EHP 2017a*) (Habitat Quality Guide), which was in effect at the time of the surveys. As described in Section 4.1, habitat quality was calculated using a combination of the methods outlined in version 1.2 and version 1.3 of the Habitat Quality Guide (refer to EcoSM, 2020a in Appendix 12 of the AEIS).

Fauna assessments were undertaken for the ID surveys undertaken in 2018 and 2019 and included systematic trap sites, spotlighting, call playback, infrared cameras, active searching, supplementary survey sites, harp traps, Anabat survey sites, Koala transects and observation (e.g. bird surveys and opportunistic observations). The field work consisted of systematic and supplementary survey sites and opportunistic observations and included:

- 800 Elliott A trap nights;
- 124 pitfall trap nights;
- 200 funnel trap nights;
- 41 hrs of spotlighting;
- 19 hrs nocturnal owl and Koala call playback sessions;
- 45 infrared camera trap nights;
- 58 hrs targeted diurnal bird survey hours;
- 205 hrs opportunistic incidental bird survey hours;
- 36 hrs active searching hours;
- 16 Anabat survey nights;
- 18 harp trap nights; and
- 12 Koala transects totalling 104.2 ha or survey area.

Survey methods were undertaken in accordance with applicable Commonwealth and Queensland threatened species and communities survey guidelines including:

- Commonwealth guidelines;
  - Survey guidelines for Australia's threatened birds (DEWHA, 2010a)
  - Survey guidelines for Australia's threatened bats (DEWHA, 2010b)
  - Survey guidelines for Australia's threatened reptiles (SEWPaC, 2011a)
  - Survey guidelines for Australia's threatened mammals (SEWPaC, 2011b)
  - EPBC Act referral guidelines for the vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DotE, 2014)
  - SPRAT databases for relevant EPBC Act listed species and communities (as of July 2016)
- Queensland guidelines;

  - Flora Survey Guidelines – Protected Plants *Nature Conservation Act 1992* (EHP, 2014)
  - Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al., 2014).

## 3.2 MNES Requiring Offsets

The ecological assessments identified three fauna species (Koala, Greater Glider and Squatter Pigeon) listed as vulnerable under the EPBC Act as requiring offsets due to residual impacts occurring to the species habitat. Note, no significant residual impact to Squatter Pigeon dispersal habitat is predicted and as such, no offsets are proposed for impacts to this habitat. Offsets are proposed for impacts to Squatter Pigeon breeding and foraging habitat

Those MNES for which this draft OAMP applies, and the corresponding impacts areas are shown in Table 2.

**Table 2 MNES impacted by the Project for which offsets will be required**

| MNES | EPBC Act status | Impact area requiring offsets (ha) | Required offset area (ha) |
|---|---|---|---|
| Koala *(Phascolarctos cinereus)* | Vulnerable | 131.9# | 610 |
| Greater Glider *(Petauroides volans)* | Vulnerable | 120.9 | 560 |
| Squatter Pigeon (Southern) *(Geophaps scripta scripta)* | Vulnerable | Breeding (66.6)<br>Foraging (55.5)<br>Total 122.1 ha | 565 |
| #. The AEIS identified that 126.6 ha of Koala habitat would be impacted. Following consultation with DAWE during the preparation of the EIS Assessment Report, the area of impacted Koala habitat was revised to 131.9 ha. | | | |

### 3.2.1 Koala (*Phascolarctos cinereus*)

***Description***

The Koala is one of Australia's most distinctive wildlife species (TSSC, 2012). It is a large grey, arboreal mammal with woolly fur, long black claws, a large black nose, fluffy ears, and no tail (van Dyck & Strahan, 2008). They have a head and body length of approximately 65-74 cm depending on sex with males larger than females and they can weigh up to 9 kg (van Dyck & Strahan, 2008).

***Distribution***

The Koala is found in eastern Australia in fragmented populations, from the temperate south to the tropical north. In Queensland, the Koala is widespread in sclerophyll forest and woodlands on foothills and plains on both sides of the Great Dividing Range from about Chillagoe, Queensland to Mt Lofty Ranges in South Australia (Menkhorst & Knight, 2011).

***Habitat***

Koalas use a range of habitats, including temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by Eucalyptus species. However, they are strongly associated with eucalypt forests which it feeds on (van Dyck & Strahan, 2008). This species feeds on approximately 50 different eucalypt species across its range, with food preferences varying locally and across regions (Krockenberger et. al., 2012). The South East Queensland Koala Conservation State Planning Regulatory Provisions define Koala food trees as species of the *Corymbia*, *Melaleuca*, *Lophostemon* or *Eucalyptus* genera (DES, 2017; DotEE, 2017c).

Any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees provides potential Koala habitat. The Koala is also known to occur in modified or regenerating native vegetation communities (DoEE, 2017c).

It has been suggested that shelter (non-food) trees are important to Koalas, with Crowther et. al. (2013) indicating that shelter trees are equally important as food tree. Shelter trees play an essential role in thermoregulation and are likely to be selected based on height, canopy cover and elevation, with large trees occurring in gullies being preferable (Crowther et. al., 2013).

***Suitable Habitat Within the Offset Area***

Based on the SPRAT habitat description and the habitat definition included in recent EPBC Act approvals for the current IPM projects, any forest or woodlands, including remnant, regrowth and modified communities that contain Koala food trees or shrublands with emergent food trees are all potential Koala habitat. This is further supported by Atlas of Living Australia records which show Koalas have been previously found immediately adjacent to the investigation area and along the Peak Downs Highway (Figure 4). The presence of Koalas is also supported by anecdotal evidence from the landowner who has indicated that Koalas have previously been seen within the investigation area and throughout the wider Mt Spencer Station (D. Wright *pers comm.*).

Field assessments of the offset site undertaken in June, July and October 2020 confirmed the presence of the Koala throughout of broader offset investigation area including the 610 ha offset area for which this OAMP applies. Over the three field visits, 13 instances of Koala sightings (Figure 5) were recorded and throughout the broader offset investigation area along with evidence of Koala’s in the form of tree scratches and scats. A Koala and Koala scats were identified from within the ID offset area adjacent to the road easement that traverses the south-western portion of the offset area (Figure 5 and Figure 6).

The minimum offset area required for the Koala is 610 ha and offset for the Greater Glider and Squatter Pigeon will be co-located with the Koala offsets (Figure 6). The intent is to manage the 610 ha offset area as a whole rather than piecemeal for each species, unless species specific management actions are required. Field verified Regional Ecosystem mapping shows the offset management area consists of a Eucalypt Woodland BVG comprising two (2) REs and non-remnant ecosystems. The offset area is dominated by vegetation consistent with REs 11.12.1 and 11.3.4 and the area is considered appropriate habitat for Koala. These REs support known Koala food trees and are consistent with the habitat definitions for the Koala as outlined in recent EPBC Act approvals for the current IPM projects.

Start habitat quality calculations for the Koala within the 610 ha offset area averaged 5 out of 10. An increase in habitat quality will be realised through various management actions outlined in Section 6.0.

***Key Threats***

Wildfire and drought are semi-natural processes that are considered to threaten Koala populations, particularly in dryland areas where water sources and the availability of shelter trees have been anthropogenically altered (TSSC, 2012). Other threats to the Koala are the loss and fragmentation of habitat resulting in loss of food and shelter trees, increased risk of vehicle strike, dog attacks and isolation of populations (TSSC, 2012). Habitat fragmentation results in isolated high-density population areas where the risk of disease transmission is increased and the potential to recolonise dryland areas post-drought is impeded (TSSC, 2012).

### 3.2.2 Greater Glider (*Petauroides volans*)

***Description***

The Greater Glider is the largest gliding possum in Australia, with a head and body length of approximately 35-46 cm and a long furry tail measuring approximately 45-60 cm. The Greater Glider has thick fur that is white or cream below and varies from dark grey, dusky brown through to light mottled grey and cream above (TSSC, 2016). The Greater Glider is nocturnal and uses tree hollows during the day to rest and/or nest (van Dyck & Strahan, 2008).

***Distribution***

Greater Gliders are restricted to eastern Australia, between Windsor Tableland in north Queensland and Wombat State Forest in central Victoria and occurs from sea level up to 1,200 m above sea level. Two isolated subpopulations exist in Queensland, one in the Gregory Range west of Townsville and another in the Einasleigh Uplands (TSSC, 2016).

***Habitat***

The Greater Glider occurs in a range of eucalypt-dominated habitats, including low open forests on the coast to tall forests in the ranges and low woodland to the west of the Dividing Range. It does not use rainforest habitats (van Dyck & Strahan 2008; van Dyck et. al., 2013). This species favours taller, montane, moist eucalypt forests with relatively old trees and abundant hollows and a diversity of eucalypt species (TSSC, 2016).

The Greater Glider has an almost exclusive diet of eucalypt leaves but also feeds occasionally on flowers or buds (van Dyck & Strahan, 2008; TSSC, 2016). Although the species is known to feed on a range of eucalypt species, in any area it is likely to only forage on a select number of species (van Dyck & Strahan, 2008).

***Suitable Habitat Within the Offset Area***

The approved conservation advice for the Greater Glider (TSSC, 2016) along with habitat definitions included in recent EPBC Act approvals for the current IPM projects, indicate that Greater Glider habitat largely overlaps Koala habitat. As such, Eucalypt Forests and Woodlands that contain hollow bearing trees, particularly in riparian areas, are all potential Greater Glider habitat.

Desktop assessment including the Atlas of Living Australia database, showed the multiple Greater Glider records approximately 8 km to the west of the offset investigation in similar habitat within the large and unfragmented Epsom State Forest and the adjacent which directly connects to the offset area (see Figure 4). Greater Gliders have also been recorded along the Peak Downs Highway in the vicinity of Mt Spencer during the DTMR Koala Research Project (Melzer et al. 2018).

Two Greater Gliders were confirmed as present in the central section of the broader offset investigation area during the October 2020 field assessments. One location is within the ID offsets area and adjacent to the road easement and the eastern property boundary. The other confirmed location was to the north-west and adjacent to habitat quality site 12 and was approximately 300m west of boundary of the ID offset area (Figure 5 and Figure 6).

The minimum offset area required for the Greater Glider is 560 ha and will be co-located within the larger 610 ha area required for the Koala (Figure 6). On-ground assessments to remap the offset area confirmed the area comprises a Eucalypt Woodland BVG that is dominated by vegetation communities consistent with REs 11.12.1 and 11.3.4. These communities are considered appropriate habitat for the Greater Glider as the diverse Eucalypt community supports known Greater Glider habitat food and foraging trees. The intent is to manage the larger 610 ha offset area as a whole rather than piecemeal for each species.

Across the investigative area, start habitat quality for the Greater Glider averaged 5 out of 10. An increase in habitat quality will be realised through various management actions including; monitoring access and fencing, preventing vegetation clearing and managing grazing, fire pest animals and weeds (see Section 6.0 for further details).

***Key Threats***

Key threats to Greater Gliders are habitat loss leading to increased habitat fragmentation and loss of nesting habitat in tree hollows, predation by owls and frequent and intense bushfires. Loss of hollow bearing trees and distance between habitat patches in particular is thought to have contributed to the decline of Greater Gliders in central Queensland over the last 20 years (TSSC, 2016).

### 3.2.3 Squatter Pigeon - southern sub-species (*Geophaps scripta scripta*)

***Description***

EPBC Act = Vulnerable

The Squatter Pigeon (southern) is a medium-sized ground dwelling pigeon approximately 30 cm long. Adults of both sexes are generally grey-brown with black and white stripes on the face and throat, have iridescent green or violet patches on the wings, a blue-grey lower breast and white flanks and lower belly. The southern Squatter Pigeon sub-species has a patch of blue-grey skin around the eye, whereas the northern Squatter Pigeon has an orange-red orbital skin patch (TSSC, 2015).

***Distribution***

Squatter Pigeons are largely restricted to Queensland with the southern sub-species of the Squatter Pigeon known to occur north of the Burdekin River, east to Townsville and Proserpine and south to the Queensland-New South Wales Border and west as far as Longreach. Where Squatter Pigeon occurs, it can be locally abundant (Reis, 2012). The known distribution of the southern sub-species overlaps with the known distribution of the northern subspecies (DotEE, 2018).

The estimated extent of occurrence is approximately 440,000 km$^2$ (DotEE, 2018). The estimated total population of the species is an estimate as no systematic surveys have been undertaken. However, in 2000 the population was estimated at 40,000 breeding birds (Garnett & Crowley, 2000). Given the Squatter Pigeon's ubiquitous nature and relative abundance, the population is thought to be stable at present. It is also thought this species occurs as a single, contiguous (i.e. inter- breeding) population (DotEE, 2018).

Squatter Pigeons can occur in tropical dry, open sclerophyll woodlands and occasionally in savannah habitats with overstorey species of *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris*. Patchy groundcover layer is typical and generally consists of native, perennial tussock grasses or a mix of grasses and low shrubs or forbs. The groundcover layer rarely exceeds 33% of the ground area. It appears to favour sandy soil dissected with low gravely ridges and is less common on heavier soils with dense grass cover (DotEE, 2018). As outlined in recent EPBC Act approvals for the current IPM projects, Squatter Pigeons are regularly found in close proximity (within 3 km) of a suitable, permanent or seasonal waterbody

(DAWE, 2020) which can include farm dams and cattle watering points, wetlands and waterways.

### *Breeding Habitat*

Squatter Pigeons nest on the ground, usually laying two eggs in sheltered positions amongst vegetation which are incubated for about 17 days. (Crome, 1976; Frith, 1982). Their breeding habitat is any remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by *Eucalyptus, Corymbia, Acacia* or *Callitris* species, on sandy or gravelly soils (including, but not limited to, areas mapped as Queensland land zones 3, 5 or 7) and where groundcover vegetation is less than 33% of the ground area, within 1 km of a suitable, as outlined in recent EPBC Act approvals for the current IPM projects.

Squatter Pigeons typically breed from April to October, although this is variable and highly dependent on food availability (Frith, 1982, Squatter Pigeon Workshop, 2011). Nests are depressions scraped into the ground beneath a tussock of grass, bush, fallen tree or log, and sparsely lined with grass (Frith, 1982). Chicks remain in the nest for two to three weeks and are dependent on their parents for around four weeks (DotEE, 2018a).

### *Foraging Habitat*

As outlined recent EPBC Act approvals for the current IPM projects, Squatter Pigeon foraging habitat is any remnant or regrowth open-forest to sparse, open woodland or scrub dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species, on sandy or gravelly soils within (including, but not limited to, areas mapped as Queensland land zones 3, 5 or 7) and where groundcover vegetation is less than 33% of the ground area, within 3 km of a suitable. It feeds primarily on seeds of grasses, herbs and shrubs but is also known to consume legumes, herbs and forbs, acacia seeds, insects and ticks (DotEE, 2018a).

### *Dispersal Habitat*

Any forest or woodland occurring between patches of foraging or breeding habitat that facilitates movement between patches of foraging habitat, breeding habitat and/or waterbodies, and areas of cleared land less than 100 m wide linking areas of suitable breeding and/or foraging habitat (DoE, 2021).

### *Suitable Habitat Within the Offset Area*

Squatter Pigeons have been previously found throughout Mt Spencer (D. Wright *pers. comm.*). Based on the habitat definitions in recent EPBC Act approvals for the current IPM projects, the preliminary desktop assessment of the investigation area using current Queensland Government (Department of Natural Resources: DNR) mapping suggests the majority of the broader offset investigation area has the potential to provide breeding and foraging habitat.

Field assessment in June and July 2020 located Squatter Pigeons throughout the broader offset investigation area and within the 565 ha ID offset area (Figure 5). Squatter Pigeons were observed at five (5) separate locations during the June survey in the south-eastern section of the property and within a range of differing habitat types (Figure 5). Six (6) instances of Squatter Pigeons were recorded during the detailed survey in July 2020 and occurred in the southern, middle and north-east section of the offset investigation area, including the proposed ID offset area (Figure 5). Within the ID offsets area, Squatter Pigeons were observed adjacent to the road easement and within the fringes of RE 11.3.4 and RE11.12.1 (Figure 7). Within the broader offsets area, Squatter Pigeons were found in various habitat types including the RE 11.3.4 and RE 11.12.1 as well as the non-remnant areas. Squatter Pigeons were also observed inhabiting vegetation with cover exceeding 33% and approximating 60% cover.

Squatter Pigeon breeding habitat covers the full ID offset area as defined within recent approvals for the IPM projects and constrained to 1 km of a seasonal waterways. A significant waterway runs through the middle of the ID offset area and provides a source of seasonal/semi-permanent water (i.e. ephemeral) and cattle watering points also occur throughout the offset area. By definition, the 565 ha offset area is also within 3 km of a seasonal waterway. Hence, the 565 ha offset area comprises both breeding and foraging habitat for the Squatter Pigeon.

Based on the recent habitat definitions, RE 11.12.1 and RE 11.3.4 are considered appropriate habitat as they support a rich and diverse understorey comprised primarily of grasses that are known to provide foraging habitat and are known to support Squatter Pigeons. The majority of the offset area is within 1 km of a seasonal/semi-permanent water source (including artificial water sources) and numerous waterways and is therefore classed as breeding and foraging habitat (Figure 7). Further, Squatter Pigeons have been observed on several different occasions during all survey events undertaken to date inhabiting areas of land zone 12 and 3 (Figure 5). Of the 11 observations made of Squatter Pigeons during field surveys, four observations were in land zone 12.

The minimum offset area for the Squatter Pigeon is 565 ha and includes offsets for breeding and foraging habitat. Given the overlap between suitable habitat, Squatter Pigeon offsets can be collocated with offsets for the Koala and Greater Glider (Figure 5).

The Squatter Pigeon offset area had an average habitat quality score of 5 out of 10 (Section 4.3). An increase in habitat quality for the Squatter Pigeon will be realised through strategic grazing aimed at managing understory cover and fuel loads, and targeted control of rabbits which will assist in increasing foraging habitat such as perennial grass cover. The Squatter Pigeon will also benefit from control of feral predators including Wild Dogs, Feral Cats and Foxes.

***Key Threats***

The primary threats to the Squatter Pigeon (southern) are ongoing habitat clearing, overgrazing of habitat by livestock and feral herbivores such as rabbits, thickening of understorey vegetation, and predation by invasive mammals such as cats and foxes (TSSC, 2015). Their habit of remaining stationary when disturbed makes them particularly vulnerable to predation and vehicle strikes. Other known threats include fragmentation of habitat, trampling of nests by domestic stock and feral herbivores, invasion of habitat by weeds such as *Cenchrus ciliaris* (Buffel Grass), drought, and bushfires (TSSC, 2015). Changes in hydrological regimes can also affect Squatter Pigeons by changing the distance between water sources and feeding habitat, affecting their movement through the landscape (Reis, 2012).

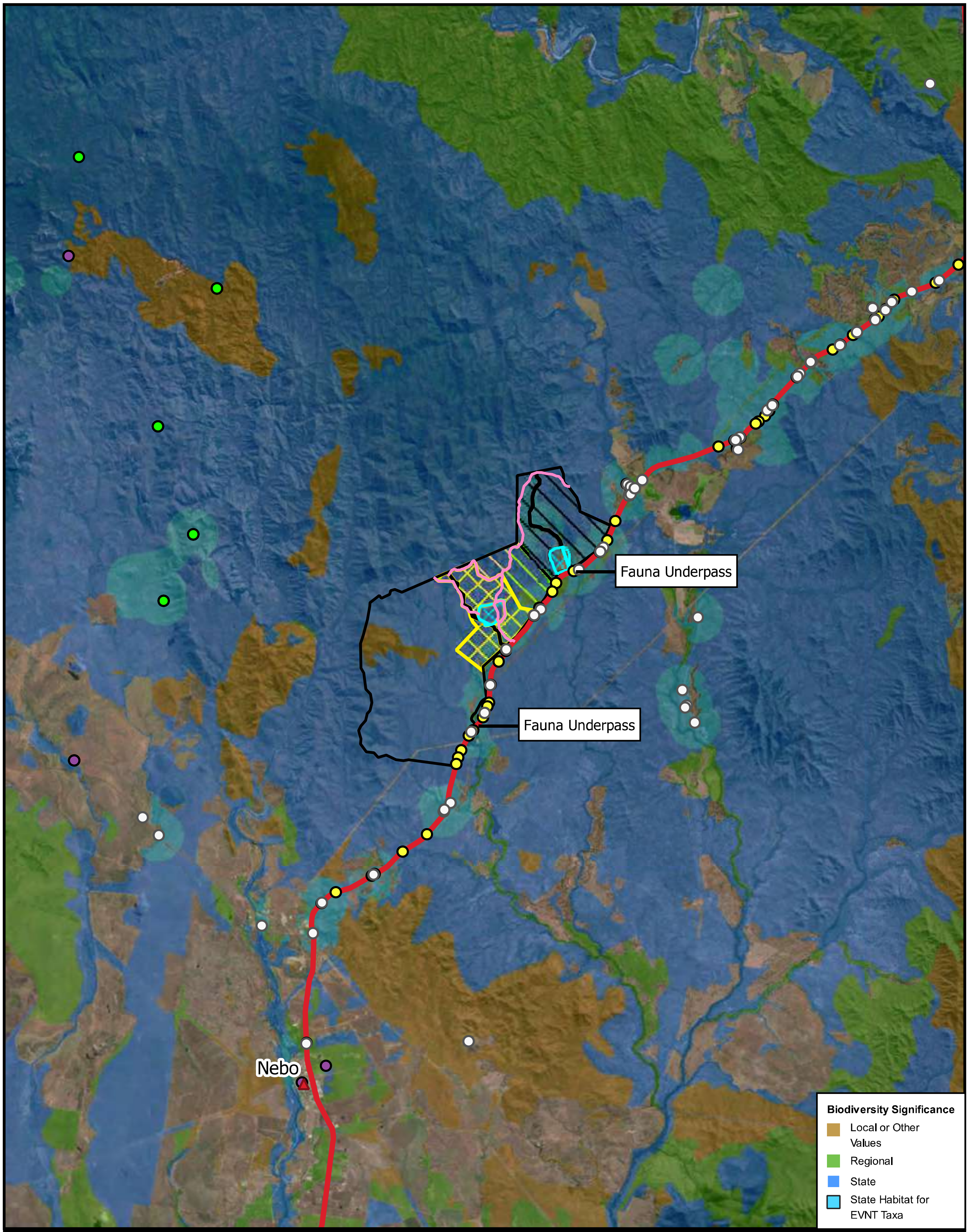

Figure 4: Historical Fauna Records Within 20 Km of Lot 4SP277438

Legend

- ▲ Towns
- Existing Fenceline
- Highways
- ☐ Lot 4SP277438 Boundary

**ALA & Wildnet Records**

- ● Greater Glider
- ○ ALA: Koala
- ● Squatter Pigeon
- ● DTMR: Koala Records
- ☒ Holding Yards
- ▨ IPEE Offset Area
- ▨ IPE Offset Area
- ☒ ID Offset Area
- ▨ Area Removed From ID Offset Area

0 2 4 km

Scale @ A3: 1 : 200000
Date: 23/11/2021
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Resources) 2021; Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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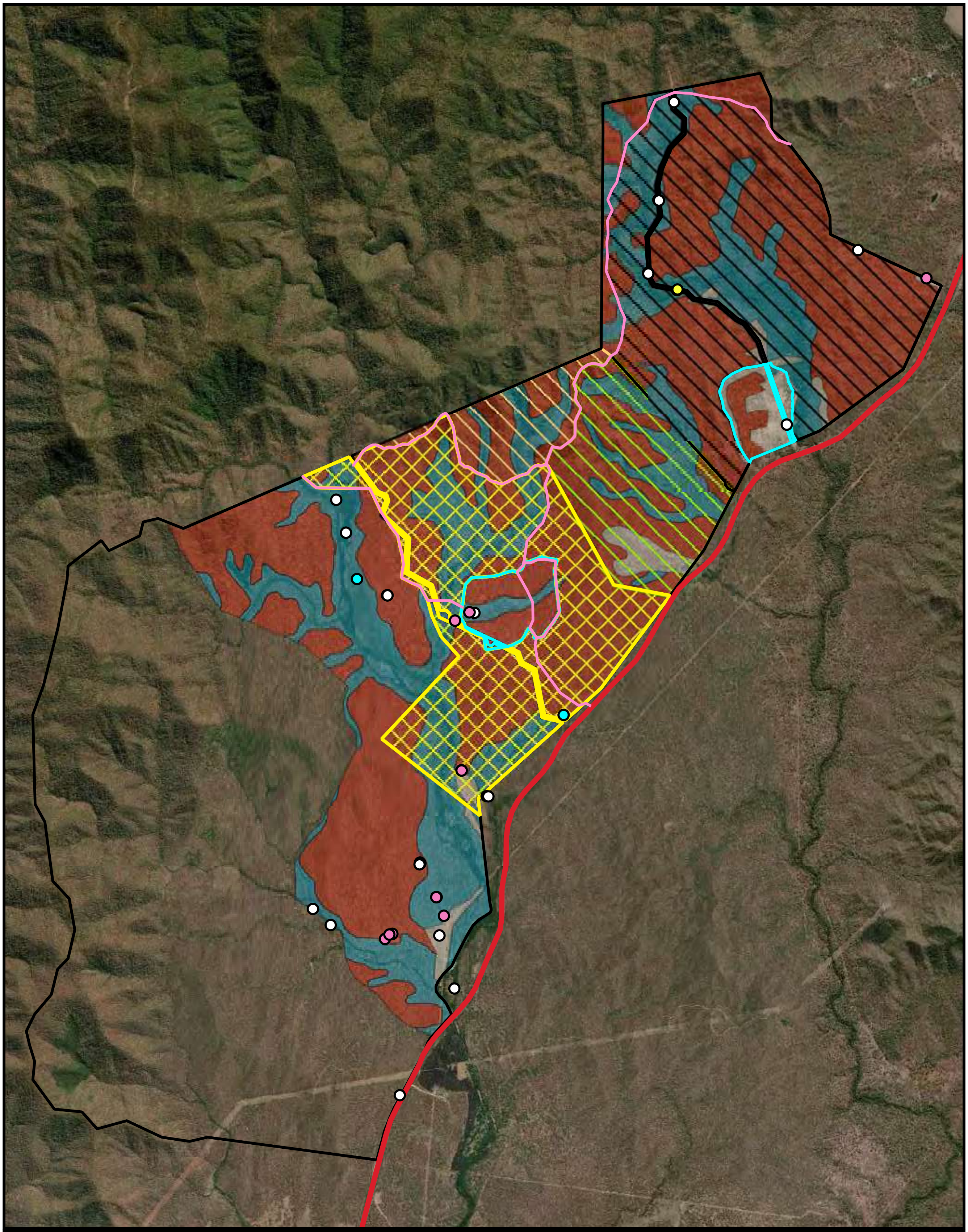

Figure 5: Species Occurance Within Lot 4SP277438

Scale @ A3: 1 : 55000
Date: 23/11/2021
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Resources) 2021; Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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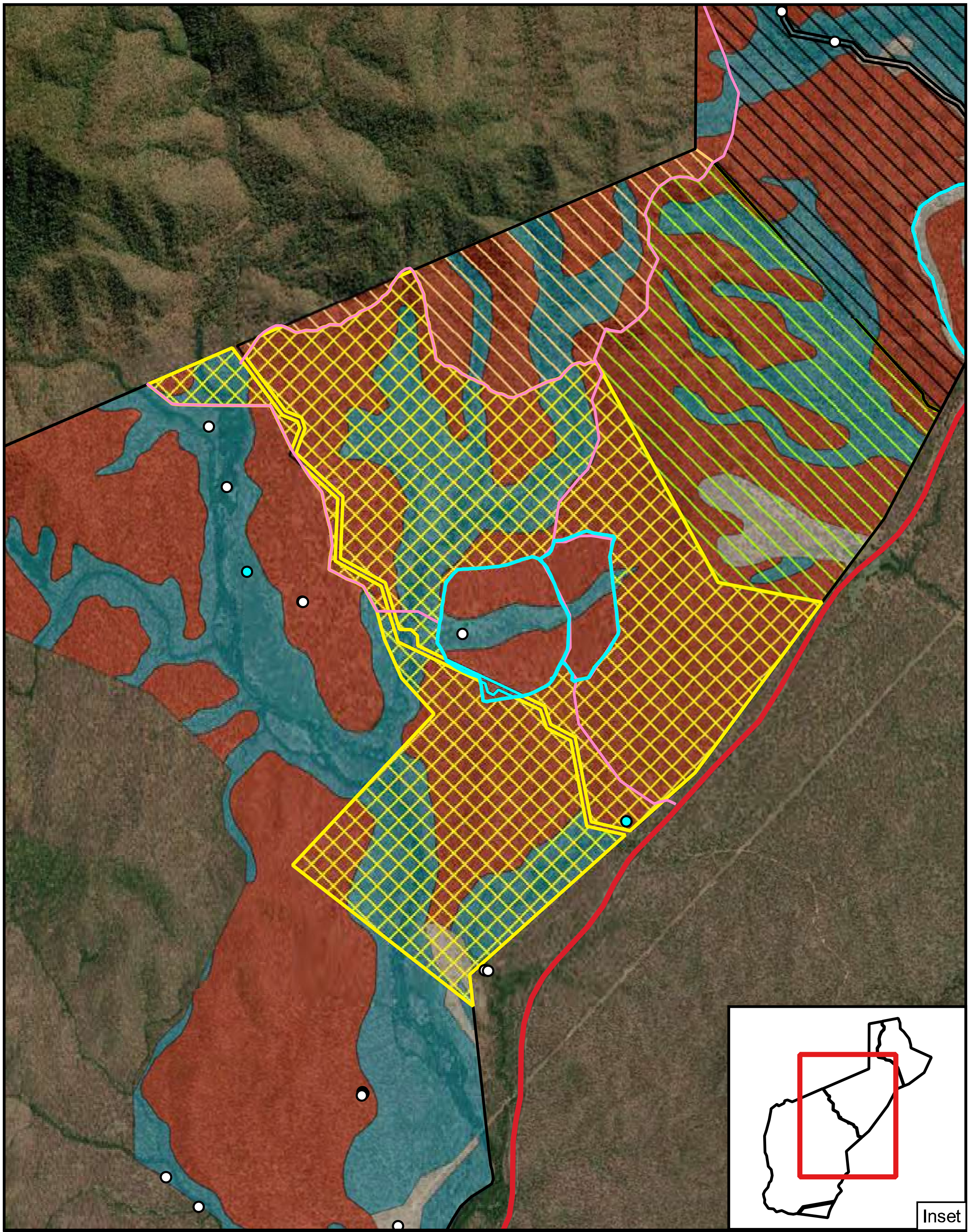
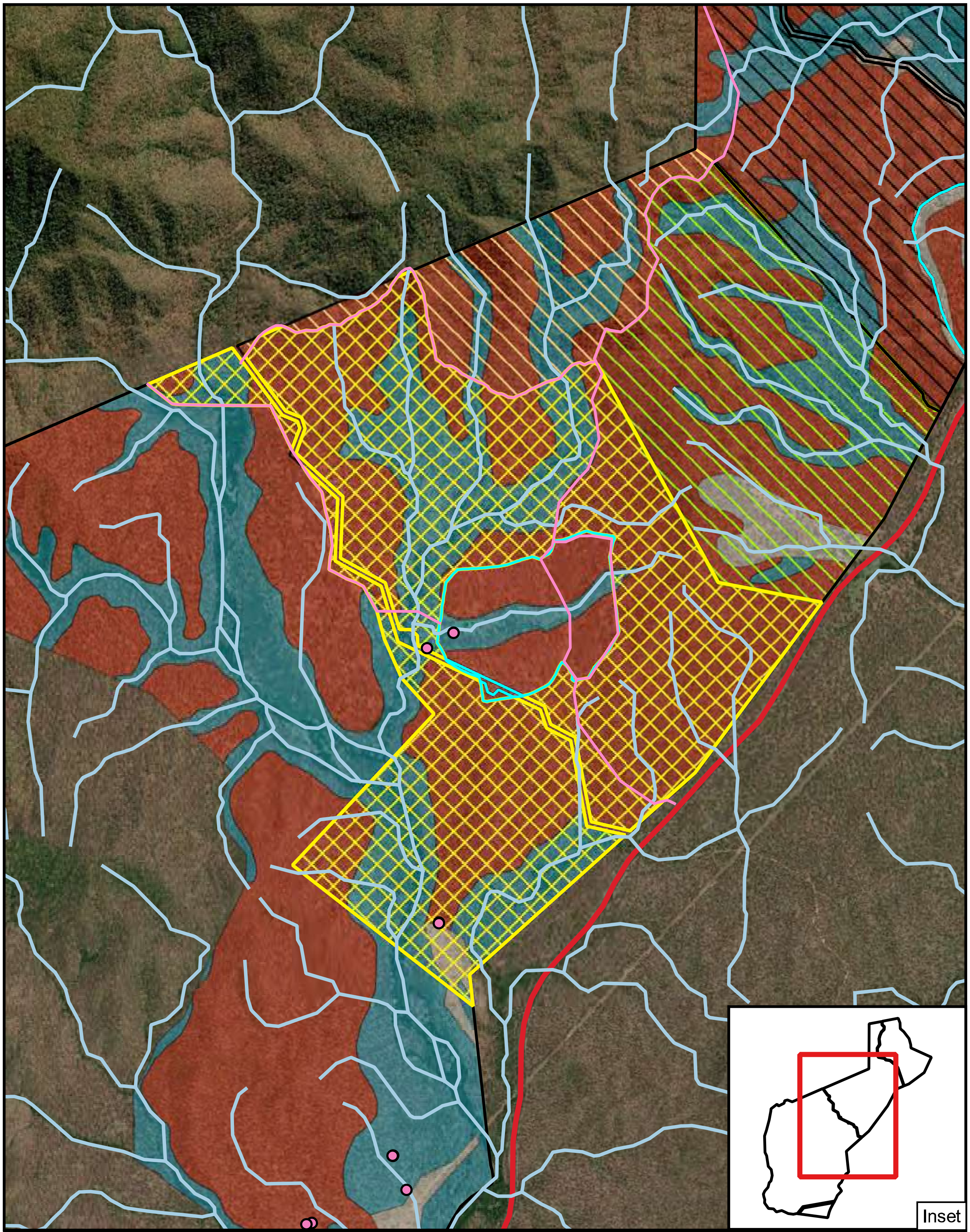


Figure 6: Koala and Greater Glider Habitat Within ID Offset Area

Scale @ A3: 1 : 30000
Date: 23/11/2021
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Resources) 2021; Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

BASE/



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Date: 23/11/2021
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Resources) 2021; Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

# Figure 7: Squatter Pigeon Habitat Within ID Offset Area

## Legend

- — Existing Fenceline
- ▬ Highways
- ☐ Lot 4SP277438 Boundary
- ● Squatter Pigeon
- ☐ Holding Yards
- ☒ IPEE Offset Area
- ▨ IPE Offset Area
- ☒ ID Offset Area
- ▨ Area Removed From ID Offset Area
- — VM Watercourse Mapping

**Field Verified RE**

- 🟥 11.12.1
- 🟦 11.3.4
- Non-Remnant

BASE/

# 4.0 Proposed Offsets

## 4.1 Habitat Quality Methodology and Scoring

As part of the Project's approvals process, detailed ecological assessments were undertaken to determine the presence/absence of listed fauna species within the Project (Impact) area and to assess and determine the level of residual impacts for listed species that had the potential to require offsets (EcoSM, 2020b). As outlined in EcoSM, 2020a (in Appendix 12 of the AEIS), assessments for the purposes of determining habitat quality were undertaken in accordance with version 1.2 and version 1.3 of the Guide to Determining Terrestrial Habitat Quality (DES, 2017; DES, 2020) (Habitat Quality Guide).

Habitat quality scores for the impact site were calculated using a combination of data collected using version 1.2 of the Habitat Quality Guide and criteria determined by DAWE as outlined in EcoSM, 2020a (in Appendix 12 of the AEIS). Since the completion of those impact area ecological surveys, the Habitat Quality Guide has been updated and version1.3 (DES 2020) is currently in effect. Therefore, the habitat quality methodology is an adaption of the approach used to originally calculate habitat quality in impact site and habitat quality within the broader strategic offset area (Base, 2018; EcoSM, 2020a) but incorporating the revised 'species attribute' calculations as per version 1.3 of the Habitat Quality Guide (refer to EcoSM, 2020a in Appendix 12 of the AEIS for further information). Calculation of habitat quality is further outlined below.

Habitat quality scoring for the impact and offset site was assessed using the Guide which, being based on the Queensland BioCondition survey methodology, uses a range of habitat indicators to measure the ecological viability and habitat values of a site and its capacity to support fauna. The process used for assessing habitat quality is designed so that it is repeatable and relatively simple and uses a combination of field attributes associated with vegetative structure, GIS assessment of the site in reference to its location in the landscape and species-specific habitat requirements.

As stated in the Guide, the assessment must measure habitat quality at the impact site and the offset site in order to quantify and compare the scores. Each of the three indicators are scored then summed to derive a final score out of 10 (refer to the Guide for calculation methodology). The key indicators for determining habitat quality of a land-based impact site or an offset site are:

- Site condition: a general condition assessment of vegetation compared to a benchmark site;
- Site context: an analysis of the site in relation to the surrounding environment; and
- Species habitat index: the ability of the site to support a given species.

Habitat quality of the impact and offset sites for the purposes of providing inputs into the EPBC offsets calculator were calculated following advice from the-then DoEE (now DAWE) during July 2018. To assess habitat quality, the majority of the attributes from the three indicators were used but partitioned differently with the majority of the species habitat index attributes being partitioned between site condition and site context as follows.

- **Site Condition (15 attributes):**
    - Recruitment of woody perennial species in EDL
    - Native plant species richness - trees
    - Native plant species richness - shrubs
    - Native plant species richness - grasses
    - Native plant species richness - forbs

  - Tree canopy height
  - Tree canopy cover
  - Shrub canopy cover
  - Native perennial grass cover
  - Organic litter
  - Large trees
  - Coarse woody debris
  - Non-native plant cover
  - Quality and availability of food and foraging habitat
  - Quality and availability of shelter

The first 13 attributes listed above are generated from direct measurements taken in the field within a standardised habitat quality plot. While these attributes are not a direct or specific measurement of the habitat value for a certain species, they do provide an indication of the overall ecological condition of the community. Ecological condition requirements that are specific to a species are captured by the assessment of the quality and availability of food/foraging habitat and shelter attributes in line with the Habitat Quality Guide. EcoSM, 2020a (in Appendix 12 of the AEIS) developed a scoring system for these attributes that is based on the SPRAT profile, published research and field-based knowledge of the target species. As habitat scoring between the impact site and offset need to be comparable, this scoring system was also used to assess habitat quality of the ID offset area. The methodology for scoring these attributes is provided in Appendix A of Appendix 12 of the AEIS. It is important to note that the total habitat indices score differs between species.

- **Site Context (6 attributes):**
  - Size of patch
  - Connectedness
  - Context
  - Ecological Corridors
  - Threat to Species
  - Species mobility capacity

In line with the Habitat Quality Guide, the first four attributes above are calculated using GIS spatial analysis. Site context requirements that are specific to a species are captured by the assessment of the threats to species and species mobility capacity attributes of the Habitat Quality Guide. The methodology for scoring these attributes is provided in Appendix A included in Appendix 12 of the AEIS.

- **Species Stocking Rate:**
  - Species stocking rate as outlined in the EPBC offsets calculator guide, replaces species habitat index as a measure of the presence of a species at the impact and offset site. In accordance with the requirements of DAWE, species stocking rate for this OAMP is assessed on a scale of 0 - 4 as categorised below:
    - 0: No evidence the species is present at the site;
    - 1: Evidence of species presence at the site during surveys conducted for the purpose of the EPBC environmental assessment;
    - 2: There is a statistically significant increase in species density relative to the species density determined for a score of 1 or species

density is equal to or greater than the species density at a reference site (not required to be an important population);

- 3: Equivalent to the species density at a reference site associated with an important population; and
- 4: Equivalent to the maximum species density measured at a DAWE agreed number of reference sites associated with important populations.

To achieve an overall habitat quality score out of 10, site condition and site context are multiplied by a weighting factor out of 10 based on the level of importance attributed to site condition, site context and stocking rate for the MNES in question. The DAWE determined the weighting factors for these MNES will be 30% for site condition, 30% for site context and 40% for species stocking rate.

## 4.2 Impact Area Assessments

Habitat quality scores for the impact area were determined from surveys undertaken in October 2018 and March 2019 from survey sites within the field verified assessment units and in accordance with the methods outlined in EcoSM 2020a; b (in Appendix 12 and 10, respectively of the AEIS). These surveys were undertaken specifically to determine habitat quality of the impact site for input into the EPBC Offsets Calculator to calculate offset areas for the Koala, Greater Glider and Squatter Pigeon for this OAMP. Scores were based on survey site data that corresponded to the species-specific habitats to be impacted as outlined in this OAMP.

Where multiple survey sites occurred within an assessment unit, the corresponding habitat quality score was derived from averaging site condition and site context from the survey sites. The average scores were then summed and divided by the corresponding maximum possible scores.

Site condition and site context were determined for each offset matter using data collected from only those habitats that were deemed as being suitable during the ecological assessments undertaken to support the approvals process. Stocking rate was determined based on the outcomes of the ecological surveys and the presence of MNES. The ID impact site condition and site context scores that were used to derive the impact area habitat quality scores for the Koala, Greater Glider and Squatter Pigeon are outlined in Appendix 12 of the AEIS and shown in Table 3, Table 4 and Table 5.

**Table 3 Impact area habitat quality scores and habitat descriptions for the Koala**

| Offset Attribute | Value | Description |
|---|---|---|
| Habitat Quality | **4/10** | **Site Condition = 1.8 (raw score = 6.1 multiplied by 30% weighting).**<br>The impact site disturbance footprint encompasses habitat that is considered to be critical habitat for the Koala. The species was recorded in riparian habitats within and adjacent to the ID disturbance footprint. Further, there is an abundance and diversity of Koala food trees present, most notably in riparian habitats, particularly those associated with the Isaac River.<br>The diversity of food trees in non-riparian areas tends to be lower than that of riparian communities. The majority of the project disturbance footprint encompasses vegetation communities on land zones 4, 5 and 7, that support only one or two potential food tree species and the canopy is fragmented and discontinuous, with the exception of the small basin of RE 11.5.3b.<br>**Site Context = 1.2 (raw score = 4.0 multiplied by 30% weighting).** |

| Offset Attribute | Value | Description |
|---|---|---|
| | | In the context of inland sites, DAWE (DotE 2014) considers refuge habitats that enable Koalas to persist during droughts and periods of extreme heat, particularly riparian environments and other areas with reliable soil moisture and fertility, as being important to the recovery of the Koala.<br>The project disturbance footprint encompasses and adjoins areas of refuge habitat for this species in the form of riparian vegetation associated with Isaac River, Billy's Gully and Southern Gully. However, the majority of the project disturbance footprint does not encompass riparian communities or other areas that provide refuge habitat for the Koala. Nonetheless, larger areas of habitat that surround and provide connectivity between refuge habitats are also relevant to the recovery of the Koala.<br>Dog attack is recognised as a key threatening process for the Koala. Wild dogs were recorded within and adjacent to the project disturbance footprint during the terrestrial ecology surveys (EcoSM, 2020a) and likely to present as a threat to the local Koala population.<br>**Species Stocking Rate = 1.**<br>Koalas, or evidence of their presence (i.e. scats and scratch marks) were recorded at a number of locations within riparian vegetation communities within and adjacent to the project disturbance footprint. No records were from within vegetation communities on clays plains, sand plains or scarps (land zones 4, 5 and 7) which comprise most of the project disturbance footprint. Stocking rate within the project disturbance footprint is considered to be less than that within adjacent riparian areas, with the exception of the small portion (i.e. 1.1 ha) of RE 11.3.25 associated with Billy's Gully that occurs within the project disturbance footprint. |

**Table 4 Impact area habitat quality scores and habitat descriptions for the Greater Glider**

| Offset Attribute | Value | Description |
|---|---|---|
| Habitat Quality | **4/10** | **Site Condition = 1.8** **(raw score = 6.1 multiplied by 30% weighting).**<br>The project disturbance footprint encompasses habitat for the Greater Glider in the form of woodland communities dominated by *Eucalypt* and *Corymbia* species that support or have the potential to develop hollows. The species was recorded in riparian habitat (RE 11.3.25) associated with the Isaac River. Riparian and alluvial communities are considered to provide higher quality habitat for this species than drier woodlands located away from waterways. Overall, riparian communities and alluvial communities were found to support the greatest availability of old hollow-bearing trees and provide connectivity with larger patches of suitable habitat in the broader landscape.<br>The greatest level of impacts associated with project will happen in communities that are considered to provide lower quality habitat resources for this species and/or habitat within which this species less commonly recorded (i.e. RE 11.3.2 and RE 11.5.3). This assessment is based on a comparison of the diversity of feed tree species, presence/absence of preferred feed trees Queensland Blue Gum and/or River Red Gum, abundance of denning resources |

| Offset Attribute | Value | Description |
|---|---|---|
| | | and number of records between RE types being impacted by the project (EcoSM, 2020a).<br>**Site Context = 1.3** **(raw score = 4.3 multiplied by 30% weighting).**<br>Riparian habitats within the project site, particularly RE 11.3.25, is considered to provide important refuge habitat that enable Greater Glider to persist during droughts and periods of extreme heat (EcoSM, 2020a). These areas also support an abundance of hollow-bearing trees and are dominated by preferred feed trees, Queensland Blue gum (*Eucalyptus tereticornis*) and River Red Gum (*E. camaldulensis*). The project disturbance footprint encompasses relatively small areas of refuge habitat for this species in the form of riparian vegetation associated with Isaac River, Billy's Gully and Southern Gully. However, the majority of the project disturbance footprint encompasses habitat that is considered to provide lower quality habitat and/or habitat within which this species less commonly recorded (i.e. RE 11.3.2 and RE 11.5.3). In addition, connectivity of high-quality habitat associated with Isaac River and Southern Gully will not be impacted by the project<br>**Species Stocking Rate = 1.**<br>The Greater Glider was recorded at a number of locations in Queensland Blue Gum/River Red Gum woodland fringing the Isaac River, Southern Gully and Billy's Gully. This species or evidence of its presence (i.e. scats) was not recorded during spotlight surveys within other eucalypt dominated communities within the study area (e.g. RE 11.4.8, RE 11.5.3, RE 11.5.12). As such, the Greater Glider was given a species stocking rate score of 1 and was allocated a weighting of 40%. |

**Table 5 Impact area habitat quality scores and habitat descriptions for the Squatter Pigeon**

| Offset Attribute | Value | Description |
|---|---|---|
| Habitat Quality | **4/10** | **Site Condition = 1.8** **(raw score = 6.5 multiplied by 30% weighting).**<br>The project disturbance footprint encompasses breeding and foraging habitat for this species. Suitable breeding and/or foraging habitat present consists of remnant eucalypt and Acacia dominated woodlands on sandy, gravelly soils (particularly land zones 5 and 7, but also land zones 3 and 4) within 3 km of a seasonal water source. These communities have been exposed to varying levels of disturbance in the form of historic vegetation clearing, cattle grazing and invasion by Buffel Grass. However, this species is known to use disturbed habitats where there is a suitable level of tree cover to provide shelter from predators.<br>Degradation of habitat by cattle and invasion of weed species, particularly Buffel Grass are recognised as a threat to the Squatter Pigeon. As noted above, these threats are currently in effect in Squatter Pigeon habitat within the impact area disturbance footprint<br>**Site Context = 1.4** **(raw score = 4.6 multiplied by 30% weighting).**<br>The Squatter Pigeon is a highly mobile species and is likely to use remnant eucalypt woodland communities present to disperse through the study area and beyond. The majority of habitat that will be impacted is in the southern portion of the project disturbance footprint. The pattern of clearing will reduce the availability of breeding and/or foraging habitat. However, connectivity to retained |

| Offset Attribute | Value | Description |
|---|---|---|
| | | areas of habitat within and adjacent to the project, will be maintained along the Isaac River corridor. The project will not result in the fragmentation and isolation of habitat for this species. Predation by Feral Cat is recognised as a key threatening process for the Squatter Pigeon. Feral Cats were recorded within and adjacent to the impact area disturbance footprint during the terrestrial ecology surveys (EcoSM, 2020b) and are likely to present as a threat to the local Squatter Pigeon population.<br>**Species Stocking Rate = 1.**<br>Eight individuals of this species were recorded at one location in remnant eucalypt woodland (i.e. RE 11.3.2) associated with the flood plain of Isaac River during the terrestrial ecology surveys. |

## 4.3 Overview of Offset Property and Offset Area

The identified 610 ha offset area is in the central section of Lot 4SP277438 within the Mt Spencer Station property (Figure 1) and is immediately adjacent to the IPE offset area which borders the ID offset area to the north, north-east located (Figure 3). Lot 4SP277438 encompasses 4,810 ha of which 4,693 ha is currently mapped as remnant vegetation that has the potential to provide offsets for impacts to the MNES. Further, Mt Spencer Station (inclusive of Lot 4) covers 22,712 ha which includes approximately 20,190 ha of remnant vegetation that has the potential to provide offsets for impacts to the MNES.

Mt Spencer Station is a beef cattle and cropping property located between the Brigalow Belt (the majority of the ID offset area) and Central Queensland Coast (small sections to the north, north-west of the offset area) bioregions straddling the Clarke-Connors ranges (in the western section) and the Nebo-Connors Ranges (in the eastern section). The Clarke-Connors Ranges sub-region is currently classified as an intact landscape which reflect the minimal levels of habitat fragmentation that have occurred relative to other bioregions in Queensland. However, the Nebo-Connors Ranges sub-region in contrast is currently classified as a fragmented landscape which generally reflects higher levels of historic disturbance and habitat fragmentation. Vegetation surveys undertaken in July and October 2020 determined the on-ground vegetation communities do not vary either side of the bioregion boundary and as such, the RE vegetation community that accurately matched the on-ground vegetation (11.3.4 and 11.12.1) was used for the purposes of remapping the vegetation and calculating the habitat quality scores.

The Biodiversity Planning Assessment (BPA) mapping shows the majority of Mt Spencer Station has been mapped as containing areas of State Significance. Linear areas along the Peak Downs Highway (which bisects the whole of Mt Spencer Station) includes areas of State and Regional Habitat for Endangered, Vulnerable and Near Threatened (EVNT) fauna (refer to Figure 4). This area also corresponds to areas mapped as Essential Habitat for the Koala.

The eastern boundary of the investigation area is bordered by non-remnant vegetation characterised by the Peak Downs Highway (although remnant vegetation occurs on the eastern side of the Highway and connectivity occurs via road underpasses (Figure 4). The remaining northern, western, and southern boundaries are bordered by large tracts of remnant vegetation that include protected areas such as the Epsom State Forest and Homevale National Park (Figure 3). As outlined above, the north, north-west boundary is bordered by the IPE offsets area.

The identified ID offset area is also bisected by a road licence that runs parallel to the southern boundary of the offset area. This licence area is still managed as part of Lot 4 and allows the landowner to restrict access such that no general (public) access is permitted. Although the road is included in the day to day management of Lot 4, it has been excised from the ID offset area, as it is a separate cadastral area.

There is a small section in the central portion of Lot 4 which is currently used as cattle holding yards, linked with the road licence, and this has been excised from the ID offset area.

### 4.3.1 Offset Area Habitat Quality

The proposed 610 ha offset area contains suitable habitat and environmental values to offset the required impacts to the Koala, Greater Glider and Squatter Pigeon and was chosen such that all required offsets for the three MNES could be co-located within the one offset area. Three field investigations were undertaken by suitably qualified ecologists (refer to Appendix A) in June, July and October 2020 (Refer to Appendix B for the ecological survey report). The June event was primarily a general reconnaissance survey to assess where the most suitable offset areas occurred within Lot 4. Opportunistic fauna observations were also recorded, and sightings of the Koala and Squatter were observed while suitable Greater Glider habitat and tree hollows were noted.

The July and October 2020 surveys were targeted towards confirming the presence of all three species as well as collecting habitat quality data. As the July survey did not detect the Greater Glider within the offset investigation area, DAWE suggested a further survey should be undertaken to target this species. This targeted survey was undertaken in October 2020 and the ecologists took opportunity to collect further habitat quality data and to confirm the boundaries of the remapped REs.

The July and October 2020 surveys confirmed the broader offset investigation area comprises a Eucalypt Woodland BVG that is dominated by vegetation consistent with RE 11.12.1 and RE 11.3.4 and interspersed with small and isolated non-remnant patches. These vegetation communities are considered appropriate for Koala as these REs support known Koala food trees, Greater Glider habitat and Squatter Pigeon breeding and foraging habitat. The proposed offset site is shown in Figure 3-8. As outlined above, the ID offset area straddles both Bioregion 11 and Bioregion 8, but the offset area is dominated by Bioregion 11 (approximately 90% of the area is in Bioregion 11 – Brigalow Belt). The on-ground vegetation communities and REs were the same in either side of the Bioregion boundary and as such, the RE description that most closely matched the on-ground vegetation communities (RE 11.12.1 and RE 11.3.4) were used as benchmark REs for calculating the habitat quality scores.

The July and October field assessments determined the baseline habitat quality of the offset area in accordance with the Guide and assessed the species stocking rate (presence) of the Koala Greater Glider, and Squatter Pigeon. Habitat quality of the offset area was determined in accordance with the methods outlined in Section 4.1 and in the same manner for the impact site as outlined in Appendix 12 of the AEIS.

A total of 31 habitat quality plots were used to determine habitat quality within the broader strategic offset area. The intent of the broader offset area was to provide offsets for all three of Stanmore's projects (IPE, IPEE and ID). The broader offset area was subdivided for each offset area based on order of importance of submitting an OAMP for approval and construction schedules. This necessitated the IPEE OAMP to be developed first and the IPE offset area second, as shown on Figure 3. The IPEE offset area is located in the northern section of Lot 4. The IPE OMP followed and was located immediately to the south, south-west of and bordering the IPEE offset area (Figure 3). Combined, the IPEE (15 plots) and IPE (7 plots) offsets areas included 22 of the 31 habitat quality survey plots with the number of survey plots within the boundary of the offset areas being dictated by the configuration of the offset area boundaries which were determined through consultation with the landowners. Habitat quality scores for both the IPEE and IPE areas were very similar with any minor differences being driven by species stocking rate rather than site condition or site context.

For the ID offsets area, only the south, south-western boundary could vary based on the configuration of the IPEE and IPE offset boundaries, the preference for all three offset areas to be adjacent to one another, the eastern boundary being constrained by the Peak Downs Highway and the western boundary being constrained by the State Forest. Several offset area boundary configurations were discussed with the landowner with the preferred boundary location chosen based on the location of current fence lines.

The most practical offset boundary is shown in this OAMP (Figures 3-8). Due to the constraints associated with determining the offset boundary, five (5) habitat quality plots occur within the ID offset area; three (3) are located within RE 11.12.1 (plot 6 is on the boundary and was included), one (1) located in RE 11.3.4 and one (1) occurring in non-remnant vegetation community. The small area of non-remnant was included in the offset area as the pre-clearance vegetation community is analogous to RE 11.3.4 and the Squatter Pigeon and Koala have previously been observed on the edge of the non-remnant area.

As the site condition and site context scores generally show minimal variation throughout the broader offset site, an additional two (2) habitat quality plots were selected from the remaining three (3) survey plots in RE 11.3.4 to obtain sufficient representative data to calculate the habitat quality score and hence, the offset area required. Unsurprisingly, the habitat quality scores for site condition and site context were very similar to those for the IPEE and IPE offset areas and very similar to the broader offset area when assessed as a whole (i.e. 4/10 when excluding stocking rate). The number of habitat quality plots within each of the assessment units is shown in Table 6. Additional sampling sites for ongoing monitoring will be established during the detailed monitoring undertaken in year 1 as outlined in Section 8.3.

**Table 6 Assessment units and corresponding count of habitat quality plots**

| Assessment unit | RE | Area of RE (ha) | Number of HQPs |
|---|---|---|---|
| AU1 | 11.12.1 | 403.3 | 3 |
| AU2 | 11.3.4 | 200.1 | 3 |
| AU3 | Non-remnant (11.3.4) | 6.6 | 1 |
| **Total** | | **610** | **7** |

Habitat quality score metrics for each of the MNES are summarised in Table 7. Individual scores from each of the habitat quality plot survey sites are outlined in Appendix A. Offset area habitat quality descriptions are provided in Table 11 to 13 for the Koala, Greater Glider and Squatter Pigeon, respectively. Representative photos of the offset investigation area are shown in Plates 1-2.

**Plate 1 Representative photo from AU1 (RE 11.12.1) within the offset site**

**Plate 2 Representative photo of riparian vegetation (RE11.3.4) within the offset site**

**Plate 3 Representative photo of non-remnant vegetation (analogous with RE11.3.4) within the offset site**

**Table 7 Summary of habitat quality of the offset site to be secured on Mount Spencer Station**

| MNES | Site condition[2] | Site context[3] | Species stocking rate[4] | Starting habitat quality score (HBS)[5] | AU area weighted HBS |
|---|---|---|---|---|---|
| Koala *(Phascolarctos cinereus)* | 1.7 | 1.8 | 1 | 5/10 (up from 4.5) | 5/10 (rounded up from 4.8) |
| Greater Glider *(Petauroides Volans*) | 1.7 | 2.2 | 1 | 5/10 (rounded up from 4.9) | 5/10 (rounded down from 5.1) |

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[2] Average from the two assessment units after applying DAWEs weighting of 30%
[3] Average from the two assessment units after applying DAWEs weighting of 30%
[4] Average from the two assessment units after applying DAWEs weighting of 40%
[5] Weighted habitat quality score as calculated from the DAWE modified QLD habitat Quality Spreadsheet

| MNES | Site condition[2] | Site context[3] | Species stocking rate[4] | Starting habitat quality score (HBS)[5] | AU area weighted HBS |
|---|---|---|---|---|---|
| Squatter Pigeon (Southern) *(Geophaps scripta scripta)* | 1.8 | 2.1 | 1 | 5/10 (rounded up from 4.9) | 5/10 (rounded down from 5.2) |

### 4.3.2 EPBC Offset Area Calculator Attributes

In accordance with the EPBC Act Environmental Offsets Policy, the results of the field survey and calculation of habitat quality as outlined in Section 4.1, were used to provide inputs into the EPBC Offset Assessment Guide calculator to determine the offset area required and the percent of impact that could be offset within the proposed offset area for each of the MNES. Based on the results of these analyses, Table 8 outlines the impact areas of the Project, the offset area required to be secured, the habitat quality score as calculated using the methods outlined in Section 4.1 and the percent of the impact that is offset. The habitat quality scores of the impact site are included in Appendix 12 of the ID AEIS and in Appendix C of this document for the offset area.

The input values used for the calculation are provided below and reflect a realistic assessment of the area to provide offsets into the future as well as the likely future habitat quality in the absence of offsets. The EPBC Offset Assessment Guide calculator results indicate that the proposed 610 ha offset area will fully meet offset requirements for the Koala, Greater Glider and Squatter Pigeon. Although the offsets area is generally encompassed by remnant vegetation and habitat suitable for the MNES, the area also includes several threatening processes that is limiting the habitat values of the area for those MNES.

Table 9, Table 10 and Table 11 provide descriptions of the input values for each MNES and the output worksheets from the EPBC Offset Assessment Guide calculator are included in Appendix D. Table 12 summarises separately the risk of loss, confidence and time to ecological benefit for the offset area as these attributes are consistent for all three MNES.

**Table 8 Summary of the offset area to be secured on Mount Spencer Station**

| Offset Matter | Impact area (ha) | Offset area (ha) | Baseline habitat quality score | Future habitat quality with management | Percent acquitted |
|---|---|---|---|---|---|
| Koala | 131.9 | 610 | 5/10 | 6/10 | 100.01 |
| Greater Glider | 120.9 | 560 | 5/10 | 6/10 | 100.14 |
| Squatter Pigeon | 122.1 | 565 | 5/10 | 6/10 | 100.04 |

**Table 9 Species specific habitat quality offsets calculator metrics and habitat details for the Koala offset area**

| Offset Calculator Input | Score | Comment |
|---|---|---|
| Quality of impact area | 4 | The Koala was confirmed as present within the impact area, as was Koala habitat confirmed as present. The overall habitat quality of the impact area is somewhat limited due to past processes such as habitat clearing, grazing, fire and disturbance by feral animals and weed species. The impact area does support a moderate abundance of foraging habitat for the Koala. As all Eucalypt trees are considered Koala habitat, the full clearing extent of 131.6 ha is considered to impact Koala habitat.<br>The quality of the impact area was assessed in accordance with the Guide and the methods outlined in Section 4.1 which identified a habitat quality score of 4/10. |
| Starting quality of offset area | 5 | The offset area of 610 ha is dominated RE 11.12.1 and 11.3.4. The offset area also contains a small portion (6.6 ha) of non-remnant vegetation in the southeast corner. Although this vegetation is classified as non-remnant, it has features and traits analogous with RE 11.3.4.<br>These Eucalypt dominated REs are considered suitable habitat for the Koala as they support known or potential habitat trees required for shelter and foraging. Although evidence of recruitment of canopy trees was observed in the offset area, this did not equate to establishment of large canopy trees which showed low abundance relative to the impact area and benchmark sites. Therefore, the offset site has a lower level of foraging and shelter habitat relative to both the impact area and benchmark.<br>The offset area is currently used for livestock grazing and has moderate levels of disturbance caused by feral animals, past fire practices and incursion by invasive weed containing species known to occur within 11.3.4 including Lantana, Rubber Vine and Parthenium. Combined, these threatening processes result in a habitat that is moderately degraded with low-moderate levels of floristic diversity within the ground mid-story layers.<br>The quality of the Koala offset area was assessed in accordance with the Guide and the methods outlined in Section 4.1 which and identified a habitat quality score of 5/10. |
| Future quality of the offset area without offset management | 5 | An assessment of the likely habitat quality of the offset area was undertaken and considered the current habitat quality as determined by and assessed in accordance with, the DES Guide, the threatening processes to the Koala and the effect of these processes on the future habitat quality. |

| Offset Calculator Input | Score | Comment |
|---|---|---|
| | | In addition, Queensland's *Planning Act 2016* (PA Act) includes a range of exemptions for landholders to manage vegetation including establishing new infrastructure, fences, roads, tracks, fire management lines and firebreaks. Approval to thin vegetation can also be sought. The implementation of these actions will not result in the entire removal of vegetation; however, coupled with cattle stocking rates has the potential to degrade woodland habitats, such as a further reduction in habitat quality associated with the ground and mid-canopy layers.<br>The current processes and the presence of known invasive weeds of State and National significance, particularly Lantana would continue to have a detrimental impact on tree species recruitment (and establishment), and native plant habitat quality via a decrease in species richness for grasses, shrubs, and forbs, a decrease in native grass cover and an increase in non-native plant cover.<br>Specifically, the offset area was found to contain a variety of WONS including Rubber Vine, Lantana, Velvety tree pear and Parthenium (within the offset Ecology Report in Appendix B). These species are highly invasive and coupled with habitat degradation by feral animals including Feral Pigs, Feral Horses and Rabbits may create heightened conditions for the spread and establishment of these invasive weeds. Associated impacts are likely to include increased erosion which can lead to a further habitat disturbance.<br>These processes and land management actions, whilst primarily on the ground and mid-storey floristic structural layers, have the potential to degrade the quality and availability of food and foraging habitat for the Koala and an increased threat to Koala's from predators accessing the area.<br>The current threats from traffic related deaths along the Peak Downs Highway are likely to continue to be a risk to the species. However, DTMR have recently installed Koala fencing at several locations along the Peak Downs Highway and if this fencing is successful in funnelling Koalas under the Peak Downs Highway, threats from traffic related deaths may decrease.<br>Taking into consideration the above threatening processes, the predicted effects of these processes, current management practices and obligations on all landowners under Queensland biosecurity legislation to appropriately control invasive weeds and pest animals, no decrease in habitat quality is anticipated for the offset site without the offset being in place. |
| Future quality of the offset area with offset management | 6 | The quality of Koala habitat will be improved and maintained through the establishment of the proposed offset area. Future quality of the offset represents the ecological gain that can be achieved over 20 years of active land management aimed at improving the ecological condition of habitat specifically for the species.<br>Detailed management actions are outlined in Section 6.0 and are specifically targeted towards providing enhanced habitat values for the Koala. The management actions will reduce pest animal abundance, increase flora species richness, enhance recruitment of large canopy trees, and increased quality of food and shelter habitat encouraging Koalas to inhabit the area. Management actions include: |

| Offset Calculator Input | Score | Comment |
|---|---|---|
| | | • A pest management control program to reduce the number of pest animals, including Feral Pigs and Rabbits which may degrade the area, constraining vegetation recruitment and prompting weed infestations; and Wild Dogs, Foxes and Feral Cats which can prey on Koala's as they move between habitat trees and dispersing Koalas;<br>• Strategic cattle grazing management to improve the condition of habitat through improved tree recruitment, reduce weed infestations and excessive ground cover;<br>• Weed management to reduce the infestation of weeds that currently out-compete native tree species; and<br>• Strategic fire management to maximise recruitment and establishment of large canopy trees and increase canopy cover. Maximising the establishment of canopy trees will increase foraging habitat and increasing tree canopy and sub-canopy cover will provide additional shelter habitat.<br>Fire management will be a key management action. Properly managed fire regimes will promote cooler fires and avoid hot and intense fires which are known to destroy fauna habitat, including shelter and food resources. Removing and controlling Lantana will also minimise the potential for hot fires as significant stands of Lantana occur along the riparian and surrounding vegetation and these stands promote fire to funnel up to the tree canopies |

**Table 10 Species specific habitat quality offsets calculator metrics and habitat details for the Greater Glider offset area**

| Offset Calculator Input | Score | Comment |
|---|---|---|
| Quality of impact area | 4 | The Greater Glider was confirmed as present within riparian corridors adjacent to the impact area. The overall habitat quality of the impact area is somewhat limited due to the habitat of the Greater Glider being primarily restricted to the riparian vegetation and the levels of habitat fragmentation as well past processes such as grazing and disturbance by feral animals and weed species. The impact area generally has lower levels of habitat connectivity compared to intact landscapes and lower densities of large hollow bearing trees which provide shelter and nesting habitat for the Greater Glider.<br>The quality of impact area was assessed using the Guide and the methods outlined in Section 4.1 which identified a habitat quality score of 4/10. |
| Starting quality of offset area | 5 | The offset area for the Greater Glider (560 ha) will be collocated entirely within the Koala offset area. The offset area occurs within the single mixed RE polygon dominated by RE 11.12.1 and RE 11.3.4, as well as a small portion (6.6 ha) of non-remnant vegetation in the southeast corner. Although this vegetation is classified as non-remnant, it has features and traits analogous with RE 11.3.4. Habitat quality scores were derived from the methods outlined in the DES Guide.<br>Although these Eucalypt dominated REs are considered suitable habitat for the Greater Glider and individuals were found within the ID offset area. The 11.3.4 vegetation community is considered |

| Offset Calculator Input | Score | Comment |
|---|---|---|
| | | important drought refuge and wildlife corridors for arboreal animals and 11.12.1 can provide important nesting habitat for arboreal animals via the general prevalence of tree hollows.<br>Although evidence of recruitment of canopy trees was observed in the offset area, this did not equate to an abundance of large canopy trees which have the greatest potential to provide shelter and nesting habitat for Greater Gliders, but the number of large canopy trees was in most cases, below Benchmark. Habitat quality scores from RE 11.3.4 and RE 11.12.1 were variable with some attributes higher than Benchmark values and others lower.<br>The offset area is currently used for livestock grazing and has moderate levels of disturbance caused by feral animals and incursion by invasive weed species, particularly Lantana. Combined, these threatening processes result in a habitat that is moderately degraded with restricted habitat values at present.<br>The quality of habitat within the Greater Glider offset area was 5/10. |
| Future quality of the offset area without offset management | 5 | Future habitat quality without an offset in place was assessed by taking into consideration the current habitat quality, the current threatening processes and the effect of these processes on the habitat quality scores as determined by the accepted habitat quality scoring process outlined in the DES Guide.<br>Queensland's *Planning Act 2016* (PA Act) includes a range of exemptions for landholders to manage vegetation including establishing new infrastructure, fences, roads, tracks, fire management lines and firebreaks. Approval to thin vegetation can also be sought. The implementation of these actions will not result in the entire removal of vegetation; however, coupled with cattle stocking rates has the potential to degrade woodland habitats, such as a further reduction in habitat quality associated with the ground and mid-canopy layers.<br>The main threatening process that are contributing the habitat quality of the site are the loss and degradation of foraging and shelter/nesting habitat by feral animals, fire regimes and the presence of known invasive weeds of State and National significance. These processes would continue to have a detrimental impact on several site condition attributes including decreasing tree species recruitment (and establishment), decrease in species richness of grasses, shrubs, and forbs, a decrease in native grass cover and an increase in non-native plant cover.<br>The project area was found to contain a variety of WONS including Rubber Vine, Velvety tree pear and Lantana. These species are highly invasive and coupled with habitat degradation by feral animals including Feral Pigs and Rabbits is expected to exacerbate the spread and establishment of these invasive weeds. Associated impacts may include increased erosion which can lead to further habitat disturbance.<br>Over an extended period, this would lead to a decrease in sub-canopy and canopy floristics and abundance and in turn, limit the potential for nesting and foraging habitat.<br>These processes, whilst primarily restricted to the ground and mid-storey floristic layers, may degrade the quality and availability of food and foraging habitat and an increased threat from predators accessing the area. In addition, these processes would likely lead to |

| Offset Calculator Input | Score | Comment |
|---|---|---|
| | | hotter and more intense fires which could prevent the offset site from increasing in habitat quality. Further degradation to the 11.12.1 vegetation (which can provide important nesting habitat for arboreal animals via the general prevalence of tree hollows) would decrease the ecological values of the area.<br>Taking into consideration the above threatening processes the predicted effects of these processes, current management practices and obligations on all landowners under Queensland biosecurity legislation to appropriately control invasive weeds and pest animals, no decrease in habitat quality is anticipated for the offset site without the offset being in place. |
| Future quality of the offset area with offset management | 6 | The quality of the Greater Glider habitat will be improved and maintained through the establishment of the proposed offset area. Future quality of the offset represents the ecological gain that can be achieved over 20 years of active land management practices to improve the ecological condition of habitat for the species.<br>It has been conservatively calculated that by implementing the detailed management actions outlined in Section 6.0 of this OAMP, the habitat quality score can increase from 5/10 to 6/10 (an increase in habitat quality of 1 and the stocking rate remaining unchanged). The management actions are aimed at increasing canopy tree recruitment and minimising disturbance such that the presence of trees and shelter habitat can be established.<br>Management actions include:<br>• A pest management control program to reduce and the number pest animals, including Feral Pigs, Feral Horses and Rabbits that are currently degrading the area, constraining vegetation recruitment and prompting weed infestations and Foxes, Feral Cats and Wild Dogs which are known predators of the MNES. Feral cats were observed traversing the offset area during spotlighting and on one occasion, a Feral Cat was seen adjacent to a tree hollow with the observed behaviour consistent with predatory behaviour;<br>• Strategic cattle grazing management to improve the condition of habitat through improved floral recruitment and strategic grazing to reduced weed infestations and excessive ground cover;<br>• Weed management to reduce the infestation of weeds that currently out-compete native tree species; and<br>• Strategic fire management to maximise recruitment allow mid to upper storey habitat trees to mature and promote the establishment of tree hollows. Using appropriate fire regimes will also minimise the incidence of hot and damaging fires which would likely destroy existing hollow bearing trees and retard the establishment of new hollows. Maximising the establishment of hollow bearing trees will provide denning habitat opportunities and increased tree canopy and sub-canopy cover will provide additional habitat for the Greater Glider.<br>Implementation of this OAMP must increase habitat quality over the 20 year period from 5/10 to 6/10 at a minimum. |

# Table 11 Species specific habitat quality offsets calculator metrics and habitat details for the Squatter Pigeon offset area

| Offset Calculator Input | Score | Comment |
|---|---|---|
| Quality of impact area | 4 | Eight individuals of this species were recorded at one location in remnant eucalypt woodland (i.e. RE 11.3.2) associated with the flood plain of Isaac River. Habitat was in moderate condition with suitable breeding and/or foraging habitat consisting of remnant eucalypt and Acacia dominated woodlands on sandy, gravelly soils (particularly land zones 5 and 7, but also land zones 3 and 4) within 3 km of a seasonal water source. These communities have been exposed to varying levels of disturbance in the form of historic vegetation clearing, cattle grazing and invasion by Buffel Grass.<br>Although the impact area was fragmented, and threatening processes were observed, the relatively broad habitat utilised by Squatter Pigeons resulted in a habitat quality score of 4/10. |
| Starting quality of offset area | 5 | The offset area for the Squatter Pigeon is 564 ha. This offset area will be collocated with offsets for the Koala and Greater Glider as shown on Figures 3-5. Eucalypt dominated REs are considered suitable habitat for the Squatter Pigeon, including the non-remnant vegetation within the offset area (analogous with RE 11.3.4) where several squatter pigeons have been sighted. These suitable habitats are within an area of multiple known Squatter Pigeon records, are consistent with the foraging and breeding habitat definitions included on the SPRAT profile and recent IPM project approvals, and they support a rich and diverse grassy understorey within an area of known Squatter Pigeon records. In addition, most of the offset area is within 1 km of seasonal and permanent water sources including artificial stock watering points. On several occasions including the RE groundtruthing survey event in June 2020 and the detailed ecological survey events in July 2020, Squatter Pigeons were found in a range of habitat types including RE 11.12.1 and varying level of groundcover.<br>Within the offset area, land zone 12 primarily consists of soils and geology that is deeply weathered. This is similar to that found on land zone seven (7) and land zone five (5) and is consistent with known Squatter Pigeon foraging and breeding habitat. As such, this habitat is considered suitable Squatter Pigeon habitat based on the observations made over three different survey events, as well as confirmed sightings over many years by the landowners, and taking into consideration the topography, soils, geology and understorey microhabitats.<br>The offset area is currently used for livestock grazing and has moderate levels of disturbance caused by feral animals (Feral Pigs and Rabbits), past fire practices and incursion by weed species. Combined, these threatening processes result in an altered understorey habitat that is moderately degraded with restricted habitat values at present.<br>The quality of habitat within the offset area was 5.0/10. |
| Future quality of the offset area without offset management | 5 | The main threatening process are the loss and degradation of the ground layer (grasses and forbs) which directly impacts the Squatter Pigeon by degrading their preferred foraging and breeding/nesting habitat. Habitat degradation is occurring through feral animals, fires and the presence of invasive weeds of State and National significance. These processes, without being controlled by the landowner, would have a detrimental impact on several site |

| Offset Calculator Input | Score | Comment |
|---|---|---|
| | | condition attributes important to Squatter Pigeons including decreasing species richness and cover of grasses, shrubs, and forbs, an increase in non-native plant cover and a decrease in quality and availability of food and foraging habitat.<br>The offset area contains a variety of WONS including Rubber Vine, Parthenium, Velvety tree pear and Lantana (within the offset Ecology Report in Appendix B), and which are subject to general biosecurity obligations. These species are highly invasive and coupled with habitat degradation by feral animals including Feral Pigs and Rabbits would exacerbate the spread and establishment of these invasive weeds. Associated impacts are likely to include increased erosion which can lead to further habitat disturbance. Further, increased erosion and could lead to altered hydrological regimes and drainage, particularly in the alluvial soils, which is known to impact on nesting and foraging habitat.<br>In addition, Queensland legislation allows for land managers to manage vegetation including establishing new infrastructure, fences, roads, tracks, fire management lines, firebreaks and thinning. When combined with cattle grazing, weed invasion and disturbance by feral animals, these actions would degrade woodland habitats causing a further reduction in habitat quality associated with the ground layer and as such, Squatter Pigeon breeding, nesting, foraging and bathing habitat.<br>Taking into consideration the above threatening processes the predicted effects of these processes, current management practices and obligations on all landowners under Queensland biosecurity legislation to appropriately control invasive weeds and pest animals, no decrease in habitat quality is anticipated for the offset site without the offset being in place. |
| Future quality of the offset area with offset management | 6 | The quality of Squatter Pigeon habitat will be improved and maintained through the establishment of the proposed offset area. Future quality of the offset represents the ecological gain that can be achieved over 20 years of active land management practices to improve the ecological condition of habitat for the species.<br>Detailed management actions are outlined in Section 6.0 of this OAMP and are specifically targeted towards providing enhanced habitat values and include:<br>• A pest management control program to reduce and the number pest animals, including Feral Pigs, Feral Horses and Rabbits that are currently degrading the offset area and promoting weed infestations and reducing native grasses and Foxes, Feral Cats and Wild Dogs which are known predators of the MNES;<br>• Strategic cattle grazing management to improve the condition of ground cover habitat, reduce weed infestations and excessive ground cover;<br>• Weed management to reduce the infestation of weeds that currently out-compete native ground cover species, particularly the significant stands of Lantana within RE 11.3.4; and<br>• Strategic fire management to maintain a suitable ground cover biomass.<br>Implementation of this OAMP must increase habitat quality over the 20 year period from 5/10 to 6/10 at a minimum. |

**Table 12 Generic habitat quality offsets calculator metrics (Confidence, Risk and time until benefit)**

| Confidence, Risk and Timeline | Score | Comments |
|---|---|---|
| Confidence in the offset achieving the predicted quality score | 90 % | Implementing the actions outlined in this OAMP will provide a high degree of confidence that a conservative increase in future habitat quality of one (1) from the current condition can be achieved. This increase does not include any increases in stocking rates for any of the MNES. Annual reporting will be undertaken for compliance with the management action outlined in the OAMP. This will allow for timely identification of any corrective actions required. Biodiversity monitoring will also be conducted as part of the OAMP (refer to Sections 7.2 and 1.1) to measure the progress of the offset area and ensure the offset area achieves its required offset obligations.<br>It should be noted that an increase in future habitat quality of one (1) is conservative and is based on assessing the current habitat quality scores and those scores that could realistically be achieved through implementation of the management actions. The increase in a score of 1 also excludes any increases associated with stocking rate. An assessment has been undertaken and considered the current habitat score, the proposed management actions and the resulting changes to the habitat quality scoring. The proposed management actions are predicted to increase tree species recruitment, native plant species richness for trees and shrubs, decrease non-native plant cover, increase quality and availability of food and foraging habitat, increase the quality and availability of shelter and decrease threats to the species. |
| Risk of loss without the offset | 0 % | Without the offset there is considered to be a zero (0) % risk that the vegetation communities will be lost (i.e. cleared) particularly with restrictions implemented by the Queensland Government on vegetation clearing for agricultural purposes. Although there are a number of threatening processes occurring within the offset area, these processes are likely to result in a loss of habitat quality rather than a loss of habitat *per se.*<br>Based on these factors, zero (0) % is considered a reasonable estimate of the risk of loss without the offset. |
| Risk of loss with the offset | 0 % | Risk of loss with offset is estimated to be zero (0) %. The offset area is proposed to be protected through a Voluntary Declaration which will prevent clearing. By definition, the risk of loss under a protection mechanism must be less than or equal to the risk of loss in the absence of such a mechanism. Therefore, a risk of loss with protection is also zero (0) %.<br>The offset area will be declared as an area of high nature conservation value under section 19F of the *Vegetation Management Act 1999* (VM Act). |
| Confidence in the risk of loss predictions | 90 % | The legally binding Voluntary Declaration will be registered on the land title and will be binding on all current and future landowners to ensure that the habitat is protected in perpetuity.<br>The legally binding mechanism precludes development unless the Queensland Government authorises an activity. However, for the activity to be authorised, offsets must be provided for the original offset obligation as well as any additional offsets that are required by the new activity. This process is very costly both economically |

| Confidence, Risk and Timeline | Score | Comments |
|---|---|---|
| | | and in time and provides a strong deterrent for development within a protected offset area. |
| Time over which the risk of loss is averted | 20 years | The offset area will be protected by a legally binding mechanism which will remain in effect in perpetuity as required by the applicable State and Commonwealth legislative requirements. Therefore, the time over which loss is averted is the maximum allowable time of 20 years as per the EPBC Offset Assessment Guide calculator. |
| Time until ecological benefit | 20 years | It is estimated that to achieve an improved habitat quality score of one (1) unit for all three MNES could take up to 20 years but improvements could occur in as little as 10 years. An improvement of one (1) unit is achievable via increasing habitat quality. The improvement of habitat quality will be achieved by implementing a range of management actions (refer to Section 6.0) aimed at managing the current threatening processes that are constraining habitat improvement. Such actions will involve managing fire, grazing, weed and pest management and are aimed at increasing recruitment and establishment of large canopy trees which will increase foraging and shelter habitat as well as decreasing potential threats from feral animals and weeds.<br>These management actions will result in an improvement in the habitat quality score within the 20 year timeframe. |

## 4.4 Property Details

Landowner and relevant property details for the ID offset area can be provided on request.

## 4.5 Registered Interests

With the exception of a mortgagee, there are currently no registered interests, no mining interests (exploration or production) and no petroleum interests (exploration or production) over the offset area.

## 4.6 Offset Area Protection Mechanism

The offset will be secured by a Voluntary Declaration under section 19E and 19F of the VM Act as an area of high nature conservation value within 12 months of the date of the approval. It is Stanmore's intention that the Voluntary Declaration will be declared over the proposed 610 ha offset area for Koala, Greater Glider and Squatter Pigeon. The Voluntary Declaration will be registered on the property's title and will be binding on current and future landholders. Once the declaration has been registered on the property title, the offset area will be mapped as a Category A area on the Property Map of Assessable Vegetation (PMAV) which is shown as red and described as an "Area subject to compliance notices, offsets and voluntary declarations". Category A areas have a similar level of protection as endangered REs.

A Voluntary Declaration under the VM Act is an authorised legally binding mechanism and is considered an appropriate mechanism to legally secure MNES values and protect the area from vegetation clearing. The Voluntary Declaration will remain in place in perpetuity and may only be removed if the chief executive of the Queensland Department of Natural Resources considers it is necessary.

However, Queensland's Guide to Voluntary Declarations under the VM Act states that under section 19L of the VM Act, a declaration cannot end (i.e. be removed from the property title) until the management outcomes of the management plan have been achieved. Hence, the legally binding mechanism, and by extension implementation of this OAMP, will remain in effect for the period of the EPBC Act approval. The EPBC Act Environmental Offset Policy states the offset must be provided for duration of the impact, which is in this instance indefinitely.

## 4.7 Environmental Offsets Framework

An overview of how the proposed offset area outlined in Section 4.3 meets the requirements of the EPBC Act Environmental Offsets Policy is outlined in Table 13.

The offset area meets the requirements of the Environmental Offsets Policy (EOP). Consideration was also given to property plans and any potential conflicting future use of the property to minimise the potential for conflicting land use pressures within and around the ID offset area.

**Table 13 EPBC Act environmental offsets policy requirements**

| Policy Requirements | Project Offsets |
|---|---|
| Deliver an overall conservation outcome that improves or maintains the viability of the MNES in question | The proposed offset area within Mt Spencer Station fully acquits the offset requirements for the approved impacts to the Koala, Greater Glider and Squatter Pigeon.<br>The proposed offset area currently poses a number of threatening process that limit the habitat value of the area, in particular the low tree species recruitment levels, low abundance of large trees, degraded ground cover and presence of pest animals and weeds. The proposed offset area will be managed to improve habitat condition and the viability of all three MNES in accordance with EPBC Act offset obligations and the management action outlined in this OAMP. The offset area will be managed and monitored for 20 years following approval of this OAMP to ensure the future habitat condition improves to the predicted future habitat quality scores outlined in Table 9 Species specific habitat quality offsets calculator metrics and habitat details for the Koala offset area<br>Locating the offset on Lot 4 of Mt Spencer will also allow this Lot to receive greater management focus by the landowner relative to other sections of the wider Mt Spencer property. This in turn will allow the habitat quality for all three species to improve. |
| Be primarily built around direct offsets but may also include other compensatory measures | Mt Spencer Station is able to fully acquit the offset requirements for Koala, Greater Glider and Squatter Pigeon. Therefore, no other compensatory requirements are necessary. |
| Be in proportion to the level of statutory protection that applies to the MNES | The threat status of the Koala, Greater Glider and Squatter Pigeon is taken into account by the EPBC Offset Assessment Guide calculator in determining the area of the offset to be provided and was taken into account during the approval of the Project's impact. |
| Be of a size and scale proportionate to the residual impacts on the protected matter | The size of the proposed offset area has been calculated in accordance with the EPBC Act Environmental Offsets Policy and the EPBC Offset Assessment Guide calculator. Inputs and justifications are based on the results of the detailed field assessments that were undertaken within the impact and offset areas with the corresponding habitat quality calculated in accordance with the Habitat Quality Guide and the methods outlined in Section 4.1 and in EcoSM, 2020a. |
| Account for and manage the risks of the offset not succeeding | The suitability of the offset area has been calculated in accordance with EPBC Act Environmental Offsets Policy and the EPBC Offset Assessment Guide calculator which takes into consideration a number of metrics including confidence in the |

| Policy Requirements | Project Offsets |
|---|---|
| | offset succeeding. The inputs and justifications are shown in Table 9, Table 10, Table 11 and Table 12.<br>Risks associated with the offset have been assessed (refer to Table 23) and appropriate mitigation and management measures are provided in Table 16.<br>Further, locating the offsets within Mt Spencer Station provides a further level of certainty of success as the property is multi-generational and is also used as a rehabilitation site for returning injured wildlife, including Koalas to the wild. Hence, the management actions required to enhance habitat values and protect fauna species are well known. |
| Be additional to what is already required | The proposed ID offset area is zoned rural under the Nebo Shire Planning Scheme 2008 and is located within the Isaac Regional Council Local Government Area. These areas have been historically used for cattle grazing with improvements including sheds, accommodation, water storages, fencing and dirt roads. The landowner is currently obliged to appropriately manage pest animals and invasive weed species to protect environmental values (amongst other values) under state government general biosecurity obligations. However, the proposed pest animal and weed management activities are additional to those required under the *Biosecurity Act 2014* (Qld). See Sections 6.6 and 6.7 for further detail. |
| Be efficient, effective, timely, transparent, scientifically robust and reasonable | The proposed offset area has been identified and its suitability assessed using standard practices approved by both Commonwealth and State Governments and were undertaken by suitably qualified ecologists using an evidence-based and scientifically robust approach. Stanmore commits to legally securing the offset area within 12 months or as required by DAWE and the assumed EPBC approval conditions. This OAMP outlines a transparent and scientifically robust ongoing monitoring program (refer to Section 7.0) that can be readily audited to assess its effectiveness of assessing the success of the offset area in achieving the required offset obligations. Further, this OAMP supports an efficient, effective, timely, transparent, scientifically robust and reasonable approach to providing offsets. |
| Have transparent governance arrangements including management actions, monitoring and auditing | This OAMP outlines a clear governance framework and delivery pathway to legally secure the offset area and a transparent and scientifically robust monitoring and reporting program. The OAMP also provides an auditing framework that allows for continual improvement to ensure the offset area achieves the required offset obligations. |

## 4.8 Additional Management and Protection

Establishing the offset on the proposed area would add additional protection for biodiversity values from clearing and provide additional biosecurity management. However, remnant vegetation is still subject to limited clearing for essential management as well as removal/thinning of undergrowth vegetation and removal of fallen woody debris. Further, the VM Act does not require landholders to maintain the existing condition of regulated vegetation or fauna habitat areas. Establishing the offset would therefore provide additional protection and management for both remnant and the non-remnant vegetation.

Queensland's *Biosecurity Act 2014* imposes a 'general biosecurity obligation' on all people to manage biosecurity risks that area under their control and that they know about or could reasonably be expected to know about. In general terms, this means that for livestock owners, the owners are expected to stay informed about pests and diseases that could affect or be carried by the animals, as well as weeds and pest animals that could be present on their property. Landowners are also expected to manage them appropriately. For landowners, there is an expectation that they will stay informed about the weeds and pest animals (such as feral dogs, cats, pigs etc.) that could be on their property. There is also an expectation that appropriate management will be undertaken.

The obligations outlined in this OAMP are additional to these general *Biosecurity Act 2014* obligations. For example, ongoing feral animal control will be undertaken to minimise the numbers of al feral animals with the end goal being eradication, where possible. This is above and beyond the requirements of the *Biosecurity Act* as is the reduction of weed species to less than 10% weed cover within the offset area over the life of the OAMP.

## 5.0 Management Objectives

The environmental outcomes sought by this OAMP are to improve the condition and ecological values of the vegetation communities for the Koala, Greater Glider and Squatter Pigeon within the offset area. These environmental outcomes will be realised by achieving the completion criteria for each matter defined in Table 15.

Implementation of this OAMP will also effectively manage risks to the Koala, Greater Glider and Squatter Pigeon and implement adaptive management actions to continually refine, revise and update the management actions as additional data on the success of the offset area is collected.

As outlined in Table 14, the specific management objectives of this OAMP are to:

- Strategically graze cattle to reduce and manage understorey fuel loads and native and non-native flora densities;
- Reduce the risk of unplanned fire causing adverse impacts to MNES through strategic fire management;
- Minimise habitat degradation caused by Feral Pigs (*Sus scrofa*) and Rabbits (*Oryctolagus cuniculus*), Feral Horses *(Equus caballus*) to reduce impacts on habitat variables for MNES including tree species recruitment and understorey vegetation composition;
- Restrict unauthorised access and prevent alternative land-use;
- Control invasive weed species to reduce impacts on MNES from an overdominance of non-native floristic abundance in the understorey; and
- Minimise predation risk to MNES by Feral Cats (*Felis catus*), Wild Dogs (*Canis domesticus*) and Foxes (*Vulpes vulpes*).

These management objectives and the corresponding management actions outlined in Section 6.0 and Table 16 are specific to the 610 ha offset area and based on the MNES requiring offsetting, with consideration of identified threats and recovery actions specific to each species as outlined in the Commonwealth listing and conservation advice, recovery plans and other relevant documents (Table 14).

**Table 14 Relevant conservation advice, recovery plans and threat abatement plans**

| MNES | Relevant conservation advice and plans | Main threats and recommended actions | Measures proposed in this OAMP |
|---|---|---|---|
| Koala | • Approved Conservation Advice for *Phascolarctos cinereus*, Koala (combined populations in Queensland, New South Wales and the Australian Capital Territory), (SEWPaC, 2012);<br>• Threat abatement plan for predation by feral cats (Commonwealth of Australia, 2015); and | • Habitat fragmentation, vehicle strike and predation.<br>• Feral Cat control strategies.<br>• European Fox control strategies. | • Avoidance of habitat clearing by using existing tracks and fence lines.<br>• Vehicle access and movement restrictions.<br>• Restricted offset area access and educational awareness of MNES.<br>• Feral animal control strategies. |

| MNES | Relevant conservation advice and plans | Main threats and recommended actions | Measures proposed in this OAMP |
|---|---|---|---|
| | • Threat abatement plan for predation by the European red fox (DEWHA 2008a). | | |
| Greater Glider | • Conservation Advice for *Petauroides Volans*, Greater Glider (TSSC, 2016). | • Habitat loss, fires and predation from owls. | • Avoidance of habitat clearing by using existing tracks and fence lines.<br>• Fire management regimes. |
| Squatter Pigeon (Southern) | • Approved Conservation Advice for *Geophaps scripta scripta* (Squatter Pigeon (southern)) (TSSC, 2015);<br>• Threat abatement plan for predation by feral cats (Commonwealth of Australia, 2015);<br>• Threat abatement plan for competition and land degradation by rabbits (Commonwealth of Australia, 2016); and<br>• Threat abatement plan for predation by the European red fox (DEWHA 2008a). | • Habitat clearing.<br>• Livestock and feral herbivore grazing.<br>• Predation, by Feral Cats and European Foxes.<br>• Feral Cat control strategies.<br>• European Fox control strategies | • Avoidance of habitat clearing by using existing tracks and fence lines.<br>• Strategic grazing practices.<br>• Grazing exclusion periods.<br>• Feral animal control strategies. |

## 5.1 Completion Criteria and Interim Performance Targets

The EPBC Act EOP states that an offset area must deliver an overall conservation outcome that improves or maintains the viability of the MNES as if the action had not occurred. In accordance with the EOP the final habitat quality score (offset completion criteria) at the offset site must be equal to or greater than the habitat quality score of the impact area.

Completion criteria and interim performance targets associated with habitat for each MNES are summarised in Table 15 and have been developed as a measure to assess and ensure that the final habitat quality scores as outlined for each of the offset matters in Section 4.3.2, are achieved. Interim performance targets are also included in Table 15. The intent of these targets is to assess, revise and if required, amend the OAMP to allow the completion criteria to be achieved within the proposed 20-year time frame. The interim performance targets will help to assist the management and improvement of the offset area, enabling evaluation of the effectiveness of progress towards completion criteria.

The completion criteria and corresponding increase in habitat quality scores will be reached by the implementation of the management actions outlined in Table 16 and ongoing monitoring of the effectiveness of those actions. Annual reports will provide transparency regarding the implementation of the management measures and where relevant, identify any non-compliance with the OAMP and *force majeure* events that impact the offset area.

Failing to meet the interim performance targets will prompt adaptive management and the landowner will apply various mitigation measures to ensure the completion criteria will be met. The need for additional mitigation measures will be addressed during the annual compliance reporting of the OAMP.

The interim performance targets and completion criteria in the form of habitat quality scores for each of the MNES are outlined in Table 15 and have been developed as a measure to assess and ensure that the final habitat quality scores (competition criteria) as outlined for each of the offset matters in Section 4.3.2, are achieved. The completion criteria and corresponding increase in habitat quality scores will be reached by implementing the management actions outlined in Table 16 and monitoring of those actions (refer to Section 7.0).

The intent of the interim performance targets is to assess, revise and if required, amend the OAMP such that the completion criteria can be attained within the proposed 20-year time frame. Corrective actions that must be undertaken if interim performance targets are not met are outlined in Table 16.

**Table 15 Completion Criteria and Interim Values**

| Assessment Unit | Starting Habitat Quality Score | Interim Performance Targets | | | Final Habitat Quality (Year 20) – Completion Criteria |
|---|---|---|---|---|---|
| | | Year 5 | Year 10 | Year 15 | |
| **Koala** | | | | | |
| AU1 - RE 11.12.1 | 5 | 5 | 5-5.5 | 5.5-6 | 6 |
| AU2 - RE 11.3.4 | 5 | 5 | 5-5.5 | 5.5-6 | 6 |
| AU3 - non-remnant (11.3.4) | 4 | 4 | 4-4.5 | 4.5-5 | 5 |
| Weighted total | 5 | 5 | 5-5.5 | 5.5-6 | 6 |
| **Greater Glider** | | | | | |
| AU1 - RE 11.12.1 | 5 | 5 | 5-5.5 | 5.5-6 | 6 |
| AU2 - RE 11.3.4 | 5 | 5 | 5-5.5 | 5.5-6 | 6 |
| AU3 - non-remnant (11.3.4) | 4 | 4 | 4-4.5 | 4.5-5 | 5 |
| Weighted total | 5 | 5 | 5-5.5 | 5.5-6 | 6 |
| **Squatter Pigeon** | | | | | |
| AU1 - RE 11.12.1 | 5 | 5 | 5-5.5 | 5.5-6 | 6 |
| AU2 - RE 11.3.4 | 5 | 5 | 5-5.5 | 5.5-6 | 6 |
| AU3 - non-remnant (11.3.4) | 4 | 4 | 4-4.5 | 4.5-5 | 5 |
| Weighted total | 5 | 5 | 5-5.5 | 5.5-6 | 6 |
| *Note that interim and complete scores will be calculated using methodology consistent with the initial surveys see Section 4.1 | | | | | |

The completion criteria and final habitat scores for each MNES, will be calculated using the scoring method described in Section 4.1. The specific attributes of site condition, site context and species stocking rate that are expected to change over the life of the approval and lead to the final habitat score/competition criteria may change from those outlined below. However, the calculation method will remain unchanged and the final habitat quality/completion criteria scores remain as outlined in Table 15.

It is anticipated that with the management measures described in Section 6.0, habitat quality improvements will be made be as follows:

- Remnant RE 11.3.4 and 11.12.1 will improve in habitat quality score of one (1) point from predicted increase in habitat quality scores by:

  - Increasing recruitment of Woody perennials in the ecologically dominant layer (EDL) by reducing competition from non-native shrub species, cattle grazing management to reduce the effects of cattle grazing such as trampling and over-grazing. and controlled burning to abate the effects of hot fires. Fire regime should be in accordance with the fire management guidelines for these RE type that are designed to maintain and enhance biodiversity.
  - Increasing native perennial richness of shrubs and forbs.
  - Increasing shrub cover and recruitment.
  - Increasing native grass species richness
  - Organic litter cover and course woody debris increase is expected with the growth of above ground biomass of tree species over time and the application of the appropriate fire regime.
  - The number of large trees is expected to increase through natural growth of canopy and subcanopy trees by excluding any selective harvesting of both Eucalypt and non-Eucalypts trees and implementing controlled burns.
  - Increasing large trees and controlling the potential for hot fires, coarse woody debris is expected to increase.
  - Exotic cover (weeds) is expected to be reduced within the first 5 years by mechanical removal, spraying and an appropriate fire regime. The control of exotic species will be applied throughout the life (20 years of the offset to maintain weed cover at <10%).
- Non-remnant RE 11.3.4[6] will improve in habitat quality score of one (1) point from predicted increase in habitat quality scores by:
  - Minimising the removal of Eucalypt and non-Eucalypt regrowth and mature paddock trees.
  - Increasing native perennial richness of shrubs and forbs.
  - Increasing shrub cover and recruitment.
  - Increasing native grass species richness.
  - Exotic cover of shrub layer species is expected to reduce within the first 5 years by mechanical removal, spraying and an appropriate fire regime.
- In addition to the above habitat attributes, threats to the MNES can be reduced by:
  - Koala: Threats to koalas can be reduced by feral animal control of predatory species including Feral Dogs, and a reduction of hot fires by reducing fuel loads especially exotic shrub layer species including Lantana. This would reduce the ability of fire to ladder into the canopies of the tree layers that are utilized as food and refuge trees.
  - Greater Glider: Threats to Greater Gliders can be reduced by feral animal control of predatory species including Feral Cats and reducing hot and intense fires by reducing fuel loads especially exotic shrub layer species including Lantana. This would reduce the ability of fire to ladder into the canopies of the tree layers that are utilised as food and denning trees.

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[6] This non-remnant vegetation community includes species consistent with RE 11.3.4.

- Squatter Pigeon: Threats to Squatter Pigeons can be reduced by feral animal control of predatory species including Feral Cats, Feral Dogs and Feral Pigs and increase shrub and canopy cover to provide cover/shelter from predatory birds.
- Overall, the increases in habitat quality scores will increase the quality of Koala, Greater Glider and Squatter Pigeon habitat by improving the quality of the grassy areas and woodlands, encouraging tree recruitment and decreasing the weed cover.

# 6.0 Management Actions

This OAMP is based on the principles of adaptive management, and management objectives and actions that have been developed based on field surveys. The ongoing suitability of the management actions will be informed by the results of the monitoring activities outlined in Section 7.0. This OAMP will be adapted and updated annually, if required as determined by any corrective actions as outlined in Table 16.

This section of the OAMP outlines the management actions that will be implemented within the offset area to abate the identified threats to the Koala, Greater Glider and Squatter Pigeon and to protect and enhance the habitat values of the offset area. The management actions focus on the key threatening processes for these species as outlined in Section 6.0 and described in the DAWE SPRAT species profiles and relevant EPBC Act statutory documents for the species. Additional threats that are known to degrade habitat have also been taken into consideration.

Detailed management actions for the offset area are outlined in Table 16 and should be read in conjunction with Section 6.1 to Section 6.7. These sections provide the detail on how the management actions will be implemented. The majority of the ongoing and routine management actions are expected to be undertaken by the registered landowner (e.g. grazing management, fire management, feral animal and weed management) under agreement with Stanmore. Ongoing ecological monitoring will be undertaken by suitably qualified ecologists also under agreement with Stanmore.

Should the results of ongoing monitoring identify that the relevant management action(s) have been unsuccessful, corrective action(s) will be undertaken and the management actions reviewed and updated accordingly as shown in Table 16.

**Table 16 Management actions, triggers for further action and corrective actions**

| Habitat management objectives | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|
| Habitat or vegetation loss through unplanned land clearing | • No unapproved and/or intentional clearing of vegetation within the offset area, except for clearing that is required for fencing, access, firebreaks or public safety.<br>• Signs and fences will be erected within three months of the offset being legally secured. They will be erected at all entrances and potential access points to the site identifying the area as an environmental offset and stating that access to the site is forbidden.<br>• Fences will be maintained to prevent unauthorised access, to minimise incursions by feral herbivores and to control stock presence<br>• Ecological thinning may be carried out, but only in accordance with the advice of a suitably qualified expert and only as approved by DAWE. | • Any activities that are in contravention of the Voluntary Declaration.<br>• Detection of damaged fences associated with vehicle access roads/tracks<br>• Detection of prohibited forestry operations, native timber harvesting or clearing outside of established access tracks, fire control lines and fence lines (existing infrastructure). | • Monitoring and inspections will monitor and document if there is evidence of recent forestry or timber harvesting activities or illegal clearing.<br>• Monitoring will also document vegetation clearing that has occurred for fire break, access road or fence line maintenance.<br>• Refer to Section 7.0 for detail on required monitoring.<br>• The annual compliance report will document any illegal/ unauthorised land clearing. | • **Notify the Department within 10 business days of clearing**<br>• Upon being notified or becoming aware of prohibited forestry operations, native timber harvesting or clearing outside of existing infrastructure, the landholder is to assess how unauthorised persons accessed the site<br>• Review existing access restrictions and inspect signage and offset area fencing within one fortnight of detection of the clearing.<br>• Corrective actions will be implemented immediately (e.g. the regeneration of those areas will be undertaken, and these areas added to the ongoing monitoring sites) and if appropriate the OAMP will be revised and updated if required.<br>• Any changes to the OAMP will be reported to the Minister for approval prior to changes in management. |

| Habitat management objectives | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|
| Control invasive weed species to reduce impacts on MNES from an overdominance of non-native floristic abundance in the understorey. | • Access to the offset site will be restricted to authorised persons only.<br>• Weed management and weed hygiene restrictions will be implemented across the offset site to reduce the extent of existing weeds and to control the potential introduction of other exotic weed species.<br>• Weed hygiene and management will be undertaken in consultation with the landowner.<br>• Chemical and/or mechanical control of declared weed species will be undertaken in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets or other sources of information.<br>• Refer to Section 6.7 for further details on weed management. | • An increase in the average percent (%) cover score of weed species from baseline and/or previous monitoring events.<br>• Outbreak of infestations of weed species not previously recorded in the offset area during baseline and/or previous monitoring events.<br>• An increase in the presence of weeds (relative abundance and/or area of occurrence) as determined from photo monitoring results.<br>• An interim performance target is not attained, or a completion criterion is not attained and/or maintained. | • Monitoring of weeds and non-native plants will be undertaken during the habitat quality assessment surveys using the same methodology used to the baseline habitat quality as outlined Section 4.1 of this OAMP and EcoSM, 2020a, as well as incidental observations as part of routine management.<br>• The annual compliance report will document the presence of weeds, weed control measures and extent of weed cover during the reporting period, and the relevant responsive actions. | • Any increase in the relative abundance of invasive or other weed populations from those recorded during the baseline survey, or subsequent monitoring events will trigger the following corrective actions that must be undertaken:<br>○ Review adherence to current weed hygiene procedures to ensure compliance and to update restrictions.<br>○ Review timing and frequency of weed management measures, and implement alternative weed management timeframes.<br>○ Investigate alternative weed management control actions (e.g. spot spraying and/or injection of herbicides) and implement.<br>○ Undertake additional weed management measures until weed populations are reduced.<br>• Suitably qualified ecologist to review the OAMP within one month and update if required. |

| Habitat management objectives | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|
| Strategic cattle grazing to reduce and manage understorey fuel loads and, native and non-native flora densities. | • Stock management will be undertaken in consultation with the landowner and as required to achieve the performance objectives and completion criteria.<br>• If and where new fencing is required to demarcate the offset area, ensure fencing is permanent and prohibit unintended grazing by cattle.<br>• Squatter Pigeon breeding period can vary depending on localised site conditions but generally peaks in the early to mid-dry season (May-July). Grazing will be excluded during the peak Squatter Pigeon breeding and egg laying periods in the early to mid-dry season. | • Livestock located in the offset areas outside of strategic grazing events.<br>• Livestock located in the offset areas during breeding season (May to and including July).<br>• Damaged fencing is observed<br>• Habitat Quality assessments indicate native grass groundcover is <30% or >55%.<br>• If ecological surveys indicate an extended or varied peak breeding period outside the early to mid-dry season. | • Regular inspections of the offset area will be undertaken during normal land management and farming practices to examine fence lines when stock are grazing in the offset area and/or adjacent to the offset area.<br>• Records will be kept of when and how many cattle graze in offset areas.<br>• Regular inspections will be undertaken to assess signs of overgrazing and pugging.<br>• Habitat quality assessments will be undertaken in accordance with this OAMP and will include assessment of percentage cover of native perennial grasses. | • Amend livestock management practices including amendment of stocking rates, and/or timing, and/or duration and/or frequency of strategic grazing events until native grass cover is >30% <55%.<br>• Repair offset area boundary fencing if damaged within one week of detection.<br>• Removing stock when excessive pugging or overgrazing is observed such that native grass cover is <30%.<br>• Remove stock from Squatter Pigeon breeding habitat where found to be grazing in Squatter Pigeon breeding season.<br>• Construct additional fencing if required.<br>• Should monitoring activities identify triggers for further action, the OAMP will be reviewed by a suitably qualified ecologist within one month and updated if required.<br>• Any corrective action identified will be |

| Habitat management objectives | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|
| | | | | implemented within 1 month of the OAMP being updated. |
| Minimise habitat degradation caused by feral animals including Feral Pigs and Feral Horses. | • Pest animal management will be undertaken in consultation with the landowner and in accordance with general pest management processes. Refer to Section 6.6 for details.<br>• Pest management will include a range of best management practice actions including shooting, trapping, fencing and baiting, and will be undertaken in accordance with Queensland's Department of Agriculture and Fisheries (DAF) guidelines[7] and the requirements of the *Biosecurity Act 2014.*<br>• If an increase in feral pest species is noted above trigger levels, additional pest management/control measures will be instigated until the increased activity has ceased. | • Any increase in sightings/signs (tracks) and/or the relative abundance of pest animals above baseline levels and/or previous monitoring event.<br>• Observation of, or signs of, a feral animal not identified as occurring within the Project area during the baseline surveys.<br>• Habitat quality scores for interim performance targets are not achieved by:<br>○ Year 5<br>○ Year 10<br>○ Year 15<br>○ Year 20 | • Feral animal presence will be monitored as a minimum through visual signs recorded during monitoring and direct observations. Remote camera monitoring will also be used to assess the presence of feral animals.<br>• Feral animal monitoring results, and associated actions, will be included in annual reporting to the Department.<br>• Monitoring of habitat quality scores will be undertaken. The results of monitoring events will be compared against baseline habitat quality scores, interim performance targets and completion criteria to determine the progress of the offset area and recorded as part of reporting. | • Review adherence to pest animal management actions.<br>• Investigate potential sources or reasons for an increase in pest animal numbers and rectify.<br>• Increase the frequency or revise the type of invasive pest animal control efforts in accordance with DAF guidelines, and in conjunction with neighbouring landowners.<br>• Suitably qualified ecologist to review the OAMP within one month and update if required. |

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[7] https://www.daf.qld.gov.au/business-priorities/plants/weeds-pest-animals-ants

| Habitat management objectives | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|
| Reduce the risk of unplanned fire causing adverse impacts to MNES by strategic fire management[8]. | • Controlled burns will be undertaken in consultation with the landowner and in accordance with the recommended fire management guidelines for Regional Ecosystems and will involve a range of burn strategies including patchwork burns.<br>• Fire is to be excluded from the offset area except for planned and strategic burns as required to reduce understorey fuel loads having a detrimental impact on canopy tree recruitment and establishment and to maintain existing fire breaks.<br>• Create firebreaks around the offset area boundary to minimise unplanned fire from adjacent lands.<br>• Firebreaks are to be co-located, where possible, with roads, fence lines and vehicle access tracks. No areas of MNES will be cleared unless necessary for safety management and | • Unplanned fire within the offset area.<br>• Planned fires become out of control or the required burning regime is not achieved.<br>• Habitat Quality assessments indicate native grass groundcover is <30% or >55%. | • Fire breaks are to be inspected annually in September<br>• Visual inspection of signs of fire during routine land management and during the habitat quality assessments.<br>• Fuel loads will be monitored through monitoring of ground cover and to inform fire management strategies. | • Occurrences of fire are to be recorded during the visual inspections undertaken during routine land management.<br>• If an uncontrolled bushfire has impacted the offset area (including if controlled burning becomes out of control), review the grazing management and fire management strategies and adherence to these strategies and exclude cattle for at least three months (depending on conditions for re-growth). All fire breaks will be inspected, maintained, and repaired if required.<br>• To ensure compliance, with performance criteria, undertake remedial action including:<br>○ Alteration to stocking rates, and/or duration and frequency of strategic grazing events; and/or<br>○ Amendments to fire management practices as required including fire |

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[8] https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/fire-management

| Habitat management objectives | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|
| | without consideration to the impacts and Department requirements (i.e. habitat areas are not reduced). | | | safety and containment management.<br>• Suitably qualified ecologist to review the OAMP within one month and update if required. |
| Habitat degradation and direct impact to MNES due to unauthorised access to offset site. | • All signs and fences will be erected within three months of the offset being legally secured.<br>• Signs will be erected at all entrances and potential access points to the site stating that access to the site is forbidden.<br>• Fences will be maintained to prevent unauthorised access, to minimise incursions by feral herbivores and to control stock presence. | • Evidence of unauthorised or unplanned access by persons, vehicles, and/or stock is detected during exclusion periods.<br>• Evidence of stock is detected at any point during exclusion times.<br>Damage is detected to any fence or sign. | • Monitoring of fence lines will be undertaken by the Landholder or suitable qualified person appointed by the approval holder within 3 months of the offset area being legally secured and during quarterly inspections.<br>• Inspections will monitor and document damage or loss of signs and evidence of unauthorised access to the offset area. | • Upon being notified or becoming aware of prohibited access to the offset area, the approval holder is to reassess access protocols for any lessees etc., signage and general access within one fortnight.<br>• Damage to signage and fences will be repaired within one month of noting the damage.<br>• If there are areas that have been negatively impacted by unauthorised access, the regeneration of those areas will be undertaken, and these areas added to the ongoing monitoring sites.<br>• Signage will be repaired and maintained as required by the Landholder or suitable qualified person appointed by the approval holder. |
| Offset fails to achieve the interim performance targets and completion criteria | • All management actions outlined in this OAMP will be implemented to ensure that the interim performance | • Interim performance targets are not achieved by year 5, 10 or 15. | • Habitat quality score assessments will be | • Within one month of detection of the trigger, complete an investigation into the reasons why the |

| Habitat management objectives | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|
| within the anticipated 5, 10, 15 and/or 20-year time intervals. | targets and competition criteria are achieved.<br>• The Voluntary Declaration under the VM Act will ensure that the landholder remains obliged to undertake active management of the offset until all completion criteria are achieved.<br>• Monitoring will continue for the life of the approval to ensure that completion criteria have been met and maintained. | • Completion criteria are not achieved by year 20. | undertaken for each 5-year period, as a minimum.<br>• Monitoring of the offset area will be undertaken in accordance with the methods outlined in this OAMP.<br>• Monitoring results will be compared against the interim performance targets and completion criteria to assess progress of offset area in achieving the requirements of this OAMP. | interim performance targets or the completion criteria were not achieved within the specified timeframes. This investigation must re-evaluate the suitability of the relevant management actions and identify appropriate corrective actions.<br>• As soon as practicable, and within six months of detection of the trigger, implement revised corrective actions. These may include (but not limited to):<br>○ Increasing the frequency and intensity of pest animal and weed control measures or revising the type of measures to be implemented.<br>○ Modify fire management measures, to better support enhancement of offset values.<br>○ If the investigation outlined above requires changes to the management actions, then as soon as possible, and within six months of detection of the trigger, implement a revised OAMP, as approved by |

| Habitat management objectives | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|
| | | | | the Minister, incorporating those recommended changes.<br>• Additional offsets will need to be sought by the approval holder, and approved by the Minister, should the above corrective actions not be successful. |

## 6.1 Access and Fencing

Access to the offset area is restricted to authorised personnel only including the landowner and persons authorised by the landowner and Stanmore to undertake monitoring programs and maintenance. Although a road licence easement traverses the ID offset area (and has been excluded from the offset area), the landowner is permitted to restrict access and this permission will be enforced. Existing and new fences, if required, will be used to restrict access into offset areas. Signs will be erected in prominent locations (i.e. at access points into the offset site) which recognise that the area is protected for conservation purposes and that access into these areas is restricted to authorised personnel only. Signs will be installed prior to commencement of the action. Environmental awareness training will be provided to all workers as part of site induction and will include specific topics on MNES, risks and protective measures, and identification of the MNES

Existing access tracks will be used to enable management, monitoring and maintenance to be undertaken. In the event that existing access tracks become impassable (e.g. from erosion, flooding or vegetation regrowth), maintenance and remediation of the existing access tracks will be undertaken. Any new access tracks will be noted in revisions of this OAMP and the offset area increased accordingly where tracks impact remnant vegetation. Should new tracks be required, consultation will be undertaken with DAWE prior to construction to ensure appropriate approvals, if required, are obtained including Minister approval of any revised OAMP.

## 6.2 Vehicles

Vehicle access will be restricted to vehicles (e.g. quad bikes) approved by the landowner/offset area manager and Stanmore. Vehicle movement will be limited to designated access tracks in the offset area and vehicles will travel to track conditions and as advised by the landowner/offset area manager in order to minimise the risk of injury to MNES, particularly Koala's and Squatter Pigeons, or habitat degradation by vehicles and/or recovery machinery should vehicles become bogged or accidents occur. Speed limits of 30 km/h will be enforced by the landowner on access tracks throughout the offset area and access to the offset area along the road licence easement will be restricted by the landowner.

Persons entering the offset area will be required to ensure all vehicles and equipment are certified weed free. Any authorised personnel (e.g. contractors) entering the offset area will be required to hold a current weed hygiene certificate and be approved to access the area by the landowner/offset area manager. Evidence is to be provided on request to the landowner that vehicles and any machinery are weed and seed free prior to entry to minimise potential weed spread. Records of people entering the offset area and evidence of certified weed free must be kept and provided to the Department upon request.

All vehicles entering the offset area will be required to stay on the formed tracks and be issued with weed inspection certificates and all staff or contractors entering offset areas are to be made aware of, and provided access to, this OAMP.

## 6.3 Vegetation Clearing

Vegetation clearing is not permitted within the offset area. With the exception of clearing that is exempt under Queensland's VM Act and is required for:

- Maintenance of currently established access tracks and/or fire breaks;
- As directed by emergency management response personnel in the event of uncontrolled bushfire or other emergency procedures. Any native vegetation cleared from the offset area in this circumstance will be revegetated using the same species that were cleared. The OAMP will be revised to include revegetation works and submitted to DAWE within 3 months of this clearing occurring.

## 6.4 Grazing Management

The offset area has historically been used for cattle grazing and there was evidence of grazing throughout the offset area. To optimise canopy tree recruitment and establishment and to achieve the interim performance targets and final completion criteria of ground layer species richness and cover, grazing will be strategically controlled to allow the ecological communities/species habitat to continue to improve, to minimise unplanned fires adversely impacting the offset area, and to minimise soil compaction and erosion.

Existing fences will be used to manage access to and demarcate the offset area, including management of strategic grazing activities. If and where additional fencing is required to be installed, it should preferably be constructed of 1.4 m high, 4-strand barbed-wire, with plain wire as the top strand and the bottom wire set 350 mm from the ground to allow native wildlife access, or an alternate and equally suitable fence design as determined by the landowner. Restricted access will also be established prior to commencement of the action to prevent unauthorised access.

Grazing will be permitted throughout the offset area under strict controls in order to reduce fuel loads, to control exotic flora and to increase native species richness of the ground layer. Following grazing, the offset area will be spelled in accordance with the current land management practices undertaken on Mt Spencer Station to allow for grasses to seed and to facilitate recovery of perennial grasses and the herbaceous layer while mitigating wildfire risk by restricting fuel loads. The suitability of conditions for undertaking a grazing event outside of the wet season will be directed by the landowner/offset area manager and based on sound environmental practices.

To minimise erosion and subsequent impacts on water quality that may in turn impact on Squatter Pigeon habitat and/or affect attainment of the interim performance targets and/or completion criteria, strategic grazing will be excluded where rainfall causes inundated or waterlogged soils. Grazing will also be restricted within the offset area during the peak breeding and egg laying season for the Squatter Pigeon which is the early to mid-dry season (i.e. May-July). The location and extent of grazing exclusion areas will be reviewed annually based on the results of management and monitoring events.

Strategic grazing will be determined by biomass monitoring described in Section 7.7.

## 6.5 Fire Management

Fuel loads in the offset area and in the surrounding paddocks will be controlled through a combination of strategic grazing, weed control measures and fuel reduction burns to minimise the risk and impacts of unplanned and hot and intense fires and to improve habitat quality through controlling weeds and increased recruitment and establishment of native plants.

Regular maintenance (e.g. grading and vegetation spraying) of firebreaks, roads and tracks will be an integral part of fire management to mitigate the risks associated with unplanned fire. Ground cover monitoring will be undertaken annually as part of fire management activities to assess fuel loads, determine the risk of unplanned fires to the offset area and inform fire management strategies (Section 7.7).

Fire management will be consistent with the recommend fire management regime for REs within the offset area as recommended in the Fire Management Guidelines produced by the Queensland Herbarium (refer to Appendix E for the relevant fire management regime for each of the REs composing the mixed RE vegetation community of the offset area).

All the REs within the offset area benefit from controlled burns of low intensity fires that occur in the early dry season where there is good soil moisture. Controlled burns will be low intensity with the aim of reducing fuel loads and promoting understorey growth. Moderate to high intensity fires will be avoided as they can degrade vegetation structure and destroy fauna habitats, particularly tree hollows and kill native fauna.

Good fire management within offset areas should be based on maintaining vegetation composition, structural diversity, animal habitats (in particular hollow-bearing trees and logs) and preventing extensive wildfires. The recommended control burn intervals vary depending on the RE and range from every 2-7 years for RE 11.3.4 to every 6-15 years for RE 11.12.1. Shorter intervals between burns for RE 11.12.1 of 5-10 years can be undertaken but should be greater than every three (3) years. To cover the requirements of the REs and MNES within the offset area, controlled burns will be undertaken every 5-10 years depending on fuel loads and groundcover and undertaken in general accordance with the Fire Management Guidelines. Burn intervals for conservation purposes will differ from that for grazing purposes with the latter generally being much shorter. For riparian vegetation such as RE 11.3.4, fires will be ignited from the upper ridges so that they burn downwards towards the lower slopes.

## 6.6 Pest Animal Management

Several pest animals have been recorded in the offset area and include Wild Dogs, Feral Pigs, Rabbits, Feral Cats, Feral Horses and Foxes. These pest animals pose threats to the MNES including predation (Wild Dogs, Feral Cats and Foxes) and habitat degradation (Feral Pigs, Feral Horses and Rabbits).

Additional assessments of pest animals will be undertaken as part of a comprehensive baseline habitat quality assessment that will be undertaken in year one (1) (refer to Sections 7.2 and 7.6). These assessments will form part of the ongoing monitoring program and will consist of surveys to assess the presence, and extent of, pest animals within the offset area and to also assess impacts to fauna habitat values and vegetation condition (refer to Section 7.0 for monitoring schedules). Results from these assessments will inform the most appropriate species-specific control measures and management activities. These results and any additional management actions will be included in an updated OAMP and as part of the annual compliance report.

Pest animal controls will be undertaken in accordance with the *Biosecurity Act 2014*, DAF guidelines and in conjunction with neighbouring landowners and include the following control methods as approved by DAF:

- Wild Dogs (DAF, 2017): Shooting, trapping, baiting and fencing. Baiting and trapping will be undertaken at peak activity times including breeding (March/May) and rearing of young (September/November) and will target watering locations. Dingoes will not be shot or trapped. One or a combination of the control methods outlined below will be implemented to reduce the abundance of Wild Dogs accessing/utilising the offset area.
    - Shooting is an opportunistic method, mostly used for control of small populations or individual problem animals.
    - Trapping is predominantly used in areas with low populations and to control ‘problem’ Wild Dogs. Foot-hold traps will be used at times of the year corresponding with peak activity, with traps placed in high activity areas and poisoned with strychnine for humane reasons and to prevent escape. Lures such as scents can be used to attract dogs to the traps.
    - Baiting can be used in conjunction with other control tools. Poison baits using 1080 and strychnine and fresh meat baits are delivered by hand, from vehicles or aircraft.
- Feral Pigs (DAF, 2016a): Control of Feral Pigs will be by implementing a collaborative approach with surrounding landowners and will include;
    - Poisoning with 1080 baits. Generalised feeding with non-poisoned bait will be performed for several days prior to laying poisoned baits to attract animals.

  - Shooting is an opportunistic method, mostly used for control of small populations or individual problem animals.
  - Trapping in smaller areas to control remaining individuals from poisoning programmes.
- Rabbits (DAF, 2016b): An integrated control approach, combining different control methods in concert with land management practices, will be implemented to control Rabbits and includes:
  - Destroying (ripping) rabbit warrens. All warrens within 1 km of a permanent water sources will be ripped.
  - Baiting using 1080-sodium fluoroacetate or Pindone in the non-breeding season and when food sources are low. Pre-feeding should be undertaken to accustom Rabbits to the new food sources.
  - Trapping using a mix of cage traps and barrel traps, followed by humanly euthanising. Traps will be put in place and left open for 2-3 days to allow Rabbits to be accustomed to the trap before trapping begins.
  - Shooting as a means to target remaining individuals following other control measures. Shooting is most effective when rabbits are active (early afternoon, late afternoon or night).
- Feral Cats (DAF, 2016c): Control programs will be comprised of multiple methods, including night shooting, poisoning, trapping and fencing, combined with land management practices.
  - Shooting at night when Cats are foraging.
  - Poisoning using fresh meat baits containing 1080 (sodium fluoroacetate).
  - Rubber-jawed and leg-hold traps will be set at territorial markers such as faecal deposits and pole-clawing are present.
  - Trapping using a cage traps baited with meat or fish.
- Foxes: (DAF, 2016d): Control methods include shooting, trapping and baiting combined with land management.
  - Shooting used opportunistically to control small populations of problem individuals.
  - Trapping using paddled or offset laminated jawed traps are acceptable for use. Generally effective when done in conjunction with other control techniques.
  - Poison baits using 1080 and strychnine and fresh meat baits are an effective control strategy and can be distributed by hand, from vehicles or aircraft. Baits will be placed along tracks and fence lines, approximately 200-500 m apart and buried approximately 8-10 cm underground and covered with loose soil. Bating is best undertaken in spring followed by June/July when food demand is highest.

## 6.7 Weed Management

Several weed species were identified from the offset area and adjacent paddocks during the July and October 2020 field assessments. Of the weeds observed, five (5) are classified as category 3 Restricted Matters under the *Biosecurity Act 2014* and all five weeds are also classified as Weeds of National Significance and include the following. Several other species of invasive plants were also identified (refer to the offset Ecology Report in Appendix B).

- Rubber Vine (*Cryptostegia grandiflora*);

- Parthenium (*Parthenium hysterophorus*);
- Lantana (*Lantana camara);*
- Chinee Apple (*Ziziphus mauritiana*); and
- Velvety Tree Pear (*Opuntia tomentosa*).

These weeds and invasive plants pose a considerable threat to habitat quality in the offset area due to the increase in groundcover biomass and the risk of uncontrolled fires. The highest distribution of weeds and invasive plants were generally confined to areas of prior disturbance, riparian corridors, waterway and drainage lines and along existing access tracks.

Additional comprehensive surveys of the offset site will be undertaken in year 1 to determine distribution and abundance of weeds species. Results of these comprehensive surveys will inform the most appropriate species-specific weed control measures, location and timing for management activities. In general, however, weed management will be undertaken in accordance with the current management practices implemented at Mt Spencer Station

General visual inspections will also be undertaken to monitor the distribution and abundance of weed species and invasive plants within the offset area. Weed infestations will be controlled and managed by preventing seed set and dispersal in accordance with Queensland's DAF recommended control measures. Species-specific control measures including timing of management activities will be reviewed by a suitably qualified ecologist on an annual basis based on the results of ongoing weed monitoring in the offset area.

For Mt Spencer Station, weed management will include spot spraying weeds within riparian corridors, waterways and drainage lines, and along existing access tracks and fence lines as well as mechanical removal and the strategic use of fire. Spraying will occur in the early dry season following periods of active growth. Strategic spraying of small, isolated patches of invasive species will be undertaken and follow-up inspection and treatment will be implemented two to four weeks later if regrowth is evident, including mechanical removal of woody weeds. Woody weeds will be managed through a combination of herbicide and mechanical techniques.

Weed hygiene measures will also be implemented to prevent the movement of weed material into the offset area (Section 6.2). Prior to entering the offset area, all vehicles and equipment will be inspected for weeds, and will only be permitted access if approved by the landowner and accompanied by a weed inspection certificate. To further restrict the spread of weeds, vehicles will be restricted to designated access tracks.

Ongoing regular maintenance of firebreaks, roads and tracks will also help reduce the risk of weed incursion by preventing traffic into habitat for MNES.

# 7.0 Monitoring

Stanmore commits to implementing a monitoring program to assess the effectiveness of management measures outlined in Section 6.0 and to make timely decisions on corrective actions to ensure the performance criteria outlined in Sections 5.1 and 6.0 are achieved.

The monitoring methods are:

- Specific to the interim performance targets and competition criteria being assessed and will determine whether the performance criteria have been achieved or whether corrective actions are needed; and
- Quantitative and repeatable such that the monitoring assessments can be compared to each other which provides for changes between sampling events to be detected.

The overarching objectives of the monitoring program are to:

- Evaluate performance of the OAMP against interim performance targets and competition criteria;
- Ensure management triggers are defined and can be detected;
- Develop and implement corrective actions when management triggers are detected;
- Inform subsequent reviews and amendments to the OAMP and associated management plans.

## 7.1 General Site and Visual Inspections

Offset area inspection visits will be conducted at least biannually (prior to and following the wet season) by the land manager/offset area manager to inspect the offset area and assess the following:

- Fencing and signage condition (Note: fencing will be inspected every four weeks when stock are adjacent to the offset area);
- Evidence of excessive pugging or areas of overgrazing while stock are in the offset area;
- Condition of firebreaks;
- Fuel loads;
- Damage and/or degradation resulting from pest animal activity within the offset area;
- New weed outbreaks;
- Signs of unplanned fires; and
- Incidental fauna observations and any additional risks to offset values (i.e. evidence of predation of MNES).

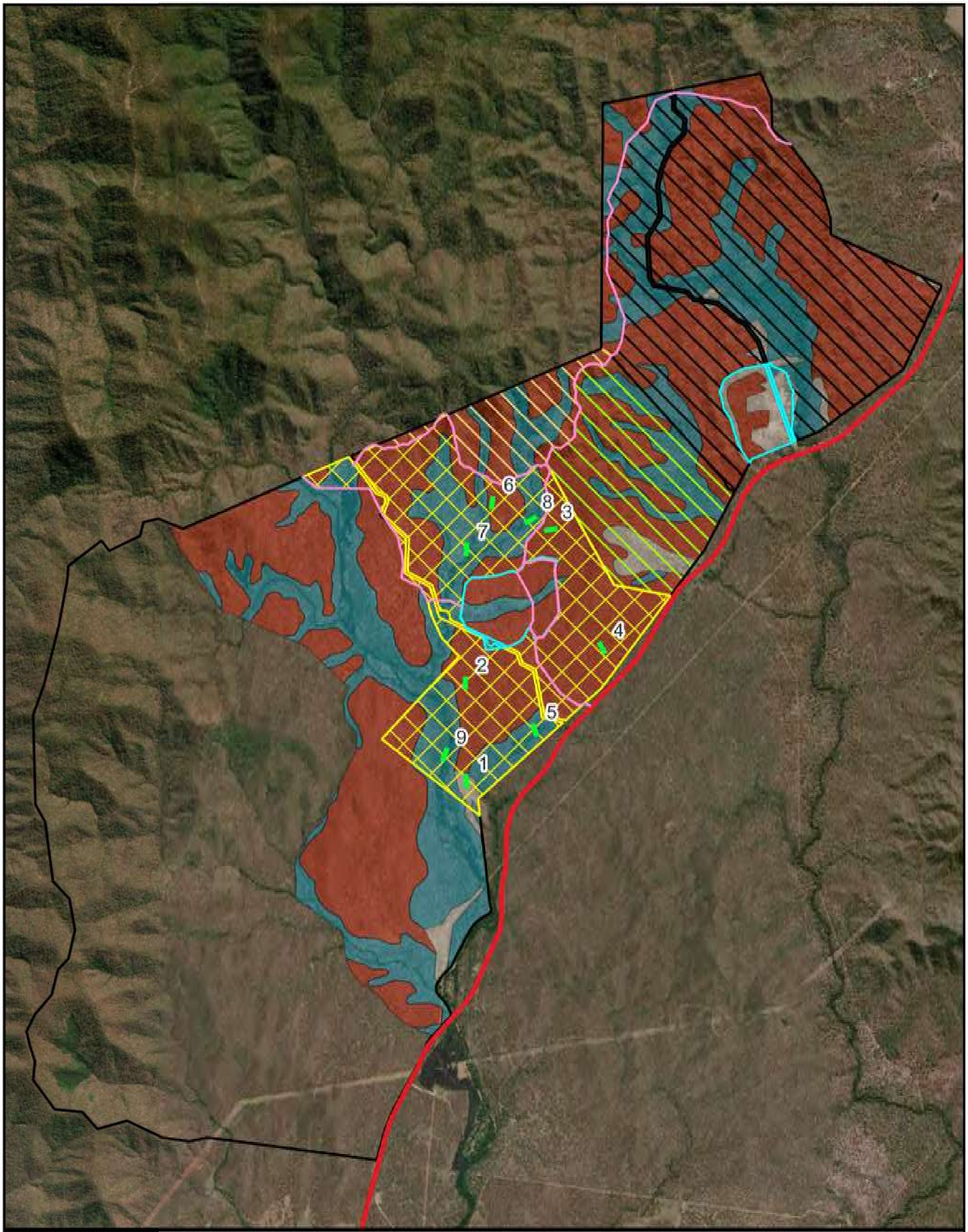
## 7.2 Habitat Quality Monitoring Sites

Ongoing monitoring will be undertaken at nine (9) permanent habitat monitoring sites within the offset area and include four (4) sites in each of RE 11.12.2 and 11.3.4 and one (1) site in the non-remnant patch (refer to Figure 8). The location of these survey sites was determined following advice from suitably qualified ecologists. The location of the sites is in accordance with QLD guidelines and methodologies used in this OAMP, and there are sufficient sample sites and spatial coverage to assess any variation in condition across the offset area and effectively assess key habitat features for each offset matter.

All habitat monitoring sites will be used to assess habitat quality for all three MNES as relevant habitat overlaps where offsets for all three MNES are collocated. Each monitoring site will include a 100 m transect, with the start and central points to be marked with permanent markers (i.e. star picket) and the GPS location recorded. The final monitoring locations will be included in the first annual compliance report for the offset area. Photo monitoring will also be undertaken with photographs taken from north, south, east and west directions. All subsequent monitoring events will be undertaken at the same locations.

The permanent habitat quality monitoring sites will be utilised as part of the following monitoring activities:

- Habitat quality assessments undertaken in accordance with the Guide and the methods outlined in Section 4.1;
- Fauna assessments including bird surveys, spotlighting and Koala Spot Assessment Technique (SAT) surveys;
- Photo monitoring, undertaken at the ends of each of the habitat monitoring site transects;
- Presence of feral animals;
- Presence of weeds and invasive plants; and
- Signs of fire.



0 500 1,000 1,500 m

Scale @ A3: 1 : 55000
Date: 03/11/2021
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Resources) 2021; Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 8: Habitat Quality Transects within the Offset Area

Legend

- Existing Fenceline
- Highways
- ☐ Lot 4SP277438 Boundary
- Habitat Quality Transect
- ☐ Holding Yards
- ▨ IPEE Offset Area
- ▨ IPE Offset Area
- ▨ ID Offset Area
- ▨ Area Removed From ID Offset Area

**Field Verified RE**

- 🟥 11.12.1
- 🟦 11.3.4
- Non-Remnant

BASE/

### 7.3 Habitat Quality and Fauna Monitoring

Initial baseline habitat quality assessments were undertaken in July and October 2020. A comprehensive habitat quality and fauna assessment will be undertaken in year 1 following approval of the initial OAMP and during or immediately following the wet season, nominally March/April/May (depending on rainfall intensity, duration and accessibility), with subsequent assessments undertaken every five (5) years and then at the end of approval. Habitat quality and targeted fauna surveys will be undertaken to compare the offset against the interim performance targets and the completion criteria.

If habitat quality and fauna monitoring indicate a decline in habitat quality and/or a reduction in the abundance or distribution of the MNES in the offset area, monitoring may increase in frequency (e.g. every two years) until trends indicate an increase in habitat quality and/or abundance of the MNES.

The Habitat Quality Guide as well as the methods outlined in Section 4.1 of this OAMP and EcoSM, 2020a, will be used to assess habitat quality for each MNES and is based on the methodology set out in the BioCondition Assessment Manual and BioCondition benchmarks (Eyre et., al. 2015). A range of habitat variables are assessed using standard methods and compared to benchmarks (undisturbed) sites as a measure of how well a terrestrial ecosystem is functioning for biodiversity.

The guide allows for a habitat quality score to be calculated for each MNES based on three key indicators as outlined in Section 4.1 and include:

- Site condition: assessment of vegetation compared to benchmark (undisturbed) areas;
- Site context: a geospatial analysis of the assessment area in relation to the surrounding environment; and
- Species habitat index: the ability of assessment area site to support a species.

To assess habitat quality in line with the EPBC Offsets Policy, the attributes from the three indicators are used but partitioned as outlined in Section 4.1 which uses 15 attributes for site condition and 7 attributes for site context.

For inputs into the EPBC offsets calculator, species stocking rate as outlined in the EPBC offsets calculator guide, replaces species habitat index as a measure of the presence of a species at the impact and offset site. As recommended by DAWE to meet the requirements of the offsets policy, species stocking rate for this OAMP is to be assessed on a scale of 0-4 as outlined in Section 4.1.

The habitat quality assessment will include targeted fauna surveys for the Koala, Greater Glider and Squatter Pigeon and will be undertaken in accordance with the relevant Survey Guidelines as outlined in Table 17. Fauna surveys as well as the habitat quality assessment will be undertaken by suitably qualified ecologists generally during the late wet season (nominally March/April/May) which corresponds to peak species activity and detectability. The habitat quality assessments will also include assessments of weed abundance and distribution and an assessment on the presence of pest animals.

**Table 17 Survey techniques for MNES**

| MNES | Survey | Survey guideline |
|---|---|---|
| Koala | Direct observations:<br>• Nocturnal surveys for Koalas will be undertaken using nocturnal spotlighting techniques described in the EPBC Act referral guidelines for the vulnerable Koala, which uses spotlighting to identify the presence/absence of the species within the sampling area.<br>Indirect Survey Methods<br>• Surveys for Koalas will be undertaken using the Spot Assessment Technique (SAT) methodology (Phillips & Callaghan, 2001), which uses a tree-based scat sampling methodology to provide presence/absence data.<br>• SAT surveys will be randomly throughout the offset area at each of the habitat quality monitoring sites. The exact number of survey sites will be determined by the suitably qualified expert and will be guided by the final offset area configuration.<br>• The location of any tree scratches or observed koalas will also be recorded and photographed as part of the koala surveys or incidentally (Eyre et. al. 2014).<br>• Where the presence of Koalas have been identified within the offset area either through direct survey or incidental observation, a minimum of two (2) 400 m x 50 m (i.e. two (2) ha) transects will be randomly established in proximity to the siting location. The final location, length and orientation of the transects will be determined by the suitably qualified expert. The number of Koalas encountered within each of the transect will be noted and converted to density/ha. | • Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et. al. 2018).<br>• EPBC Act referral guidelines for the vulnerable Koala (DotE, 2014).<br>• Survey guidelines for Australia's threatened mammals (SEWPaC, 2011).<br>• Spot Assessment Technique (SAT) methodology (Phillips & Callaghan, 2001).<br>• Regularised, grid-based SAT (RGB-SAT) sampling (Biolink Ecological Consultants, 2008). |
| Greater Glider | • Nocturnal spotlight searches will be conducted over a minimum of five (5) survey days and nights during periods of known peak activity (wet season) around suitable habitat including tree hollows and riparian areas.<br>• Greater Glider scats observed during the Koala SAT surveys will also be recorded.<br>• Searches will be undertaken along designated transects determined through field survey and identified as potential habitat for the species. Nocturnal surveys will record the presence of Greater Gliders within 25 m of the centre line (i.e. 50 m wide). The transects will be traversed slowly with approximately 100 m traversed every 10 minutes.<br>• Where Greater Gliders have been identified within the transects, the number of Greater | • Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et. al., 2018).<br>• Greater Glider Survey Standards (MacHunter et. al., 2011) |

| MNES | Survey | Survey guideline |
|---|---|---|
| | Gliders encountered will be noted and converted to density/ha. | |
| Squatter Pigeon | • Surveys will be undertaken over a minimum of 3 days during the breeding season (between Spring and Summer). In accordance with the Survey Guidelines for Australia's Threatened Birds squatter pigeons will be passively surveyed by flushing them while traversing by vehicle and on foot. The number and abundance of Squatter Pigeons will be recorded during survey events.<br>• Squatter Pigeon densities will be determined from ten (10) 50 m x 10 m transects by converting numbers to density/ha. | • Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et. al., 2018).<br>• Survey guidelines for Australia's threatened birds (DEWHA, 2010). |

Where the habitat quality assessments do not demonstrate improvements in each of the individual site condition and site context attributes, and the overall habitat quality/interim performance targets and/or the completion criteria for the offset area, the adaptive management framework allows for a review of management actions and corrective actions to be undertaken to assess if additional management measures or corrective actions are required. If the review deems additional actions are required, the OAMP will be revised and approval of the revised OAMP sought from the Minister.

As outlined in Table 15, a period of 20 years has been chosen as the time period of which the final habitat quality, and hence, increased habitat values of the MNES will be reached (i.e. 2041). This time period was chosen as 20 years is the nominated time until ecological benefit used in offsets calculations and is the time required for large canopy trees to become established and for additional tree hollows to form. Habitat quality site assessments are scheduled every five (5) years through to the end of the approval. The final assessment will be undertaken in approximately 2041 (depending on the length of the approval) to demonstrate that the final habitat quality of the offset area conforms to that outlined in this OAMP and that the competition criteria has been achieved.

Where the overall habitat quality score identified in the offset calculator (i.e. 'Habitat Quality with Offset') and shown in Tables 9-11 is not achieved by the end of the approval, management actions will continue until the offset requirements are realised. In contrast, if the completion criteria are met prior to the end of the approval, all management actions and monitoring will continue until the end of the approval to ensure the completion criteria and habitat quality is maintained throughout the life of the approval.

## 7.4 Photo Point Monitoring

Photo monitoring will be undertaken at each monitoring location during the habitat quality assessments to allow habitat changes to be visually assessed over time. Photos at each photo monitoring point will be taken in a north, east, south and westerly direction. A permanent feature will be included within the photo frame to provide a fixed reference point. A record of the photographs will be maintained, including GPS location, date, time, direction and the height above the ground at which the photograph was taken. Data from habitat quality assessments and photo monitoring will be recorded on survey sheets and these will be attached to annual monitoring reports.

## 7.5 Weeds

The offset area will be monitored for weeds and invasive plants and will include a comprehensive weed survey in year 1 which will map the distribution and density of weed infestations in the early dry season. The final mapping methodology will be determined by the suitably qualified ecologist prior to and during the comprehensive year 1 surveys. Ongoing seasonal weed monitoring surveys will be undertaken in conjunction with the habitat quality monitoring surveys outlined in Sections 7.2. Comprehensive weeds surveys aimed at re-mapping the distribution and density of weed will be undertaken every five (5) years.

Assessing the presence and abundance of weed cover will be done in accordance with the methodology outlined in the Habitat Quality Guide for assessing non-native plant cover (DES, 2020). Briefly, this method involves establishing a 50 m x 10 m plot and dividing this plot into 20 smaller 5 m x 5 m sub-plots. Percent (%) weed cover will be assessed in each of the 20 sub-plots and the total percent weed cover determined by taking the average from the 20 plots. Photo monitoring will also be undertaken within each plot in the same manner described in Section 7.4.

In addition to the permanent weed monitoring sites, incidental observations will be recorded from the offset area during general observations during routine land management. This will provide instances of weed infestations that occur away from the permanent weed monitoring sites. If trigger levels for weeds are met or exceeded, additional monitoring will be undertaken and will occur in conjunction with appropriate weed management measures outlined in Section 6.7, until the presence and distribution of weeds reduces to baseline levels or below.

## 7.6 Feral Animals

The offset area will be monitored for pest animals and will include a comprehensive survey in year 1 which will map the presence of feral animals. Ongoing feral animal monitoring surveys will be undertaken in conjunction with the habitat quality monitoring surveys outlined in Section 7.2 and at the same surveys locations as the habitat quality assessment surveys in Figure 8 as well as additional sites established during the Year 1 monitoring event as outlined in Section 7.2. Monitoring will primarily entail standardised timed visual observations in a similar manner undertaken for bird surveys as well as camera trap monitoring and nocturnal spotlighting surveys. Evidence of faecal samples and damage cause by pest animals will also be recorded. The final methodology will be determined by the suitably qualified ecologist during the initial comprehensive survey in year 1. Exact monitoring methods will be determined by the suitably qualified ecologist engaged to undertake the monitoring.

Feral animals will also be opportunistically surveyed throughout the year outside of monitoring times, including observations for potential new pest animal species that have not been previously recorded, and which are known to prey on MNES and/or degrade MNES habitat (e.g. Feral Pigs). Any evidence of mortality or injury to MNES as a result of pest animals will also be recorded during the surveys. If trigger levels for any pest animal species are met or exceeded, additional monitoring will be undertaken and will occur in conjunction with appropriate feral animal management measures until pest animal presence reduces to baseline levels or below.

## 7.7 Fuel Loads

Fuel load monitoring for fire management will be undertaken annually in the early dry season when biomass (i.e. ground cover) is at its greatest, to determine the risk of fire to the offset site and to inform fire management strategies. Groundcover will be monitored at the same permanent habitat quality monitoring sites established as part of the comprehensive baseline surveys in year 1.

Fuel loads will be managed through strategic grazing events if the percent cover of native grasses exceeds 55%. For strategic grazing, the cattle stocking rate will be determined by the percent ground cover vegetation and native grass cover as outlined in Table 16.

# 8.0 Data Management, Reporting, Implementation and Auditing

## 8.1 Data Management

Stanmore or their authorised representative, will be responsible for overseeing and managing the monitoring activities required as part of this OAMP. This will include maintaining data records to confirm all activities associated with the management actions in this OAMP have been undertaken as outlined in this OAMP and/or any subsequent approval conditions. These records will be made available to DAWE as required.

## 8.2 Reporting

A reporting schedule is shown in Table 19 and this process will enable assessment of changes in vegetation condition/habitat quality relative to baseline data and determine progress towards the offset completion criteria (see Section 5.1). Reporting will also determine the success of the management actions and note any changes due to climatic conditions and will inform the type and frequency of management measures required in the upcoming monitoring period.

The results of the monitoring activities will be documented by suitably qualified ecologists in stand-alone progress reports and combined into an annual compliance report.

The reports will include the following information:

- EPBC approval number;
- General description of the climatic conditions for the monitoring period (e.g. rainfall, duration of the wet season etc.);
- All activities undertaken during the monitoring period including monitoring undertaken and the entity who undertook the monitoring and results of the monitoring undertaken;
- Location (GPS coordinates) and details of all confirmed sightings of Greater Glider, Koala and Squatter Pigeon identified during surveys and monitoring;
- An indication of whether any additional risks/threats over and above those outlined in the final approved OAMP are apparent and management actions to be employed to manage those risks;
- If any triggers were detected, and if so, the corrective actions that were implemented;
- Discussion on progress towards achieving the management objective and offset obligations outlined in the OAMP;
- Recommendations for improving/updating the OAMP in accordance with adaptive management.

## 8.3 Implementation

Based on recent approvals for the IPM projects, it is the expectation that Stanmore must not commence clearing of habitat for the MNES listed Table 1 of this OAMP, until the OAMP has been approved. Following approval, the OAMP will be implemented and will be remain effective for the life of the approval. Stanmore commits to implementing management actions under this OAMP prior to clearing habitat for the MNES and legally securing the environmental offsets within 12 months from the commencement of clearing habitat for the MNES outlined in Table 1 of this OAMP. Stanmore commits to commencing components of this OAMP (e.g. year 1 baseline monitoring) of the offset area following approval of the initial OAMP and prior to formal legal security if agreed by the landowner and Stanmore. The schedule of monitoring activities is shown at Table 18 and the schedule of reporting is shown in Table 19.

Table 18 Proposed monitoring schedule of offset area

| Monitoring Type | Monitoring Attributes | Monitoring Frequency | Monitoring Method | Monitoring Locations |
|---|---|---|---|---|
| **Habitat Quality surveys undertaken by suitably qualified ecologists** | | | | |
| Initial habitat quality assessment | Site condition, site context and species stocking rates as outlined in this OAMP. | Initial and baseline assessment was completed in July and October 2020. | Visual inspections and detailed habitat quality assessment as per the Guide and as outlined in this OAMP. | Assessment sites outlined in Section 7.2. |
| Ecological Condition | Recruitment of woody perennial species in the ecologically dominant layer (EDL) | Year 1 (following approval of the initial OAMP and securing the offset area), then every 5 years until the end of the approval. | As per the methods outlined in the Guide and in Section 4.1.<br>Visual observations and, where relevant, methods outlined in the Guide to determining terrestrial habitat quality and with reference to interim criteria as per Table 15 for the relevant RE and AU being monitored. | |
| | Native plant species richness – trees | | | |
| | Native plant species richness – shrubs | | | |
| | Native plant species richness – grasses | | | |
| | Native plant species richness – forbs | | | |
| | Tree canopy height | | | |
| | Tree canopy cover | | | |
| | Shrub canopy cover | | | |
| | Native perennial grass cover | | | |
| | Organic litter | | | |
| | Large trees | | | |
| | Course woody debris | | | |
| | Non-native plant cover (i.e. weeds) | | | |

| Monitoring Type | Monitoring Attributes | Monitoring Frequency | Monitoring Method | Monitoring Locations |
|---|---|---|---|---|
|  | Quality and availability of food and foraging habitat (e.g. tree canopy height and cover, organic litter, tree and shrub species richness). |  |  |  |
|  | Quality and availability of shelter (e.g. presence of tree hollows). |  |  |  |
| Site context[9] | Threats to species (e.g. lack of EDL recruitment, presence of feral animals and weeds etc.). |  |  |  |
|  | Threats to mobility capacity. |  |  |  |
| Species stocking rates/targeted fauna surveys for the MNES | Presence/absence of MNES.<br>MNES abundance and density (where relevant). | Every five (5) years until the completion criteria have been achieved. The survey frequency is justified as changes to vegetation communities and ecosystems and the fauna that inhabit those communities takes time and is generally a relatively slow process. | Refer to Section 4.1. | Refer to Section 7.2. |
| **Visual inspection surveys undertaken by the landowner or authorised landowner representative and targeted weed and feral animal surveys undertaken by suitably qualified ecologists.** |  |  |  |  |
| Photo points | General vegetation condition and vegetation cover. | Year 1 (following approval of the initial OAMP and securing the offset | Photographs of offset area to be taken from the same location and direction for each monitoring event. | Assessment sites outlined in Section 7.2. |

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[9] Non-GIS attributes that can be measured in the field.

| Monitoring Type | Monitoring Attributes | Monitoring Frequency | Monitoring Method | Monitoring Locations |
|---|---|---|---|---|
| | | area), then every 5 years until the end of the approval. | | |
| Grazing | Stocking rates, ground cover and fencing. | Stocking rates will be routinely monitored until the end of the approval. Biomass will be monitored annually in the early dry season. Fencing will be monitored during routine land management of the offset area and at least quarterly. | Assessments of the offset area will be undertaken by the landowner/land manager or authorised representative to observe and record grass cover, presence of weeds and pest animals, evidence of fire and evidence of unauthorised access.<br>Fire break and fence maintenance activities will be recorded for inclusion in the annual report. Any unplanned fires will also be recorded as well as monitoring results for any planned cool or mosaic burns on habitat.<br>Weed cover will be recorded as per the Level 2B methodology described in the Land Manager's Monitoring Guide (DERM, 2010) (or any subsequent published version of this document or similar recognised methods). This methodology is suitable for landowners to rapidly assess whether weed management measures need to be conducted within the offset area.<br>Detailed assessments as outlined in Section 7.0 will also be undertaken in conjunction with the habitat quality assessments. | Throughout the offset area. |
| Fire | Presence of fire and extent of burning.<br>Condition of fire breaks. | At least quarterly and following known fire events.<br>Biomass will be monitored annually in the early dry season. | | |
| Feral animals | Presence of pest animals, control measures undertaken and success of the control measures. | Visual inspections undertaken during routine land management.<br>Year 1 (following approval of the initial OAMP and securing the offset area), then every 5 years until the end of the approval. | | |
| Weeds/ pest plants | Presence of weeds, control measures undertaken and success of the control measures. | Visual inspections undertaken during routine land management.<br>Year 1 (following approval of the initial OAMP and securing the offset area), then every 5 years until the end of the approval. | | |
| Fencing and site access | Condition of fencing and access tracks. | Visual inspections undertaken during routine land management. | | |

| Monitoring Type | Monitoring Attributes | Monitoring Frequency | Monitoring Method | Monitoring Locations |
|---|---|---|---|---|
| Unauthorised impacts to vegetation from activities such as illegal harvesting and illegal access. | Unauthorised clearing or disturbances. | Visual inspections undertaken during routine land management and undertaken at least quarterly. | Observe and record accessibility to the offset site (i.e. condition of fencing), evidence and location of illegal clearing, fire and/or pest animal incursion. | Throughout the offset area and particularly along and adjacent to the road licence easement and the boundary to the Epsom State Forest. |
| Cyclone events | Condition and damage to vegetation and any dead or injured fauna. | Following cyclones or large tropical rainfall events. | Visual throughout the offset area. | Throughout the offset area. |

### Table 19 Proposed reporting schedule of offset area

| Report | Reporting period | Responsibility | Submission period |
|---|---|---|---|
| EPBC Act Annual Compliance Report which will report on compliance with the EPBC Act approval. | Every 12 months for the duration of the approval or until otherwise advised by the Minister | Stanmore | Within 3 months of every 12 month anniversary of the commencement of the action. |
| Offset Area Report that will outline the results and the effectiveness of the management actions outlined in this OAMP, including against habitat quality score criteria. This report will include all monitoring results, management actions, investigations and any corrective actions taken. | Every 12 months from approval | Generally, Stanmore but with inputs from relevant suitably qualified persons and/or the landowner. | The report will be an appendix to the Compliance Report |
| Ecological Condition Assessment Report that provides results of the habitat quality surveys. | In year 1 and then every 5 years from the approval for the life of the approval | Suitably qualified person. | The report will be an appendix to the Compliance Report |
| Internal Audit Report that confirms compliance and effectiveness of the OAMP. This report will also provide any necessary corrective actions of management action improvements. | In year 1 and then every 5 years from the grant of the VDec for the life of the approval. | Stanmore | Within 3 months of the submission of the Ecological Condition Assessment Report |
| External Audit Report confirming compliance with the approval conditions. | As and if required by DAWE | Generally, Stanmore but with inputs from relevant suitably qualified persons. | As and if required by DAWE |
| Revised OAMP as approved by the Minister to document any required changes to the management actions of the offset area due to the interim habitat quality values or completion criteria not being met. | Only required if the management actions in the OAMP needs to be amended to ensure the interim and/or completion criteria are met, or should additional offsets be required in the event that completion criteria cannot be achieved. | Stanmore | Within 6 months of failing to meet the interim habitat quality values or completion criteria where the management actions require amending. |
| Notification of illegal timber harvesting or clearing to the relevant Queensland Government | Only required if illegal clearing or timber harvesting occurs within the offset area | Stanmore. | Within 10 business days of detection of illegal timber |

| Report | Reporting period | Responsibility | Submission period |
|---|---|---|---|
| Departments and Queensland Police (as relevant). | | | harvesting or clearing. |

## 8.4 Auditing and Review

Internal audits/reviews of management and monitoring activities will be undertaken in response to a trigger for further action (outlined in Table 16) being triggered and non-compliances with the OAMP requirements. External auditing will be undertaken as required by the approval conditions and will be published in annual compliance reports that will include details on the progress towards achieving the interim performance targets and/or completion criteria specified in this OAMP.

The effectiveness of actions within this OAMP will be reviewed annually and amended (if required) to incorporate changes identified through management activities and monitoring activities. Any changes to this OAMP, including but not limited to monitoring and management measures must be approved in the form of a revised OAMP by the Minister, prior to implementing changes to practices. Changes may include amendments to management actions, identification of additional monitoring activities and responses to adaptive management triggers. If the completion criteria have been attained prior to the end of the approval, the OAMP will continue to be implemented and reviewed to ensure the completion criteria are maintained until the approval expires.

# 9.0 Risk Assessment

A risk assessment was undertaken using the risk assessment process provided by the DAWE to assess the risks associated with failing to achieve the objectives outlined in this OAMP for mitigating impacts to MNES. For each identified risk, the potential consequence of the risk (Table 20) was assessed against the likelihood of that risk occurring (Table 21) to determine an overall risk rating using the matrix in Table 22. The consequence and likelihood of each risk occurring was reassessed following the implementation of the management and mitigation measures (i.e. control measures) to provide a residual risk rating (Table 23).

**Table 20 Consequence classification**

| Qualitative measure of consequences (what will be the consequence/result if the issue does occur) | |
|---|---|
| **Minor (Mi)** | Minor risk of failure to achieve the plan's objectives. Results in short term delays to achieving plan objectives, implementing low cost, well characterised corrective actions. |
| **Moderate (Mo)** | Moderate risk of failure to achieve the plan's objectives. Results in short term delays to achieving plan objectives, implementing well characterised, high cost/effort corrective actions. |
| **High (H)** | High risk of failure to achieve the plan's objectives. Results in medium-long term delays to achieving plan objectives, implementing uncertain, high cost/effort corrective actions. |
| **Major (Ma)** | The plan's objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies. |
| **Critical (C)** | The plan's objectives are unable to be achieved, with no evidenced mitigation strategies. |

**Table 21 Likelihood classification**

| Qualitative measure of likelihood (how likely is it that this event/circumstances will occur after management actions have been put in place/are being implemented) | |
|---|---|
| **Highly likely (Hi)** | Is expected to occur in most circumstances. |
| **Likely (L)** | Will probably occur during the life of the project. |
| **Possible (P)** | Might occur during the life of the project. |
| **Unlikely (U)** | Could occur but considered unlikely or doubtful. |
| **Rare (R)** | May occur in exceptional circumstances. |

**Table 22 Risk rating matrix**

| | | **Consequence** | | | | |
|---|---|---|---|---|---|---|
| | | **1. Minor** | **2. Moderate** | **3. High** | **4. Major** | **5. Critical** |
| **Likelihood** | **5. Highly Likely** | Medium | High | High | Severe | Severe |
| | **4. Likely** | Low | Medium | High | High | Severe |
| | **3. Possible** | Low | Medium | Medium | High | Severe |
| | **2. Unlikely** | Low | Low | Medium | High | High |
| | **1. Rare** | Low | Low | Low | Medium | High |

For the purposes of this risk assessment, the risk levels are defined as follows:

- Severe: Unacceptable risk that must not proceed until suitable and comprehensive control measures have been adopted to reduce the level of risk.
- High: Moderate to critical consequences. Works should not proceed without considerations of additional actions to minimising the risk.
- Medium: Acceptable with formal review. Medium level risks require active monitoring due to the level of risk being acceptable.
- Low: Acceptable with active management not considered required.

Table 23 Risk assessment and management

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Likelihood[1] | Consequence[2] | Result[3] | | Likelihood[1] | Consequence[2] | Result[3] | | | | |
| **Standard Risks** | | | | | | | | | | | | |
| Habitat or vegetation loss through unplanned clearing | As the offset site occurs within a beef production property, it is possible for unplanned/ illegal clearing to occur. This is unlikely as the landholder will enter into an offset arrangement with the approval holder.<br>Clearing can also occur by vehicles traversing the area off designated roads/tracks This is also considered improbable as | U | Mj | H | No unapproved and/or intentional clearing of vegetation within the offset area, except for clearing that is required for fencing, access, firebreaks or public safety.<br>Ecological thinning may be carried out, but only in accordance with the advice of a suitably qualified expert and only after approval by the Department. | R | Mj | M | No unauthorised access.<br>No evidence of clearing within the offset area.<br>Offset Area is mapped as Category A on PMAV. | Any activities that are in contravention of the Voluntary Declaration.<br>Detection of prohibited clearing outside of established access tracks, fire control lines and fence lines (existing infrastructure). | Upon being notified or becoming aware of clearing outside of existing infrastructure, the landholder is to assess how any unauthorised clearing occurred and, where relevant, any unauthorised persons accessed the site<br>Report breach to the Department within 10 business days.<br>Review existing access restrictions and inspect signage and offset area fencing within one fortnight of detection of the clearing. | Monitoring and inspections will monitor and document if there is evidence of recent illegal clearing.<br>Monitoring will also document vegetation clearing that has occurred for fire break, access road or fence line maintenance. |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | Likelihood[1] | Consequence[2] | Result[3] | | Likelihood[1] | Consequence[2] | Result[3] | | | | |
| | access to the site will be restricted.<br>Potential unplanned clearing could come from application of chemicals on adjacent properties which stray across the offset site boundary. | | | | | | | | | | Any corrective action identified will be implemented within 1 month of the OAMP being updated. | |
| Timber harvesting /collection | Unauthorised access to the offset area may result in timber harvesting/ collection. Such actions can remove important habitat features and harm the structure of the vegetation communities | U | Mo | L | All signs and fences will be erected within three months of the offset being legally secured.<br>Signs will be erected at all entrances and potential access points to the site identifying the area as an | R | Mo | L | No unauthorised access to the offset site.<br>No evidence of unapproved clearing within the offset area.<br>Offset area mapped as Category A on PMAV. | Damaged fences associated with vehicle access.<br>Detection of prohibited forestry operations, native timber harvesting or clearing outside of established access tracks, fire control lines and fence lines | Upon being notified or becoming aware of prohibited forestry operations, native timber harvesting or clearing outside of existing infrastructure, the landholder is to assess who and how unauthorised persons accessed the site | The annual compliance report will document any illegal/unauthorised timber harvesting.<br>All field monitoring will report on the presence of any unauthorised access and clearing. |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | Likelihood[1] | Consequence[2] | Result[3] | | Likelihood[1] | Consequence[2] | Result[3] | | | | |
| | and habitat for the Koala, Greater Glider and Squatter Pigeon. | 🟩 | 🟩 | 🟩 | environmental offset and stating that access to the site is forbidden.<br>Fences will be maintained to prevent unauthorised access, to minimise incursions by feral herbivores and to control stock presence | 🟦 | 🟩 | 🟩 | | (existing infrastructure). | Report breach to the Department within 10 business days.<br>The approval holder is to reassess access protocols for any lessees etc., signage and general access within one fortnight. | |
| Control invasive weed species to reduce impacts on MNES. | Infestation of previously unidentified weeds within the offset area.<br>Expansion of range and abundance of existing weed species within the offset site.<br>Left unchecked, weed invasion and proliferation | P | H | M | Access to site will be restricted to authorised persons.<br>Weed management and weed hygiene restrictions will be implemented across the offset site to reduce the extent of existing weeds and to control the potential introduction of new | U | Mi | L | No infestations of new species in the offset area, covering more than 100m$^2$.<br>No increase in the average percent (%) cover score weed species from baseline and/or previous | An increase in the average percent (%) cover score weed species from baseline and/or previous monitoring events.<br>Outbreak of infestations of weed species not previously recorded in the offset area during | Review adherence to weed hygiene procedures to ensure compliance and to update restrictions where required.<br>Review timing and frequency of weed management measures, and implement alternative weed management timeframes as required. | Monitoring of weeds and non-native plants will be undertaken during the habitat quality assessment surveys using the same methodology used to the baseline habitat quality as outlined in the Section 4.1, as well as |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | Likelihood[1] | Consequence[2] | Result[3] | | Likelihood[1] | Consequence[2] | Result[3] | | | | |
| | could cause significant deterioration of the offset site. | | | | exotic weed species.<br>Weed hygiene and management will be undertaken in consultation with the landowner.<br>Chemical and/or mechanical control of all declared weeds in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets or other sources of information. | | | | monitoring events. | baseline and/or previous monitoring events.<br>An increase in the presence of weeds (relative abundance and/or area of occurrence) from photo monitoring results.<br>An interim performance target is not attained, or a completion criterion is not attained and/or maintained. | Investigate alternative weed management control actions (e.g. spot spraying and/or injection of herbicides, as well as intensification for most affected areas) and implement as required.<br>Undertake additional weed control measures and continue until weed cover is below baseline levels and in accordance with performance criteria.<br>Update OAMP as required. | incidental observations as part of routine management.<br>The annual report will document the weed presence, weed control measures and extent of weed cover during the reporting period and relevant responsive actions. |
| Inappropriate grazing regimes | Inappropriate cattle grazing destroys shrubs and native grass cover and slows or reverses the | P | H | M | Stock will be managed in accordance with Section 6.4.<br>If and where new fencing is required | U | Mi | L | Stock are removed from the offset area for it to be spelled in accordance with | Stock are observed on site in exclusion times, outside of strategic grazing events. | Amend livestock management practices including amendment of stocking rates, and/or timing, and/or | Regular site inspections by landowner during exclusion periods as well as to assess for signs |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | Likelihood[1] | Consequence[2] | Result[3] | | Likelihood[1] | Consequence[2] | Result[3] | | | | |
| | regeneration of threatened fauna habitat.<br>Grazing can also lead to the trampling of Squatter Pigeon (southern) nests, impairing breeding. | 🟨 | 🟨 | 🟨 | to demarcate the offset area, ensure fencing is permanent and prohibit unintended grazing by cattle.<br>Squatter Pigeon breeding period can vary depending on localised site conditions but generally peaks in the early to mid-dry season (May-July). Grazing will be restricted at least during the peak Squatter Pigeon breeding and egg laying periods in the early to mid-dry season. | 🟩 | 🟦 | 🟩 | the current land management practices undertaken on Mt Spencer Station to allow for grasses to seed and to facilitate recovery of perennial grasses and the herbaceous layer while mitigating wildfire risk by restricting fuel loads.<br>Ground cover always remains above the minimum cover limits.<br>Native grass groundcover is <30% or >55%. | Livestock located in the offset areas outside of strategic grazing events.<br>Livestock located in Squatter Pigeon breeding habitat during breeding season.<br>Damaged fencing is observed<br>Habitat Quality assessments indicate native grass groundcover is <30% or >55%.<br>If ecological surveys indicate an extended or varied peak breeding period outside the early to mid-dry season. | duration and/or frequency of strategic grazing events until native grass cover is >30% or <55%.<br>Repair offset area boundary fencing if damaged.<br>Remove stock from Squatter Pigeon breeding habitat.<br>Removing stock when excessive pugging or overgrazing is observed such that native grass cover is <30%.<br>Construct additional fencing if required. Additional fencing will not clear areas of MNES habitat.<br>Should monitoring activities identify | of overgrazing and pugging.<br>Regular inspections of the offset area will be undertaken during normal land management and farming practices to examine fence lines when stock are grazing in the offset area and/or adjacent to the offset area.<br>Habitat quality assessments will be undertaken in accordance with this OAMP and will include assessment of percentage cover of native perennial grasses<br>The annual offset compliance report |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | Likelihood[1] | Consequence[2] | Result[3] | | Likelihood[1] | Consequence[2] | Result[3] | | | | |
| | | | | | | | | | | | triggers for further action, the OAMP will be reviewed by a suitably qualified ecologist within one month and update if required.<br>Any corrective action identified will be implemented within 1 month of the OAMP being updated. | will document vegetation condition. |
| Increased population of feral animals in the offset area causing habitat degradation or direct impacts to MNES | Pest animals pose threats to the MNES including predation (Wild Dogs, Feral Cats and Foxes) and habitat degradation (Feral Pigs, Feral Horses and Rabbits).<br>Feral Pigs and rabbits can impact on Koala | P | H | M | Pest animal management will be undertaken in consultation with the landowner and in accordance with general pest management processes.<br>Pest management will include a range of best management practice actions including shooting, | P | Mi | L | No increase in abundance of feral animals.<br>Maintain pest animal control program.<br>No evidence of new pest species. | Observed increase in sightings/signs and/or the relative abundance of pest animals above baseline levels and/or previous monitoring event (whichever is lower).<br>Observation of, or signs of, a feral animal not | Review adherence to pest animal management.<br>Investigate potential sources or reasons for an increase in pest animal numbers and rectify<br>Increase the frequency or revise the type of invasive pest animal control efforts in accordance with DAF guidelines, and in conjunction | Review adherence to pest animal management actions.<br>Investigate potential sources or reasons for an increase in pest animal numbers and rectify.<br>Increase the frequency or revise the type of invasive pest |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | Likelihood[1] | Consequence[2] | Result[3] | | Likelihood[1] | Consequence[2] | Result[3] | | | | |
| | habitat including tree species recruitment and understorey vegetation composition. | 🟨 | 🟨 | 🟨 | trapping, fencing and baiting, and will be undertaken in accordance with Queensland's Department of Agriculture and Fisheries (DAF) guidelines[10] and the requirements of the *Biosecurity Act 2014.*<br>If an increase in feral pest species is noted, additional pest management/control measures will be instigated until the increased activity has ceased. | 🟨 | 🟦 | 🟩 | | identified as occurring within the Project area during the baseline surveys.<br>Habitat quality scores for interim performance targets are not achieved by, Year 5, Year 10, Year 15 and Year 20. | with neighbouring landowners.<br>Update OAMP if required. | animal control efforts in accordance with DAF guidelines, and in conjunction with neighbouring landowners.<br>Suitably qualified ecologist to review the OAMP within one month and update if required |

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[10] https://www.daf.qld.gov.au/business-priorities/plants/weeds-pest-animals-ants

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | Likelihood[1] | Consequence[2] | Result[3] | | Likelihood[1] | Consequence[2] | Result[3] | | | | |
| Unauthorised access | Access to the offset site by any unauthorised persons poses risks to the MNES through habitat degradation (introduction of new weeds), incursion by feral herbivores if gates are left open, MNES mortality through vehicle strike. | P | Mo | M | All signs and fences will be erected within three months of the offset being legally secured.<br>Signs will be erected at all entrances and potential access points to the site stating that access to the site is forbidden.<br>Fences will be maintained to prevent unauthorised access, to minimise incursions by feral herbivores and to control stock presence. | U | Mo | L | No unauthorised access to the offset site. | Evidence of unauthorised or unplanned access by persons, vehicles, and/or stock is detected during exclusion periods.<br>Evidence of stock is detected at any point during exclusion times.<br>Damage is detected to any fence or sign. | Upon being notified or becoming aware of prohibited access to the offset area, the approval holder is to reassess access protocols for any lessees etc., signage and general access within one fortnight.<br>Damage to signage will be repaired within one month of noting the damage.<br>If there are areas that have been negatively impacted by unauthorised access, the regeneration of those areas will be added to the ongoing monitoring sites.<br>Signage will be repaired and maintained as required by the Landholder or | Monitoring of fence lines will be undertaken by the Landholder or suitable qualified person appointed by the approval holder within 3 months of the offset area being legally secured and during quarterly inspections.<br>Inspections will monitor and document damage or loss of signs and evidence of unauthorised access to the offset area. |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | | | | | | | | | | suitable qualified person appointed by the approval holder. | |
| Bushfire (unplanned) | If unchecked bushfire may degrade some or all of the offset site and increase related risks such as erosion.<br>Fire late in the management period would also reduce the environmental improvement achieved at the offset site. | P | H | M | Controlled burns will be undertaken in consultation with the landowner and in accordance with the recommended fire management guidelines for Regional Ecosystems and will involve a range of burn strategies including patchwork burns.<br>Fire is to be excluded from the offset area except for planned and strategic burns as required to reduce understorey fuel loads having a detrimental impact on canopy tree recruitment and | U | H | M | | Unplanned fire within the offset area.<br>Planned fires become out of control or the required burning regime is not achieved.<br>Habitat Quality assessments indicate native grass groundcover >55%. | Occurrences of fire are to be recorded during the visual inspections undertaken during routine land management.<br>If an uncontrolled bushfire has impacted the offset area (including if controlled burning becomes out of control), review the grazing management and fire management strategies and adherence to these strategies and exclude cattle for at least three six months (depending on conditions for re-growth). All fire breaks months. All | Fire breaks are to be inspected annually in September<br>Visual inspection of signs of fire during routine land management and during the habitat quality assessments.<br>Fuel loads will be monitored through monitoring of ground cover and to inform fire management strategies. |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | Likelihood¹ | Consequence² | Result³ | | Likelihood¹ | Consequence² | Result³ | | | | |
| | | 🟨 | 🟨 | 🟨 | establishment and to maintain existing fire breaks.<br>Create firebreaks around the offset area boundary to minimise unplanned fire from adjacent lands.<br>Firebreaks are to be co-located, where possible, with roads, fence lines and vehicle access tracks. No areas of MNES will be cleared unless necessary for safety management. | 🟩 | 🟨 | 🟨 | | | fire breaks will be inspected, maintained, and repaired if required.<br>To ensure compliance, with performance criteria, undertake remedial action including:<br>• Alteration to stocking rates, and/or duration and frequency of strategic grazing events; and/or<br>• Amendments to fire management practices as required including fire safety and containment management.<br>Suitably qualified ecologist to review the OAMP within one month and update if required. | |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | Likelihood[1] | Consequence[2] | Result[3] | | Likelihood[1] | Consequence[2] | Result[3] | | | | |
| Offset fails to achieve the interim performance targets and completion criteria within the 5, 10, 15 and/or 20-year time intervals.<br>Offset site initially achieves the completion criteria but declines before the end of the approval. | The offset site has not met the requirement of the offset policy or this OAMP, nor achieved the outcomes that were key to the rationale for the approval decision. | R | C | H | The Voluntary Declaration under the VM Act will ensure that the landholder remains obliged to undertake active management of the offset until all completion criteria are achieved, leading to further management. | R | Mo | L | Completion criteria are achieved, by the timeframes established and through to the end of the approval. | Interim performance targets are not achieved by year 5, 10 or 15.<br>Completion criteria are not achieved by year 20. | Within one month of detection of the trigger, complete an investigation into the reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. This investigation must re-evaluate the suitability of the relevant management actions and identify appropriate corrective actions.<br>As soon as practicable, and within six months of detection of the trigger, implement revised corrective actions. These may include (but not limited to): | Monitoring of the offset area will be undertaken in accordance with this OAMP.<br>Monitoring results will be compared against the interim performance targets and completion criteria to assess progress of offset area in achieving the requirements of this OAMP. |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | 🟦 | 🟥 | 🟧 | | 🟦 | 🟦 | 🟩 | | | • Increasing the frequency and intensity of pest animal and weed control measures or revising the type of measures to be implemented.<br>• Modify fire management measures, to better support enhancement of offset values.<br>• If the investigation outlined above requires changes to the management actions, then as soon as possible, and within six months of detection of the trigger, implement a | |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | Likelihood[1] | Consequence[2] | Result[3] | | Likelihood[1] | Consequence[2] | Result[3] | | | | |
| | | | | | | | | | | | revised OAMP, as approved by the Minister, incorporating those recommended changes.<br>Additional offsets will need to be sought by the approval holder, and approved by the Minister, should the above corrective actions not be successful. | |
| **Force Majeure Events** | | | | | | | | | | | | |
| Drought | The risk posed by drought is a decrease in groundcover, an increase in the likelihood of unplanned fire due to the dry conditions from lightning strikes and an increase | P | Mo | M | Limited mitigation measures can be implemented.<br>Should the offset be deemed by the approval holder or the Department to have been delayed, all parties will work together to determine to | P | Mo | M | Achievement of 20-year completion criteria. | Drought declaration. | Allow offset area to recover post drought, particularly through the control of weeds as per Section 6.7.<br>Exclude stock grazing until groundcover improves to >55% immediately prior to | The annual offset compliance report will document vegetation condition and report on drought impacts. |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | Likelihood[1] | Consequence[2] | Result[3] | | Likelihood[1] | Consequence[2] | Result[3] | | | | |
| | in weed cover when rainfall is received.<br>Reduced/ retarded plant growth may would be expected, depending on the severity of drought. This may prevent affect achieving interim performance targets or the completion criteria within the 20-year period. | | | | determine an appropriate response. | | | | | | the annual grazing period.<br>Within one month of determining that the outcomes of the OAMP are likely to be delayed, consultation between Stanmore, the landowner and DAWE will be undertaken to develop an appropriate response. | |
| Cyclone/ severe tropical lows/ flooding | The most significant impact from tropical cyclones or tropical lows is typically flooding and | L | Mo | M | Limited mitigation measures can be implemented.<br>Part of the offset site is relatively flat and may experience flooding | L | Mo | M | The subsequent monitoring event (as per Section 7.0) will include habitat quality surveys and supplemented habitat features | Any incident of cyclone or flood impacting the site. | As soon as reasonably practicable and safe following the cyclone or flood, undertake a monitoring event as per Section 7.0 and implement | The annual offset compliance report will document vegetation condition and report on cyclone/ flood impacts. |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | Likelihood[1] | Consequence[2] | Result[3] | | Likelihood[1] | Consequence[2] | Result[3] | | | | |
| | destruction of habitat<br>The season for such weather events is between December and April. | 🟧 | 🟩 | 🟨 | from the nearby waterways. However, cyclones and severe tropical lows are relatively infrequent (although likely to occur at some point during the life of the offset). Although flooding is not expected to be of sufficient duration, wind speed has the potential to be severe and may  to cause substantial long-term harm to the site. Additionally, the increased availability of soil moisture following flood is expected to increase the growth rates of vegetation, and thus facilitate repair to damage to vegetation, | 🟧 | 🟩 | 🟨 | assessments, as soon as is safe and reasonably practicable to do so following any cyclone or flood. Appropriate weed management measures will be implemented, as required. | | management measures as required. This may include additional planting of fauna habitat trees as determined by suitably qualified ecologists. | |

| Risk Event | Risk Description | Initial Risk Ranking | | | Management Measures / Actions | Residual Risk Ranking | | | Performance Criteria | Management Triggers | Corrective Actions | Monitoring Mechanisms |
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| | | Likelihood¹ | Consequence² | Result³ | | Likelihood¹ | Consequence² | Result³ | | | | |
| | | 🟧 | 🟩 | 🟨 | following subsidence of flood waters.<br>Increased soil moisture may assist weed growth. The subsequent monitoring event (as per Section 7.0) will include groundcover survey to detect any areas of increased weed density. | 🟧 | 🟩 | 🟨 | | | | |

[1] Hl - Highly Likely; L - Likely; P - Possible; U - Unlikely; R - Rare

[2] Mi - Minor; Mo - Moderate; H - High; Mj - Major; C - Critical

[3] L - Low; M - Medium; H - High; S - Severe

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Appendix A

# Suitably Qualified Persons

## Dr Craig Streatfeild

Principal Environmental Scientist

Craig is a Principal Environmental Scientist with over 20 years' experience in providing leadership and technical expertise in environmental impact assessments, environmental legislation, permitting and approvals, preparation of environmental management plans and environmental management, monitoring and compliance. Craig has also been responsible for fauna and flora assessments and mitigating impacts to fauna. He has undertaken training in quality, environmental management and health and safety systems auditing, erosion and sediment control and conflict resolution.

Craig has extensive experience with environmental approvals and permitting under Commonwealth and State environmental legislation and has developed an understanding of the permitting requirements associated with a range of industries. He has also undertaken numerous environmental assessments primarily ecological and fauna related but also for soils, surface water and sediment and groundwater.

## Lincoln Smith

Principal Ecologist

Lincoln is a Commonwealth Government approved Terrestrial Ecologist. He has significant experience with site environmental management including the coordination of vegetation clearing, fauna spotting and weed mapping and management. He has undertaken numerous ecology surveys for land development, mining and infrastructure projects across Queensland and northern NSW. Recently, Lincoln has provided ecology services for the Carmichael Rail Project including the coordination of vegetation clearing and access track construction of the detailed geotechnical investigation program. This included supervising access construction across waterways and areas of challenging terrain to ensure compliance with approval conditions, applicable exemptions and general environmental duty. Lincoln also fulfilled a site Environmental Advisor / Ecologist role for Santos on the GLNG Project.

## Andrew Craig

Senior Ecologist

Andrew is a Senior Ecologist with over 20 years practical experience in the areas of flora and fauna surveys throughout Queensland and the Northern Territory. Andrew's main area of expertise is the identification and classification of flora and fauna and the management of threatened species and communities as listed under the *Environment Protection and Biodiversity Conservation Act 1999*, *Nature Conservation Act 1992* and *Vegetation Management Act 1999.*

Andrew has significant experience in some of Queensland's largest infrastructure projects including coordinating geotechnical surveys for rail and gas projects, on-ground flora assessments and development of weed and vegetation management and rehabilitation strategies.

Appendix B

# Habitat Quality Ecological Report – Offset Area

# Ecological Assessment Report

## Mount Spencer Station Offsets Investigation Area

BASE/

| | |
|---|---|
| Client: | Stanmore Coal Pty Ltd |
| Reference: | J0053 |

## Document Control

| | |
|---|---|
| **Title:** | Mount Spencer Ecological Assessment Report |
| **Address:** | Mount Spencer Property (Lot 4 SP277438) |
| **Job Number:** | J0053 Biodiversity Offset Management Plan (Stanmore) |
| **Client:** | Stanmore IP Coal Pty Ltd |

## Document Issue

| Issue | Date | Prepared By | Reviewed By |
|---|---|---|---|
| DRAFT 1 | 2/9/2020 | IW/LS | CS |
| DRAFT 2 | 6/10/2020 | JH/IW | CS |
| FINAL DRAFT | 23/10/2020 | JH | CS |

# Contents

# 1.0 Introduction

## 1.1 Project Background

The Isaac Plains Complex (IPC) is an operating metallurgical open cut coal mine located approximately 5 km northeast of Moranbah in Central Queensland (see Figure 1). Mining operations are carried out under an existing State Government approved environmental authority (EA) and occurs across several approved mining leases (ML), namely ML 70342, ML 700016, ML 700017, ML 700018 and ML 700019.

The Isaac Plains Mine (IPM) originally commenced operation in 2006 and produced approximately 2.8 million tonnes per annum (Mtpa) of coking coal for export to international markets. The IPM was put into care and maintenance by the previous owners and was acquired by Stanmore IP Coal Pty Ltd (Stanmore) in late 2015, who recommenced operations from the existing open cut pit. In 2018, approval was received from State and Commonwealth Governments for the Isaac Plains Extension (IPE) project which involved mining on ML 700016, ML 700017, ML 700018, ML 700019. State and Commonwealth approvals for the IPE Project limited the disturbance footprint of proposed activities within the approved mining leases.

Additionally, the Isaac Plains East Extension (IPEE) is immediately adjacent to the existing IPE mining area and involves additional disturbance areas, an increase to the total production volume and extends the duration of mining. The extension involves the expansion of the IPE open cut pits to the east which is estimated to extend the mining life by approximately four years. Additional supporting infrastructure such as haul roads, power lines and water management infrastructure are required to facilitate the extension and an existing upgrade to the CHPP and associated coal stockpiling areas within the IPM is proposed.

Stanmore Coal also proposes to develop the Isaac Downs Project, an open cut metallurgical coal mine expected to produce up to approximately 35Mt of ROM coal over 16 years. Isaac Downs is located adjacent to the IPE and IPEE projects and is expected to extend the life of the company's assets at the Isaac Plains Complex. The project will limit its footprint by using Stanmore's existing coal processing plant and rail infrastructure.

For these projects, offsets are required for significant residual impacts to Matters of National Environmental Significance (MNES) including the Koala (Phascolarctos cinereus), Greater Glider (Petauroides volans), and Squatter Pigeon (southern) (Geophaps scripta scripta). Stanmore proposes to legally secure offsets for impacts to the Koala, Greater Glider and Squatter Pigeon within Lot 4 SP277438 which is part of Mt Spencer Station (Figure 2) as outlined in

Table ***1*** in Section 2.2. It is the intent of Stanmore to collocate all required offsets within an area of 2900.68 ha within Mount Spencer Station.

Base Consulting Group (Base) was commissioned by Stanmore IP Coal Pty Ltd (Stanmore) to prepare this ecological assessment report to support the offsets process and to outline the extent of habitat (in hectares) and habitat condition for the Koala, Greater Glider and Squatter Pigeon within the Mount Spencer Station. Data collected during the ecology surveys will provide the baseline habitat quality information to inform the Projects Offset Area Management Plans (OAMP).

## 1.2 Scope and Purpose of Report

This ecological assessment report was prepared as a requirement of the Commonwealth approval conditions (for the IPE) and the Commonwealth approval process for the IPEE and ID projects. The purpose of the baseline survey was to measure the habitat quality of the field-verified vegetation communities within the proposed offset investigation area (herein referred to as the 'study site'). This report identifies the ecological values of the proposed offset site, relevant to MNES and presents the results of habitat quality assessments for threatened species and habitat. This information will be incorporated into the Project OAMP.

## 1.3 Location

The offset investigation area is located on Lot 4 SP277438 which forms part of the larger Mount Spencer Station. Lot 4SP277438 encompasses 4,810 ha of which 4,693 ha is currently mapped as remnant vegetation. Further, Mt Spencer Station (inclusive of Lot 4) covers 22,712 ha which includes approximately 20,190 ha of remnant vegetation. Lot 4 is approximately 105 km to the northeast of the IPEE project and lies within the Isaac Regional Council Local Government Area.

Lot 4 straddles the Brigalow Belt and Central Queensland Coast bioregions with the offset investigation area also straddling the Clarke-Connors ranges (in the western section) and the Nebo -Connors Ranges (in the eastern section). The offset investigation area is located in the central and northern section of Lot 4 SP277438 within the larger Mount Spencer Station (Figure 2).

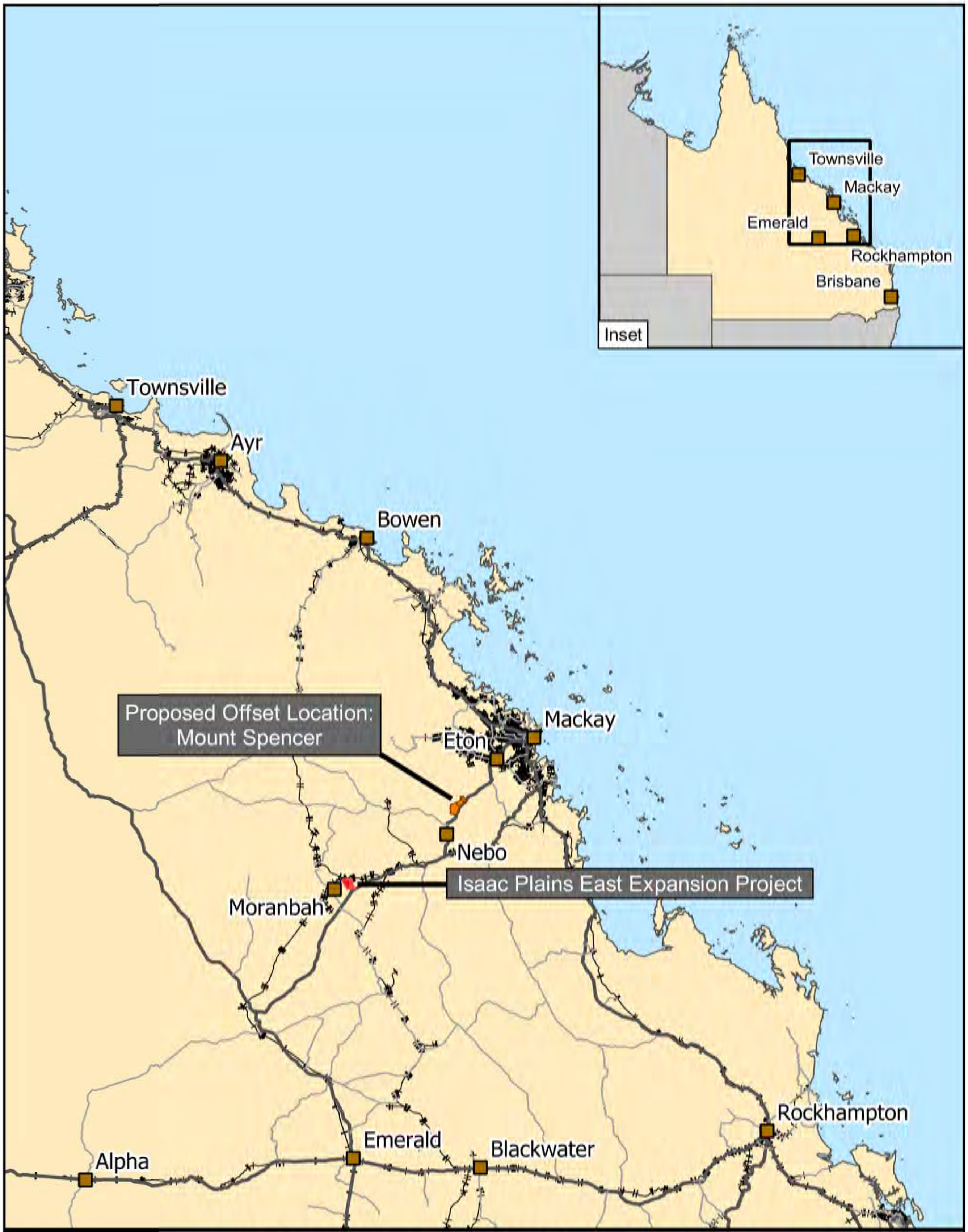


Figure 1: Mine and Proposed Offset Site Context

Legend

🟫 Towns

— Highways

— Roads

⊢ Rail Network

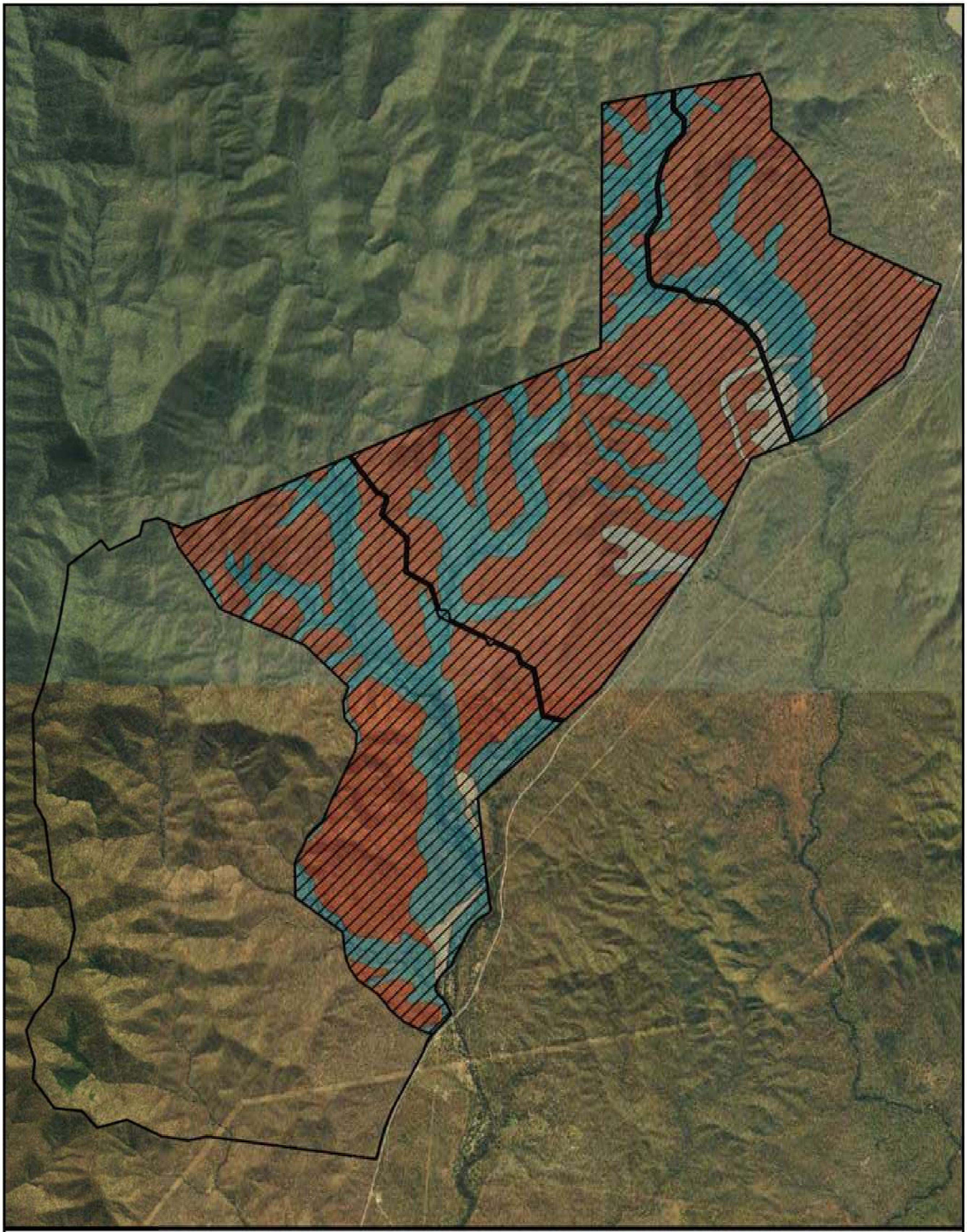
🟥 Isaac Plains East

🟧 Mount Spencer (Lot 4SP277438)

0 30 60 km

Scale @ A3: 1 : 2500000
Date: 19/10/2020
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2020; QSPATIAL 2020; The State of Queensland (Department of Natural Resource and Mines) 2020;



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Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2020; QSPATIAL 2020; The State of Queensland (Department of Natural Resource and Mines) 2020;

Figure 2: Mount Spencer Offset Investigation Area

Legend

- ☐ Lot 4 Property Boundary
- ▨ Offset Investigation Area

**Field Verified Regional Ecosystem**

- 🟥 11.12.1
- 🟦 11.3.4
- ☐ Non-Remnant

BASE/

# 2.0 Offset Requirements and Offset Area

Under the Environment Protection and Biodiversity Conservation 1999 (EPBC Act) Environmental Offsets Policy, offsets are required where a residual impact is likely to occur after avoidance, mitigation and management measures have been undertaken. For this project, offsets for residual impacts are to be legally secured for the MNES in Table 1.

## 2.1 Policy Principles

The EPBC Act Environmental Offsets Policy (October 2012), has five key aims that involve:

- Ensuring the use of offsets are efficient, effective, timely, transparent and scientifically robust;
- Providing all stakeholders with greater certainty on how offsets are determined and provided;
- Delivering improved environmental outcomes;
- Outlining the appropriate nature and scale of offsets; and
- Providing guidance on acceptable offsets and their delivery.

The Policy also provides eight key principles that are applied in determining the suitability of offsets. The principles relevant to the ecological assessment are as follows.

- Deliver an overall conservation outcome that improves or maintains the viability of the MNES in question;
- Be primarily built around direct offsets but may also include other compensatory measures;
- Be in proportion to the level of statutory protection that applies to the MNES;
- Be of a size and scale proportionate to the residual impacts on the protected matter;

Considering the above policy principles and the offsets required, ecological assessments have been undertaken on Mount Spencer Station to assess the site's potential as an offset area.

Mount Spencer Station has approximately 4,693 ha of remnant vegetation that has the potential to provide offsets for impacts to the MNES.

## 2.2 Summary of Project Impacts

Potential direct and indirect impacts within and adjacent to the IPE, IPEE and ID projects has been described in the various approval documents. These impacts include the direct loss of native vegetation, habitat and resources as a result of vegetation clearing within the Project footprint. The area of direct impact encompasses potential habitat for three (3) MNES protected under the EPBC Act. The potential impacts on these environmental values are summarised in Table 1.

Offsets are required for the three (3) MNES to account significant residual impacts as a result of the Project. In accordance with the EPBC Environmental Offsets Policy, it is necessary to assess the quality of these areas to accurately calculate the offset obligations.

**Table 1 MNES impacted by the Project for which offsets will be sourced from the offset investigation area**

| MNES | EPBC Act status | Impact area requiring offsets (ha) | | |
|---|---|---|---|---|
| | | IPE | IPEE | ID |
| Koala *(Phascolarctos cinereus)* | Vulnerable | 125 | 207.8 | 138 |
| Greater Glider *(Petauroides volans)* | Vulnerable | 125 | 207.8 | 68 |
| Squatter Pigeon (Southern) *(Geophaps scripta scripta)* | Vulnerable | 74 | 117.1 (breeding)<br>63.6 (foraging) | 246 |

# 3.0 Methodology

## 3.1 Approach

A combined desktop and field-based program was undertaken to determine the habitat quality of the offset investigation area.

## 3.2 Desktop Assessment

### 3.2.1 Literature Review

The following literature was reviewed as part of the desktop assessment for the Survey Area.

- Isaac Plains East Project Habitat Quality Assessments Report for Stanmore Coal prepared by Ecological Survey and Management, July 2018
- Guide to determining terrestrial habitat quality: A toolkit for assessing land-based offsets under the Queensland Environmental Offsets Policy, Version 1.2 April 2017
- Guide to determining terrestrial habitat quality: Methods for assessing habitat quality under the Queensland Environmental Offsets Policy, Version 1.3 February 2020
- Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2015). BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2. Queensland Herbarium, Department of Science, Information Technology, Innovation and Arts, Brisbane
- Survey Guidelines for Australia's threatened mammals (Guidelines for detecting Guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999)
- SPRAT profiles, referral guidelines, Threatened Species Scientific Committee Conservation and Listing Advice.

### 3.2.2 Desktop Review

Desktop assessment was conducted to assess the suitability of the offset investigation area as an offset site, to assist in determining target areas for the field surveys and to provide data for the determination of the quality of habitat for MNES within the offset investigation area.

The following resources were reviewed as part of the desktop assessment for the offset investigation area to:

- Wildlife Online Search (20 km buffer of central point co-ordinates -21.52418, 148.75140)
- Existing vegetation mapping released under the provisions of the Vegetation Management Act 1999
- Queensland Herbarium (2019) Regional Ecosystem Description Database (REDD), Version 11.1 (April 2019) (DES, Brisbane)
- Department of Natural Resources, Mines and Energy (DNRME) Vegetation Management Regional Ecosystem and Remnant Map spatial layer (version 10.1)
- Queensland Herbarium BioCondition Benchmarks for Regional Ecosystem Condition Assessment, Department of Environment and Science, Brisbane

## 3.3 Field Assessment

### 3.3.1 Timing and Climatic Conditions

An initial field-based assessment was undertaken on June 29 and 30 to determine the suitability of the property to provide potential offsets for habitat for the Koala, Greater Glider and Squatter Pigeon, and to determine if the current DNRME mapping was correct. This assessment focused on the southern portion of the Lot; however, the western section of this area was determined as unsuitable for Squatter Pigeon and the detailed ecological and habitat quality survey focused on the remainder of the Lot to the north. This initial assessment also recorded opportunistic sighting of the MNES.

Further field assessments to determine habitat quality were undertaken over two separate events by two suitably qualified ecologists as follows:

- Survey event 1: Seven (7) days from July 23 and July 29, 2020
- Survey event 1: Four (4) days from October 5 to October 8, 2020

Survey event 1 included field verifying the on-ground vegetation communities, undertaking habitat quality assessments within the field verified communities and targeted fauna surveys for the Koala, Greater Glider and Squatter Pigeon across the total offset investigation area. Survey event 2 was undertaken to specifically target the presence of the Greater Glider and to supplement the habitat quality assessment undertaken in survey event 1.

Weather conditions during and leading up to the July survey period were relatively dry and mild, with maximum day time temperatures reaching mid to high 20's and night-time temperatures between 4 and 13˚C. Total rainfall for the region leading up to the field survey was substantially less than average, except in January, February and May 2020, as shown in Table 2. Weather data was retrieved from the Moranbah Airport Weather Station (034035).

**Table 2 Monthly rainfall (mm) recorded at Moranbah Airport prior to and following the July survey**

| Month | 2019 | | | | | 2020 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul |
| Average (all years) | 7 | 7.3 | 24.4 | 42 | 56 | 87.6 | 100.15 | 92.4 | 23.8 | 30.2 | 16.7 | 27.9 |
| Actual Rainfall Total | 5.4 | 0.2 | 13.4 | 16.6 | 9.0 | 100.2 | 76.4 | 53.2 | 5.2 | 52.6 | 11.8 | 15.4 |

Source: BOM accessed 24th August 2020 (http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_stn_num=034035).

Weather conditions during and leading up to the October survey period were dry and warm, with maximum day time temperatures reaching low 30's and night-time temperatures between 14 and 16˚C. Total rainfall for the region leading up to the field survey was substantially less than average, except in January, February and May 2020, as shown in Table 3. Weather data was retrieved from the Moranbah Airport Weather Station (034035).

**Table 3 Monthly rainfall (mm) recorded at Moranbah Airport prior to and following the October survey**

| Month | 2019 | | | 2020 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** |
| Average (all years) | 24.4 | 42.0 | 56.0 | 87.6 | 100.1 | 92.4 | 23.8 | 30.2 | 16.7 | 27.9 | 7 | 7.3 |
| Actual Rainfall Total | 13.4 | 16.6 | 9.0 | 100.2 | 76.4 | 53.2 | 5.2 | 52.6 | 11.8 | 15.4 | 15.0 | 16.0 |

Source: BOM accessed 14th October 2020 (http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_stn_num=034035).

### 3.3.2 Determining Habitat Quality Assessment Units

The Department of Natural Resources, Mining and Environment (DNRME) vegetation management regional ecosystem mapping was used to initially determine the likely number and location of habitat assessment plots. These plots were refined following field verification of the mapped vegetation which was undertaken in accordance with the 'Methodology for Survey and Mapping of Regional Ecosystems (RE) and Vegetation Communities in Queensland' (Neldner et. al. 2020). RE classification was determined on the vegetation, soil and landform characteristics identified in the field, geological mapping for the region and the Regional Ecosystem Description Database (REDD).

Regional ecosystem polygons were assigned to remnant or non-remnant status as defined by the Vegetation Management Act 1999 (VM Act). Reference benchmarks for these criteria were obtained from published data (Queensland Herbarium, 2019).

Three (3) assessment units were defined for the offset investigation area following field verification of the on-ground vegetation. During the July survey event, 16 habitat quality plots (HQPs) were assessed across the three (3) assessment units and a further 15 HQPs were assessed during the October survey event (refer Figure 3). The number of HQPs were selected to comply with the Queensland's Department of the Environment and Science (DES) Guide to determining terrestrial habitat quality: A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy, Version 1.2 (EHP, 2017) (the 'Guide').

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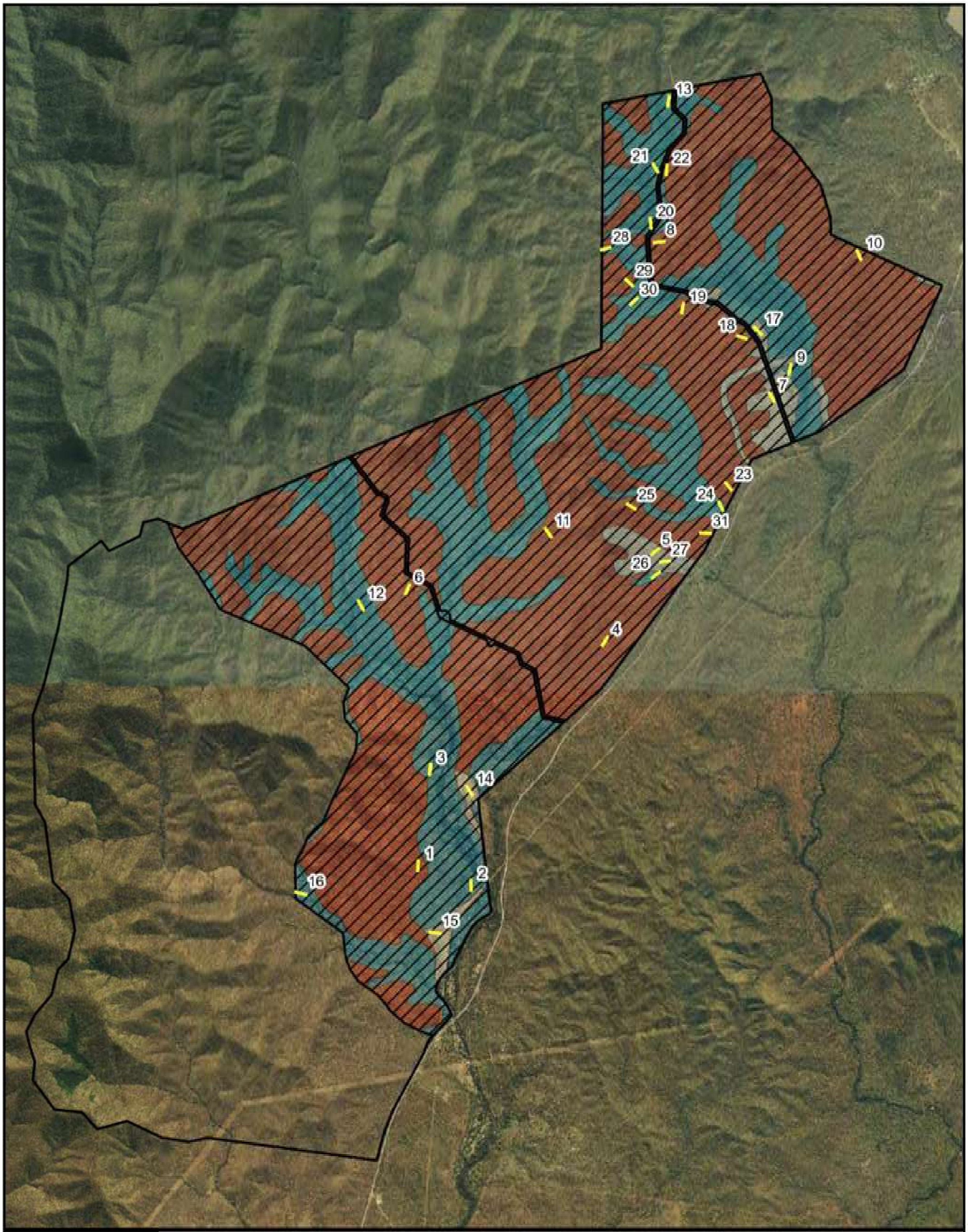


0 500 1000 1500 m

Scale @ A3: 1 : 55000
Date: 19/10/2020
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2020: QSPATIAL 2020; The State of Queensland (Department of Natural Resource and Mines) 2020;

Figure 3: Assessment Units and Habitat Quality Plots

Legend

- Habitat Quality Transect
- ☐ Property Boundary
- ▨ Offset Investigation Area

**Field Verified Regional Ecosystem**

- 🟥 (AU 1) 11.12.1
- 🟦 (AU 2) 11.3.4
- ⬜ (AU 3) Non-Remnant

BASE/

### 3.3.3 Habitat Quality and Scoring

Habitat quality and ecological assessments to assess habitat quality were undertaken within the field verified REs and assessment units as per the requirements of the Guide. The Guide which uses a range of habitat indicators to measure the ecological viability and habitat values of a site and its capacity to support fauna and are separated into three main categories: Site condition, species habitat indices and site context. The first two categories use data collected in the field whereas site context is a geospatial exercise.

Habitat quality within the offset investigation area and the potential of the area to support fauna species including Koala, Squatter Pigeon (southern) and Greater Glider was assessed from 31 habitat quality plots from surveys undertaken in July and October 2020 (Section 3.3.2). Data on the following habitat variables were collected during the field survey:

- Site Condition
- Recruitment of woody perennial species in EDL
- Native plant species richness - trees
- Native plant species richness - shrubs
- Native plant species richness - grasses
- Native plant species richness - forbs
- Tree canopy height
- Tree canopy cover
- Shrub canopy cover
- Native perennial grass cover
- Organic litter
- Large trees
- Coarse woody debris
- Non-native plant cover
- Quality and availability of food and foraging habitat
- Quality and availability of shelter
- Threat to Species
- Species mobility capacity

### 3.3.4 Photo monitoring points

Photographs were taken within each assessment plot for the purposes of providing baseline imagery for ongoing monitoring. Photographs were taken along the Biocondition transect centreline at the ends of each plot (e.g. at 0 m and 100 m), and in the order: north (0°), east (90°), south (180°) and west (270°) at the centre of the plot (e.g. at 50 m mark) Photos of the groundcover intersected by the centreline tape and soils were also taken at some HQPs 50 m along the plot. These photos are provided in Appendix C.

### 3.3.5 Targeted Fauna Surveys and Spotlighting

Diurnal bird surveys, diurnal koala searches nocturnal spotlighting surveys were undertaken on the nights of the 23rd and 27th July 2020, and again between October 5 and 8, 2020. Surveys were undertaken in accordance with the relevant survey guidelines and modified were required based ecological experience in maximizing the detection of the Koala, Greater Glider and Squatter Pigeon. Diurnal searches for Koala’s and Squatter Pigeon were undertaken during the habitat quality assessment and whilst traversing between the HQP. For spotlighting, a minimum of two person hours was spent per night, using a combination of high-powered spotlights and head torches. Visual surveys were undertaken in target habitat, searching trees, shrubs and understory habitats for the Koala and Greater Glider.

To maximise the likelihood of detecting the Koala and Greater Glider the search effort was targeted within remnant vegetation supporting koala food trees and trees bearing hollow’s large enough for the Greater Glider. Target areas included areas of remnant RE 11.3.4 on floodplains and fringing major watercourses. All opportunistic records were also recorded as were signs of the Koala including tree scratches and scats.

### 3.3.6 Weed and pest surveys

Active and opportunistic searches were used to identify weed and pest species presence. Weed species were recorded within HQPs and opportunistically while traversing the offset investigation area. Pest species were also opportunistically surveyed throughout the offset investigation area during the day and at night while undertaking nocturnal surveys and spotlighting (refer section 3.3.5).

# 4.0 Results

The initial field based resulted in the exclusion of the southern and south-western portion of Lot 4 as suitable habitat for the Squatter Pigeon. The Koala and Squatter Pigeon (southern) were positively identified within the south-eastern and middle sections of the Lot and suitable habitat for Greater Glider in the form of large tree hollows were also identified along the riparian areas. The initial survey also determined the current DNRME mapping was also likely to be incorrect based on the clear distinctions between the riparian zones and the adjacent woodlands. However, a remapping exercise was not undertaken but deferred to the detailed ecological and habitat quality survey.

## 4.1 Vegetation mapping

Desktop assessment of the current DNRME Regional Ecosystem mapping identified four (4) REs within the offset investigation area with small, isolated sections of non-remnant also present. The riparian areas were represented by mixed polygons of 11.12.1 and 11.3.4 (Table 4).

Field verification of the offset investigation area identified two (2) REs (11.3.4 and 11.12.1) as being present and confirmed the non-remnant areas as correct. The field verification could also separate the mixed 1.12.1/11.3.4 polygons based on the clear separation of the underlying landzone. The preliminary field verified RE mapping was later refined using aerial photography and contour data. Figure 3 shows the field verified RE mapping over the offset investigation area.

The two (2) field verified REs along with the non-remnant area were used as the assessment units for the purposes of calculating the number of habitat quality plots required.

**Table 4 Regional ecosystems within the offset investigation area**

| RE | Short Description | VM Act Status |
|---|---|---|
| 11.12.1/11.3.4 | *Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains | Of concern |
| 11.12.1a | *Eucalyptus crebra* woodland on igneous rocks | Least concern |
| 11.12.6a | *Corymbia citriodora* open forest on igneous rocks (granite) | Least concern |
| 8.12.7 | *Corymbia citriodora* +/- *Eucalyptus portuensis* +/- *E. drepanophylla* (or *E. crebra*) open forest on hill slopes and undulating plateaus, on Mesozoic to Proterozoic igneous | Least concern |
| Non-remnant | - | None |

Based on the size of the assessment units and the requirements of The Guide, 31 HQPs were assessed across the three (3) assessment units (Table 5 and Figure 3).

**Table 5 Habitat quality plots and corresponding RE**

| Assessment Unit | RE | Number HQPs |
|---|---|---|
| AU1 | 11.12.1 | 13 |
| AU2 | 11.3.4 | 12 |
| AU3 | Non-remnant | 6 |
| **Total** | | **31** |

## 4.2 Habitat Quality Scoring

The field data recorded at each of the HQPs for each assessment unit was used in combination with geospatial information to determine a habitat quality score for habitat in the offset investigation area. Data collected from each of the 31 HQPs was compared with the BioCondition benchmarks for the corresponding REs and converted to a score out of 10 using the Department of Agriculture, Water and the Environment (DAWE) Modified Habitat Quality Spreadsheet.

The offset area habitat quality scores for each of the three species for the whole of the offset investigation area before any sub-division of the area into specific project boundaries is:

- Koala – 5/10 (rounded up from 4.8);
- Greater Glider – 5/10 (rounded from 5.2); and
- Squatter Pigeon – 5/10 (rounded from 5.2).

## 4.3 Targeted Fauna Surveys and Spotlighting

### 4.3.1 Desktop results

Based on the SPRAT habitat description and the habitat definition included in the IPEE Public Environmental Review (PER) Guideline, any forest or woodlands, including remnant, regrowth and modified communities that contain Koala food trees or shrublands with emergent food trees are all potential Koala habitat. Desktop assessment identified Koalas have been previously found immediately adjacent to the investigation area and along the Peak Downs Highway (Figure 4). The presence of Koalas within the offset investigation areas is also supported by anecdotal evidence from the landowner who has indicated that Koalas have previously been seen within the investigation area and throughout the wider Mt Spencer Station (A. Key *pers comm*. and D. Wright *pers comm*.).

The approved conservation advice for the Greater Glider (TSSC, 2016) along with habitat definitions included in the PER Guidelines, indicate that Greater Glider habitat overlaps Koala habitat. As such, Eucalypt Forests and Woodlands that contain hollow bearing trees, particularly in riparian areas, are all potential Greater Glider habitat. Desktop assessment including the Atlas of Living Australia database, showed the multiple Greater Glider records approximately 8km to the west of the offset investigation in similar habitat within the large and unfragmented Epsom State Forest and the adjacent which directly connects to the offset area (see Figure 4). Greater Gliders have also been recorded along the Peak Downs Highway in the vicinity of Mt Spencer during the DTMR Koala Research Project (Melzer et al. 2018).

Squatter Pigeon records within the vicinity of the offsets investigation area are limited with the nearest occurring approximately 8km to the west and south-west (Figure 4). Anecdotal evidence from the landowner has indicated that Squatter Pigeons have previously been seen within the investigation area and throughout the wider Mt Spencer Station (D. Wright *pers comm*.). Based on the PER habitat definition, the preliminary desktop assessment of the investigation area using current DNRME mapping suggests the majority of the broader offset investigation area has the potential to provide breeding and foraging habitat For the Squatter Pigeon.

### 4.3.2 Field results

The presence of the Koala was confirmed during the initial site visit in late June and the subsequent detailed ecological and habitat quality surveys in July and October. One Koala was sighted during the June site visit, three Koala's were sighted during the detailed survey in July and nine (9) Koala's were sighted in the October survey. These sightings occurred in the south-eastern, middle and north-eastern section of the investigation area. Evidence in the form of tree scratches and scats were also observed during all surveys throughout the offset investigation area (Figure 5, Plate 1). Further, numerous instances of Koala road kills have been recorded along the Peak Downs Highway adjacent to the offset investigation area and several road kills were observed during the July survey period. As the Koala sightings over the three field assessment are likely to be repeat sightings of some of the same individuals, an estimate of the actual numbers of individual Koalas is not possible at this stage.

During the initial survey in June and the detailed July the Greater Glider was not confirmed present, although surveys recorded numerous instances of large tree hollows along the riparian zones of RE 11.3.4 and desktop. The presence of the Greater Glider was confirmed during the October survey which was undertaken to specifically target the species, and occurred in the southern/middle section of the offset investigation area (Figure 5; Plate 2). An additional sighting of a Glider sp. with similar morphology to the Greater Glider, was observed along the Cut Creek riparian corridor in the northeastern section of the offset investigation area the and within habitat RE 11.3.4 that is known to support the Greater Glider.

Squatter Pigeons (southern) were also observed throughout the investigation area during the June and July survey periods. Squatter Pigeons were observed at five (5) separate locations during the June survey and was confined to the south-eastern section of the investigation area and in a arrange of differing habitat types including remnant and non-remnant vegetation with varying extents of ground cover (Figure 5; Plate 3). Six (6) instances of Squatter Pigeons (southern) were recorded during the detailed survey in July and occurred in the southern, middle and north-east section of the offset investigation area. Squatter pigeons were not observed in the October surveys.

The following additional species were identified during spotlighting surveys:

- Yellow-bellied Glider (*Petaurus australis*)
- Rufous Bettong (*Aepyprymnus rufescens*)
- Brushtail Possums (*Trichosurus vulpecula*)
- Stony-creek Frog (call) (*Litoria wilcoxi*)

*Plate 1 Koala scat (left) and individual koala observed in a Eucalyptus crebra tree (right) during the July 2020 field surveys*

*Plate 2 Greater Glider observed in Corymbia erythrophloia during the October 2020 surveys*

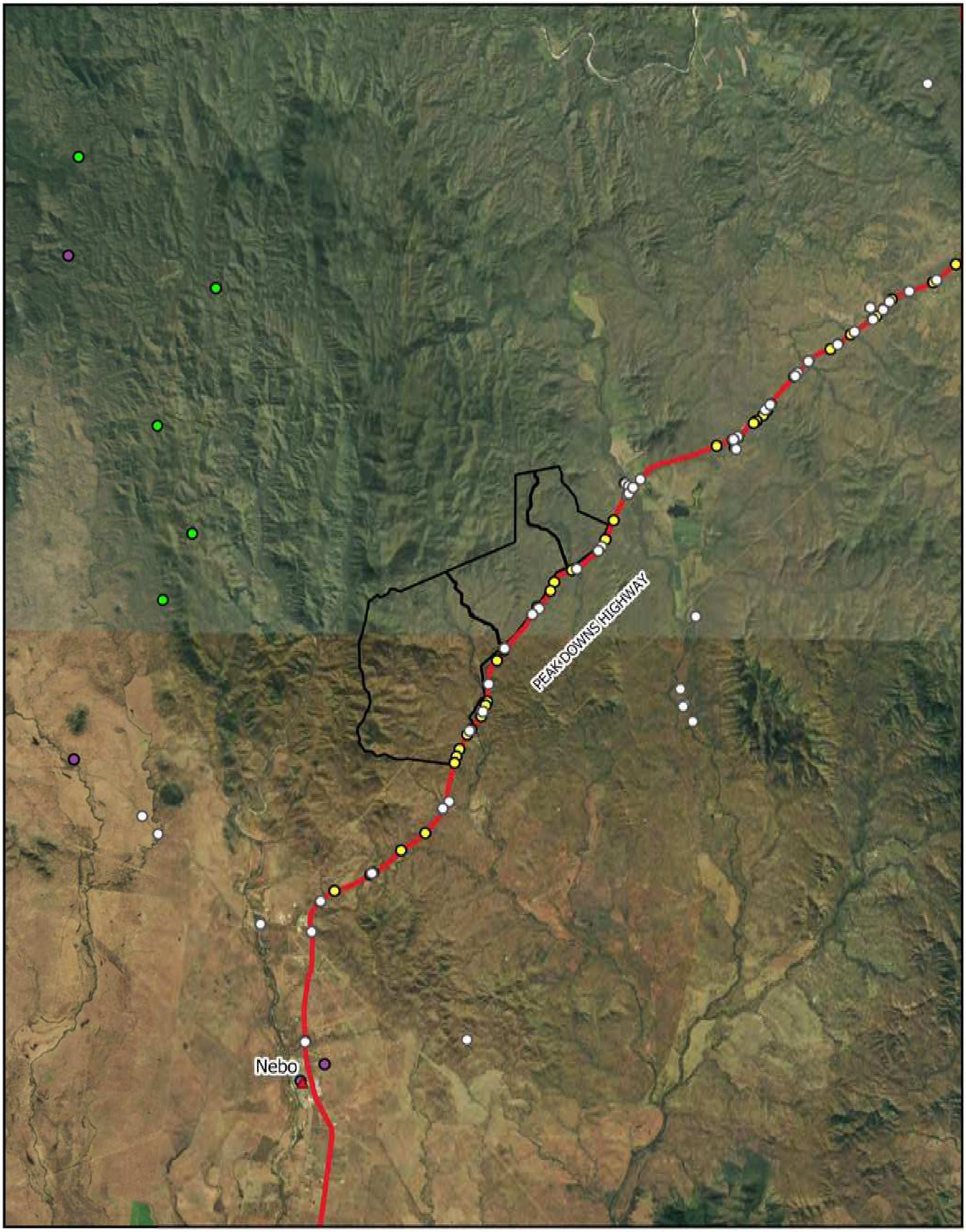
*Plate 3 Squatter Pigeon observed during the June 2020 field surveys*

## 4.4 Weeds and pests

A total of 34 weed species were recorded within the offset investigation area, of which five (5) are 'restricted matters' under the Queensland Biosecurity Act 2014. Of these five (5) species, four (4) are Weeds of National Significance (WoNS). *Lantana camara* was observed throughout the majority of the HQPs and was most abundant within RE 11.3.4 especially along the banks of watercourses. Johnston grass (*Sorghum halepense*) was observed throughout a select few HQPs, high abundance was recorded when observed indicating seeding for fodder.

Introduced fauna species were identified either directly or via their traces (e.g. scats, tracks, diggings). A total of eight (8) introduced fauna species were identified, including six (6) that are 'Restricted Matters' under the Queensland *Biosecurity Act 2014*.

The full list of weeds and pests is provided in Appendix B.



0 2 4 km

Scale @ A3: 1 : 200000
Date: 21/10/2020
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2020; QSPATIAL 2020; The State of Queensland (Department of Natural Resource and Mines) 2020;

Figure 4: Historical Fauna Records Within 20 Km of Lot 4SP277438

Legend

- ▲ Towns
- **ALA & Wildnet Records**
- ● Greater Glider
- ○ Koala ALA
- ● Squatter Pigeon
- ● DTMR: Koala Records
- ▬ Highways
- ☐ Lot 4SP277438 Boundary
- ▨ Offset Investigation Area

**BASE/**

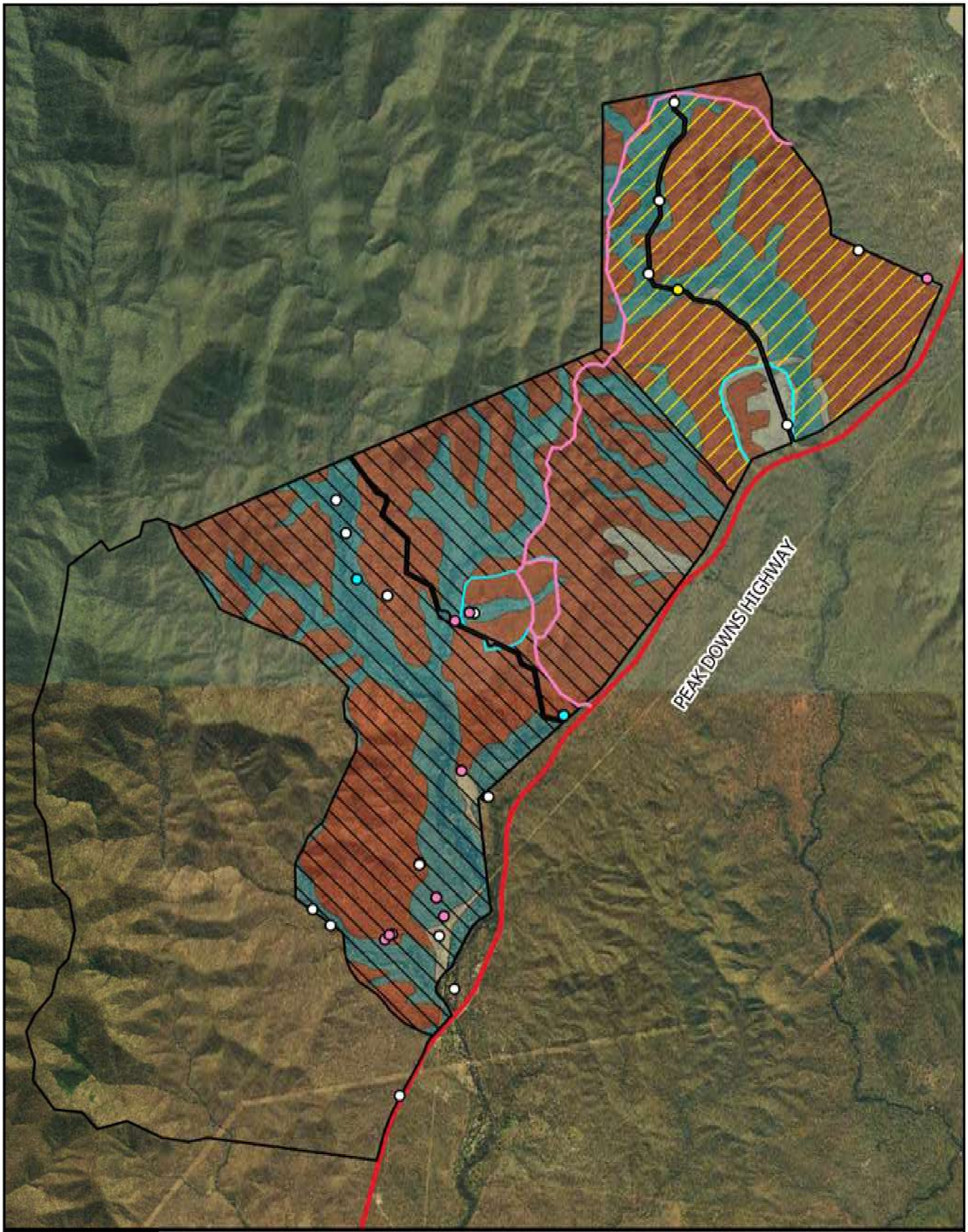


Figure 5: Species Occurrence Within Lot 4SP277438

0 1 km

Scale @ A3: 1 : 55000
Date: 21/10/2020
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2020; QSPATIAL 2020; The State of Queensland (Department of Natural Resource and Mines) 2020;

Legend

- ○ Koala/Koala Scats
- ● Greater Glider
- ● Greater Glider (Unconfirmed)
- ● Squatter Pigeon
- ☐ Lot 4SP277438 Boundary
- ☐ IPEE Offset Area
- ▨ Offset Investigation Area
- ☐ Holding Yards

**Field Verified RE Mapping**

- 🟥 11.12.1
- 🟦 11.3.4
- ☐ Non-Remnant

BASE/

# 5.0 Conclusion

In order to assess the suitability of Lot 4 within Mt Spencer Station to provide suitable offsets for impact to Koala, Greater Glider and Squatter Pigeon from impacts associated with the development of the IPE, IPEE and ID projects, a combined desktop and field-assessment was undertaken to determine the habitat quality of the Mount Spencer Station offset investigation area and to determine the presence of the three MNES within the offset investigation area.

Remnant vegetation was present across most of the offset investigation area and was assessed as providing suitable habitat for the three (3) target species. Additionally, all three (3) target species were confirmed present during the three (3) survey events.

Assessment Units located within suitable habitat areas in which habitat quality assessments were undertaken, and a habitat quality score calculated.

The offset area habitat quality scores for each of the three species for the whole of the offset investigation area before any sub-division of the area into specific project boundaries is:

- Koala – 5/10 (rounded up from 4.8);
- Greater Glider – 5/10 (rounded from 5.2); and
- Squatter Pigeon – 5/10 (rounded from 5.2).

Given the moderate quality of the habitat and the confirmed presence of the three (3) target species within the offset investigation area,  the proposed offset area is considered suitable to offset the residual impacts of the IPE, IPEE and ID projects on the Koala, Greater Glider and Squatter Pigeon.

# 6.0 References

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Queensland Herbarium. 2019. BioCondition Benchmarks for Regional Ecosystem Condition Assessment. Department of Environment and Science, Brisbane. Available from: https://www.qld.gov.au/__data/assets/pdf_file/0026/67391/brb-benchmarks.pdf. Accessed 20/07/2020.

Threatened Species Scientific Committee (TSSC), 2016. Approved Conservation Advice for the Greater Glider (Petauroides Volans). Department of the Environment, Australian Government, Canberra.

# Appendix A Targeted Fauna Species Records

| Attribute | Count | Date | Latitude | Longitude |
|---|---|---|---|---|
| Koala Scat | - | 28/07/2020 | -21.5557 | 148.7529 |
| Squatter Pigeon | 1 | 28/07/2020 | -21.4918 | 148.8023 |
| Squatter Pigeon | 1 | 28/07/2020 | -21.5519 | 148.7526 |
| Squatter Pigeon | 1 | 23/07/2020 | -21.5556 | 148.7478 |
| Koala in *Casuarina cristata* | 1 | 28/07/2020 | -21.5422 | 148.7578 |
| Koala Scat | - | 23/07/2020 | -21.5532 | 148.7399 |
| Koala | 1 | 26/07/2020 | -21.4891 | 148.7952 |
| Squatter Pigeon | 1 | 27/07/2020 | -21.5253 | 148.7542 |
| Squatter Pigeons | 2 | 29/06/2020 | -21.5555 | 148.7481 |
| Squatter Pigeons | 10 | 29/06/2020 | -21.556 | 148.7473 |
| Koala scats | - | 29/06/2020 | -21.5548 | 148.7417 |
| Koala scats | - | 29/06/2020 | -21.5607 | 148.7545 |
| Koala scats | - | 29/06/2020 | -21.5229 | 148.747 |
| Squatter Pigeon | 1 | 29/06/2020 | -21.5397 | 148.755 |
| Squatter Pigeons | 7 | 29/06/2020 | -21.5397 | 148.755 |
| Squatter Pigeons | 5 | 29/06/2020 | -21.5537 | 148.7534 |
| Dead Koala | 1 | 25/07/2020 | -21.6197 | 148.7096 |
| Koala in *Casuarina cunninghamiana* | 1 | 28/07/2020 | -21.5422 | 148.7576 |
| Koala scats | - | 30/06/2020 | -21.5711 | 148.749 |
| Squatter Pigeons | 5 | 30/06/2020 | -21.5244 | 148.7557 |
| Fresh Koala Scat | - | 30/06/2020 | -21.5245 | 148.7562 |
| Dead Koala | 1 | 25/07/2020 | -21.6197 | 148.7097 |

| | | | | |
|---|---|---|---|---|
| Koala | 1 | 29/06/2020 | -21.5229 | 148.7472 |
| Koala | 1 | 28/07/2020 | -21.5486 | 148.7508 |
| Dead Koala | 1 | 28/07/2020 | -21.6162 | 148.716 |
| Koala | 1 | 29/06/2020 | -21.5229 | 148.7472 |
| Squatter Pigeons | 3 | 30/06/2020 | -21.5245 | 148.7557 |
| Squatter Pigeon | 1 | 28/07/2020 | -21.552 | 148.7526 |
| Koala | 1 | 28/07/2020 | -21.5488 | 148.7508 |
| Koala | 1 | 28/07/2020 | -21.5487 | 148.7509 |
| Greater Glider | 1 | 6/10/2020 | -21.5343 | 148.7655 |
| Greater Glider | 1 | 6/10/2020 | -21.5214 | 148.744 |
| Koala | 2 | 5/10/2020 | -21.4751 | 148.7761 |
| Koala | 1 | 6/10/2020 | -21.5169 | 148.7428 |
| Koala | 1 | 5/10/2020 | -21.4845 | 148.7746 |
| Koala | 1 | 5/10/2020 | -21.4846 | 148.7747 |
| Greater Glider (unconfirmed) | 1 | 5/10/2020 | -21.4931 | 148.7767 |
| Koala | 1 | 5/10/2020 | -21.506 | 148.7881 |
| Koala | 1 | 5/10/2020 | -21.4932 | 148.7767 |
| Koala | 1 | 5/10/2020 | -21.4916 | 148.7737 |
| Koala | 1 | 5/10/2020 | -21.4916 | 148.7737 |
| Koala | 1 | 6/10/2020 | -21.5138 | 148.7418 |

# Appendix B Weed and Pest Species List

| Scientific name | Common Name | Status | |
|---|---|---|---|
| | | WoNS | Biosecurity Act 2014 Restricted Matter Category |
| **Weeds** | | | |
| *Ageratum houstonianum* | Blue-billy goat weed | - | - |
| *Alysicarpus ovalifolius* | Oval-leafed Alysicarpus | - | - |
| *Asclepias curassavica* | red-head cotton bush | - | - |
| *Bidens pilosa* | Cobbler's pegs | - | - |
| *Bothriochloa pertusa* | Indian couch | - | - |
| *Cenchrus ciliaris* | Buffel grass | - | - |
| *Cirsium vulgare* | Spear thistle | - | - |
| *Cryptostegia grandiflora* | Rubber vine | Yes | Category 3 |
| *Cyclospermum leptophyllum* | Wild celery | - | - |
| *Cyperus esculantus* | Yellow nutsedge | - | - |
| *Emilia sonchifolia* | Sow thistle | - | - |
| *Gomphocarpus physocarpus* | Ballon cotton bush | - | - |
| *Justicia betonica* | Paper plume | - | - |
| *Lantana camara* | Lantana | Yes | Category 3 |
| *Lepidium africanum* | African pepperwort | - | - |
| *Malvastrum americanum* | Spiked malvastrum | - | - |
| *Megathyrsus maximus* | Green panic | - | - |
| *Melenis repens* | Red natal | - | - |
| *Opuntia tomentosa* | Velvety tree pear | Yes | Category 3 |
| *Oxalis corniculata* | Creeping woodsorrel | - | - |
| *Parthenium hysterophorus* | Parthenium | Yes | Category 3 |
| *Passiflora suberosa* | Corky passionflower | - | - |
| *Portulaca pilosa* | Hairy portulaca | - | - |
| *Praxelis clematidea* | Praxelis | - | - |
| *Richardia brasiliensis* | White eye | - | - |
| *Richardia stellaris* | Field madder | - | - |
| *Senna obtusifolia* | Sicklepods | - | Category 3 |
| *Senna occidentalis* | Coffee senna | - | - |

| **Scientific name** | **Common Name** | **Status** | |
|---|---|---|---|
| | | **WoNS** | **Biosecurity Act 2014 Restricted Matter Category** |
| *Sida cordifolia* | Flannel weed | - | - |
| *Sida rhombifolia* | Paddy's lucerne | - | - |
| *Sorghum halepense* | Johnstone grass | - | - |
| *Sonchus oleraceus* | Common sowthistle | - | - |
| *Stylosanthes scabra* | Shrubby stylo | - | - |
| *Themeda quadrivalvis* | Grader grass | - | - |
| *Urochloa decumbens* | Sabi grass | - | - |
| **Pests** | | | |
| *Oryctolagus cuniculus* | Rabbit | | Categories 3,4,5,6 |
| *Sus scrofa* | Feral pig | | Categories 3,4,6 |
| *Canis lupus familiaris* | Wild dog | | Categories 3,4,6 |
| *Canis lupus dingo* | Dingo | | Categories 3,4,5,6 |
| *Vulpes vulpes* | European Fox | | Categories 3,4,5,6 |
| *Equus caballus* | Feral horse | | N/A |
| *Bufo marinus* | Cane toad | | N/A |
| *Felis catus* | Feral cat | | Categories 3,4,6 |

# Appendix C Habitat Quality Plot photos

### Habitat Quality Plot 1

Start of transect (0m) - North-North east

Centre point (50m) - North

Centre point (50m) - East

Centre point (50m) - South

Centre point (50m) - West

End of transect (100m) - South

**Habitat Quality Plot 2**

Start of transect (0m) - North

Centre point (50m) - North

Centre point (50m) - East

Centre point (50m) - South

Centre point (50m) - West

End of transect (100m) - South

**Habitat Quality Plot 3**

Start of transect (0m) - North

Centre point (50m) - North

Centre point (50m) - East

Centre point (50m) - South

Centre point (50m) - West

End of transect (100m) - South

| Habitat Quality Plot 4 | | |
|---|---|---|
| <br>Start of transect (0m) - North | <br>Centre point (50m) - North | **PHOTO NOT AVAILABLE**<br>Centre point (50m) - East |
| <br>Centre point (50m) - South | <br>Centre point (50m) - West | <br>End of transect (100m) - South |

<table>
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<tr><td><br>Start of transect (0m) - North</td><td><br>Centre point (50m) - North</td><td><br>Centre point (50m) - East</td></tr>
<tr><td><br>Centre point (50m) - South</td><td><br>Centre point (50m) - West</td><td><br>End of transect (100m) - South</td></tr>
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**Habitat Quality Plot 6**

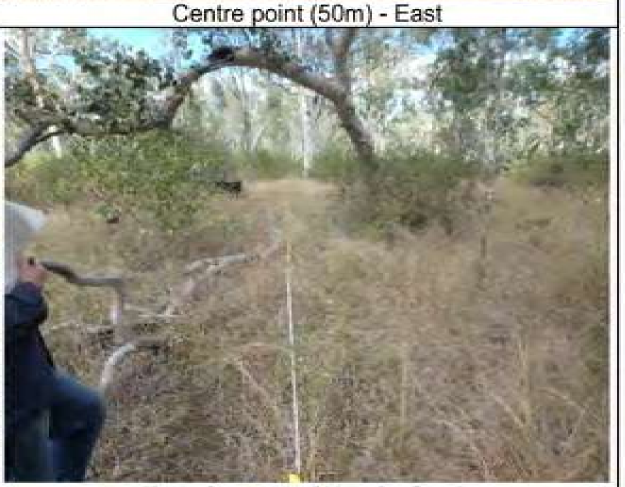

Start of transect (0m) - North


Centre point (50m) - North


Centre point (50m) - East


Centre point (50m) - South


Centre point (50m) - West


End of transect (100m) - South

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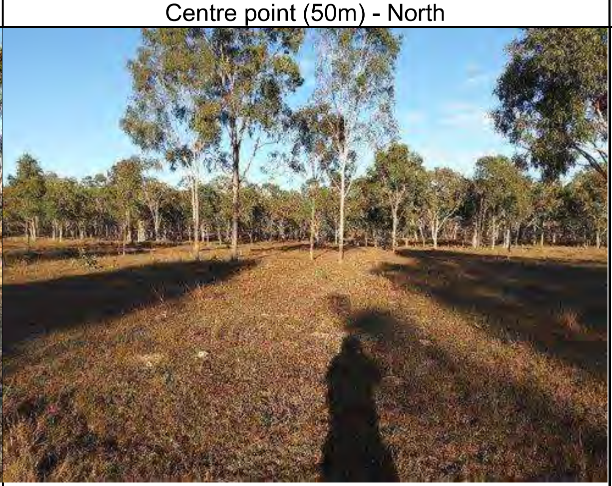
<td><br>Centre point (50m) - West</td>
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**Habitat Quality Plot 8**


Start of transect (0m) - North


Centre point (50m) - North


Centre point (50m) - East


Centre point (50m) - South


Centre point (50m) - West


End of transect (100m) - South

**Habitat Quality Plot 9**

Start of transect (0m) - North

Centre point (50m) - North

Centre point (50m) - East

Centre point (50m) - South

Centre point (50m) - West

End of transect (100m) - South

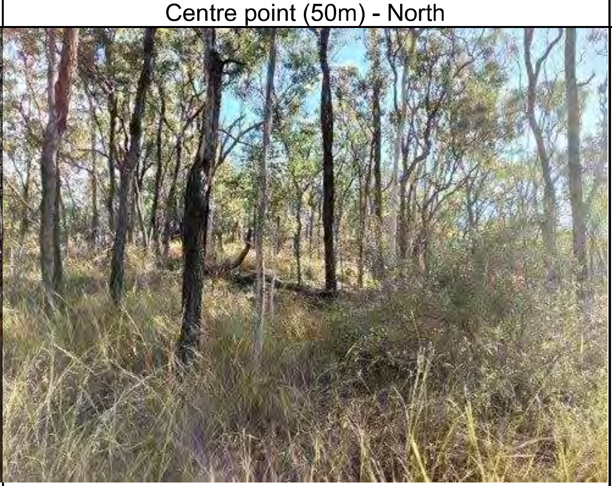
**Habitat Quality Plot 10**

Start of transect (0m) - North

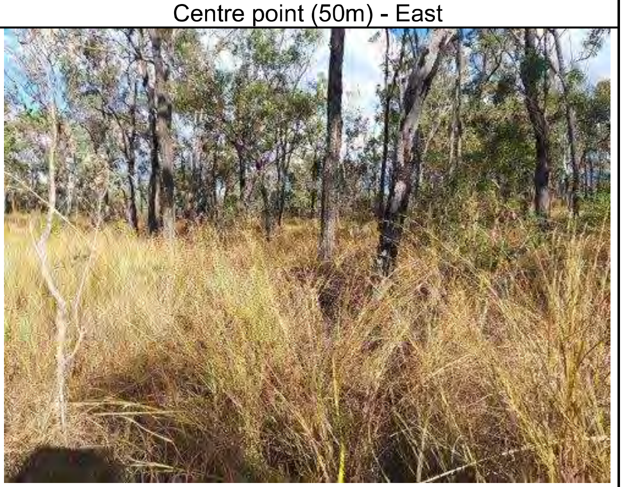
Centre point (50m) - North

Centre point (50m) - East

Centre point (50m) - South



Centre point (50m) - West



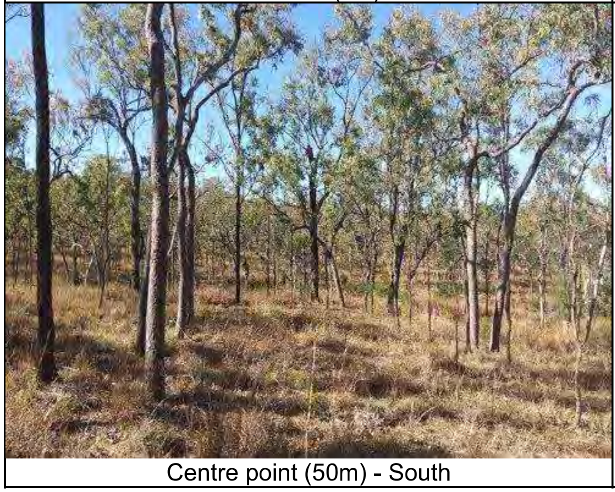
End of transect (100m) - South

**Habitat Quality Plot 11**

Start of transect (0m) - North

Centre point (50m) - North

Centre point (50m) - East



Centre point (50m) - South

**PHOTO NOT AVAILABLE**

Centre point (50m) - West

End of transect (100m) - South

**Habitat Quality Plot 12**

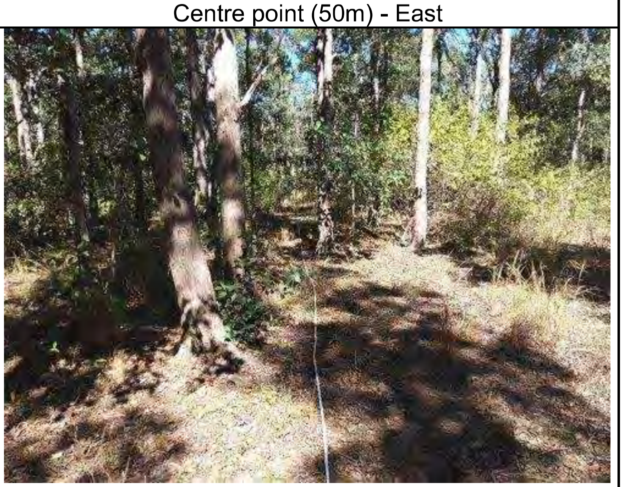
Start of transect (0m) - North

Centre point (50m) - North

Centre point (50m) - East

Centre point (50m) - South

Centre point (50m) - West



End of transect (100m) - South

**Habitat Quality Plot 13**

Start of transect (0m) - North

Centre point (50m) - North

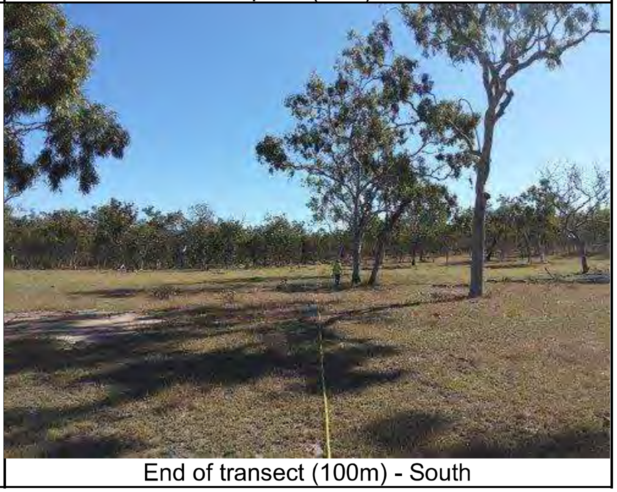
Centre point (50m) - East

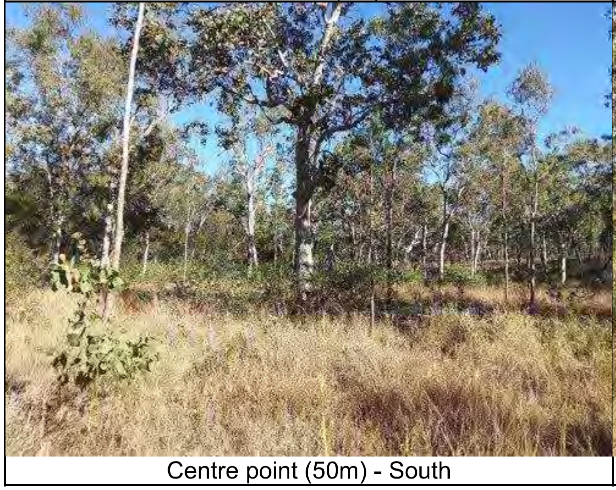
Centre point (50m) - South

Centre point (50m) - West

End of transect (100m) - South

| Habitat Quality Plot 14 | | |
|---|---|---|
| **PHOTO NOT AVAILABLE**<br>Start of transect (0m) | <br>Centre point (50m) - North | <br>Centre point (50m) - East |
| <br>Centre point (50m) - South | <br>Centre point (50m) - West | **PHOTO NOT AVAILABLE**<br>End of transect (100m) |

| Habitat Quality Plot 15 | | |
|---|---|---|
| <br>Start of transect (0m) - East | **PHOTO NOT AVAILABLE**<br>Centre point (50m) - North | <br>Centre point (50m) - East |
| <br>Centre point (50m) - South | **PHOTO NOT AVAILABLE**<br>Centre point (50m) - West | <br>End of transect (100m) - South |

| Habitat Quality Plot 16 | | |
|---|---|---|
| <br>Start of transect (0m) - North | **PHOTO NOT AVAILABLE**<br>Centre point (50m) - North | <br>Centre point (50m) - East |
| <br>Centre point (50m) - South | <br>Centre point (50m) - West | <br>End of transect (100m) - South |

| **Habitat Quality Plot 17** | | |
|---|---|---|
| <br>Start of transect (0m) | <br>Centre point (50m) - North | <br>Centre point (50m) - East |
| <br>Centre point (50m) - South | <br>Centre point (50m) - West | **Photo not available**<br>End of transect (100m) |

| Habitat Quality Plot 18 | | |
|---|---|---|
| <br>Start of transect (0m) | <br>Centre point (50m) - North | <br>Centre point (50m) - East |
| <br>Centre point (50m) - South | <br>Centre point (50m) - West | <br>End of transect (100m) |

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<td><br>End of transect (100m)</td>
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| Habitat Quality Plot 24 | | |
|---|---|---|
| <br>Start of transect (0m) | <br>Centre point (50m) - North | <br>Centre point (50m) - East |
| <br>Centre point (50m) - South | <br>Centre point (50m) - West | <br>End of transect (100m) |

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<td><br>Centre point (50m) - South</td>
<td><br>Centre point (50m) - West</td>
<td><br>End of transect (100m)</td>
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## Habitat Quality Plot 26


Start of transect (0m)


Centre point (50m) - North


Centre point (50m) - East


Centre point (50m) - South


Centre point (50m) - West


End of transect (100m)

<table>
<tr><th colspan="3">Habitat Quality Plot 27</th></tr>
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<td><br>End of transect (100m)</td>
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| **Habitat Quality Plot 28** | | |
|---|---|---|
| <br>Start of transect (0m) | <br>Centre point (50m) - North | <br>Centre point (50m) - East |
| <br>Centre point (50m) - South | <br>Centre point (50m) - West | <br>End of transect (100m) |

<table>
<tr><th colspan="3">Habitat Quality Plot 29</th></tr>
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<tr><td><br>Centre point (50m) - South</td><td><br>Centre point (50m) - West</td><td><br>End of transect (100m)</td></tr>
</table>

## Habitat Quality Plot 30

Start of transect (0m)

Centre point (50m) - North

Centre point (50m) - East

Centre point (50m) - South

Centre point (50m) - West

End of transect (100m)

<table>
<tr><th colspan="3">Habitat Quality Plot 31</th></tr>
<tr>
<td><br>Start of transect (0m)</td>
<td><br>Centre point (50m) - North</td>
<td><br>Centre point (50m) - East</td>
</tr>
<tr>
<td><br>Centre point (50m) - South</td>
<td><br>Centre point (50m) - West</td>
<td><br>End of transect (100m)</td>
</tr>
</table>

Appendix C

# Offset Site Habitat Quality Scores

**OFFSET AREA - KOALA**

| Assessment Unit - Regional Ecosystem | AU 1 - RE 11.12.1 remnant | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site Reference | **Benchmark** | MSB11 | | | MSB4 | | | MSB6 | | | Average | Average |
| | **11.12.1** | Raw Data | % Benchmark | Score | Raw Data | % Benchm | Score | Raw Data | % Benchm | Score | % | Score |
| **Site Condition** | | | | | | | | | | | | |
| Recruitment of woody perennial species in EDL | **100** | 66 | 66.00 | 3 | 66 | 66.00 | 3 | 100 | 100.00 | 5 | 77.33% | 3.67 |
| Native plant species richness - trees | **3** | 3 | 100.00 | 5 | 3 | 100.00 | 5 | 3 | 100.00 | 5 | 100.00% | 5.00 |
| Native plant species richness - shrubs | **6** | 1 | 16.67 | 2.5 | 0 | 0.00 | 2.5 | 0 | 0.00 | 2.5 | 5.56% | 2.50 |
| Native plant species richness - grasses | **8** | 2 | 25.00 | 3 | 5 | 62.50 | 3 | 5 | 62.50 | 3 | 50.00% | 3.00 |
| Native plant species richness - forbes | **13** | 11 | 84.62 | 3 | 9 | 69.23 | 3 | 11 | 84.62 | 3 | 79.49% | 3.00 |
| Tree canopy height (average of emergent, canopy, sub-canopy) | **12.5** | 14.4 | 115.20 | 5 | 13.6 | 108.80 | 5 | 13.6 | 108.80 | 5 | 110.93% | 5.00 |
| Tree canopy cover (average of emergent, canopy, sub-canopy) | **21** | 31.4 | 149.52 | 5 | 39.7 | 189.05 | 5 | 23.4 | 111.43 | 5 | 150.00% | 5.00 |
| Shrub canopy cover | **4** | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0.00% | 0.00 |
| Native grass cover | **41** | 45 | 109.76 | 5 | 39 | 95.12 | 5 | 16 | 39.02 | 1 | 81.30% | 3.67 |
| Organic litter | **28** | 37.4 | 133.57 | 5 | 31.4 | 112.14 | 5 | 45.6 | 162.86 | 5 | 136.19% | 5.00 |
| Large trees (euc plus non-euc) | **20** | 22 | 110.00 | 15 | 18 | 90.00 | 10 | 16 | 80.00 | 10 | 93.33% | 11.67 |
| Coarse woody debris | **408** | 45 | 11.03 | 2 | 267 | 65.44 | 5 | 207 | 50.74 | 5 | 42.40% | 4.00 |
| Non-native plant cover | **1** | 3 | | 10 | 8 | | 5 | 8 | | 5 | | 6.67 |
| Quality and availability of food and foraging habitat | | | | 15 | | | 15 | | | 15 | | 15.00 |
| Quality and availability of shelter | | | | 18 | | | 12 | | | 15 | | 15.00 |
| Site Condition Score | | | | 96.5 | | | 83.5 | | | 84.5 | | 88.2 |
| *MAX Site Condition Score* | | | | *140* | | | *140* | | | *140* | | *140* |
| **Site Condition Score - out of 3** | | | | | | | | | | | | **1.89** |
| **Site Context** | | | | | | | | | | | | |
| Size of patch | | | | 10 | | | 10 | | | 10 | | 10.00 |
| Connectedness | | | | 5 | | | 5 | | | 5 | | 5.00 |
| Context | | | | 5 | | | 5 | | | 5 | | 5.00 |
| Threats to the species | | | | 16 | | | 14 | | | 16 | | 15.33 |
| Species mobility capacity | | | | 13 | | | 13 | | | 13 | | 13.00 |
| Site Context Score | | | | 49 | | | 47 | | | 49 | | 48.3 |
| *MAX Site Context Score* | | | | *70* | | | *70* | | | *70* | | *70* |
| **Site Context Score - out of 3** | | | | | | | | | | | | **2.07** |

| Assessment Unit - Regional Ecosystem | AU 2 - RE 11.3.4 remnant | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site Reference | **Benchmar** | MSB2 | | | MSB3 | | | MSB12 | | | Average % | Average |
| | **11.3.4** | Raw Data | % Benchm | Score | Raw Data | % Benchm | Score | Raw Data | % Benchm | Score | benchmark | Score |
| **Site Condition** | | | | | | | | | | | | |
| Recruitment of woody perennial species in EDL | 100 | 100 | 100.00 | 5 | 33 | 33.00 | 3 | 75 | 75.00 | 3 | 69.33% | 3.67 |
| Native plant species richness - trees | 4 | 5 | 125.00 | 5 | 3 | 75.00 | 3 | 4 | 100.00 | 5 | 100.00% | 4.33 |
| Native plant species richness - shrubs | 2 | 1 | 50.00 | 3 | 3 | 150.00 | 5 | 4 | 200.00 | 5 | 133.33% | 4.33 |
| Native plant species richness - grasses | 7 | 7 | 100.00 | 5 | 5 | 71.43 | 3 | 3 | 42.86 | 3 | 71.43% | 3.67 |
| Native plant species richness - forbes | 10 | 8 | 80.00 | 3 | 6 | 60.00 | 3 | 10 | 100.00 | 5 | 80.00% | 3.67 |
| Tree canopy height (average of emergent, canopy, sub-canopy) | 17 | 13.6 | 80.00 | 5 | 13.6 | 80.00 | 5 | 15.2 | 89.41 | 5 | 83.14% | 5.00 |
| Tree canopy cover (average of emergent, canopy, sub-canopy) | 11 | 21.85 | 198.64 | 5 | 23.9 | 217.27 | 3 | 32 | 290.91 | 3 | 235.61% | 3.67 |
| Shrub canopy cover | 1 | 0 | 0.00 | 0 | 1.5 | 150.00 | 5 | 0 | 0.00 | 0 | 50.00% | 1.67 |
| Native grass cover | 43 | 44 | 102.33 | 5 | 28 | 65.12 | 3 | 14.6 | 33.95 | 1 | 67.13% | 3.00 |
| Organic litter | 20 | 36.4 | 182.00 | 5 | 57.2 | 286.00 | 5 | 78.6 | 393.00 | 3 | 287.00% | 4.33 |
| Large trees (euc plus non-euc) | 26 | 14 | 53.85 | 10 | 20 | 76.92 | 10 | 12 | 46.15 | 5 | 58.97% | 8.33 |
| Coarse woody debris | 384 | 336 | 87.50 | 5 | 72 | 18.75 | 2 | 195 | 50.78 | 5 | 52.34% | 4.00 |
| Non-native plant cover | 0 | 28 | | 3 | 7 | | 5 | 15 | | 5 | | 4.33 |
| Quality and availability of food and foraging habitat | | | | 5 | | | 5 | | | 5 | | 5.00 |
| Quality and availability of shelter | | | | 12 | | | 12 | | | 18 | | 14.00 |
| Site Condition Score | | | | 76 | | | 72 | | | 71 | | 73.0 |
| *MAX Site Condition Score* | | | | *140* | | | *140* | | | *140* | | *140* |
| **Site Condition Score - out of 3** | | | | | | | | | | | | **1.56** |
| **Site Context** | | | | | | | | | | | | |
| Size of patch | | | | 10 | | | 10 | | | 10 | | 10.0 |
| Connectedness | | | | 5 | | | 5 | | | 5 | | 5.0 |
| Context | | | | 5 | | | 5 | | | 5 | | 5.0 |
| Threats to the species | | | | 10 | | | 13 | | | 16 | | 13.0 |
| Species mobility capacity | | | | 13 | | | 13 | | | 13 | | 13.0 |
| Site Context Score | | | | 43 | | | 46 | | | 49 | | 46 |
| *MAX Site Context Score* | | | | *70* | | | *70* | | | *70* | | *70* |
| **Site Context Score - out of 3** | | | | | | | | | | | | **1.97** |

| Assessment Unit - Regional Ecosystem | AU 3 - RE 11.3.4 non-remnant | | | | | | **Total average % benchmark** | **Total average score** |
|---|---|---|---|---|---|---|---|---|
| Site Reference | **Benchmark** | MSB14 | | | Average | Average | | |
| | **11.3.4** | Raw Data | % Benchmark | Score | % | Score | | |
| **Site Condition** | | | | | | | | |
| Recruitment of woody perennial species in EDL | 100 | 0 | 0.00 | 0 | 0% | 0.0 | 63% | 3.14 |
| Native plant species richness - trees | 4 | 1 | 33.33 | 3 | 33% | 3.0 | 90% | 4.67 |
| Native plant species richness - shrubs | 2 | 0 | 0.00 | 2.5 | 0% | 2.5 | 60% | 3.29 |
| Native plant species richness - grasses | 7 | 3 | 37.50 | 3 | 38% | 3.0 | 57% | 3.29 |
| Native plant species richness - forbes | 10 | 3 | 23.08 | 2.5 | 23% | 2.5 | 72% | 3.21 |
| Tree canopy height (average of emergent, canopy, sub-canopy) | 17 | 11.2 | 89.60 | 5 | 90% | 5.0 | 96% | 5.00 |
| Tree canopy cover (average of emergent, canopy, sub-canopy) | 11 | 9 | 42.86 | 2 | 43% | 2.0 | 171% | 4.00 |
| Shrub canopy cover | 1 | 0 | 0.00 | 0 | 0% | 0.0 | 21% | 0.71 |
| Native grass cover | 43 | 1 | 2.44 | 0 | 2% | 0.0 | 64% | 2.86 |
| Organic litter | 20 | 19 | 67.86 | 3 | 68% | 3.0 | 191% | 4.43 |
| Large trees (euc plus non-euc) | 26 | 4 | 20.00 | 5 | 20% | 5.0 | 68% | 9.29 |
| Coarse woody debris | 384 | 215 | 52.70 | 5 | 53% | 5.0 | 48% | 4.14 |
| Non-native plant cover | 0 | 55 | | 0 | | 0.0 | | 4.71 |
| Quality and availability of food and foraging habitat | | | | 10 | | 10.0 | | 10.00 |
| Quality and availability of shelter | | | | 10 | | 10.0 | | 13.86 |
| Site Condition Score | | | | 51 | | 51 | | 76.36 |
| *MAX Site Condition Score* | | | | *100* | | *100* | | *140* |
| **Site Condition Score - out of 3** | | | | | | **1.53** | | **1.64** |
| **Site Context** | | | | | | | | |
| Size of patch | | | | 10 | | 10 | | 10.00 |
| Connectedness | | | | 5 | | 5 | | 5.00 |
| Context | | | | 5 | | 5 | | 5.00 |
| Threats to the species | | | | 1 | | 1 | | 12.29 |
| Species mobility capacity | | | | 4 | | 4 | | 11.71 |
| | | | | 1 | | 1 | | |
| Site Context Score | | | | 26 | | 26 | | 44.14 |
| *MAX Site Context Score* | | | | *56* | | *56* | | *70* |
| **Site Context Score - out of 3** | | | | | | **1.39** | | **1.89** |

| **Species Stocking Rate (SSR)** | | | | | |
|---|---|---|---|---|---|
| Presence detected on or adjacent to site (neighbouring property with connecting habitat) | Score | 0 | | 5 | 10 |
| | | No | Yes - adjacent | | Yes - on site |
| Species usage of the site (habitat type & evidenced usage) | Score | 0 | 5 | 10 | 15 |
| | | Not habitat | Dispersal | Foraging | Breeding |
| Approximate density (per ha) | Score | 0 | 10 | 20 | 30 |
| | | 0% | | | |
| Role/importance of species population on site* | Score (*Total from supplementary table below*) | 0 | 5 | 10 | 15 |
| | | 0 | 5 - 15 | 20 - 35 | 40 - 45 |
| Total SRR score (out of 70) | | | | | |
| **SRR Score (out of 4)** | | | | | |

| ***SSR Supplementary Table** | | | |
|---|---|---|---|
| *Key source population for breeding | Score | 0 | 10 |
| | | No | Yes/ Possibly |
| *Key source population for dispersal | Score | 0 | 5 |
| | | No | Yes/ Possibly |
| *Necessary for maintaining genetic diversity | Score | 0 | 15 |
| | | No | Yes/ Possibly |
| *Near the limit of the species range | Score | 0 | 15 |
| | | No | Yes |

| **Final habitat quality score (weighted)** | **AU1** | **AU2** | **AU3** | **Average/Final** |
|---|---|---|---|---|
| Site Condition score (out of 3) | 1.9 | 1.6 | 1.5 | 1.7 |
| Site Context Score (out of 3) | 2.1 | 2.0 | 1.4 | 1.8 |
| Species Stocking Rate Score (out of 4) | 1.0 | 1.0 | 1.0 | |
| Habitat Quality score (out of 10) | *5.0* | *4.5* | *3.9* | ***4.5*** |
| Assessment Unit area (ha) | 403.3 | 200.1 | 6.6 | 610.0 |
| Total offset area (ha) | 610.0 | 610.0 | 610.0 | |
| Size Weighting | 0.7 | 0.3 | 0.0 | |
| ***Weighted Habitat Quality Score*** | ***3.3*** | ***1.5*** | ***0.0*** | ***4.8*** |

**OFFSET AREA - GREATER GLIDER**

| Assessment Unit - Regional Ecosystem | **AU 1 - RE 11.12.1 remnant** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site Reference | **Benchmark** | MSB11 | | | MSB4 | | | MSB6 | | | Average | Average |
| | **11.12.1** | Raw Data | % Benchmark | Score | Raw Data | % Benchm | Score | Raw Data | % Benchm | Score | % | Score |
| **Site Condition** | | | | | | | | | | | | |
| Recruitment of woody perennial species in EDL | **100** | 66 | 66.00 | 3 | 66 | 66.00 | 3 | 100 | 100.00 | 5 | 77% | 3.7 |
| Native plant species richness - trees | **3** | 3 | 100.00 | 5 | 3 | 100.00 | 5 | 3 | 100.00 | 5 | 100% | 5.0 |
| Native plant species richness - shrubs | **6** | 1 | 16.67 | 2.5 | 0 | 0.00 | 2.5 | 0 | 0.00 | 2.5 | 6% | 2.5 |
| Native plant species richness - grasses | **8** | 2 | 25.00 | 3 | 5 | 62.50 | 3 | 5 | 62.50 | 3 | 50% | 3.0 |
| Native plant species richness - forbes | **13** | 11 | 84.62 | 3 | 9 | 69.23 | 3 | 11 | 84.62 | 3 | 79% | 3.0 |
| Tree canopy height (average of emergent, canopy, sub-canopy) | **12.5** | 14.4 | 115.20 | 5 | 13.6 | 108.80 | 5 | 13.6 | 108.80 | 5 | 111% | 5.0 |
| Tree canopy cover (average of emergent, canopy, sub-canopy) | **21** | 31.4 | 149.52 | 5 | 39.7 | 189.05 | 5 | 23.4 | 111.43 | 5 | 150% | 5.0 |
| Shrub canopy cover | **4** | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0% | 0.0 |
| Native grass cover | **41** | 45 | 109.76 | 5 | 39 | 95.12 | 5 | 16 | 39.02 | 1 | 81% | 3.7 |
| Organic litter | **28** | 37.4 | 133.57 | 5 | 31.4 | 112.14 | 5 | 45.6 | 162.86 | 5 | 136% | 5.0 |
| Large trees (euc plus non-euc) | **20** | 22 | 110.00 | 15 | 18 | 90.00 | 10 | 16 | 80.00 | 10 | 93% | 11.7 |
| Coarse woody debris | **408** | 45 | 11.03 | 2 | 267 | 65.44 | 5 | 207 | 50.74 | 5 | 42% | 4.0 |
| Non-native plant cover | **1** | 3 | | 10 | 8 | | 5 | 8 | | 5 | | 6.7 |
| Quality and availability of food and foraging habitat | | | | 5 | | | 5 | | | 5 | | 5.0 |
| Quality and availability of shelter | | | | 20 | | | 15 | | | 10 | | 15.0 |
| Site Condition Score | | | | 88.5 | | | 76.5 | | | 69.5 | | 78.2 |
| *MAX Site Condition Score* | | | | *140* | | | *140* | | | *140* | | *140* |
| **Site Condition Score - out of 3** | | | | | | | | | | | | **1.68** |
| **Site Context** | | | | | | | | | | | | |
| Size of patch | | | | 10 | | | 10 | | | 10 | | 10.0 |
| Connectedness | | | | 5 | | | 5 | | | 5 | | 5.0 |
| Context | | | | 5 | | | 5 | | | 5 | | 5.0 |
| Threats to the species | | | | 17 | | | 9 | | | 11 | | 12.3 |
| Species mobility capacity | | | | 15 | | | 20 | | | 10 | | 15.0 |
| Site Context Score | | | | 52 | | | 49 | | | 41 | | 47.3 |
| *MAX Site Context Score* | | | | *60* | | | *60* | | | *60* | | *60* |
| **Site Context Score - out of 3** | | | | | | | | | | | | **2.37** |

| Assessment Unit - Regional Ecosystem | **AU 2 - RE 11.3.4 remnant** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site Reference | **Benchmark** | MSB2 | | | MSB3 | | | MSB12 | | | Average | Average |
| | **11.3.4** | Raw Data | % Benchm | Score | Raw Data | % Benchmark | Score | Raw Data | % Benchm | Score | % | Score |
| **Site Condition** | | | | | | | | | | | | |
| Recruitment of woody perennial species in EDL | 100 | 100 | 100.00 | 5 | 33 | 33.00 | 3 | 75 | 75.00 | 3 | 69% | 3.7 |
| Native plant species richness - trees | 4 | 5 | 125.00 | 5 | 3 | 75.00 | 3 | 4 | 100.00 | 5 | 100% | 4.3 |
| Native plant species richness - shrubs | 2 | 1 | 50.00 | 3 | 3 | 150.00 | 5 | 4 | 200.00 | 5 | 133% | 4.3 |
| Native plant species richness - grasses | 7 | 7 | 100.00 | 5 | 5 | 71.43 | 3 | 3 | 42.86 | 3 | 71% | 3.7 |
| Native plant species richness - forbes | 10 | 8 | 80.00 | 3 | 6 | 60.00 | 3 | 10 | 100.00 | 5 | 80% | 3.7 |
| Tree canopy height (average of emergent, canopy, sub-canopy) | 17 | 13.6 | 80.00 | 5 | 13.6 | 80.00 | 5 | 15.2 | 89.41 | 5 | 83% | 5.0 |
| Tree canopy cover (average of emergent, canopy, sub-canopy) | 11 | 21.85 | 198.64 | 5 | 23.9 | 217.27 | 3 | 32 | 290.91 | 3 | 236% | 3.7 |
| Shrub canopy cover | 1 | 0 | 0.00 | 0 | 1.5 | 150.00 | 5 | 0 | 0.00 | 0 | 50% | 1.7 |
| Native grass cover | 43 | 44 | 102.33 | 5 | 28 | 65.12 | 3 | 14.6 | 33.95 | 1 | 67% | 3.0 |
| Organic litter | 20 | 36.4 | 182.00 | 5 | 57.2 | 286.00 | 5 | 78.6 | 393.00 | 3 | 287% | 4.3 |
| Large trees (euc plus non-euc) | 26 | 14 | 53.85 | 10 | 20 | 76.92 | 10 | 12 | 46.15 | 5 | 59% | 8.3 |
| Coarse woody debris | 384 | 336 | 87.50 | 5 | 72 | 18.75 | 2 | 195 | 50.78 | 5 | 52% | 4.0 |
| Non-native plant cover | 0 | 28 | | 3 | 7 | | 5 | 15 | | 5 | | 4.3 |
| Quality and availability of food and foraging habitat | | | | 5 | | | 5 | | | 5 | | 5.0 |
| Quality and availability of shelter | | | | 25 | | | 25 | | | 30 | | 26.7 |
| Site Condition Score | | | | 89 | | | 85 | | | 83 | | 85.7 |
| *MAX Site Condition Score* | | | | *140* | | | *140* | | | *140* | | *140* |
| **Site Condition Score - out of 3** | | | | | | | | | | | | **1.84** |
| **Site Context** | | | | | | | | | | | | |
| Size of patch | | | | 10 | | | 10 | | | 10 | | 10.0 |
| Connectedness | | | | 5 | | | 5 | | | 5 | | 5.0 |
| Context | | | | 5 | | | 5 | | | 5 | | 5.0 |
| Threats to the species | | | | 15 | | | 15 | | | 20 | | 16.7 |
| Species mobility capacity | | | | 7 | | | 13 | | | 13 | | 11.0 |
| Site Context Score | | | | 42 | | | 48 | | | 53 | | 47.7 |
| *MAX Site Context Score* | | | | *60* | | | *60* | | | *60* | | *60* |
| **Site Context Score - out of 3** | | | | | | | | | | | | **2.38** |

| Assessment Unit - Regional Ecosystem | **AU 3 - RE 11.3.4 non-remnant** | | | | | | **Total** | **Total** |
|---|---|---|---|---|---|---|---|---|
| Site Reference | **Benchmark** | MSB14 | | | Average | Average | **average %** | **average** |
| | **11.3.4** | Raw Data | % Benchmark | Score | % | Score | **benchmark** | **score** |
| **Site Condition** | | | | | | | | |
| Recruitment of woody perennial species in EDL | 100 | 0 | 0.00 | 0 | 0% | 0.0 | 63% | 3.14 |
| Native plant species richness - trees | 4 | 1 | 33.33 | 3 | 33% | 3.0 | 90% | 4.43 |
| Native plant species richness - shrubs | 2 | 0 | 0.00 | 2.5 | 0% | 2.5 | 60% | 3.29 |
| Native plant species richness - grasses | 7 | 3 | 37.50 | 3 | 38% | 3.0 | 57% | 3.29 |
| Native plant species richness - forbes | 10 | 3 | 23.08 | 2.5 | 23% | 2.5 | 72% | 3.21 |
| Tree canopy height (average of emergent, canopy, sub-canopy) | 17 | 11.2 | 89.60 | 5 | 90% | 5.0 | 96% | 5.00 |
| Tree canopy cover (average of emergent, canopy, sub-canopy) | 11 | 9 | 42.86 | 2 | 43% | 2.0 | 171% | 4.00 |
| Shrub canopy cover | 1 | 0 | 0.00 | 0 | 0% | 0.0 | 21% | 0.71 |
| Native grass cover | 43 | 1 | 2.44 | 0 | 2% | 0.0 | 64% | 2.86 |
| Organic litter | 20 | 19 | 67.86 | 3 | 68% | 3.0 | 191% | 4.43 |
| Large trees (euc plus non-euc) | 26 | 4 | 20.00 | 5 | 20% | 5.0 | 68% | 9.29 |
| Coarse woody debris | 384 | 215 | 52.70 | 5 | 53% | 5.0 | 48% | 4.14 |
| Non-native plant cover | 0 | 55 | | 0 | | 0.0 | | 4.71 |
| Quality and availability of food and foraging habitat | | | | 10 | | 10.0 | | 5.71 |
| Quality and availability of shelter | | | | 10 | | 10.0 | | 19.29 |
| Site Condition Score | | | | 51 | | 51.0 | | 77.5 |
| *MAX Site Condition Score* | | | | *100* | | *100* | | *140* |
| **Site Condition Score - out of 3** | | | | | | **1.53** | | **1.66** |
| **Site Context** | | | | | | | | |
| Size of patch | | | | 10 | | 10 | | 10.00 |
| Connectedness | | | | 5 | | 5 | | 5.00 |
| Context | | | | 5 | | 5 | | 5.00 |
| Threats to the species | | | | 7 | | 7 | | 13.43 |
| Species mobility capacity | | | | 7 | | 7 | | 12.14 |
| Site Context Score | | | | 34 | | 34 | | 45.6 |
| *MAX Site Context Score* | | | | *56* | | *56* | | *71* |
| **Site Context Score - out of 3** | | | | | | **1.82** | | **1.93** |

| **Species Stocking Rate (SSR)** | | | | | |
|---|---|---|---|---|---|
| Presence detected on or adjacent to site (neighbouring property with connecting habitat) | Score | 0 | 5 | | 10 |
| | | No | Yes - adjacent | | Yes - on site |
| Species usage of the site (habitat type & evidenced usage) | Score | 0 | 5 | 10 | 15 |
| | | Not habitat | Dispersal | Foraging | Breeding |
| Approximate density (per ha) | Score | 0 | 10 | 20 | 30 |
| | | 0% | | | |
| Role/importance of species population on site* | Score (*Total from supplementary table below*) | 0 | 5 | 10 | 15 |
| | | 0 | 5 - 15 | 20 - 35 | 40 - 45 |
| Total SRR score (out of 70) | | | | | |
| **SRR Score (out of 4)** | | | | | |

| ***SSR Supplementary Table** | | | |
|---|---|---|---|
| *Key source population for breeding | Score | 0 | 10 |
| | | No | Yes/ Possibly |
| *Key source population for dispersal | Score | 0 | 5 |
| | | No | Yes/ Possibly |
| *Necessary for maintaining genetic diversity | Score | 0 | 15 |
| | | No | Yes/ Possibly |
| *Near the limit of the species range | Score | 0 | 15 |
| | | No | Yes |

| **Final habitat quality score (weighted)** | **AU1** | **AU2** | **AU3** | **Average/Final** |
|---|---|---|---|---|
| Site Condition score (out of 3) | 1.7 | 1.8 | 1.5 | 1.7 |
| Site Context Score (out of 3) | 2.4 | 2.4 | 1.8 | 2.2 |
| Species Stocking Rate Score (out of 4) | 1.0 | 1.0 | 1.0 | |
| Habitat Quality score (out of 10) | *5.0* | *5.2* | *4.4* | *4.9* |
| Assessment Unit area (ha) | 403.3 | 200.1 | 6.6 | 610.0 |
| Total offset area (ha) | 610.0 | 610.0 | 610.0 | |
| Size Weighting | 0.7 | 0.3 | 0.0 | |
| ***Weighted Habitat Quality Score*** | ***3.3*** | ***1.7*** | ***0.0*** | ***5.1*** |

**OFFSET AREA - SQUATTER PIGEON**

| Assessment Unit - Regional Ecosystem | AU 1 - RE 11.12.1 remnant | | | | | | | | | | | | AU 2 - RE 11.3.4 remnant | | | | | | | | | | | | AU 3 - RE 11.3.4 non-remnant | | | | | | | Total average % benchmark | Total average score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site Reference | Benchmark | MSB11 | | | MSB4 | | | MSB6 | | | Average % | Average Score | Benchmar | MSB2 | | | MSB3 | | | MSB12 | | | Average % | Average Score | Benchmark | MSB14 | | | Average % | Average Score | | |
| | 11.12.1 | Raw Data | % Benchmark | Score | Raw Data | % Benchm | Score | Raw Data | % Benchm | Score | | | 11.3.4 | Raw Data | % Benchm | Score | Raw Data | % Benchm | Score | Raw Data | % Benchm | Score | | | 11.3.4 | Raw Data | % Benchmark | Score | | | | |
| **Site Condition** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Recruitment of woody perennial species in EDL | **100** | 66 | 66.00 | 3 | 66 | 66.00 | 3 | 100 | 100.00 | 5 | 77% | 3.7 | 100 | 100 | 100.00 | 5 | 33 | 33.00 | 3 | 75 | 75.00 | 3 | 69% | 3.7 | 100 | 0 | 0.00 | 0 | 0% | 0.0 | 63% | 3.14 |
| Native plant species richness - trees | **3** | 3 | 100.00 | 5 | 3 | 100.00 | 5 | 3 | 100.00 | 5 | 100% | 5.0 | 4 | 5 | 125.00 | 5 | 3 | 75.00 | 3 | 4 | 100.00 | 5 | 100% | 4.3 | 4 | 1 | 33.33 | 3 | 33% | 3.0 | 90% | 4.43 |
| Native plant species richness - shrubs | **6** | 1 | 16.67 | 2.5 | 0 | 0.00 | 2.5 | 0 | 0.00 | 2.5 | 6% | 2.5 | 2 | 1 | 50.00 | 3 | 3 | 150.00 | 5 | 4 | 200.00 | 5 | 133% | 4.3 | 2 | 0 | 0.00 | 2.5 | 0% | 2.5 | 60% | 3.29 |
| Native plant species richness - grasses | **8** | 2 | 25.00 | 3 | 5 | 62.50 | 3 | 5 | 62.50 | 3 | 50% | 3.0 | 7 | 7 | 100.00 | 5 | 5 | 71.43 | 3 | 3 | 42.86 | 3 | 71% | 3.7 | 7 | 3 | 37.50 | 3 | 38% | 3.0 | 57% | 3.29 |
| Native plant species richness - forbes | **13** | 11 | 84.62 | 3 | 9 | 69.23 | 3 | 11 | 84.62 | 3 | 79% | 3.0 | 10 | 8 | 80.00 | 3 | 6 | 60.00 | 3 | 10 | 100.00 | 5 | 80% | 3.7 | 10 | 3 | 23.08 | 2.5 | 23% | 2.5 | 72% | 3.21 |
| Tree canopy height (average of emergent, canopy, sub-canopy) | **12.5** | 14.4 | 115.20 | 5 | 13.6 | 108.80 | 5 | 13.6 | 108.80 | 5 | 111% | 5.0 | 17 | 13.6 | 80.00 | 5 | 13.6 | 80.00 | 5 | 15.2 | 89.41 | 5 | 83% | 5.0 | 17 | 11.2 | 89.60 | 5 | 90% | 5.0 | 96% | 5.00 |
| Tree canopy cover (average of emergent, canopy, sub-canopy) | **21** | 31.4 | 149.52 | 5 | 39.7 | 189.05 | 5 | 23.4 | 111.43 | 5 | 150% | 5.0 | 11 | 21.85 | 198.64 | 5 | 23.9 | 217.27 | 3 | 32 | 290.91 | 3 | 236% | 3.7 | 11 | 9 | 42.86 | 2 | 43% | 2.0 | 171% | 4.00 |
| Shrub canopy cover | **4** | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0% | 0.0 | 1 | 0 | 0.00 | 0 | 1.5 | 150.00 | 5 | 0 | 0.00 | 0 | 50% | 1.7 | 1 | 0 | 0.00 | 0 | 0% | 0.0 | 21% | 0.71 |
| Native grass cover | **41** | 45 | 109.76 | 5 | 39 | 95.12 | 5 | 16 | 39.02 | 1 | 81% | 3.7 | 43 | 44 | 102.33 | 5 | 28 | 65.12 | 3 | 14.6 | 33.95 | 1 | 67% | 3.0 | 43 | 1 | 2.44 | 0 | 2% | 0.0 | 64% | 2.86 |
| Organic litter | **28** | 37.4 | 133.57 | 5 | 31.4 | 112.14 | 5 | 45.6 | 162.86 | 5 | 136% | 5.0 | 20 | 36.4 | 182.00 | 5 | 57.2 | 286.00 | 5 | 78.6 | 393.00 | 3 | 287% | 4.3 | 20 | 19 | 67.86 | 3 | 68% | 3.0 | 191% | 4.43 |
| Large trees (euc plus non-euc) | **20** | 22 | 110.00 | 15 | 18 | 90.00 | 10 | 16 | 80.00 | 10 | 93% | 11.7 | 26 | 14 | 53.85 | 10 | 20 | 76.92 | 10 | 12 | 46.15 | 5 | 59% | 8.3 | 26 | 4 | 20.00 | 5 | 20% | 5.0 | 68% | 9.29 |
| Coarse woody debris | **408** | 45 | 11.03 | 2 | 267 | 65.44 | 5 | 207 | 50.74 | 5 | 42% | 4.0 | 384 | 336 | 87.50 | 5 | 72 | 18.75 | 2 | 195 | 50.78 | 5 | 52% | 4.0 | 384 | 215 | 52.70 | 5 | 53% | 5.0 | 48% | 4.14 |
| Non-native plant cover | **1** | 3 | | 10 | 8 | | 5 | 8 | | 5 | | 6.7 | 0 | 28 | | 3 | 7 | | 5 | 15 | | 5 | | 4.3 | 0 | 55 | | 0 | | 0.0 | | 4.71 |
| Quality and availability of food and foraging habitat | | | | 15 | | | 18 | | | 18 | | 17.0 | | | | 18 | | | 18 | | | 18 | | 18.0 | | | | 10 | | 10.0 | | 16.43 |
| Quality and availability of shelter | | | | 5 | | | 5 | | | 10 | | 6.7 | | | | 10 | | | 15 | | | 10 | | 11.7 | | | | 10 | | 10.0 | | 9.29 |
| Site Condition Score | | | | 83.5 | | | 79.5 | | | 82.5 | | 81.8 | | | | 87 | | | 88 | | | 76 | | 83.7 | | | | 51 | | 51 | | 78.214286 |
| *MAX Site Condition Score* | | | | *130* | | | *130* | | | *130* | | *130* | | | | *130* | | | *130* | | | | | *130* | | | | *100* | | *100* | | *130* |
| **Site Condition Score - out of 3** | | | | | | | | | | | | **1.89** | | | | | | | | | | | | **1.93** | | | | | | **1.53** | | **1.80** |
| **Site Context** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Size of patch | | | | 10 | | | 10 | | | 10 | | 10.0 | | | | 10 | | | 10 | | | 10 | | 10.0 | | | | 10 | | 10 | | 10.00 |
| Connectedness | | | | 5 | | | 5 | | | 5 | | 5.0 | | | | 5 | | | 5 | | | 5 | | 5.0 | | | | 5 | | 5 | | 5.00 |
| Context | | | | 5 | | | 5 | | | 5 | | 5.0 | | | | 5 | | | 5 | | | 5 | | 5.0 | | | | 5 | | 5 | | 5.00 |
| Threats to the species | | | | 25 | | | 15 | | | 25 | | 21.7 | | | | 15 | | | 25 | | | 25 | | 21.7 | | | | 7 | | 7 | | 19.57 |
| Species mobility capacity | | | | 13 | | | 13 | | | 13 | | 13.0 | | | | 13 | | | 13 | | | 16 | | 14.0 | | | | 4 | | 4 | | 12.14 |
| Site Context Score | | | | 58 | | | 48 | | | 58 | | 54.7 | | | | 48 | | | 58 | | | 61 | | 55.7 | | | | 31 | | 31 | | 51.7 |
| *MAX Site Context Score* | | | | *70* | | | *70* | | | *70* | | *70* | | | | *70* | | | *70* | | | | | *70* | | | | *56* | | *56* | | *81* |
| **Site Context Score - out of 3** | | | | | | | | | | | | **2.34** | | | | | | | | | | | | **2.39** | | | | | | **1.66** | | **1.92** |

| **Species Stocking Rate (SSR)** | | | | | |
|---|---|---|---|---|---|
| Presence detected on or adjacent to site (neighbouring property with connecting habitat) | Score | 0 | 5 | | 10 |
| | | No | Yes - adjacent | | Yes - on site |
| Species usage of the site (habitat type & evidenced usage) | Score | 0 | 5 | 10 | 15 |
| | | Not habitat | Dispersal | Foraging | Breeding |
| Approximate density (per ha) | Score | 0 | 10 | 20 | 30 |
| | | 0% | | | |
| Role/importance of species population on site* | Score (*Total from supplementary table below* ) | 0 | 5 | 10 | 15 |
| | | 0 | 5 - 15 | 20 - 35 | 40 - 45 |
| Total SRR score (out of 70) | | | | | |
| **SRR Score (out of 4)** | | | | | |

| ***SSR Supplementary Table** | | | |
|---|---|---|---|
| *Key source population for breeding | Score | 0 | 10 |
| | | No | Yes/ Possibly |
| *Key source population for dispersal | Score | 0 | 5 |
| | | No | Yes/ Possibly |
| *Necessary for maintaining genetic diversity | Score | 0 | 15 |
| | | No | Yes/ Possibly |
| *Near the limit of the species range | Score | 0 | 15 |
| | | No | Yes |

| **Final habitat quality score (weighted)** | **AU1** | **AU2** | **AU3** | **Average/Final** |
|---|---|---|---|---|
| Site Condition score (out of 3) | 1.9 | 1.9 | 1.5 | 1.8 |
| Site Context Score (out of 3) | 2.3 | 2.4 | 1.7 | 2.1 |
| Species Stocking Rate Score (out of 4) | 1.0 | 1.0 | 1.0 | |
| Habitat Quality score (out of 10) | *5.2* | *5.3* | *4.2* | *4.9* |
| Assessment Unit area (ha) | 403.3 | 200.1 | 6.6 | 610.0 |
| Total offset area (ha) | 610.0 | 610.0 | 610.0 | |
| Size Weighting | 0.7 | 0.3 | 0.0 | |
| ***Weighted Habitat Quality Score*** | ***3.5*** | ***1.7*** | ***0.0*** | ***5.2*** |

Appendix D

# EPBC Offset Calculator Results

# Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

| **Matter of National Environmental Significance** | |
|---|---|
| **Name** | Koala |
| **EPBC Act status** | Vulnerable |
| **Annual probability of extinction**<br>Based on IUCN category definitions | **0.2%** |

| **Key to Cell Colours** |
|---|
| User input required |
| Drop-down list |
| Calculated output |
| Not applicable to attribute |

## Impact calculator

| Protected matter attributes | Attribute relevant to case? | Description | Quantum of impact | | Units | Information source |
|---|---|---|---|---|---|---|
| ***Ecological communities*** | | | | | | |
| **Area of community** | No | | **Area** | | | |
| | | | **Quality** | | | |
| | | | **Total quantum of impact** | 0.00 | | |
| ***Threatened species habitat*** | | | | | | |
| **Area of habitat** | Yes | Refer to supporting documentation | **Area** | 131.9 | Hectares | Refer to supporting documentation |
| | | | **Quality** | 4 | Scale 0-10 | |
| | | | **Total quantum of impact** | 52.74 | Adjusted hectares | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Description** | **Quantum of impact** | | **Units** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | |
| ***Threatened species*** | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | |

## Offset calculator

| Protected matter attributes | Attribute relevant to case? | Total quantum of impact | Units | Proposed offset | Time horizon (years) | | Start area and quality | | Future area and quality without offset | | Future area and quality with offset | | Raw gain | Confidence in result (%) | Adjusted gain | Net present value (adjusted hectares) | | % of impact offset | Minimum (90%) direct offset requirement met? | Cost ($ total) | Information source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Ecological Communities*** | | | | | | | | | | | | | | | | | | | | | |
| **Area of community** | No | | | | **Risk-related time horizon (max. 20 years)** | | **Start area (hectares)** | | **Risk of loss (%) without offset** | | **Risk of loss (%) with offset** | | | | | | | | | | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 0.0 | **Future area with offset (adjusted hectares)** | 0.0 | | | | | | | | | |
| | | | | | **Time until ecological benefit** | | **Start quality (scale of 0-10)** | | **Future quality without offset (scale of 0-10)** | | **Future quality with offset (scale of 0-10)** | | | | | | | | | | |
| ***Threatened species habitat*** | | | | | | | | | | | | | | | | | | | | | |
| **Area of habitat** | Yes | 52.74 | Adjusted hectares | Refer to supporting documentation | **Time over which loss is averted (max. 20 years)** | 20 | **Start area (hectares)** | 610 | **Risk of loss (%) without offset** | 0% | **Risk of loss (%) with offset** | 0% | 0.00 | 90% | 0.00 | 0.00 | 52.75 | 100.01% | Yes | | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 610.0 | **Future area with offset (adjusted hectares)** | 610.0 | | | | | | | | | |
| | | | | | **Time until ecological benefit** | 20 | **Start quality (scale of 0-10)** | 5 | **Future quality without offset (scale of 0-10)** | 5 | **Future quality with offset (scale of 0-10)** | 6 | 1.00 | 90% | 0.90 | 0.86 | | | | | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Total quantum of impact** | **Units** | **Proposed offset** | **Time horizon (years)** | | **Start value** | | **Future value without offset** | | **Future value with offset** | | **Raw gain** | **Confidence in result (%)** | **Adjusted gain** | **Net present value** | | **% of impact offset** | **Minimum (90%) direct offset requirement met?** | **Cost ($ total)** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | | | | | | | | | | | | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | | | | | | | | | | | | | | | | |
| ***Threatened species*** | | | | | | | | | | | | | | | | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | | | | | | | | | | | | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | | | | | | | | | | | | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | | | | | | | | | | | | | | | | |

# Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

| **Matter of National Environmental Significance** | |
|---|---|
| **Name** | Greater Glider |
| **EPBC Act status** | Vulnerable |
| **Annual probability of extinction**<br>Based on IUCN category definitions | **0.2%** |

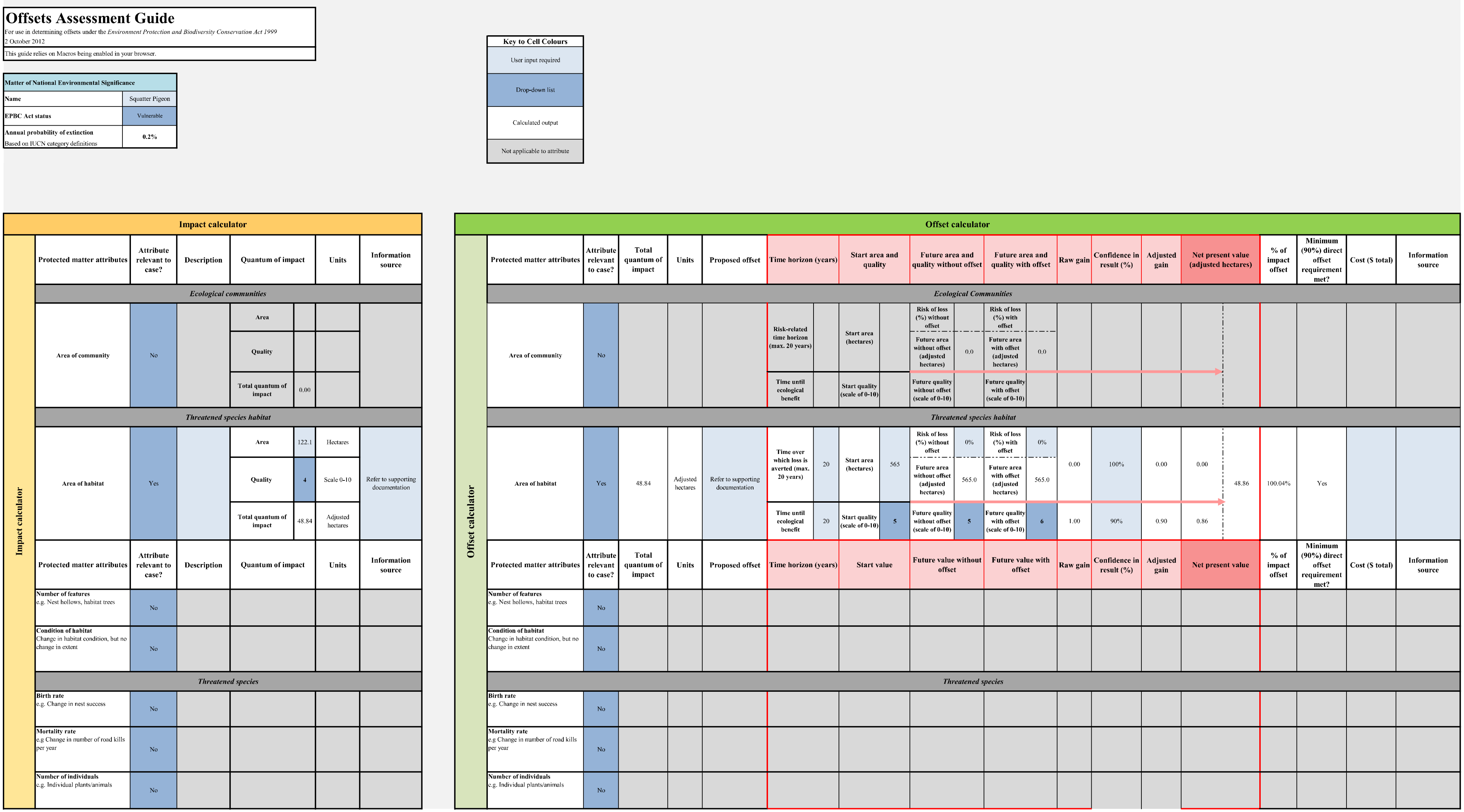
| **Key to Cell Colours** |
|---|
| User input required |
| Drop-down list |
| Calculated output |
| Not applicable to attribute |

## Impact calculator

| Protected matter attributes | Attribute relevant to case? | Description | Quantum of impact | | Units | Information source |
|---|---|---|---|---|---|---|
| *Ecological communities* | | | | | | |
| Area of community | No | | Area | | | |
| | | | Quality | | | |
| | | | Total quantum of impact | 0.00 | | |
| *Threatened species habitat* | | | | | | |
| Area of habitat | Yes | Refer to supporting documentation | Area | 120.9 | Hectares | Refer to supporting documentation |
| | | | Quality | 4 | Scale 0-10 | |
| | | | Total quantum of impact | 48.36 | Adjusted hectares | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Description** | **Quantum of impact** | | **Units** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | |
| *Threatened species* | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | |

## Offset calculator

| Protected matter attributes | Attribute relevant to case? | Total quantum of impact | Units | Proposed offset | Time horizon (years) | | Start area and quality | | Future area and quality without offset | | Future area and quality with offset | | Raw gain | Confidence in result (%) | Adjusted gain | Net present value (adjusted hectares) | | % of impact offset | Minimum (90%) direct offset requirement met? | Cost ($ total) | Information source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Ecological Communities* | | | | | | | | | | | | | | | | | | | | | |
| Area of community | No | | | | Risk-related time horizon (max. 20 years) | | Start area (hectares) | | Risk of loss (%) without offset | | Risk of loss (%) with offset | | | | | | | | | | |
| | | | | | | | | | Future area without offset (adjusted hectares) | 0.0 | Future area with offset (adjusted hectares) | 0.0 | | | | | | | | | |
| | | | | | Time until ecological benefit | | Start quality (scale of 0-10) | | Future quality without offset (scale of 0-10) | | Future quality with offset (scale of 0-10) | | | | | | | | | | |
| *Threatened species habitat* | | | | | | | | | | | | | | | | | | | | | |
| Area of habitat | Yes | 48.36 | Adjusted hectares | Refer to supporting documentation | Time over which loss is averted (max. 20 years) | 20 | Start area (hectares) | 560 | Risk of loss (%) without offset | 0% | Risk of loss (%) with offset | 0% | 0.00 | 90% | 0.00 | 0.00 | 48.43 | 100.14% | Yes | | |
| | | | | | | | | | Future area without offset (adjusted hectares) | 560.0 | Future area with offset (adjusted hectares) | 560.0 | | | | | | | | | |
| | | | | | Time until ecological benefit | 20 | Start quality (scale of 0-10) | 5 | Future quality without offset (scale of 0-10) | 5 | Future quality with offset (scale of 0-10) | 6 | 1.00 | 90% | 0.90 | 0.86 | | | | | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Total quantum of impact** | **Units** | **Proposed offset** | **Time horizon (years)** | | **Start value** | | **Future value without offset** | | **Future value with offset** | | **Raw gain** | **Confidence in result (%)** | **Adjusted gain** | **Net present value** | | **% of impact offset** | **Minimum (90%) direct offset requirement met?** | **Cost ($ total)** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | | | | | | | | | | | | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | | | | | | | | | | | | | | | | |
| *Threatened species* | | | | | | | | | | | | | | | | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | | | | | | | | | | | | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | | | | | | | | | | | | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | | | | | | | | | | | | | | | | |



# Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*

2 October 2012

This guide relies on Macros being enabled in your browser.

| **Matter of National Environmental Significance** | |
|---|---|
| **Name** | Squatter Pigeon |
| **EPBC Act status** | Vulnerable |
| **Annual probability of extinction**<br>Based on IUCN category definitions | **0.2%** |

| **Key to Cell Colours** |
|---|
| User input required |
| Drop-down list |
| Calculated output |
| Not applicable to attribute |

## Impact calculator

| Protected matter attributes | Attribute relevant to case? | Description | Quantum of impact | | Units | Information source |
|---|---|---|---|---|---|---|
| *Ecological communities* | | | | | | |
| Area of community | No | | Area | | | |
| | | | Quality | | | |
| | | | Total quantum of impact | 0.00 | | |
| *Threatened species habitat* | | | | | | |
| Area of habitat | Yes | | Area | 122.1 | Hectares | Refer to supporting documentation |
| | | | Quality | 4 | Scale 0-10 | |
| | | | Total quantum of impact | 48.84 | Adjusted hectares | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Description** | **Quantum of impact** | | **Units** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | |
| *Threatened species* | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | |

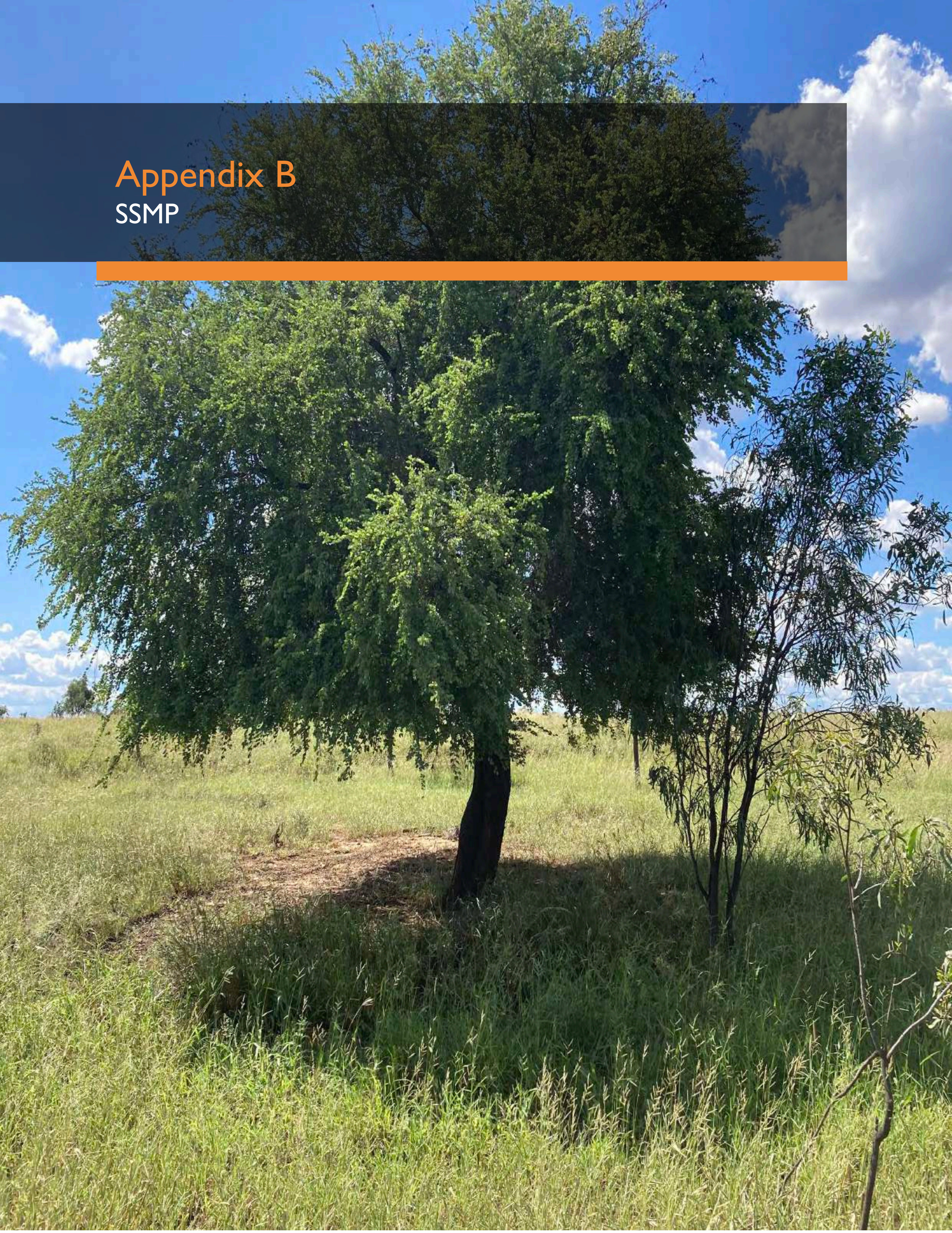
## Offset calculator

| Protected matter attributes | Attribute relevant to case? | Total quantum of impact | Units | Proposed offset | Time horizon (years) | | Start area and quality | | Future area and quality without offset | | Future area and quality with offset | | Raw gain | Confidence in result (%) | Adjusted gain | Net present value (adjusted hectares) | | % of impact offset | Minimum (90%) direct offset requirement met? | Cost ($ total) | Information source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Ecological Communities* | | | | | | | | | | | | | | | | | | | | | |
| Area of community | No | | | | Risk-related time horizon (max. 20 years) | | Start area (hectares) | | Risk of loss (%) without offset | | Risk of loss (%) with offset | | | | | | | | | | |
| | | | | | | | | | Future area without offset (adjusted hectares) | 0.0 | Future area with offset (adjusted hectares) | 0.0 | | | | | | | | | |
| | | | | | Time until ecological benefit | | Start quality (scale of 0-10) | | Future quality without offset (scale of 0-10) | | Future quality with offset (scale of 0-10) | | | | | | | | | | |
| *Threatened species habitat* | | | | | | | | | | | | | | | | | | | | | |
| Area of habitat | Yes | 48.84 | Adjusted hectares | Refer to supporting documentation | Time over which loss is averted (max. 20 years) | 20 | Start area (hectares) | 565 | Risk of loss (%) without offset | 0% | Risk of loss (%) with offset | 0% | 0.00 | 100% | 0.00 | 0.00 | 48.86 | 100.04% | Yes | | |
| | | | | | | | | | Future area without offset (adjusted hectares) | 565.0 | Future area with offset (adjusted hectares) | 565.0 | | | | | | | | | |
| | | | | | Time until ecological benefit | 20 | Start quality (scale of 0-10) | 5 | Future quality without offset (scale of 0-10) | 5 | Future quality with offset (scale of 0-10) | 6 | 1.00 | 90% | 0.90 | 0.86 | | | | | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Total quantum of impact** | **Units** | **Proposed offset** | **Time horizon (years)** | | **Start value** | | **Future value without offset** | | **Future value with offset** | | **Raw gain** | **Confidence in result (%)** | **Adjusted gain** | **Net present value** | | **% of impact offset** | **Minimum (90%) direct offset requirement met?** | **Cost ($ total)** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | | | | | | | | | | | | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | | | | | | | | | | | | | | | | |
| *Threatened species* | | | | | | | | | | | | | | | | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | | | | | | | | | | | | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | | | | | | | | | | | | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | | | | | | | | | | | | | | | | |

Appendix E

# Regional Ecosystem Fire Management Guidelines

| RE index | Bioregion | Regional Ecosystem | Description label | Fire guidelines |
|---|---|---|---|---|
| 110304 | BRB | 11.3.4 | Eucalyptus tereticornis and/or Eucalyptus spp. woodland on alluvial plains | SEASON: Late wet to early dry season when there is good soil moisture. Early storm season or after good spring rains. INTENSITY: Low to moderate. INTERVAL: 6-10 years (shorter in north of bioregion: 2 - 7 years). STRATEGY: Restrict to less than 30% in any year. Burn under conditions of good soil moisture and when plants are actively growing. Sometimes a small amount of wind may move the fire front quickly so that burn intensity is not too severe to destroy habitat trees. ISSUES: Burn interval for conservation purposes will differ from that for grazing purposes; the latter being much shorter. Management of this vegetation type should be based on maintaining vegetation composition, structural diversity, fauna habitats (in particular hollow-bearing trees and logs) and preventing extensive wildfire. Maintaining a fire mosaic will help ensure protection of habitat and mitigate against wildfires. Fire can control shrub invasives (e.g., Eremophila spp. and A. stenophylla in the red soil country in particular). Fire will also control cypress. Low to moderate intensity burns with good soil moisture are necessary to minimise loss of hollow trees. Avoid burning riparian communities as these can be critical habitat for some species. Culturally significant (scar) trees may need protection, such as rake removal of ground fuels. Planned burns have traditionally been carried out in the winter dry season; further research required. |
| 111201 | BRB | 11.12.1 | Eucalyptus crebra woodland on igneous rocks | SEASON: Late wet to early dry season when there is good soil moisture. Early storm season or after good spring rains. INTENSITY: Various. b, c: Various. Mainly low, but also moderate. INTERVAL: 6-15 years (shorter intervals north of bioregion 5 - 10 years). b, c: >3years. STRATEGY: Burn less than 30% in any year. Burn under conditions of good soil moisture and when plants are actively growing. All shrubby areas will carry fire after a good season. b, c: Low to moderate burns can help limit the spread of fires. Burn less than 30% in any year. Burn under conditions of good soil moisture and when plants are actively growing. ISSUES: Management of this fire tolerant vegetation type should be based on maintaining vegetation composition, structural diversity, animal habitats and preventing extensive wildfire. Maintaining a fire mosaic will ensure protection of habitat and mitigate against wildfires. Planned burns have traditionally been carried out in the winter dry season; further research required. b, c: Fire can be used to control weed invasions, although there are also risks of promoting weeds. |



# Appendix B

## SSMP

# Isaac Downs – MNES Significant Species Management Plan

Stanmore IP South Pty Ltd

| | |
|---|---|
| Client | Stanmore IP South |
| Reference | J0053 |

## Document Control

| | |
|---|---|
| **Title** | Isaac Downs MNES Significant Species Management Plan |
| **Job Number** | J0053 |
| **Client** | Stanmore IP South Pty Ltd |

## Document Issue

| Issue | Date | Prepared By | Reviewed/Approved By |
|---|---|---|---|
| Rev A DRAFT | 26/02/2021 | Josh Tomarchio/Craig Streatfeild | Craig Streatfeild |
| Rev B DRAFT | 06/03/2021 | Craig Streatfeild/ Jack Caleo | Richard Oldham |
| Rev O Final for submission to DAWE | 12/03/2021 | Craig Streatfeild | Richard Oldham |

# Table of Contents

# Glossary

| Term | Definition |
|---|---|
| Action Area | This area is the Project area of the proposed action that is referred to in the Isaac Downs Project environmental impact statement (EIS) and amended EIS (AEIS). The Action Area is the same as the Project area. |
| Threatened Species | Prescribed to a threatened species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). |
| EPBC Act conservation status | The EPBC Act lists threatened species in a range of categories including:<br>Extinct in the wild:<br>▪ Only known to survive in cultivation, in captivity or as a naturalised population well outside its past range; or<br>▪ Not recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a timeframe appropriate to its life cycle and form.<br>Critically Endangered:<br>▪ It is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.<br>Endangered:<br>▪ It is not critically endangered; and it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.<br>Vulnerable:<br>▪ It is not critically endangered or endangered; and<br>▪ It is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria. |
| Project Area | The area defined on Figure 1 and Figure 2. |
| Disturbance Area | The areas shown on Figures 2-7. |
| Regional ecosystem | A vegetation community within a bioregion that is consistently associated with a particular combination of geology, landform and soils. Prescribed to regional ecosystems listed under the Queensland *Vegetation Management Act 1999.* |
| Regulated vegetation | Vegetation regulated through Queensland's *Planning Act 2016* and *Vegetation Management Act 1999.* |
| Remnant vegetation | Defined under the Queensland *Vegetation Management Act 1999* as, woody vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70 % of the height and >50 % of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy. |
| Significant species and vegetation | Refers to:<br>Species listed as Critically Endangered, Endangered or Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.<br>Threatened ecological community listed as Critically Endangered, Endangered or Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Regional ecosystems with an Endangered or Of Concern biodiversity status or *Vegetation Management Act 1999* status. |
| Threatened ecological community | A community listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. |

| Term | Definition |
|---|---|
| Vegetation Management Act status | This is a statutory classification under the Queensland *Vegetation Management Act 1999*.<br>A regional ecosystem is listed as 'endangered' if:<br>Remnant vegetation for the regional ecosystem is less than 10 % of its pre-clearing extent across the bioregion; or 10-30 % of its pre- clearing extent remains and the remnant vegetation for the regional ecosystem is less than 10,000 ha.<br>A regional ecosystem is listed as 'of concern' if:<br>Remnant vegetation for the regional ecosystem is 10-30 % of its pre- clearing extent across the bioregion; or more than 30 % of its pre- clearing extent remains and the remnant vegetation extent for the regional ecosystem is less than 10,000 ha.<br>A regional ecosystem is listed 'least concern' if:<br>Remnant vegetation for the regional ecosystem is over 30 % of its pre-clearing extent across the bioregion, and the remnant vegetation area for the regional ecosystem is greater than 10,000 ha. |

# 1.0 Introduction

Base Consulting Group (Base) was commissioned by Stanmore IP South Pty Ltd (IP South), a wholly owned subsidiary of Stanmore Coal Ltd (Stanmore) to prepare this Significant Species Management Plan (SSMP) for potential impacts to listed Commonwealth fauna species from operations at the proposed Isaac Downs (ID) Project (the Project). This SSMP has been prepared to support a referral for the project under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). DAWE notified Stanmore that the ID would be a controlled action and assessed via the bilateral agreement with Queensland on 14 May 2019 (EPBC: 2019/8413).

Stanmore IP Coal Pty Ltd (IP Coal), a separate subsidiary of Stanmore, operates the Isaac Plains Mine (IPM) (Refer to Figure 1 and Figure 2) on granted mining lease (ML) 70342, ML 700016, ML 700017, ML 700018 and ML 700019, subject to an existing environmental authority (EA). These mining leases encompass the Isaac Plains Est (IPE) and Isaac Plains East Extension (IPEE) mining areas, and are located immediately to the north of ID.

As part of the Stanmore's existing IPE and IPEE projects and to address the Commonwealth's requirements, Significant Species Management Plans (SSMPs) were developed and approved. This ID SSMP has been developed as supporting information for the ID approval and to address the expectation that if approved, a SSMP would be required.

## 1.1 Background

The Project is located approximately 10 km south-east of Moranbah township in central Queensland (refer to Figure 1). ML applications 700046, 700047 and 700048 have been made for the Project. The Project MLs and EA will extend over parts of MDL 137, EPC 755, EPC 728 and EPC 548 and the Project area is shown on Figure 2.

The Project involves the following components:

- Open cut metallurgical coal mine;
- In-pit and out of pit spoil dumps;
- Flood protection levee;
- Mine infrastructure area (MIA);
- Water management infrastructure including mine water dam, sediment dams and clean water diversion;
- Access road from the Peak Downs Highway;
- Linear infrastructure corridors to connect the Project to the existing Isaac Plains Mine on ML 70342 (See Figure 2 and Figure 3) with a ROM coal haul road, power supply and water pipelines (linear infrastructure); and
- Use of existing Isaac Plains Mine CHPP, tailings management systems, and train load out facility.

## 1.2 Purpose

During the planning stage for the ID, site ecological investigations indicated that the Project has potential to impact on Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

For the ID, Stanmore is required to provide appropriate management of the EPBC Act listed species within the Project area. Listed MNES identified as being present within the ID study area and for which this SSMP applies are shown in Table 1, along with the quantum of suitable habitat for each species that is proposed to be disturbed within the ID footprint.

**Table 1: Disturbance areas for MNES identified as occurring within the ID footprint**

| MNES | EPBC Act status | Proposed disturbance area (ha) |
|---|---|---|
| Koala *(Phascolarctos cinereus)* | Vulnerable | 131.9 |
| Greater Glider *(Petauroides volans)* | Vulnerable | 120.9 |
| Squatter Pigeon (Southern) *(Geophaps scripta scripta)* | Vulnerable | 122.1 |
| Ornamental Snake (*Denisonia maculata*) | Vulnerable | 173.5 |
| Black-faced Monarch (*Monarcha melanopsis*) | Migratory | 122.2 |
| Satin Flycatcher (*Myiagra cyanoleuca*) | Migratory | 65.7 |

This SSMP presents the management objectives and measures that are proposed to be implemented within the Project footprint for species management and to minimise impacts to current biodiversity values of the site. As ID is immediately adjacent to the existing IPM, the MNES impacted are the same as those impacted by the previous IPM projects. Therefore, the previously approved SSMPs have been used as a basis for this SSMP and expanded on where relevant and necessary.

Although the ID Project has yet to be approved, this SSMP has been developed to support the approval process for the Project.

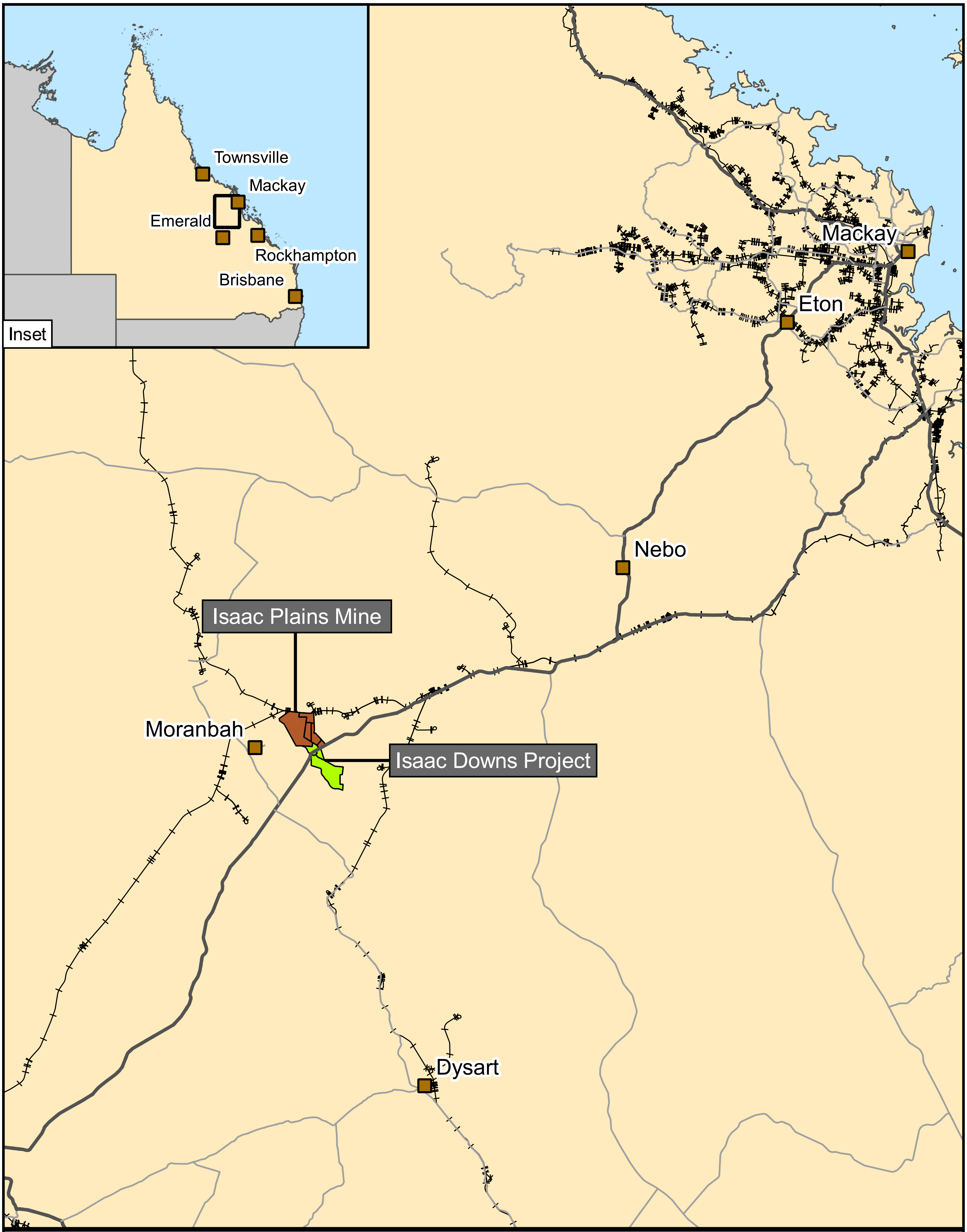


Figure 1: Site Context

Legend

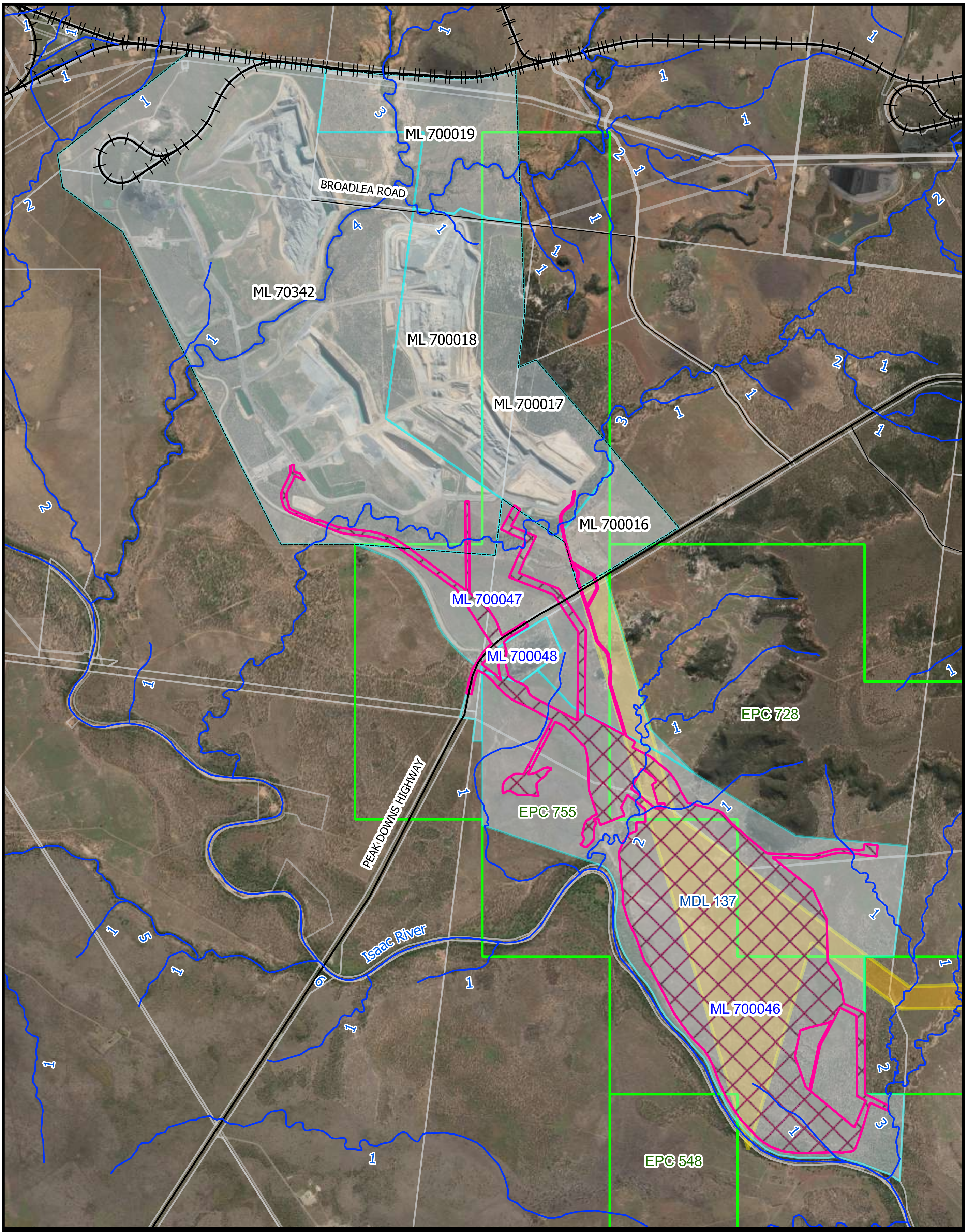
🟫 Towns
— Highways
— Roads
⊢ Rail Network
🟫 Isaac Plains East
🟩 Isaac Downs Project

0 10 20 km

Scale @ A3: 1 : 750000
Date: 09/03/2021
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Natural Resource and Mines) 2021;

BASE/



0 1 2 km

Scale @ A3: 1 : 75000
Date: 08/03/2021
Drawn: Josh T

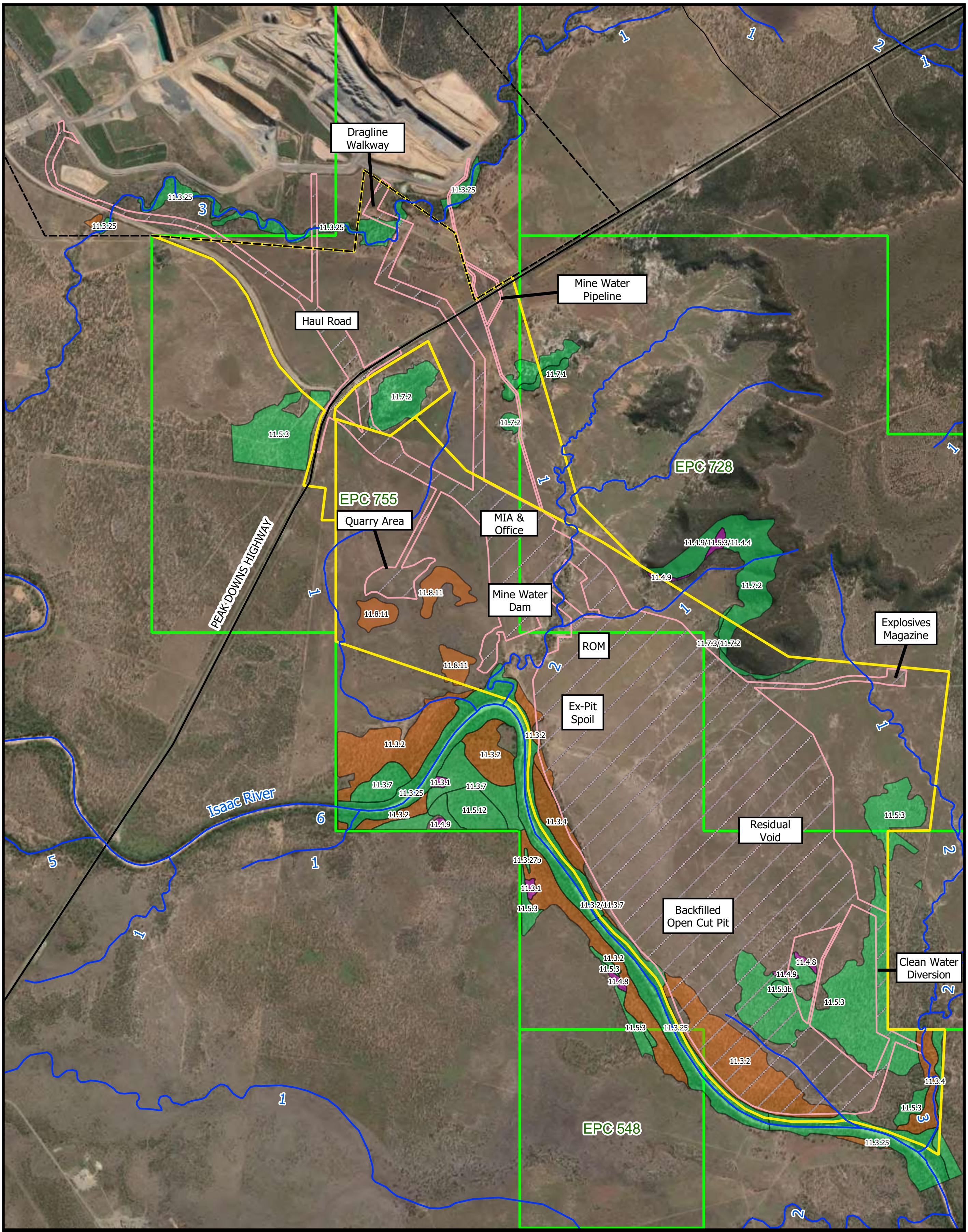
DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Natural Resource and Mines) 2021; Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 2: Project Setting

Legend

- — Watercourse
- — Highway
- — Local Roads
- ⊢ Railway
- ⬚ Isaac Plains Complex
- ☒ ID Project Layout
- ☐ Mine Lease
- 🟨 Mineral Development Licence
- 🟩 Exploration Permits (Coal)
- ☐ Cadastral Boundaries

BASE/



# Figure 3: Project Layout and Disturbance Boundaries

0 1 km

Scale @ A3: 1 : 52000
Date: 10/03/2021
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Natural Resource and Mines) 2021; Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

## Legend

— Watercourse
— Highway
— Local Road
⬚ Isaac Plains Complex
🟨 Mine Lease
▨ ID Project Layout
🟩 Exploration Permits (Coal)

**Remnant Vegetation**
🟪 Endangered
🟩 Least Concern
🟧 Of Concern

BASE/

## 1.3 Relationships to other plans

Various other management plans will be implemented to address the requirements of Commonwealth and Queensland legislation and there will be some interaction among the plans during the construction and operation phases.

The following management plans and site procedures, amongst others, as developed for the IPM or specifically for the ID are relevant to this SSMP:

- Existing approved IPM Commonwealth Species Management Plans;
- Erosion and Sediment Control Plan;
- Dust Management Plan;
- Weed and Feral Animal Management Plan;
- Permit to Disturb;
- Rehabilitation Management and Monitoring Plan;
- Offsets Area Management Plan (OAMP); and
- Approved Species Management Program (for State listed fauna species)

Prior to the commencement of construction works, the Permit to Disturb process will be used to authorise clearing and the management commitments within this SSMP will be implemented through the Permit to Disturb process.

## 1.4 Responsibilities

This SSMP, once approved by the Commonwealth, will be implemented as part of construction, operational and decommissioning contracts for the mining activities including where vegetation clearing, or other activities will result in the disturbance of fauna habitat, vegetation and soil.

All employees, contractors or other agents will be required to operate in accordance with this SSMP, once approved, as part of the activity. The Project’s Environmental Officer (EO) will be required to apply this SSMP to the activity areas and implement where necessary, corrective actions outlined in Section 5.7.

# 2.0 Regulatory framework

## 2.1 *Environment Protection and Biodiversity Conservation Act 1999* – Commonwealth

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Commonwealth Government's principal piece of environmental legislation and is administered by the DAWE. The EPBC Act is designed to protect Mattes of National Environmental Significance (MNES), which include threatened species of flora and fauna, threatened ecological communities (TECs), migratory species as well as other protected matters. The Act includes categories of threat for threatened flora and fauna, identifies key threatening processes to their survival and provides for the preparation of recovery plans for threatened flora and fauna.

Approval is required under the EPBC Act for any action (e.g. a development) that is likely to have a significant impact on MNES. Proponents of projects that are likely to have a significant residual impact refer the Project to the DAWE for a determination on whether the proposed activity requires assessment under the EPBC Act via a controlled action, and if so, the level of assessment required. For controlled actions, five different levels of assessment are possible and include assessment based on information provided in the referral, assessment by preliminary documentation, assessment by an Environmental Impact Statement (EIS), assessment by a Public Environment Report (PER) and assessment by public enquiry.

The ID Project was determined by DAWE determined be a controlled action on 14 May 2019 and assessed via an EIS under the under bilateral agreement between the Commonwealth and the Queensland Governments. This SSMP describes the management measures for listed species identified in the terrestrial ecology assessment for the Project as being present in the Project's study area as outlined in Table 23 of the EcoSM, 2020 report (included as Appendix 10 to the AEIS).

## 2.2 Environmental Offsets Policy - Commonwealth

Under the EPBC Act Environmental Offsets Policy 2012 (EPBC Act Environmental Offsets Policy), environmental offsets are actions taken to counterbalance significant residual impacts on MNES. Offsets are used as a last resort and only considered after all management actions have been considered and where significant residual impacts remains.

The EPBC Act Environmental Offsets Policy came into force in October 2012 and provides guidance on the role of offsets in environmental impact assessments and how DAWE considers the suitability of a proposed offset package (SEWPaC 2012).

## 2.3 *Environmental Offsets Act 2014* – Queensland

The *Environmental Offsets Act 2014* (EO Act), *Environmental Offsets Regulation 2014* (EO Regulation) and the Queensland Environmental Offsets Policy (Version 1.7) (QEOP) (DES, 2019) comprise the Queensland Environmental Offsets Framework. As per the offset's framework, offsets must be provided for any significant, residual impacts on Matters of State Environmental Significance (MSES). However, as stated in the EO Act, an offset for a prescribed environmental matter that has been assessed under the EPBC Act for impacts to MNES is not subject to offset conditions under the EO Act.

## 2.4 *Nature Conservation Act 1992* - Queensland

The *Nature Conservation Act 1992* (NC Act) provides for the conservation of biodiversity and threatened species within Queensland. Specifically, critical habitat areas, management of protected areas, protection of wildlife and lists the protected flora and fauna species (extinct in the wild, endangered, vulnerable, near threatened), international wildlife and prohibited wildlife.

# 3.0 Matters of national environmental significance (MNES)

As part of the Project's State and Commonwealth approvals process, detailed ecological surveys and assessments have been undertaken across the ID Project area. These surveys and assessments were undertaken, to:

- Determine the presence/absence of listed flora and fauna species within the Project area;
- Assess the vegetation characteristics and the presence of ecological communities within the Project area;
- Describe the likely adverse impacts on MNES within the Project area;
- Describe measures that would be implemented to avoid and mitigate impacts on those MNES; and
- Assess the baseline habitat quality of the impact area.

This section provides a summary of the ecological assessments undertaken to determine the likelihood of occurrence of fauna MNES to occur within the ID Project area and to assess the potential impacts to those MNES. Detailed information including habitat quality within the Project area for each of the MNES is outlined in the EcoSM, 2020 report in Appendix 10 of the ID EIS.

## 3.1 Description of the survey area

The study area is situated within Exploration Permit Coal (EPC) 755, MDL137, EPC 548 and EPC 728 (Figure 3). The study area is bisected by the Peak Downs Highway and the IPM access road in the north. The Isaac River extends along the south-western and western boundaries of the study area. Two 3rd order watercourses occur within the study area and drain towards the Isaac River: Billy's Gully in the northern portion; and an unnamed tributary in the southern portion (referred to as Southern Gully). One second order watercourse, 5 Mile Gully, extends through the central portion of the study area in a southerly direction and discharges into the Isaac River. Two 1st order drainage channels also occur within the study area and flow in a south-easterly direction across the study area towards the Isaac River.

The majority of the study area has been cleared in the past to facilitate cattle grazing activities (Figure 3). Currently, remnant woodlands and open forests generally occur along the Isaac River, Billy's Gully and Southern Gully. Remnant wattle-dominated woodland communities are associated with the prominent jumpups in the northern portion of the study area, while natural grassland communities extend through the central-northern portion of the study area. Small pockets of Brigalow dominated vegetation occur throughout the southern portion of the study area. Several small wetland communities occur on alluvial plains on the western side of the Isaac River, with another associated with a broad depression on sand plains in the south-eastern portion of the study area.

The topography within the study area is relatively flat. However, steeper slopes are associated with jump-ups in the north and the low range that adjoins the eastern boundary of the study area. The study area drains broadly in a south-westerly direction towards the Isaac River. Areas of gilgai are located within lower-lying areas in the south-eastern portion of the study area. Small seasonal wetlands also occur within the southern portion of the study area.

## 3.2 Impact assessment ecological survey effort

The detailed ecological assessment to support the initial ID EPBC referral incorporated a dry season and a wet season fauna and flora survey. The dry season surveys were conducted over nine days in late-September and early October 2018 with the wet season surveys undertaken over eight days in late February and early March 2019 (EcoSM, 2020).

A variety of flora and fauna survey methods were used to detect MNES during the assessment surveys (EcoSM, 2020 as included in Appendix 10 of the ID EIS). Flora surveys were undertaken in accordance with the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 4.0 (Nelder et al., 2017)*. Assessment sites were undertaken across the entire Project area and included both vegetation assessment sites and photo monitoring points within each vegetation community type as outlined below.

- 208 vegetation assessment sites in total comprising;
    - 38 detailed secondary sites
    - 48 tertiary sites
    - 74 modified quaternary sites
    - 48 photo monitoring sites
    - Targeted flora surveys
    - Random traverses

At 30 secondary sites detailed plots were installed and vegetation condition data collected in accordance with the Department and Environment and Science's (DES) '*Guide to determining terrestrial habitat quality, V1.2' (EHP 2017a*) (Habitat Quality Guide), which was in effect at the time of the surveys.

Fauna assessments were undertaken for the ID surveys undertaken in 2018 and 2019 and included systematic trap sites, spotlighting, call playback, infrared cameras, active searching, supplementary survey sites, harp traps, Anabat survey sites, Koala transects and observation (e.g. bird surveys and opportunistic observations). The field work consisted of systematic and supplementary survey sites and opportunistic observations and included:

- 800 Elliott A trap nights;
- 124 pitfall trap nights;
- 200 funnel trap nights;
- 41 hrs of spotlighting;
- 19 hrs nocturnal owl and Koala call playback sessions;
- 45 infrared camera trap nights;
- 58 hrs targeted diurnal bird survey hours;
- 205 hrs opportunistic incidental bird survey hours;
- 36 hrs active searching hours;
- 16 Anabat survey nights;
- 18 harp trap nights; and
- 12 Koala transects totalling 104.2 ha or survey area.

Survey methods undertaken were in accordance with applicable Commonwealth and Queensland threatened species and communities survey guidelines including:

- Commonwealth guidelines;
    - Survey guidelines for Australia's threatened birds (DEWHA, 2010a)
    - Survey guidelines for Australia's threatened bats (DEWHA, 2010b)
    - Survey guidelines for Australia's threatened reptiles (SEWPaC, 2011a)
    - Survey guidelines for Australia's threatened mammals (SEWPaC, 2011b)
    - EPBC Act referral guidelines for the vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DotE, 2014)
    - Draft referral guidelines for nationally listed Brigalow Belt reptiles (SEWPaC, 2011c)
    - SPRAT databases for relevant EPBC Act listed species and communities (as of July 2016)

- Queensland guidelines;
  - Flora Survey Guidelines – Protected Plants *Nature Conservation Act 1992* (EHP, 2014)
  - Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al., 2014).

The Commonwealth guidelines provide survey methodologies specifically for threatened flora and fauna species and ecological communities listed under the EPBC Act. The Queensland survey guidelines provide general guidance on survey methods and survey effort for assessing the presence of all species. The survey effort undertaken used a range of survey methods aimed at maximising the probability of detecting species, if they were present.

### 3.2.1 Threatened species habitat mapping

Habitat mapping was undertaken as part of the ecological assessment and was based on field verified vegetation mapping to assign areas of potential habitat based on known habitat preferences and field observations. Habitat preferences for the Greater Glider, Squatter Pigeon, Ornamental Snake and Koala are based DAWE's Species Profile and Threats Database (SPRAT) profiles and conservation advice, as well as the recent EPBC Act approvals for the current IPM projects and relevant published research and expert opinion. Habitat preferences for the Black-face Monarch and Sating Flycatcher are based on description in EcoSM, 2020, relevant conservation advice and general species profiles from published resources.

A summary of the ecological results from the ecological assessments are shown below.

***Greater Glider***

Greater Gliders were recorded at >20 locations in the study area along the Isaac River, Billy's Gully and a tributary of the Isaac River in the east of the study area (Figure 4). With the exception of one record, which was located in RE 11.3.4 along Southern Gully, all individuals were recorded within remnant Queensland Blue Gum/River Red Gum woodland (RE 11.3.25) along the Isaac River (Figure 4).

The approved conservation advice for this species (TSSC 2016) indicates that taller, moist eucalypt forest with relatively old trees and abundant hollows and a diversity of eucalypt species is favoured by this species. Using this description and in consideration of the communities in which the Greater Glider was observed in the study area and in other surveys conducted throughout Central Queensland, the riparian and alluvial communities were considered to provide the most suitable habitat for this species. These vegetation communities are considered to provide the greatest availability of large old hollow-bearing trees and provide the greatest connectivity with larger patches of remnant vegetation in the landscape.

As outlined in EcoSM, 2020 and recent EPBC Act approvals for the current IPM projects, all areas of eucalypt forests or woodlands that contain hollow-bearing trees (e.g. riparian vegetation and dry eucalypt woodland) are considered habitat for the Greater Glider. Based on this habitat definition and associated habitat mapping, there is 120.9 ha of potential Greater Glider habitat within the ID footprint (refer to Figure 4). Potential habitat conservatively includes all remnant and regenerating dry Eucalypt woodlands as well as riparian communities (EcoSM, 2020).

***Squatter Pigeon (Southern)***

Eight Squatter Pigeons were recorded from 1 location during the dry season survey period within the Popular Box woodland (RE 11.3.2). In accordance with the SPRAT profile and as outlined in recent EPBC Act approvals for the current IPM projects, the following habitat types have been identified for the species:

- Breeding habitat – Any remnant or regrowth open-forest to sparse, open- woodland or scrub dominated by *Eucalyptus, Corymbia, Acacia* or *Callitris* species, on sandy or gravelly soils (but not limited to areas mapped as Queensland land zones 3, 5 or 7) and where groundcover vegetation is less than 33% of the ground area, within 1 km of a suitable, permanent or seasonal waterbody;
- Foraging habitat – Any remnant or regrowth open-forest to sparse, open- woodland or scrub dominated by *Eucalyptus, Corymbia, Acacia* or *Callitris* species, on sandy or gravelly soils (but not limited to areas mapped as Queensland land zones 3, 5 or 7) and where groundcover vegetation is less than 33% of the ground area, within 3 km of a suitable, permanent or seasonal waterbody; and
- Dispersal habitat – Any forest or woodland occurring between patches of foraging or breeding habitat that facilitates movement between patches of foraging habitat, breeding habitat and/or waterbodies, and areas of cleared land less than 100 m wide linking areas of suitable breeding and/or foraging habitat.

Based on the above habitat definitions, there is a total of 122.1 ha of potentially suitable breeding and foraging habitat for the Squatter Pigeon in the study area which comprises (refer to Figure 5):

- 66.6 ha of breeding habitat;
- 55.5 ha of foraging habitat; and
- The
- re is also 107.6 ha of dispersal habitat.

### *Ornamental Snake*

Two individuals of the Ornamental Snake were detected in the study area during both surveys. One individual was spotlighted during the dry season survey within a patch of non-remnant vegetation supporting well-developed gilgai at supplementary site S5 (refer to EcoSM, 2020 and Figure 6). The second individual was recorded during the wet season survey while active searching at supplementary site S18 (refer to EcoSM, 2020 and Figure 6). This individual was recorded from mid-mature Brigalow with small shallow gilgai formations that grade into a very broad overland flow path.

Habitat definitions in recent IPM approvals specifies that Ornamental Snake habitat consists of gilgai mounds and depressions with cracking-clay soils and moist areas (particularly within, or close to, habitat that is known to be favoured by its prey [frogs]) with microhabitat features (i.e. logs, woody debris and leaf litter), and Brigalow threatened ecological community.

Suitable habitat for the Ornamental Snake identified in the study area (Figure 6) encompasses areas of non-remnant vegetation supporting gilgai, seasonal wetland communities (i.e. REs 11.3.27b and 11.5.3b) and Brigalow communities supporting gilgai (i.e. REs 11.3.1, 11.4.8 and 11.4.9). Therefore, this habitat within the ID footprint is mapped as potential habitat for the Ornamental Snake resulting in 173.5 ha of Ornamental Snake habitat within the ID footprint (refer to Figure 6).

### *Koala*

One Koala was identified during spotlighting along the Isaac River. Koala scats and scratch marks were also located in a number of locations along the Isaac River as well as Billy's Gully and Southern Gully.

All the areas of remnant vegetation within the study area, and particularly the riparian corridors of Isaac River, Billy's Gully and Southern Gully, are considered to provide habitat for the Koala due to the presence of the Koala feed trees. These Eucalypt and Corymbia Woodlands along the riparian zones primarily include RE 11.3.2, RE 11.3.4, RE 11.3.25, RE 11.5.3 and RE 11.5.9.

Based on the above definition, there is approximately 131.9 ha of suitable habitat for the Koala within the ID footprint (refer to Figure 7).

### *Black-faced Monarch*

One Black-faced Monarch was recorded from the Blue Gum/River Red Gum riparian woodland comprising RE 11.3.25 during the dry season surveys. Habitat for this species is likely to be restricted to more intact riparian communities associated with Isaac River (i.e. REs 11.3.2, 11.3.4, 11.3.7 and 11.3.25). However, it is considered unlikely that the study area provides important habitat for this species, as the habitat present is homogenous in the landscape and would be unlikely to form important breeding habitat for this species. There is a total of 122.2 ha of potential habitat for this species in the Project disturbance footprint.

### *Satin Flycatcher*

Two Satin Flycatchers were recorded, one within RE 11.3.25 associated with Isaac River and the other within RE 11.5.12. Habitat for this species is likely to be restricted to remnant vegetated areas within the study area, particularly the more intact riparian communities associated with Isaac River. However, it is considered unlikely that the study area provides important habitat for this species, as the habitat present is homogenous in the landscape and would be unlikely to form important breeding habitat for this species. Specifically, eucalypt forest and woodlands, at high elevations are considered breeding habitat for this species (DotE, 2015).

The Satin Flycatcher is more likely to use intact riparian woodlands associated with the Isaac River (i.e. REs 11.3.1, 11.3.2, 11.3.4, 11.3.7 and 11.3.25). There is a total of 65.7 ha of potential habitat for this species in the Project disturbance footprint.

## 3.3 Threatened fauna

Fauna assessments undertaken in support of State and Commonwealth approvals identified three fauna species listed as vulnerable under the EPBC Act as being present on site (Greater Glider, Squatter Pigeon and Ornamental Snake), one species listed as vulnerable as having the potential to occur based on habitat availability (Koala) and two migratory species (Black-face Monarch and Sating Flycatcher).

Refer to the EcoSM, 2020 in Appendix 10 of the ID AEIS for detailed information on the habitat areas within the Project area for each of the MNES as well as the areas that will be impacted through direct habitat clearing.

### 3.3.1 Greater Glider (*Petauroides volans*)

This species was recorded at a number of locations in Queensland Blue Gum/River Red Gum woodland fringing the Isaac River, Southern Gully and Billy's Gully (Figure 4).

### *Description*

EPBC Act = Vulnerable

The Greater Glider is the largest gliding possum in Australia, with a head and body length of approximately 35−46 cm and a long furry tail measuring approximately 45−60 cm. The Greater Glider has thick fur that is white or cream below and varies from dark grey, dusky brown through to light mottled grey and cream above (TSSC, 2016). The Greater Glider is nocturnal and uses tree hollows during the day to rest and/or nest (van Dyck & Strahan, 2008).

### *Distribution*

Greater Gliders are restricted to eastern Australia between Windsor Tableland in north Queensland and Wombat State Forest in central Victoria and occur from sea level up to 1,200 m above sea level. Two isolated subpopulations exist in Queensland, one in the Gregory Range west of Townsville and another in the Einasleigh Uplands (TSSC, 2016).

### General habitat preferences

The Greater Glider occurs in a range of eucalypt-dominated habitats, including low open forests along the coast to tall forests in the ranges and low woodland to the west of the Dividing Range. It does not use rainforest habitats (van Dyck & Strahan 2008; van Dyck et al., 2013). This species favours taller, montane, moist eucalypt forests with relatively old trees and abundant hollows and a diversity of eucalypt species (TSSC, 2016).

### Foraging habitat

The Greater Glider has an almost exclusive diet of eucalypt leaves but also feeds on flowers or buds (van Dyck & Strahan, 2008; TSSC, 2016). Although the species is known to feed on a range of eucalypt species, in any area it is likely to only forage on a select number of species (van Dyck & Strahan, 2008).

### Breeding habitat

Breeding occurs between March and June with only a single young born (van Dyck & Strahan, 2008; TSSC, 2016). The young stays with the mother or is left in the nest and becomes independent at about 9 months of age (Menkhorst & Knight, 2011).

### Additional information

Greater Gliders can glide over distances of up to 100 m and appear to have low dispersal ability with small home ranges of approximately 1-4 ha which appear to be related to food and nest availability. In lower productivity forests, home ranges may be as large as 16 ha for males. In general, home ranges of males do not typically overlap (TSSC, 2016) which suggests a degree of territorial behaviour.

### Nearest record

Greater Gliders were recorded within the ID study area at >20 locations five locations along the Isaac River, Billy’s Gully and a tributary of the Isaac River in the east of the study area (refer to Figure 4 and EcoSM, 2020). However, no Greater Gliders were recorded within the disturbance footprint during the ecological surveys (EcoSM, 2020).

### Suitable habitat within the project area

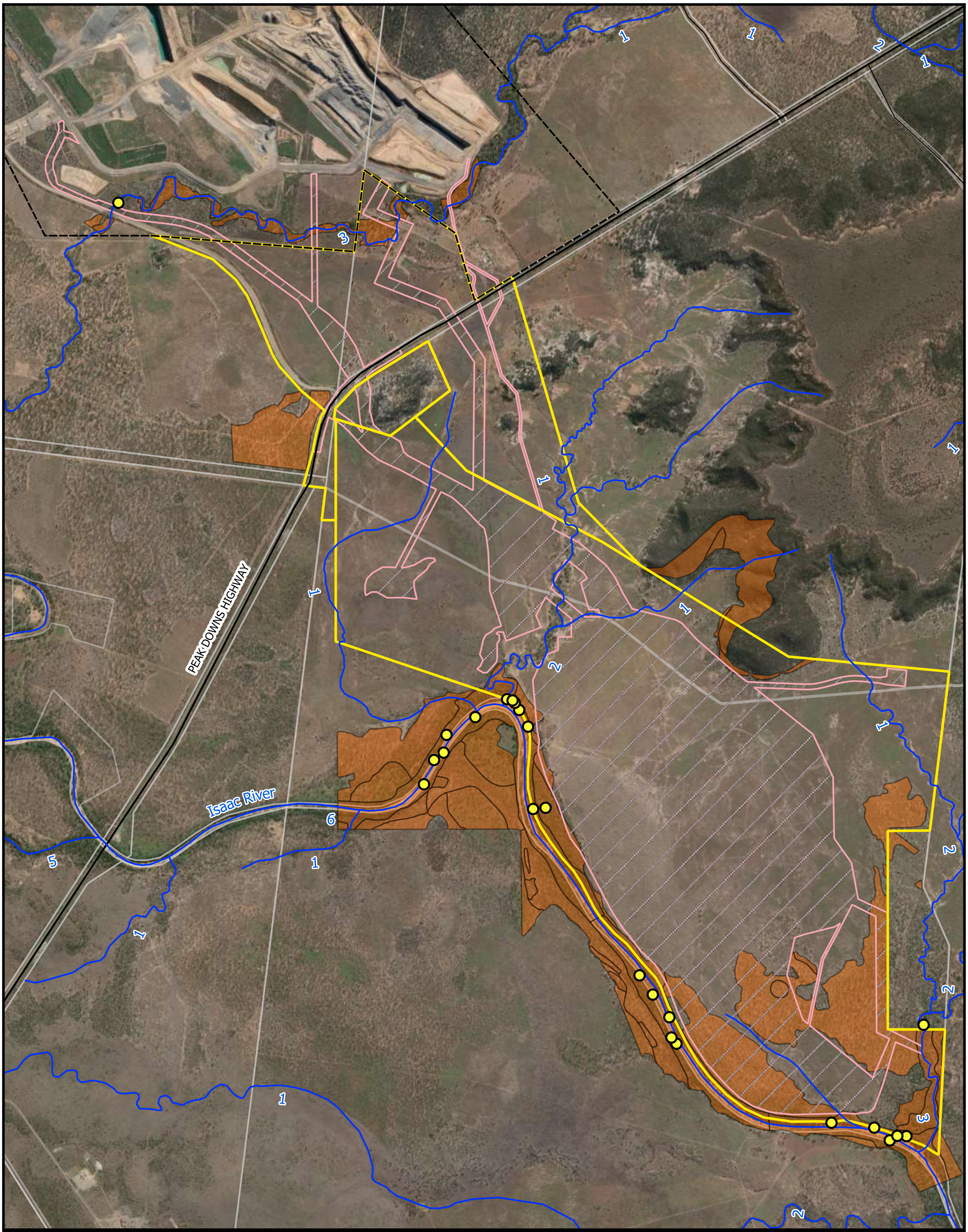
The approved conservation advice for the Greater Glider (TSSC, 2016) along with habitat definitions included in recent IPM approvals and EcoSM, 2020 suggests that all areas of Eucalypt forests or woodlands that contain hollow-bearing trees (e.g. riparian vegetation and dry eucalypt woodland) are potential Greater Glider habitat.

### Impacted habitat within the project area

Based on the above habitat definition, it is estimated that residual impacts to approximately 120.9 ha of potential Greater Glider habitat are likely to occur from the proposed Project works.

### Key threats

Key threats to Greater Gliders are habitat loss leading to increased habitat fragmentation and loss of nesting habitat in tree hollows, predation by owls and frequent and intense bushfires. Loss of hollow bearing trees and distance between habitat patches in particular, is thought to have contributed to the decline of Greater Gliders in central Queensland over the last 20 years (TSSC, 2016).



0 1 km

Scale @ A3: 1 : 52000
Date: 08/03/2021
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Natural Resource and Mines) 2021; Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

## Figure 4: Greater Glider Habitat Impacted By Project

Legend

- ● Recorded Greater Glider
- — Watercourse
- — Highway
- — Local Road
- ⬚ Isaac Plains Complex
- ☐ Mine Lease
- ▨ ID Project Layout
- ☐ Cadastral Boundaries
- ■ Greater Glider Habitat

BASE/

### 3.3.2 Squatter Pigeon – southern sub-species (*Geophaps scripta scripta*)

The Squatter Pigeon was the only threatened avian species to be recorded within the ID footprint with eight individuals recorded at one location within remnant RE 11.3.2 (refer to Figure 5).

#### *Description*

EPBC Act = Vulnerable

The Squatter Pigeon (southern) is a medium-sized ground dwelling pigeon approximately 30 cm long. Adults of both sexes are generally grey-brown with black and white stripes on the face and throat, have iridescent green or violet patches on the wings, a blue-grey lower breast and white flanks and lower belly. The southern Squatter Pigeon sub-species has a patch of blue-grey skin around the eye, whereas the northern Squatter Pigeon has an orange-red orbital skin patch (TSSC, 2015).

#### *Distribution*

Squatter Pigeons are largely restricted to Queensland with the southern sub-species of the Squatter Pigeon known to occur north of the Burdekin River, east to Townsville and Proserpine and south to the Queensland-New South Wales Border and west as far as Longreach. Where Squatter Pigeon occurs, it can be locally abundant (Reis, 2012). The known distribution of the southern sub-species overlaps with the known distribution of the northern subspecies (DotEE, 2018a).

The estimated extent of occurrence is approximately 440,000 km$^2$ (DotEE, 2018a). The estimated total population of the species is an estimate as no systematic surveys have been undertaken. However, in 2000 the population was estimated at 40,000 breeding birds (Garnett & Crowley, 2000). Given the Squatter Pigeon's ubiquitous nature and relative abundance, the population is thought to be stable at present. It is also thought this species occurs as a single, contiguous (i.e. inter- breeding) population (DotEE, 2018a).

#### *General habitat preferences*

Squatter Pigeons can occur in tropical dry, open sclerophyll woodlands and occasionally in savannah habitats with overstorey species of *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris*. Patchy groundcover layer is typical and generally consists of native, perennial tussock grasses or a mix of grasses and low shrubs or forbs. The groundcover layer rarely exceeds 33% of the ground area. It appears to favour sandy soil dissected with low gravely ridges and is less common on heavier soils with dense grass cover. Squatter Pigeons are regularly found in close proximity (within 3 km) to permanent water (DotEE, 2018a).

#### *Foraging habitat*

As per recent IPM approvals, Squatter Pigeon foraging habitat is any remnant or regrowth open-forest to sparse, open woodland or scrub dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species, on sandy or gravelly soils within (including, but not limited to, areas mapped as Queensland land zones 3, 5 or 7) and where groundcover vegetation is less than 33% of the ground area, within 3 km of a suitable, permanent or seasonal waterbody (DAWE, 2020) It feeds primarily on seeds of grasses, herbs and shrubs but is also known to consume legumes, herbs and forbs, acacia seeds, insects and ticks (DotEE, 2018a).

#### *Breeding habitat*

Squatter Pigeons nest on the ground, usually laying two eggs in sheltered positions amongst vegetation which are incubated for about 17 days. (Crome, 1976; Frith, 1982). Their breeding habitat is any remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by *Eucalyptus, Corymbia, Acacia* or *Callitris* species, on sandy or gravelly soils (including, but not limited to, areas mapped as Queensland land zones 3, 5 or 7) and where groundcover vegetation is less than 33% of the ground area, within 1 km of a suitable, permanent or seasonal waterbody (DAWE, 2020).

Squatter Pigeons typically breed from April to October, although this is variable and highly dependent on food availability (Frith, 1982, Squatter Pigeon Workshop, 2011). Nests are depressions scraped into the ground beneath a tussock of grass, bush, fallen tree or log, and sparsely lined with grass

(Frith, 1982). Chicks remain in the nest for two to three weeks and are dependent on their parents for around four weeks (DotEE, 2018a).

### *Dispersal habitat*

Any forest or woodland occurring between patches of foraging or breeding habitat that facilitates movement between patches of foraging habitat, breeding habitat and/or waterbodies, and areas of cleared land less than 100 m wide linking areas of suitable breeding and/or foraging habitat.

### *Nearest record*

Squatter Pigeons were recorded at a single location during the ecological assessments. Individuals were recorded only within remnant RE 11.3.2 associated with the Isaac River (Figure 5; EcoSM, 2020).

### *Suitable habitat within the project area*

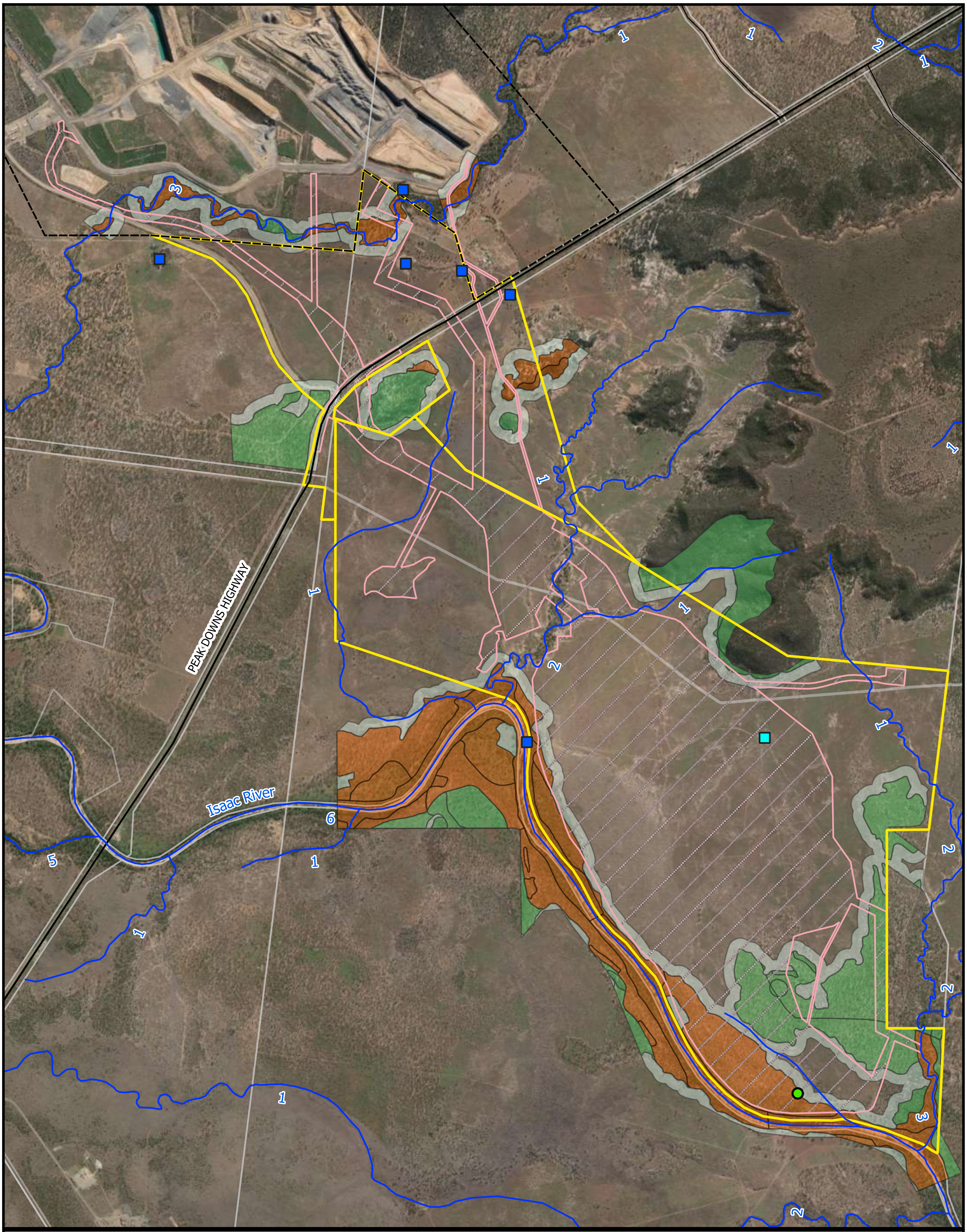
This species has a relatively broad habitat definition, i.e. grassy woodland habitat (DAWE 2020a). However, breeding habitat is more restricted and defined as any remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species, on sandy or gravelly soils within 1 km of a suitable, permanent or seasonal waterbody (EcoSM, 2020). Within the Project area, all remnant vegetation on land zones 5 and 7 (that provide sandy gravelly soils) and within 1 km of a seasonal or permanent water source is the most likely breeding habitat (refer to EcoSM, 2020).

### *Impacted habitat within the project area*

Based on the above habitat definitions, there is approximately 122.1 ha of suitable habitat for the Squatter Pigeon in the study area which comprises 66.6 ha of breeding habitat and 55.5 ha of foraging habitat (refer to Figure 5).

### *Key threats*

The primary threats to the Squatter Pigeon (southern) are ongoing habitat clearing, overgrazing of habitat by livestock and feral herbivores such as rabbits, thickening of understorey vegetation, and predation by invasive mammals such as cats and foxes (TSSC, 2015). Their habit of remaining stationary when disturbed makes them particularly vulnerable to predation and vehicle strikes. Other known threats include fragmentation of habitat, trampling of nests by domestic stock and feral herbivores, invasion of habitat by weeds such as Buffel Grass (*Cenchrus ciliaris*) drought, and bushfires (TSSC, 2015). Changes in hydrological regimes can also affect Squatter Pigeons by changing the distance between water sources and feeding habitat; affecting their movement through the landscape (Reis, 2012).



## Figure 5: Squatter Pigeon Habitat Impacted By Project

0 1 km

Scale @ A3: 1 : 52000
Date: 08/03/2021
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Natural Resource and Mines) 2021; Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

### Legend

- ● Recorded Squatter Pigeon
- ■ Permanent Water Point
- ■ Seasonal Water Point
- — Watercourse
- — Highway
- — Local Road
- ⬚ Isaac Plains Complex
- ☐ Mine Lease
- ▨ ID Project Layout
- ☐ Cadastral Boundaries

**Squatter Pigeon Habitat**

- 🟧 Breeding Habitat
- ☐ Dispersal Habitat
- 🟩 Foraging Habitat

**BASE/**

### 3.3.3 Ornamental Snake (*Denisonia maculata*)

The only threatened reptile to be recorded within the Project area was the Ornamental Snake, with a single individual recorded at two locations in the southern section of the ID footprint during the dry and wet season surveys in an area of non-remnant vegetation supporting well developed Gilga and from mid-mature Brigalow with small shallow gilgai formations that grade into a very broad overland flow path.

***Description***

EPBC Act = Vulnerable

The Ornamental Snake is a stout brown, grey-brown or grey-black snake with a darkly flecked or overall darker head with the lips distinctly barred in white/cream. The belly is white or cream with dark spots/flecks on the outer edges (TSSC, 2014). The iris is usually golden and the tail often grades to a lighter orange-brown at the tip. The Ornamental Snake is nocturnal, moving only at night. It is probably active year-round but can remain inactive in shelters for periods of months during dry conditions (SEWPaC, 2011c). Peak activity is likely to be late spring to early summer (SEWPaC, 2011c).

***Distribution***

The Ornamental Snake is only known from the Brigalow Belt North, and parts of the Brigalow Belt South Bioregions (DotEE, 2018b). The stronghold of this species is within the Fitzroy and Dawson River catchments (McDonald et al., 1991).

***General habitat preferences***

Ornamental Snakes are found in close association with frogs which form the majority of its prey and is known to favor woodlands and open forests associated with moist areas, particularly gilgais with clay soils but is also known from lake margins, wetlands and waterways. This species is most likely to be found in Brigalow (*Acacia harpophylla*), Gidgee (*Acacia cambagei*), Blackwood (*Acacia argyrodendron*) or Coolabah (*Eucalyptus coolabah)* – dominated vegetation communities or pure grassland associated with gilgais. Regional ecosystems where it has been recorded include: 11.4.3, 11.4.6, 11.4.8 and 11.4.9 and 11.3.3 and 11.5.16 (DotEE, 2018b).

Ornamental Snakes tend to shelter in logs, under coarse woody debris and in ground litter and seem to prefer a diversity of gilgai size and depth, with some fringing groundcover vegetation and timber debris, where soils are of a high clay content with deep-cracking characteristics. Habitat patches greater than 10 ha and connected to larger areas of remnant vegetation are preferred (DotEE 2018b). The IPM approvals described Ornamental Snake habitat as gilgai mounds and depressions with cracking-clay soils and moist areas (particularly within, or close to, habitat that is known to be favoured by its prey [frogs]) with microhabitat features (i.e. logs, woody debris and leaf litter), and Brigalow threatened ecological community. Further, the Draft Referral guidelines for the nationally listed Brigalow Belt reptiles describes gilgai depressions and mounds as being important habitat with habitat connectivity between gilgai and other suitable habitats also being important (SEWPaC, 2011c).

***Foraging and refuge habitat***

Soil cracks on the high ground of gilgai development provide shelter for Ornamental Snakes during dry periods, and an abundance of frogs in gilgai areas provide food resources during wet periods (Brigalow Belt Reptiles Workshop, 2010). Ornamental Snakes prefer areas with ground cover such as logs and coarse woody debris, and ground litter, which it uses for shelter (DotEE, 2018b).

***Nearest record***

This species was identified at two locations in the study area but only one location was within the Project's disturbance footprint (refer to Figure 6). Both locations supported gilgai or wetland formations that have the potential to hold water and support populations of prey species (i.e. frogs) during the wet season (EcoSM, 2020).

***Suitable habitat within the project area***

Ornamental Snakes prefer habitat that is in closely associated with its preferred prey such as moist areas within open woodlands but particularly gilgai and wetland habitat. Although the prey of Ornamental

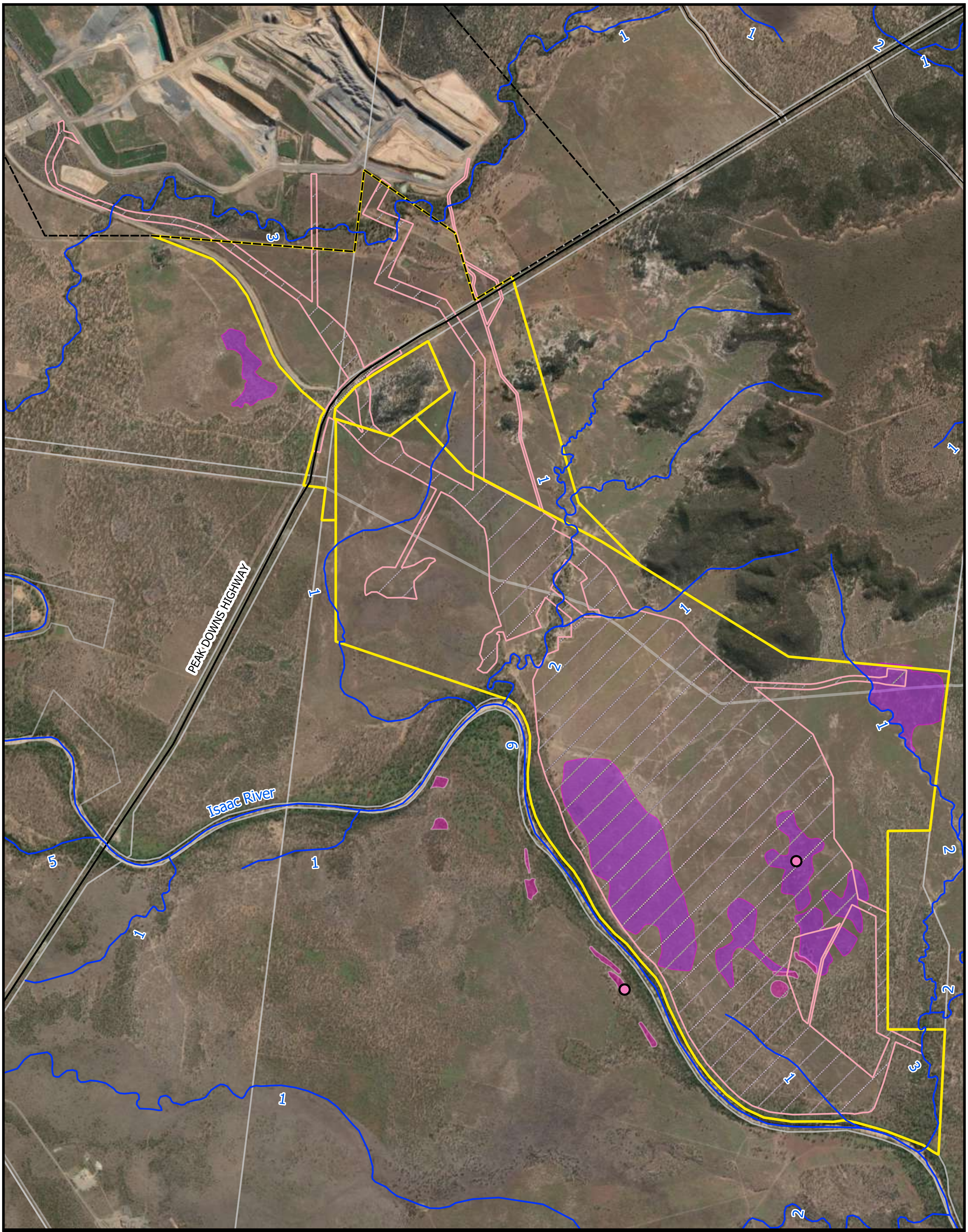
Snakes were identified as occurring within the Project area including several of its preferred frog species including the Sotted Marsh Frog, Ornate Burrowing Frog and the Broad-palmed Rocket Frog, suitable habitat within the Project area, is limited. Suitable habitat for the Ornamental Snake identified in the study area (Figure 6) encompasses areas of non-remnant vegetation supporting Gilgai, seasonal wetland communities (i.e. REs 11.3.27b and 11.5.3b) and Brigalow communities supporting gilgai (i.e. REs 11.3.1, 11.4.8 and 11.4.9).

### *Impacted habitat within the project area*

There are approximately 173.5 ha of suitable habitat for the Ornamental Snake in the Project's footprint area consisting of remnant Brigalow and wetland habitat and cleared paddock supporting gilgai (Figure 6)

### *Key threats*

The primary threats to the Ornamental Snake are historical broad-scale habitat clearing for grazing and habitat degradation by cattle (TSSC, 2014; Cogger et. Al., 1993) combined with ongoing habitat loss for agriculture and development (Cogger et. al., 1993). Feral pigs are also of great concern, given their degradation of wet areas, competition for frog prey (TSSC, 2014) and potential predation on snakes they encounter. Additional threats include alteration of landscape hydrology and water quality in gilgai environments (which affect the primary prey species of the Ornamental Snake), invasive weeds, and predation by feral predators (foxes and cats) (Eco Logical Australia, 2015).



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Scale @ A3: 1 : 52000
Date: 08/03/2021
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Natural Resource and Mines) 2021; Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 6: Ornamental Snake Habitat Impacted By Project

Legend

- ● Recorded Ornamental Snake
- — Watercourse
- — Highway
- — Local Road
- ⌜⌟ Isaac Plains Complex
- ☐ Mine Lease
- ▨ ID Project Layout
- ☐ Cadastral Boundaries

**Ornamental Snake Habitat**

- ■ Gilgai In Cleared Paddocks
- ■ Gilgai In Remnant Vegetation

BASE/

### 3.3.4 Koala (*Phascolarctos cinereus*)

One Koala was identified during spotlighting along the Isaac River. Koala scats and scratch marks were also located in a number of locations along the Isaac River as well as Billy's Gully and Southern Gully (Figure 7).

#### *Description*

EPBC Act = Vulnerable

The Koala is one of Australia's most distinctive wildlife species (TSSC, 2012). It is a large grey, arboreal mammal with woolly fur, long black claws, a large black nose, fluffy ears, and no tail (van Dyck & Strahan, 2008). They have a head and body length of approximately 65−74 cm depending on sex with males larger than females and they can weigh up to 9 kg (van Dyck & Strahan, 2008).

#### *Distribution*

The Koala is found in eastern Australia in fragmented populations, from the temperate south to the tropical north. In Queensland, the Koala is widespread in sclerophyll forest and woodlands on foothills and plains on both sides of the Great Dividing Range from about Chillagoe, Queensland to Mt Lofty Ranges in South Australia (Menkhorst & Knight, 2011).

#### *General habitat preferences*

Koalas use a range of habitats, including temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by Eucalyptus species. However, they are strongly associated with eucalypt forests which it feeds on (van Dyck & Strahan, 2008). Habitat quality for Koalas is based on the identification of local preferences for food tree species and quantification of the availability of those species (Phillips et al., 2000). Any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees provides potential Koala habitat. The Koala is also known to occur in modified or regenerating native vegetation communities (DoEE, 2017c).

#### *Foraging and refuge habitat*

Koalas rely on eucalyptus trees for food and shelter. This species feeds on approximately 50 different eucalypt species across its range, with food preferences varying locally and across regions (Krockenberger et al., 2012). The South East Queensland Koala Conservation State Planning Regulatory Provisions define Koala food trees as species of the *Corymbia*, *Melaleuca*, *Lophostemon* or *Eucalyptus* genera (DES, 2017; DotEE, 2017c).

It has been suggested that shelter (non-food) trees are important to Koalas, with Crowther et al. (2013) indicating that shelter trees are equally important as food tree. Shelter trees play an essential role in thermoregulation and are likely to be selected based on height, canopy cover and elevation, with large trees occurring in gullies being preferable (Crowther et al., 2013).

In the drier regions of the Burdekin, Isaac, Whitsunday and Charters Towers Shires, Koalas prefer to feed and shelter in Forest Red Gum (*Eucalyptus tereticornis*) and River Red Gum (*E. camaldulensis*) but are also known to feed on Brown's box (*E. 21rownie*), Dawson River blackbutt (*E. cambageana*), Coolabah (*E. coolabah*), Queensland peppermint (*E. exserta*), Gum-topped box (*E. moluccana*), Yapunyah (*E. ochrophloia*), Mountain coolabah (*E. orgadophila*) and Poplar Box (*E. populnea*).

#### *Breeding habitat*

In Queensland, Koalas breed between September and April (Krockenberger et al., 2012). Female Koalas can breed annually, from 2 years of age (van Dyck & Strahan, 2008). Koala joeys remain in the pouch for approximately 6 months and become independent at 12 months of age (van Dyck & Strahan, 2008).

#### *Additional information*

The Koala is solitary, mostly nocturnal and spends much of its time in distinct home ranges which vary in size depending on availability of food and shelter resources (van Dyck & Strahan, 2008). In areas of high quality habitat, home ranges overlap extensively and can be quite small (1−2 ha) but are discrete and larger (100 ha) at lower abundances and in less favourable habitat (van Dyck & Strahan, 2008). Young female Koala's often stay in similar areas as their mother, whereas males disperse to new areas once they reach 2−3 years old. At Blair Athol in central Queensland, home ranges are estimated at 135 ha for males and 101 ha for females (Ellis et al., 2009).

The Koala is inactive for a large portion of the day (van Dyck & Strahan, 2008) with movements between feeding trees species generally occurring at dawn, dusk and night (Crowther et al. 2013). These moves can be several hundred metres making Koalas particularly vulnerable to attacks by wild and domestic dogs. Koala activity generally peaks between August and January, and breeding females with back-young are most easily observed at this time (DotEE, 2017c). Individuals tend to use the same set of trees, but generally not at the same time, and they change trees only a few times per day (TSSC, 2012).

### *Nearest record*

One Koala was identified during spotlighting along the Isaac River within the study area; however, this location occurs outside the disturbance footprint (Figure 7). Koala scats and scratch marks were also located in a number of locations along the Isaac River as well as Billy's Gully and Southern Gully (refer to Figure 7).

### *Suitable habitat within the project area*

Based on the SPRAT habitat description and the habitat definition included in recent IPM approvals, any forest or woodland (including remnant, regrowth and modified vegetation communities) containing species that are Koala food trees or any shrubland with emergent Koala food trees are considered Koala habitat. This equates to regional ecosystems dominated by Eucalypt and Corymbia species and include 11.3.2, 11.3.25, 11.5.3, 11.5.8b, 11.5.9, 11.5.12, 11.7.2, 11.8.5 and 11.9.7a. Some areas of non-remnant vegetation with emergent food tress such as Narrow-leaved Red Ironbark also provide potential habitat (EcoSM, 2020).

### *Impacted habitat within the project area*

Based on the above habitat definition, residual impacts to approximately 131.9 ha of Koala habitat are likely to occur from the proposed Project works (refer to Figure 7).

### *Key threats*

Primary threats to the Koala are the loss and fragmentation of habitat resulting in loss of food and shelter trees, increased risk of vehicle strike, dog attacks and isolation of populations (TSSC, 2012). Habitat fragmentation results in isolated high-density population areas where the risk of disease transmission is increased and the potential to recolonise dryland areas post-drought is impeded (TSSC, 2012). Wildfire and drought are semi-natural processes that are also considered to threaten Koala populations, particularly in dryland areas where water sources and the availability of shelter trees have been anthropogenically altered (TSSC, 2012).

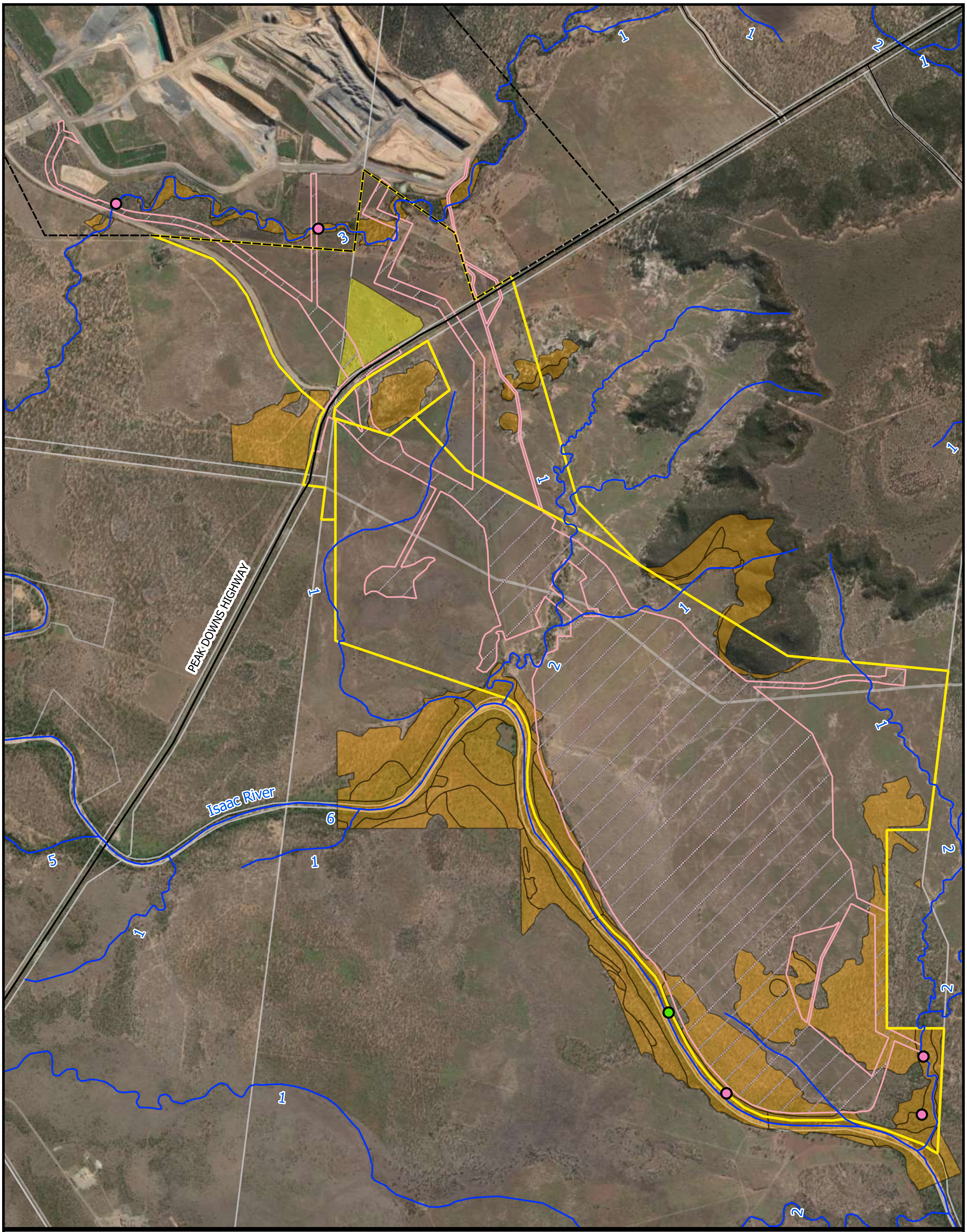


Figure 7: Koala Habitat Impacted By Project

0 1 km

Scale @ A3: 1 : 52000
Date: 08/03/2021
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Natural Resource and Mines) 2021; Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- ● Recorded Koala
- ● Recorded Evidence Of Koala
- — Watercourse
- — Highway
- — Local Road
- ⬚ Isaac Plains Complex
- ☐ Mine Lease
- ▨ ID Project Layout
- ☐ Cadastral Boundaries
- 🟧 Koala Habitat
- 🟨 Marginal Koala Habitat

BASE/

### 3.3.5 Black-faced Monarch (*Monarcha melanopsis*)

One individual was recorded in the ID study area from Queensland Blue Gum/River Red Gum woodland (RE 11.3.25) fringing the Isaac River during the dry season survey.

***Description***

EPBC Act = Migratory

The Black-faced Monarch has a distinctive black face that does not extend across the eyes, grey upperparts, wings and upper breast, contrasting with a rufous (red-orange) belly. The dark eye has a thin black eye ring and a lighter area of pale grey around it. The blue-grey bill has a hooked tip. Young birds are similar but lack the black face, have a black bill and tend to have a brownish body and wings. The Black-faced Monarch is one of the monarch flycatchers, a forest and woodland-dwelling group of small insect-eating birds and is strictly arboreal (found in trees).

***Distribution***

The movements of the Black-faced Monarch are reasonably well known, with the species flying across Torres Strait from their wintering grounds in southern New Guinea to their breeding areas in eastern Australia. The species is considered widespread in eastern Australia (DAWE, 2020). In Queensland, it is widespread from the islands of the Torres Strait and on Cape York Peninsula, south along the coasts (occasionally including offshore islands) and the eastern slopes of the Great Divide, to the New South Wales border (DAWE, 2020).

***General habitat preferences***

The Black-faced Monarch is found in a range of rainforests, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest. As well as, eucalypt woodlands and forest (mainly wet sclerophyll), especially in gullies with a dense, shrubby understorey as well as in dry sclerophyll forests and woodlands, often with a patchy understorey. The species especially occurs in 'marginal' habitats during winter or during passage (migration). The species also occurs on coastal scrubs dominated by Coast Banksia (Banksia integrifolia) and Southern Mahogany (*Eucalyptus botryiodes*), rainforest gullies, mountain gullies and damp gullies, as well as softwood scrub dominated by Brigalow (*Acacia harpophylla*) (Leach 1995), occasionally among mangroves and sometimes in suburban parks and gardens (DAWE 2020e; Pizzey et al. 2012). It may also be found in more open woodland when migrating. These habitat communities are described as important habitat under the EPBC Act (DAWE 2020e).

***Foraging and refuge habitat***

The Black-faced Monarch feeds mostly in rainforest but also in open eucalypt forest. They forage at all vertical levels of the forest, though most often at low or middle levels, within 6 m of the ground. They collect most prey from the foliage, and to a lesser extent, branches and crevices of trees and shrubs. They may also catch prey in the air, but very rarely feed on the ground or from the trunks of trees and from loose bark (DAWE, 2020).

The species builds nests about 3 m to 6 m above the ground. However, the species is strictly arboreal (found in trees).

***Breeding and feeding habitat***

The Black-faced Monarch breeds in rainforest habitat, and generally nests near the top of trees with large leaves, in the tops of small saplings, or in lower shrubs. The species builds a deep cup nest of casuarina needles, bark, roots, moss and spider web in the fork of a tree, about 3 m to 6 m above the ground. Only the female builds the nest, but both sexes incubate the eggs and feed the young. Breeding season is between the months of October to January. Clutch size can vary between two to three eggs (DAWE, 2020).

### *Nearest record and suitable habitat within the project area*

This species was found within the ID study area but outside the disturbance footprint, from Queensland Blue Gum/River Red Gum woodland (RE 11.3.25) fringing the Isaac River (EcoSM, 2020).

### *Impacted habitat within the project area*

Based on the above habitat definition, there are approximately 122.2 ha of potential overfly habitat for the lack-faced Monarch habitat in the proposed Project area (EcoSM, 2020).

### *Key threats*

There are generally considered to be few threats to populations of the Black-faced Monarch (DAWE, 2020). However, in Australia, potential threats include (DAWE, 2020):

- Collision with lighthouses, windows.

### 3.3.6 Satin Flycatcher (*Myiagra cyanoleuca*)

This species was recorded at two locations in the study area. One individual was recorded in RE 11.3.25 associated with Isaac River and the other within RE 11.5.12 (Figure 8).

#### *Description*

EPBC Act = Marine/Migratory

The Satin Flycatcher has a length around 17.5 cm, a wingspan of 23 cm and a weight of 17 g. The species is characterised by an upright posture, short erectile crest, and a distinctive habit of quivering the tail when perched. Males are glossy blue-black above, with a blue-black chest and white below, while females are duskier blue-black above, with a orange-red chin, throat and breast, and white underparts and pale-edged wing and tail feathers. Young birds are dark brown-grey above, with pale streaks and buff edges to the wing feathers, and a mottled brown-orange throat and chest (Higgins et al. 2006).

#### *Distribution*

The Satin Flycatcher is widespread in eastern Australia and vagrant to New Zealand (Blakers et al. 1984; Coates 1990a). In Queensland, it is widespread but scattered in the east, being recorded on passage on a few islands in the western Torres Strait. It is patchily recorded on Cape York Peninsula, from the Cape south to a line between Aurukun and Coen. The species is more widespread farther south, though still scattered, from Musgrave Station south to c. 24° S, mostly in coastal areas, but also on the Great Divide, and occasionally further west (Blakers et al. 1984).

Satin Flycatchers are widespread in south-eastern Queensland, in the area from Fraser Island, west to Goombi and south to the NSW border (Blakers et al. 1984). In NSW, they are widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains (Blakers et al. 1984; Cooper & McAllan 1995; Morris et al. 1981).

#### *General habitat preferences*

Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests (Blakers et al. 1984; Emison et al. 1987; Officer 1969). Satin Flycatchers mainly inhabit eucalypt forests, often near wetlands or watercourses. They also occur in eucalypt woodlands with open understorey and grass ground cover and are generally absent from rainforest (Emison et al. 1987; Officer 1969). Satin Flycatchers are mainly recorded in eucalypt forests, especially wet sclerophyll forest, often dominated by eucalypts such as Brown Barrel, *Eucalypt fastigata*, Mountain Gum, *E. dalrympleana*, Mountain Grey Gum, Narrow-leaved Peppermint, Messmate or Manna Gum, or occasionally Mountain Ash, *E. regnans*. Such forests usually have a tall shrubby understorey of tall acacias, for example Blackwood, *Acacia melanoxylon*. They sometimes also occur in dry sclerophyll forests and woodlands, usually dominated by eucalypts such as Blakely's Red Gum, *E. blakelyi*, Mugga Ironbark, *E. sideroxylon*, Yellow Box, White Box, *E. albens*, Manna Gum or stringybarks, including Red Stringybark, *E. macrorhyncha* and Broad-leaved Stringybark, usually with open understorey (Ford & Bell 1981; Traill et al. 1996).

During migration, this species prefers coastal forests, woodlands, mangroves, gardens and open country (Pizzey et al. 2012). More common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands this species prefers open, grassy habitats. Habitat becomes more varied during migration and includes most wooded habitats except rainforests, although wintering birds may use rainforests in northern Queensland.

This species is typically associated with heavily vegetated gullies in forests and taller woodlands and during migration coastal forests, woodlands, mangroves, gardens and open country (Pizzey et al. 2012).

### *Foraging and refuge habitat*

Satin Flycatchers are mainly insectivorous, preying on arthropods, mostly insects, although very occasionally they will also eat seeds. They are arboreal foragers, feeding high in the canopy and subcanopy of trees, usually sallying for prey in the air or picking prey from foliage and branches of trees, flitting from one perch to another, constantly wagging their tail

### *Breeding and feeding habitat*

Satin Flycatchers prefer to nest in a fork of outer branches of trees, such as paperbarks, eucalypts, and banksias. From 83 records in the Birds Australia Nest Record Scheme 2002, 78 (94%) were in eucalypts, including Tasmanian Blue Gum, Manna Gum, Broad-leaved Peppermint, Mountain Grey Gum, Narrow-leaved Peppermint, Messmate, Mountain Gum, Snow Gum, Broad-leaved Stringybark, Sydney Peppermint and Yellow Box. Satin Flycatchers usually nest in a high, exposed position in a slender fork on an outer branch, also on dead horizontal branches and once on a branch which curved upwards in a shallow bow, with the nest at the highest part of the curve (BA NRS 2002). They nest in the same locality each year, and sometimes in the same tree (BA NRS 2002). The average height of the nest is 12.3 m (BA NRS 2002).

### *Nearest record and suitable habitat within the project area*

This species was recorded at two locations in the study area but outside the disturbance footprint. One individual was recorded in RE 11.3.25 associated with Isaac River and the other within RE 11.5.12 during the dry season fauna survey.

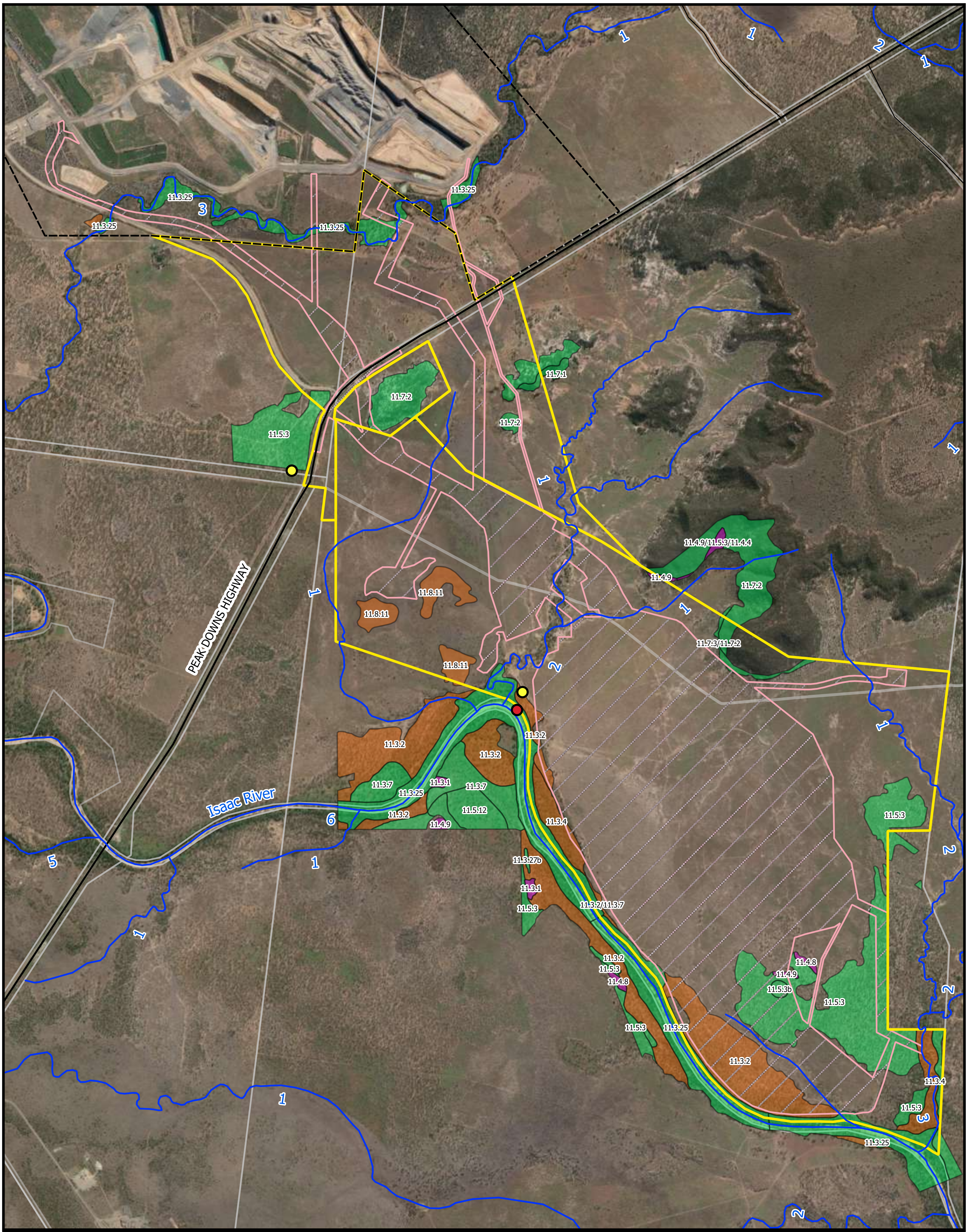
### *Impacted habitat within the project area*

The Satin Flycatcher is more likely to use intact riparian woodlands associated with the Isaac River (i.e. REs 11.3.1, 11.3.2, 11.3.4, 11.3.7 and 11.3.25). There is a total of 470.9 ha of potential habitat for this species in the study area, of which 65.7 ha falls within the Project disturbance footprint.

Based on the above habitat definition, there are approximately 65.7 ha of potential habitat for the Satin Flycatcher habitat in the proposed Project area.

### *Key threats*

Populations of the Satin Flycatcher have been reduced by clearing and logging of forests in south-eastern Australia, mainly the loss of mature forests (Blakers et al. 1984). Satin Flycatchers are largely absent from regrowth forest.



# Figure 8: Migratory Birds Habitat Impacted By Project

Scale @ A3: 1 : 52000
Date: 08/03/2021
Drawn: Josh T

DATA SOURCE
BASE CONSULTING GROUP 2021; QSPATIAL 2021; The State of Queensland (Department of Natural Resource and Mines) 2021; Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

## Legend

- ● Recorded Black-faced Monarch
- ● Recorded Satin Flycatcher
- — Watercourse
- — Highway
- — Local Road
- ⌐ Isaac Plains Complex
- ☐ Mine Lease
- ▨ ID Project Layout
- ☐ Cadastral Boundaries

**Remnant Vegetation**

- 🟪 Endangered
- 🟩 Least Concern
- 🟧 Of Concern

BASE/

# 4.0 Impact assessment

This section of the report summarises the likely impacts of the Project on the EPBC Act listed fauna species outlined in Section 0 (refer to EcoSM, 2020 for a detailed impact assessment). Project activities that have the potential to impact vegetation communities and fauna habitat include:

- Direct impacts from vegetation clearing; and
- Indirect impacts such as the effects of the introduction or spread of invasive species, groundwater drawdown, habitat fragmentation, erosion and sedimentation, vehicle strike, noise and dust.

These impacts are described in this section and mitigation measures for these impacts are outlined in Section 5.7.

## 4.1 Direct impacts

The ID layout and disturbance footprint is shown in Figure 2 and Figure 3. The Project involves clearing of remnant and non-remnant vegetation for open cut mining activities and associated infrastructure including:

- Open cut pit mining activities;
- In-pit and out of pit spoil dumps;
- Mine infrastructure area;
- Access road from the Peak Downs Highway
- Linear infrastructure corridors to connect the Project to the existing IPM on ML 70342 with a coal haul road, power supply and water pipelines; and
- Quarrying areas for extraction of hard rock.

The proposed disturbance footprint encompasses an area of approximately 1,157.0 ha comprised of 1,135.0 ha within the proposed Isaac Downs MLs and 22.0 ha in the IPM MLs. The proposed disturbance footprint has been designed to avoid impacts to remnant vegetation and fauna habitat as much as practically possible. In areas where impacts to vegetation communities, flora species and fauna habitat cannot be avoided, control measures have been designed to minimise impacts on vegetation and habitat as far as practical. Clearing for mining activities will be undertaken gradually over a period of approximately 16 years as the open cut pit is progressed. Clearing will cause a direct impact by removing areas of vegetation that may also support habitat features for threatened species. Disturbed areas will be progressively rehabilitated during mining with final rehabilitation completed once mining has ceased. This will minimise the area of disturbed ground at any one time and encourage fauna to move away from the disturbance area of their own accord.

### 4.1.1 Impacts to threatened fauna species

The main impact to threatened fauna as a result of the Project will come from vegetation clearing which will result in the loss and reduction in species habitat. The majority of clearing associated with the Project will occur within non-remnant vegetation. However, approximately 122.2 ha of remnant vegetation will be cleared as a result of the Project. Further, some areas of non-remnant vegetation that will be impacted provide suitable habitat (e.g. gilgai) for various threatened species (refer to Figure 3 for the clearing footprint). The proposed clearing footprint includes some areas of endangered Brigalow woodland (which are also a part of the Brigalow TEC) vegetation, regulated vegetation (i.e. of concern REs, vegetation management wetlands and watercourse REs) and protected wildlife habitat (refer to EcoSM, 2020 in Appendix 10 of the ID EIS for further information).

As outlined in EcoSM, 2020 (Appendix 10 of the ID EIS) crossings of 5 Mile Gully and Billy's Gully will be required for linear infrastructure (i.e. haul roads, transmission line, water pipelines, dragline walk route) with potential for vegetation clearing, construction impacts, and changes to flow (depending on design criteria of the crossings). There will be no direct impacts to remnant vegetation associated with 5 Mile Gully. However, where linear infrastructure crosses Billy's Gully, impacts to remnant least concern vegetation (i.e. RE 11.3.25) will be required.

A summary of the potential fauna habitat areas proposed to be cleared for each EPBC Act listed species is outlined below in Table 2 and included in EcoSM, 2020. It is important to note that the impact areas are not additive as for example, Koala and Greater Glider habitats overlap.

**Table 2: Fauna habitat within the disturbance footprint**

| Species | EPBC Act conservation status | Total area of potential suitable habitat within the ID footprint (ha) |
|---|---|---|
| Greater Glider | Vulnerable | 131.9 |
| Squatter Pigeon (southern) | Vulnerable | 120.9 |
| Ornamental Snake | Vulnerable | 122.1 |
| Koala | Vulnerable | 173.5 |
| Black-faced Monarch | Migratory | 122.2 |
| Sating Flycatcher | Migratory | 65.7 |

## 4.2 Indirect impacts

The Project has potential to have indirect impacts on the ecological values of the remaining vegetation and habitat following the proposed clearing. The potential for indirect impacts to occur are primarily related to:

- Habitat fragmentation and associated habitat degradation such as edge effects;
- Potential spread and/or introduction of weeds and pest animals;
- Increased noise, vibration, dust and light;
- Potential fauna injury and/or mortality due to vehicle strikes; and
- Erosion of disturbed areas leading to increased sedimentation of waterways.

### 4.2.1 Habitat fragmentation

Vegetation clearing can result in fragmenting the remaining habitat which can have adverse impacts on fauna species by restricting or inhibiting fauna movement. Clearing for this Project will further fragment habitat.

The majority of the Project's footprint is located in non-remnant vegetation (Figure 3). However, fragmentation of remnant vegetation will result where linear infrastructure (i.e. roads, transmission lines, water pipelines, clean water diversion) intersects with remnant vegetation mapped in the southern portion of the Project and along Billy's Gully. This has the potential to fragment fauna habitat and create barriers (i.e. cleared corridors) which may impair movement of some species, and impact connectivity of habitat. In some areas, fragmentation may isolate some smaller vegetation polygons. However, many areas within the study area were found to already be cleared and fragmented due to cattle grazing, as well as the presence of existing roads.

The Project will result in a reduction in the width of remnant vegetation associated with Isaac River corridor. However, the connectivity of remnant riparian vegetation along the length of the Isaac River riparian corridor will be maintained, not severed by the Project layout. A 50 to 200 m setback between the proposed construction area for the levee and the high bank of the Isaac River has been included in the Project layout. This setback is consistent with the above recommendations to maintain terrestrial habitat associated with watercourses. The width of the setback and to some extent the levee itself, will reduce the penetration of indirect impacts such as light, dust and noise, generated from the mine into the Isaac River riparian corridor. In addition, a number of measures are proposed to manage these indirect impacts to the extent they will not have a significant impact on retained habitat adjacent to the mine. As shown in the detailed levee drawings in AEIS Chapter 4 and the RE mapping in Figure 10 of Appendix 10 to the ID AEIS, vegetation associated with RE 11.3.25 along the Isaac River riparian corridor will not be impacted. There are some small areas of vegetation clearing associated with RE 11.3.4 in the northern section of the levee, but the buffer zone in this area is up to 200 m, and was designed to maximise avoidance of impacts on RE 11.3.4. In the southern section of the levee, RE

11.3.2 is within the footprint of the Project, but this RE is described as Poplar Box woodland on alluvial plains, and is in an area subject to grazing, historical fragmentation and with a moderately degraded groundcover with exotic pasture species. However, areas of RE 11.3.2 that fringe RE 11.3.25 remain within the buffer zone and will not be impacted.

It is unlikely that mining operations will deter fauna from using the riparian corridor and adjacent habitats. Further, the remnant vegetation communities and associated fauna habitat on the opposite side of the Isaac River to the Project, will be retained and are also unlikely to be significantly affected by indirect impacts. It is anticipated that the Isaac River riparian corridor will continue to provide safe movement opportunities for dispersing wildlife, as well as providing refuge during extended dry periods and natural disturbances such as bushfire.

### 4.2.2 Pest plants and animals

The ID is located within a highly modified landscape of grazing activities, and coal mining infrastructure. Hence, weeds, introduced plants and some feral predators are present. During the ecological assessments undertaken for the Project, eight Queensland declared pest plants were recorded with and included Mother of Millions, Rubber Vine, Harrisia Cactus, Bellyache Bush, Common Lantana, Common Prickly Pear, Velvety Tree Pear and Parthenium (EcoSM, 2020). Buffel Grass, although not a declared weed but a significant environmental weed, was also common throughout the Project area. Although the potential exists for the Project to introduce weeds through vehicles, plant, workers and materials that will enter site from various locations, it is unlikely as the Project area is already highly disturbed and as such, the proposed works are unlikely to increase the presence of weeds.

Several pest animals were recorded during the ecological surveys including the Cane Toad, Wild Dogs, Feral Cats, Feral Pig and European Rabbit. Although not seen, it is likely the European Fox and Black Rat are also present within the Project area. As these animals can readily move throughout the landscape, activities from the Project are unlikely to introduce new pest animals to the area (refer to Risk Assessment in Section 8.0).

Although the Project is unlikely to introduce new plant and animal pests or lead to an increase of pests, the Project has management measures in place at the adjacent IPM to manage plant and animal pests, and these will be extended to ID. These measures are outlined in Section 5.7.

Impacts from pest animals and plants have the potential to impact on all MNES species shown in Table 2.

### 4.2.3 Predation

The ecological assessments identified Wild Dogs and Feral Cats as being present in the Project area and the European Fox and Feral Pigs as likely to be present. The Greater Glider, Squatter Pigeon, Ornamental Snake and Koala all suffer from predation to varying degrees and predation is listed as a threat in the respective species EPBC Act conservation advice. Feral fauna pests as well as wild dogs all have the potential to prey on these species. Predation impacts will be mitigated through the implementation of plant and pest animal management and monitoring measures, based on the existing Isaac Plains Mine.

Predation from feral animals has the potential to impact on the Greater Glider, Squatter Pigeon, Koala and Ornamental Snake.

### 4.2.4 Noise and vibration

Noise and vibration will be generated from a range of sources including mining equipment and operations, excavators and blasting activities.

Noise from these activities may cause changes to the behavioural ecology of some species by modifying feeding, foraging and breeding activities (Francis & Barber, 2013). However, most fauna species exhibit a range of adaptive responses to noise impacts. Depending on the extent and duration of construction and operational noise generated, some species may respond by moving away from the areas where noise is being generated and where a decrease in the ecological values of these habitats has occurred such as within the riparian corridors.

The ID Project is adjacent to the existing IPM and will extend mining activities to the south of the Peak Downs Highway. Hence, mining activities will continue in a similar manner to that which is currently occurring including similar levels of operational noise. Any potential noise and vibration impacts are likely to be minimal as the Project area is already impacted by noise and vibration from the existing operation and the change in noise and vibration generated from this Project is not considered to be significant. Further, the fauna species listed in Section 0 are already inhabiting the site or in the case of Koala, have the potential to inhabit the site.

Impacts on fauna from ground vibration (e.g. from blasting) will be similar to noise disturbance. It is possible that some species would move away from areas close to the vibration source, where the intensity of the vibration exceeds the tolerance of the species. This is likely to be greatest in the vicinity of the open cut pit but is also considered a temporary impact. The ecological values within the Project area are therefore not likely to be impacted, in the long term, by ground vibration from the ID Project.

In accordance with the existing IPM approvals, specific noise and vibration management actions are currently being implemented which are focused on impacts to humans and their place of residence (sensitive receptors). In the absence of specific fauna measures, these management actions will be extended to this Project and are outlined in Section 5.7.

Impacts from noise and vibration has the potential to impact on all MNES species shown in Table 2, although, with the proposed site management measures, this is not predicted to be a significant impact (EcoSM, 2020).

#### 4.2.5 Dust

Mining activities, including construction and operation will generate dust which has the potential to impact on vegetation/fauna habitat through reducing the health of vegetation and foraging resources for fauna that are in close proximity to mined and/or disturbed areas.

The existing IPM immediately to the north of this Project, currently utilises dust minimisation and suppression management actions including watering of haul roads and air quality monitoring. These management actions will continue with this Project and are outlined in Section 5.7. Further, vegetation clearing will be progressive and gradual, which will minimise disturbance areas and areas of bare ground with the potential to generate dust. Mined areas will undergo progressive rehabilitation to further reduce dust generation and associated impacts to vegetation and fauna.

Impacts from dust has the potential to impact on all MNES species shown in Table 2, although, with the proposed site management measures, this is not predicted to be a significant impact (EcoSM, 2020).

#### 4.2.6 Light

The Project has the potential to generate additional artificial light within and adjacent to the mine activity areas. Potential impacts from artificial light include altered behaviour with some species attracted to the new light source whereas others are repelled or unaffected (Stone et. al., 2012). Hence, the extent of impacts will vary between species and will depend on habitat being utilised and the direction and intensity of the artificial light (Bennie et. al., 2015). The fauna species present on site are likely to have some degree of habituation to artificial lighting as the current IPM currently generates light as does the Peak Downs Highway, Goonyella Rail Line and Millennium Mine.

The ID Project will have limited additional light sources, and these will be limited to operational areas within the open cut pits, overburden piles and vehicles. As the mining operation will be progressive, a relatively small proportion of the Project area will be operational at any one time as lights will only be used in the operating areas of the mine at night. Further, as lighting will be directed towards the open cut pits and existing buildings, light spill will be mainly confined to the light source with minimal glare into the surrounding vegetation and undisturbed areas. Lighting impacts from vehicles travelling along the haul road will also be transitory and irregular.

Light spill has the potential to impact on the Greater Glider, Squatter Pigeon, Koala and Ornamental Snake, although, with the proposed site management measures, this is not predicted to be a significant impact (EcoSM, 2020).

#### 4.2.7 Vehicle strike

The construction and operation of mining haul roads have the potential to impact fauna through vehicle strikes that lead to injury or mortality. Ground dwelling or semi-arboreal mammals are more prone to vehicle strikes although birds and reptiles such as Squatter Pigeons and Ornamental Snakes may also be impacted. The dedicated ROM haul road is proposed to be located largely within cleared areas, which would reduce the incidence of vehicle strike (EcoSM, 2020). Nevertheless, some mortality of animals as a result of vehicle strike is likely, particularly in areas where haul roads cross through remnant vegetation. However, this impact is not expected to be significant and the impact would only occur for the duration of mining activities (approximately 16 years).

Vehicle strikes have the potential to impact on the Squatter Pigeon, Koala and Ornamental Snake, although, with the proposed site management measures, this is not predicted to be a significant impact (EcoSM, 2020).

#### 4.2.8 Erosion and sediment control

The Project has the potential to cause erosion from vegetation clearing for the open cut pit, flood levee and the construction of haul roads and associated mining infrastructure. This is particularly relevant where linear infrastructure will be constructed across Billy's Gully. Erosion, if not managed, the associated surface runoff can lead to increased sediment loads within local waterways.

Erosion and sedimentation of waterways, in the absence of controls, has the potential to impact on the Squatter Pigeon and Ornamental Snake.

#### 4.2.9 Fire

Fire has the potential to result in either temporary or permanent loss of vegetative cover, microhabitat and hollow bearing trees (particularly stags) which in turn, has the potential to impact on terrestrial fauna and ecological values. The Project is not expected to alter fire regimes.

The risk of fire associated with the Project is considered unlikely. Under Queensland's *Coal Mining Safety and Health Act 1999*, mining operations in general have detailed safety practices due to the operational health and safety implications of fire. The current fire management measures being implemented at the Isaac Plains Mine will be extended to this Project and updated where necessary as determined by the Senior Site Executive and the General Manager – Operations.

Impacts from fire has the potential to impact on all MNES species shown in Table 2.

#### 4.2.10 Altered flood regimes

Surface drainage features in the ID ecology study area are the Isaac River to Billy's Gully in the northern portion; an unnamed tributary in the southern portion (referred to as Southern Gully) and 5 Mile Gully which extends through the central portion of the study area. These waterways are ephemeral and characterised by short-duration flows following periods of high rainfall.

Sustained changes to flow regimes can influence the riparian and floodplain ecosystems through influencing abiotic conditions (e.g. soil anoxia and toxicity) and life-cycle processes such as adult mortality, timing of flowering and fruit-set, recruitment and seedling survivorship. The main components of flow regime can be described as follows (WRM 2020):

- Timing – when water is present, can vary within and between years
- Frequency – how often does flooding and drying occur
- Duration – how long does inundation last
- Extent and depth – the area of inundation and depth of water
- Rate of change (variability) – how quickly flow changes from one magnitude to another (e.g. the slope of the rising or fallings limbs of a hydrograph). The minimal changes in hydrology will occur and therefore, have very low potential to impact on the Greater Glider, Squatter Pigeon, Koala and Ornamental Snake.

Timing, frequency and duration are primarily driven by rainfall, seasonality and climate patterns that will not be directly influenced by the Project. Therefore, the Project will not impact timing, frequency and duration of the flow regime. However, the extent and depth of water across the floodplain, and the rate of change (variability) may be changed as result of the levee during operations or the final landform post mining. Whilst changes in duration of flood events will not be affected by the Project, the rate of change over the duration of different flood events at different locations has been assessed (WRM 2020). It is noted that the levee will prevent areas to north of the Isaac River from experiencing flooding during the life of the Project. However, the majority of vegetation and fauna habitat in the pre-mining 1:1,000 flood extent area will be removed for construction and operation of the mine. Hence, these ecosystems are directly impacted by mining operations, not by changes to flow regime (EcoSM, 2020).

Hydrological and hydraulic modelling has been undertaken for the Project (WRM2020). Modelling for the operational and post-mining scenarios has demonstrated that changes to flow regime associated with Project for the 1 in 2 (39% AEP), 1 in 10 (10% AEP), 1 in 20 (5% AEP) year flood events remain generally confined to the channel of the Isaac River with little to no overbank flows occurring and no predicted changes on flood depths and velocities for events up to and including the 5% AEP event (WRM 2020). As per the existing conditions, more substantial overtopping of the Isaac River banks occurs during the 1 in 50 year (2% AEP) flood event, and less frequent flood events (1 in 100 year and 1 in 1,000 year events) (EcoSM, 2020).

Modelling indicates that the flow regime parameters are generally similar, and often remain unchanged between the existing, operational and post-mining conditions for most flood events. Further, the ecosystems associated with the Isaac River riparian corridor and floodplain will experience negligible to minor change in the depth of inundation between the existing, operational and post-mining scenarios. Moreover, for the 1 in 20 year, 1 in 50 year and 1 in 100 year flood events, the depth of inundation remains largely unchanged between the three scenarios. Minor increases in the depth of flooding are modelled to occur during the 1 in 1,000 year event for the operational period. However, this scale of event of event is unlikely to occur during the life of the Project and the minor modelled increase in depth during operations is further reduced in the post-mining landform scenario (EcoSM, 2020).

A similar pattern is observed for peak velocities experienced by riparian corridor and floodplain ecosystems. The peak velocities modelled across the floodplain during the operational and post-mining periods are similar to the existing conditions, with peak velocities occurring along the centre of the Isaac River channel (i.e. not across the floodplain). In addition, modelling showed that the duration of inundation does not change between the existing, operational and post-mining scenarios (EcoSM, 2020).

The hydrological modelling shows negligible changes to the flow regime for regular flood events that are more likely to occur during the life of the Project (i.e. 1 in 20 year, 1 in 50 year); and negligible to minor changes for rarer (i.e. 1 in 100, 1 in 1,000 year) flood events. Localised and brief changes in depth and velocity during flood events that have been modelled during the operational period (i.e. 16 years); however, the duration of flood events experienced remains unchanged. Further, minor modelled changes in depth and velocity are further reduced during the post-mining period and return to being similar or unchanged from the existing scenario. It is therefore unlikely that the minor changes to depth and velocity modelled for the operational period will translate into major shifts in the structure and composition of riparian and floodplain vegetation and hence, impact on MNES.

## 4.3 Impact duration

The duration and timing of the Project's impacts has important effects on the magnitude of the overall impacts of the Project. Vegetation clearing for pit and infrastructure development is the principal direct impact from this Project to vegetation communities and fauna habitat. The Project is proposed to have a relatively short mine life of approximately 16 years. Clearing will take place progressively as pit development progresses. Progressive rehabilitation will occur, with final rehabilitation at completion of mining activities. Disturbed areas will be rehabilitated to a stable landform with a self-sustaining vegetation cover.

# 5.0 Mitigation and management measures

The objectives, performance criteria, mitigation and management measures and monitoring have been chosen based on practicalities of implementing the measures and programs, recent IPM approval conditions and anticipated EA conditions (using the IPM EA's as a reference) approval conditions, relevant coal mining legislative requirements and current approved management measures and monitoring programs for the existing and adjacent IPM.

Of particular importance are the *Coal Mining Safety and Health Act 1999* (CMSHA) and *Coal Mining Safety and Health Regulation 2017* (CMSHR) which govern all coal mining operations in Queensland. The CMSHA prescribes statutory obligations to ensure that coal mines operate under an acceptable level of risk. A major requirement is the development and implementation of a Safety and Health Management System (SHMS) for operation of the mine which is based on a risk assessment of all hazards present at the mine. Adherence to the requirements of the CMSHA and CMSHR is of particular relevance to this SSMP as it outlines statutory provisions for matters such as fire management, management of haul roads, vehicle speeds and dust suppression which are applicable to the management of impacts to MNES.

## 5.1 Management objectives

The main objectives of this SSMP are to:

- Ensure no clearing/disturbance to MNES habitats occurs beyond the disturbance limits outlined in the approved ID footprint as outlined in the ID EIS and AEIS;
- Prevent injury or mortality of MNES fauna during construction, operation and decommissioning of the Project; and
- Manage remaining areas of MNES habitats to maintain condition and habitat quality for the threatened fauna species outlined in Section 0 through weed, pest and fire management and limiting disturbance to exclusion areas.

Specific management objectives to be achieved through the implementation of this SSMP and the associated performance criteria related to each management objective are shown in Table 3.

**Table 3: Habitat management objectives and performance criteria**

| SMP management objectives | Performance criteria |
|---|---|
| Limit or avoid loss of MNES and/or habitat for MNES. | • Clearing of habitat for MNES does not occur outside of the approved and proposed disturbance footprints.<br>• No net loss of habitat for the Koala and Greater Glider outside of the approved disturbance limits.<br>• No net loss of permanent water sources for the Squatter Pigeon outside of the approved disturbance limits.<br>• No net loss of habitat for the Squatter Pigeon outside of the approved disturbance limits.<br>• No net loss of Ornamental Snake foraging resources outside of the approved disturbance limits.<br>• No net loss of foraging habitat for the Black-faced Monarch and Satin Flycatcher outside of the approved disturbance limits.<br>• Rehabilitation of disturbed areas will be rehabilitated in accordance with the Project's Rehabilitation Management Plan. |
| Prevent injury or mortality of MNES fauna | • Ensure vehicle speed limits are enforced.<br>• Provide fauna recognition training to make staff aware of the local fauna species. |
| Prevent habitat degradation and a decline in habitat values within habitat | • Maintain habitat quality within the retained MNES habitat in relation to baseline habitat quality scores outlined in EcoSM, 2020). |

| SMP management objectives | Performance criteria |
|---|---|
| adjacent to that within the Project area (i.e. habitat not proposed to be cleared for the Project or previously approved mining activities a IPC). | • Rehabilitation of disturbed areas will be rehabilitated in accordance with the Project's Rehabilitation Management Plan. |
| Minimise risk of weed introduction and/or the spread of existing weed species in habitat area for MNES. | • No new weed species are established in areas of MNES habitat areas based on baseline data.<br>• Spreading of weeds does not occur as in areas of retained MNES habitat compared to baseline habitat quality surveys. |
| Reduce habitat degradation and potential predation on MNES by pest animals. | • No new pest animal species are established in areas of MNES habitat in comparison to baseline data.<br>• Reduction in pest animal numbers in areas of habitat for MNES to below baseline levels. |
| Minimise impact of dust deposition on habitat for MNES during construction and operation of the Project. | • Dust deposition does not exceed 120 mg per square metre per day, averaged over one month when measured at any sensitive receptor<br>• Dust is monitored in accordance with the ID Dust Management Plan. |
| Minimise noise and vibration impacts in areas of MNES habitat. | • When measured, noise and vibration levels at sensitive receptors do not exceed the general criteria set out in the ID Management Plan. |
| Minimise degradation of habitat for MNES from an increased risk of fire due resulting from Project activities. | • No uncontrolled fires within the Project area resulting from Project related activities. |
| Minimise alteration of Squatter Pigeon and Ornamental Snake habitat from changes to water quality and hydraulic activity. | • Water quality is maintained within the ID Project area and does not exceed the receiving waters trigger levels at downstream monitoring sites listed in the IPM Receiving Environment Monitoring Program which will be updated to include the ID Project.<br>• Water quality monitoring is undertaken in accordance with the ID Receiving Environment Monitoring Program. |
| Minimise potential for mortality or injury to MNES from Project activities (e.g. habitat clearing, vehicle strikes etc). | • No mortality or injury to MNES as a result of Project activities (e.g. from clearing activities, vehicle strikes etc). |

## 5.2 Relevant plans and guidelines

Table 4 lists the conservation advice and plans relevant to each of the MNES species covered by this SMP. These documents have been reviewed in preparing the SSMP to capture those management objectives and measures outlined in Table 5 that are specific to each of the threatened species and to address the key threatening processes to each MNES.

**Table 4: Relevant conservation advice, recovery plans and threat abatement plans, and relationships to management objectives and measures outlined in Table 5**

| MNES | Relevant conservation advice and plans | Main threats and recommended actions | Management objectives for this SMP |
|---|---|---|---|
| Koala *(Phascolarctos cinereus)* | Approved Conservation Advice for *Phascolarctos cinereus*, Koala (*combined* populations in Queensland, New South Wales and the Australian Capital | Habitat fragmentation, vehicle strike and predation. | • Limit or avoid loss of MNES and/or habitat for MNES.<br>• Prevent habitat degradation and a decline in habitat values within the retained habitat adjacent to the |

| MNES | Relevant conservation advice and plans | Main threats and recommended actions | Management objectives for this SMP |
|---|---|---|---|
| | Territory), (SEWPaC, 2012. | | Project area and mining areas.<br>• Reduce habitat degradation and potential predation on MNES by pest animals.<br>• Minimise potential for mortality or injury to MNES from Project activities (e.g. habitat clearing, vehicle strikes etc). |
| Greater Glider *(Petauroides volans)* | Conservation Advice for *Petauroides Volans*, Greater Glider (TSSC, 2016). | Habitat loss, fires and predation from owls. | • Limit or avoid loss of MNES and/or habitat for MNES.<br>• Prevent habitat degradation and a decline in habitat values within the retained habitat adjacent to the Project area and mining areas.<br>• Reduce habitat degradation and potential predation on MNES by pest animals.<br>• Minimise risk of degradation of habitat for MNES through onsite fire management and prevention practices for the Project. |
| Squatter Pigeon (Southern) *(Geophaps scripta scripta)* | • Approved Conservation Advice for *Geophaps scripta scripta* (Squatter Pigeon (southern)) (TSSC, 2015);<br>• Threat abatement plan for predation by feral cats (Commonwealth of Australia, 2015).<br>• Threat abatement plan for competition and land degradation by rabbits (Commonwealth of Australia, 2016). | • Habitat clearing.<br>• Livestock and feral herbivore grazing.<br>• Predation, by Feral Cats and European Foxes.<br>• Feral Cat control strategies.<br>• European Fox control strategies. | • Limit or avoid loss of MNES and/or habitat for MNES.<br>• Reduce habitat degradation and potential predation on MNES by pest animals.<br>• Minimise impacts of dust deposition on habitat for MNES during construction and operation of the Project.<br>• Minimise potential for mortality or injury to MNES from Project activities (e.g. habitat clearing, vehicle strikes etc). |

| MNES | Relevant conservation advice and plans | Main threats and recommended actions | Management objectives for this SMP |
|---|---|---|---|
| | • Threat abatement plan for predation by the European red fox (DEWHA 2008a). | | |
| Ornamental Snake (*Denisonia maculata*) | Approved Conservation Advice for *Denisonia maculata* (Ornamental Snake) (DotE, 2014). | Habitat clearing and degradation of habitat including wetland and frog habitat by Feral Pigs. | • Limit or avoid loss of MNES and/or habitat for MNES.<br>• Prevent habitat degradation and a decline in habitat values within the retained habitat adjacent to the Project area and mining areas.<br>• Reduce habitat degradation and potential predation on MNES by pest animals.<br>• Minimise impacts of dust deposition on habitat for MNES during construction and operation of the Project.<br>• Minimise habitat alteration from changes to water quality and hydraulic activity.<br>• Minimise potential for mortality or injury to MNES from Project activities (e.g. habitat clearing, vehicle strikes etc). |
| Black-faced Monarch (*Monarcha melanopsis*) and Satin Flycatcher (*Myiagra cyanoleuca*) | Referral guideline for 14 birds listed as migratory species under the EPBC Act (Commonwealth of Australia 2015).<br>Action Plan for Listed Migratory Species (ACT Government, 2018). | Collision with infrastructure.<br>Presumed threats to the species include clearing of habitat through forestry and predation by introduced predators such as cats and foxes). | • Limit or avoid loss of MNES and/or habitat for MNES.<br>• Prevent habitat degradation and a decline in habitat values within the retained habitat within the Project area. |

Management and mitigation measures have been specified to address the general requirements of these plans (refer to Table 6) in relation to:

- Avoid loss of MNES habitat through unauthorised vegetation and habitat clearing (all species)
- Minimising the risk of direct harm to threatened fauna during vegetation clearing and construction of the Project (all species)
- Staff and contractor awareness of threatened fauna in the Project area (all species)

- Minimising the risk of vehicle strike to threatened fauna during construction, operation and decommissioning of the Project (primarily Koala, Squatter Pigeon and Ornamental Snake)
- Fire management to minimise risk of fire (all species)
- Pest plant and animal management within the Project area to minimise predation and the spread of weeds and reduce the extent of weed species and pest animals within and in habitats adjacent the Project area (all species)
- Appropriate rehabilitation that returns habitat features and food resources to the Project area (all species).

## 5.3 General management actions

Planning and management of disturbances for the proposed mine extension were assessed taking into consideration the expected requirements of approval conditions as well as a set of hierarchical management principles as outlined in State and Commonwealth offset policies. These actions are designed to avoid impacts, minimise impacts and mitigate impacts to the environmental values including threatened fauna.

This SSMP has been developed considering these management principles (in order of preference) with relevance to impacts on threatened fauna species:

- *Avoidance:* Avoiding direct and indirect adverse impacts where possible through Project design
- *Minimise:* Minimising direct and indirect adverse impacts where impacts cannot be avoided through modifying design, the timing of construction or employing specialist clearing and construction methods
- *Mitigate:* Implement mitigation and management actions to unavoidable impacts, through design management actions and rehabilitation
- *Remediation and rehabilitation:* Actively and progressively remediate and rehabilitate impacted areas to promote and maintain long-term recovery
- *Provide offsets:* Stanmore will be required to provide suitable offsets for activities that result in unavoidable significant residual adverse impacts to MNES. These offsets will be provided in accordance with the final EPBC approval conditions.

The hierarchy of management actions will be applied to all activities with the aim of minimising impacts to threatened MNES fauna species.

## 5.4 Design phase strategy

The Project aimed at utilising existing infrastructure where possible to minimise impacts to MNES. Where this has not been possible such as additional access tracks and haul roads, the designs have minimised the overall footprint as much as practicable.

## 5.5 Pre-construction and construction phase strategy

As part of the vegetation clearing and soil disturbance phases of the activity, pre-clearance surveys undertaken by suitably qualified ecologists will assess the presence of EPBC Act listed threatened fauna species within 48 hours of the disturbance activities and relocate any detected native fauna to suitable habitat outside of the disturbance areas. Qualified Fauna Spotter/Catchers will oversee all vegetation clearing works, with the most suitable ratio of Fauna Spotter/Catcher per machine undertaking clearing activities to be determined by the Qualified Fauna Spotter prior to commencement of clearing activities. This will allow animals to be relocated away from the disturbance area if necessary and for disturbance activities to cease until any danger to the health and wellbeing of fauna has passed.

## 5.6 Rehabilitation, operation and maintenance phase strategy

To minimise impacts to terrestrial fauna caused by habitat loss, habitat degradation and erosion, rehabilitation of disturbed areas will occur, including the riparian corridor crossings. Rehabilitation and decommissioning will be undertaken in accordance with the rehabilitation requirements of the final EPBC approval conditions and the final ID conditions including a Rehabilitation Management Plan, with the aim of providing a stable landform with a self-sustaining vegetation cover.

The final ID approval and Rehabilitation Management Plan will include rehabilitation goals, objectives, indicators and completion criteria for the Project for each mine domain. The mine domains are split into mine infrastructure, overburden emplacement areas and final void. Other than the final void, all domains have a post mining grazing land use. Completion criteria, including foliage and ground cover, soil quality, plant regeneration, presence of key plant species, weed abundance, and achievement of grazing land use classification in accordance with Queensland Guideline for Agricultural Land Evaluation, are conditioned to demonstrate the suitability of rehabilitation areas.

The final ID approval and Rehabilitation Management Plan will also set milestones for when the rehabilitation schedule must be completed, including progressive rehabilitation of overburden emplacement areas, and reshaping to final landform design, topsoiling and seeding. Rehabilitation monitoring will be undertaken in accordance with the requirements of the yet to be approved EA (it is expected this will be similar to the IPM EA) to identify if rehabilitation goals, objectives, indicators and completion criteria are being achieved, and to take remedial action where monitoring shows this is required.

## 5.7 Management measures

This section of the SSMP outlines a series of management measures designed to avoid and/or mitigate potential impacts to threatened fauna species, based on known threats to each species identified in Section 0. Table 5 outlines relevant management measures that will be undertaken to mitigate, manage and monitor the impacts of the Project on MNES, and achieve the objectives for habitat management.

The management objectives, performance criteria, management and monitoring activities outlined in Table 6 have been developed based on baseline field surveys and considering operational practicalities. Development has also been undertaken in accordance with the key threats and recommended priority actions as outlined in the species-specific recovery plans, threat abatement plans and conservation advices.

### Table 5: Measures to avoid/mitigate impacts to EPBC Act listed threatened fauna

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| Limit or avoid loss of MNES and/or habitat for MNES. | • Clearing of habitat for MNES does not occur outside of approved disturbance limits and does not exceed the disturbance limits detailed in Table 1 of this SSMP.<br>• No net loss of habitat for the Koala, Greater Glider, Ornamental Snake, Black-faced Monarch and Satin Flycatcher outside of the approved disturbance limits.<br>• No net loss of habitat and permanent water sources for the Squatter Pigeon outside of the approved disturbance limits.<br>• Rehabilitation of disturbed areas will be rehabilitated in accordance with the Project's Rehabilitation Management Plan. | • Infrastructure will be sited in accordance with the State and Commonwealth approval conditions.<br>• Areas requiring vegetation removal will be clearly delineated to ensure disturbance to areas being retained is avoided. Limits of clearing are to be delineated using barricading or temporary fencing and signage prior to works commencing. Exclusion areas are to be clearly shown and labelled on all operational and management drawings and plans. GIS shapefiles will be provided to clearing personnel and/or contractors prior to the commencement of clearing operations.<br>• Where exclusion fencing is required, consideration shall be given to fauna movement, current land uses and worker safety requirements.<br>• Permanent water sources for retention such as farm dams outside of the disturbance limits will be clearly delineated and shown and labelled on all operational and management drawings and plans<br>• Avoid where possible and within the constraints of the mining schedule, impacting on MNES habitat during breeding periods through timing of clearing and creek disturbance activities to avoid the main breeding season of impacted MNES (i.e. mid dry season to wet season for Squatter Pigeon. | • Clearing of MNES habitat exceeds the approved disturbance limits in Table 1 of this SSMP and/or occurs outside of any approved disturbance limits.<br>• Disturbance to permanent water sources, which may provide habitat for Squatter Pigeons and Ornamental Snakes, outside of the disturbance areas.<br>• Rehabilitation and decommissioning fails to meet the objectives of the Rehabilitation Management Plan. | • Fauna Spotter will monitor, and record clearing activities and all fauna encountered.<br>• The Environmental Officer (EO) will monitor and record the total area of MNES habitat cleared every quarter and assess against the disturbance limits outlined in Table 1 of this SSMP.<br>• Auditing of the Permit to Disturb will be undertaken quarterly by the EO to ensure any disturbance has been undertaken in accordance with the requirements of the Permit to Disturb, this SSMP and approval conditions and to ensure no unauthorised disturbance has occurred.<br>• Rehabilitation monitoring will be undertaken in accordance with Rehabilitation Monitoring Plan that will be required by the final approval conditions. | • Should clearing of habitat for MNES exceeds the approved disturbance limits in Table 1 of this SSMP and/or occurs outside of the Project footprint, clearing, works are to cease immediately, and DAWE notified of the incident within five business days. The incident will be recorded in the Project's environmental and incident reporting system register.<br>• Following clearing, the area will be assessed within 20 business days by a suitably qualified expert with corrective actions provided to the DAWE via a Corrective Action Contingency Plan.<br>• The Plan will include a schedule to implement the corrective actions.<br>• Should rehabilitation and decommissioning fail to meet the objectives, completion criteria and schedule of the Rehabilitation Management |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | | • Prior to entry to the Project area, all site personnel including contractors shall be made aware via toolbox talks and site information sheets, of the sensitive environs they will be working in and around and be advised of specific limitations to construction works being undertaken in or adjacent to threatened fauna habitat. All staff and contractors will be required to report sightings of relevant fauna in the activity area to the EO immediately.<br>• An internal 'Permit to Disturb' system will be used by the EO to ensure that all clearing activities are authorised prior to disturbance. Conditions listed in the Permit to Disturb must be implemented.<br>• The EO or delegate will routinely inspect the disturbance limit boundaries to ensure that no clearing or disturbance of vegetation or habitat beyond the approved limits has taken place.<br>• Temporary stockpile sites for soil and equipment, access routes, laydown areas and other associated infrastructure will, as afar as reasonably practical, be located in cleared areas and will not be situated in areas of MNES habitat.<br>• Prior to construction activities commencing, signage, including speed limits, will be erected in the vicinity of exclusion areas to warn of the potential presence of threatened fauna in the area.<br>• Pre-clearance surveys will be undertaken by a suitably qualified ecologist using approved | | | Plan, the reasons of the failure will be investigated.<br>**Corrective Actions:**<br>• The Corrective Actions identified in the Corrective Action Contingency Plan and approved by DAWE will be implemented and may include additional rehabilitation or offsets or provision of additional permanent water sources for the Squatter Pigeon and/or Ornamental Snake prey.<br>• Within 20 business days of a rehabilitation trigger being activated, a Contingency Plan will be developed by a suitably qualified expert to address the reason for the failure and identify appropriate Corrective Actions. |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | | State and Commonwealth survey guidelines within 48 hours before clearing activities commencing.<br>• The pre-clearance survey will be undertaken in order to:<br>  • Record the location of all hollow bearing trees, log piles and nest using a GPS. Features of tree hollows (diameter, number and whether active/inactive) should be recorded in the Environmental Diary/Register; and<br>  • Relocate all captured non-breeding animals to suitable habitat adjacent to the disturbance area and within the Project Area.<br>• A Fauna Spotter will be present for all clearing activities and will conduct a walk-through survey prior to commencement of clearing and prior to clearing works each day to check vegetation and other fauna habitats.<br>• The Fauna Spotter will reinspect the area of cleared vegetation immediately after clearing to locate any potentially injured fauna that should then be taken to a wildlife carer or veterinarian.<br>• Vegetation clearing will be undertaken progressively and trees will be felled in the direction of the clearance zone to avoid impacts to adjoining retained vegetation and habitat.<br>• Hollow bearing trees will be clearly flagged and surrounding vegetation removed with | | | |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | | the hollow bearing tree left standing for at least one night to encourage fauna to relocate of its own accord. Hollow bearing trees will be inspected to determine if hollows are occupied.<br>• If after one night the resident fauna have not moved on, the hollow entrance will be blocked with a towel or similar and the hollow removed by cutting below the hollow section. The hollow with the animal inside will then be installed in nearby similar and adjoining vegetation to be retained at a similar height and orientation with the entrance unblocked at dusk.<br>• If the procedure described above is not possible for any reason, hollow-bearing trees will be felled using a tree grab or similar that can remove the tree in a controlled fashion. If possible and safe to do so, hollow trees will be felled at dusk to allow fauna the opportunity to disperse during their normal activity period. These trees will be felled away from hollow openings. The tree will be knocked at the base several times prior to felling to encourage fauna to relocate of their own accord. Once the tree is felled, it will be inspected for any fauna and any injured fauna rescued and taken to a wildlife carer or veterinarian.<br>• Any fauna that is captured will be relocated into the adjacent habitat at least 200 m from the clearing area if clearing works are yet to be completed.<br>• Where threatened fauna is identified and delaying the clearing of area is not feasible, | | | |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | | (i.e. the clearing is critical to the activity schedule), a 50 m exclusion zone will be established and the area must not be disturbed for a minimum of 24 hours while clearing is undertaken around the exclusion zone. After 24 hours, a Fauna Spotter/Catcher may relocate the breeding animal to suitable habitat at least 200 m away from the disturbance area. Where survival of young or eggs is unlikely as a result of the disturbance, these are to be handed over to a previously identified wildlife carer or veterinarian. | | | |
| Prevent habitat degradation and a decline in habitat values within the retained habitat adjacent to the Project area and mining areas. | Maintain habitat quality scores within the retained MNES habitat in relation to baseline habitat quality scores. | • Areas of MNES habitat adjacent to the disturbance footprint and within mining leases, will be clearly delineated and shown and labelled on all operational and management drawings and plans. GIS shapefiles will be provided to clearing personnel and/or contractors prior to the commencement of clearing operations.<br>• Site access is only to occur along designated site access tracks. No unauthorised access is permitted.<br>• Prior to commencement of the action signage, including speed limits, will be erected to warn of the potential presence of threatened fauna in the area.<br>• Posters will be developed and displayed in meeting areas that reminds staff and contractors about the MNES present in the Project area.<br>• Prior to entry to the Project area, all site personnel including contractors shall be | The habitat quality score in areas of retained MNES are not maintained (e.g. habitat falls below the baseline habitat quality score). | • Habitat quality assessments will be integrated with the existing IPM monitoring program. Specific ID monitoring will be undertaken every two (2) years in retained vegetation that provides habitat for MNES. Monitoring will be undertaken in accordance with the Commonwealth survey guidelines and the State guidelines guide for determining terrestrial habitat quality.<br>• | • Where inadvertent disturbance to MNES habitat occurs, an investigation will be undertaken.<br>• Should a decline in the habitat quality scores be observed, the cause will be investigated, and a Corrective Actions Contingency Plan will be developed by a suitably qualified ecologist within 20 business days of the decline being detected. The Plan will include appropriate corrective actions and an implementation schedule for those actions. The DAWE will be notified within 20 business days of |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | | made aware via toolbox talks and site information sheets, of the sensitive environs they will be working in and around and be advised of specific limitations to construction and/or operational works being undertaken in or adjacent to threatened fauna habitat. All staff and contractors will be required to report sightings of MNES fauna to the EO immediately<br>• Where tree hollows that are suspected as being used by Greater Gliders are identified from within the disturbance area, they are to be salvaged to the greatest extent possible and relocated within retained vegetation. As far as practical, the site of the relocation is to be within retained vegetation and replicate the height and orientation of the original breeding or nesting structure. Sections of hollow branch or log will be secured in the new location by mechanical means deemed appropriate by the Fauna Spotter/Catcher (e.g. bolts, metal bands). Relocation is to be undertaken under the supervision of a spotter/catcher.<br>• Selected trees and/or logs will be salvaged and reused as fauna habitat to enhance retained vegetation habitat values (Riparian areas). Trees and other habitat features to be salvaged will be identified and flagged by the Fauna Spotter/Catcher during the walk-through survey and/or clearance activities.<br>• If an occupied tree hollow cannot be relocated the breeding habitat should be replaced nearby and in retained vegetation (but at least 200 m away from the | | | the decline in habitat quality.<br>**Corrective Actions:**<br>• Corrective actions identified in the Plan will be implemented within 30 days of the trigger being detected. Depending on the cause of the decline in habitat quality scores, potential corrective actions may include:<br>o Rehabilitation of MNES habitat.<br>o Additional environmental awareness training to workers regarding MNES.<br>o Increasing pest animal and weed control measures or revising the type of measures implemented.<br>o Increasing the frequency of dust suppression techniques.<br>o Repair fences if damaged, or installation of new fencing. |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | | disturbance area) in undisturbed habitat, with an artificial nesting structure at a ratio of 1:1 using current best practice nest box design.<br>• Implementation of dust suppression techniques in accordance with the Dust Management Plan and the CMSHA and the CMSHR.<br>• Maintenance of existing fences.<br>• Maintenance of existing water management infrastructure and erosion and sediment control devices.<br>• Pest animals and weeds will be managed in accordance with the Project's Weed and Pest Management Plan.<br>• Light spill we be directed to the open cut pits to minimise light spill.<br>• The use of low wattage lighting with list spill guards. | | | • Provision of additional offsets if required. |
| Minimise risk of weed introduction and/or the spread of existing weed species in habitat area for MNES. | • No new weed species are established in areas of MNES habitat based on baseline data.<br>• Spreading of weeds does not occur relative to baseline data. | • Weeds will be managed in accordance with the existing Project's Weed and Pest Management Plan.<br>• The Plan includes the following:<br>o A site induction program that provides weed management information to staff, contractors and visitors.<br>o Detailed control measures aimed at eradicating where possible, or otherwise reducing the extent of weeds in accordance with the Queensland Department of Agriculture and Fisheries | • An increase in the average percent (%) cover score of weed species from baseline and/or previous monitoring events.<br>• Detection of weed species not previously recorded in the Project area during baseline and/or previous monitoring events. | • Monitoring of weeds outside of the disturbance areas will be undertaken during the habitat quality assessment surveys.<br>• Monitoring will be undertaken every two years (refer to Section 6.1.3). | • Should an increase in weed cover or presence of new weed species be observed, an investigation will be undertaken to determine the cause. This will involve reviewing adherence to the Weed and Pest Management Plan and an assessment of the distribution of weeds within the Project area in relation to baseline to |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | | (DAF) guidelines and the requirements of the *Biosecurity Act 2014*.<br>o Weed washdown procedures for all vehicles brought to site that will be traveling beyond the site office carpark.<br>o Targeted weed control measures within the Project area. | | | determine the cause of the incursions.<br>• From the investigation, a Corrective Action Contingency Plan will be developed by a suitably qualified ecologist within 20 business days of the trigger being detected. The Contingency Plan will include appropriate corrective actions and an implementation schedule for those corrective actions.<br>**Corrective Actions:**<br>• Corrective actions identified in the contingency plan will be implemented within 30 days of the trigger being detected.<br>• Potential corrective actions may include:<br>o Increasing the frequency and/or duration of weed control efforts.<br>o Investigating and/or implementing alternate weed management control actions. |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | | | | | o Amending weed hygiene practices.<br>o Updating the Weed and Pest Management Plan. |
| Reduce habitat degradation and potential predation on MNES by pest animals. | • No new pest animal species are established in areas of MNES habitat in comparison to baseline data.<br>• Reduction in pest animal numbers in areas of habitat for MNES to below baseline levels. | • Pest animals will be managed in accordance with the ID Weed and Pest Management Plan.<br>• The Weed and Pest Management Plan will include requirements for:<br>o Appropriate waste management and waste disposal.<br>o A reporting framework to ensure sightings of pest animals are recorded.<br>o Site inductions to include information on pest animals including control requirements, importance of appropriate waste management and reporting requirements when pest animals are observed within the Project area during construction and operation activities.<br>o Control of pest animals.<br>• Pest management actions outlined in the Weed and Pest Management Plan will primarily focus on those pest animals identified within the Project area and include Cane Toads, Feral Cats, Wild Dogs, House Mice and European Rabbits and that have a potential to impact on MNES and their habitat. Additional pests will be included as necessary if identified as occurring within the Project area during the habitat quality | • Observed increase in sightings/signs and/or the relative abundance of pest animals in areas of retained MNES habitat above baseline levels.<br>• Direct observation or signs of, a pest animal not identified as occurring within the Project area during the baseline surveys. | • Monitoring of weeds outside of the disturbance areas will be undertaken during the habitat quality assessment surveys.<br>• Monitoring will be undertaken every two years (refer to Section 6.1.4). | • Should evidence of pest animals show an increase compared to baseline, undertake an investigation to assess possible reasons for the increase (e.g. inappropriate waste management leading to increased pest animals).<br>• Should predation of MNES be observed undertake an investigation to assess possible reasons for the incident(s).<br>• Review adherence to the Project's Weed and Pest Management Plan.<br>• From the investigation, a Corrective Actions Contingency Plan will be developed by a suitably qualified ecologist within 20 business days of the trigger being detected. The Contingency Plan will include appropriate corrective actions and an implementation schedule for those corrective actions. |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | | monitoring program (European Foxes and Feral Pigs).<br>- Pest management will include a range of best management practice actions including shooting, trapping, fencing and baiting in and will be undertaken in accordance with site safety and health requirements, and DAF guidelines and the requirements of the *Biosecurity Act 2014* and as permitted under the SHMS. | | | **Corrective Actions:**<br>- Corrective actions identified in the contingency plan will be implemented within 30 days of the trigger being detected.<br>- Potential corrective actions may include:<br>o Increasing the frequency and/or duration of pest animal control efforts.<br>o Investigating and/or implementing alternate pest animal control methods in consultation with Queensland Department of Agriculture and Fisheries (DAF).<br>o Updating the exiting Weed and Pest Management Plan to include new species where relevant. |
| Minimise impacts of dust deposition on habitat for MNES during construction and operation of the Project. | - Dust deposition does not exceed 120 mg per square metre per day, averaged over one month when measured at any sensitive receptor. | - Dust suppression will be undertaken in accordance with the Dust Management Plan and include the following actions:<br>o Staging vegetation clearing to minimise areas of disturbed and bare ground. | - Dust deposition levels exceed 120 mg per square metre per day when averaged over one month at sensitive receptors.<br>- Visual inspections of vegetation adjacent to the | - Monitoring of dust deposition will be undertaken in accordance with EA approval conditions and the Project’s Dust Management Plan. | - If dust deposition monitoring exceed the trigger value of 120 mg per square metre averaged over one month, Stanmore must investigate whether the exceedance is a result of Project activities and |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | • Dust is monitored in accordance with the Dust Management Plan. | o Progressively rehabilitating disturbed areas.<br>o Removal and dumping of overburden as soon as reasonably practical following blasting activities<br>o Regular watering of haul roads and access tracks in accordance with the CMSHR.<br>o Dust suppression spraying of stockpiles.<br>o Limiting grading and/or dozing in high dust generating areas.<br>o Limiting overburden drilling.<br>o Enforcing speed limits in accordance with the requirements of the CMSHA and CMSHR. | disturbance areas show visible signs of dust deposition. | • Existing monitoring includes visual inspections of vegetation adjacent to the disturbance areas. | notify the administering authority within seven days of the exceedance occurring.<br>• Should an exceedance of dust deposition levels be attributed to Project activities Stanmore will implement dust abatement measures.<br>**Corrective Actions:**<br>• Corrective actions identified in the Dust Management plan will be implemented within 10 days of the trigger being detected. |
| Minimise noise and vibration impacts in areas of MNES habitat. | When measured, noise and vibration levels do not exceed criteria set out in the approval conditions. | • Regularly maintaining and servicing all plant equipment to minimise machinery noise.<br>• All engine covers will be kept closed while equipment is operating.<br>• Blasting will only occur between 9am and 7pm. | • When measured at sensitive receptors noise and vibration levels exceed criteria set out in the approval conditions.<br>• When blasting occurs outside of the approved blast times. | • Noise and vibration monitoring will be undertaken in accordance with monitoring requirements set out in the approval conditions . | • If noise and vibration monitoring exceed the trigger values outlined, Stanmore must investigate whether the exceedances are the result of the mining activities and notify the administering authority within seven days of the exceedance occurring.<br>• Should exceedance levels be attributed to mining activities, noise and vibration abatement measures will be implemented. |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | | | | | **Corrective Actions:**<br>• Corrective actions identified during investigations will be implemented within 10 days of the trigger being detected. |
| Minimise risk of degradation of habitat for MNES through onsite fire management and prevention practices for the Project. | No uncontrolled fires within the Project area resulting from Project related activities. | • Fire management for coal mining operations in Queensland is governed by the CMSHA and the CMSHR with the CMSHR prescribing management of fires for coal mines.<br>• Section 37 of the CMSHR prescribes that the coal mines Safety and Health Management System (SHMS) must include standard operating procedures for action to be taken when a fire is discovered at the mine.<br>• Buffers will be maintained around potential ignition sources such as plant and machinery, haul roads and mine infrastructure areas.<br>• Prior to site entry, all relevant site personnel, including contractors, will be made aware of fire safety and risks.<br>• Fuel loads will be minimised and managed through the weed control measures outlined in the ID Weed and Pest Management Plan. | • An uncontrolled fire occurs within the Project area that is due to mining activities.<br>• Weed cover exceeds baseline levels and groundcover biomass (e.g. vegetation) exceeds benchmark levels. | • Compliance with the SHMS will be monitored in accordance with the requirements of the CMSHA and CMSHR.<br>• Monitoring of biomass (groundcover including organic litter) for fire management will be undertaken during the habitat quality assessments that will occur every two (2) years thereafter (refer to Section 6.1.2). | • Should an uncontrolled fire occur within the Project area, the existing IPM Emergency Response Plan will be enacted. Should any corrective actions and changes to fire management be required, they will be done in accordance with the CMSHA and CMSHR and incorporated into the SHMS.<br>• Should biomass monitoring indicate that there is a risk of an uncontrolled fire occurring, biomass control measures will be assessed by a suitably qualified ecologist within 20 business days and Corrective Actions suggested. Biomass control measures aimed at reducing fuel loads may include controlled burns, strategic grazing or |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | | | | | modified weed management measures.<br>**Corrective Actions:**<br>Any corrective actions identified will be implemented within 30 days of the trigger being detected. |
| Minimise alteration of Squatter Pigeon, Ornamental Snake riparian habitat from changes to water quality, hydraulic activity. | • Water quality, as a result of the Project, does not exceed the receiving waters trigger levels at downstream monitoring sites listed in the approval conditions.<br>• Water quality monitoring is undertaken in accordance with the Receiving Environment Monitoring Program (REMP).<br>• Erosion and sediment control is undertaken in accordance with the Erosion and Sediment Control Plan (ESCP).<br>• Maintain riparians habitat quality scores within the retained | • Site stormwater management will be undertaken in accordance with the management plans and programs required by the approval conditions including a REMP.<br>• The site specific WMP, REMP and ESCP as well as other water management requirements as outlined in the approval conditions.<br>• Required management plans will be implemented with the aim of minimising alterations to receiving environment water quality erosion, minimising mobilisation of sediments and minimising erosion related disturbances to the current hydrological regime.<br>• The maintenance and cleaning of any vehicles, plant or equipment must not be carried out in areas from which contaminants can be released into any receiving waters.<br>• Spillage of wastes, contaminants or other materials must be cleaned up as quickly as practicable to minimise the release of wastes, contaminants or materials to any | • Water quality monitoring exceeds the approved receiving environment trigger levels outlined in the approval conditions and.<br>• Visual inspections of water management infrastructure show signs of failure.<br>• The habitat quality score in areas of retained riparian vegetation are not maintained (e.g. habitat falls below the baseline habitat quality score). | • Water quality monitoring will be undertaken in accordance with the approval conditions and REMP.<br>• Monitoring of the effectiveness of the erosion and sediment control devices and water management infrastructure will be undertaken in accordance with approval conditions.<br>• Habitat quality assessments will be undertaken every two (2) years in retained vegetation that provides habitat for MNES. | • If water quality characteristics of the downstream monitoring point exceed those trigger levels outlined in the final EA, and these levels are higher than upstream monitoring locations, Stanmore must investigate the exceedance and the potential for environmental harm and provide a written report to the administering authority as part of the Project's Annual Return.<br>• Should an exceedance of water quality trigger levels be attributed to Project activities, an assessment on the effectiveness of the WMP and REMP will be undertaken and appropriate Corrective Actions included in Plan revisions and the Annual reports in accordance with approval conditions. |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | MNES habitat in relation to baseline habitat quality scores | stormwater drainage system or receiving waters. | | | - Should a decline in the riparian habitat quality scores be observed, the cause will be investigated, and a Corrective Actions Contingency Plan will be developed by a suitably qualified ecologist within 20 business days of the decline being detected. The Plan will include appropriate corrective actions and an implementation schedule for those actions. The DAWE will be notified within 20 business days of the decline in habitat quality.<br>**Corrective Actions:**<br>- Corrective actions identified will be implemented within 10 days of the trigger being detected. |
| Minimise potential for mortality or injury to MNES from Project activities (e.g. habitat clearing, vehicle strikes etc). | No mortality of, or injuries to, MNES as a result of Project activities (e.g. from clearing activities, vehicle strikes etc). | - Environmental awareness training will be provided to all workers as part of site induction and will include specific topics on MNES, risks and protective measures, and identification of the MNES.<br>- Pre-clearance surveys will be undertaken within 48 hours prior to clearing activities to assess the presence of MNES within the disturbance area to be cleared. | Injury or mortality to an MNES | - All personnel will be required to be report any interactions between vehicles and/or /machinery and MNES in the Project area.<br>- Visual observations during normal working hours. | - Should an injury to, or mortality of, an MNES, an investigation will be undertaken to ascertain the cause of the injury or mortality.<br>- Should the injury or mortality be attributed to mining activities, a Contingency Plan will be |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
| | | - At least one qualified Fauna Spotter/Catcher will be present during clearing activities.<br>- A wildlife carer will be called to collect any injured fauna.<br>- Speed limits of 60 km/hr will be set and enforced on all internal roads including haul roads, with the exception of creek crossings at night which will have 40 km/he limits.<br>- Vehicles must abide by vehicle speed limits and access to any restricted areas or exclusion zones must be limited to critical site-specific activities to minimise threats to MNES.<br>- All injured fauna encountered during the construction and operation of the activity will be taken to a wildlife carer/facility or veterinarian within 24 hours.<br>- Where injured fauna is encountered, and it is unsafe to handle the animals, the following should be undertaken<br>o The location of the injured animal will be identified so it can be located again<br>o The species of animal will be identified if possible and its sex and approximate size determined<br>o The type of injury sustained will be identified if possible<br>o The EO shall immediately contact Queensland's Department of Environment and Science (DES) and report the animal and arrange for its | | - Incidental observations during habitat quality assessments. | developed by a suitably qualified ecologist within 20 business days and will include Corrective Actions and an implementation schedule for the Corrective Actions.<br>**Corrective Actions:**<br>- Corrective actions identified in the contingency plan will be implemented within 30 days of the trigger being detected. |

| Habitat Management objectives | Performance criteria | Management and mitigation measures | Trigger for further action | Monitoring | Corrective actions |
|---|---|---|---|---|---|
|  |  | capture and transportation to a wildlife carer or veterinarian. |  |  |  |

# 6.0 Monitoring

Stanmore has implemented a monitoring program for the existing IPM Projects. Monitoring required specially for the ID Project will be based on the existing monitoring program as the ID Project is immediately adjacent to the IPM project area. The aim of the monitoring program is to assess the effectiveness of the management measures outlined in the approved ID SSMP. A review of the existing monitoring program will be undertaken to ensure its applicability to the management measures outlined in Section 5.7 and to ensure the corrective actions and performance criteria outlined in Section 5.1 and Section 5.7 are achieved.

The monitoring methods are:

- Specific to the performance criteria being assessed and will determine whether the performance criteria have been achieved or whether corrective actions needed; and
- Quantitative and repeatable such that each monitoring event can be compared to each other to allow changes over time to be. Monitoring to assess the presence of weeds and pest animals was undertaken during the ecological surveys to support the Project approvals to establish a baseline for comparison against subsequent monitoring events. Ongoing monitoring will be outlined in the ID monitoring program and be undertaken every two (2) years as outlined in Section 6.1.2.

The overarching objectives of the monitoring program are to:

- Evaluate performance of the SSMP against performance criteria;
- Identify triggers requiring further action;
- Develop corrective actions if required; and
- Inform subsequent reviews and amendments to the SSMP and associated management plans.

### 6.1.1 General site inspections

General site inspections of the retained MNES habitat, erosion and sediment control devices, water storages, diversion drains and rehabilitated areas (once commenced) will be undertaken at least twice yearly to assess:

- Signs of erosion;
- Visible changes to water quality;
- Signs of damaged erosion and sediment control devices;
- Confirmation that all exclusion fencing and signage are intact;
- Seepage from water storages;
- Signs of dust deposition on vegetation adjacent to disturbance area;
- Any injured or dead MNES; and
- Incidental observations of weeds and pest animals.

### 6.1.2 Habitat quality monitoring

Baseline ecological surveys were undertaken in September/October 2018 (dry season) and February/March 2019 as part of the ID approval process. Ongoing habitat quality monitoring will be undertaken at the monitoring points which were established during the baseline ecological surveys and specific monitoring for this Project will be include in a standalone ID monitoring program or combined into an overarching IPM monitoring program.

Habitat quality assessments undertaken by suitably qualified ecologists include the following methods as required by State and Commonwealth fauna survey guidelines:

- Infrared cameras;
- Funnel traps;
- Spotlighting;
- Diurnal bird surveys;

- Active searches;
- Koala/Greater Glider transects and scat searches; and
- Koala call playbacks.

The habitat quality assessments also include assessments of weed abundance and distribution and an assessment on the presence and relative abundance of pest animals.

Photo monitoring is undertaken at each monitoring location during the habitat quality assessments to allow habitat changes to be visually assessed over time. Photos at each photo monitoring point are taken in a north, east, south and westerly direction with a permanent feature included within the photo frame to provide a fixed reference point. A record of the photographs is maintained, including GPS co-ordinates, date, time, direction and the height above the ground the photograph was taken.

Data from habitat quality assessments and photo monitoring are recorded on survey sheets and these are attached to the monitoring reports that are included in the annual compliance reports.

### 6.1.3 Weed monitoring

The presence and distribution of weeds was initially assessed during the baseline ecological surveys that were undertaken in September/October 2018 and February/March 2019.

Ongoing weed surveys within the ID footprint will be undertaken every two years for the life of the ID approval and will be undertaken in conjunction with the habitat quality monitoring outlined in Section 6.1.2.

In addition to the permanent weed monitoring sites, all incidental observations of weeds are recorded from within the wider Project area, including through quarterly inspections of access points, access tracks and roads. This will provide instances of weed infestations that occur away from the permanent weed monitoring sites. If ID trigger levels for weeds are met or exceeded, additional monitoring will be undertaken and will occur in conjunction with appropriate management measures until the presence and distribution of weeds reduces to baseline levels or below.

### 6.1.4 Pest animals

An initial assessment of the presence and distribution of pest animals was undertaken during the baseline ecological surveys that were undertaken in September/October 2018 and February/March 2019.

Existing and ongoing pest animal surveys will be undertaken every two years for the life of the ID approval in conjunction with the habitat quality assessment surveys.

Pest animals are also opportunistically surveyed throughout the year outside of monitoring times, including observations for potential new pest animal species that have not been previously recorded, and which are known to prey on MNES or degrade MNES habitat. Any evidence of mortality or injury to MNES because of pest animals are being recorded during the surveys. If ID trigger levels for any pest animal species are met or exceeded, additional monitoring will be undertaken and will occur in conjunction with appropriate management measures until pest animal presence reduces to baseline levels or below.

### 6.1.5 Dust

Dust deposition is monitored in accordance with approval conditions and the Dust Management Plan. Dust monitoring will continue to be undertaken at all dust monitoring locations and the monitoring undertaken within the retained vegetation is to assess the impact of dust on retained MNES habitat. Dust within the retained vegetation is also being assessed for visual dust deposition during general site inspections including through quarterly inspections of access points, access tracks and roads.

Where monitoring is requested by the administering authority or because of a complaint, the administering authority must be notified of the results 14 days following completion of the monitoring.

### 6.1.6 Noise and vibration

Noise generated by mining activities is monitored in accordance with approval conditions.

Where monitoring is requested by the administering authority or because of a complaint, the administering authority must be notified of the results 14 days following completion of the monitoring. If the monitoring identifies an exceedance of the relevant noise limits at a sensitive receptor (that will be outlined in the approval conditions), the administering authority must be notified within seven (7) days of the exceedance occurring.

### 6.1.1 Water and erosion and sediment control

Water quality is monitored in accordance with the approval conditions and the required management plans, which includes locations, frequencies and monitoring criteria (trigger levels). Approval conditions are expected to outline water release points, the release limits and the contaminant trigger levels that must be monitored. Approval conditions are also expected to provide notification timeframes associated with the start and cessation of release events and stipulate reporting requirements and outline requirements for monitoring of water storages including monitoring locations and frequencies. Monitoring will be undertaken in accordance with all approval conditions and the REMP.

Visual inspection monitoring will also undertaken for all erosion and sediment control devices and water storages immediately prior to the wet season (e.g. August – October) and following rainfall events >70 mm in 24 hours, unless approval conditions determine otherwise.

### 6.1.2 Fire

Fire management within the Project area is currently undertaken in accordance with the requirements of the CMSHA, CMSHR and the SHMS to mitigate fires from mining activities that have the potential to spread to MNES habitat. The CMSHR includes monitoring and review requirements for the SHMS.

Monitoring of biomass for fire management is undertaken during the habitat quality assessments as outlined in Section 6.1.2. The habitat quality monitoring attributes associated with ground covers such as grass cover, organic litter, coarse woody debris and weeds are surrogates for biomass. Should these surrogates show an increase beyond benchmark values, suitable management actions aimed at reducing biomass loads will be investigated by a suitably quantified expert in consultation with the site senior executive and within the requirements of the CMSHA, CMSHR and the SHMS.

# 7.0 Data management, reporting, implementation and auditing

## 7.1 Data management

The EO will be responsible for overseeing and managing all the monitoring activities and programs required as part of this SSMP, including maintaining data records.

## 7.2 Reporting

The results of all monitoring programs will be documented in stand-alone progress reports and combined into an annual compliance report. The annual report will be provided to DAWE and DES as required. The required compliance reports will include as a minimum an introduction, purpose, activities undertaken in the reporting period and a compliance table outlining compliance with approval conditions but also compliance with the management actions outlined in Table 6.

## 7.3 Implementation

Stanmore will not commence clearing of habitat for the MNES listed Table 1 of this SSMP until the ID Project (the action) has been approved by the Minister and all pre-construction approval conditions have been met. Following approval, this SSMP will be implemented and will remain effective for the life of the Project.

Habitat quality assessments including monitoring for the presence and distribution of weeds and pest animals will be undertaken at the habitat quality plots established during the baseline ecological surveys. Table 6 outlines an indicative monitoring implementation schedule.

**Table 6: Proposed monitoring implantation schedule**

| | Year | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2022 | 2024 | 2026 | 2028 | 2030 | 2032 | 2034 | 2036 | 2038 | 2040 | 2042 | 2044 | 2046 |
| **Ecological monitoring program** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

## 7.4 Auditing and review

Internal audits/reviews of management and monitoring activities will be undertaken in response to a trigger for further action being detected (refer to Table 6) and potential non-compliance with SSMP requirements. External auditing will be undertaken in accordance with approval conditions and if directed by the Minister.

The effectiveness of actions within this SSMP will be reviewed two years after approval and implementation and the SSMP will be adapted to include additional or revised actions where necessary. This SSMP will then be reviewed every two years and immediately prior to the decommissioning phase of the Project.

The reviews will also assess the available monitoring data to determine the effectiveness of the management measures and the corrective actions outlined in Section 5.7 and Table 6. All monitoring data will be reviewed by suitably qualified ecologists and analysed using appropriate analytical methodologies as determined by the ecologist to assess any non-compliances with the actions outlined in Table 6.

# 8.0 Risk assessment

A risk assessment was undertaken using the risk assessment process provided by the DAWE to assess risks associated with failing to achieve the management objectives outlined in this SSMP for mitigating impacts to MNES. For each identified risk, the potential consequence of the risk (Table 7) was assessed against the likelihood of that risk occurring (Table 8) to determine an overall risk rating using the matrix in Table 9.

The consequence and likelihood of each risk occurring was assessed following the implementation of the management and mitigation measures (i.e. control measures) to provide a residual risk rating (Table 10).

**Table 7: Consequence classification**

| Qualitative measure of consequences (what will be the consequence/result if the issue does occur) | |
|---|---|
| **Minor** | Minor risk of failure to achieve the SMPs objectives. Results in short term delays to achieving plan objectives, implementing low cost, well characterised corrective actions. |
| **Moderate** | Moderate risk of failure to achieve the SMPs objectives. Results in short term delays to achieving plan objectives, implementing well characterised, high cost/effort corrective actions. |
| **High** | High risk of failure to achieve the SMPs objectives. Results in medium-long term delays to achieving plan objectives, implementing uncertain, high cost/effort corrective actions. |
| **Major** | The SMPs objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies. |
| **Critical** | The SMPs objectives are unable to be achieved, with no evidenced mitigation strategies. |

**Table 8: Likelihood classification**

| Qualitative measure of likelihood (how likely is it that this event/circumstances will occur after management actions have been put in place/are being implemented) | |
|---|---|
| **Highly likely** | Is expected to occur in most circumstances. |
| **Likely** | Will probably occur during the life of the project. |
| **Possible** | Might occur during the life of the project. |
| **Unlikely** | Could occur but considered unlikely or doubtful. |
| **Rare** | May occur in exceptional circumstances. |

**Table 9: Risk Rating Matrix**

| | | Consequence | | | | |
|---|---|---|---|---|---|---|
| | | 1. Minor | 2. Moderate | 3. High | 4. Major | 5. Critical |
| Likelihood | 5. Highly Likely | Medium | High | High | Severe | Severe |
| | 4. Likely | Low | Medium | High | High | Severe |
| | 3. Possible | Low | Medium | Medium | High | Severe |
| | 2. Unlikely | Low | Low | Medium | High | High |
| | 1. Rare | Low | Low | Low | Medium | High |

For the purposes of this risk assessment, the risk levels are defined as follows:

- Severe: Unacceptable risk that must not proceed until suitable and comprehensive control measures have been adopted to reduce the level of risk.
- High: Moderate to critical consequences. Works should not proceed without considerations of additional actions to minimising the risk.
- Medium: Acceptable with formal review. Medium level risks require active monitoring due to the level of risk being acceptable.
- Low: Acceptable with active management not considered required.

**Table 10: Risk assessment and management**

| Objectives for MNES Management | Risk | Event or Circumstance | Control Strategies | Residual Risk Rating | | |
|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Overall Risk Rating. |
| Limit or avoid loss of MNES and/or habitat for MNES. | • Clearing of habitat for MNES occurs outside of the approved disturbance limits.<br>• A loss of habitat for the Koala, Greater Glider, Ornamental Snake, Black-faced Monarch and Satin Flycatcher outside of the approved disturbance limits.<br>• A loss of habitat and permanent water sources for the Squatter Pigeon outside the approved disturbance limits.<br>• Disturbed areas are not rehabilitated in accordance with the Rehabilitation Management Plan. | • Clearing contractors unaware of the disturbance limits or MNES habitat.<br>• Clearing occurs outside of the disturbance limits.<br>• Rehabilitation is not undertaken in accordance with the Rehabilitation Management Plan | • Infrastructure will be sited in accordance with the State and Commonwealth approval conditions.<br>• Areas requiring vegetation removal will be clearly delineated to ensure disturbance to areas being retained is avoided. Limits of clearing are to be delineated using barricading or temporary fencing and signage prior to works commencing. Exclusion areas are to be clearly shown and labelled on all operational and management drawings and plans. GIS shapefiles will be provided to clearing personnel and/or contractors prior to the commencement of clearing operations.<br>• Where exclusion fencing is required, consideration shall be given to fauna movement, current land uses and worker safety requirements.<br>• Permanent water sources for retention such as farm dams outside of the disturbance limits will be clearly delineated and shown and labelled on all operational and management drawings and plans<br>• Avoid where possible and within the constraints of the mining schedule, impacting on MNES habitat during breeding periods through timing of clearing and creek disturbance activities to avoid the main breeding season of impacted MNES (i.e. late dry season to wet season).<br>• Prior to entry to the Project area, all site personnel including contractors shall be made aware via | 2 | 2 | L |

| Objectives for MNES Management | Risk | Event or Circumstance | Control Strategies | Residual Risk Rating | | |
|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Overall Risk Rating. |
| | | | toolbox talks and site information sheets, of the sensitive environs they will be working in and around and be advised of specific limitations to construction works being undertaken in or adjacent to threatened fauna habitat. All staff and contractors will be required to report sightings of SMP relevant fauna in the activity area to the EO immediately.<br>• An internal 'Permit to Disturb' system will be used by the EO to ensure that all clearing activities are authorised prior to disturbance. Conditions listed in the Permit to Disturb must be implemented.<br>• The EO or delegate will routinely inspect the disturbance limit boundaries to ensure that no clearing or disturbance of vegetation or habitat beyond the approved limits has taken place.<br>• Temporary stockpile sites for soil and equipment, access routes, laydown areas and other associated infrastructure will be located in cleared areas and will not be situated in areas of MNES habitat.<br>• Prior to construction activities commencing, signage, including speed limits, will be erected in the vicinity of exclusion areas to warn of the potential presence of threatened fauna in the area.<br>• Pre-clearance surveys will be undertaken by a suitably qualified ecologist using approved State and Commonwealth survey guidelines within 48 hours of clearing activities commencing.<br>• The pre-clearance survey will be undertaken in order to: | | | 🟩 |

| Objectives for MNES Management | Risk | Event or Circumstance | Control Strategies | Residual Risk Rating | | |
|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Overall Risk Rating. |
| | | | ◦ Record the location of all hollow bearing trees, log piles and nest using a GPS. Features of tree hollows (diameter, number and whether active/inactive) should be recorded in the Environmental Diary/Register; and<br>◦ Relocate all captured non-breeding animals to suitable habitat adjacent to the disturbance area and within the footprint area.<br>• A Fauna Spotter will be present for all clearing activities and will conduct a walk-through survey prior to commencement of clearing and prior to clearing works each day to check vegetation and other fauna habitats.<br>• The Fauna Spotter will reinspect the area of cleared vegetation immediately after clearing to locate any potentially injured fauna that should then be taken to a wildlife carer or veterinarian.<br>• Vegetation clearing will be undertaken progressively, and trees will be felled in the direction of the clearance zone to avoid impacts to adjoining retained vegetation and habitat.<br>• Hollow bearing trees will be clearly flagged, and surrounding vegetation removed with the hollow bearing tree left standing for at least one night to encourage fauna to relocate of its own accord. Hollow bearing trees will be inspected to determine if hollows are occupied.<br>• If after one night the resident fauna have not moved on, the hollow entrance will be blocked with a towel or similar and the hollow removed by cutting below | | | 🟩 |

| Objectives for MNES Management | Risk | Event or Circumstance | Control Strategies | Residual Risk Rating | | |
|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Overall Risk Rating. |
| | | | the hollow section. The hollow with the animal inside will then be installed in nearby similar and adjoining vegetation to be retained at a similar height and orientation with the entrance unblocked at dusk.<br>• If the procedure described above is not possible for any reason, hollow-bearing trees will be felled using a tree grab or similar that can remove the tree in a controlled fashion. If possible and safe to do so, hollow trees will be felled at dusk to allow fauna the opportunity to disperse during their normal activity period. These trees will be felled away from hollow openings. The tree will be knocked at the base several times prior to felling to encourage fauna to relocate of their own accord. Once the tree is felled, it will be inspected for any fauna and any injured fauna rescued and taken to a wildlife carer or veterinarian.<br>• Any fauna that is captured will be relocated into the adjacent habitat at least 200 m from the clearing area if clearing works are yet to be completed.<br>• Where threatened fauna is identified and delaying the clearing of area is not feasible, (i.e. the clearing is critical to the activity schedule), a 50 m exclusion zone will be established and the area must not be disturbed for a minimum of 24 hours while clearing is undertaken around the exclusion zone. After 24 hours, a Fauna Spotter/Catcher may relocate the breeding animal to suitable habitat at least 200 m away from the disturbance area. Where survival of young or eggs is unlikely as a result of the | | | 🟩 |

| Objectives for MNES Management | Risk | Event or Circumstance | Control Strategies | Residual Risk Rating | | |
|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Overall Risk Rating. |
| | | | disturbance, these are to be handed over to a previously identified wildlife carer or veterinarian. | | | |
| Prevent habitat degradation and a decline in habitat values within the retained habitat adjacent to the Project area and mining areas. | • Habitat quality score within the retained MNES habitat falls below the baseline habitat quality score. | • Increased weed abundance or an introduction of new weed species due to mining activities.<br>• Increased pest animal abundance or new pest animal species occur due to mining activities.<br>• Uncontrolled fire from mining activities.<br>• Increased dust deposition resulting from mining activities.<br>• Altered flooding regimes impacts riparian vegetation. | • Areas of MNES habitat adjacent to the disturbance footprint and within the. mining lease, will be clearly delineated and shown and labelled on all operational and management drawings and plans. GIS shapefiles will be provided to clearing personnel and/or contractors prior to the commencement of clearing operations.<br>• Site access is only to occur along designated site access tracks. No unauthorised access is permitted.<br>• Prior to commencement of the action signage, including speed limits, will be erected to warn of the potential presence of threatened fauna in the area.<br>• Posters will be developed and displayed in meeting areas that reminds staff and contractors about the MNES present in the Project area.<br>• Prior to entry to the Project area, all site personnel including contractors shall be made aware via toolbox talks and site information sheets, of the sensitive environs they will be working in and around and be advised of specific limitations to construction and/or operational works being undertaken in or adjacent to threatened fauna habitat. All staff and contractors will be required to report sightings of MNES fauna to the EO immediately<br>• Where tree hollows that are suspected as being used by Greater Gliders are identified from within the disturbance area, they are to be salvaged to the greatest extent possible and relocated within | 3 | 2 | M |

<table>
<tr><th rowspan="2">Objectives for MNES Management</th><th rowspan="2">Risk</th><th rowspan="2">Event or Circumstance</th><th rowspan="2">Control Strategies</th><th colspan="3">Residual Risk Rating</th></tr>
<tr><th>Likelihood</th><th>Consequence</th><th>Overall Risk Rating.</th></tr>
<tr><td></td><td></td><td></td><td>retained vegetation. As far as practical, the site of the relocation is to be within retained vegetation and replicate the height and orientation of the original breeding or nesting structure. Sections of hollow branch or log will be secured in the new location by mechanical means deemed appropriate by the Fauna Spotter/Catcher (e.g. bolts, metal bands). Relocation is to be undertaken under the supervision of a spotter/catcher.<br>• Selected trees and/or logs will be salvaged and reused as fauna habitat to enhance retained vegetation habitat values (e.g. riparian areas). Trees and other habitat features to be salvaged will be identified and flagged by the Fauna Spotter/Catcher during the walk-through survey and/or clearance activities.<br>• If an occupied tree hollow cannot be relocated the breeding habitat should be replaced nearby and in retained vegetation (but at least 200 m away from the disturbance area) in undisturbed habitat, with an artificial nesting structure at a ratio of 1:1 using current best practice nest box design.<br>• Implementation of dust suppression techniques in accordance with the Dust Management Plan and the CMSHA and the CMSHR.<br>• Maintenance of existing fences.<br>• Pest animals and weeds will be managed in accordance with the Project’s Weed and Pest Management Plan.</td><td></td><td></td><td></td></tr>
</table>

| Objectives for MNES Management | Risk | Event or Circumstance | Control Strategies | Residual Risk Rating | | |
|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Overall Risk Rating. |
| | | | • Light spill we be directed to the open cut pits to minimise light spill.<br>• The use of low wattage lighting with list spill guards. | | | 🟨 |
| Minimise risk of weed introduction and/or the spread of existing weed species in habitat area for MNES. | • Spread of existing weed species within Project area.<br>• New weed species being established in areas of MNES habitat. | • Weed management not undertaken for the Project or a Weed and Pest Management Plan not developed.<br>• Vehicle weed washdowns not occurring.<br>• Targeted wed control not undertaken or ineffective. | • Weeds will be managed in accordance with the Project's Weed and Pest Management Plan.<br>• The Plan will include the following:<br>o A site induction program that provides weed management information to staff, contractors and visitors.<br>o Detailed control measures aimed at eradicating where possible, or otherwise reducing the extent of weeds in accordance with the Queensland DAF guidelines and the requirements of the *Biosecurity Act 2014*.<br>o Weed washdown procedures for all vehicles brought to site that will be traveling beyond the site office carpark.<br>o Targeted weed control measures within the Project area. | 2 | 2 | L |
| Reduce habitat degradation and potential predation on MNES by pest animals. | • Increase in the relative abundance of (or signs of) pest animals in habitat for MNES.<br>• Observation of (or signs of) a pest animal species not previously recorded in the Project site. | • Pest animal management not undertaken for the Project or a Weed and Pest Management Plan not developed. | • Pest animals will be managed in accordance with the Project's Weed and Pest Management Plan.<br>• The Project's Weed and Pest Management Plan includes requirements for:<br>o Appropriate waste management and waste disposal. | 2 | 2 | L |

| Objectives for MNES Management | Risk | Event or Circumstance | Control Strategies | Residual Risk Rating | | |
|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Overall Risk Rating. |
| | • Predation of MNES by pest animals. | • Pest animals within the Project area are not controlled. | o A reporting framework to ensure sightings of pest animals are recorded.<br>o Site inductions to include information on pest animals including control requirements, importance of appropriate waste management and reporting requirements when pest animals are observed within the Project area during construction and operation activities.<br>o Control of pest animals.<br>• Pest management actions outlined in the Weed and Pest Management Plan will primarily focus on those pest animals identified within the Project area and include Cane Toads, Feral Cats, Wild Dogs, House Mice and European Rabbits and that have a potential to impact on MNES and their habitat. Additional pests will be included as necessary if identified as occurring within the Project area during the habitat quality monitoring program (European Foxes and Feral Pigs).<br>• Pest management will include a range of best management practice actions including shooting, trapping, fencing and baiting in and will be undertaken in accordance with site safety and health requirements, and DAF guidelines and the requirements of the *Biosecurity Act 2014* and as permitted under the SHMS. | | | |
| Minimise impacts of dust deposition on habitat for MNES during construction and | Dust deposition exceeds 120 mg per square meter per day, averaged over one | • Vegetation not progressively cleared and excessive | • Dust suppression will be undertaken in accordance with the Dust Management Plan and include the following actions: | 3 | 1 | L |

| Objectives for MNES Management | Risk | Event or Circumstance | Control Strategies | Residual Risk Rating | | |
|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Overall Risk Rating. |
| operation of the Project. | month when measured at any sensitive receptor. | disturbed areas left exposed.<br>• Progressive rehabilitation not undertaken.<br>• Requirements of the Dust Management Plan not implemented.<br>• Speed limits not observed or enforced. | o Staging vegetation clearing to minimise areas of disturbed and bare ground.<br>o Progressively rehabilitating disturbed areas.<br>o Removal and dumping of overburden as soon as reasonably practical following blasting activities<br>o Regular watering of haul roads and access tracks in accordance with the CMSHR.<br>o Dust suppression spraying of stockpiles.<br>o Limiting grading and/or dozing in high dust generating areas.<br>o Limiting overburden drilling.<br>• Enforcing speed limits in accordance with the requirements of the CMSHA and CMSHR. | | | |
| Minimise noise and vibration impacts in areas of MNES habitat. | When measured, noise and vibration levels exceed criteria set out in the approval conditions. | • Mining operations not undertaken to minimise night time noise.<br>• Machinery is poorly maintained.<br>• Engines covers are left off or open during operation.<br>• Blasting occurs outside the approved timeframes. | • Regularly maintaining and servicing all plant equipment to minimise machinery noise.<br>• All engine covers will be kept closed while equipment is operating.<br>• Blasting will only occur between 9am and 7pm. | 2 | 1 | L |

| Objectives for MNES Management | Risk | Event or Circumstance | Control Strategies | Residual Risk Rating | | |
|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Overall Risk Rating. |
| Minimise risk of degradation of habitat for MNES through onsite fire management and prevention practices for the Project. | An uncontrolled fire occurs because of Project activities. | • Fire prevention as outlined in the SHMS is not adhered to.<br>• Fire prevention mechanism are faulty or not maintained.<br>• Buffers around ignition sources are not maintained.<br>• Groundcover fuel loads increase past benchmark levels and are not managed. | • Fire management for coal mining operations in Queensland is governed by the CMSHA and the CMSHR with the CMSHR prescribing management of fires for coal mines.<br>• Section 37 of the CMSHR prescribes that the coal mines Safety and Health Management System (SHMS) must include standard operating procedures for action to be taken when a fire is discovered at the mine.<br>• Buffers will be maintained around potential ignition sources such as plant and machinery, haul roads and mine infrastructure areas.<br>• Prior to site entry, all relevant site personnel, including contractors, will be made aware of fire safety and risks.<br>• Fuel loads will be minimised and managed through the weed control measures outlined in the Weed and Pest Management Plan. | 2 | 2 | L |
| Minimise alteration of Squatter Pigeon, Ornamental Snake riparian habitat from changes to water quality and hydraulic activity. | • Water quality, as a result of the Project, does not exceed the receiving waters trigger levels at downstream monitoring sites as outlined in the approval conditions.<br>• Water quality monitoring is not undertaken as required by the REMP. | • Water releases exceed trigger levels.<br>• ESCP devices not functional or damaged.<br>• Water management not undertaken in accordance with the REMP or WMP. | • Site stormwater management will be undertaken in accordance with the management plans and programs required by the as outlined in the approval conditions and a Receiving Environment Monitoring Program (REMP).<br>• The site specific WMP, REMP and ESCP as well as other water management requirements as outlined in approval conditions, will be implemented by a suitably qualified person<br>• Required management plans will be implemented with the aim of minimising alterations to receiving | 2 | 2 | L |

| Objectives for MNES Management | Risk | Event or Circumstance | Control Strategies | Residual Risk Rating | | |
|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Overall Risk Rating. |
| | - Riparian vegetation decreases in quality. | | environment water quality erosion, minimising mobilisation of sediments and minimising erosion related disturbances to the current hydrological regime.<br>- The maintenance and cleaning of any vehicles, plant or equipment must not be carried out in areas from which contaminants can be released into any receiving waters.<br>- Spillage of wastes, contaminants or other materials must be cleaned up as quickly as practicable to minimise the release of wastes, contaminants or materials to any stormwater drainage system or receiving waters. | | | |
| Minimise potential for mortality or injury to MNES from Project activities (e.g. habitat clearing, vehicle strikes etc). | Injury or mortality of an MNES occurs because of Project activities. | - MNES are injured and/or killed from mining related activities.<br>- Speed limits not adhered to. | - Environmental awareness training will be provided to all workers as part of site induction and will include specific topics on MNES, risks and protective measures, and identification of the MNES.<br>- Pre-clearance surveys will be undertaken within 48 hours prior to clearing activities to assess the presence of MNES within the disturbance area to be cleared.<br>- At least one qualified Fauna Spotter/Catcher will be present during clearing activities.<br>- A wildlife carer will be called to collect any injured fauna.<br>- Day time speed limits of 60 km/hr will be set and enforced on all internal roads including haul roads. | 2 | 2 | L |

| Objectives for MNES Management | Risk | Event or Circumstance | Control Strategies | Residual Risk Rating | | |
|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Overall Risk Rating. |
| | | | • Night time speed limits at creek crossing at night will be limited to 40 km/hr.<br>• Vehicles must abide by vehicle speed limits and access to any restricted areas or exclusion zones must be limited to critical site-specific activities to minimise threats to MNES.<br>• All injured fauna encountered during the construction and operation of the activity will be taken to a wildlife carer/facility or veterinarian within 24 hours.<br>• Where injured fauna is encountered, and it is unsafe to handle the animals, the following should be undertaken;<br>o The location of the injured animal will be identified so it can be located again<br>o The species of animal will be identified if possible and its sex and approximate size determined<br>o The type of injury sustained will be identified if possible<br>o The EO shall immediately contact Queensland's Department of Environment and Science (DES) and report the animal and arrange for its capture and transportation to a wildlife carer or veterinarian. | | | 🟩 |

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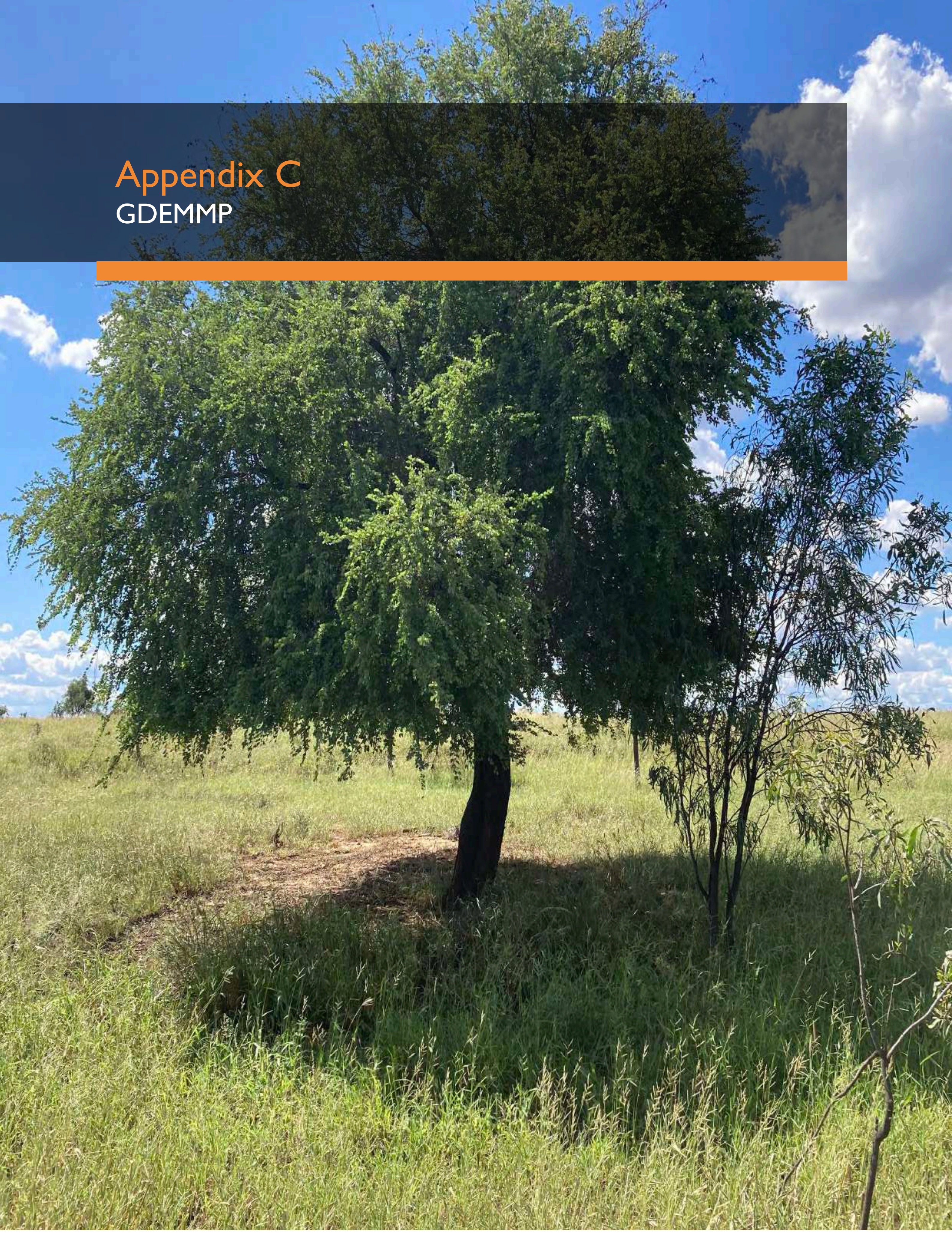

# Appendix C

## GDEMMP

# Groundwater Dependent Ecosystem (GDE) Management and Monitoring Plan

## Isaac Downs Project

Prepared for **Stanmore IP South** *by*

**3d Environmental**

**Final – April 2021_(Revised following DAWE review).**

**Project No**. 2020_231

**Project Manager:** David Stanton

**Client:** Stanmore IP South Pty Ltd

**Purpose: Groundwater dependent ecosystem assessment for the Isaac Downs Project**

| **Draft** | **Date Issued** | **Issued By.** | **Purpose** |
|---|---|---|---|
| Revision 1 | 6 October 2020 | David Stanton | First Draft GDEMMP for comment. |
| Revision 2 | 30 October 2020 | David Stanton | Second Draft GDEMMP following R Oldham comments. |
| Revision 3 | 3 November 2020 | David Stanton | Third review following completion of EIS report and R Oldham comments. |
| Final Document | 6 November 2020 | David Stanton | Final document following corrections. |
| Rev 5 | 21 February 2020 | David Stanton | Draft following review and incorporation of comments from DAWE regarding the amended EIS. |
| Rev 6 | 01 March 2021 | David Stanton | Final updates prior to re-submission to DAWE |
| Final | 14 April 2021 | David Stanton | Finalisation of GDEMMP follow final review by DAWE |

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## Figures

## Tables

## List of Abbreviations

| Abbreviation | Description |
|---|---|
| DAWE | Department of Agriculture Water and Environment (Commonwealth) |
| DES | Department of Environment and Science (Qld) |
| DoEE | Department of Environment and Energy (Commonwealth) |
| EA | Environmental Authority |
| EIS | Environmental Impact Statement |
| EPBC Act | Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) |
| EPBC Approval | Approval granted by the Commonwealth under the EPBC Act |
| EP Act (Water) | Environmental Protection Act (Qld) 1994 |
| ESCP | Erosion and Sediment Control Plan |
| EWR | Environmental Water Requirement |
| GDE | Groundwater Dependent Ecosystem |
| GDEMMP | Groundwater Dependent Ecosystem Monitoring and Management Plan |
| GMMP | Groundwater Management and Monitoring Plan |
| IPM | Isaac Plains Mine |
| LAI | Leaf Area Index |
| LWP | Leaf Water Potential |
| ML | Mining Lease |
| MNES | Matters of National Environmental Significance, as defined under the EPBC Act. |
| NDVI | Normalised Difference Vegetation Index |
| REMP | Receiving Environment Monitoring Program |
| SMP | Soil Moisture Potential |
| SSMP | Significant Species Management Plan |
| WMP | Water Management Plan |

## Glossary

| | |
|---|---|
| Alluvial aquifer | An aquifer comprising unconsolidated sediments deposited by flowing water usually occurring beneath or adjacent to the channel of a river. |
| Aquifer | A geological formation or structure that stores or transmits water to wells or springs. Aquifers typically supply economic volumes of groundwater. |
| Base flow | Streamflow derived from groundwater seepage into a stream. |
| Capillary fringe | The unsaturated zone above the water table containing water in direct contact with the water table though at pressures that are less than atmospheric. Water is usually held by soil pores against gravity by capillary tension. |
| Confined aquifer | A layer of soil or rock below the land surface that is saturated with water with impermeable material above and below providing confining layers with the water in the aquifer under pressure. |
| Perched groundwater system | A groundwater system or aquifer that sit above the regional aquifer due to a capture of infiltrating moisture on a discontinuous aquitard. |
| Phreatic zone | The zone of sub-surface saturation separated from the unsaturated zone in unconfined aquifers by the water table. |

| | |
|---|---|
| Phreatophyte | Plants whose roots extend downward to the water table to obtain groundwater or water within the capillary fringe. |
| Obligate phreatophyte | A plant that is completed dependent on access to groundwater for survival. |
| Evapotranspiration | The movement of water from the landscape to the atmosphere including the sum of evaporation from the lands surface and transpiration from vegetation through stomata. |
| Facultative phreatophyte | A plant that occasionally or seasonally utilises groundwater to maintain high transpiration rates, usually when other water sources are not available. |
| Fractured rock aquifer | An aquifer in which water flows through and is stored in fractures in the rock caused by folding and faulting. |
| Fluvial | Relating to processes produced by or found in rivers. |
| Groundwater | Those areas in the sub-surface where all soil or rock interstitial porosity is saturated with water. Includes the saturated zone and the capillary fringe. |
| Water table | The upper surface of the saturated zone in the ground, where all the pore space is filled with water. |
| Groundwater dependent ecosystems (GDE) | Natural ecosystems which require access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services (Richardson et al. 2011). |
| Infiltration | Passage of water into the soil by forces of gravity and capillarity, dependent on the properties of the soil and moisture content. |
| Leaf water potential (LWP) | The total potential for water in a leaf, consisting of the balance between osmotic potential (exerted from solutes), turgor pressure (hydrostatic pressure) and matric potential (the pressure exerted by the walls of capillaries and colloids in the cell wall). |
| Leaf area index (LAI) | The ratio of total one-sided area of leaves on a plant divided by the area of the canopy when projected vertically on to the ground. |
| Percolation | The downward movement of water through the soil due to gravity and hydraulic forces. |
| Permeability | A materials ability to allow a substance to pass through it, such as the ability of soil or rocks to conduct water under the influence of gravity and hydraulic forces. |
| Preferential flow | Movement of surface water rapidly from surface to aquifer along preferential flow paths, bypassing older moisture in the upper soil profile. |
| Unconfined aquifer | An aquifer whose upper surface is at atmospheric pressure, producing a water table, which can rise and fall in response to recharge by rainfall. |
| Soil water potential | A measure of the difference between the free energy state of soil water and that of pure water. Essentially a measure of the energy required to extract moisture from soil. |
| Stable isotope | An isotope that does not undergo radioactive decay. |
| Surface water | Movement of water above the earths' surface as runoff or in streams. |
| Transpiration | The process of water loss from leaves, through stomata, to the atmosphere. |
| Terrestrial GDE | Terrestrial vegetation supported by sub-surface expression of groundwater (i.e. tree has roots in the capillary fringe of groundwater table). |
| Vadose zone | The unsaturated zone, above the water table in unconfined aquifers. |
| Water Potential | The free energy potential of water as applied to soils, leaves plants and the atmosphere. |

# 1.0 Introduction

## 1.1 Background

3d Environmental has been engaged by Stanmore IP South Pty Ltd (IP South) to prepare a Groundwater Dependent Ecosystem (GDE) Management and Monitoring Plan (GDEMMP) for the proposed Isaac Downs Project (ID Project), an open cut metallurgical coal project.
The Project is in the Bowen Basin coal field, Central Queensland, approximately 145 km south-west of Mackay and 10 km south-east of Moranbah. The proponent has applied for mining leases (MLs) and an environmental authority (EA) to enable the development of the Project, to mine approximately 35 million tonnes over 16 years, with a variable annual profile.

IP South is a subsidiary of Stanmore Coal Ltd (Stanmore). Stanmore IP Coal Pty Ltd (IP Coal, a separate subsidiary of Stanmore Coal Ltd (Stanmore), operates the Isaac Plains Mine (IPM) on granted mining lease (ML) 70342, ML 700016, ML 700017, ML 700018 and ML 700019, and subject to an existing environmental authority. Subject to agreement with IP Coal, IP South will utilise existing infrastructure at IPM for coal processing, rejects management, coal railing, power supply and water management to minimise the infrastructure required for the Isaac Downs Project and reduce the Project's impacts, transitioning to Isaac Downs as production at IPM declines.

As a component of the approval process for the ID Project, a Groundwater Dependent Ecosystem (GDE) assessment was undertaken by 3d Environmental which identified the presence of GDEs associated with the Isaac River which forms the western boundary of the MLA and fringes the proposed mining pit. This GDEMMP has been developed in response to this finding.

## 1.2 Purpose of the Management Plan

This GDEMMP has been prepared to manage the environmental impacts of the Project on GDEs through the development of consistently applied monitoring actions, analysis and reporting of data trends. Corrective actions (mitigations) are described and should be implemented when statistically significant impacts on GDE function caused by mining activity are detected. The plan is to be used as a reference for management actions prior to construction, during construction and operation, extending though stages of project rehabilitation, decommission and post operation.

## 1.3 Objectives

Objectives of this GDEMMP are described as follows:

1. Characterise GDEs that are likely to be impacted by the ID Project in terms of ecological function, interaction with surface water and interaction with groundwater as presented in 3d Environmental (2020a).
2. Provide a synopsis of the potential risks to GDE integrity posed by mining activities associated with the ID Project.
3. Identify biophysical parameters that can be applied to the monitoring of GDE function that can be repeated objectively and consistently throughout the life of the ID Project to measure GDE health.
4. Describe the most appropriate actions to measure changes to biophysical function of GDEs that may indicate a decline in GDE health and provide a statistically robust framework that can demonstrate whether impacts to GDEs are associated with mining activities rather than natural variation.

5. Develop triggers that may be used to initiate the application of corrective actions, which can be refined over time as monitoring data is collected.
6. Develop a suite of corrective actions that may be applied to ameliorate impacts to GDEs and prevent or repair declining GDE health.
7. Develop disturbance thresholds and offset requirements should corrective actions not be successful.

## 1.4 Relevant Legislation

The ID Project is being assessed under the bilateral agreement between the Commonwealth and the State of Queensland using the EIS prepared under the *Environmental Protection Act 1994* (Qld) (EP Act), and it is intended that this GDEMMP satisfies both state and federal provisions. General principals under relevant state and federal regulatory mechanisms are described below.

### *1.4.1 Queensland Legislation*

***Environmental Protection Act 1994:*** Under regulatory provisions of the EP Act*,* IP South applied for a voluntary EIS on 6 March 2019, which was approved by the Department of Environment and Science (DES) on 5 April 2019. A site-specific EA was applied for on 28 June 2019 under Section 125 of the EP Act with the EIS process forming part of the EA application process. The EIS process will be completed on the issue of the EIS Assessment Report by DES in March 2021.

### *1.4.2 Federal Legislation*

***Environment Protection and Biodiversity Conservation Act 1999:*** The ID Project was referred on 6 March 2019 to the Commonwealth Department of the Environment and Energy (DoEE) (EPBC 2019/8413). On 14 May 2019, the Minister for the Environment determined the ID Project to be a controlled action under the EPBC Act. The controlling provisions are sections 18 and 18A (listed threatened species and communities) and sections 24D and 24E (a water resource, in relation to coal seam gas development and large coal mining development).

The *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the protection of environmental values, prescribed under the EPBC Act as Matters of National Environmental Significance (MNES). Any action that will or may cause a significant impact on MNES is subject to assessment approval process under the EPBC Act. In June 2013, the EPBC Act was amended to capture water resources as MNES. Under the amendment, water resources include groundwater and surface water, and organisms and ecosystems that depend on it to maintain ecological function and condition. These ecosystems are otherwise termed GDEs and are captured under the water trigger.

The regulatory guideline *Significant impact guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources* (DoEE 2013a) identify a 'significant impact' as 'an impact which is important, notable, or of consequence, having regard to its context or intensity'. This GDEMMP addresses the uncertainties that are associated with the nature and significance of impacts to GDEs through provision of comprehensive monitoring protocols, including development of 'early warning' triggers which can be used to identify a decline in GDE health.

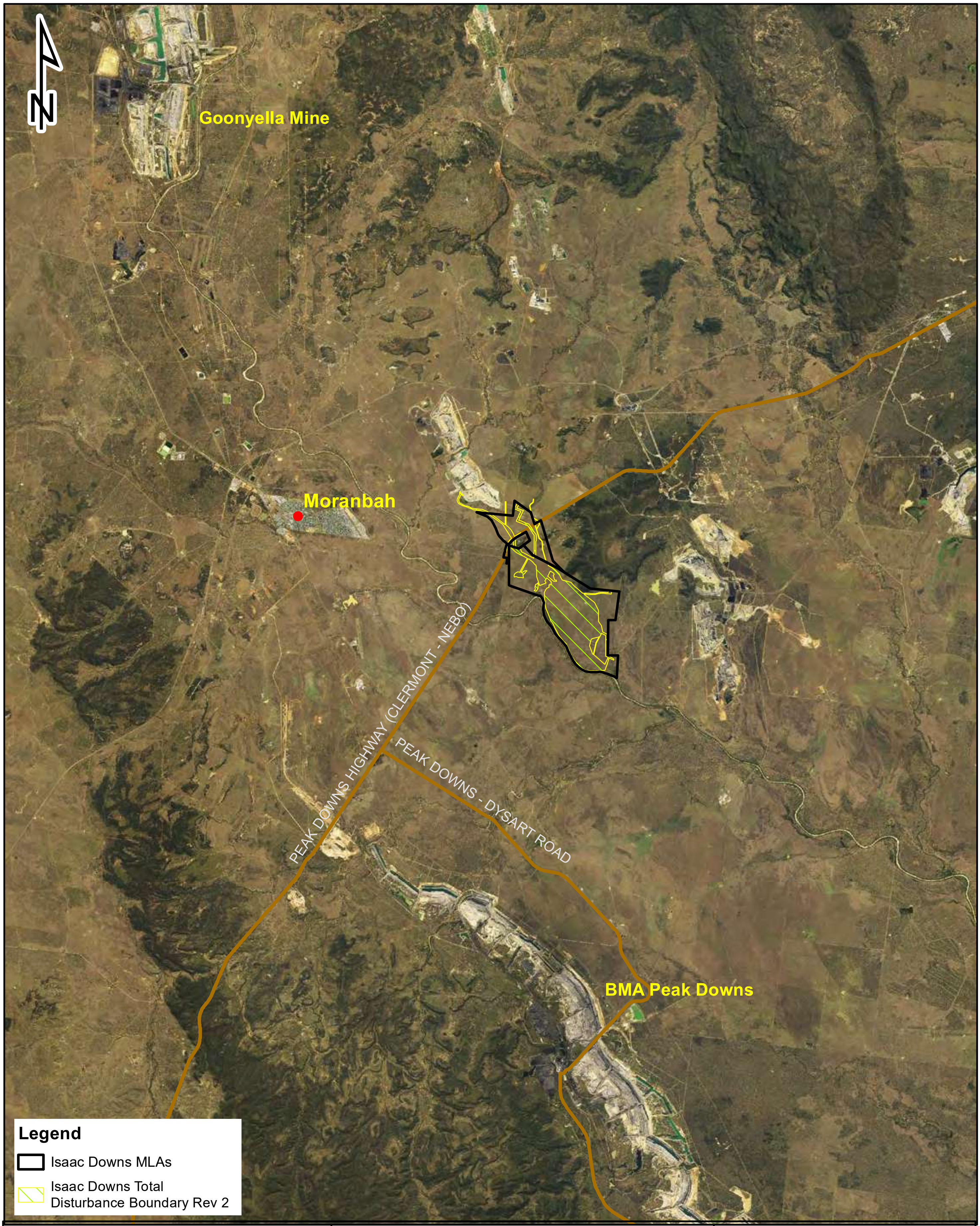

**Figure 1.** Location of the 'The Project'

**Client**

**Stanmore IP South Pty Ltd**

0 4 8 12 16
Kilometers

**Scale** 1:261,384

**Drawn By** DG

**Checked** DS

**File Path**

**Date** 29/10/2020

A4

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D:\Backup C Drive 26519\3D Environmental\Issac\Issac_Map.mxd

## 1.5 Relationship with other plans and management controls

This GDEMMP interacts with the following impact assessments and plans which directly aim to monitor, avoid and / or minimise impact to water and ecology:

1. **Groundwater monitoring and management:** Description of groundwater monitoring and management measures provided in the groundwater impact assessment report for Isaac Downs (AGE 2020).
2. **Isaac Downs Receiving Environment Management Plan (REMP) Document:** Monitors, identifies, and describes any impacts to aquatic ecology and surface water quality values from discharges associated with approved mining activities (FRC 2020a).
3. **Isaac Downs Erosion and Sediment Control Plan (ESCP):** Provides actions and processes to manage sediment dispersal, which may impact GDEs when associated with surface flows.
4. **Isaac Downs Water Management Plan (WMP):** Water management measures are contained in the Isaac Downs Project Surface Water Assessment (WRM 2020) which contains information on potential contaminants, water balance model, description of the site water management system, measures to manage / prevent saline and acid rock drainage, contingency procedures for emergencies and a monitoring and review program for the effectiveness of the WMP.
5. **Isaac Downs –Significant Species Management Plan (SSMP)**: The Terrestrial Ecology Impact Assessment Report for the Isaac Downs Project (EcoSM 2020) Identifies Australian painted snipe (endangered), koala (vulnerable), greater glider (vulnerable), ornamental snake (vulnerable) and squatter pigeon (vulnerable) as potentially being impacted by the ID Project. The SSMP presents the management objectives and measures that are to be implemented within the ID Project footprint for species management and to minimise impacts to current biodiversity values of the site.
6. **Isaac Downs Project –Riparian Baseline Monitoring Program:** Includes measures to monitor the ecological condition of habitat for threatened species under relevant state and federal legislation. The program is described in the Terrestrial Ecology Impact Assessment Report for the Isaac Downs Project (EcoSM 2020).
7. Approvals documents for the Project, once granted (i.e. environmental authority and EPBC Act approval).

## 1.6 Structure of this Document

This GDEMMP intends to compile knowledge on the ecohydrological function of relevant GDEs, scope has been made to update monitoring requirements including methods, timing and interval as the knowledge base increases with each subsequent monitoring survey event. A summary of the key components of this GDEMMP is provided below:

- Section 2: A contextual description of the project in relation to mining layout and project timeframes.
- Section 3: A general description of the existing environment to contextualise hydrogeological and ecological setting with reference to detailed description provided in 3d Environmental (2020a).
- Section 4: Describes in detail the hydro-ecological function of GDEs in the Project area with reference to detailed information in 3d Environmental (2020a).
- Section 5: Provides a summary for what are considered the major risks to GDE health imposed by the ID Project, as presented in 3d Environmental (2020a).

- Section 6: A summary of how the biotic impacts to GDEs may manifest in the environment.
- Section 7: The general approach to the monitoring program.
- Section 8: An overview of monitoring techniques and their application.
- Section 9: A summary of reporting requirements for each monitoring event as well as preparation of a baseline synopsis.
- Section 10: Approach to determining trigger thresholds for which impacts to GDEs are investigated and corrective actions applied where appropriate.
- Section 11: A discussion identifying potential corrective actions that may be applied to ameliorate impacts to GDEs that have been created by mining activities.
- Appendix: Provides the basis for risk assessment, a summary of monitoring methods, monitoring timing, raw data from prior GDE surveys, and preliminary results from the November 2020 GDE monitoring assessment. The Appendix is structured to provide:
    - Appendix A. Mining stages and development plans
    - Appendix B. Summary of GDE sampling methods
    - Appendix C. Sampling localities from the EIS assessment.
    - Appendix D. Stable isotope results from the EIS assessment
    - Appendix E. Summary data from November 2020 GDE monitoring assessment.
    - Appendix F. GDE monitoring two-year schedule.

# 2.0 Project Description and Timing

## 2.1 Project Activities

The three mining lease applications (MLAs) associated with the Project being MLA 700046, MLA 700047 and MLA 700048, are shown on **Figure 2**, which also shows proposed mine infrastructure which will include a ROM coal haul road, linear infrastructure, access road, ROM coal pad, levee and mine infrastructure area. Specific infrastructure will include:

- A purpose built, dedicated haul road to the adjoining IPM to the north.
- A mining infrastructure area (MIA) which will comprise workshops and offices.
- A levee will be constructed during operations to protect the open cut mining operations from flood inundation up to the 1:1000-year flood event from the Isaac River.

Post mining, overburden dumps will be rehabilitated, and a residual void will remain outside of the floodplain of the Isaac River. The residual void area has been minimised through landform modifications and assessment of potential uses of the residual void area. A permanent levee will not be required post mining.

## 2.2 Project Stages and Timing

It is intended, subject to project approvals, that construction will commence in 2021 subject to obtaining all required approvals, with mining operations with mining commencing in 2022. The Project will extract approximately 3.2 Mtpa ROM coal over the first nine years, and then approximately 1 Mtpa over the next seven years as the strip ratio increases. Mining will be completed in 2037. Mine stage plans have been developed, representing the progression of mining activities at each stage, which will be used to inform the management of impacts throughout the life of the mine. The stage plans provided in **Appendix A** which relate to the following mine stages:

- **Year 1,** which is the initial stage of mining operations which includes infrastructure development and the initial box cut.
- **Year 3** box cut has been developed and out of pit dumping is in progress.
- **Year 5** with out of pit dumping substantially complete and in-pit dumping ongoing, with progressive rehabilitation occurring.
- **Year 10** at which point mining well be well advanced, with in-pit dumping ongoing and progressive rehabilitation occurring.
- **Year 16** being the final year of mining operations, with in-pit dumping complete and progressive rehabilitation occurring.
- **Final landform –** post mining rehabilitation and decommissioning completed.

# 3.0 Existing Environment

This section provides an overview of the local and regional setting, including climate, existing and surrounding landuse. For context, detailed information on the following features is described in Isaac Downs Project – Groundwater Dependent Ecosystem Assessment (3d Environmental 2020).

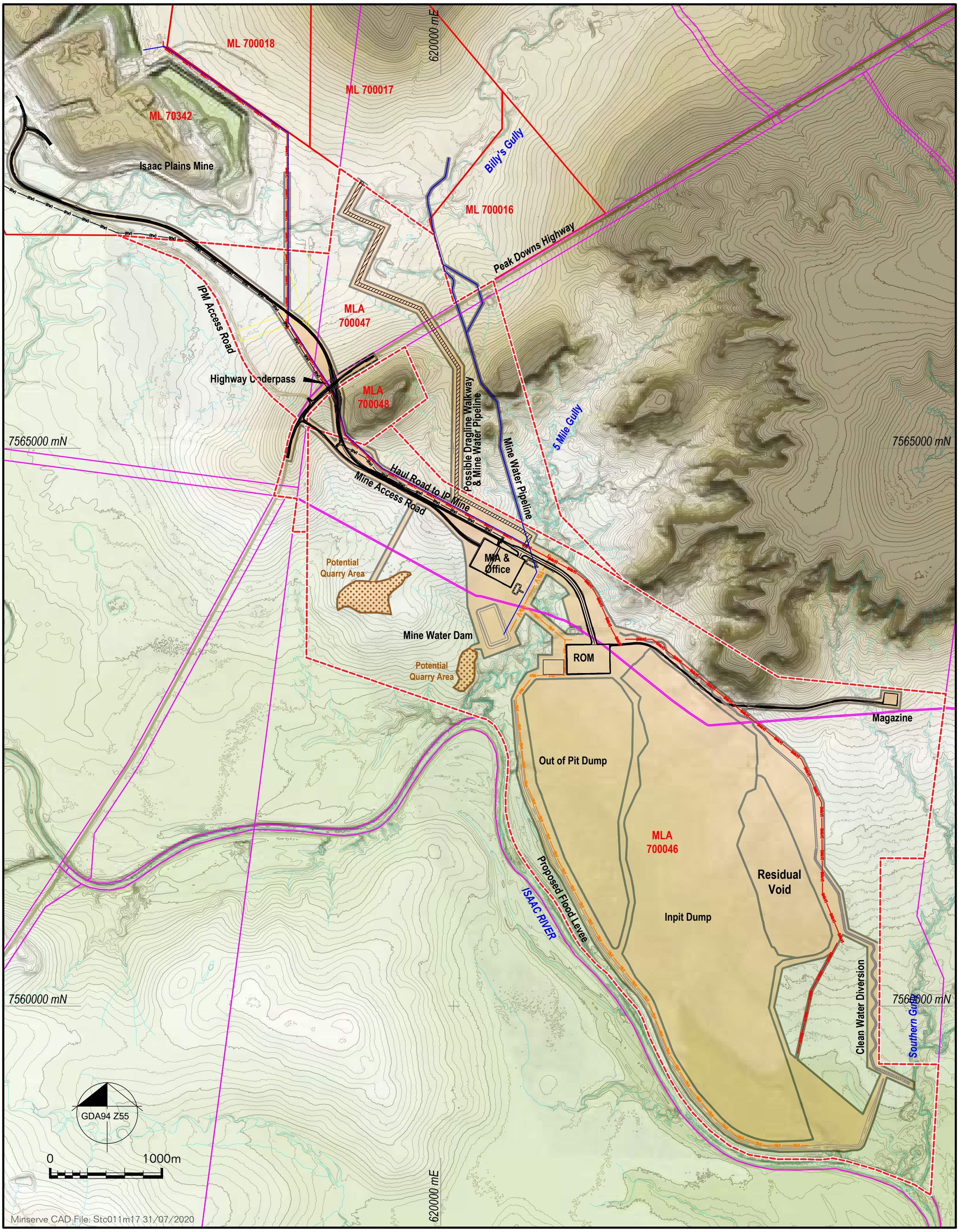
1. Ecological characteristics of the site including potentially groundwater dependent regional ecosystems (REs) and species (**Section 2.1** of 3d Environmental 2020).
2. Hydrogeological setting and the major groundwater bearing units (**Section 2.2** of 3d Environmental 2020).
3. Surface water flows including water quality and flood regimes (**Section 2.3** of 3d Environmental 2020).

## 3.1 Site Setting

The ID Project area is located within the Northern Bowen Basin subregion of the Brigalow Belt Bioregion in central Queensland. The Brigalow Belt North Bioregion is an ecologically complex area characterised by clay soils interspersed with Tertiary plateaus, sand plains, basalt plains and some more expansive ranges formed on sandstone and granite. Vegetation is typically dominated by forests and woodlands of *Acacia harpophylla* (Brigalow), *Acacia shirleyi* (lancewood) eucalyptus woodlands and grassland habitats.

The region surrounding the ID Project area has been extensively cleared of native vegetation to accommodate pastoral activities, except for topographically rugged areas and drainage lines where intact vegetation has generally been retained. Riparian vegetation associated with the larger watercourses is generally continuous, though largely restricted to channel margins with attenuations along minor tributaries and occasionally buffered by broader areas of floodplain woodland. Coal mining has been a more recent activity in the region, emerging in the 1970's as a major industrial activitySeveral coal mines and projects are approved in the region including:

- the Grosvenor Mine adjacent to the IPM
- the Moranbah North Mine located northwest
- the Burton, Broadlea and Ironbark No. 1 Mines located north
- Carborough Downs Mine located north east
- Millennium and Poitrel Mines located several kilometres to the east, and
- the Moranbah South Project and Caval Ridge Mine located to the west.



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| | | | |
|---|---|---|---|
| 🟥 | ML | 〰 | Drainage |
| ⬚ | Isaac Downs Project MLAs | — | Roads - Major |
| 🟧 | Project Footprint | — | Cadastral Boundary |
| | | — | Topography 1m Contours |

ISAAC DOWNS PROJECT

# Proposed Project Layout

Figure 2

Other non-approved projects (at the time of the voluntary EIS decision) that are in the process of being developed include:

- the Winchester South Project, located approximately 10 km south on the western side of the Isaac River, to be developed by Whitehaven Coal
- Olive Downs Project, located approximately 25 km south, to be developed by Pembroke Resources, which also fringes the Isaac River
- Eagle Downs Project located approximately 10 km south, to be developed by South32.

The location of coal mining operations that fringe the ID MLs is shown in **Figure 3**.

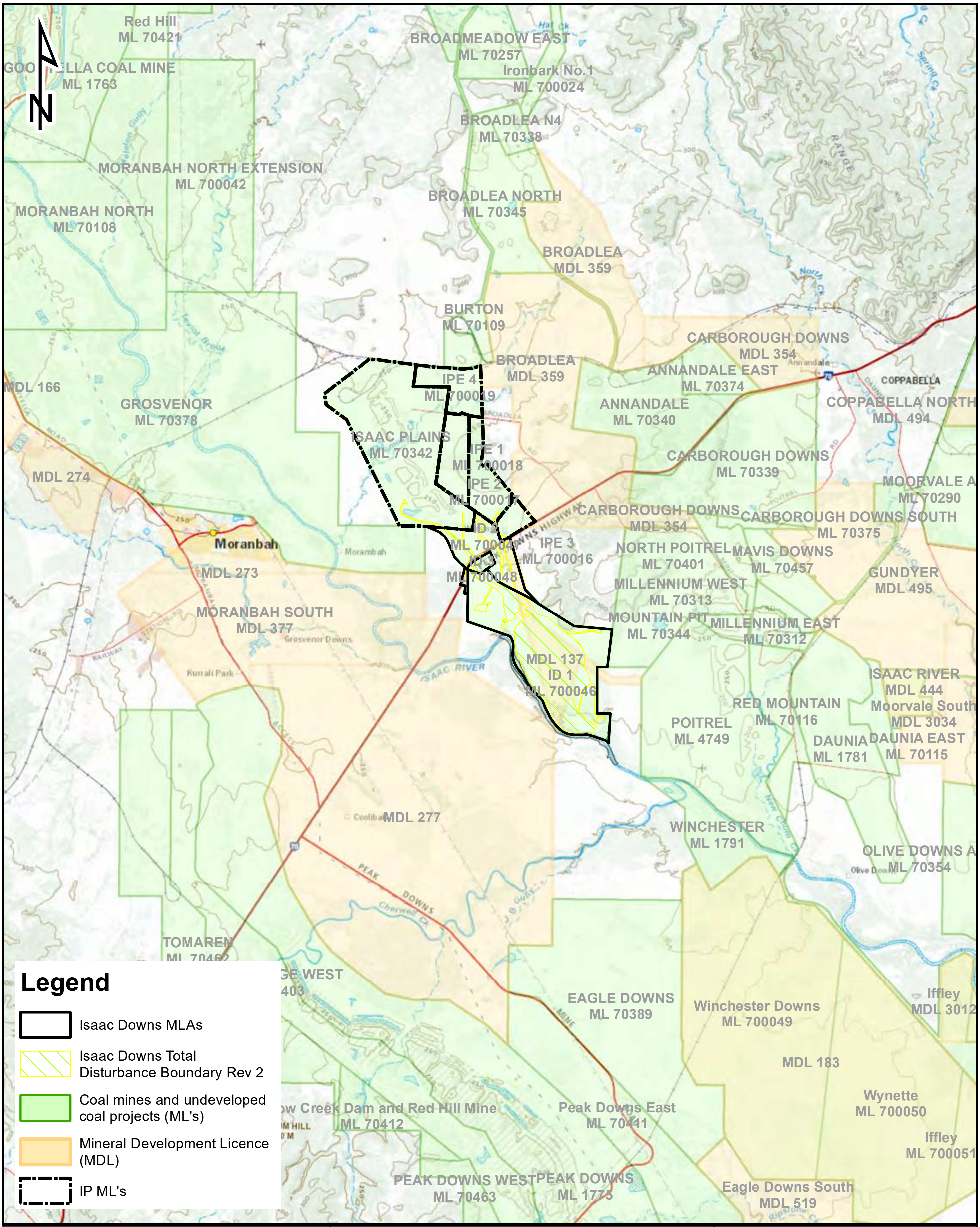

**Figure 3.** Adjacent mining projects

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## 3.2 Climatic Considerations

The region is sub-tropical with average temperatures recorded in Moranbah of between 21.1°C and 34.8°C in the summer months, and 8.9°C and 25.2 °C in the winter months. The long-term average rainfall (30 years of data between January 1990 and December 2019) from the Moranbah Water Treatment Plant is 590.4mm (SILO 2020) with a pronounced wet season. Approximately 75% of the annual rainfall is recorded between November and March, inclusive (BoM 2020). Plant growth in the region is strongly limited by moisture rather than temperature (Hutchinson et al. 1992) which is reflected in the evapotranspiration rates at the Moranbah Airport for the 2019 – 2020 period being considerably higher than rainfall for all months (except for the wettest months). Between January 2015 and December 2019, the largest offset between rainfall and evapotranspiration occurred between October to December during the build-up to summer storms (**Figure 4**) (data from SILO 2020).

The region has experienced several significant drought events, many of which have resulted in tree dieback. The early to mid-1990's drought, the worst on record for north Queensland, and the millennium drought from 2000 through to 2007 both resulted in substantial dieback of native woodland habitats, typically affecting ironbark woodlands and most severely on basaltic substrates (Fensham et al 2009a). **Figure 5** demonstrates the major climatic cycles in terms of Cumulative Rainfall Departure (CRD) (Weber and Stewart 2004), representing a cumulative departure of monthly rainfall from the long term mean monthly rainfall (1990 to 2020) at the Moranbah Water Treatment Plant (SILO 2020). Strongly decreasing rainfall trends between 1990 to 1996; and 2000 to 2007 representing major drought periods are strongly evident, interspersed with periods of above average rainfall between January 1998 and January 2001, January 2010 and July 2012, and January 2016 to March 2017, which were considerably wetter than average conditions.

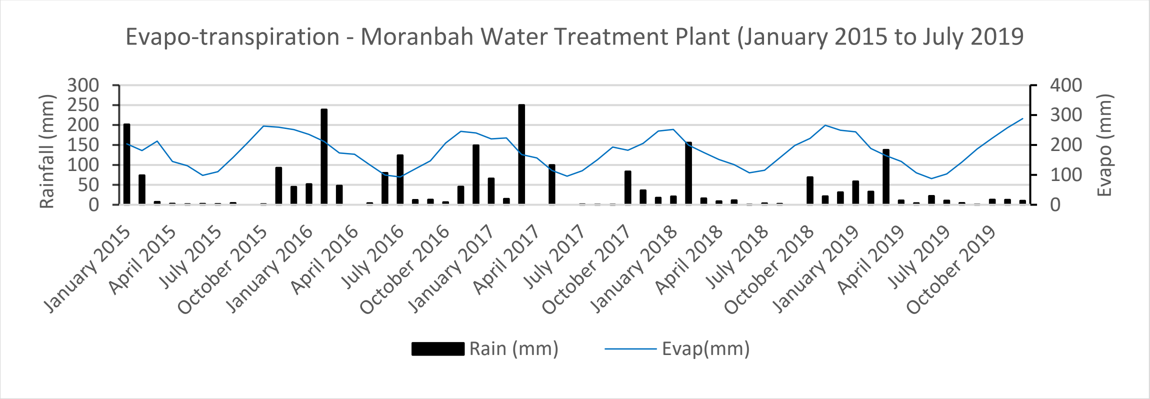


**Figure 4.** Evapotranspiration trends on a seasonal basis for Moranbah Water Treatment Plant.

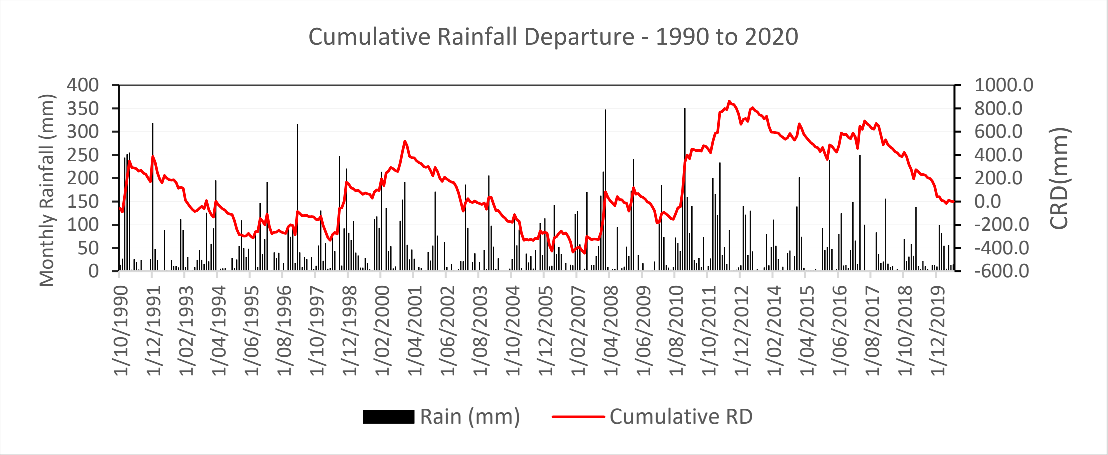


Figure 5. Cumulative rainfall departure calculated for the Moranbah Water Treatment Plant.

### 3.3 Topography and Drainage

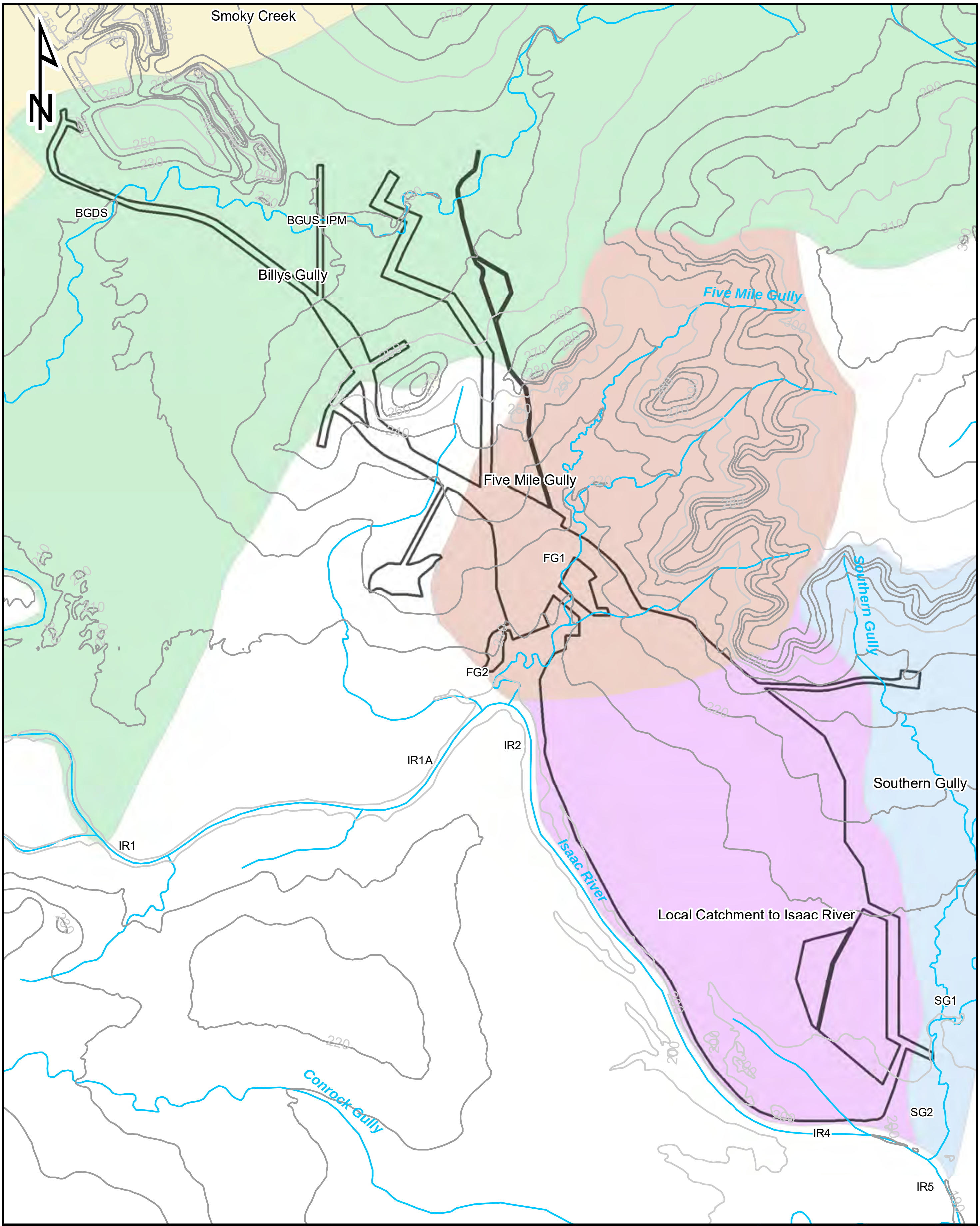
The ID Project is situated on gentle topography with the Isaac River forming a western boundary to the mining footprint, with a broad flood plain extending up to 2km east and west from the main river channel. To the east, the flood plain rises gently with slopes <2° to a broad jump-up which forms the most topographically elevated portion of the local landscape approximately 2km east of its nearest point to the Isaac River. Several drainage features traverse the Project area including the Isaac River, defined by a broad sandy flood channel incised into its flood plain, broadly defining the western limit of the mining footprint. Smaller tributaries include Five Mile Gully and 'Southern Gully' join the Isaac River to the immediate north of, and south of, the ID mining footprint respectively. A haul road crossing of Billy's Gully, an ephemeral watercourse which joins the Isaac River to the north of the Peak Down's Highway and immediately south of the IPM will be established (**Figure 6**).

### 3.4 Surface Geology

Isaac Downs is in the northern part of the Bowen Basin, comprising sediments that are mostly Permian to Triassic age representing principally fluvial and some marine sediments. Economic coal seams are contained in the Rangal Coal Measures, which are late Permian age and approximately 100 m thick. The Rangal's are underlain by the Fort Cooper Coal Measures and overlain by the Early Triassic Rewan Group. Coal deposits in the Project area are bound to the north and east by the Isaac Thrust Fault which is a major structural feature with over 50m vertical displacement. The main geological units in the Project area, from youngest to oldest include:

- Quaternary alluvium associated with Isaac River
- Thin Cainozoic surficial sediments
- Triassic/Permian sediments comprising
    - Surficial weathered zone at outcrop
    - Triassic Rewan Group sediments; and
    - Permian sediments that are divided into the Rangal Coal Measures, Fort Cooper Coal Measures and Moranbah coal measures.

In addition, there is a regional Tertiary basalt flow aligned along a paleochannel system situated to the north-west to west of the Project. (**Figure 7**).



## Legend

— Drainage

☐ Isaac Downs Total Disturbance Boundary Rev 2

**Figure 6.** Topography and drainage

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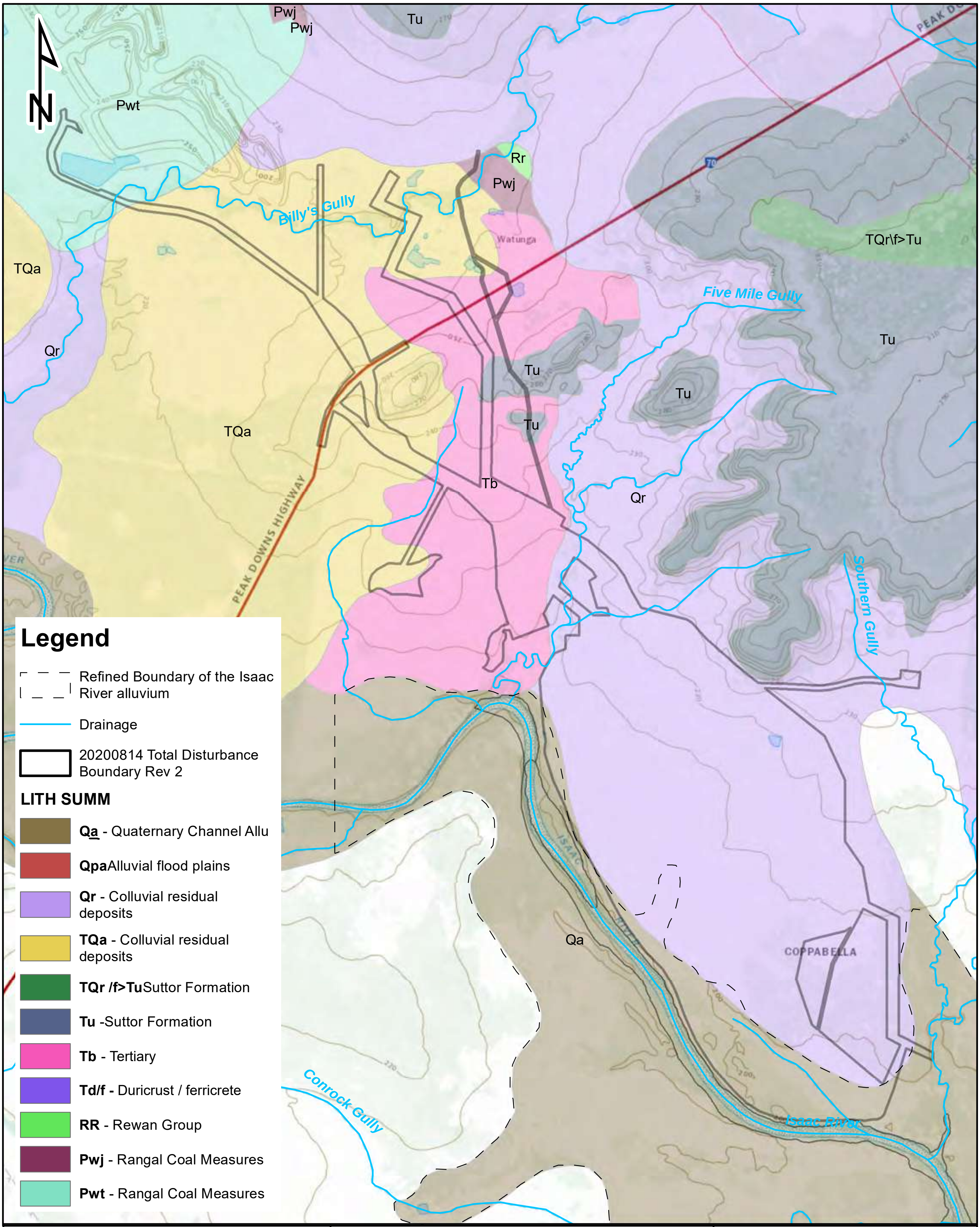

Source: DNRM 2018

**Figure 7.** Surface geology in the Isaac Downs project area

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## 4.0 The Distribution and Hydro-ecological Function of GDEs at Isaac Downs.

Detailed descriptions of the function of GDEs at Isaac Downs, including block model conceptualisations and cross sections have been developed and described in the **Section 5.0** of the Isaac Downs Project Groundwater Dependent Ecosystem Assessment Report (3d Environmental 2020) and should be referred to for more detailed conceptual information. In summary, two GDE areas are identified as being associated with the Isaac River within the Project area being GDE Area 1 and GDE Area 2 (see **Figure 8**). The characteristics of these GDE Areas are described below.

1. **GDE Area 1:** Most trees in this area are inferred to be permanently interacting with shallow groundwater in the alluvial aquifer. This is due to the geomorphic characteristics of the river channel in this location, with a broad inner bench and flood overflow facilitating rapid recharge of the shallow aquifer. There is also the likelihood, that basement rock subcrop is elevated in this area relative to other locations on the river and supports a perched aquifer that is disconnected from the broader aquifer associated with the Isaac River alluvium.
2. **GDE Area 2**: Vegetation on the riparian fringe is variably interacting with groundwater and surface water, and dependence varies in response to position on the riverbank and other geomorphic controls. Trees on the lower riverbank generally demonstrate a greater degree of groundwater interaction than those higher up the bank and on the upper terrace. There is also likely to be a significant proportion of trees in GDE Area 2 that demonstrate no, or limited dependence on groundwater.

From this assessment, it was concluded that vegetation on the older, more elevated alluvial terraces of the Isaac River consistently demonstrated water stress indicative of trees reliant on moisture held in the shallow soil moisture profile rather than groundwater.

## 5.0 Major Risks to GDE Function

A detailed assessment of the potential risks to GDEs at Isaac Downs is developed in **Section 6.0** of the Isaac Downs Groundwater Dependent Ecosystem Assessment Report (3d Environmental 2020) and this document should be consulted if additional detail or specific information is required. Drawdown of the groundwater in the coal seams, propagated into the Isaac River alluvium where coal seams sub-crop, provides the most likely potential impact pathway potentially leading to a decline in GDE function. Groundwater modelling by AGE (2020) indicates project related drawdown of the water table with declines of up to 10m in localised areas beneath the Isaac River where coal seams sub-crop into the alluvium (see **Figure 9**). However, the impacts of this drawdown to GDE function may be ameliorated by:

1. Flooding events and other environmental flows which are the major source of recharge for the groundwater resource being utilised by GDEs on the Isaac River (see **Section 6.0** of 3d Environmental 2020). Flow regimes (i.e. intensity, duration, frequency) will not be impacted by the Project, with negligible to minor changes in the extent and rate of change in flood behaviour (see **Section 2.3** of 3d Environmental 2020).
2. The capacity of river red gum (including forest red gum) to adapt to changing water availability and utilise moisture from several non-saturated water sources (see **Section 6.2.1** of 3d Environmental 2020).

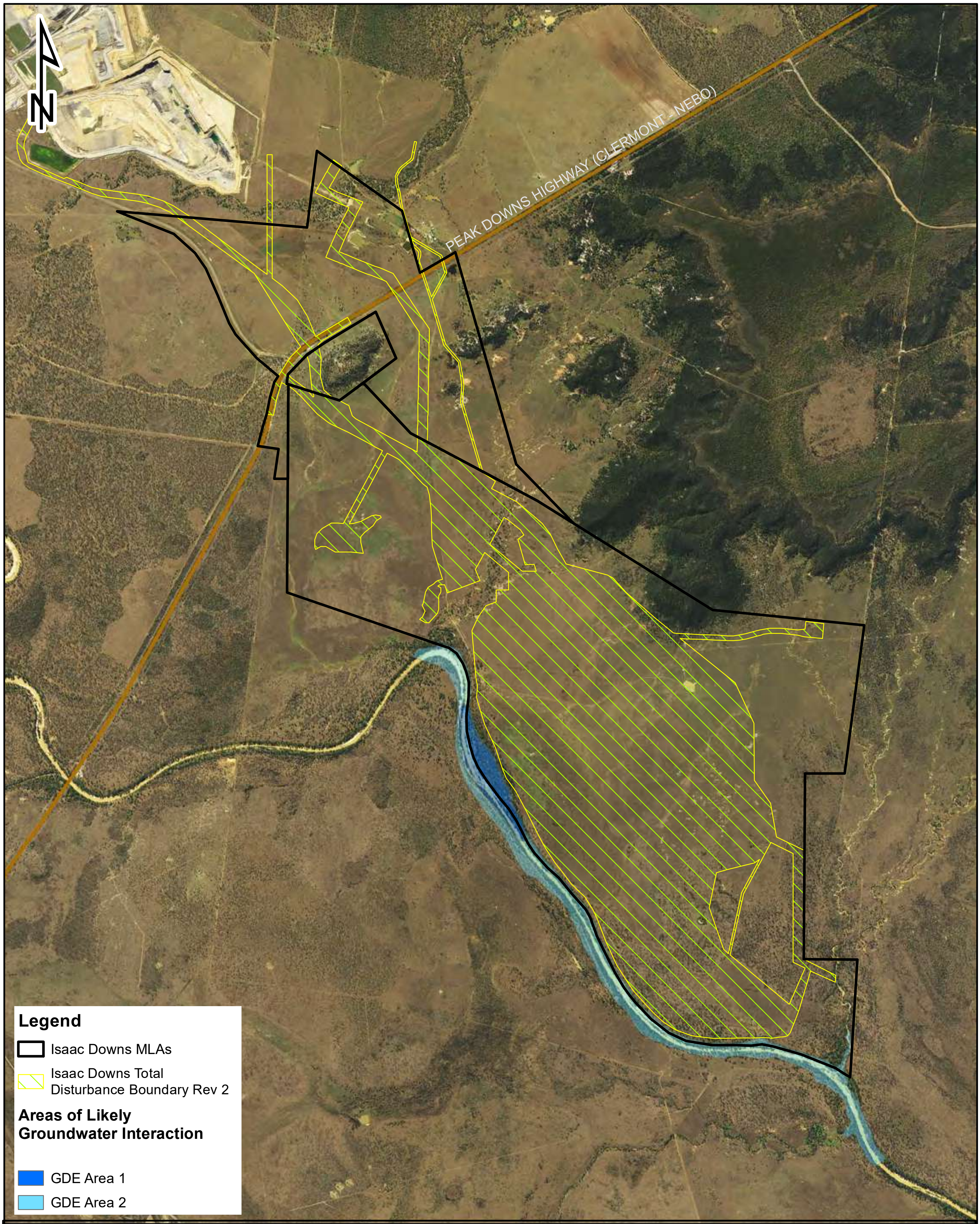

**Figure 8.** Location of GDE Areas.

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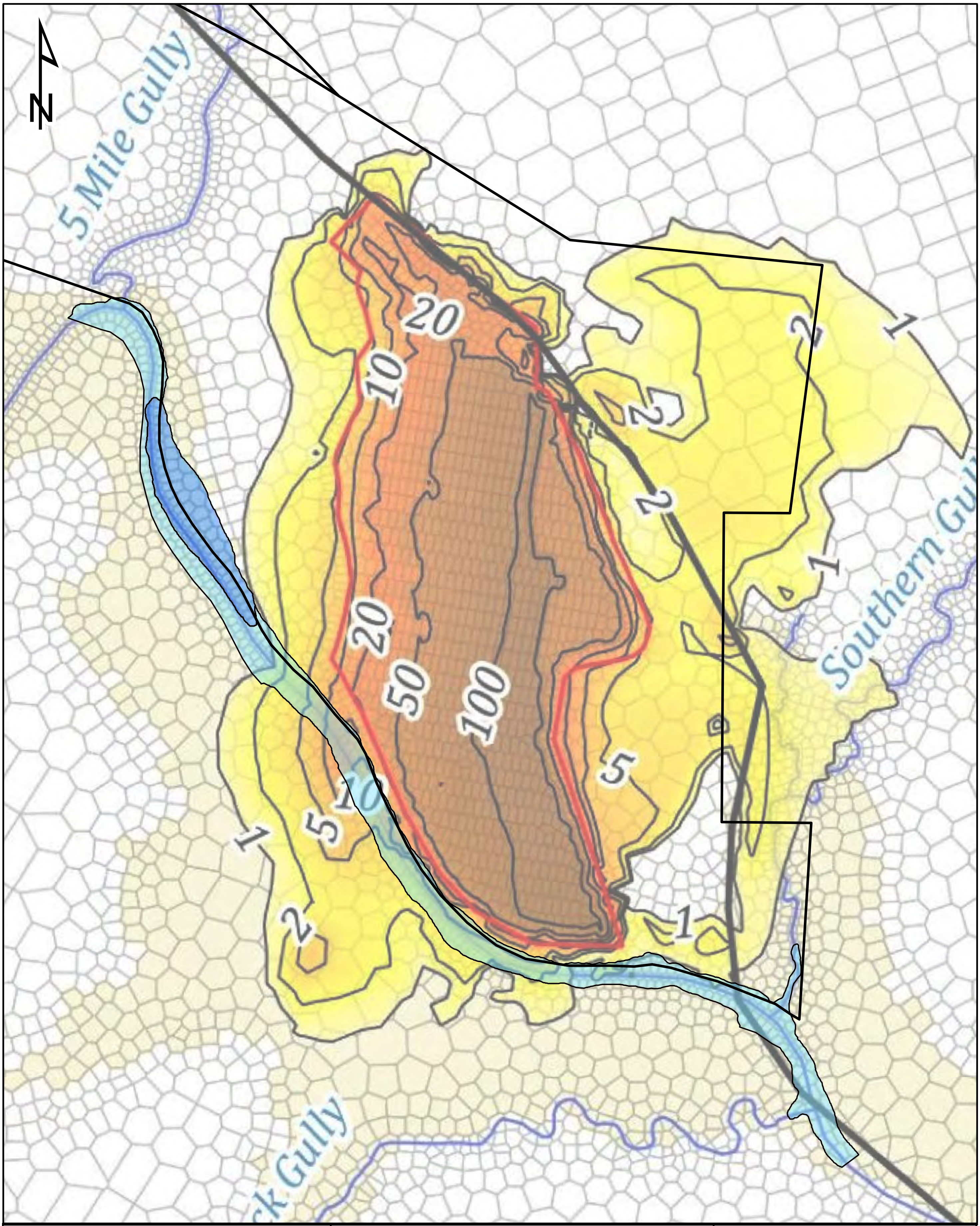

**Legend**

▭ Isaac Downs MLAs

**Areas of Likely Groundwater Interaction**

🟦 GDE Area 1

🟦 GDE Area 2

**Figure 9.** Location of mapped GDEs relative to maximum drawdown during mining.

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Based on maximum predicted drawdown of the water table from the Project and rate of groundwater drawdown at specific point localities (dummy points) (AGE 2020), mapping of GDE zones was completed to characterise the likelihood of impacts to mapped GDE Areas. A summary of GDE 'Zones' for the purpose of risk assessment is provided in **Table 1** with a mapping of Zones (from 3d Environmental 2020) provided in **Figure 10**.

**Table 1.** Descriptors and ranking for the likelihood of impact to GDE health occurring attributed to specific GDE Risk Categories.

| **Rank** | **GDE Zone** | **Likelihood of Impact** | **Description** |
|---|---|---|---|
| 1 | Zone 1 | Highly unlikely | The GDE is outside area of predicted drawdown. |
| 2 | Zone2 | Unlikely | < 2m drawdown over the 17 yr life of the mining operation or a maximum drawdown rate <0.1m / yr (Point 1, Point 5 and Point 6), |
| 3 | Zone3 | Possible | > 2m drawdown to <5m drawdown over the life of the mining operation and a maximum drawdown rate <0.5m / yr (Point 3 and Point 4). |
| 4 | Zone4 | Likely | >5m drawdown with a maximum drawdown rate >0.5m /yr (Point 2). |

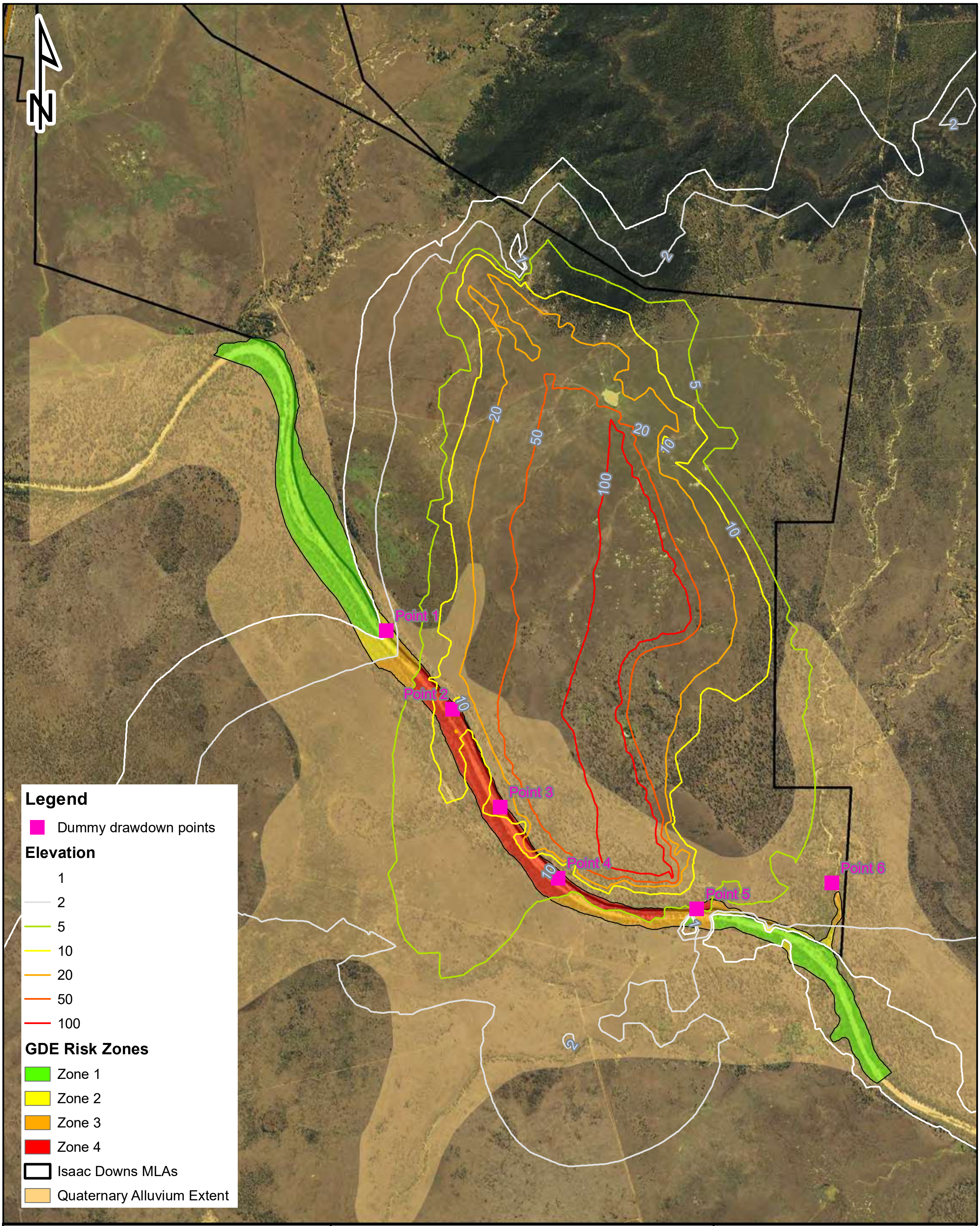

**Figure 10.** GDE zones of potential impact associated with maximum project water table drawdown

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## 6.0 Biophysical Response to Reduced Water Availability / Quality

Eamus et al (2009) provides a conceptual assessment of the major stressors that contribute to declining GDE health. Reduced water availability is the major determinate of GDE health and the flow-on effects of this are outlined in **Figure 11**. Based on conceptualisations provided in **Section 6.1** and risk assessment completed in **Section 6.5** of 3d Environmental (2020a), an unmitigated 'moderate' risk of impact to GDE function is associated with:

1. Zone 3 and Zone 4 of the GDE Zone mapping (**Figure 10)**.
2. A period when maximum groundwater drawdown is associated with a period of drought[1] that diminishes the opportunity for groundwater recharge facilitated by river flows and flooding.

In a 'worst case' scenario when maximum drawdown coincides with a period of drought, the predicted impact would be of 'moderate' magnitude, which in the context of the risk assessment detailed in **Section 6.4** of 3d Environmental (2020) would result in a:

> *'Threshold breach of Leaf Area Index (LAI) that indicates plant stress linked to mining activities that does not result in > 25% dieback of mature canopy trees (defined as a canopy tree with DBH >60cm). The Impact is reversible with mitigation'.*

The decrease in groundwater availability associated which drawdown of the water table, and seasonal dryness extending into the summer months when transpiration is highest will be likely to trigger stomatal closure and reduction in LAI. Over an extended period with sustained conditions of drought, increasing levels of plant mortality may occur and in a general context, these adverse physiological responses may ultimately result in the conversion of a diverse, functioning habitat to a simplified system with reduced ecological value (Doody et al 2009). As detailed in **Figure 11,** the time taken for the first measurable impacts on vegetation due to groundwater drawdown to manifest may take months with habitat conversion due to dieback of the original canopy taking many years to decades with the rate of dieback dependent on climatic controls. However, detectable changes in vegetation health would be apparent within months to a few years, if this were to occur. Many of the physical responses of vegetation to reduced water availability can also occur because of natural seasonal variation and hence any monitoring program must have capacity to distinguish what is natural variation from impacts that result from anthropogenic disturbance to the hydrogeological regime.

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[1] Defined as a standardised 3-year cumulative index of <-1, meaning that based on average rainfall values, <2years of rainfall is received over a period of 3 years (Fensham et al 2009b).

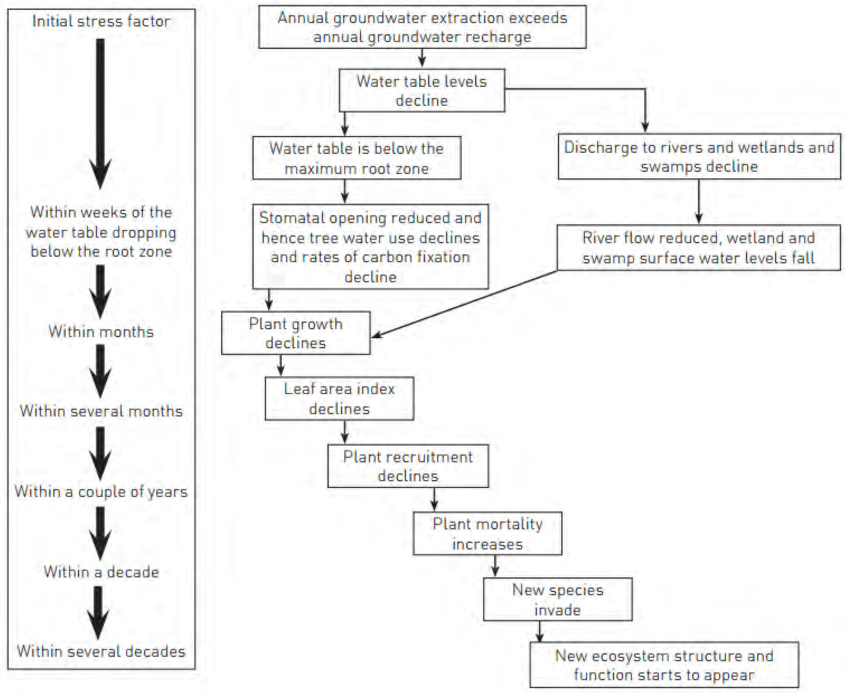

**Figure 11.** Schematic outline of the response of plants and communities of plants to reduced availability of groundwater from Eamus (2009).

# 7.0 Approach to Monitoring and Management Program

## 7.1 Overview

This document provides a framework for the management and monitoring of GDEs associated with the Isaac River including areas both within the area of predicted groundwater drawdown and more broadly throughout the Isaac River frontage upstream and downstream from the ID Project area. The monitoring program also considers the major tributaries of Southern Gully and Conrock Gully which occur in the south of the Project area, and while not being considered GDEs (BOM 2020), are captured within the monitoring program due to riparian linkages with the Isaac River GDE system. A sequential approach to monitoring and management has been applied which allows for adaptive implementation of monitoring and management protocols reliant on results of prior assessment activities. The major components of the GDEMMP include provision to:

- Apply monitoring and assessment techniques that support development of an environmental baseline for GDE function commencing prior to operations, including an upstream and downstream control site for GDE monitoring.
- Produce a statistically robust multi-parameter dataset that can be used to validate perturbations in GDE function that fall beyond thresholds of natural seasonal variation.
- Allow a flexible approach to monitoring which is subject to ongoing review and allows methods to be adapted based on results of lead-up monitoring and data analysis.
- Utilise biophysical and ecological parameters to establish:
    - an appropriate ecological trigger threshold, applied to indicate requirement for further investigation or corrective action; and
    - an appropriate disturbance level threshold applied to indicate requirement for offsets should corrective actions not be successful.
- Develop a comprehensive suite of management actions and corrective measures which will be applied if a breach of trigger threshold is identified, noting that the suite of management actions implemented will depend on impacts identified, and all may not be required for any given breach of a trigger threshold.
- Assess the effectiveness of management actions and corrective measures, determine if significant residual impacts to MNES have occurred, and where significant residual impacts have occurred, provide offsets.

The approach is consistent with the GDE Toolbox approach (Richardson 2011a and 2011b) which recommends a sequential assessment, as outlined below:

- Stage 1 – GDE location, classification and basic conceptualisation. The focus of Stage 1 is to gain a baseline understanding of where potential GDEs exist including classification of GDE type and ecohydrological function.
- Stage 2 – Characterisation of groundwater reliance. Stage 2 assessment builds on conceptual information provided in Stage 1 to characterise the degree of reliance of the GDE on groundwater.
- Stage 3 – Characterisation of ecological response to change: During Stage 3 assessment, knowledge of baseline ecohydrological function is utilised to describe and quantify likely changes to biophysical function and health of GDEs if impacts to groundwater regimes manifest.

The GDE characterisation undertaken by 3d Environmental (2020) as a component of the Project EIS process meets the requirements of Stage 1, the outcomes of which are described in accordance with conceptual models provided in **Section 5.0** of the EIS report (3d Environmental 2020). Ongoing adjustment of the ecohydrological models may be required as the monitoring program develops, and ecological data is collected and analysed.

Stage 2 and Stage 3 of the monitoring program will rely on collection of temporal data to support characterisation of baseline ecohydrological function. Seasonal monitoring events will allow for baseline data to be acquired to predict trends in GDE function and identify impacts that extend beyond the range of natural variation.

## 7.2 Approach

The monitoring and management program has been separated into two stages:

- Two years of intensive data collection during which investigative thresholds will be defined (see **Section 10**).
- The period after 2 years, comprising the remainder of operations and the post mining period, which will utilise data collected in the initial two years to re-assess the thresholds.

The process for establishing thresholds is described in **Section 10**, involving collection of data from the impact site (i.e. drawdown area) and two control sites, upstream and downstream from the area of potential impact. The thresholds for impact are linked to vegetation health and provide a comparison between the control and impact sites. Should the established thresholds be exceeded, this will trigger an investigation that will make use of other monitoring data (See **Section 10.2**) on the bio-physical function of vegetation, groundwater and surface water to determine the cause of a threshold exceedance. If activities associated with the ID Project is found to be the cause of the threshold exceedance, then mitigation measures (see **Section 11**) will be implemented, and the effect of mitigation measures monitored. If mitigation measures are not effective, an assessment will be made as to whether disturbance thresholds have been breached and, if so, the habitat quality data from the riparian 'habitat quality' monitoring program will be used to determined offset requirements, consistent with the approach outlined in Section 11. The riparian monitoring program is described in **Section 8.3** of the Terrestrial Ecology Impact Assessment Report (ECoSM 2020) for the amended Isaac Downs EIS.

The initial two years of intensive data collection aims to refine thresholds for monitoring and impact assessment, including provision of a dataset to support investigative action. For the subsequent period after 2 years, the process remains the same; however, the thresholds may be amended to reflect alternative parameters for monitoring and / or the threshold values attached to those parameters. Although the data collected in the initial GDE characterisation (3d Environmental 2020) included data that is critical to the characterisation of GDEs on the site, it lacked some of the vegetation indices that will form the basis of the ongoing monitoring program. It is therefore proposed that the initial two- year period of intensive data collection commence in the late dry season of 2020 (November) with a total of four monitoring events finalised in March 2022. While this may overlap with the early construction and operational phase of the mine, this will have little impact on the validity of the data for the purpose of ongoing monitoring as both control (outside the area of predicted drawdown) and impact (within the area of predicted drawdown) sites will be measured. This will facilitate collection of high resolution ecological, bio-physical and remote sensing data, coincident with the early stages of mine development, to allow a robust comparison of control and impact sites to be made.

## 8.0 Monitoring and Analysis Techniques

The GDE Toolbox – Part 2 (Richardson 2011b) provides a suite of technically robust tools to identify GDEs and determine their ecological water requirements. These tools are based on established methods repeated in studies within Australia and abroad, many of which are published in peer-reviewed scientific journals. Many of these tools were applied in the EIS GDE characterisation (3d Environmental 2020) and for the purpose of baseline characterisation, are recommended for inclusion as a component of ongoing monitoring. **Table 2** provides a list of tools used in the GDE characterisation and describes their purpose and ongoing relevance to monitoring. Several additional methods adapted from the GDE Toolbox have also been included, being recommended components of an ongoing monitoring program. Technical details of recommended assessment methods are provided in **Appendix B.**

**Table 2.** Assessment methods that will be applied during GDE monitoring.

| Assessment Method | Utilised in ID GDE Characterisation | GDE Toolbox Method No. | Method Description | Primary Utility |
|---|---|---|---|---|
| Conceptual modelling | Yes | Tool 2 | Aims to conceptualise the interactions between biotic factors (e.g., trees) and abiotic (e.g., soil, surface water and groundwater). Conceptualisation formalises the understanding of the major components of a GDE system and allows impact pathways to be contextualised. | Conceptualisation and informing monitoring program design and implementation. |
| Leaf water potential | Yes | Tool 3 | LWP provides the primary biophysical measure of tree water availability and defines a continuum between the relationship of soil, water and plant. Trees associated with high water availability will have a high (least negative) LWP. LWP provides an indication of which trees have access to a saturated or near saturated water source, although does not identify the nature of the source (i.e., groundwater, saturated pockets in the soil, surface water from stream pools). | Site based assessment with some application for seasonal monitoring to identify plant water deficits. Used in conjunction with Leaf Area Index (LAI). |
| Stable Isotopes of water in plants | Yes | Tool 4 | The stable isotopic signature (2H and 18O) of the dominant water source for a tree will be imparted on its hydraulic architecture, typically measured in twigs. The stable isotope signature in twigs may be directly analogous to a single water source if that source provides a predominant contribution to a trees water requirement. It may also be a combination of a number or sources, requiring a mixing model to be employed to calculate relative contributions of each water source. | Identifies plant water sources. Monitoring application in the initial two-year baseline investigation to:<br>1. Determine the proportions of various water sources used by tree in response climate controls.<br>2. Determine how these contributions change over a seasonal cycle to fully evaluate the GDE risk profile. |
| Leaf Area Index | No | Tool 1, Tool 2 | Leaf Area Index (LAI) is a ratio of the total leaf area within a canopy to the ground area covered by the canopy. It is a measure of canopy vigour and the | A fundamental application used in monitoring, in conjunction with remote sensing, to measure |

| Assessment Method | Utilised in ID GDE Characterisation | GDE Toolbox Method No. | Method Description | Primary Utility |
|---|---|---|---|---|
| | | | rationale applied is that plants with access to permanent sources of water (i.e., groundwater) will have greater vigour and LAI than vegetation that has only periodic access to groundwater resources (e.g., Zolfagher 2014). LAI is likely to vary on a seasonal basis if the sustaining source of moisture is variable, or the groundwater is only seasonally utilised. | seasonal variation in vegetation health. |
| Remote sensing | No | Tool No 1 | Assessment utilises the Normalised Difference Vegetation Index (NDVI) as a measure of canopy health and vigour, that can be directly correlated to LAI. It is a widely accepted method and with advances in satellite technology, has the capacity to assess the health of individual trees rather than landscapes. | Application for long-term monitoring once baseline conditions have been established. |
| Site based groundwater monitoring | Yes – for data from regional groundwater units including the Permian coal measures, Triassic weathered sediments and the Isaac River alluvium. | Tool No 10, 13 | Local installation of groundwater monitoring bores targeted to monitor the groundwater source which the GDE is utilising. Additional monitoring bores are proposed to specifically target groundwater / GDE interaction. Groundwater monitoring will include collection of EC and other water quality data. | Long term monitoring applications as a basis to draw correlations with biotic assessment parameters (e.g. LAI). Used to determine mechanisms of groundwater recharge into and discharge from the Isaac River. |
| Surface Water Monitoring | Ongoing monitoring under the developed REMP. | Tool No 10 | Ongoing monitoring of surface water flows and quality from dedicated monitoring points (see **Section 3.4.5**). | Long term monitoring applications to draw correlations between surface flows and recharge of the Isaac River alluvium. |
| Riparian Monitoring Program | Yes – baseline data from terrestrial ecology surveys to characterise regional ecosystems composition, structure and biocondition. | n/a | Permanent riparian habitat quality monitoring sites have been established as a component of the terrestrial ecology impact assessment studies (EcoSM 2020). The quality and condition of habitat associated with GDEs associated with the Isaac River frontage potentially impacted by groundwater drawdown, as well as locations outside the area of proposed impact, will be monitored. Species specific habitat indices will also be | Site based assessment with some application for seasonal monitoring to assess changes in habitat quality in the riparian zone. Monitoring undertaken to inform:<br>• changes in GDE health have resulted in changes in habitat |

| Assessment Method | Utilised in ID GDE Characterisation | GDE Toolbox Method No. | Method Description | Primary Utility |
|---|---|---|---|---|
| | | | assessed in line with Queensland Government's Guide to Determining Terrestrial Habitat Quality – a toolkit for assessing land-based offsets under the Queensland Environmental Offsets Policy, Version 1.3. Additional sites may be required in GDE assessment localities chosen as control sites (see **Section 8.1**). | quality for the above listed species<br>• remediation measures, if required, have benefited habitat quality<br>• changes in habitat quality are in exceedance of the disturbance thresholds and require offsets. |

## 8.1 Site Selection and Application

**Table 3** provides the recommended data collection requirements for each of the chosen monitoring parameters. Parameters to be applied include LAI, LWP, NDVI image capture, stable isotope assessment of twig xylem, soil, surface water and groundwater. Data collection will occur within GDE Area 1 and GDE Area 2 including a control site located upstream at (-22.04613 / 148.14992) and downstream (-22.08047 / 148.20736). The upstream control site is approximately 4.5 km upstream from the northern limits of the predicted drawdown area in the Isaac River alluvium (2.8 km direct to the north-east). The downstream monitoring site is located 600m downstream from the confluence of Isaac River and Southern Gully, within an area where drawdown of the water table is not predicted. The location of the downstream monitoring site is constrained by the influence of the Poitrel Mine void which is a further 5km downstream. Specific detail on proposed monitoring methods is provided for statistical analysis (**Section 8.3**), stable isotopes (**Section 8.4**), NDVI analysis (**Section 8.5**) and groundwater monitoring (**Section 8.6**) with general information on monitoring procedures provided in the **Appendix B** as listed below:

1. LWP and SMP provided in **Appendix B1**
2. Stable Isotope analysis in **Appendix B2**
3. Measurement of field-based LAI in **Appendix B3**
4. NDVI assessment in **Appendix B4**
5. Groundwater monitoring bores in **Appendix B5**.

The location of areas proposed for specific monitoring activity is provided in **Figure 12** with summary of assessment sites provided in **Table 3,** and details of the sampling program in **Table 4.** The monitoring includes GDE sampling within predicted drawdown and non-drawdown areas (including control sites), and the related / nearby groundwater monitoring bores, habitat quality sites from EcoSM (2020) and surface water monitoring locations. The proposed GDE assessment sites in relation to predicted drawdown zones are shown in **Figure 13**. Where possible, sample points, including trees, should include those that were sampled during the EIS assessment (3d Environmental 2020) to facilitate dataset continuity, with sampling locations from the EIS shown in **Appendix C**.

**Table 3.** Sampling localities and associated monitoring programs and linkages.

| Location | Drawdown Zone | Sites from EIS Study* | Relevant Groundwater Monitoring Bores* | Relevant Habitat Quality Sites |
|---|---|---|---|---|
| Drawdown Site 1 (DD1) | Zone 4 | NA | MBID11, MBID21 | HQ15, HQ16 |
| Drawdown Site 2 (DD2) | Zone 4 | Site 6 | MBID03, MBID23 | HQ13, HQ14 |
| Drawdown Site 3 (DD3) | Zone 4 / Zone 3 | NA | MBID07, MBID22, MBID28, RN162817 | HQ11, HQ12 |
| Drawdown Site 4 (Southern Gully) (DD4) | Zone 2 | NA | MBID25, MBID26 | HQ4 |
| Non-drawdown Site 1 and Site 2 (ND1_2, ND3) | Zone 1 | Site 1, Site 2 | MBID01, MBID19 | HQ17, HQ18, HQ21 |
| Non-drawdown Site 3 | Zone 1 | Site 3 | MBID01, MBID17 | HQ22, HQ23 |
| Upstream Control (IDUC) | Zone 1 | NA | MBID17 | To be established |
| Downstream Control (IDDC) | Zone 1 | NA | MBID25 | HQ5 |

*Includes groundwater monitoring bores installed into alluvium and weathered Triassic sediments.

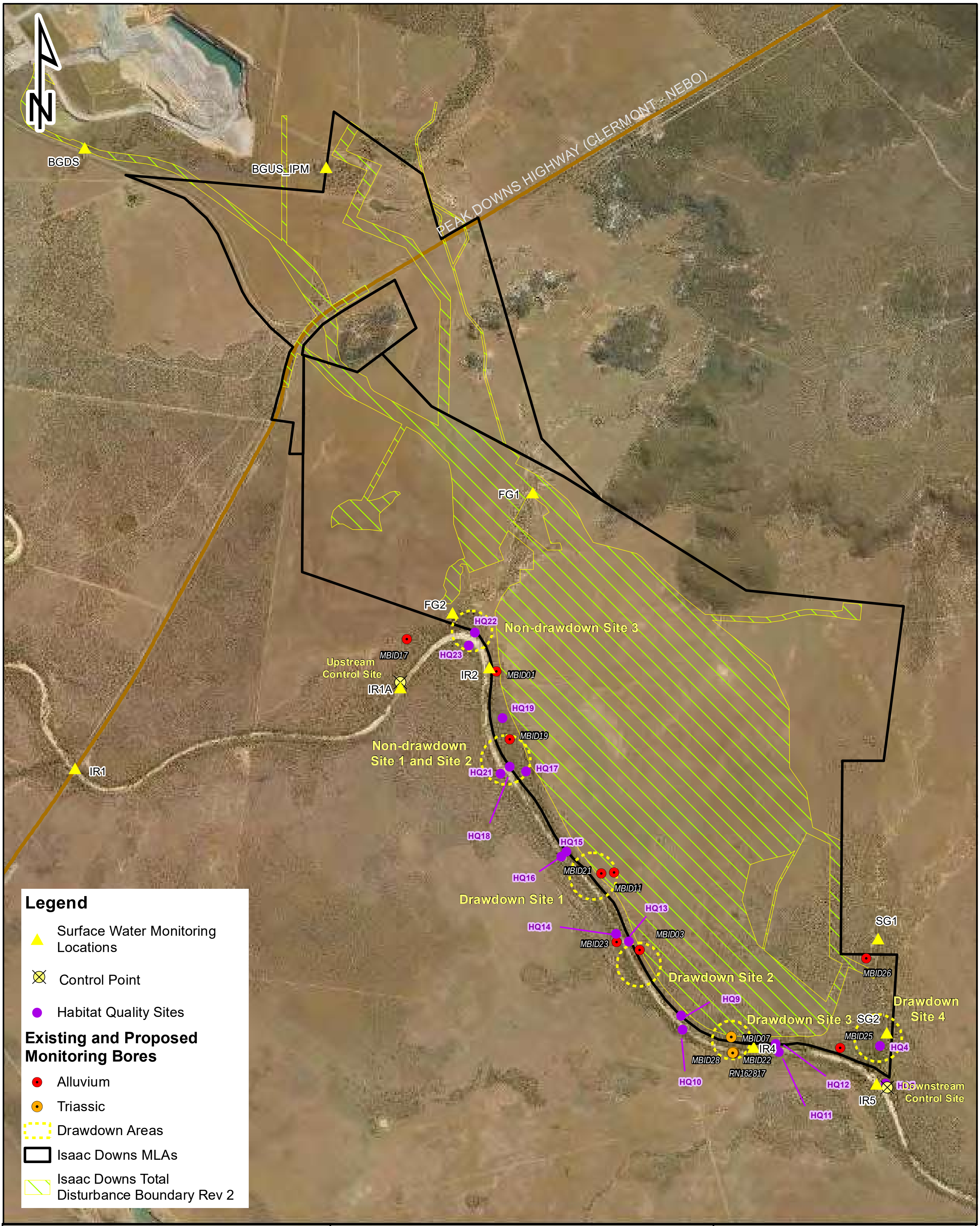

**Figure 12.** Location of proposed GDE assessment sites for ongoing monitoring.

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0 0.6 1.2 1.8 2.4

Kilometers

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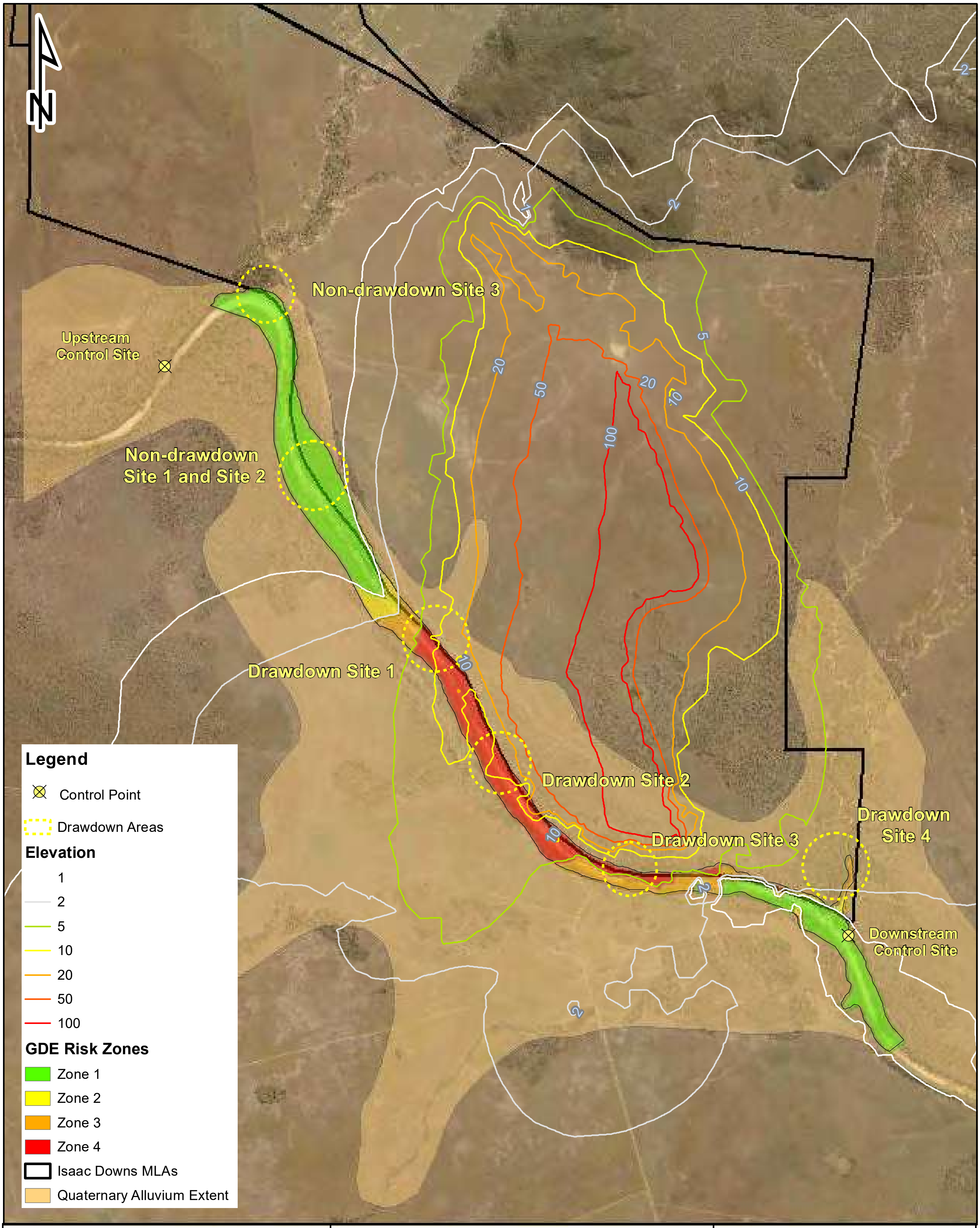

**Figure 13.**. Location of GDE assessment sites in relation to GDE risk zones.

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Kilometers

**Scale** 1:34,176

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**Date** 15/04/2021

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**Table 4.** Proposed GDE sampling program

| **Sampling Method** | **Sampling Locality** | **Sampling Intensity** |
|---|---|---|
| LAI | Isaac River alluvium predicted drawdown area | A minimum of 15 permanently located capture points in the predicted drawdown area including:<br>a) Five capture points in the vicinity of groundwater monitoring bore MBID11 and MBID21, coinciding with habitat quality sites* HQ15 and HQ16 (DD1).<br>b) Five capture points in the vicinity of groundwater monitoring bore MBID03 and MBID23 which coincides with Site 6 from the EIS GDE assessment#. This locality coincides with habitat quality site HQ13 and HQ14 (DD2).<br>c) Five capture points in the vicinity of groundwater monitoring bore MBID07, MDID22 and MBID28 which coincides with habitat quality sites HQ11 and HQ12 (DD3).<br>d) Five capture points in the vicinity of monitoring bore MBID25 and MBID26 which coincides with habitat quality site HQ4 (DD4). |
| | Isaac River ID MLA outside the drawdown area. | A minimum of 10 permanently located capture points including:<br>a) Five capture points in GDE Area 1 covering Site 1 and Site 2 from the EIS GDE assessment#. Capture points will coincide with groundwater monitoring bore MBID01 and MBID19 and habitat quality sites HQ17, HQ18 and HQ21 (ND1_2).<br>b) Five capture points at Site 3 from the EIS GDE assessment#. Capture points are to coincide with habitat quality sites HQ22 and HQ23 with the nearest groundwater monitoring bore being MBID01 and the reference bore MBID17 (ND3). |
| | Isaac River Control Sites | A minimum of 10 permanently located capture points including:<br>a) Five capture points at the upstream control site.<br>b) Five capture points at the downstream control site at Southern Gully. |
| LWP[3] | Isaac River alluvium predicted drawdown area | A minimum of 15 capture (tree) points in the predicted drawdown area including:<br>a) Five trees in the vicinity of groundwater monitoring bore MBID11 and MBID21, coinciding with habitat quality sites* HQ15 and HQ16 (DD1).<br>b) Five trees in the vicinity of groundwater monitoring bore MBID03 and MBID23 which coincides with Site 6 from the EIS GDE assessment#. This locality coincides with habitat quality site HQ13 and HQ14 (DD2).<br>c) Five trees in the vicinity of groundwater monitoring bore MBID07, MDID22 and MBID28 which coincide with habitat quality site HQ11 and HQ12 (DD3).<br>d) Five capture points in the vicinity of monitoring bore MBID25 and MBID26 which coincides with habitat quality site HQ4 (DD4). |
| | Isaac River ID MLs outside the drawdown area. | A minimum of 10 capture (tree) points including:<br>c) Five trees in GDE Area 1 covering Site 1 and Site 2 from the EIS GDE assessment#. These trees coincide with groundwater monitoring bore MBID01 and MBID19 and habitat quality sites HQ17, HQ18 and HQ21 (ND1_2).<br>d) Five trees at Site 3 from the EIS GDE assessment#. These trees coincide with habitat quality sites HQ22 and HQ23 with the nearest groundwater monitoring bore being MBID01 and the reference MBID17 (ND3). |

| Sampling Method | Sampling Locality | Sampling Intensity |
|---|---|---|
| | Isaac River Control Sites | A minimum of 10 capture (tree) points including:<br>c) Five trees at the upstream control site.<br>d) Five trees at the downstream control site at Southern Gully. |
| Stable Isotopes[2] | All localities | The aim of the stable isotope program will be to determine the relative proportion of each moisture source being utilised by groundwater dependent vegetation and is to be completed as a component of the 2-year intensive data collection period. Further details of the purpose of the stable isotope sampling program are provided in **Section 7.4** which details the methods to be applied.<br>Sampling for stable isotopes will be completed for a minimum:<br>a) 12 trees within the drawdown area including:<br>a. three trees in the vicinity of groundwater monitoring bore MBID11 and MBID21, coinciding with habitat quality sites* HQ15 and HQ16 (DD1).<br>b. three trees in the vicinity of groundwater monitoring bore MBID03 and MBID23 which coincides with Site 6 from the EIS GDE assessment# (DD2) and habitat quality site HQ13 and HQ14.<br>c. Three trees in the vicinity of groundwater monitoring bore MBID07, MDID22 and MBID28 which coincides with habitat quality site HQ11 and HQ12 (DD3).<br>d. Three trees in the vicinity of monitoring bore MBID25 and MBID26 which coincides with habitat quality site HQ4 (DD4).<br>b) A minimum of six trees from GDE Area 1 including Site 1 and Site 2 from the EIS GDE assessment#<br>c) A minimum of six trees from control sites, including three trees from the upstream control site and three trees from the downstream control site at Southern Gully.<br>Stable isotope sampling will cover:<br>d) Twigs from representative trees (12 from the area of predicted drawdown (DD1 to DD4), six from outside drawdown area (ND1_2, ND3) and six from control)<br>e) Surface water from flows, if available at time of survey.<br>f) Groundwater stored in riverbed (bank) sand aquifer in the river channel.<br>g) Groundwater from alluvial monitoring bores collected during routine sampling events.<br>h) Soil samples from auger holes, including 7 auger holes (three in the drawdown area; Two outside drawdown area; Two at control sites). |
| NDVI Capture | Approximately 100km$^2$ capture to cover the relevant parts of Isaac Downs MLs ensuring the full extent of the GDE monitoring area to be covered | High resolution imagery from the WorldView 3 and WorldView 4 satellites (0.3m resolution, 4 -16 band multispectral) is recommended and will allow detailed monitoring of canopy vigour at extremely fine scale.<br><br>The application of NDVI Imagery for the purpose of monitoring GDE / Vegetation health is discussed in **Section 7.5**. Localities will be established for permanent monitoring of NDVI to coincide with areas proposed for GDE monitoring and the location of habitat quality |

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[2] Collection of LWP and the analysis of stable isotopes was completed in the EIS assessment (3d Environmental 2020) and hence can be augmented with the intensive data collection period.

| Sampling Method | Sampling Locality | Sampling Intensity |
|---|---|---|
| | (including control sites). | transects. Established transects will be 100m length with measurement of NDVI completed at 1m centres along transect. |
| Groundwater Monitoring Bores | GDE monitoring bores as part of the dedicated groundwater monitoring program. | Monitoring bores which are applicable to monitoring of impacts to GDEs include existing and proposed bores installed in the Isaac River alluvium and Triassic weathered sediments being MBID01, MBID03, MBID11, MBID17, MBID19, MBID21, MBID22, MBID23, MBID25, MBID26, MBID27, MBID28, RN162817.<br>Monitoring of groundwater quality will be undertaken monthly or quarterly in accordance with the Isaac Downs groundwater monitoring program and will include parameters detailed in **Section 10.2.4**. The location and timing of groundwater monitoring bores (and the associated groundwater monitoring program) coincides with sites proposed for measurement of LAI, NDVI and riparian habitat quality to allow results for all parameters to be directly comparable. |

[*] From the Terrestrial Ecology Impact Assessment Report prepared for ID by EcoSM (2020).

[#]From the Groundwater Dependent Ecosystem Assessment Report prepared for ID by 3d Environmental (2020a).

## 8.2 Interactions with Established Monitoring Programs and Parameters

The following interactions with monitoring programs that are either existing, or will be developed as a component of the ID project approval process:

1. **Surface water:** Surface water quality and environmental flows will be a component of the ID mine site REMP that has been developed (FRC 2020a), allowing for early detection of any impacts and employment of appropriate corrective actions. Surface flow and water quality datasets will be used, in conjunction with other parameters, to inform the baseline characterisation of the Isaac River GDE system and assess project impacts.
2. **Riparian habitat quality:** A riparian habitat quality monitoring program will be applied, utilising the habitat quality sites assessed by EcoSM (2020) to complement ‘early warning’ vegetation parameters measured as a component of the GDE monitoring program. The riparian monitoring program will assist measurement of the significance of any impacts to GDEs resultant from activities associated with the ID Project.
3. **Groundwater:** The groundwater monitoring program is described in AGE (2020). The program covers operation of the monitoring bore network established as part of the EIS groundwater investigations and will be continued throughout the life of the Project. Records of groundwater levels and water quality from monitoring bores will continue to provide baseline information for groundwater fluctuations in response to rainfall and Isaac River flow. These measurements will be used to distinguish groundwater drawdown resulting from proposed mining activities from natural fluctuation and provide a basis for investigation that can be related to the health and function of GDEs. Further information on the groundwater monitoring network including existing and proposed bores and water quality parameters is provided in **Section 8.6**.

## 8.3 Detection of Trends and Statistical Analysis

The BACI (Before After / Control Impact) provides a statistically robust survey design to test for environmental change in response to disturbance. The method takes single impact site and a single control site (outside the impact area) before and after the management or impact has occurred to detect environmental change. In this regard, the proposed monitoring program includes:

1. Four monitoring sites (comprising multiple trees and LAI capture points) within the area of proposed groundwater drawdown (see **Table 4**).
2. Two sites outside the area of predicted groundwater drawdown, though adjacent the Project mining leases.
3. Two control sites located upstream and downstream from the area of groundwater drawdown in the Isaac River alluvium.

Statistical analysis will need to consider interactions between multiple datasets to establish baseline conditions and allow identification of statistically significant deviations from these conditions that may be associated with ID Project mining activities. The most critical interactions will be between biotic health (typically measured in LAI, LWP and NDVI) and abiotic factors such as groundwater levels and salinity.  Statistical tests applied to analysis of data will depend on whether datasets are normally distributed and may include bivariate analysis of two datasets (e.g., NDVI and LAI) applying a Pearson or Spearman Correlation. ‘T-tests’ will be applied to identify significant differences in mean values between sampling localities. More complex statistical analysis may be applied if investigative actions are required including multivariate analysis of variance (PERMANOVA) to interacting datasets.

The overriding purpose of the data collection and subsequent statistical analysis is to provide representation of natural variation in the system applied to both biotic factors and abiotic controls and allow appropriate trigger thresholds to be proposed, which are further discussed in **Section 9.0**.

## 8.4 Application of Stable Isotopes to Determine Relative Contribution of Various Moisture Sources Utilised by Groundwater Dependent Vegetation.

The two-year intensive data collected period will be used to refine existing information on the sources of water utilised by groundwater dependent vegetation, including relative contribution each moisture source makes to a tree’s total water budget. While it may not be possible to precisely determine these proportions, it will be possible to determine the dominant sources of moisture utilised by trees at any sampling event. The process will involve:

1. Collection of xylem stable isotope samples from all trees proposed as permanent monitoring points (see **Table 4**) to determine isotopic signatures. To maximise the capacity to identify variations in moisture sources, trees proposed for sampling should be located at various geomorphic positions on the stream bank including trees at the foot of the bank, and trees on the upper terrace.
2. Collection of soil samples for stable isotope analysis from seven dedicated auger holes, four within the area of groundwater drawdown, one within GDE Area 1 (outside of drawdown area) and two augers placed at a control site. Augers should be:

   a. A maximum depth of 5m, or down to intersection with basement rock or groundwater strike.
   b. Sampled at 0.5m intervals down the soil profile.
3. Collection of groundwater held in riverbed (bank) aquifer associated with the Isaac River channel for stable isotope analysis.
4. Opportunistic collection of rainfall for stable isotope analysis.
5. Opportunistic collection of water from Isaac River surface flows for stable isotope analysis.
6. Collection of groundwater from groundwater monitoring bores installed into the Isaac River alluvium for stable isotope analysis.

At a minimum sampling will need to be undertaken on a biannual basis, with collection of rainfall and surface water to be undertaken opportunistically throughout the baseline assessment period.

While comparison of stable isotope signatures in biplots, as completed during the EIS assessment (3d Environmental 2020), provides a rapid means to identify the predominant sources of moisture utilised by vegetation, analysis of time series (seasonal) datasets may provide a measure of the water source partitioning of trees (i.e., the proportions used of each potential moisture source) during the various seasons. The Line Conditioned Excess method (Petit and Froend 2018) provides the simplest analysis technique, which relies on establishment of a local meteoric water line (LMWL) applying the method of Crosbie (2012), which can be used to identify stable isotope datasets that have undergone significant evaporative fractionation. To test for evaporative isotopic enrichment, the line-conditioned excess (or precipitation offset as per Evaristo et al., 2015) of soil moisture, xylem water, groundwater and other collected water sources will need to be calculated (lc excess = [δ2H − a δ18O – b]/S where a and b are the slope and intercept of the LMWL, and S is the standard deviation of both δ2H and δ18O values). Where lc excess values are close to zero, it indicates values similar to rainfall isotope values that have not been affected by high rates of evaporation (as per Petit and Froend 2018). By comparing the lc-excess for soil moisture, surface flows, stored groundwater in the channel, groundwater, and xylem water, it will be possible to identify which moisture sources are significantly different from each other. This provides a fingerprinting tool for the comparison of the lc-excess for xylem moisture to groundwater and other potential moisture sources will enable the 'degree of similarity' to be calculated, and identification of the dominant source of moisture utilised during typical seasonal variation. More importantly, it will make it possible to identify the variety of water sources utilised by trees that occur at various distances from the river channel and positions on the stream bank, allowing impacts to vegetation that result from groundwater vegetation to be more accurately predicted. The basis and process for stable isotope sampling and analysis is provided in **Appendix B2** with raw data from stable isotope sampling undertaken during the EIS assessment provided in **Appendix D.**

## 8.5 Application of NDVI Analysis

The NDVI datasets will provide a permanent record of vegetation health captured biannually during the intensive data collection period, with annual capture in the following period thereafter. To provide analysis of vegetation health that can be repeated precisely between capture events, permanently placed 100m transects will be co-located with habitat quality sites (from EcoSM 2020) at each of the eight proposed GDE monitoring sites detailed in Table 3. Two additional sites will be established on Southern Gully and Conrock Gully upstream from the confluence of the Isaac River, to monitor health of riparian vegetation associated with these tributaries. Using permanent transect start and end points (from either relevant habitat quality sites or other established locations), the NDVI value will be sampled at 1m intervals along each transect (101 points in total from start to end point). This will extract data that can be presented in a line graph, to represent seasonal variation between survey events (see **Appendix B4**). A minimum of eleven transects in total are to be selected within:

1. Each of the four drawdown sites (Drawdown Site 1 to Site 4)
2. Each of the three non-drawdown sites (Non-drawdown sites Site 1 to 3).
3. The upstream and downstream control sites.
4. A selected transect within RE11.3.25 in Southern Gully.
5. A selected transect within a riparian RE in Conrock Gully.

Additional locations for permanent transects may be chosen through the monitoring period should information gaps be identified which require additional NDVI data collection to address.

## 8.6 Groundwater Monitoring

The objective of the groundwater monitoring network design was to provide information to conceptualise the site hydrogeology and provide a monitoring network to establish baseline conditions. Of relevance to GDE function, the groundwater monitoring network will continue to provide baseline information concerning fluctuations in the groundwater table as a response to rainfall and Isaac River flow and assist identification of depressurisation of the alluvial aquifer and Triassic weathered sediments that is associated with mining activities. Groundwater quality and salinity will form part of the ongoing suite of chemical parameters that will be measured.

Groundwater monitoring bores will be manually dipped on at least a three-monthly frequency for all monitoring bores. Continuous groundwater level loggers have been installed in all monitoring network bores (excluding one landholder bore), and will be installed in proposed bores, to provide detailed information of water level changes from rainfall or Isaac River recharge, extended dry conditions, landholder bore activity and information on changes to groundwater levels when the Project commences.

Groundwater quality samples have been collected from nine sampling events between November 2018 to July 2020, with further monthly sampling after July 2020 until present. The sampling was undertaken from a subset of the monitoring bores within the monitoring network.

Existing and proposed groundwater monitoring bores, their purpose and function for ongoing monitoring (including monitoring of water levels and quality alluvium and Triassic weathered sediments) are described in groundwater impact assessment for the EIS (AGE, 2020).

**Groundwater Quality Parameters:** In the context of GDE health, salinity and standing water level are the most critical chemical and physical monitoring parameters. There are currently no water quality guidelines for GDEs that rely on subsurface expression of groundwater that characterise the Project area. The suite of water quality parameters that are important for vegetation health should be considered as part of the groundwater monitoring program (Australian Government 2013) and would include:

1. Salinity
2. Dissolved oxygen

3. pH
4. nitrogen
5. phosphorus
6. organic carbon

## 8.7 Summary results of dry season (November 2020) GDE monitoring assessment.

A late dry season field based GDE monitoring assessment has been completed between 20th and 24th November 2020 applying the proposed GDE sampling program detailed in **Table 4** (**Section 8.1**). The assessment coincided with an extremely dry preceding period with only 69.5mm of precipitation falling in the preceding 6 months (June to November) which is significantly below long-term average for those months of 233.8mm (SILO 2020), meaning vegetation would have been subject to maximum seasonal water stress. A dedicated monitoring report is being prepared, pending receipt and analysis of all assessment parameters. The following provides an interim summary of assessment results:

1. **Suitability of control and impact monitoring sites:** T-tests have been completed comparing LAI values from upstream / downstream control sites[3] with LAI values from areas where drawdown is predicted and areas where drawdown is not predicted (ND1_2, ND3 as per **Table 3** and **Figure 12**). The T-tests indicate that some statistically significant differences occur between mean LAI values for these monitoring localities, although utilisation of both an upstream and downstream control site provides representation of structural endpoints enabling a meaningful comparison between monitoring localities for ongoing monitoring purposes. A summary of T-test results, mean LAI values per GDE monitoring area and raw data from the LAI field measurements is provided in **Appendix E1**, **Appendix E2** and **Appendix E3** respectively.
2. **Percentile values for LAI with potential application as impact thresholds:** The following LAI percentile values have been calculated for the four predicted drawdown sites (DD1, DD2, DD3, DD4), two sites outside the area of predicted drawdown (ND1_2, ND3) and the two control sites (IDUC, IDDC). These values may have application for setting disturbance thresholds at the completion of the baseline monitoring assessment:
    a. Drawdown sites (DD1, DD2, DD3, DD4)
        i. LAI average value = 0.5428
        ii. 10 percentile LAI value = 0.3400
        iii. 20 percentile LAI value = 0.4081
    b. Non-drawdown sites (ND1_2, ND3)
        i. LAI average value = 0.7417
        ii. 10 percentile LAI value = 0.5455
        iii. 20 percentile LAI value = 0.5701
    c. Control sites
        i. LAI average value = 0.5252
        ii. 10 percentile LAI value = 0.3803
        iii. 20 percentile LAI value = 0.4292

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[3] The location of upstream and downstream control sites has been adjusted following completion of dry season monitoring assessment and results from updated control site localities will be incorporated into all subsequent monitoring reports.

3. **LWP assessment:** Pre-dawn LWP measurements from 41 individual trees spread across the eight GDE monitoring areas have been captured. The monitoring assessment included trees measured during the EIS assessment where practical. **Appendix E4** provides a summary of mean LWP measurements per GDE monitoring area with **Appendix E5** providing raw field data including LWP measurements of trees undertaken during the EIS assessment. The LWP measurements support the conclusion of the EIS assessment, that groundwater reliance is patchy and discontinuous along the river frontage, with many trees demonstrating extremely low LWP values that are not consistent with groundwater utilisation.
4. **NDVI analysis:** High resolution imagery sourced from the WorldView 4 satellite (0.3m resolution, 4 -16 band multispectral) has been acquired (capture date 30 November 2020) to complement the field measured parameters. A total of 15 x 100m monitoring transects were placed at GDE monitoring locations coincident with groundwater monitoring bores and habitat quality monitoring sites with NDVI values have been captured at 1m intervals along each transect. The permanent placement of these transects will enable repeat measurement of canopy vigour with comparisons made on a seasonal basis. Raw plots from the NDVI transects at control and impact sites are provided in **Appendix E6** with a comparison of mean NDVI values for each monitoring area provided in **Appendix E7**. Raw NDVI and natural colour imagery captured during the assessment, shown in relation to GDE monitoring areas, LAI and LWP capture points is provided in **Appendix E8** and **Appendix E9**.
5. **Correlation analysis:** Pearson correlation (*r*) analysis identified the following relationships between monitoring parameters following the initial phase of GDE monitoring:
    a. A strong and statistically significant positive correlation (r *= 0.927; p=0.008*) is calculated between average NDVI value (taken from representative NDVI transects) and average LAI for six of the assessment sites (IDUC, DD1, DD2, DD3, DD4, ND 1_2). For IDDC and ND3, this correlation breaks down and further collection of temporal data will be required to understand the anomalous nature of values at these localities. Graphical representation of average NDVI and LAI values per monitoring locality is provided in **Figure 14.**
    b. A strong and statistically significant positive correlation (*r = 0.7316; p=0.039*) is calculated between average NDVI value (taken from representative NDVI transects) and average LWP for all assessment sites **(Figure 15). **This indicates that canopy vigour (in terms of chlorophyll abundance) is strongly controlled by moisture availability.
    c. At the completion of the initial monitoring assessment, no statistically significant correlation could be identified between LWP and LAI calculated for individual trees (*r=0.1734, p=0.2783*). While additional temporal monitoring will be required to confirm the relationship between these parameters, this initial result suggests that foliage density can be maintained at relatively low levels of water availability for trees that are naturally adapted to conditions of water deficit (i.e., tolerant of low LWPs under natural conditions) (see **Figure 16**), and a low LWP does not necessarily constitute a tree with poor canopy health.

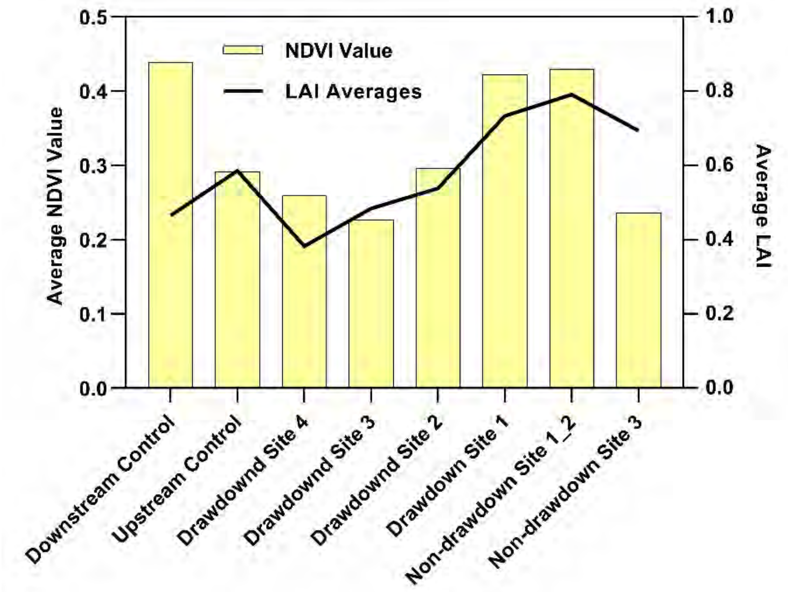

**Figure 14.** Correlation between average NDVI and average LAI for GDE monitoring sites, with a breakdown in correlation evident for the Downstream Control and Non-drawdown Site 3.

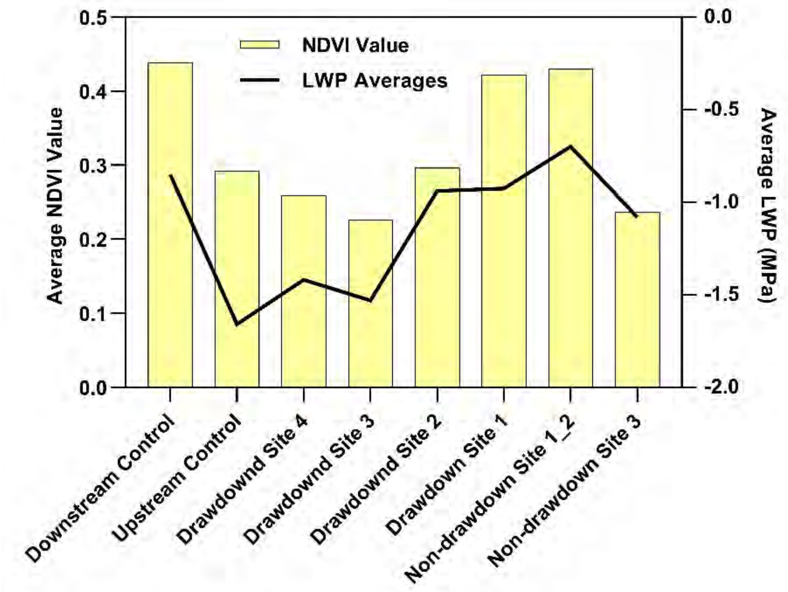

**Figure 15.** Correlation between average NDVI value and LWP averages for each GDE monitoring site.

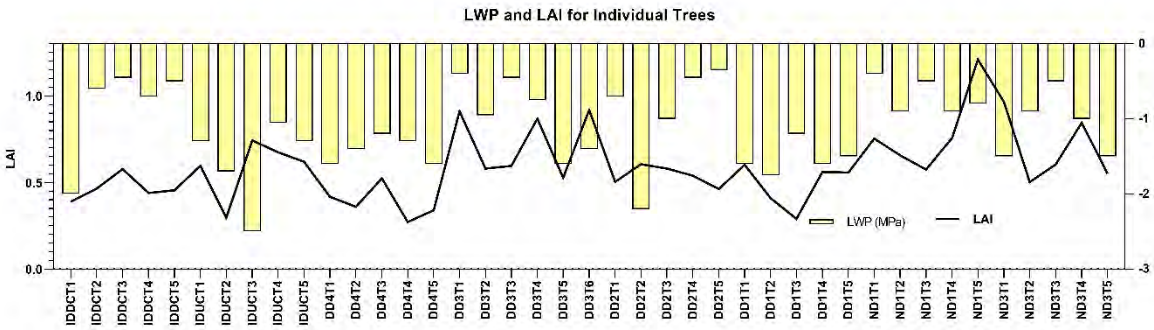

**Figure 16.** Comparison of LAI and LWP for individual trees at each GDE monitoring assessment locality.

## 9.0 Reporting, Periodic Review, Timing and Objectives

**General program:** This GDEMMP proposes methods that will result in collection of baseline ecological and biophysical data that will facilitate increased understanding of the ecohydrological function of the Isaac River GDE system. During compilation and analysis of monitoring data, information gaps or data trends may be identified that indicate a need to update the GDEMMP approach and methods. To accommodate this requirement:

1. Reporting will be prepared at the completion of each monitoring event which describes:
    a. Methods employed.
    b. Factors that may have influenced data and monitoring results.
    c. Data trends for each of the parameters measured.
    d. Information gaps which may influence the assessment.
    e. Correlations between datasets which characterise ecological function.
    f. Trends which appear abnormal or indicative of unexplained / un-natural decrease in ecological function, warranting further investigation or corrective action.
2. Bi-annual monitoring (four events covering two wet seasons and two dry seasons) should be undertaken for a two-year period.
3. At the completion of four monitoring events (excluding the original GDE assessment associated with the EIS), a consolidated report will be prepared which provides a synopsis of the data collected, including correlations between parameters and statistical analysis (where possible) of seasonal ecological function.

The aim of the four-event intensive data collection period is to determine the range of natural seasonal variation in the measured parameters, particularly LWP and LAI which are fundamental indicators of plant stress. These parameters can be correlated to the NDVI signature, which will allow future monitoring to be undertaken remotely at an ‘on demand’ basis, supplemented with field assessment. Additional field sampling assessments may be required if a significant departure from baseline condition is detected. Reporting and review requirements have been incorporated into a proposed two-year monitoring schedule as per **Appendix F**.

**Ongoing monitoring following baseline:** Following completion of the two-year (four-event) intensive data collection program in March 22, NDVI will be captured on an annual basis during the height of dry season (nominally October / November) to support ongoing monitoring of GDE health. NDVI threshold values will be calculated from correlations to LAI established during the baseline assessment, and annually checked for statistically significant threshold exceedance events that affect the impact site, in the absence of similar affects at the control site. The NDVI capture will be supplemented with field assessment measuring LAI and LWP at dedicated monitoring localities including control and impact sites on a two-yearly basis, at the peak of the dry season (typically October to November). Ongoing monitoring will also include monitoring of groundwater bores and riparian habitat monitoring, as per details provided in **Table 3** and **Table 4**.

**Monitoring completion:** A monitoring event that includes field assessment of monitoring parameters will be undertaken to coincide with completion of mining at the Project. This event will include:

1. A comparison to the baseline GDE dataset to identify any significant departure from pre-impact conditions.
2. Provision of a summary memorandum detailing ecological condition of the groundwater dependent vegetation at all dedicated monitoring sites including control and impact and future monitoring requirements.

Providing there has been no significant decline in ecological condition that can be attributed to mining operations, follow up field survey periods will be:

1. Two years from completion of mining operations, timed to coincide with the driest portion of the year (typically September to November).
2. Four years following completion of mining operations, timed to coincide with the driest portion of the year.
3. A final survey event at six years following completion of the mining operation, or when rehabilitation of the mine site has been successfully completed.

Capture of NDVI datasets should continue to be completed on an annual basis for the approximate six-year period. Considering the impact of groundwater drawdown on vegetation health can take several years to manifest, a period of six years, or until rehabilitation is successfully completed, should be a sufficient to capture any trend for declining vegetative health that is a result of ID mining activity.

# 10.0 Triggers for Investigative Action and Supporting Parameters

While groundwater associated with the Isaac River flood plain is an abiotic control on the ecohydrological function of riparian vegetation fringing the Isaac River, it is the actual health of the vegetation that defines GDE habitat values. Vegetation indices will be used to provide a baseline for ecological health and define trigger thresholds to direct when investigative actions are required. The indices used to define trigger thresholds, including potential parameters applied during investigative action are described in following sections. The management framework is intended to be adaptive, with future capacity for update dependent on the ongoing results of the baseline assessment, and any information gaps identified. Data derived from the groundwater monitoring program, specifically water level and water quality data, will provide supporting information to be used in the case that vegetation threshold values are breached, and investigative actions are necessary.

## 10.1 Vegetative Indices

**Section 6.0** (**Figure 11**) identifies a decrease in LAI as an initial indicator of vegetative stress. LAI is a precursor to more intensive impacts to habitat values including canopy dieback and conversion to an alternative ecological state that may manifest over a longer time frame. LAI varies on a seasonal basis dependent on water availability, generally within the space of weeks to months, with the highest values lagging slightly behind moisture recharge events. Doody et al (2015) document typical annual LAI variation in the range of 14% to 35%, with LAI = 0.5 (i.e., 50% foliage to canopy ratio) identified as a potential threshold, indicative of critical water stress beyond which vegetation health rapidly declines. This value is taken from river red gum forest on the Murray River and its applicability to the Isaac River GDE system needs to be tested. However, the LAI threshold can be adapted based on the results of pre-impact monitoring assessments. The process for thresholds based on LAI applies the following principles:

1. Collection of time series data of LAI from control and impact sites for a period of two years to establish and test thresholds applied to vegetation indices.
2. Identifying appropriate thresholds which will be applied as a trigger for investigation and provide a mechanism to review the appropriateness of the derived trigger.
3. Statistical analysis of time series data to characterise seasonal differences in assessment parameters at control and impact sites to identify if a threshold breach occurs.

The application of a threshold value for LAI / NDVI intends to provide an 'early warning' which will trigger a requirement for investigation to identify causal factors. This will allow mitigations to be applied to restore vegetation health if a threshold breach is linked to mining activities. Where a threshold breach occurs, appropriate baseline data from a range of biotic and abiotic parameters will be available to provide a sound basis for investigation. **Figure 17** details the process and decision framework from initial data collection through to corrective actions in the case that a threshold breach can be linked to mining activity. The initial two years of the assessment covers wet and dry season surveys, to provide a baseline against which future vegetation condition trends can be assessed. The two-year baseline assessment and decision-making process are as follows:

1. Establish the proposed monitoring sites to capture LAI and supporting biophysical data (LWP and NDVI) at the proposed monitoring localities in an initial dry season assessment event (November 2020). The proposed location of the impact and control sites has been previously identified in **Section 8.1** and **Table 3**.
2. Establish an appropriate trigger threshold value based on the percentile method detailed in DSITI (2017). The proposed process for establishment of the investigative trigger thresholds is:
    a. Collect LAI data from the proposed impact and control sites (as per **Table 4**) at permanently located monitoring points in the initial dry season GDE assessment.
    b. Undertake statistical analysis (t-test) to compare dataset means and ensure the appropriateness of the control site for comparative purposes.
    c. If a significant difference is detected between the mean values of control and impact datasets in the initial assessment, the location of the control site will be re-evaluated.
    d. Assuming suitability of the control site, set the lower of the 10th percentile (or LAI of 0.5 as per Doody et al 2015, whatever value is lowest) as a trigger value for investigative action.
3. Collect seasonal data (post wet season in March to April 2021) to provide a baseline which incorporates seasonal variation.
4. Complete a follow up dry season assessment (October to November 2021). Assess appropriateness of applied thresholds and assess data for significant differences in means (t-test) to identify if a threshold breach occurs.

5. Undertake a final wet season assessment (post wet season in March to April 2022) to complete the intensive data collection phase.

At each stage, decision pathways are provided when threshold breaches are identified, including requirements for investigative action and corrective measures where causal factors can be linked to mining activity. Corrective actions, including potential requirement for biodiversity offsets in a worst-case scenario, are discussed in **Section 11**.

Following the two-year baseline assessment, statistical correlation between various assessment parameters will be drawn, particularly the relationship between LAI and NDVI to allow ongoing monitoring to be completed remotely on an annual basis, and trigger thresholds to be adapted. The full suite of parameters collected during the baseline assessment period, with their relevance, intended application in both the baseline assessment and longer-term monitoring program is provided in **Table 5.** Supporting parameters are further discussed in **Section 10.2**. The process that occurs after the two-year intensive data collection period will follow the same process as shown in the flowchart in **Figure 17.** Instead of using LAI as a threshold parameter however, NDVI is proposed for use on an annual basis, with a field assessment of LAI and LWP completed every two years as a control measure. Both NDVI and follow up field assessment will be completed in the dry season at impact and control sites to determine if the threshold is exceeded and, if exceeded, trigger the flow chart process for investigation, mitigation (corrective action) and offsets.

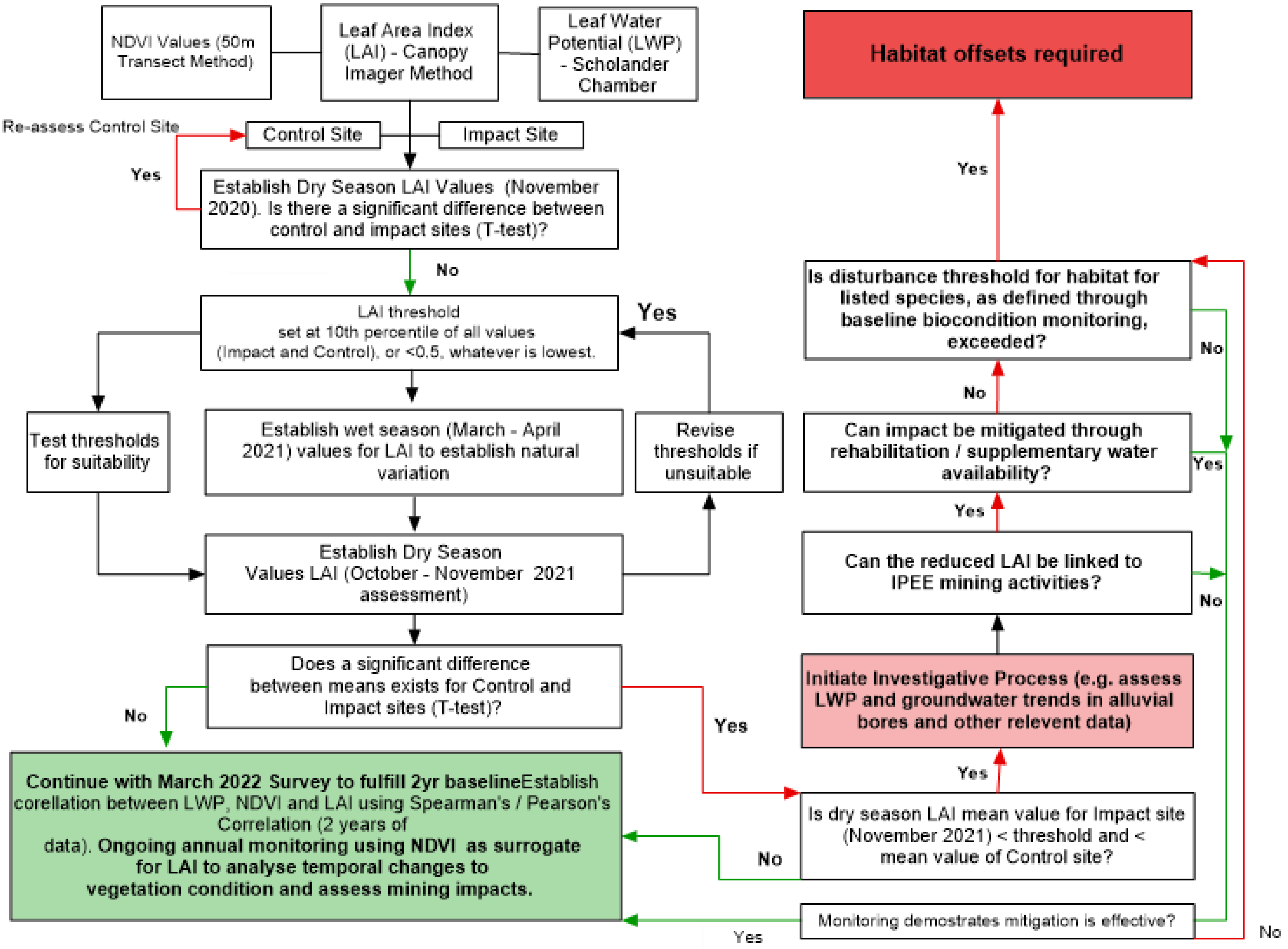

**Figure 17.** Decision process for application of investigative and corrective actions when trigger thresholds are exceeded for the initial 2-year baseline assessment.

## 10.2 Supporting Parameters

Supporting parameters are those that will be measured to provide a component of the baseline dataset and will be drawn on to support both the longer-term monitoring program and provide input into investigative action if required. Specifically, these supporting parameters will include LWP, stable isotopes, NDVI and groundwater monitoring in the Isaac River alluvial aquifer and Triassic weathered sediments.

### *10.2.1 Leaf water potential*

LWP provides the primary biophysical measure of tree water availability and defines a continuum between the relationship of soil, water, and plant. While the relationship between LWP and LAI requires further monitoring to be more fully understood, circumstance where LWP remains high and LAI decreases dramatically where this relationship breaks down, indicates factors other than water availability may be influencing the relationship (e.g., insect defoliation). LWP measurements established during the two-year intensive data collection period will be a fundamental consideration for any future investigative action.

### *10.2.2 Normalised Difference Vegetation Index*

NDVI is a measure of vegetation vigour, including a combination of greenness and biomass, which has a direct positive correlation to LAI. A correlation between field-based measurements of LAI and NDVI will be established over the 2-year intensive data collection period, to allow GDE monitoring to be undertaken remotely at a landscape scale on an annual basis. Upon completion of the two- year baseline, trigger threshold values for investigative action will be calculated based on the correlation between LAI and NDVI, and it is proposed that ongoing annual monitoring will utilise high resolution NDVI as a surrogate for field-based LAI / LWP measurements, supported by field sampling every two years. Further information on the NDVI process is provided in **Appendix B4**.

### *10.2.3 Stable isotopes*

The primary role of stable isotope investigations is to inform how sources of moisture utilised by trees vary on a seasonal basis. The process for identifying dominant water sources using stable isotopes is discussed in **Section 7.4** with the dataset used to identify endpoints where vegetation is utilising groundwater alone, shifting in status to primary utilisation of soil moisture in the unsaturated zone, rainfall or surface water from Isaac River flows. While stable isotope analysis provides insight into site ecological function, allowing risks to GDE function to be characterised, its relevance to ongoing monitoring diminishes once a seasonal dataset is established as it is not an indicator of plant health. Stable isotope analyses may be applied beyond baseline dataset collection to support investigative actions when a specific requirement or application is identified, allowing status shifts in seasonal water utilisation to be identified.

### *10.2.4 Groundwater levels and quality*

Groundwater monitoring data which will be useful to characterise GDE function, has been ongoing since the installation of 18 groundwater monitoring bores in late 2018 (November to December 2018 for MBID01 to MBID18), providing two-years' worth of water level and water quality data for baseline characterisation, with additional monitoring bores installed in June-July 2020. The data will be used to:

1. Monitor linkages between recharge of the alluvial aquifer, surface flows and rainfall.
2. Establish water quality values, particularly for EC and how these may be influenced by recharge from the various sources.
3. Identify the degree to which the alluvial aquifer is utilised by vegetation (typically through analysis of stable isotopes) on a seasonal basis.
4. Identify ecological response to aquifer recharge including correlations between alluvial aquifer recharge, LAI, LWP, NDVI and climate data.
5. Monitor and quantify the impacts of mine pit development on drawdown in aquifers that support GDEs, particularly the aquifer associated with the Isaac River alluvium.

Water levels and water quality can be directly correlated to LAI to determine the relationship between groundwater and vegetation health. While Eamus (2006) defines 1500 µS/cm as a measure where salinity becomes toxic to red gum, any impact to the seasonality and water quality of the alluvial aquifer will be directly imparted on LAI and supporting vegetative parameters. The ecological response of vegetation to falling groundwater levels cannot be accurately linked or quantified to specific thresholds as it will be influenced by several factors including:

1. The rate of drawdown which directly influences the capacity of trees to adapt to a declining water table and reduced water availability.
2. Water quality, as the response will be influenced by changes to salinity rather than by water levels alone.
3. Surface water flows including timing and duration of flooding.
4. Site specific adaptions to water stress inherent in the local groundwater dependent vegetation including exposure to drought conditions.

Hence thresholds for investigative action that relate to groundwater levels and quality are not proposed in this GDEMMP, which otherwise relies on vegetation indices which define GDE health and function. The chosen vegetation parameter (LAI) will provide a rapid response to detrimental impacts of groundwater drawdown (within weeks), with data from the groundwater monitoring program providing the basis for investigative action as required.

**Groundwater Quality Parameters:** In the context of GDE health, salinity and standing water level are the most critical chemical and physical monitoring parameters. There are currently no water quality guidelines for GDEs that rely on subsurface expression of groundwater that characterise the Project area. The suite of water quality parameters that are important for vegetation health which will be monitored at bores will include:

1. Salinity
2. Dissolved oxygen
3. pH
4. nitrogen
5. phosphorus
6. organic carbon

In addition, water quality will be sampled quarterly in accordance with the Isaac Downs groundwater monitoring program with continuous monitoring of standing water levels in each monitoring bore measured with pressure transducers.

**Table 5.** Assessment parameters, application, and analysis.

| **Data collection method** | **Purpose** | **Analysis methods / metrics** |
|---|---|---|
| **Primary Parameter** | | |
| LAI | Primary parameter used to measure plant stress and vegetation response to decreasing groundwater. | Threshold to be set at the lower of the 10th percentile for all LAI data from the initial dry season survey (or 0.5 from Doody et al 2015). A threshold response for investigative action will be triggered when:<br>1. The LAI at the impact site falls below the threshold value.<br>2. T-test indicates significant differences between means of control and impact sites, and.<br>3. Impact site has a lower mean LAI value.<br>The initial establishment of the trigger threshold will be undertaken in the dry season 2020 and relies on initial means between impact and control sites to be comparable. |
| **Supporting Parameters** | | |
| LWP | A measurement of water availability to trees, which will provide an important correlate with LAI and a baseline dataset to support a future requirement for investigative action. Supporting data which can be used to determine if any future LAI threshold trigger events are related to plant water availability. | 1. Pearson / Spearman's correlation to establish if there is a statistical relationship between LAI and LWP as a basis for inclusion in investigative action, if required.<br>2. Application of a T-test to identify if significant differences between means of control and impact sites exist during the initial dry season assessment. |
| NDVI | A remotely sensed measurement of vegetation productivity that describes the greenness and the relative density / health of forest biomass. | Confirming the relationship between NDVI, LAI and LWP through application of Pearson's / Spearman's correlation. Longer term application to remotely monitor GDE health at completion of the 2yr intensive data collection period supplemented with field survey. |
| Stable Isotopes of twig xylem, soil, groundwater and surface water. | Application as a tracer to identify the predominant sources of water utilised by trees. Useful to determine how tree / water interaction varies on a seasonal basis as groundwater levels fluctuate. Most applicable in the baseline characterisation phase though may be useful supporting information if investigative actions are initiated. | Biplot comparisons of stable isotope values (δ18O and δ2H) of tree xylem, groundwater and soil moisture to identify phase shifts.<br><br>Calculation of lc-excess as per **Section 8.4** to identify how the water sources of trees varies along the Isaac River frontage. |
| Groundwater monitoring data | The groundwater monitoring program, focused on the monitoring of the Isaac River alluvium and | 1. Water quality measurement (as per Section **10.2.4**) associated with routine water sampling schedules. |

| Data collection method | Purpose | Analysis methods / metrics |
|---|---|---|
| | Triassic weathered sediments for the purpose of GDE health will:<br>1. Monitor linkages between recharge of the alluvial aquifer, surface flows and rainfall.<br>2. Establish baseline water quality values, and the influence of aquifer recharge events from various sources.<br>3. Assist identification of the degree to which the alluvial aquifer is utilised by vegetation on a seasonal basis.<br>4. Identify ecological response to aquifer recharge including correlations between alluvial aquifer recharge, LAI, LWP, NDVI and climate data.<br>5. Monitor and quantify the impacts of mine pit development on drawdown in aquifers that support GDEs, particularly the aquifer associated with the Isaac River alluvium. | 2. Analysis of water levels and water quality in the Isaac River alluvium and Triassic weathered sediments against vegetative indices including LAI and LWP through correlation testing (Pearson / Spearman's).<br>3. Pressure inducers (data loggers) installed into selected monitoring bores to record water level changes every 4 hrs. |

# 11.0 Potential Corrective Actions and Adaptive Management

Corrective actions that halt or reverse impacts to GDEs are not well developed in literature and the suggested measures will require testing monitoring to determine / confirm their effectiveness if they are applied. Where impacts to GDEs are identified that can be related to mining activities, corrective actions will be taken to ameliorate the source of impact. Corrective actions will include treatment of affected vegetation through restoration of moisture supply, or infill planting to restore canopy gaps that have been created because of vegetation dieback.

## 11.1 Restoration of Tree Water Supply

**Direct water injection:** While there have been few case studies that have applied direct injection into the root zone, Berens et al (2009) investigated direct injection of fresh water into a saline aquifer on the Murray and found that while the trial resulted in temporary freshening of the capillary fringe, it had limited influence on tree condition as the radial extent of freshening (approximately 10 m) did not intersect with the root zone of salinity stressed trees. Therefore, application of this technique is likely to be practical for localised areas where impacts are detected in scattered trees or scattered groups of trees rather than application in broader scale impact mitigation.

**Infiltration of surface water:** Where impacts to the health of groundwater dependent vegetation is detected through LAI measurement that can be attributed to mining activities, it may be possible to restore water supply in critical portions of the tree root zone through enhancing natural infiltration. This would include:

1. Construction of a shallow trench (1m) depth within the drip zone (margins of canopy reach) of affected vegetation.
2. Flooding the trench with fresh water, where it meets water quality objectives (e.g. supply of water from sediment ponds to where it meets low flow WQO of < 720 µS/cm).

Trench construction involves disturbance of the upper soil profile and may result in damage to tree root architecture if inappropriately placed. Ecological advice should be sought prior to trench construction to ensure adverse impacts are minimised.

## 11.2 Infill Planting

River red gum (*Eucalyptus camaldulensis)* and forest red gum (*Eucalyptus tereticornis)* are the dominant groundwater dependent species occupying the banks of the Isaac River and are also the species that is most likely to demonstrate groundwater reliance. The species is ecologically adaptable, occurring on dry hillslopes as well as floodplains and is a significant plantation species. Malik and Sharma (2004) found that the species has a strong capacity to extract moisture from the shallow soil profile (0 – 150cm) in the 426mm rainfall belt and Kallarackel and Somen (1997) identified that growth rates are not limited by water deficit. Trials using locally sourced forest red gum seedlings should be undertaken to determine:

1. If infill planting of forest red gum in canopy gaps has capacity to ameliorate impacts caused by potential tree dieback.

2. Whether trees that have been planted in dry soil regimes have greater capacity to withstand environmental stressors than older established trees that have adapted over long periods to specific ecological water requirements (EWRs).

Small scale trials will commence upon approval of the GDEMMP, through planting of forest red gum and river red gum seedlings into existing canopy gaps. This will require some maintenance through drier periods until seedlings have established. Trials do not need to be extensive and will focus on the capacity of the species to survive, through planting of scattered trees into existing canopy gaps.

## 11.3 Monitoring of Corrective Actions

Where injection of fresh water into the tree root zone is applied as a management measure, the following approach to confirming the effectiveness of the measures should be considered:

1. Measurement of pre-impact LWP and LAI of trees where treatment is applied. Pre-impact canopy health can also be measured using NDVI imagery captured prior to treatment.
2. Repeat measurements for LAI and LWP to be taken at 1 month, three months and six months following treatment to measure vegetative response.
3. Ongoing annual monitoring of crown health of individual trees using high resolution NDVI in accordance with annual monitoring program post baseline assessment, supplemented with field measurements of LWP and LAI every two years.

Plantings will be checked for disease and loss of vigour:

1. At least weekly for the first month including any watering requirements to aid establishment.
2. Monthly for the next 5 months, and;
3. Annually following the initial six months, in conjunction with the annual GDE monitoring program.
4. Records must be kept of the above works.

## 11.4 Triggers for Ecological Offset

In the absence of positive results from mitigation measures and / or infill planting, and degradation of GDE habitat on the Isaac River frontage that can be directly attributed to mining activity, the requirement for biodiversity offsets will be assessed based on impacts to habitat. Disturbance thresholds that indicate a requirement for offsetting of GDEs and listed species (including habitat for koala and greater glider) will be developed in the first two years after the project approval in consultation with the Department of Agriculture, Water and the Environment, and the approach approved by the Minister in a revised GDEMMP, to be issued following completion of the two-year baseline monitoring assessment (see **Appendix F**). Triggers and requirements for offsets will be guided by the baseline biocondition information gathered in the Riparian Monitoring Program using the QLD habitat quality assessment methodology (Queensland Government's Guide to Determining Terrestrial Habitat Quality – a toolkit for assessing land-based offsets under the Queensland Environmental Offsets Policy, Version 1.3).

To adequately assess whether any detected reduction in habitat quality constitutes a threshold exceedance requiring an offset, it may be necessary to continue monitoring over an extended period (nominally 2 years). This will ensure that the original exceedance event represents a trend toward longer term decline in habitat condition or is a short-term perturbation that can be corrected with application of appropriate mitigation, or a return to normal climatic regimes.

Relevant EPBC Act listed species are identified in the *Isaac Downs – Terrestrial Ecology Impact Assessment Report – Isaac Downs Project (EcoSM 2020)* and assessment of the significance of impact should be guided by the proposed habitat quality assessment.

The decision-making process which determines the level of action required has been provided in **Figure 17**, which indicates ecological offset as a final measure applied to compensate habitat loss. The management framework is intended to be adaptive, with future capacity for update dependent on the ongoing results of the baseline assessment, and any information gaps identified.

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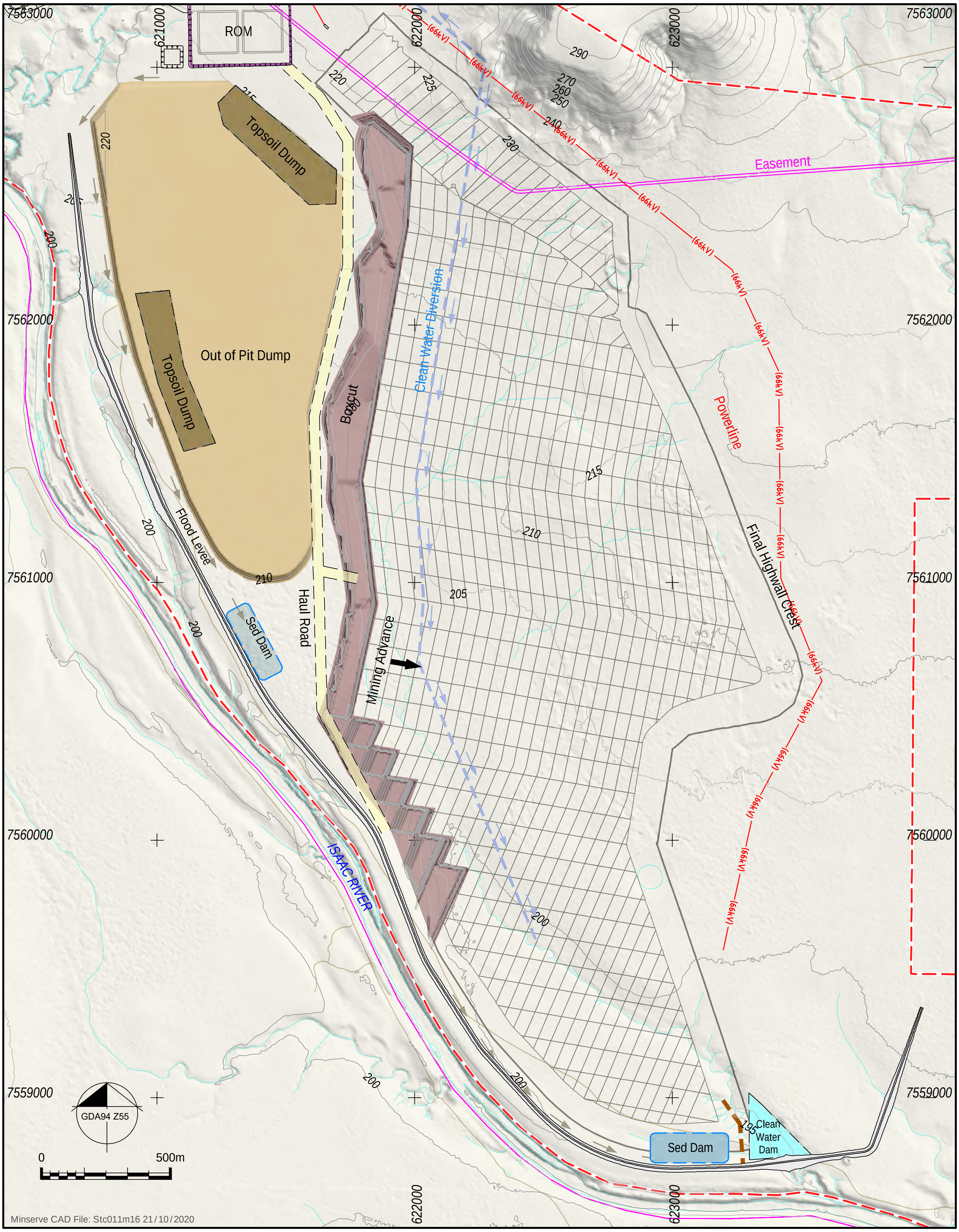
# 13.0 Appendices

## Appendix A. Isaac Downs Mining Stage Plans



LEGEND

- Isaac Downs Project MLAs
- Drainage
- Cadastral Boundary

Mining Activity

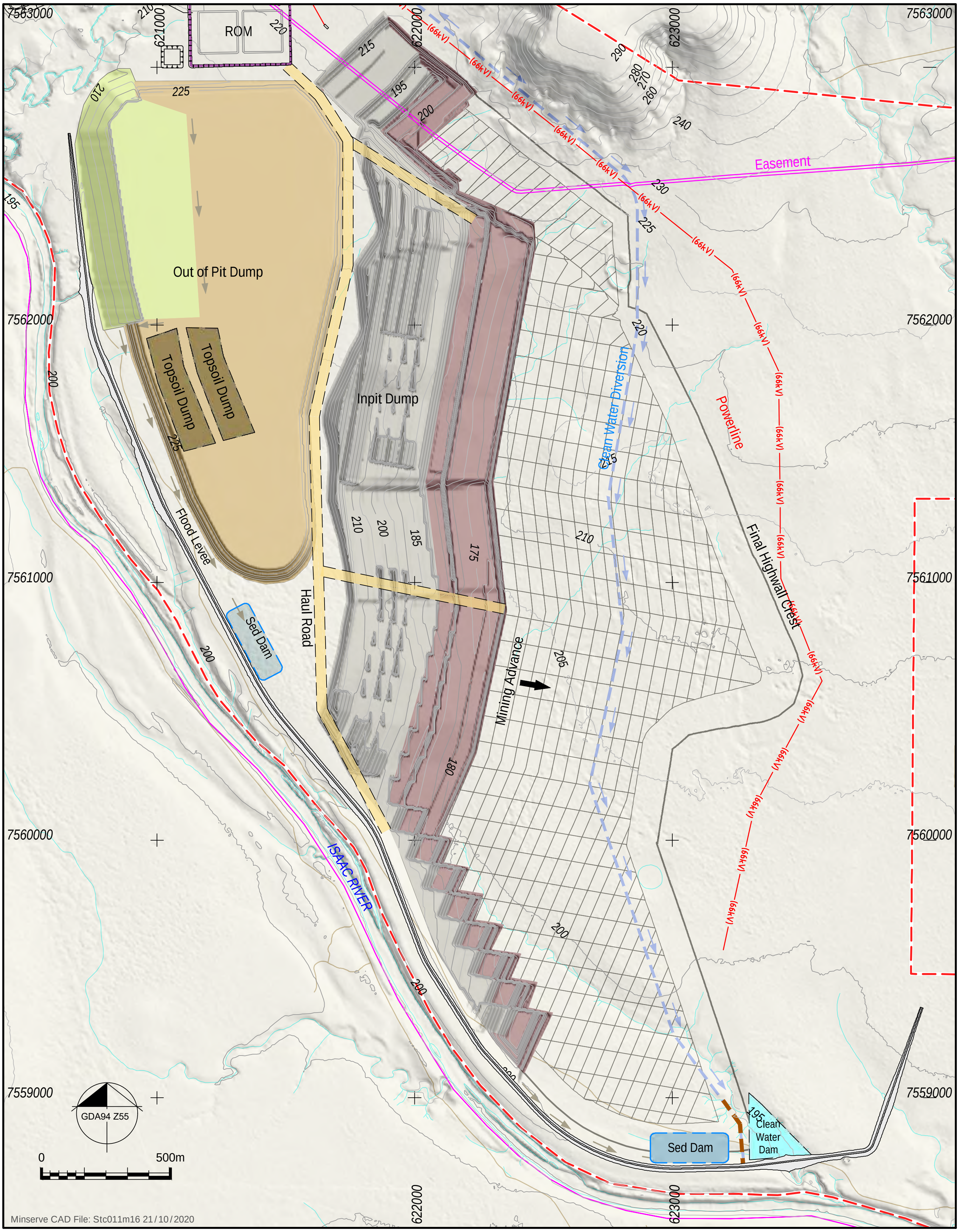
- Inpit Dump
- Out of Pit Dump
- Mining Advance
- Established Rehabilitation
- Available for Rehabilitation

ISAAC DOWNS PROJECT

stanmore
IP South

Mine Stage Plan - Year 01

Figure 4-19



Minserve CAD File: Stc011m16 21/10/2020

LEGEND

🟥 Isaac Downs Project MLAs
Drainage
Cadastral Boundary

Mining Activity
▨ Inpit Dump
▨ Out of Pit Dump
▨ Mining Advance
🟩 Established Rehabilitation
▨ Available for Rehabilitation

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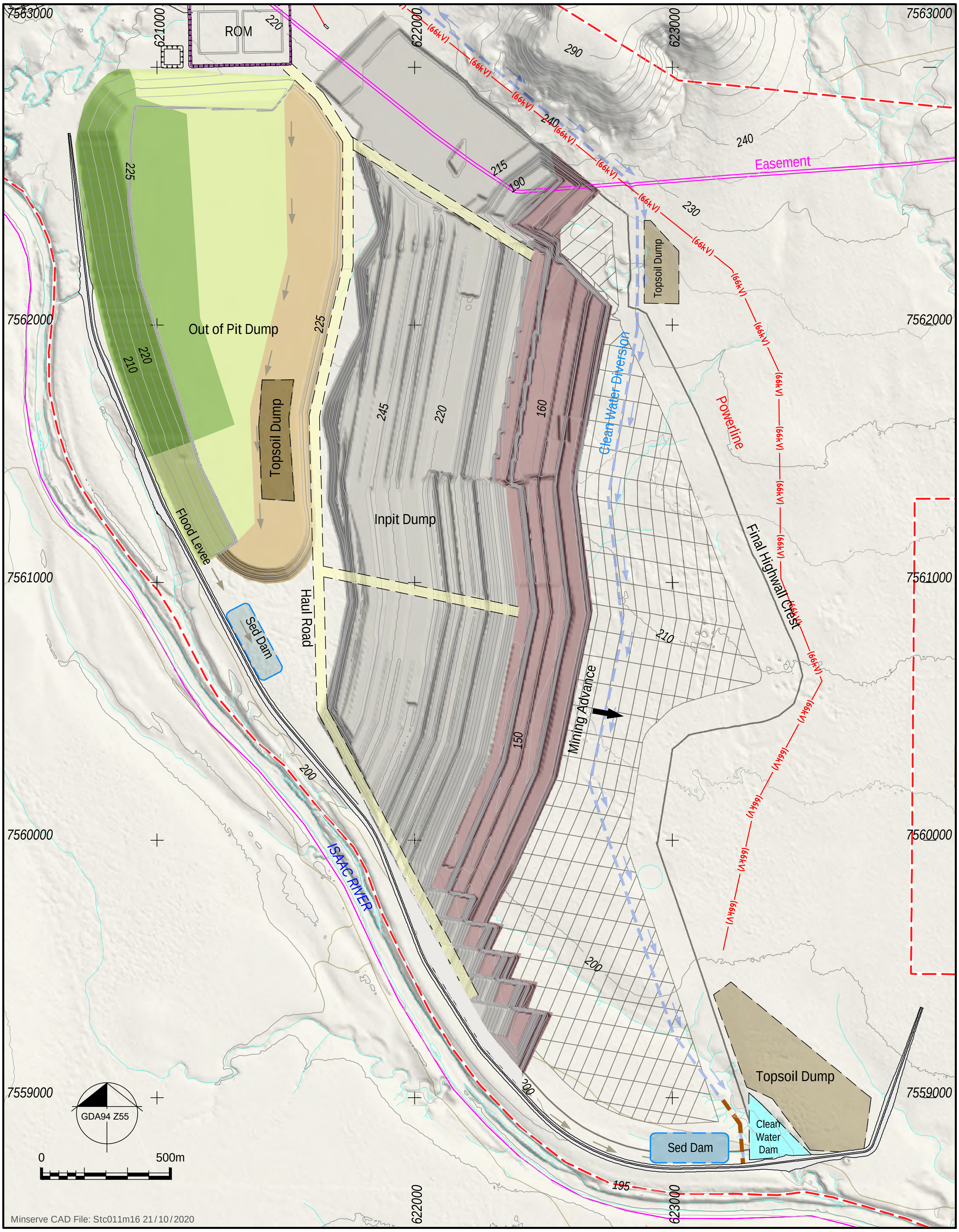
stanmore
IP South

# Mine Stage Plan - Year 03

Figure 4-20



Minserve CAD File: Stc011m16 21/10/2020

L E G E N D

- ▭ Isaac Downs Project MLAs
- ～ Drainage
- — Cadastral Boundary

Mining Activity

- ⬜ Inpit Dump
- 🟫 Out of Pit Dump
- 🟪 Mining Advance
- 🟩 Established Rehabilitation
- 🟨 Available for Rehabilitation

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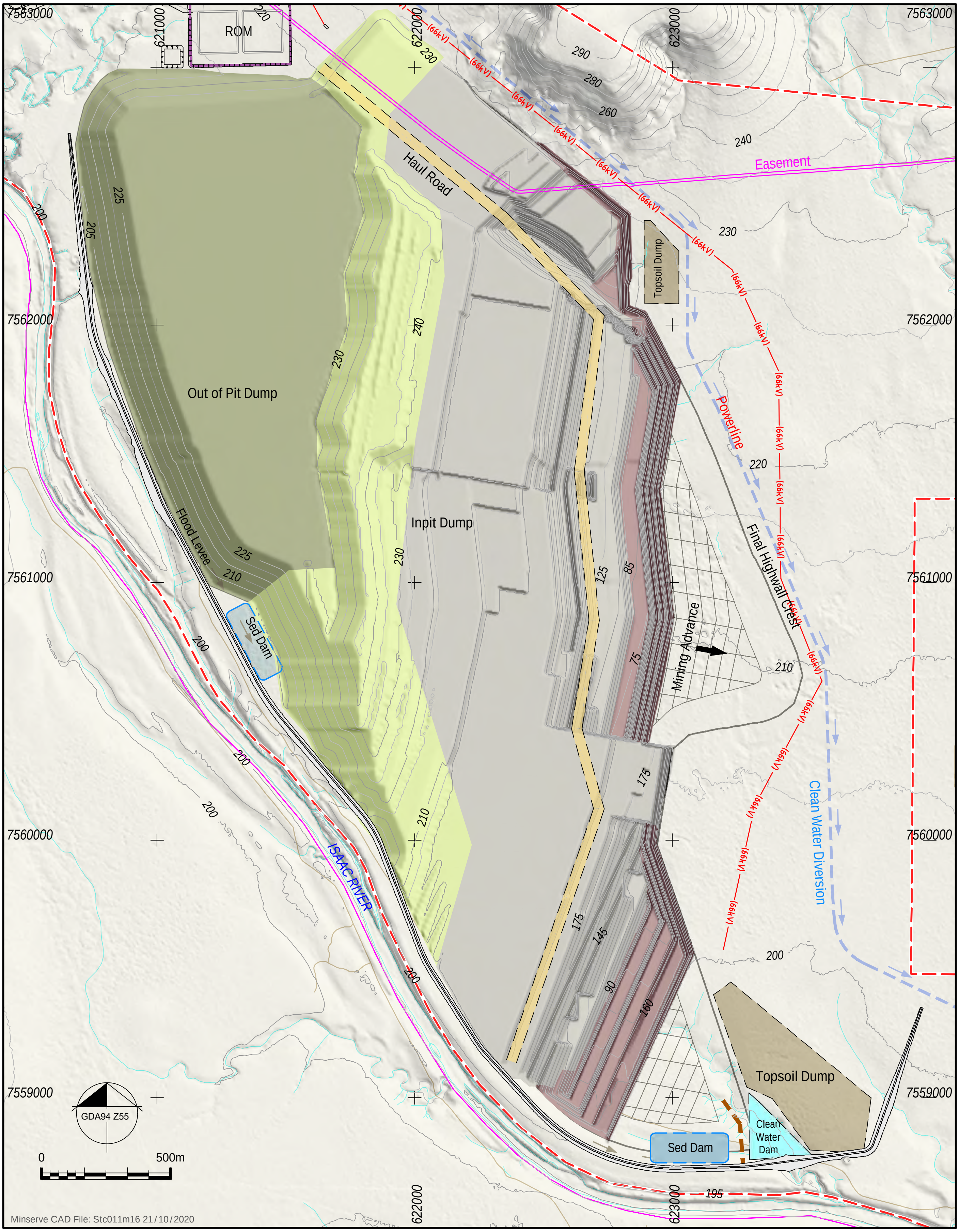
IP South

# Mine Stage Plan - Year 05

Figure 4-21



Minserve CAD File: Stc011m16 21/10/2020

LEGEND

- 🟥 Isaac Downs Project MLAs
- 〰 Drainage
- — Cadastral Boundary

Mining Activity

- ⬜ Inpit Dump
- 🟫 Out of Pit Dump
- 🟪 Mining Advance
- 🟩 Established Rehabilitation
- 🟨 Available for Rehabilitation

ISAAC DOWNS PROJECT

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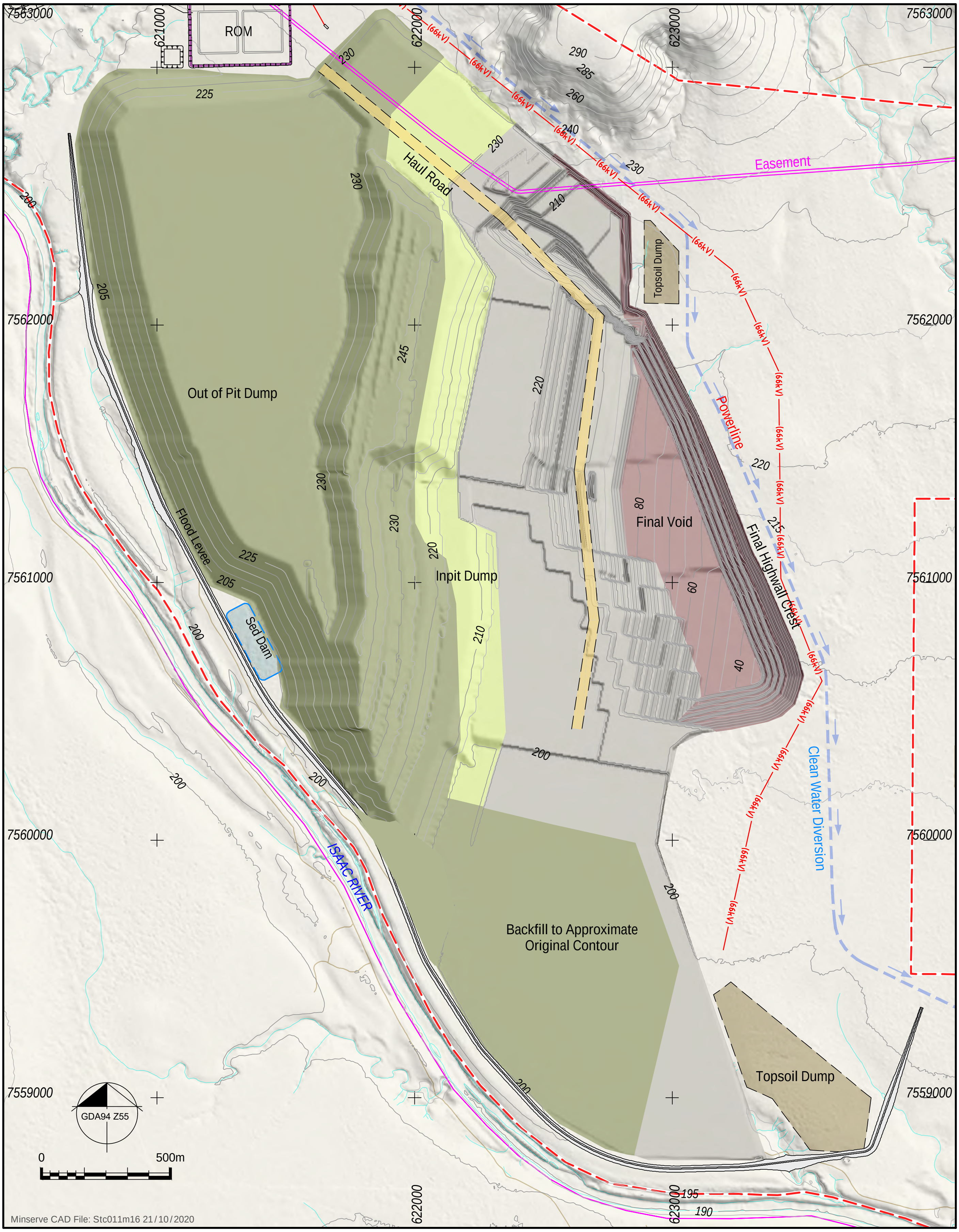
## Mine Stage Plan - Year 10

Figure 4-22



L E G E N D

| | |
|---|---|
| ▭ | Isaac Downs Project MLAs |
| ～ | Drainage |
| — | Cadastral Boundary |

Mining Activity

| | |
|---|---|
| ■ | Inpit Dump |
| ■ | Out of Pit Dump |
| ■ | Mining Advance |
| 🟩 | Established Rehabilitation |
| ■ | Available for Rehabilitation |

ISAAC DOWNS PROJECT

stanmore
IP South

## Mine Stage Plan - Year 16

Figure 4-23

Minserve CAD File: Stc011m16 21/10/2020

LEGEND

| | | | |
|---|---|---|---|
| ▭ | Isaac Downs Project MLAs | 🟫 | Residual Highwall |
| ～ | Drainage | ⬜ | Inpit Dump/Residual Void |
| — | Cadastral Boundary | 🟩 | Established Rehabilitation |

ISAAC DOWNS PROJECT

stanmore IP South

# Proposed Final Landform

Figure 4-36

# Appendix B. Sampling Methods

## *B1. Leaf / Soil Moisture Potential*

The measurement of leaf moisture potential will be targeted to specifically assess the interactions between tree roots and soil moisture / groundwater. These measurements will only be undertaken at the chosen localities on selected trees (as per **Section 8.1**) placed specifically to assess for these interactions.

### *Rationale*

Leaf water potential is the total potential for water in a leaf consisting of the balance between osmotic potential, turgor pressure and matric potential. It is defined as the amount of work that must be done per unit quantity of water to transport that water from the moisture held in soil to leaf stomata. It is a function of soil water availability, evaporative demand and soil conductivity.

Measurement of leaf water potential is undertaken by collecting leaf samples at pre-dawn and using a Scholander pressure chamber (pressure bomb) to measure the pressure required to force water from the stem of the leaf. The results of the leaf water potential measurement are then compared to either the soil moisture potential at the same site collected at regular vertical intervals by drilling down to the water table and using a dewpoint potential meter.

It is assumed that trees will be using water from a source that requires the least energy (lowest water potential) to lift water from the soil, through plant xylem to the leaf for transpiration. This will be dependent to a large part on recent rainfall as well as the specific physical attributes of the soil that holds the rooting material. Heavy clays for example, may have a relatively high water content, although this water is hard to extract due to the cohesive forces of the fine particles which hold water very tightly. Clays will thus have a lower water potential than sand which has large pore spaces between the grains and much lower cohesive forces.

It is must also be recognised that trees at the chosen monitoring sites may not be accessing water from one specific source exclusively. Moisture from several horizons within the soil profile may be contributing to tree water requirements, and the predominant source of water may vary on a seasonal basis. To maximise the likelihood of identifying trees that are predominantly using groundwater, it is important that assessments be undertaken in the seasonally driest part of the year.

### *Methodology*

Leaf water potential needs to be measured pre-dawn (prior to sunrise). The basis of this requirement is that pre-dawn measurement provides an estimate of the water potential of the wettest part of the soil profile that contains a significant amount of root matter (Eamus et al 2006). It is assumed that pre-dawn leaf water potential will equilibrate overnight to the portion of the soil profile that has the highest water potential. Hence contemporaneous measurement of both pre-dawn leaf water potential from a canopy tree at a chosen monitoring locality and soil water potential from selected depth intervals down a co-located borehole will provide an indication of the predominant source of water (soil moisture or groundwater) being utilised by trees at the time of survey.

### *Measurement of Leaf Water Potential*

Leaf water potential is measured pre-dawn (prior to 5.30 am in summer) using a Plant Water Potential Gauge (originally referred to as the Scholander pressure chamber or 'Pressure Bomb'). Measurement of leaf water potential requires:

1. Collection of leaves from an accessible part of the tree crown.
2. Preparing of leaf material for insertion into the pressure bomb.
3. Measurement of Leaf Water Potential using the pressure bomb.

***Collection of Leaf Material:*** Leaf material is to be collected from the highest accessible portion of the tree crown using an extension pole and attached lopper head (see **Section 8.5.2.2**). Leaf material should be selected that is disease free (as far as practical) and vigorous, preferably with indications of new leaf growth at the growing tips.

***Preparation of Leaf Material:*** A representative sample of healthy leaf is removed from the collected material with sufficient leaf stem (petiole) to allow it to protrude outside the water potential meter (typically 1 to 2 cm). The stem is cut square with a sharp blade and immediately inserted into the water potential metre with the grommet sealed.

***Use of the Plant Water Potential Gauge:*** The preferred Plant Water Potential gauge is the Model 3115 Plant Water Status Console due to its compactness and portability. The device is manufactured in USA (Soil Moisture Equipment Corp.) and distributed in Australia by ICT International (Armidale). The device fits into a 16 x 13 x 7inch Pelican Case and weighs approximately 11kgs which includes the compressed gas cylinder.

***Additional Safety and Operational Measures:*** The Model 3115 console is accompanied with a detailed unit operation manual which describes in detail the required operational procedures. The unit operates on a compressed gas cylinder which should be professionally refilled with compressed $N_2$. As pressure is applied to the chamber, there is potential for the leaf petiole to be forcefully ejected from the chamber. Hence safety glasses will be required during unit operation.

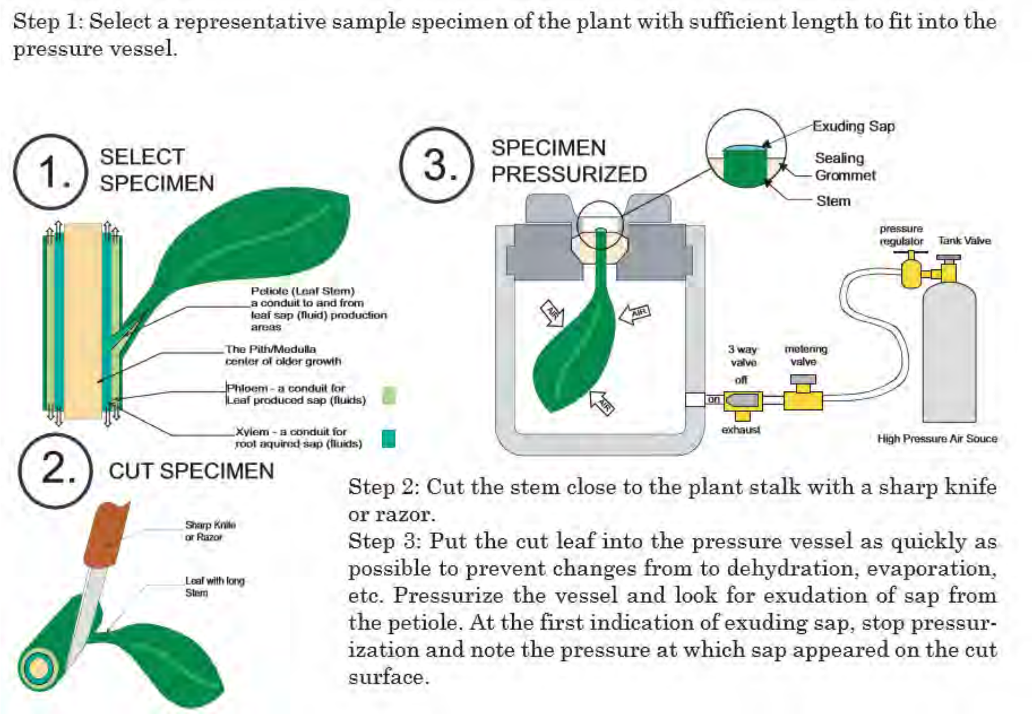
**B1.** Model 3115 Plant Water Status Console with parts description.

The Water Potential gauge measures leaf or stem water status by the following method:

1. A leaf or stem is collected from the tree that is targeted for assessment.

2. The petiole (leaf stem) is cut and placed in the pressure chamber with the cut stem protruding from the chamber at atmospheric pressure.
3. The vessel is sealed around the petiole and pressure applied via an external gas cylinder.
4. The protruding stem is observed and pressure readings recorded at the first point that water is noted to be exuding from the leaf.
5. The positive pressure applied to the leaf that forced water from the leaf stem is measured. This is the leaf water potential.

The process as supplied by Soil Moisture Equipment Corp (2006) is provided in **Figure 19** below.



Step 1: Select a representative sample specimen of the plant with sufficient length to fit into the pressure vessel.

Step 2: Cut the stem close to the plant stalk with a sharp knife or razor.

Step 3: Put the cut leaf into the pressure vessel as quickly as possible to prevent changes from to dehydration, evaporation, etc. Pressurize the vessel and look for exudation of sap from the petiole. At the first indication of exuding sap, stop pressurization and note the pressure at which sap appeared on the cut surface.

**B2.** Diagrammatic illustration of the use of the Pressure Bomb as per Soil Moisture Equipment Corp. (2006).

## Measurement of Soil Water Potential

Soil moisture potential should be measured, utilising a soil auger, in specific cases where results of LWP analysis require additional explaination. This would occur primarily as result of unexpectedly high, or unexpectedly low LWP measurements that cannot be contextualised based on seasonal conditions. The same sampling protocols applied to soil sampling for stable isotopes should be applied to assessment of soil moisture potential. This includes:

1. An initial soil sample taken within the top 10cm of the soil profile.
2. Subsequent sampling at 0.5m intervals down borehole to the top of the Permian basements.
3. Additional measurements taken whenever there is a noted change is soil texture within the soil core (i.e change from clay to sandy clay / loam).

Sampling should be undertaken with a portable hand auger with a maximum expected depth of 5m (BGMB3 is 4.5m depth).

The most convenient method of measuring soil moisture potential is with a portable Dew Point PotentiaMeter which enables measurement to be taken directly on site. Portable devices such as the WP4C uses the chilled mirror dew point technique to measure water potential with the sample being equilibrated with the headspace of a sealed chamber that contains a mirror and a means of detecting condensation on the mirror.

**B3.** The WP4C Dew Point PotentiaMeter available for hire from ICT International Pty Ltd.

The following protocols are to be followed:

1. A 7ml soil sample is inserted into the sample draw of the potentiaMeter in a 15ml stainless steel sample cup.
2. A soil sample takes between 10 -15mins to analyse.
3. Faster settings (fast mode) should be used for samples with limited water holding capacity such as sand.

The WPC4 unit will require 12V power inverter that plugs into the 12V port of a vehicle if measurements are to be taken in the field. Alternatively, samples can be collected in a sealed sample bag (with air removed) and measurements taken in an office or other areas where there is a reliable power source. The inverter should have a continuous output of at least 140 Watts.

***Outputs***

The water potential assessments of both leaf (target tree at site) and soil (from soil core) will provided the following data outputs:

1. Pre-dawn leaf water potential measurements of canopy / sub-canopy leaf samples taken with the Pressure Bomb (3115 unit). The output unit will be provided in MPA.
2. Soil moisture potential taken with the portable WPC4 Potentiometer at standard intervals along the drillhole core. The unit output will be measured in MPA consistent with leaf moisture potential. The intervals for measurement will be:
    a. Top 10cm of the soil profile.
    b. At 0.5m intervals from the soil surface to the top of the phreatic zones.
    c. Where noticeable changes in soil texture or moisture content are noted during examination of the core.

The interval for measurement is purposefully coincident with the interval applied to soil sampling for stable isotopes. This will allow for more ready comparison of the results between differing sampling methods and applications.

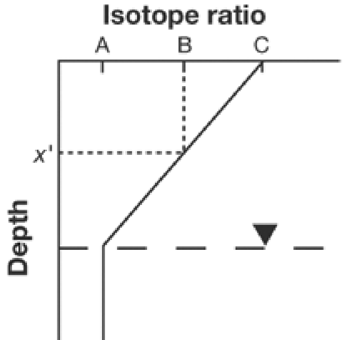
### *B2. Stable Isotope Analysis*

The overaching aim of stable isotope analysis is to determine the degree to which trees utilise groundwater on either a permanent or seasonal basis. It will be applied during the initial phase of the baseline assessment to determine seasonal sources of moisture usage by selected trees, to be phased out once baseline water utilisation patterns are established (minimum of 2 years).

#### *Rationale*

Trees may utilise water from a range of sources including the phreatic zone, the vadose zone and surface water and the stable isotopes of water, oxygen 18 (18O) and deuterium (2H) may be a useful tool to help define the predominant source of water used by terrestrial vegetation. The method relies on a comparison between the stable isotope ratios of water contained in plant xylem (from a twig or xylem core) with concentrations in the various sources of water including potential artesian water sources, and shallow soil moisture. The heavier isotopes of 18O and 2H fractionate differently to the lighter isotopes equivalents (16O and 1H). Rainfall has a typically large δ18O and δ2H as it is formed through the process of condensation which concentrates heavier isotopes. Surface water may have an extremely high δ18O if it is subject to a period of strong evaporation, whilst isotopic composition of groundwater will vary dependent on the input source, although tends to be relatively stable as it is not exposed to processes of fractionation.

The isotopic signature of water measured in a trees xylem may result from a combination of sources with varying signatures. As per Eamus et al (2006) below (Figure B4), if an isotopic signature of 'A' is recorded, then water is being sourced from the phreatic zone, and for 'C' at the surface. If an isotopic signature of 'B' is recorded, this may represent water sourced from the middle of the vadose zone (at depth x), or may be a combination of water from a deeper phreatic source (A) or a shallow source (B). Hence there is potential for considerable uncertainty when mixed isotopic signatures occur and it may be necessary to apply a linear mixing model to aid the interpretation (as per Thorburn et al, 1993).



**B4.** Schematic representation of isotope ratios within soil and groundwater and application in identifying plant water sources (from Eamus et al. 2006).

For a robust application of stable isotopes signatures obtained from plant xylem and soil pore spaces, the following general protocols should be observed:

1. Sampling of plant and soil material will need to be completed during a single sampling event to ensure the results are directly comparable.
2. Sampling of plant xylem material would be completed most efficiently from twigs, collected whilst undertaking leaf water potential measurements. Leaves have tendency to concentrate isotopic concentrations during the process of transpiration and evaporation and hence should not be used.
3. The sampling program is best completed following a period of extended drought / dry conditions to maximise the potential that plants are utilising groundwater sources.
4. Sampling of soil pore water should be undertaken at consistent intervals throughout the vadose zone (the unsaturated zone above the groundwater table) down to the groundwater table. Soil samples are to be collected to the depth of the saturated zone or consolidated bedrock (whichever comes first). Sampling needs to extended beyond the saturated zone to consolidated bedrock in the case that a perched aquifer is identified.

***Methodology***

**Sampling of Soil Pore Water for Stable Isotopes**

**Method:** Soil sampling is to be undertaken at regular intervals along a retrieved soil core to capture signatures for possible isotopic end points (ground water and surface water) and a range of potential plant moisture sources within from the upper soil surface to the top of the phreatic zone. Mensforth et al (1994) completed soil sampling at 0.1m increments to 0.4m depth; 0.2m increments to 2m depth and 0.5m increments to the groundwater surface while others such as O'Grady et al (2006) applied sampling interval of 0.5m down the entire profile. The proposed sampling interval for this assessment is:

1. Initial soil sample taken within the top 10cm of the soil profile.
2. Subsequent soil sampled taken at 0.5m intervals down borehole to the top of the phreatic zone.
3. Additional soil samples take whenever there is a noted change is soil texture within the soil core (i.e change from clay to sandy clay / loam).

Soil sampling should be continued until either the unconfined groundwater table is intersected or the top of the Pleistocene surface halts auger penetration.

**Soil sampling protocols:** The following protocols for soil sampling are to be applied based on advice from ANU Stable Isotope Laboratory:

1. A minimum 50ml equivalent of soil is to be collected for each sample to be analysed.
2. Samples are to be immediately sealed to prevent evaporation in an airtight container (double bagging recommended).
3. Samples are to be labelled with the drill hole number and sampling depth / interval in a consistent format to aid data entry and recognition
4. Samples are to be kept on ice and transported to a freezer for temporary storage prior to dispatch to the laboratory (at the completion of each hole).

5. Frozen samples are to be dispatched in an a sealed (as airtight as possible) esky via overnight courier.

**Equipment:** The following equipment will be required by the site geologist / ecologist.

1. Stainless steel spatula for sample collection (paint scraper of putty knife sufficient).
2. Tape measure (15m extendable steel builders measure).
3. Sealable polypropylene containers (30 to 70ml adequate)
4. Permanent marking pens.
5. Esky for sample storage and dispatch.
6. A chest freezer will need to be accessed off site for storage.

***Sampling of Xylem Water for Stable Isotopes***

This will require twigs to be collected from the outer branches of mature Red Gum (or Poplar Box) trees that are the subject of the assessment. It is anticipated that up to 4 twig samples will be collected from individual trees directly adjacent to the assessment locality. At each site, the following sampling protocols should be observed:Method: Sampling of leaf twigs will be undertaken in conjunction with sampling of leaves for water

1. Outer branches of up to four trees, including the central tree at the assessment locality plus three adjacent trees are to be harvested for twig material.
2. Trees subject to assessment are to be marked with a GPS.
3. Outer branches from each tree will be harvested using an extendable aluminium pole and lopping head. The longest commercially available extension pole is 7.5m giving a maximum reach of approximately 10m.
4. Stem material that is the equivalent to one joint length of the small finger should be sourced (based on advice from ANU). Hence collected branches should contain some stem diameters of at least 10mm.
5. Selected stems are to be cut into maximum 5cm lengths and the bark stripped. One to two stems of 10mm diameter stems will be sufficient although more material will be required for smaller diameter stems.
6. Stems are to be sealed in wide mouth sample containers with leakproof polypropylene closure.
7. Samples should be immediately labelled with the tree number and placed in an iced storage vessel before being transported to a freezer for temporary storage prior to dispatch to the laboratory (at the completion of each hole).
8. Frozen samples are to be dispatched in an a sealed (as airtight as possible) esky via overnight courier.

**Equipment:** The following equipment will be required by the site geologist / ecologist.

1. An extendable 7.5m aluminium pruning pole with an attached lopper head.
2. High quality secateurs for cutting stem material.
3. 125m wide mouth sample containers with a polypropylene seal cap (up to 16 required).
4. Permanent marking pens.
5. Esky for sample storage and dispatch. May be included with the frozen soil samples.

6. A chest freezer will need to be accessed off site for storage.

***Groundwater sampling for stable isotopes***

**Method:** Groundwater samples are to be collected from each groundwater monitoring bore using the low flow method. Groundwater sampling will follow methods described in the Geosciences Australia *Groundwater Sampling and Analysis – A Field Guide* (Sundaram, et al., 2009). Care should be taken not to oxygenate or agitate the sample during pumping or sample collection.

Samples for analysis of stable isotopes should be collected in laboratory prepared 28ml glass McCartney bottles or 15ml Vacutainers and kept cool during storage and transport.

***Sample Despatch and personnel***

**Personnel**: Samples are to be collected, bagged and stored by the supervising geologist / ecologist who will also be responsible for the sample dispatch to the receiving laboratory

**Dispatch:** Samples are to be dispatched directly to the ANU Stable Isotope Laboratory (address provided below).

Hilary Stuart-Williams
Stable Isotope Laboratory
Research School of Biology
R.N. Robertson Building (46)
The Australian National University Canberra ACT 0200 Australia

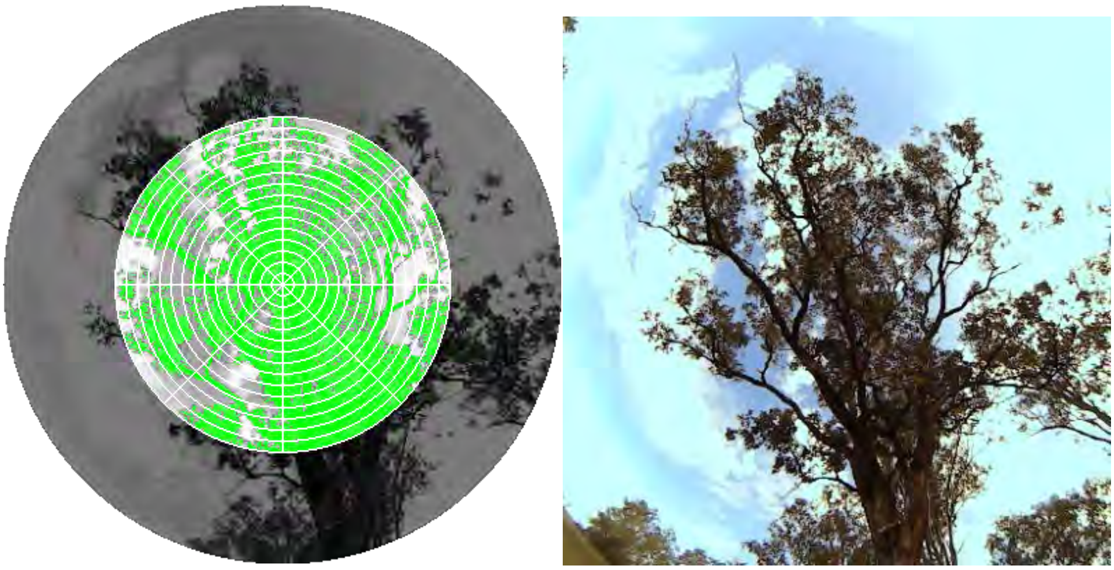
### *B3. Field Based Assessment of Leaf Area Index*

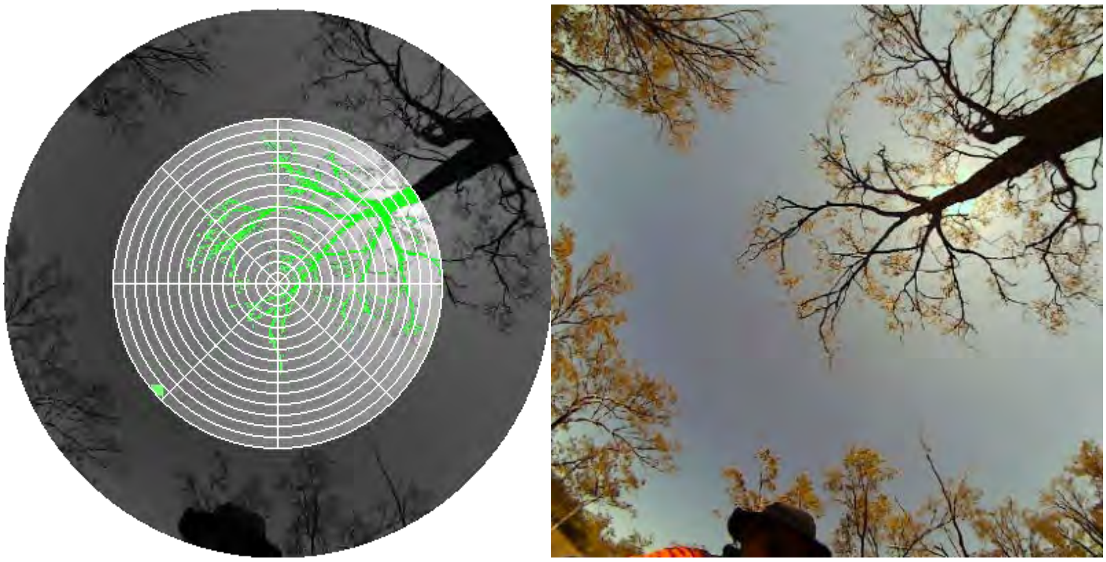
Leaf Area Index (LAI) is a ratio of the total leaf area within a canopy to the ground area covered by the canopy. It is a measure of canopy vigour and the rationale applied is that plants with access to permanent sources of water (i.e. groundwater) will have greater vigour and hence LAI than vegetation that has only periodic access to groundwater resources (e.g. Zolfagher 2014). If a previous permanent groundwater resource is withdrawn (as might occur in a CSG operation), then leaf fall will occur, and LAI will decrease.

Measurement of LAI is typically completed with a hemispherical lens, is labour intensive and utilises specialised software to analyse foliage cover. The CI-110 Plant Canopy Analyzer provides a self-leveling, wide-angled lens to capture hemispherical photographs for the analysis of leaf area index (LAI) and gap fraction analysis and photosynthetically active radiation (PAR). This instrument is integrated with the corresponding software program, and a GPS, allowing for fast and simple analysis, with immediate data available on site including:

- Leaf area index (LAI)
- Leaf angle distribution
- Extinction coefficients
- PAR LAI

The unit provides considerably greater accuracy in LAI measurement than standard hemispherical cameras and is time saving due to the immediate access of data.  Raw data outputs are provided below demonstrating a *Eucalyptus populnea* with a canopy density of 83% and a Gap Fraction LAI of 0.8 compared to a stressed *Eucalyptus populnea* with a canopy density of 52% and a Gap Fraction LAI of 0.3 (second row).  Zenith angle is set at 45° to filter out adjacent canopy trees and other interference.



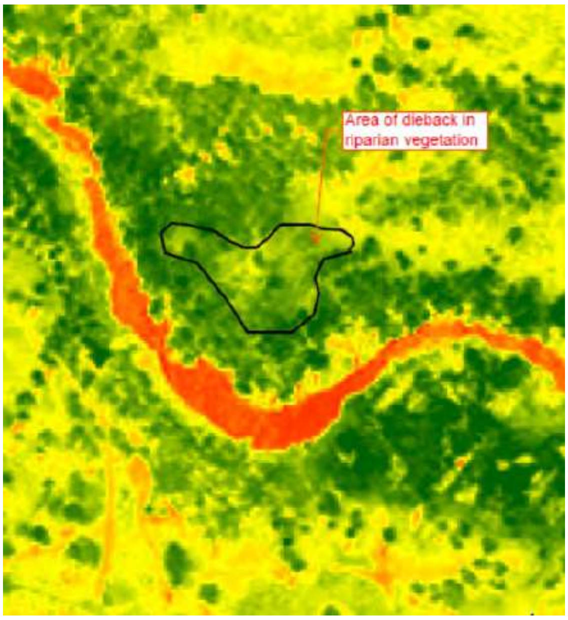


**B5.** Raw data outputs are provided below demonstrating a *Eucalyptus populnea* with a canopy density of 83% and a Gap Fraction LAI of 0.8 compared to a stressed *Eucalyptus populnea* with a canopy density of 52% and a Gap Fraction LAI of 0.3 (second row).

## *B4. Remote Sensing Methods*

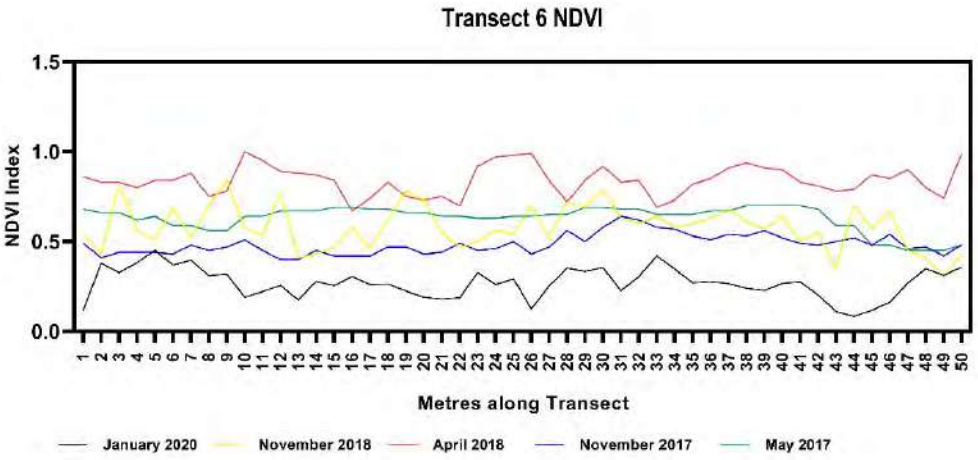
There are remote sensing based assessments used to calculate LAI (TERRA and AQUA satellites), although the spatial resolution of at 250 m x 250 m is not going be useful for the application, due to the fragmented nature of the landscape with large areas of clearing interspersed amongst native woodland.

Recent availability of high- resolution satellite imagery (WorldView-3/WorldView-2 and GeoEye-1; 0.5m Resolution 4-band Pan) to map canopy and foliage dieback in habitats potentially affected by gas seeps. Assessment utilises the Normalised Difference Vegetation Index (NDVI) as a measure of canopy health and vigor. It is a widely accepted method and with advances in satellite technology, has the capacity to assess the health of individual trees rather than landscapes. The strength of the assessment is that it enables the health of riparian (and other GDE) vegetation to be monitored across the entire landscape, rather than just a limited number of individual sites. The landscape-scale capability also has an ability to overcome issues surrounding a lack of site access and provides a long-term monitoring record of vegetation health that can be utilised as reference when a need arises. Capture can be undertaken reactively and can be tasked with a days' notice, providing weather, particularly cloud cover is amenable. An example of high resolution NDVI Imagery showing dieback in riparian vegetation is provided in **A7** (capture date May 2017).



**A7**. Healthy vegetation in bright green grading to bare ground and water in red. Area of recent canopy dieback is indicated.

Measurements of NDVI values at set intervals along permanently established transects also provides a quantifiable and easily rectifiable measure of vegetation productivity that can be undertaken on a seasonal basis. This would form a component of the baseline dataset against which trends in vegetation productivity and fluctuations in groundwater regime can be correlated. Figure A8 provides an example of a vegetation transect that that has been monitored for vegetation production for period of years, showing the strong decrease in vegetative productivity between May 2017 and January 2020.



**A8**. Seasonal variations in vegetation productivity, measured using NDVI, showing a decrease in vegetation health over a 2.5yr sampling period for a permanent monitoring transect in the Surat Basin.

## B5. Applicable Groundwater Monitoring Bore Logs

**Australasian Groundwater & Environmental Consultants Pty Ltd**
Level 2, 15 Mallon Street, Bowen Hills, Queensland 4006

# BOREHOLE LOG

page:1 of 1

## MBID01 (MB04)

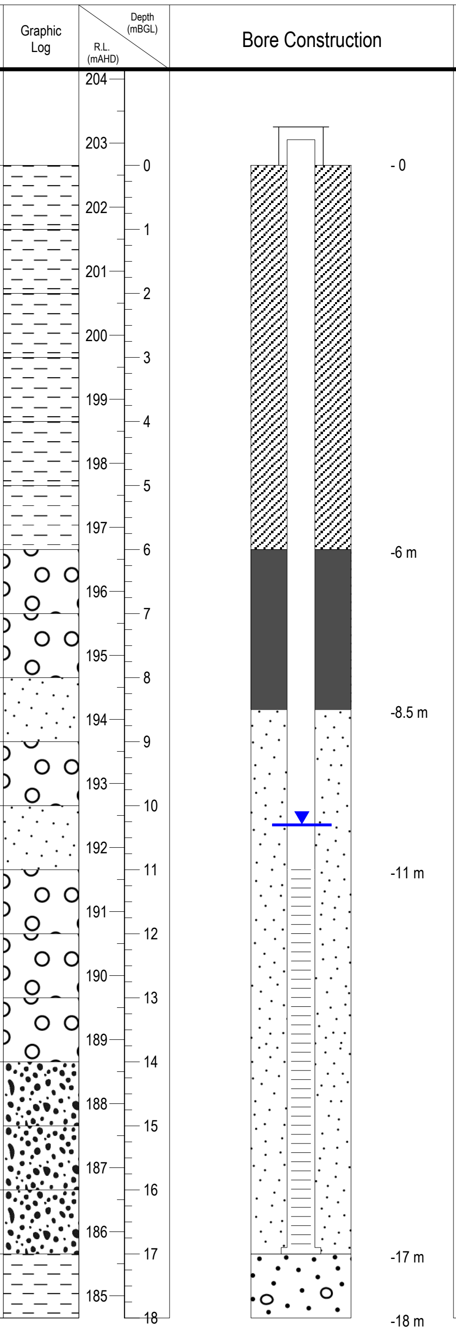
PROJECT No: **G1803B**
PROJECT NAME: **Isaac Downs**
DATE DRILLED: **11/13/2018**
LOGGED BY: **K.Hume (AGE)**

DRILLING COMPANY: **Wizard Drilling**
DRILLER: **Darren Faint**
DRILLING METHOD: **Mud Rotary**
DRILL RIG: **Bourne 500 THD**

EASTING: **620535 mE**
NORTHING: **7561989 mN**
DATUM: **Zone 55**
RL: **202.653 mAHD**
TD: **18 mBGL**

COMMENTS:

| Soil or Rock Field Material Description |
|---|
| CLAY: low plasticity, well graded, light reddish brown, Drilled with mud. |
| CLAY: low plasticity, well graded, light reddish brown. |
| GRAVEL: sub-rounded, quartz and lithic clasts, poorly graded, light reddish brown. |
| GRAVEL: sub-rounded, quartz and lithic clasts, poorly graded, light brown. |
| SAND: rounded, well graded, light brown. |
| GRAVEL: medium gravel, sub-rounded, quartz and lithic clasts, poorly graded, light brown. |
| SAND: rounded, well graded, light brown. |
| GRAVEL: coarse sand, sub-rounded, quartz and lithic clasts, poorly graded, light brown, wet. |
| GRAVEL: sub-rounded, quartz and lithic clasts, poorly graded, light brown. |
| CLAYBOUND GRAVEL: medium gravel, angular, quartz and lithic clasts, gap graded, light brown. |
| CLAYBOUND GRAVEL: medium plasticity, coarse gravel, angular, quartz and lithic clasts, gap graded, light brown. |
| CLAY: high plasticity, sub-rounded, well graded, light grey. |



**Bore Description**

Protective lockable steel collar: +1.3 m
Stick up: +0.58 m

124 mm PCD: 0 m to 18 m (Mud)

50 mm uPVC Class 18 blank casing: 0 m to 11 m

Bentonite grout (2.5%): 0 m to 6 m

Bentonite seal: 6 m to 8.8 m

SWL: 10.30 mbgl

50 mm uPVC Class 18 machine slotted casing, slot aperture: 1mm ,11 m to 17 m

2 - 4 mm washed, rounded, quartz gravel pack: 8.5 m to 17 m

Bore development: 32mins; EC: 5453mS µS/cm; pH: 7.83

Airlift flow rate: 0.18 L/s

End cap

Gravel backfill: 17 m to 18 m
End of hole: 18 m BGL

**Australasian Groundwater & Environmental Consultants Pty Ltd**

Level 2, 15 Mallon Street, Bowen Hills, Queensland 4006

# BOREHOLE LOG

page:1 of 1

## MBID03 (MB05S)

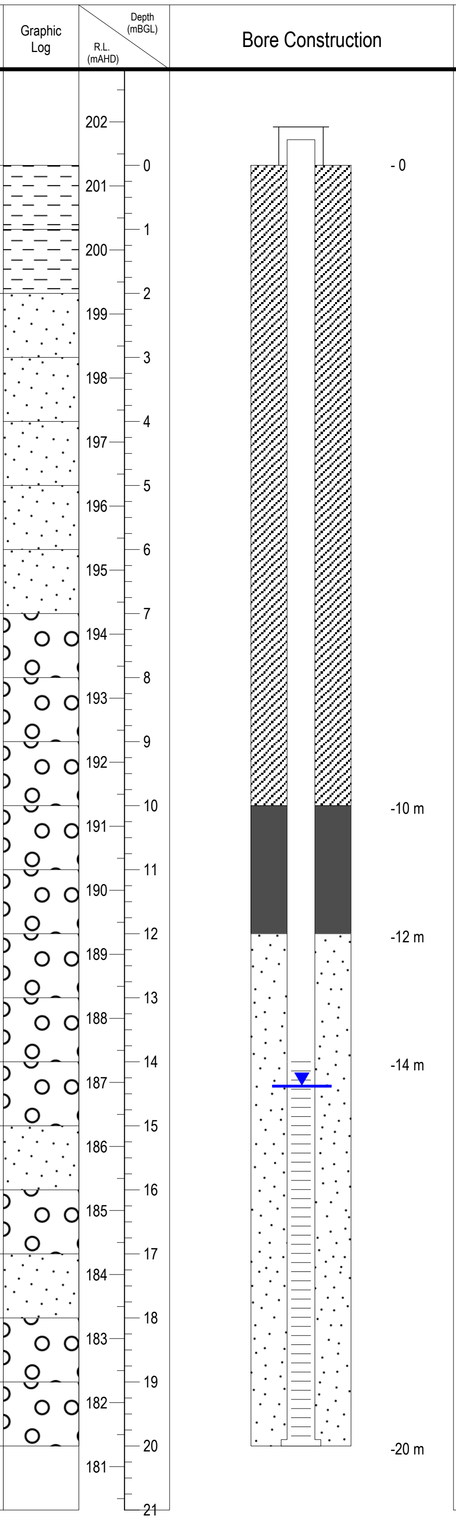
PROJECT No: **G1803B**
PROJECT NAME: **Isaac Downs**
DATE DRILLED: **11/14/2018**
LOGGED BY: **K.Hume (AGE)**

DRILLING COMPANY: **Wizard Drilling**
DRILLER: **Darren Faint**
DRILLING METHOD: **Air Rotary**
DRILL RIG: **Bourne 500 THD**

EASTING: **621899 mE**
NORTHING: **7559331 mN**
DATUM: **Zone 55**
RL: **201.322 mAHD**
TD: **20 mBGL**

COMMENTS:

| Soil or Rock Field Material Description |
|---|
| |
| CLAY: low plasticity, well graded, light brown, dry. |
| SAND: low plasticity, very fine sand, sub-rounded, well graded, clay matrix, reddish brown, dry. |
| GRAVEL: fine sand, sub-rounded, quartz and lithic clasts, poorly graded, brown / yellow, moist. |
| GRAVEL: medium plasticity, medium sand, sub-rounded, quartz and lithic clasts, poorly graded, brown / yellow, dry. |
| SAND: medium sand, well graded, brown / yellow, dry. |
| GRAVEL: fine sand, sub-rounded, quartz and lithic clasts, poorly graded, brown / yellow, dry. |
| SAND: medium sand, well graded, brown / yellow. |
| GRAVEL (40 %): medium gravel, angular, quartz and lithic clasts, poorly graded, clay matrix, bluish grey. |
| GRAVEL (50 %): medium sand, angular, quartz and lithic clasts, poorly graded, clay matrix, bluish grey. |
| |



Bore Description

Protective lockable steel collar: +1.3 m
Stick up: +0.73 m

124 mm PCD: 0 m to 20 m (Air rotary)

50 mm uPVC Class 18 blank casing: 0 m to 14 m

Bentonite grout (2.5 %): 0 m to 10 m

Bentonite seal: 10 m to 12 m

SWL: 14.38 mbgl

2 - 4 mm washed, rounded, quartz gravel pack: 12 m to 20 m

50 mm uPVC Class 18 machine slotted casing, slot aperture: 1 mm, 14 m to 20 m

End cap

End of hole: 20 m BGL

**Australasian Groundwater & Environmental Consultants Pty Ltd**

Level 2, 15 Mallon Street, Bowen Hills, Queensland 4006

# BOREHOLE LOG

page:1 of 1

## MBID11 (MB16)

PROJECT No: **G1803B**
PROJECT NAME: **Isaac Downs**
DATE DRILLED: **11/20/2018**
LOGGED BY: **K.Hume (AGE)**

DRILLING COMPANY: **Wizard Drilling**
DRILLER: **Darren Faint**
DRILLING METHOD: **Mud Rotary**
DRILL RIG: **Bourne 500 THD**

EASTING: **621655 mE**
NORTHING: **7560072 mN**
DATUM: **Zone 55**
RL: **201.391 mAHD**
TD: **17 mBGL**

COMMENTS:

Soil or Rock Field Material Description

CLAY: low plasticity, sub-rounded, well graded, reddish brown, dry.

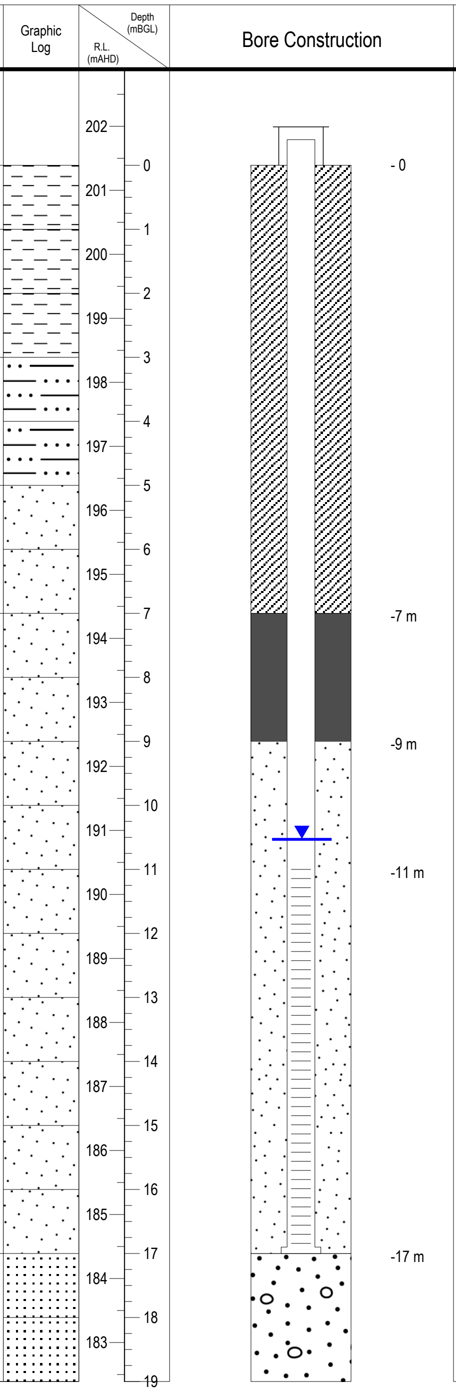
CLAY: low plasticity, sub-rounded, well graded, brown, dry.

CLAYBOUND SAND: very fine sand, sub-rounded, well graded, reddish brown, dry.

SAND: fine sand, sub-rounded, quartz and lithic clasts, poorly graded, light yellowish brown, moist.

SAND: medium sand, sub-rounded, quartz and lithic clasts, poorly graded, light yellowish brown, moist.

SANDSTONE: medium sand, sub-rounded, quartz and feldspar, well graded, greyish black, distinctly weathered wet.



Bore Description

Protective lockable steel collar: +1.3 m
Stick up: +0.8 m

124 mm PCD: 0 m to 19 m (Mud)

Bentonite grout (2.5 %): 0 m to 7 m

50 mm uPVC Class 18 blank casing: 0 m to 13 m

Bentonite seal: 7 m to 9 m

SWL: 10.53 mbgl

2 - 4 mm washed, rounded, quartz gravel pack: 11 m to 17 m

50 mm uPVC Class 18 machine slotted casing, slot aperture: 1 mm,13 m to 19 m

End cap

Gravel backfill:  17 m to 19 m

End of hole: 19 m BGL

**Australasian Groundwater & Environmental Consultants Pty Ltd**
Level 2, 15 Mallon Street, Bowen Hills, Queensland 4006

# BOREHOLE LOG

page:1 of 1

# MBID11 (MB16)

PROJECT No: **G1803B**
PROJECT NAME: **Isaac Downs**
DATE DRILLED: **11/20/2018**
LOGGED BY: **K.Hume (AGE)**

DRILLING COMPANY: **Wizard Drilling**
DRILLER: **Darren Faint**
DRILLING METHOD: **Mud Rotary**
DRILL RIG: **Bourne 500 THD**

EASTING: **621655 mE**
NORTHING: **7560072 mN**
DATUM: **Zone 55**
RL: **201.391 mAHD**
TD: **17 mBGL**

COMMENTS:

Soil or Rock Field Material Description

CLAY: low plasticity, sub-rounded, well graded, reddish brown, dry.

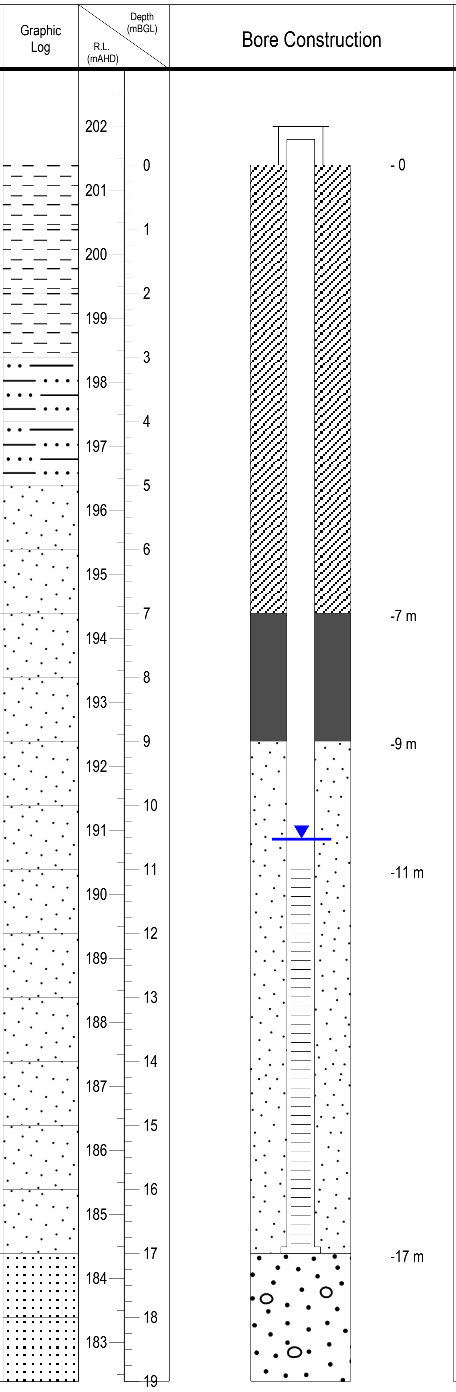
CLAY: low plasticity, sub-rounded, well graded, brown, dry.

CLAYBOUND SAND: very fine sand, sub-rounded, well graded, reddish brown, dry.

SAND: fine sand, sub-rounded, quartz and lithic clasts, poorly graded, light yellowish brown, moist.

SAND: medium sand, sub-rounded, quartz and lithic clasts, poorly graded, light yellowish brown, moist.

SANDSTONE: medium sand, sub-rounded, quartz and feldspar, well graded, greyish black, distinctly weathered wet.



Bore Description

Protective lockable steel collar: +1.3 m
Stick up: +0.8 m

124 mm PCD: 0 m to 19 m (Mud)

Bentonite grout (2.5 %): 0 m to 7 m

50 mm uPVC Class 18 blank casing: 0 m to 13 m

Bentonite seal: 7 m to 9 m

SWL: 10.53 mbgl

2 - 4 mm washed, rounded, quartz gravel pack: 11 m to 17 m

50 mm uPVC Class 18 machine slotted casing, slot aperture: 1 mm,13 m to 19 m

End cap

Gravel backfill: 17 m to 19 m

End of hole: 19 m BGL

**Australasian Groundwater & Environmental Consultants Pty Ltd**
Level 2, 15 Mallon Street, Bowen Hills, Queensland 4006

# BOREHOLE LOG

page:1 of 1

# MBID17 (MB03)

PROJECT No: **G1803B**
PROJECT NAME: **Isaac Downs**
DATE DRILLED: **12/9/2018**
LOGGED BY: **I.Crow (AGE)**

DRILLING COMPANY: **Wizard Drilling**
DRILLER: **Darren Faint**
DRILLING METHOD: **Mud Rotary**
DRILL RIG: **Bourne 500 THD**

EASTING: **619680 mE**
NORTHING: **7562295 mN**
DATUM: **Zone 55**
RL: **200.76 mAHD**
TD: **17 mBGL**

COMMENTS:

## Soil or Rock Field Material Description

SOIL: low plasticity, poorly graded, clay matrix, dark brownish grey, dry.

SOIL: low plasticity, poorly graded, clay matrix, dark brown, dry.

SAND (90 %): coarse sand, sub-angular, quartz and lithic clasts, light brown, loose, dry.

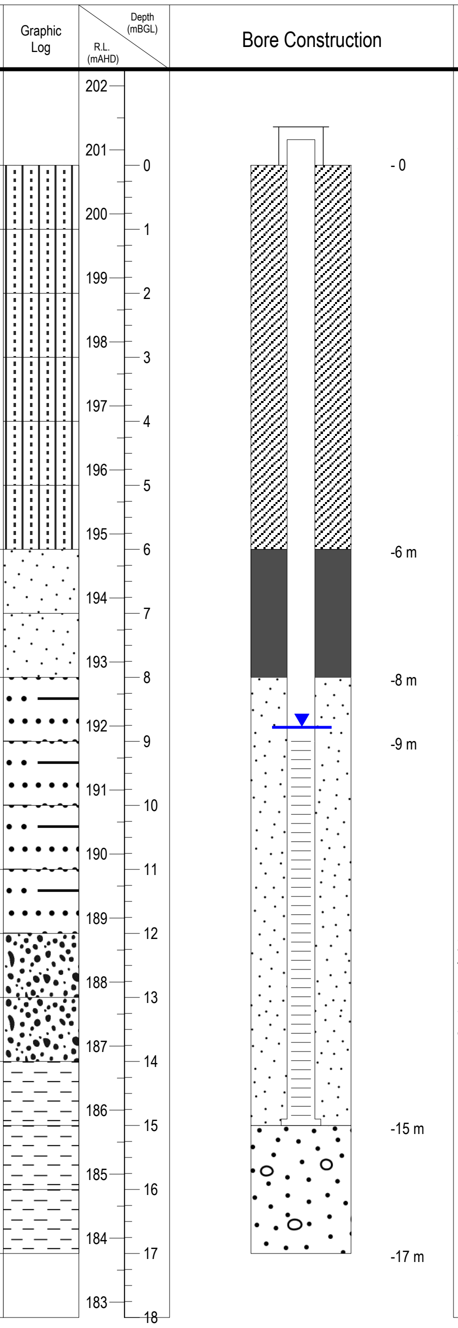
SANDY CLAY (90 %): medium plasticity, coarse sand, sub-angular, quartz and lithic clasts, poorly graded, clay matrix, light brown, soft, moist.

SANDY CLAY (90 %): medium plasticity, coarse sand, sub-angular, quartz and lithic clasts, poorly graded, clay matrix, light brown, soft, moist, Water strike @ 11mbgl.

CLAYBOUND GRAVEL (70 %): medium plasticity, coarse sand, sub-angular, Lithic clasts, poorly graded, clay matrix, light brown, wet.

CLAYBOUND GRAVEL: Lithic clasts, hard, loose, wet, Drillers noted this section of gravel was very hard (13m); base of allluvium at 14m.

SILTSTONE (80 %): high plasticity, fine gravel, sub-angular, Lithic clasts, poorly graded, clay matrix, light grey, distinctly weathered wet.



## Bore Description

Protective lockable steel collar: +1.3 m
Stick up: +0.78 m

124 mm PCD: 0 m to 17 m (Mud)

Bentonite grout (2.5 %): 0 m to 6 m

50 mm uPVC Class 18 blank casing: 0 m to 9 m

Bentonite seal: 6 m to 8 m

SWL: 8.78 mbgl

2 - 4 mm washed, rounded, quartz gravel pack: 8 m to 15 m

50 mm uPVC Class 18 machine slotted casing, slot aperture: 1 mm, 9 m to 15 m

End cap
End of hole: 17 m BGL

**Australasian Groundwater & Environmental Consultants Pty Ltd**
Level 2, 15 Mallon Street, Bowen Hills, Queensland 4006

# BOREHOLE LOG

page:1 of 1

## MBID19

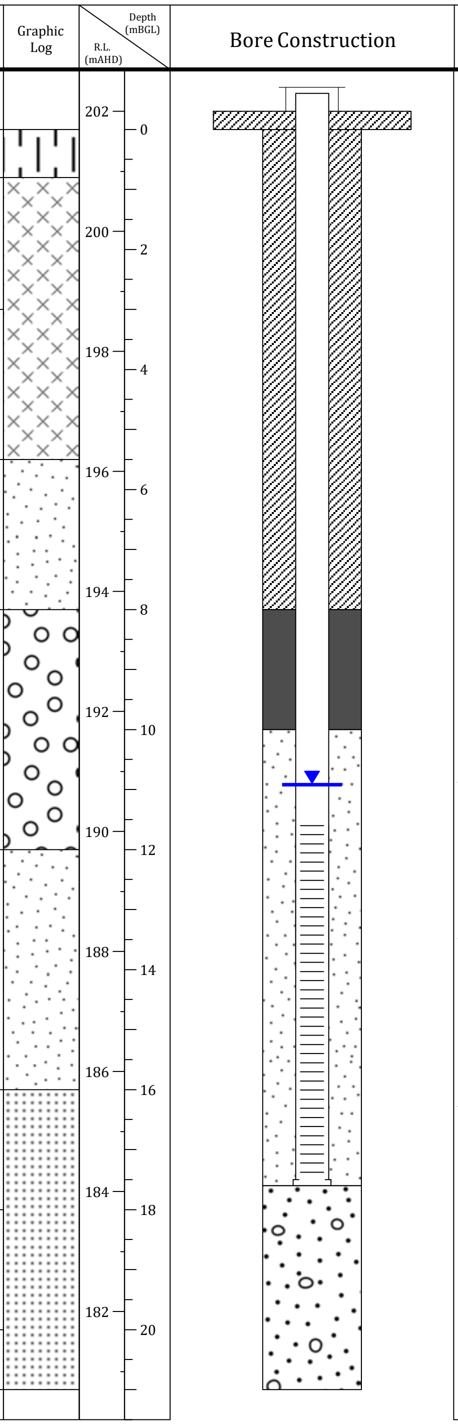
PROJECT No: **G1803M**
PROJECT NAME: **Issac Downs remote bore installation**
DATE DRILLED: **14/11/2020**
LOGGED BY: **Richard Haselwood**

DRILLING COMPANY: **Wizard Drilling**
DRILLER: **Geoff Rogers**
DRILLING METHOD: **Mud rotary**
DRILL RIG: **McCulloch DR800 Mk2**

TD: **21 mBGL**
GL ELEVATION: **201.7 mAHD**
EASTING: **620764 mE**
NORTHING: **7561516 mN**
DATUM: **GDA 94 z55 UTM**

COMMENTS:

| Soil or Rock Field Material Description |
|---|
| |
| SOIL: dark reddish-brown, residual soil, very loose. |
| SILT: dark red, very loose. |
| SILT: dark reddish-brown, very loose. |
| SAND: brown, very loose. |
| GRAVEL, extremely coarse: grey, loose. |
| SAND, coarse: orangey-grey, loose. |
| SANDSTONE, fine to medium: light grey, extremely weathered, extremely low strength rock. |
| SANDSTONE, fine: grey, extremely weathered, extremely low strength rock. |
| SANDSTONE, fine to medium: light grey, distinctly weathered, extremely low strength rock. |



| Bore Description |
|---|
| Protective lockable steel collar: +0.9 m<br>Stick up: +0.73 m<br>Cement pad: 0.5 m × 0.5 m × 0.2m |
| Bentonite grout (2 - 5 %): 0 m to 8 m |
| 50 mm uPVC Class 18 blank casing: - 0.73 m to 11.6 m |
| Bentonite seal: 8 m to 10 m |
| 125 mm Blade: 0 m to 21 m (mud rotary) |
| Water level: 10.92 m bgl on 23/11/2020 |
| 3 mm washed, rounded, quartz gravel pack: 10 m to 17.6 m |
| 50 mm uPVC Class 18 machine slotted casing, slot aperture: 1 mm, 11.6 m to 17.6 m |
| Water quality mesurements on 23/11/2020: electrical conductivity: 2,609 µS/cm; pH: 6.09 |
| End cap |
| Backfill: 17.6 m to 21 m |
| End of hole: 21 m BGL |

# BORE REPORT

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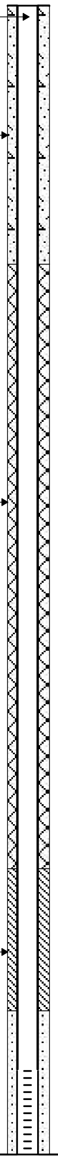
## BORE MBID 21

DRAFT

**Client:** Stanmore Coal IP Pty Ltd
**Project:** Isaac Downs Coal Mine - EIS
**Location:** Peaks Downs Highway, via Moranbah
**Project No:** 018-168C

**Page No:** 1 of 2
**Date:** 22 June 2020
**Ground Surface Level:** RL200.0m*

| Depth (m) | Description | RL (m) | Sample Type | Sample Depth (m) | Test Results | Groundwater Monitoring Bore |
|---|---|---|---|---|---|---|
| | | 200.0 | | | | |
| 0 | ***SILTY SAND (SM)***<br>- brown, fine to medium grained (topsoil) | | | | | Casing |
| | - very dense, pale brown | | S | 0.5<br>0.95 | 19,24,28<br>N=52 | |
| 1 | | 199.0 | | | | Grout |
| | ***CLAYEY SAND (SC)***<br>- dense, orange-brown, fine grained | | S | 1.5<br>1.95 | 15,18,13<br>N=31 | |
| 2 | | 198.0 | | | | |
| 3 | | 197.0 | U | 3.0<br>3.15 | pp>600 | |
| 4 | | 196.0 | | | | Backfill |
| | - very dense, grey mottled orange | | S | 4.5<br>4.94 | 12,17,30/140mm | |
| 5 | | 195.0 | | | | |
| 6 | ***SILTY CLAY (CH)***<br>- very stiff, orange-brown mottled grey | 194.0 | S | 6.0<br>6.45 | 7,11,12<br>N=23 | |
| 7 | | 193.0 | | | | |
| | - stiff to very stiff | | U | 7.5<br>7.9 | pp=300 | |
| 8 | | 192.0 | | | | Bentonite |
| 9 | ***SANDY CLAY (CI)***<br>- very stiff, orange-brown mottled grey, fine to medium grained | 191.0 | S | 9.0<br>9.45 | 6,10,11<br>N=21 | |



| | | | | | |
|---|---|---|---|---|---|
| D | **Disturbed Sample** | E | **Environmental Sample** | C | **NMLC Coring** |
| B | **Bulk Sample** | S | **Standard Penetrometer Test (SPT)** | Is(50) | **Point Load Test Result (MPa)** |
| U | **Undisturbed Tube (50mm diameter)** | HB | **SPT Hammer Bouncing** | (d) | **Diametral Point Load Strength Test** |
| pp | **Pocket Penetrometer Test (kPa)** | ( ) | **No Sample Recovery** | (a) | **Axial Point Load Strength Test** |

**Rig:** Hydrapower Scout

**Drilling Method:** Auger to 3.0m, then washbore

**Groundwater:** No free groundwater encountered during drilling

**Remarks:** *Approximate ground surface level interpolated from Robert Bird Group Drawing 20103-RBG-ZZ-XX-SK-CV-018 (Rev A) Dated April 2020

**Handheld GPS Coordinates**
**E:** 621529 **N:** 7560060

**Logged by:** ML

# BORE REPORT

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## BORE MBID 21

DRAFT

**Client:** Stanmore Coal IP Pty Ltd
**Project:** Isaac Downs Coal Mine - EIS
**Location:** Peaks Downs Highway, via Moranbah
**Project No:** 018-168C

**Page No:** 2 of 2
**Date:** 22 June 2020
**Ground Surface Level:** RL200.0m*

| Depth (m) | Description | RL (m) | Sample Type | Sample Depth (m) | Test Results | Groundwater Monitoring Bore |
|---|---|---|---|---|---|---|
| 10 | ***SANDY CLAY (CI)***<br>- very stiff, orange-brown mottled grey, fine to medium grained | 190.0 | | | | Screen |
| 11 | ***SILTY SAND (SM)***<br>- medium dense, pale grey mottled orange, fine to coarse grained | 189.0 | S | 10.5<br>10.95 | 9,14,14<br>N=28 | |
| 12 | ***SANDY GRAVEL (GP)***<br>- medium dense, orange-brown, fine to medium subrounded, medium to coarse grained sand | 188.0 | S | 12.0<br>12.45 | 7,8,11<br>N=19 | |
| 13 | | 187.0 | | | | Sand |
| 14 | ***SILTY SAND (SM)***<br>- medium dense, orange-brown, medium to coarse grained | 186.0 | S | 13.5<br>13.95 | 6,11,<br>N=19 | |
| 15 | ***SILTY CLAY (CH)***<br>- very stiff, orange-brown mottled pale grey | 185.0 | S | 15.0<br>15.45 | 12,12,15<br>N=28 | |
| 16 | | 184.0 | S | 16.5<br>16.95 | 9,10,2<br>N=22 | |
| 17 | End of Bore at 16.95 m | 183.0 | | | | |
| 18 | | 182.0 | | | | |
| 19 | | 181.0 | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **D** | **Disturbed Sample** | **E** | **Environmental Sample** | **C** | **NMLC Coring** |
| **B** | **Bulk Sample** | **S** | **Standard Penetrometer Test (SPT)** | **Is(50)** | **Point Load Test Result (MPa)** |
| **U** | **Undisturbed Tube (50mm diameter)** | **HB** | **SPT Hammer Bouncing** | **(d)** | **Diametral Point Load Strength Test** |
| **pp** | **Pocket Penetrometer Test (kPa)** | **( )** | **No Sample Recovery** | **(a)** | **Axial Point Load Strength Test** |

**Rig:** Hydrapower Scout
**Drilling Method:** Auger to 3.0m, then washbore
**Groundwater:** No free groundwater encountered during drilling
**Remarks:** *Approximate ground surface level interpolated from Robert Bird Group Drawing 20103-RBG-ZZ-XX-SK-CV-018 (Rev A) Dated April 2020

**Handheld GPS Coordinates**
**E:** 621529 **N:** 7560060

**Logged by:** ML

# BORE REPORT

**Butler Partners**
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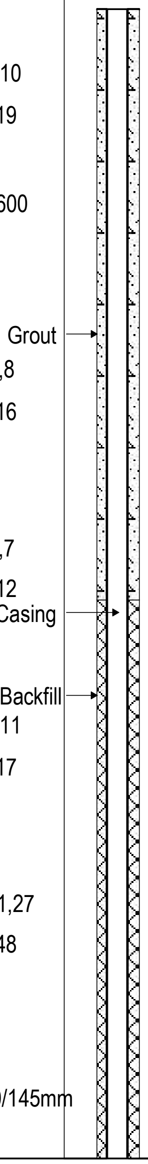
## BORE MBID 22

DRAFT

***Client:*** Stanmore Coal IP Pty Ltd
***Project:*** Isaac Downs Coal Mine - EIS
***Location:*** Peaks Downs Highway, via Moranbah
***Project No:*** 018-168C

***Page No:*** 1 of 4
***Date:*** 26 June 2020
***Ground Surface Level:*** RL198.0m*

| Depth (m) | Description | RL (m) | Lithology | Sample Type | Sample Depth (m) | Test Results | Groundwater Monitoring Bore |
|---|---|---|---|---|---|---|---|
| 0 | ***SILTY SAND (SM)***<br>- dark brown, fine to meidum grained (topsoil) | 198.0 | | | | | |
| 1 | ***CLAYEY SAND (SC)***<br>- medium dense, brown mottled orange, fine to coarse grained | 197.0 | | S | 0.5<br>0.95 | 5,9,10<br>N=19 | |
| 2 | ***SILTY CLAY (CH)***<br>- hard, brown mottled orange, with fine grained sand | 196.0 | | U | 1.5<br>1.9 | pp>600 | |
| 3<br>4 | ***CLAYEY SAND (SC)***<br>- medium dense, brown, fine to medium grained | 195.0<br>194.0 | | S | 3.0<br>3.45 | 5,8,8<br>N=16 | |
| 5 | ***SILTY SAND (SM)***<br>- medium dense, orange-brown, fine to coarse grained | 193.0 | | S | 4.5<br>4.95 | 4,5,7<br>N=12 | |
| 6<br>7 | ***SAND (SP)***<br>- medium dense, orange-brown, fine to coarse grained, with silt fines | 192.0<br>191.0 | | S | 6.0<br>6.45 | 5,6,11<br>N=17 | |
| 8 | ***CLAYEY SAND (SC)***<br>- dense, orange-brown, fine to coarse grained, with fine to medium subrounded gravel | 190.0 | | S | 7.5<br>7.95 | 12,21,27<br>N=48 | |
| 9 | ***SANDY CLAY (CI)***<br>- hard, orange mottled pale grey, fine to coarse grained sand | 189.0 | | S | 9.0<br>9.45 | 8,25,30/145mm | |



| | | | | | |
|---|---|---|---|---|---|
| **D** | **Disturbed Sample** | **E** | **Environmental Sample** | **C** | **NMLC Coring** |
| **B** | **Bulk Sample** | **S** | **Standard Penetrometer Test (SPT)** | **Is(50)** | **Point Load Test Result (MPa)** |
| **U** | **Undisturbed Tube (50mm diameter)** | **HB** | **SPT Hammer Bouncing** | **(d)** | **Diametral Point Load Strength Test** |
| **pp** | **Pocket Penetrometer Test (kPa)** | **( )** | **No Sample Recovery** | **(a)** | **Axial Point Load Strength Test** |

**Rig:** Hydrapower Scout

**Drilling Method:** Auger to 3.0m, then washbore

**Groundwater:** No free groundwater encountered during drilling

**Remarks:** *Approximate ground surface level interpolated from Robert Bird Group Drawing 20103-RBG-ZZ-XX-SK-CV-018 (Rev A) Dated April 2020

**Handheld GPS Coordinates**
**E:** 622796 **N:** 7558353

**Logged by:** ML

# BORE REPORT

**Client:** Stanmore Coal IP Pty Ltd
**Project:** Isaac Downs Coal Mine - EIS
**Location:** Peaks Downs Highway, via Moranbah
**Project No:** 018-168C

## *BORE MBID 22*

**Page No:** 2 of 4
**Date:** 26 June 2020
**Ground Surface Level:** RL198.0m*

DRAFT

| Depth (m) | Description | RL (m) | Lithology | Sample Type | Sample Depth (m) | Test Results | Groundwater Monitoring Bore |
|---|---|---|---|---|---|---|---|
| 10 | ***SANDY CLAY (CI)***<br>- hard, orange mottled pale grey, fine to coarse grained sand | 188.0 | | | | | |
| | ***CLAYEY SAND (SC)***<br>- dense, orange mottled pale grey, fine to coarse grained | | | S | 10.5<br>10.95 | 8,13,18<br>N=31 | |
| 11 | | 187.0 | | | | | |
| 12 | - medium dense | 186.0 | | S | 12.0<br>12.45 | 5,8,11<br>N=19 | |
| 13 | | 185.0 | | | | | |
| | ***SILTY CLAY (CH)***<br>- hard, pale grey mottled orange | | | S | 13.5<br>13.75 | 18,30/100mm | |
| 14 | | 184.0 | | | | | |
| 15 | - red-brown | 183.0 | | S | 15.0<br>15.26 | 12,30/105mm | |
| 16 | | 182.0 | | | | | |
| | | | | S | 16.5<br>16.64 | 30/140mm | |
| 17 | | 181.0 | | | | | |
| 18 | | 180.0 | | S | 18.0<br>18.25 | 22,30/95mm | |
| 19 | | 179.0 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **D** | **Disturbed Sample** | **E** | **Environmental Sample** | **C** | **NMLC Coring** |
| **B** | **Bulk Sample** | **S** | **Standard Penetrometer Test (SPT)** | **Is(50)** | **Point Load Test Result (MPa)** |
| **U** | **Undisturbed Tube (50mm diameter)** | **HB** | **SPT Hammer Bouncing** | **(d)** | **Diametral Point Load Strength Test** |
| **pp** | **Pocket Penetrometer Test (kPa)** | **( )** | **No Sample Recovery** | **(a)** | **Axial Point Load Strength Test** |

**Rig:** Hydrapower Scout

**Drilling Method:** Auger to 3.0m, then washbore

**Groundwater:** No free groundwater encountered during drilling

**Remarks:** *Approximate ground surface level interpolated from Robert Bird Group Drawing 20103-RBG-ZZ-XX-SK-CV-018 (Rev A) Dated April 2020

**Handheld GPS Coordinates**
**E:** 622796 **N:** 7558353

**Logged by:** ML

# BORE REPORT

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**Client:** Stanmore Coal IP Pty Ltd
**Project:** Isaac Downs Coal Mine - EIS
**Location:** Peaks Downs Highway, via Moranbah
**Project No:** 018-168C

## BORE MBID 22

**Page No:** 3 of 4
**Date:** 26 June 2020
**Ground Surface Level:** RL198.0m*

DRAFT

| Depth (m) | Description | RL (m) | Lithology | Sample Type | Sample Depth (m) | Test Results | Groundwater Monitoring Bore |
|---|---|---|---|---|---|---|---|
| | ***SILTY CLAY (CH)***<br>- hard, red-brown | | | S | 19.5<br>19.95 | 18,18,28<br>N=46 | |
| 20 | | 178.0 | | | | | |
| | | | | | | Screen | |
| 21 | | 177.0 | | S | 21.0<br>21.12 | 30/120mm | |
| 22 | | 176.0 | | | | | |
| | ***MUDSTONE (XW)***<br>- extremely low strength, grey | | | S | 22.5<br>22.58 | 30/80mm | |
| | | | | | | Bentonite | |
| 23 | | 175.0 | | | | | |
| 24 | | 174.0 | | S | 24.0<br>24.08 | 30/80mm | |
| 25 | | 173.0 | | | | | |
| | - very low to low strength | | | S | 25.5<br>25.55 | 30/50mm | |
| 26 | | 172.0 | | | | | |
| 27 | - extremely low strength | 171.0 | | S | 27.0<br>27.09 | 30/90mm | |
| 28 | | 170.0 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **D** | **Disturbed Sample** | **E** | **Environmental Sample** | **C** | **NMLC Coring** |
| **B** | **Bulk Sample** | **S** | **Standard Penetrometer Test (SPT)** | **Is(50)** | **Point Load Test Result (MPa)** |
| **U** | **Undisturbed Tube (50mm diameter)** | **HB** | **SPT Hammer Bouncing** | **(d)** | **Diametral Point Load Strength Test** |
| **pp** | **Pocket Penetrometer Test (kPa)** | **( )** | **No Sample Recovery** | **(a)** | **Axial Point Load Strength Test** |

**Rig:** Hydrapower Scout

**Drilling Method:** Auger to 3.0m, then washbore

**Groundwater:** No free groundwater encountered during drilling

**Remarks:** *Approximate ground surface level interpolated from Robert Bird Group Drawing 20103-RBG-ZZ-XX-SK-CV-018 (Rev A) Dated April 2020

**Handheld GPS Coordinates**
**E:** 622796 **N:** 7558353

**Logged by:** ML

# BORE REPORT

Butler Partners
geotechnical • geo-environmental • groundwater

## BORE MBID 22

DRAFT

**Client:** Stanmore Coal IP Pty Ltd
**Project:** Isaac Downs Coal Mine - EIS
**Location:** Peaks Downs Highway, via Moranbah
**Project No:** 018-168C

**Page No:** 4 of 4
**Date:** 26 June 2020
**Ground Surface Level:** RL198.0m*

| Depth (m) | Description | RL (m) | Lithology | Sample Type | Sample Depth (m) | Test Results | Groundwater Monitoring Bore |
|---|---|---|---|---|---|---|---|
| | ***MUDSTONE (XW)***<br>- extremely low strength, red-brown mottled pale grey | | | | | | |
| | | | | S | 28.5<br>28.59 | 30/90mm | |
| 29 | | 169.0 | | | | | |
| 30 | | 168.0 | | S | 30.0<br>30.07 | 30/70mm | |
| 31 | | 167.0 | | | | | Sand |
| | | | | S | 31.5<br>31.59 | 30/85mm | |
| 32 | | 166.0 | | | | | |
| 33 | - low strength, grey | 165.0 | | S | 33.0<br>33.04 | 30/40mm | |
| 34 | | 164.0 | | | | | |
| | | | | S | 34.5<br>34.54 | 30/40mm | |
| 35 | | 163.0 | | | | | |
| 36 | | 162.0 | | S | 36.0<br>36.05 | 30/50mm | |
| | End of Bore at 36.06 m | | | | | | |
| 37 | | 161.0 | | | | | |
| 38 | | 160.0 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| D | Disturbed Sample | E | Environmental Sample | C | NMLC Coring |
| B | Bulk Sample | S | Standard Penetrometer Test (SPT) | Is(50) | Point Load Test Result (MPa) |
| U | Undisturbed Tube (50mm diameter) | HB | SPT Hammer Bouncing | (d) | Diametral Point Load Strength Test |
| pp | Pocket Penetrometer Test (kPa) | ( ) | No Sample Recovery | (a) | Axial Point Load Strength Test |

**Rig:** Hydrapower Scout

**Drilling Method:** Auger to 3.0m, then washbore

**Groundwater:** No free groundwater encountered during drilling

**Remarks:** *Approximate ground surface level interpolated from Robert Bird Group Drawing 20103-RBG-ZZ-XX-SK-CV-018 (Rev A) Dated April 2020

**Handheld GPS Coordinates**
**E:** 622796 **N:** 7558353

**Logged by:** ML

# BORE REPORT

Butler Partners
geotechnical • geo-environmental • groundwater

## BORE MBID 23

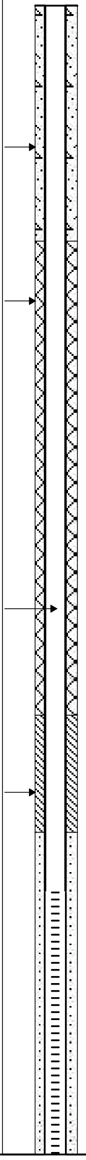
DRAFT

**Client:** Stanmore Coal IP Pty Ltd
**Project:** Isaac Downs Coal Mine - EIS
**Location:** Peaks Downs Highway, via Moranbah
**Project No:** 018-168C

**Page No:** 1 of 2
**Date:** 28 June 2020
**Ground Surface Level:** RL198.0m*

| Depth (m) | Description | RL (m) | Lithology | Sample Type | Sample Depth (m) | Test Results |
|---|---|---|---|---|---|---|
| 0 | ***SILTY SAND (SM)***<br>- brown, fine to medium grained (topsoil)<br>- medium dense | 198.0 | | | | |
| | | | | S | 0.5<br>0.95 | 8,10,11<br>N=21 |
| 1 | | 197.0 | | | | |
| | ***SANDY CLAYEY SILT (ML)***<br>- very stiff, brown, fine grained sand | | | S | 1.5<br>1.95 | 9,9,11<br>N=20 |
| 2 | | 196.0 | | | | |
| 3 | ***SILTY SAND (SM)***<br>- medium dense, brown, fine to medium grained | 195.0 | | S | 3.0<br>3.45 | 6,13,13<br>N=26 |
| 4 | | 194.0 | | | | |
| | - dense | | | S | 4.5<br>4.95 | 8,14,18<br>N=32 |
| 5 | | 193.0 | | | | |
| 6 | - medium dense to dense | 192.0 | | S | 6.0<br>6.45 | 10,14,16<br>N=30 |
| 7 | | 191.0 | | | | |
| | - dense | | | S | 7.5<br>7.95 | 14,22,27<br>N=49 |
| 8 | | 190.0 | | | | |
| 9 | - orange-brown, fine to coarse grained, trace of fine subrounded gravel | 189.0 | | S | 9.0<br>9.45 | 13,21,27<br>N=48 |

Groundwater Monitoring Bore



| | | | | | |
|---|---|---|---|---|---|
| D | Disturbed Sample | E | Environmental Sample | C | NMLC Coring |
| B | Bulk Sample | S | Standard Penetrometer Test (SPT) | Is(50) | Point Load Test Result (MPa) |
| U | Undisturbed Tube (50mm diameter) | HB | SPT Hammer Bouncing | (d) | Diametral Point Load Strength Test |
| pp | Pocket Penetrometer Test (kPa) | ( ) | No Sample Recovery | (a) | Axial Point Load Strength Test |

**Rig:** Hydrapower Scout

**Drilling Method:** Auger to 3.0m, then washbore

**Groundwater:** No free groundwater encountered during drilling

**Remarks:** *Approximate ground surface level interpolated from Robert Bird Group Drawing 20103-RBG-ZZ-XX-SK-CV-018 (Rev A) Dated April 2020

**Handheld GPS Coordinates**
**E:** 621677 **N:** 7559407

**Logged by:** ML

# BORE REPORT

**Client:** Stanmore Coal IP Pty Ltd
**Project:** Isaac Downs Coal Mine - EIS
**Location:** Peaks Downs Highway, via Moranbah
**Project No:** 018-168C

## BORE MBID 23

DRAFT

**Page No:** 2 of 2
**Date:** 28 June 2020
**Ground Surface Level:** RL198.0m*

| Depth (m) | Description | RL (m) | Lithology | Sample Type | Sample Depth (m) | Test Results | Groundwater Monitoring Bore |
|---|---|---|---|---|---|---|---|
| | ***SILTY SAND (SM)***<br>- dense, orange-brown, fine to coarse grained, trace of fine subrounded gravel | | | | | | |
| 10 | | 188.0 | | | | | |
| | | | | S | 10.5<br>10.95 | 13,20,26<br>N=46 | |
| 11 | | 187.0 | | | | | |
| | | | | | | Screen | |
| 12 | - orange-pale grey, interbedded with sandy clay bands | 186.0 | | S | 12.0<br>12.45 | 10,14,24<br>N=38 | |
| | | | | | | Sand | |
| 13 | | 185.0 | | | | | |
| | ***SILTY CLAY (CH)***<br>- very stiff, grey mottled orange | | | S | 13.5<br>13.95 | 8,12,17<br>N=29 | |
| 14 | End of Bore at 13.95 m | 184.0 | | | | | |
| 15 | | 183.0 | | | | | |
| 16 | | 182.0 | | | | | |
| 17 | | 181.0 | | | | | |
| 18 | | 180.0 | | | | | |
| 19 | | 179.0 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **D** | **Disturbed Sample** | **E** | **Environmental Sample** | **C** | **NMLC Coring** |
| **B** | **Bulk Sample** | **S** | **Standard Penetrometer Test (SPT)** | **Is(50)** | **Point Load Test Result (MPa)** |
| **U** | **Undisturbed Tube (50mm diameter)** | **HB** | **SPT Hammer Bouncing** | **(d)** | **Diametral Point Load Strength Test** |
| **pp** | **Pocket Penetrometer Test (kPa)** | **( )** | **No Sample Recovery** | **(a)** | **Axial Point Load Strength Test** |

**Rig:** Hydrapower Scout

**Drilling Method:** Auger to 3.0m, then washbore

**Groundwater:** No free groundwater encountered during drilling

**Remarks:** *Approximate ground surface level interpolated from Robert Bird Group Drawing 20103-RBG-ZZ-XX-SK-CV-018 (Rev A) Dated April 2020

**Handheld GPS Coordinates**
**E:** 621677 **N:** 7559407

**Logged by:** ML

**Australasian Groundwater & Environmental Consultants Pty Ltd**
Level 2, 15 Mallon Street, Bowen Hills, Queensland 4006

# BOREHOLE LOG

page:1 of 1

## MBID25

PROJECT No: **G1803M**
PROJECT NAME: **Issac Downs remote bore installation**
DATE DRILLED: **15/11/2020**
LOGGED BY: **Richard Haselwood**

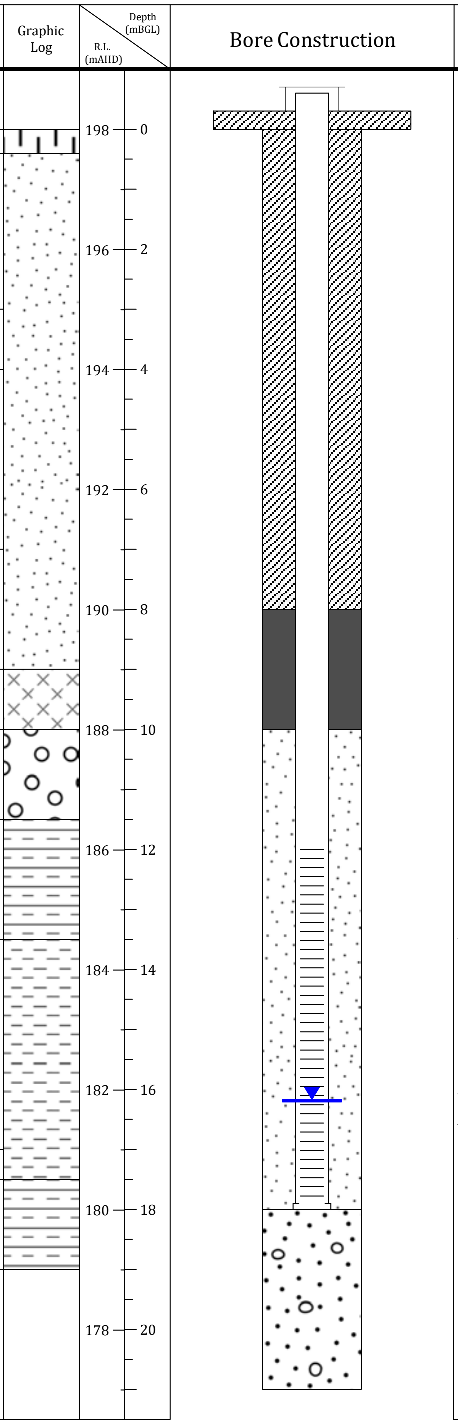
DRILLING COMPANY: **Wizard Drilling**
DRILLER: **Geoff Rogers**
DRILLING METHOD: **Mud rotary**
DRILL RIG: **McCulloch DR800 Mk2**

TD: **21 mBGL**
GL ELEVATION: **198.01 mAHD**
EASTING: **623927 mE**
NORTHING: **7558587 mN**
DATUM: **GDA 94 z55 UTM**

COMMENTS:

Soil or Rock Field Material Description

- SOIL: dark reddish-brown, residual soil, very loose.
- SAND, fine: orangey-brown, very loose.
- SAND, medium: orangey-buff, very loose.
- SAND, fine to medium: orangey-brown, very loose.
- SAND, fine: reddish-brown, very loose.
- SILT: orangey-brown, very loose.
- GRAVEL, extremely coarse: orangey-grey, sandy laminae (2-20mm), silty laminae (2-20mm), loose.
- MUDSTONE: light grey, extremely weathered, extremely low strength rock.
- SILTSTONE: dark reddish-brown, extremely weathered, firm.
- SILTSTONE: reddish-grey, extremely weathered, soft.
- MUDSTONE: grey, extremely weathered, extremely low strength rock.



Bore Description

- Protective lockable steel collar: +0.9 m
- Stick up: +0.65 m
- Cement pad: 0.5 m × 0.5 m × 0.2m
- Bentonite grout (2 - 5 %): 0 m to 8 m
- 50 mm uPVC Class 18 blank casing: - 0.65 m to 12 m
- Bentonite seal: 8 m to 10 m
- 125 mm Blade: 0 m to 21 m (mud rotary)
- 3 mm washed, rounded, quartz gravel pack: 10 m to 18 m
- 50 mm uPVC Class 18 machine slotted casing, slot aperture: 1 mm, 12 m to 18 m
- Water level: 16.19 m bgl on 23/11/2020
- Water quality mesurements on 23/11/2020: electrical conductivity: 2,793 µS/cm; pH: 7.20
- End cap
- Backfill: 18 m to 21 m
- End of hole: 21 m BGL

**Australasian Groundwater & Environmental Consultants Pty Ltd**
Level 2, 15 Mallon Street, Bowen Hills, Queensland 4006

# BOREHOLE LOG

page:1 of 1

## MBID26

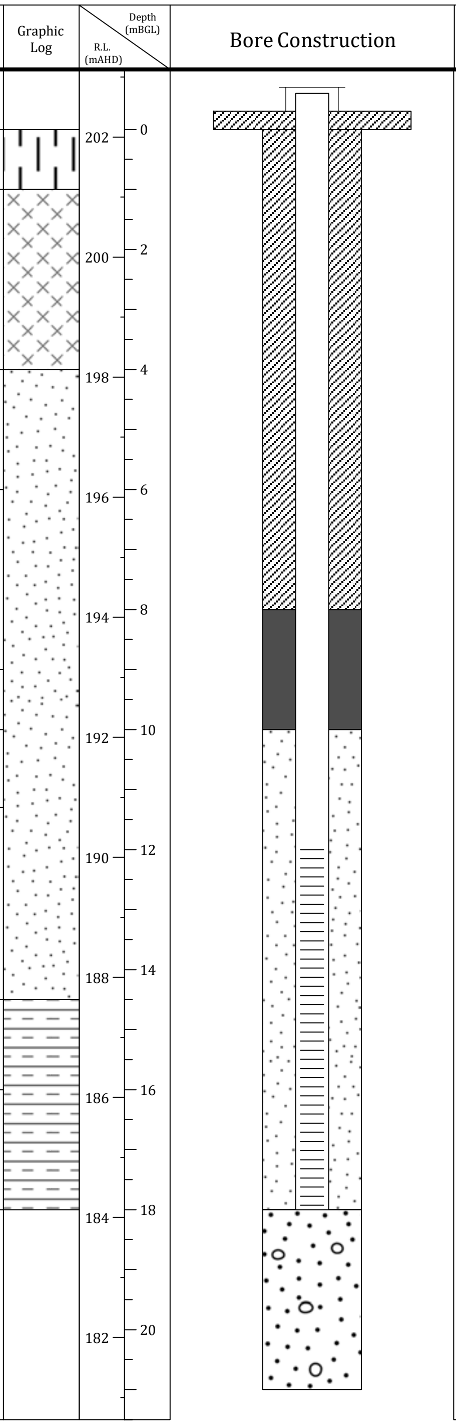
PROJECT No: **G1803M**
PROJECT NAME: **Issac Downs remote bore installation**
DATE DRILLED: **15/11/2020**
LOGGED BY: **Richard Haselwood**

DRILLING COMPANY: **Wizard Drilling**
DRILLER: **Geoff Rogers**
DRILLING METHOD: **Air rotary**
DRILL RIG: **McCulloch DR800 Mk2**

TD: **21 mBGL**
GL ELEVATION: **202.13 mAHD**
EASTING: **624171 mE**
NORTHING: **7559434 mN**
DATUM: **GDA 94 z55 UTM**

COMMENTS:

| Soil or Rock Field Material Description |
|---|
| SOIL: orangey-brown, sandy in part, residual soil, loose. |
| SILT: orangey-grey, loose. |
| SAND, fine: buff-orange, silty throughout, loose. |
| SAND, fine: reddish-brown, silty throughout, loose. |
| SAND, medium: orangey-buff, silty in part, loose. |
| SAND, medium: grey. loose. |
| SAND, medium: orangey-grey, loose. |
| MUDSTONE: grey, extremely weathered, extremely low strength rock. |
| MUDSTONE: dark grey, distinctly weathered, very low strength rock. |



Bore Description

Protective lockable steel collar: +0.9 m
Stick up: +0.66 m
Cement pad: 0.5 m × 0.5 m × 0.2m

Bentonite grout (2 - 5 %): 0 m to 8 m

50 mm uPVC Class 18 blank casing: - 0.66 m to 12 m

Bentonite seal: 8 m to 10 m

125 mm Blade: 0 m to 21 m (air rotary)

3 mm washed, rounded, quartz gravel pack: 10 m to 18 m

50 mm uPVC Class 18 machine slotted casing, slot aperture: 1 mm, 12 m to 18 m

Bore dry when dipped on 23/11/2020

End cap

Backfill: 18 m to 21 m

End of hole: 21 m BGL

**Australasian Groundwater & Environmental Consultants Pty Ltd**

Level 2, 15 Mallon Street, Bowen Hills, Queensland 4006

# BOREHOLE LOG

page:1 of 1

# MBID27

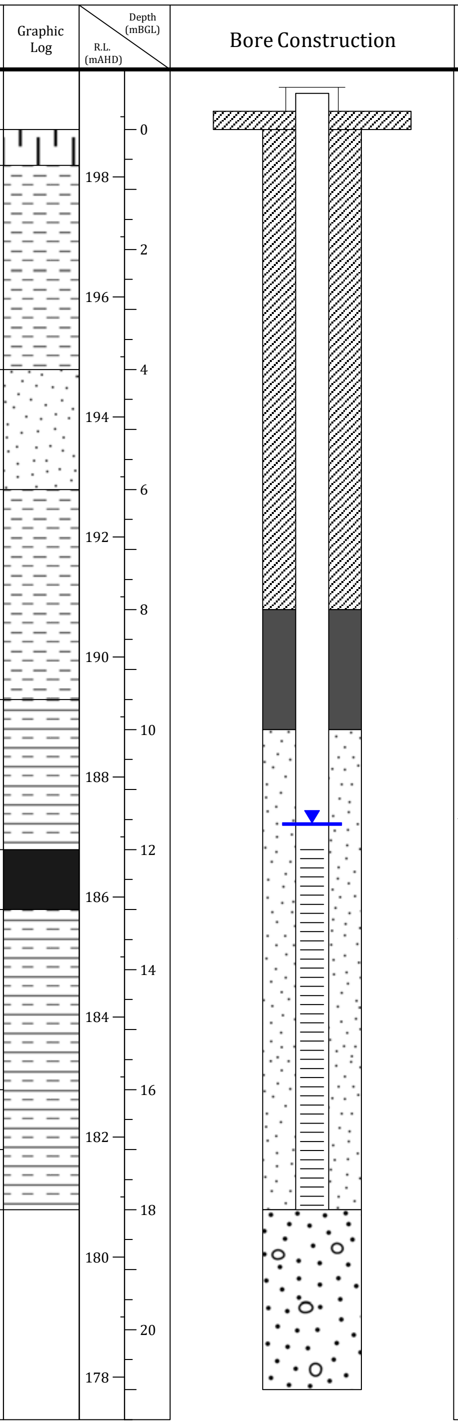
PROJECT No: **G1803M**
PROJECT NAME: **Issac Downs remote bore installation**
DATE DRILLED: **12/11/2020**
LOGGED BY: **Richard Haselwood**

DRILLING COMPANY: **Wizard Drilling**
DRILLER: **Geoff Rogers**
DRILLING METHOD: **Air rotary**
DRILL RIG: **McCulloch DR800 Mk2**

TD: **21 mBGL**
GL ELEVATION: **198.79 mAHD**
EASTING: **622212 mE**
NORTHING: **7557636 mN**
DATUM: **GDA 94 z55 UTM**

COMMENTS:

| Soil or Rock Field Material Description |
|---|
| SOIL: dark reddish-brown, residual soil, very soft. |
| CLAY: orangey-brown, soft. |
| SAND: buff-brown, residual soil, very soft. |
| CLAY: buff, soft. |
| MUDSTONE: light grey, extremely weathered, soft. |
| COAL: brownish-grey, extremely weathered, extremely low strength rock. |
| MUDSTONE: light buff-grey, distinctly weathered, extremely low strength rock. |
| MUDSTONE: dark grey, slightly weathered, very low strength rock. |
| MUDSTONE: dark grey, slightly weathered, low strength rock. |



| Bore Description |
|---|
| Protective lockable steel collar: +0.9 m |
| Stick up: +0.72 m |
| Cement pad: 0.5 m × 0.5 m × 0.2m |
| Bentonite grout (2 - 5 %): 0 m to 8 m |
| 50 mm uPVC Class 18 blank casing: - 0.66 m to 12 m |
| Bentonite seal: 8 m to 10 m |
| 125 mm Blade: 0 m to 21 m (air rotary) |
| Water level: 11.58 m bgl on 23/11/2020 |
| 3 mm washed, rounded, quartz gravel pack: 10 m to 18 m |
| 50 mm uPVC Class 18 machine slotted casing, slot aperture: 1 mm, 12 m to 18 m |
| End cap |
| Backfill: 18 m to 21 m |
| End of hole: 21 m BGL |

# BORE REPORT

**Butler Partners** geotechnical • geo-environmental • groundwater

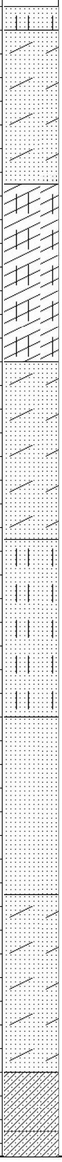
## BORE MBID 28

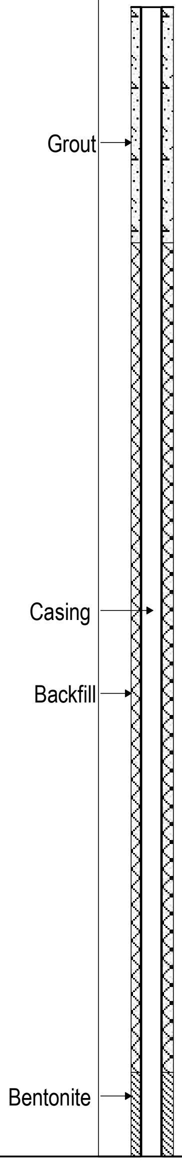
**DRAFT**

***Client:*** Stanmore Coal IP Pty Ltd
***Project:*** Isaac Downs Coal Mine - EIS
***Location:*** Peaks Downs Highway, via Moranbah
***Project No:*** 018-168C

***Page No:*** 1 of 2
***Date:*** 29 June 2020
***Ground Surface Level:*** RL198.0m*

| Depth (m) | Description | RL (m) | Lithology | Sample Type | Sample Depth (m) | Test Results | Groundwater Monitoring Bore |
|---|---|---|---|---|---|---|---|
| | | 198.0 | | | | | |
| 0 | ***SILTY SAND (SM)***<br>- dark brown, fine to meidum grained (topsoil) | | | | | | |
| | ***CLAYEY SAND (SC)***<br>- medium dense, brown mottled orange, fine to medium grained | | | | | | |
| 1 | | 197.0 | | | | | |
| | ***SILTY CLAY (CH)***<br>- hard, brown mottled orange, with fine grained sand | | | | | | |
| 2 | | 196.0 | | | | | |
| 3 | ***CLAYEY SAND (SC)***<br>- medium dense, brown, fine to medium grained | 195.0 | | | | | |
| 4 | | 194.0 | | | | | |
| | ***SILTY SAND (SM)***<br>- medium dense, orange-brown, fine to medium grained | | | | | | |
| 5 | | 193.0 | | | | | |
| 6 | ***SAND (SP)***<br>- medium dense, orange-brown, fine to coarse grained, with silt fines | 192.0 | | | | | |
| 7 | | 191.0 | | | | | |
| | ***CLAYEY SAND (SC)***<br>- dense, orange-brown, fine to coarse grained, with fine to medium subrounded gravel | | | | | | |
| 8 | | 190.0 | | | | | |
| 9 | ***SANDY CLAY (CI)***<br>- hard, orange mottled pale grey, fine to coarse grained sand | 189.0 | | | | | |





| | | | | | |
|---|---|---|---|---|---|
| D | Disturbed Sample | E | Environmental Sample | C | NMLC Coring |
| B | Bulk Sample | S | Standard Penetrometer Test (SPT) | Is(50) | Point Load Test Result (MPa) |
| U | Undisturbed Tube (50mm diameter) | HB | SPT Hammer Bouncing | (d) | Diametral Point Load Strength Test |
| pp | Pocket Penetrometer Test (kPa) | ( ) | No Sample Recovery | (a) | Axial Point Load Strength Test |

**Rig:** Hydrapower Scout
**Drilling Method:** Auger to 3.0m, then washbore
**Groundwater:** No free groundwater encountered during drilling
**Remarks:** *Approximate ground surface level interpolated from Robert Bird Group Drawing 20103-RBG-ZZ-XX-SK-CV-018 (Rev A) Dated April 2020

**Handheld GPS Coordinates**
**E:** 622795 **N:** 7558353

**Logged by:** ML

# BORE REPORT

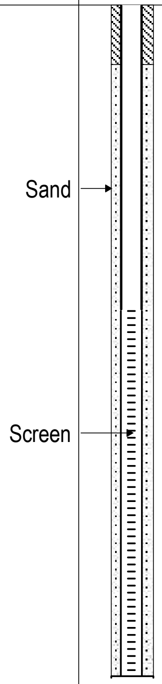
**Client:** Stanmore Coal IP Pty Ltd
**Project:** Isaac Downs Coal Mine - EIS
**Location:** Peaks Downs Highway, via Moranbah
**Project No:** 018-168C

## BORE MBID 28

**Page No:** 2 of 2
**Date:** 29 June 2020
**Ground Surface Level:** RL198.0m*

DRAFT

| Depth (m) | Description | RL (m) | Lithology | Sample Type | Sample Depth (m) | Test Results | Groundwater Monitoring Bore |
|---|---|---|---|---|---|---|---|
| 10 | ***SANDY CLAY (CI)***<br>- hard, orange mottled pale grey, fine to coarse grained sand | 188.0 | | | | | |
| 11 | ***CLAYEY SAND (SC)***<br>- dense, orange mottled pale grey, fine to coarse grained | 187.0 | | | | | |
| 12 | | 186.0 | | | | | |
| 13 | | 185.0 | | | | | |
| 14 | ***SILTY CLAY (CH)***<br>- hard, pale grey mottled orange | 184.0 | | | | | |
| 15 | End of Bore at 15 m | 183.0 | | | | | |
| 16 | | 182.0 | | | | | |
| 17 | | 181.0 | | | | | |
| 18 | | 180.0 | | | | | |
| 19 | | 179.0 | | | | | |



| | | | | | |
|---|---|---|---|---|---|
| **D** | **Disturbed Sample** | **E** | **Environmental Sample** | **C** | **NMLC Coring** |
| **B** | **Bulk Sample** | **S** | **Standard Penetrometer Test (SPT)** | **Is(50)** | **Point Load Test Result (MPa)** |
| **U** | **Undisturbed Tube (50mm diameter)** | **HB** | **SPT Hammer Bouncing** | **(d)** | **Diametral Point Load Strength Test** |
| **pp** | **Pocket Penetrometer Test (kPa)** | **( )** | **No Sample Recovery** | **(a)** | **Axial Point Load Strength Test** |

**Rig:** Hydrapower Scout
**Drilling Method:** Auger to 3.0m, then washbore
**Groundwater:** No free groundwater encountered during drilling
**Remarks:** *Approximate ground surface level interpolated from Robert Bird Group Drawing 20103-RBG-ZZ-XX-SK-CV-018 (Rev A) Dated April 2020

**Handheld GPS Coordinates**
**E:** 622795 **N:** 7558353

**Logged by:** ML

# GROUNDWATER DATABASE

## BORE REPORT

**REG NUMBER** **162817**

## REGISTRATION DETAILS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **BASIN** | 1304 | **LATITUDE** | 22-04-25 | **MAP-SCALE** | |
| **OFFICE** | Mackay | **SUB-AREA** | | **LONGITUDE** | 148-11-28 | **MAP-SERIES** | |
| **DATE LOG RECD** | | **SHIRE** | 3980-ISAAC REGIONAL | **EASTING** | 622899 | **MAP-NO** | |
| **D/O FILE NO.** | | **LOT** | 8 | **NORTHING** | 7558531 | **MAP NAME** | |
| **R/O FILE NO.** | | **PLAN** | SP277384 | **ZONE** | 55 | **PROG SECTION** | |
| **H/O FILE NO.** | | **ORIGINAL DESCRIPTION** | | **ACCURACY** | | **PRES EQUIPMENT** | |
| | | | | **GPS ACC** | | | |
| **GIS LAT** | -22.07373883 | **PARISH NAME** | 6000-NO LONGER USED | | | **ORIGINAL BORE NO** | 5 MILE BORE |
| **GIS LNG** | 148.19119613 | **COUNTY** | | | | **BORE LINE** | - |
| **CHECKED** | Y | | | | | | |
| | | | | | | **POLYGON** | |
| | | | | | | **RN OF BORE REPLACED** | |
| **FACILITY TYPE** | Sub-Artesian Facility | **DATE DRILLED** | 01/01/2002 | | | **DATA OWNER** | |
| **STATUS** | Existing | **DRILLERS NAME** | | | | | |
| **ROLES** | | **DRILL COMPANY** | | | | | |
| | | **METHOD OF CONST.** | | | | | |

## CASING DETAILS

| PIPE | DATE | RECORD NUMBER | MATERIAL DESCRIPTION | MAT SIZE (mm) | SIZE DESC | OUTSIDE DIAM (mm) | TOP (m) | BOTTOM (m) |
|---|---|---|---|---|---|---|---|---|
| A | 01/01/2002 | 1 | Polyvinyl Chloride | | | 140 | | |

## STRATA LOG DETAILS

| RECORD NUMBER | STRATA TOP (m) | STRATA BOT (m) | STRATA DESCRIPTION |
|---|---|---|---|
| 1 | 0.00 | 32.00 | NO DETAILS. 7.5 LPS |

## STRATIGRAPHY DETAILS

******  NO RECORDS FOUND  ******

## AQUIFER DETAILS

******  NO RECORDS FOUND  ******

## PUMP TEST DETAILS PART 1

# GROUNDWATER DATABASE

## BORE REPORT

**REG NUMBER** 162818

### REGISTRATION DETAILS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **BASIN** | 1304 | **LATITUDE** | 22-04-26 | **MAP-SCALE** | |
| **OFFICE** | Mackay | **SUB-AREA** | | **LONGITUDE** | 148-11-29 | **MAP-SERIES** | |
| **DATE LOG RECD** | | **SHIRE** | 3980-ISAAC REGIONAL | **EASTING** | 622909 | **MAP-NO** | |
| **D/O FILE NO.** | | **LOT** | 8 | **NORTHING** | 7558529 | **MAP NAME** | |
| **R/O FILE NO.** | | **PLAN** | SP277384 | **ZONE** | 55 | **PROG SECTION** | |
| **H/O FILE NO.** | | **ORIGINAL DESCRIPTION** | | **ACCURACY** | | **PRES EQUIPMENT** | |
| | | | | **GPS ACC** | | | |
| **GIS LAT** | -22.07375619 | **PARISH NAME** | 6000-NO LONGER USED | | | **ORIGINAL BORE NO** | 5 MILE WINDMILL |
| **GIS LNG** | 148.19129319 | **COUNTY** | | | | **BORE LINE** | - |
| **CHECKED** | Y | | | | | | |
| | | | | | | **POLYGON** | |
| | | | | | | **RN OF BORE REPLACED** | |
| **FACILITY TYPE** | Sub-Artesian Facility | **DATE DRILLED** | | | | **DATA OWNER** | |
| **STATUS** | Existing | **DRILLERS NAME** | | | | | |
| **ROLES** | | **DRILL COMPANY** | | | | | |
| | | **METHOD OF CONST.** | | | | | |

### CASING DETAILS

| PIPE | DATE | RECORD NUMBER | MATERIAL DESCRIPTION | MAT SIZE (mm) | SIZE DESC | OUTSIDE DIAM (mm) | TOP (m) | BOTTOM (m) |
|---|---|---|---|---|---|---|---|---|
| A | 01/01/1900 | 1 | Polyvinyl Chloride | | | 140 | | |

### STRATA LOG DETAILS

| RECORD NUMBER | STRATA TOP (m) | STRATA BOT (m) | STRATA DESCRIPTION |
|---|---|---|---|
| 1 | 0.00 | 30.00 | NO DETAILS. DEPTH APPROX. |

### STRATIGRAPHY DETAILS

******  NO RECORDS FOUND  ******

### AQUIFER DETAILS

******  NO RECORDS FOUND  ******

### PUMP TEST DETAILS PART 1

**REG NUMBER** **162818**

****** NO RECORDS FOUND ******

### PUMP TEST DETAILS PART 2

****** NO RECORDS FOUND ******

### BORE CONDITION

****** NO RECORDS FOUND ******

### ELEVATION DETAILS

| PIPE | DATE | ELEVATION | PRECISION | DATUM | MEASUREMENT POINT | SURVEY SOURCE |
|---|---|---|---|---|---|---|
| A | 08/02/2006 | 207.80 | GPS | AHD | R | ISAAC PLAINS BORE CENSUS |

### WATER ANALYSIS PART1

****** NO RECORDS FOUND ******

### WATER ANALYSIS PART 2

****** NO RECORDS FOUND ******

### WATER LEVEL DETAILS

| PIPE | DATE | MEASURE (m) | N/R | RMK | MEAS TYPE | PIPE | DATE | MEASURE (m) | N/R | RMK | MEAS TYPE | PIPE | DATE | MEASURE (m) | N/R | RMK | MEAS TYPE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 08/02/2006 | -13.41 | R |  | ACT |  |  |  |  |  |  |  |  |  |  |  |  |

### WIRE LINE LOG DETAILS

****** NO RECORDS FOUND ******

### FIELD MEASUREMENTS

****** NO RECORDS FOUND ******

### SPECIAL WATER ANALYSIS

****** NO RECORDS FOUND ******

## BORE REPORT

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**** End of Report. Produced:** 14/08/2018 11:34:59 AM ******

## BORE REPORT

**REG NUMBER** **162817**

****** NO RECORDS FOUND ******

## PUMP TEST DETAILS PART 2

****** NO RECORDS FOUND ******

## BORE CONDITION

****** NO RECORDS FOUND ******

## ELEVATION DETAILS

| PIPE | DATE | ELEVATION | PRECISION | DATUM | MEASUREMENT POINT | SURVEY SOURCE |
|---|---|---|---|---|---|---|
| A | 08/02/2006 | 206.10 | GPS | AHD | R | ISAAC PLAINS BORE CENSUS |

## WATER ANALYSIS PART1

****** NO RECORDS FOUND ******

## WATER ANALYSIS PART 2

****** NO RECORDS FOUND ******

## WATER LEVEL DETAILS

| PIPE | DATE | MEASURE (m) | N/R | RMK | MEAS TYPE | PIPE | DATE | MEASURE (m) | N/R | RMK | MEAS TYPE | PIPE | DATE | MEASURE (m) | N/R | RMK | MEAS TYPE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 08/02/2006 | -13.26 | R |  | ACT |  |  |  |  |  |  |  |  |  |  |  |  |

## WIRE LINE LOG DETAILS

****** NO RECORDS FOUND ******

## FIELD MEASUREMENTS

****** NO RECORDS FOUND ******

## SPECIAL WATER ANALYSIS

****** NO RECORDS FOUND ******

## BORE REPORT

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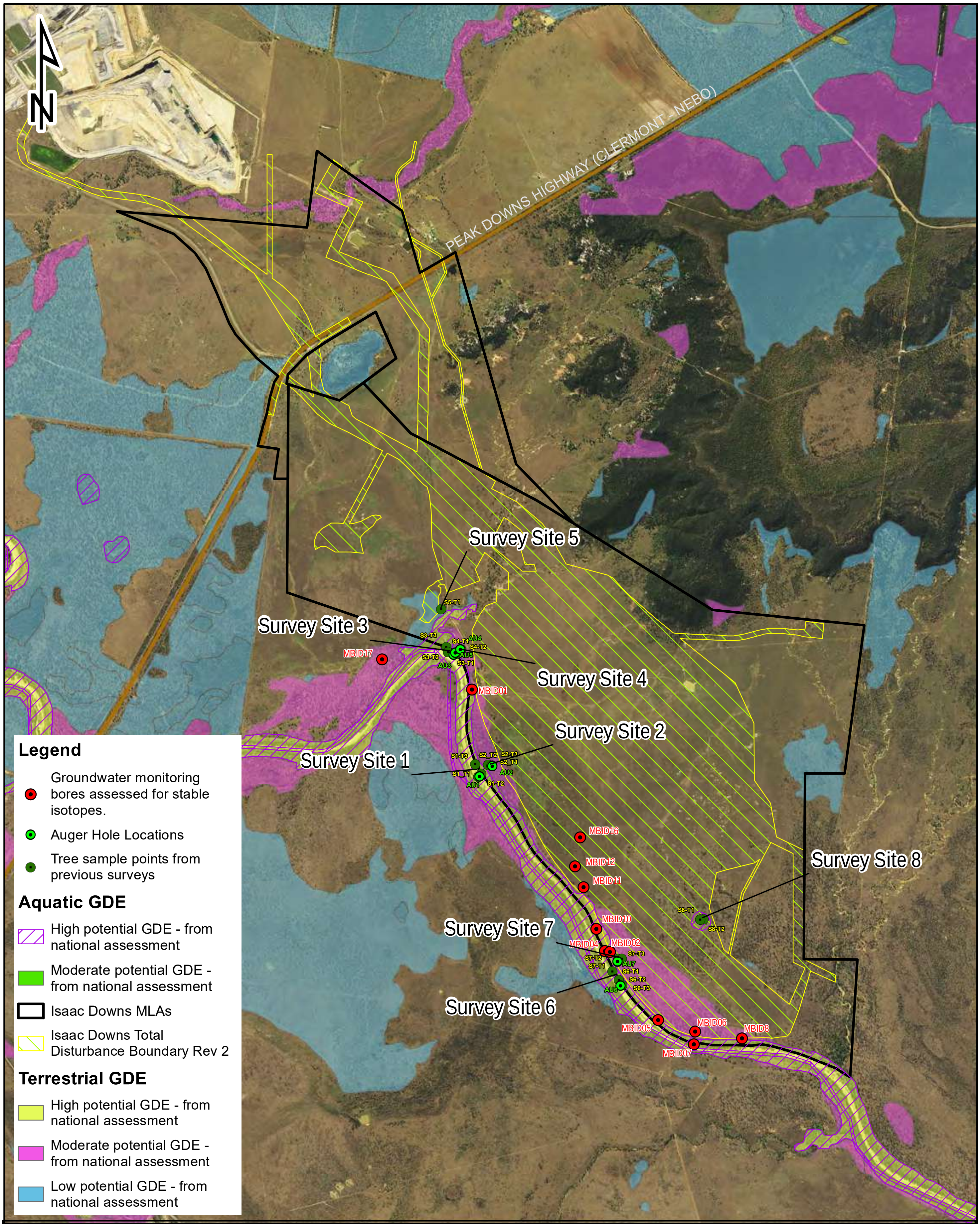
**** End of Report. Produced:** 14/08/2018 11:31:35 AM ******

# Appendix C. Sampling Localities and Methods from EIS



Source: BOM GDE Atlas (2020).

**Appendix C.** GDE sampling locations and methods

3D Environmental
Landscape & Vegetation Science

Client

Stanmore IP South Pty Ltd

P. O. Box 959
Kenmore, Qld 4069
Mobile: 0447 822 119
www.3denvironmental.com.au

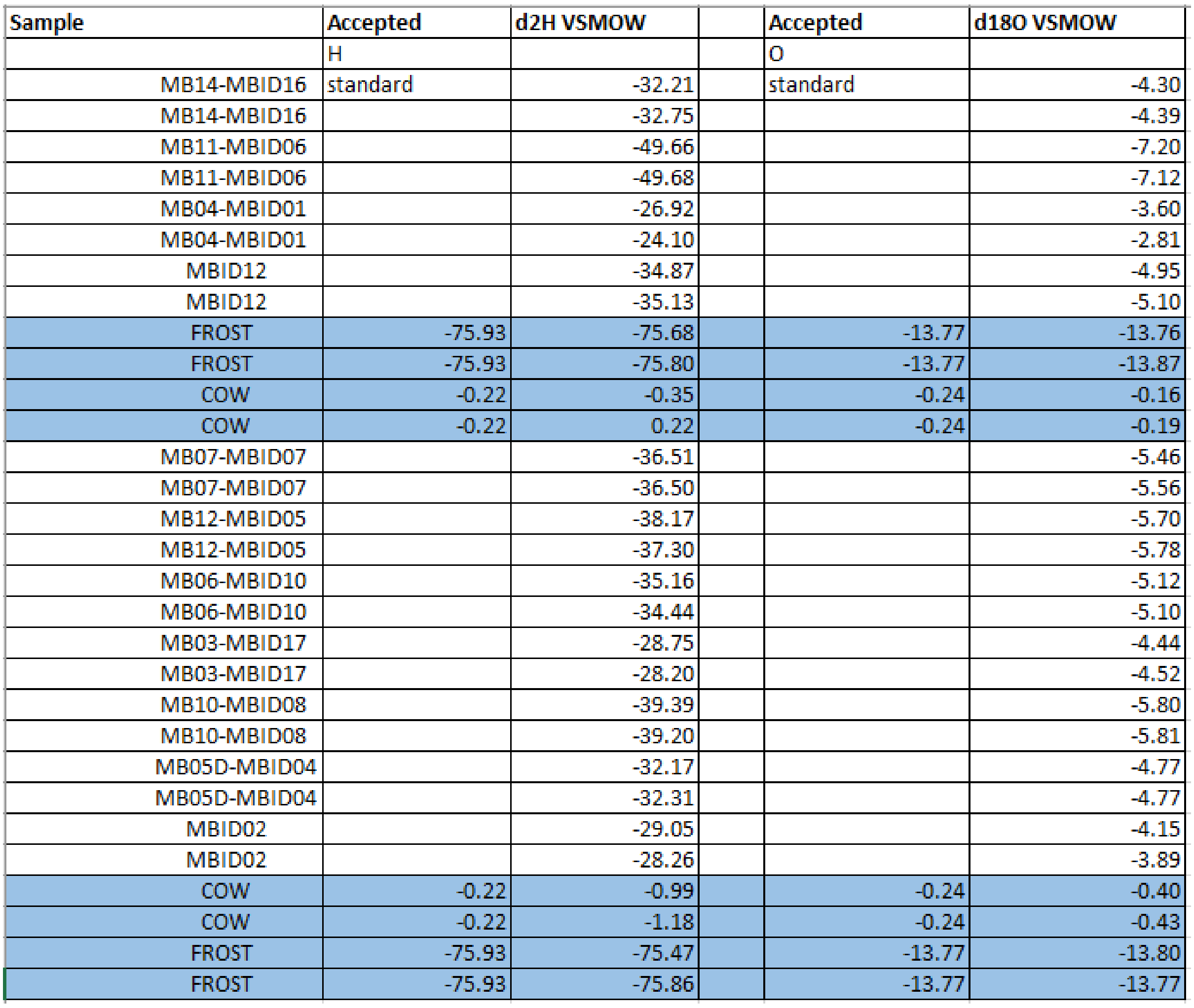
0 0.75 1.5 2.25 3
Kilometers

| Scale 1:50,000 | Drawn By DG | Checked DS | File Path | Date 29/10/2020 | A4 |
|---|---|---|---|---|---|

D:\Backup C Drive 26519\3D Environmental\Issac\Issac_Map.mxd

# Appendix D. Raw Stable Isotope Data from Isaac Downs EIS Assessment

## Stable Isotope Analysis



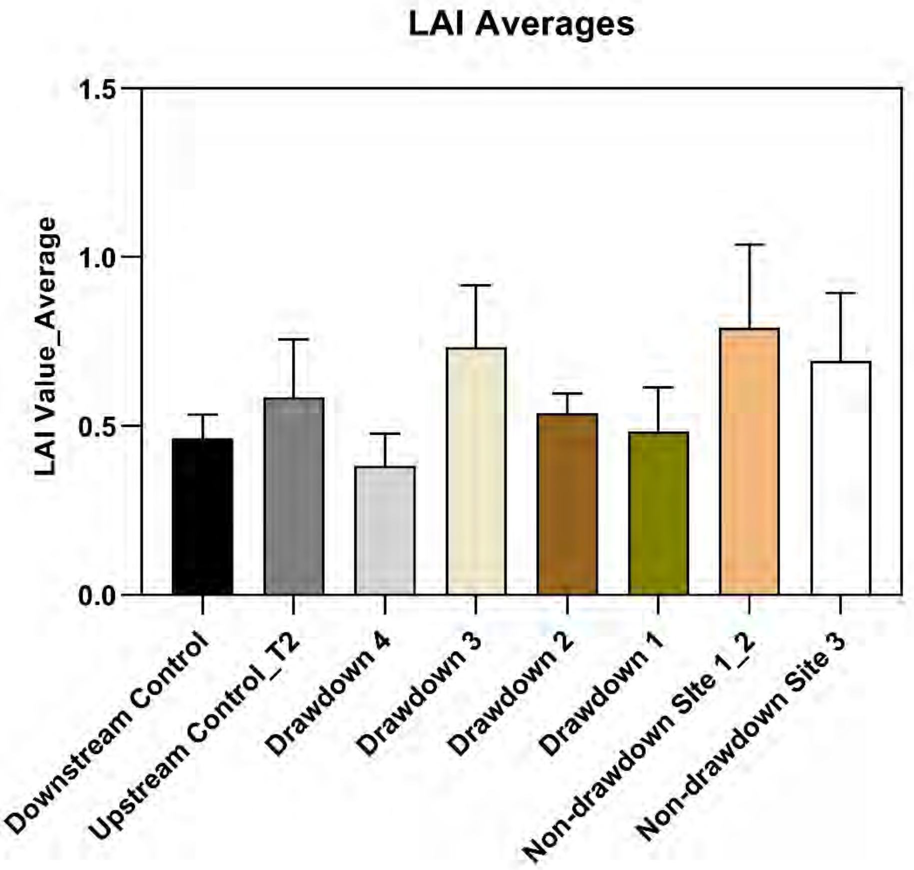
| Sample | Accepted | d2H VSMOW | | Accepted | d18O VSMOW |
|---|---|---|---|---|---|
| | H | | | O | |
| MB14-MBID16 | standard | -32.21 | | standard | -4.30 |
| MB14-MBID16 | | -32.75 | | | -4.39 |
| MB11-MBID06 | | -49.66 | | | -7.20 |
| MB11-MBID06 | | -49.68 | | | -7.12 |
| MB04-MBID01 | | -26.92 | | | -3.60 |
| MB04-MBID01 | | -24.10 | | | -2.81 |
| MBID12 | | -34.87 | | | -4.95 |
| MBID12 | | -35.13 | | | -5.10 |
| FROST | -75.93 | -75.68 | | -13.77 | -13.76 |
| FROST | -75.93 | -75.80 | | -13.77 | -13.87 |
| COW | -0.22 | -0.35 | | -0.24 | -0.16 |
| COW | -0.22 | 0.22 | | -0.24 | -0.19 |
| MB07-MBID07 | | -36.51 | | | -5.46 |
| MB07-MBID07 | | -36.50 | | | -5.56 |
| MB12-MBID05 | | -38.17 | | | -5.70 |
| MB12-MBID05 | | -37.30 | | | -5.78 |
| MB06-MBID10 | | -35.16 | | | -5.12 |
| MB06-MBID10 | | -34.44 | | | -5.10 |
| MB03-MBID17 | | -28.75 | | | -4.44 |
| MB03-MBID17 | | -28.20 | | | -4.52 |
| MB10-MBID08 | | -39.39 | | | -5.80 |
| MB10-MBID08 | | -39.20 | | | -5.81 |
| MB05D-MBID04 | | -32.17 | | | -4.77 |
| MB05D-MBID04 | | -32.31 | | | -4.77 |
| MBID02 | | -29.05 | | | -4.15 |
| MBID02 | | -28.26 | | | -3.89 |
| COW | -0.22 | -0.99 | | -0.24 | -0.40 |
| COW | -0.22 | -1.18 | | -0.24 | -0.43 |
| FROST | -75.93 | -75.47 | | -13.77 | -13.80 |
| FROST | -75.93 | -75.86 | | -13.77 | -13.77 |

## Appendix E. Summary Data from November 2020 GDE Monitoring Assessment

### *Appendix E1. T-test for comparison of LAI mean values between control and impact sites.*

| **Downstream control (Mean LAI = 0.4649)** | **Drawdown 4** | **Drawdown 3** | **Drawdown 2** | **Drawdown 1** | **Non-drawdown 1_2** | **Non-drawdown 3** |
|---|---|---|---|---|---|---|
| T value | t=1.573 | t=3.066 | t=1.821 | t=0.2825 | t=2.843, | t=2.400 |
| Degrees Freedom | df=8 | df=9 | df=8 | df=8 | df=8 | df=8 |
| Mean LAI Value | 0.3824 | 0.7332 | 0.538 | 0.4836 | 0.7901 | 0.6993 |
| P Value | p= 0.1544 | p=0.013 | p= 0.1061 | p= 0.2413 | p= 0.0217 | p= 0.0432 |
| Statistically Significant Differences | No | Yes | No | No | Yes | Yes |
| **Upstream control (Mean LAI = 0.5856)** | **Drawdown 4** | **Drawdown 3** | **Drawdown 2** | **Drawdown 1** | **Non-drawdown 1_2** | **Non-drawdown 3** |
| T value | t=2.317 | t= 1.365 | t= 0.5880 | t=1.057 | t=1.523 | t=0.9107 |
| Degrees Freedom | df=8 | df=9 | df=8 | df = 9 | df=8 | df=8 |
| Mean LAI Value | 0.3824 | 0.7332 | 0.538 | 0.4836 | 0.7901 | 0.6993 |
| P Value | p= 0.0492 | p=0.9196 | p=0.5728 | p=0.3215 | p=0.1162 | 0.3891 |
| Statistically Significant Differences | Yes | No | No | No | No | No |

## *Appendix E2. Mean LAI values for GDE monitoring localities.*



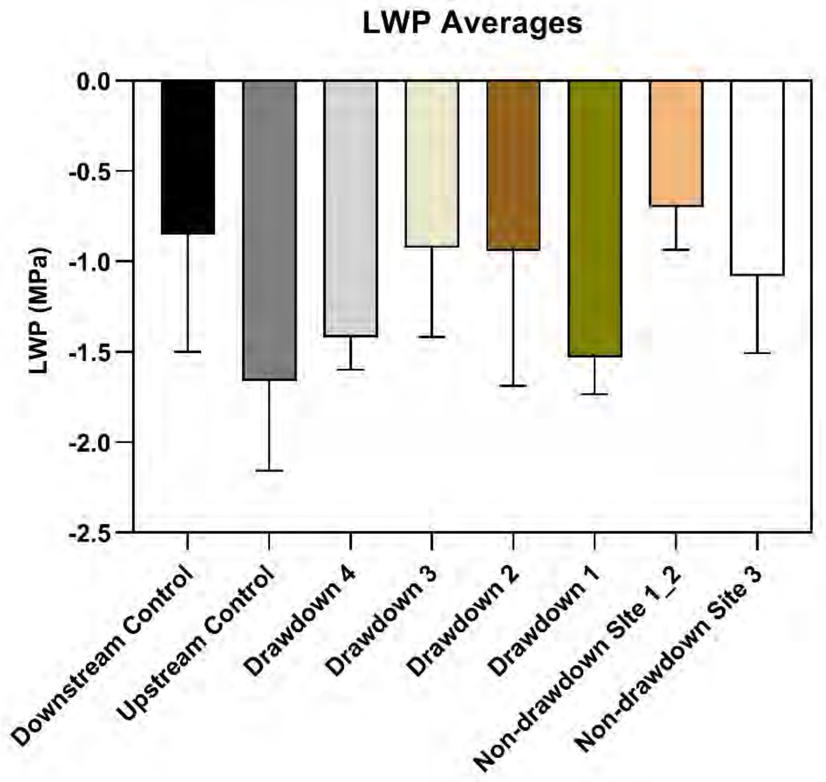
## *Appendix E3. Raw data from LAI field measurements.*

| Timestamp | Impact Area | Filename | Longitude | Latitude | Sunflecks | PAR Average | PAR LAI | GAP Fraction LAI |
|---|---|---|---|---|---|---|---|---|
| 11/23/2020 4:55:21 AM | Drawdown | DD3T_1.ci110 | 148.1916 | -22.073 | 100% | 38 | 4.706746 | **0.9101824** |
| 11/23/2020 4:58:09 AM | Drawdown | DD3T_2.ci110 | 148.1918 | -22.0729 | 100% | 73 | 3.961445 | **0.5800227** |
| 11/23/2020 5:00:01 AM | Drawdown | DD3T_3.ci110 | 148.1921 | -22.0729 | 100% | 50 | 4.400747 | **0.5953562** |
| 11/23/2020 5:02:08 AM | Drawdown | DD3T_4.ci110 | 148.1921 | -22.0727 | 100% | 43 | 4.562379 | **0.8687891** |
| 11/23/2020 5:03:51 AM | Drawdown | DD3T_5.ci110 | 148.1918 | -22.0729 | 100% | 73 | 3.960117 | **0.5266511** |
| 11/23/2020 5:06:17 AM | Drawdown | DD3T_6.ci110 | 148.1918 | -22.0729 | 100% | 73 | 3.960117 | **0.9179622** |
| 11/23/2020 5:19:59 AM | Drawdown | DD2T_1.ci110 | 148.1816 | -22.0642 | 100% | 66 | 4.079489 | **0.5030637** |
| 11/23/2020 5:21:39 AM | Drawdown | DD2T_2.ci110 | 148.1815 | -22.0642 | 100% | 58 | 4.226751 | **0.6051204** |
| 11/23/2020 5:24:05 AM | Drawdown | DD2T_3.ci110 | 148.1818 | -22.0648 | 100% | 89 | 3.733447 | **0.5804862** |
| 11/23/2020 5:26:32 AM | Drawdown | DD2T_4.ci110 | 148.1817 | -22.065 | 100% | 76 | 3.910228 | **0.5389072** |
| 11/23/2020 5:28:58 AM | Drawdown | DD2T_5.ci110 | 148.1822 | -22.0653 | 100% | 78 | 3.885535 | **0.4622823** |
| 11/23/2020 5:41:15 AM | Drawdown | DD1T_1.ci110 | 148.1778 | -22.0584 | 100% | 88 | 3.744932 | **0.6018231** |
| 11/23/2020 5:42:45 AM | Drawdown | DD1T_2.ci110 | 148.1779 | -22.0584 | 100% | 90 | 3.708989 | **0.4085942** |
| 11/23/2020 5:45:09 AM | Drawdown | DD1T_3.ci110 | 148.1778 | -22.0587 | 100% | 95 | 3.647212 | **0.28968** |
| 11/23/2020 5:49:28 AM | Drawdown | DD1T_4.ci110 | 148.1782 | -22.059 | 100% | 78 | 3.876285 | **0.5601367** |
| 11/23/2020 5:51:53 AM | Drawdown | DD1T_5.ci110 | 148.1785 | -22.0592 | 100% | 216 | 2.698145 | **0.5575907** |
| 11/24/2020 4:25:22 PM | Drawdown | DD4T_1.ci110 | 148.2046 | -22.0732 | 100% | 76 | 3.913736 | **0.4171316** |

| Timestamp | Impact Area | Filename | Longitude | Latitude | Sunflecks | PAR Average | PAR LAI | GAP Fraction LAI |
|---|---|---|---|---|---|---|---|---|
| 11/24/2020 4:26:11 PM | Drawdown | DD4T_2.ci110 | 148.2047 | -22.0734 | 100% | 281 | 2.390441 | **0.3594701** |
| 11/24/2020 4:28:31 PM | Drawdown | DD4T_3.ci110 | 148.2054 | -22.0733 | 100% | 71 | 3.991507 | **0.5242256** |
| 11/24/2020 4:29:47 PM | Drawdown | DD4T_4.ci110 | 148.2053 | -22.0736 | 100% | 135 | 3.246069 | **0.2713915** |
| 11/24/2020 4:31:12 PM | Drawdown | DD4T_5.ci110 | 148.2051 | -22.0741 | 100% | 79 | 3.8591 | **0.340004** |
| 11/22/2020 6:17:13 AM | Control | IDCUT_1.ci110 | 148.1524 | -22.0462 | 58% | 282 | 2.386745 | **0.5965444** |
| 11/22/2020 7:56:36 AM | Control | IDCUT_2.ci110 | 148.153 | -22.0464 | 100% | 239 | 2.579937 | **0.2956193** |
| 11/22/2020 8:01:22 AM | Control | IDCUT_3.ci110 | 148.1531 | -22.0463 | 100% | 481 | 1.767445 | **0.7424625** |
| 11/22/2020 8:08:11 AM | Control | IDCUT_4.ci110 | 148.1537 | -22.0464 | 100% | 211 | 2.724903 | **0.674315** |
| 11/22/2020 8:12:32 AM | Control | IDCUT_5.ci110 | 148.1541 | -22.0463 | 100% | 373 | 2.061159 | **0.6189069** |
| 11/24/2020 4:43:00 PM | Control | IDDCT_1.ci110 | 148.2063 | -22.0781 | 100% | 54 | 4.29874 | **0.389731** |
| 11/24/2020 4:41:44 PM | Control | IDDCT_2.ci110 | 148.2063 | -22.0779 | 100% | 86 | 3.770674 | **0.4644249** |
| 11/24/2020 4:46:20 PM | Control | IDDCT_3.ci110 | 148.2065 | -22.0787 | 100% | 57 | 4.24614 | **0.5768941** |
| 11/24/2020 4:48:50 PM | Control | IDDCT_4.ci110 | 148.2068 | -22.0795 | 100% | 78 | 3.879753 | **0.4391071** |
| 11/24/2020 4:49:57 PM | Control | IDDCT_5.ci110 | 148.2069 | -22.0799 | 100% | 64 | 4.102923 | **0.454218** |
| 11/22/2020 5:09:57 AM | Non-drawdown | ND1T_1.ci110 | 148.1697 | -22.0489 | 100% | 103 | 3.556934 | **0.7529624** |
| 11/22/2020 5:12:07 AM | Non-drawdown | ND1T_2.ci110 | 148.17 | -22.0487 | 100% | 70 | 4.011478 | **0.6559746** |
| 11/22/2020 5:14:09 AM | Non-drawdown | ND1T_3.ci110 | 148.1697 | -22.0484 | 100% | 67 | 4.062382 | **0.5749801** |
| 11/22/2020 5:17:20 AM | Non-drawdown | ND1T_4.ci110 | 148.1697 | -22.0472 | 100% | 71 | 3.986329 | **0.7570087** |
| 11/22/2020 5:19:25 AM | Non-drawdown | ND1T_5.ci110 | 148.1694 | -22.0469 | 100% | 88 | 3.734815 | **1.20962** |

| Timestamp | Impact Area | Filename | Longitude | Latitude | Sunflecks | PAR Average | PAR LAI | GAP Fraction LAI |
|---|---|---|---|---|---|---|---|---|
| 11/22/2020 5:43:15 AM | Non-drawdown | ND3T_1.ci110 | 148.1675 | -22.0379 | 100% | 160 | 3.043094 | **0.9662218** |
| 11/22/2020 5:46:04 AM | Non-drawdown | ND3T_2.ci110 | 148.1668 | -22.0375 | 100% | 164 | 3.01485 | **0.501779** |
| 11/22/2020 5:47:40 AM | Non-drawdown | ND3T_3.ci110 | 148.1668 | -22.0373 | 100% | 127 | 3.312043 | **0.6040511** |
| 11/22/2020 5:49:57 AM | Non-drawdown | ND3T_4.ci110 | 148.1665 | -22.0373 | 100% | 109 | 3.49474 | **0.8442059** |
| 11/22/2020 5:52:46 AM | Non-drawdown | ND3T_5.ci110 | 148.1667 | -22.0378 | 100% | 488 | 1.749929 | **0.5504543** |

## *Appendix E4. LWP Mean Values for GDE monitoring localities.*



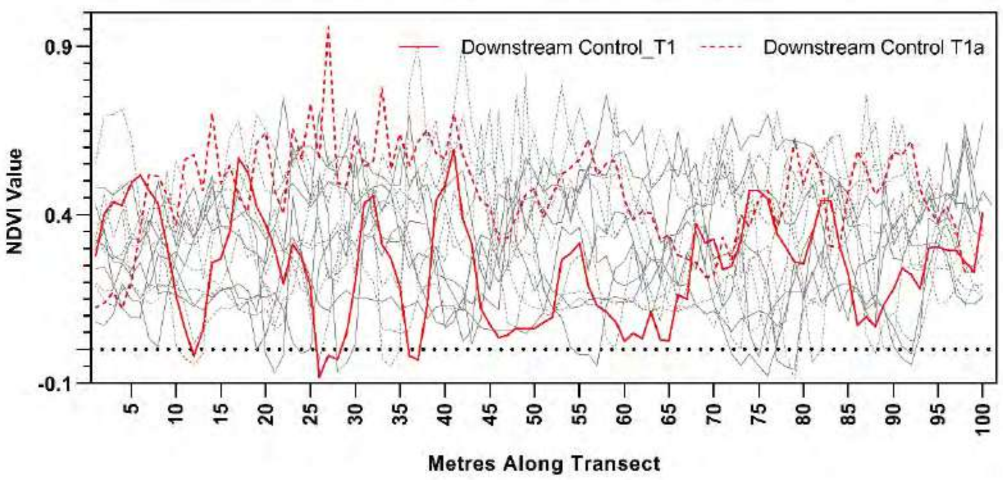
## *Appendix E5. LWP Measurement Summary*

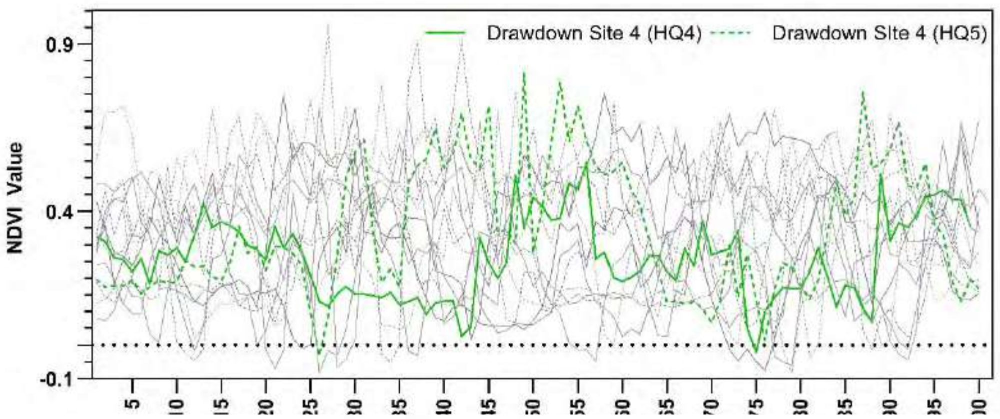
| TREE | Tree from ID EIS | Species | Y | X | HGT (m) | DBH (cm) | LWP1 MPa | LWP ID EIS | Geomorphic Position | Isotope Analysis |
|---|---|---|---|---|---|---|---|---|---|---|
| IDUCT1 | | Eucalyptus camaldulensis | -22.046238 | 148.152411 | 23 | 70 | -1.3 | | Near top of terrace | Y |
| IDUCT2 | | Eucalyptus camaldulensis | -22.046358 | 148.153015 | 90 | 27 | -1.7 | | 3m from top of bank near channel | |
| IDUCT3 | | Eucalyptus camaldulensis | -22.04628 | 148.153169 | 90 | 26 | -2.5 | | 15m from top of bank - mid terrace | Y |
| IDUCT4 | | Eucalyptus camaldulensis | -22.046427 | 148.153777 | 70 | 23 | -1.5 | | 3 m from top of bank near channel | Y |
| IDUCT5 | | Eucalyptus camaldulensis | -22.04633 | 148.15407 | 100 | 25 | -1.3 | | Near top of terrace | |
| ND3T1 | S3T1 | Eucalyptus camaldulensis | -22.037994 | 148.167417 | 90 | 23 | -1.5 | -1.25 | 2m from bank -near channel | |
| ND3T2 | | Eucalyptus camaldulensis | -22.037581 | 148.166782 | 110 | 27 | -0.9 | | On bank, directly above channel on inner levee - elevated 6-7m above channel floor | Y |
| ND3T3 | | Eucalyptus camaldulensis | -22.037365 | 148.16674 | 75 | 22 | -0.5 | | 8m above channel, adjacent to tributary gully | Y |
| ND3T4 | S3T3 | Eucalyptus camaldulensis | -22.037372 | 148.166498 | 100 | 26 | -1 | -1.89 | 5m above channel - mid terrace | Y |
| ND3T5 | S3T2 | Eucalyptus camaldulensis | -22.037884 | 148.166661 | 60 | 19 | -1.5 | -1.9 | On sandy levee within main channel | |
| ND1T1 | | Eucalyptus camaldulensis | -22.048898 | 148.169737 | 70 | 18 | -0.4 | -0.1 | Instream island in main channel.of Isaac River | Y |
| ND1T2 | | Eucalyptus camaldulensis | -22.048692 | 148.169926 | 75 | 22 | -0.9 | -0.49 | Edge of inner bench above river channel | |
| ND1T3 | | Eucalyptus camaldulensis | -22.048413 | 148.169606 | 65 | 18 | -0.5 | | Edge of inner bench above river channel | Y |
| ND1T4 | | Eucalyptus camaldulensis | -22.047177 | 148.169699 | 65 | 23 | -0.9 | | 60 metres from main channel | |
| ND1T5 | | Eucalyptus camaldulensis | -22.046918 | 148.169348 | 90 | 25 | -0.8 | | 40m from main channel on suppressed overflow | Y |
| DD2T1 | | Eucalyptus camaldulensis | -22.064183 | 148.181573 | 80 | 24 | -0.7 | | 15m from top of bank - mid terrace | Y |
| DD2T2 | | Eucalyptus camaldulensis | -22.0642 | 148.181442 | 65 | 22 | -2.2 | | On bank, 3m directly above channel | |
| DD2T3 | | Eucalyptus camaldulensis | -22.06484 | 148.181837 | 80 | 21 | -1 | | On inner terrace situated 3m above river channel. Moderately steep bank above. | |
| DD2T4 | | Eucalyptus camaldulensis | -22.065086 | 148.181862 | 60 | 21 | -0.45 | | Mid way up bank 9m above sandy channel of Isaac River | Y |

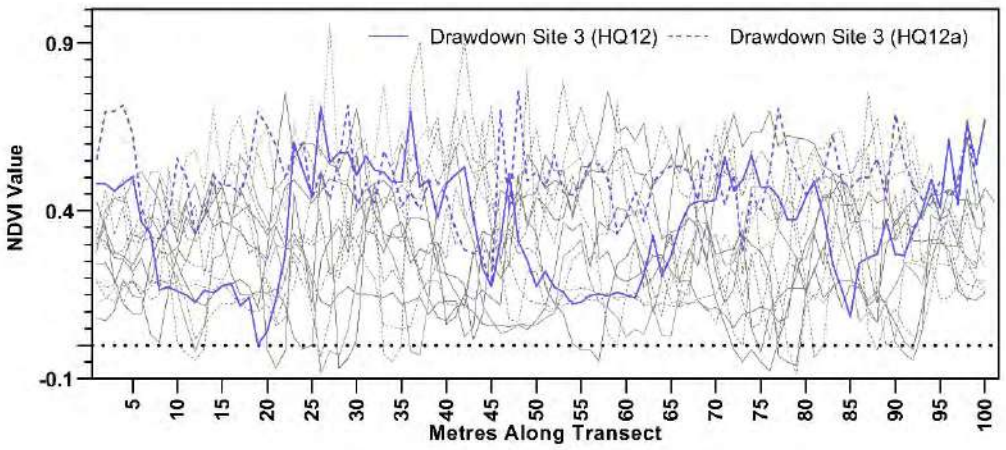
| TREE | Tree from ID EIS | Species | Y | X | HGT (m) | DBH (cm) | LWP1 MPa | LWP ID EIS | Geomorphic Position | Isotope Analysis |
|---|---|---|---|---|---|---|---|---|---|---|
| DD2T5 | | Eucalyptus camaldulensis | -22.065295 | 148.182203 | 100 | 23 | -0.35 | | On inner terrace situated 5m above river channel. Moderately steep bank above. | Y |
| DD3T1 | | Eucalyptus camaldulensis | -22.073013 | 148.191573 | 65 | 24 | -0.4 | | Top of bank 8m above main channel - low mounded levee above overflow | Y |
| DD3T2 | | Eucalyptus camaldulensis | -22.072861 | 148.191784 | 80 | 25 | -0.95 | | Margins of overflow, 25m from main channel and 10 above | |
| DD3T3 | | Eucalyptus camaldulensis | -22.073012 | 148.19199 | 65 | 23 | -0.45 | | Top of bank 5m from edge of bank, 8m above main channel - low mounded levee above overflow | |
| DD3T4 | | Eucalyptus camaldulensis | -22.072816 | 148.192125 | 70 | 24 | -0.75 | | Margins of overflow, 25m from main channel and 10 above | Y |
| DD3T5 | | Eucalyptus camaldulensis | -22.072719 | 148.191612 | 80 | 26 | -1.6 | | 10m from margins of overflow and 40m from main channel - greater than 10m above main channel. | |
| DD3T6 | | Eucalyptus camaldulensis | -22.072344 | 148.191495 | 120 | 26 | -1.4 | | 80m from main channel on upper terrace of river. >12m above main channel | Y |
| DD1T1 | | Eucalyptus camaldulensis | -22.058299 | 148.17785 | 85 | 23 | -1.6 | | 35m from main channel - 10 m above channel just below top of terrace | Y |
| DD1T2 | | Eucalyptus camaldulensis | -22.058462 | 148.177851 | 90 | 24 | -1.75 | | 25m from main channel - 7 - 8m above channel mid terrace | |
| DD1T3 | | Eucalyptus camaldulensis | -22.058702 | 148.17779 | 60 | 18 | -1.2 | | 3m from edge of bank, 3m above channel floor | Y |
| DD1T4 | | Eucalyptus camaldulensis | -22.058947 | 148.178218 | 65 | 19 | -1.6 | | 20m from edge of bank, mid terrace, 4 - 6m above channel floor | |
| DD1T5 | | Eucalyptus camaldulensis | -22.059239 | 148.17851 | 80 | 23 | -1.5 | | 20m from edge of bank, mid terrace, 4 - 6m above channel floor. On old overflow terrace? | Y |
| DD4T1 | | Eucalyptus camaldulensis | -22.073189 | 148.20456 | 70 | 23 | -1.6 | | Flood plain location on alluvium 80m from Southern Gully. Elevated >5m above channel | Y |
| DD4T2 | | Eucalyptus camaldulensis | -22.06503 | 148.1817 | 70 | 23 | -1.4 | | Flood plain location on alluvium 60m from Southern Gully. Elevated >5m above channel | |

| TREE | Tree from ID EIS | Species | Y | X | HGT (m) | DBH (cm) | LWP1 MPa | LWP ID EIS | Geomorphic Position | Isotope Analysis |
|---|---|---|---|---|---|---|---|---|---|---|
| DD4T3 | | Eucalyptus camaldulensis | -22.073314 | 148.205433 | 75 | 22 | -1.2 | | Inner terrace of Southern gully, elevated 5m above channel. | Y |
| DD4T4 | | Eucalyptus camaldulensis | -22.073582 | 148.205427 | 70 | 18 | -1.3 | | Inner terrace of Southern gully, elevated 5m above channel. | |
| DD4T5 | | Eucalyptus camaldulensis | -22.073988 | 148.2051 | 75 | 22 | -1.6 | | Upper terrace, >5m directly above channel | |
| IDDCT1 | | Eucalyptus camaldulensis | -22.077864 | 148.206375 | 100 | 26 | -2 | | 40m from at base of inner terrace. 5m above flood channel | Y |
| IDDCT2 | | Eucalyptus camaldulensis | -22.078138 | 148.206202 | 70 | 18 | -0.6 | | 10m from channel on sandy terrace seperating river channel from overflow. 3 - 5m above channel floor | |
| IDDCT3 | | Eucalyptus camaldulensis | -22.078765 | 148.206499 | 60 | 18 | -0.45 | | 5m from channel on sandy terrace seperating river channel from overflow. 3 - 5m above channel floor | Y |
| IDDCT4 | | Eucalyptus camaldulensis | -22.079462 | 148.206846 | 75 | 23 | -0.7 | | 25m from channel at base of inner terrace adjacent to narrow overflow. > 5m above channel floor | Y |
| IDDCT5 | | Eucalyptus camaldulensis | -22.079914 | 148.206866 | 70 | 23 | -0.5 | | 10m from top of bank on low overflow. 3 to 5m above channel floor. | |

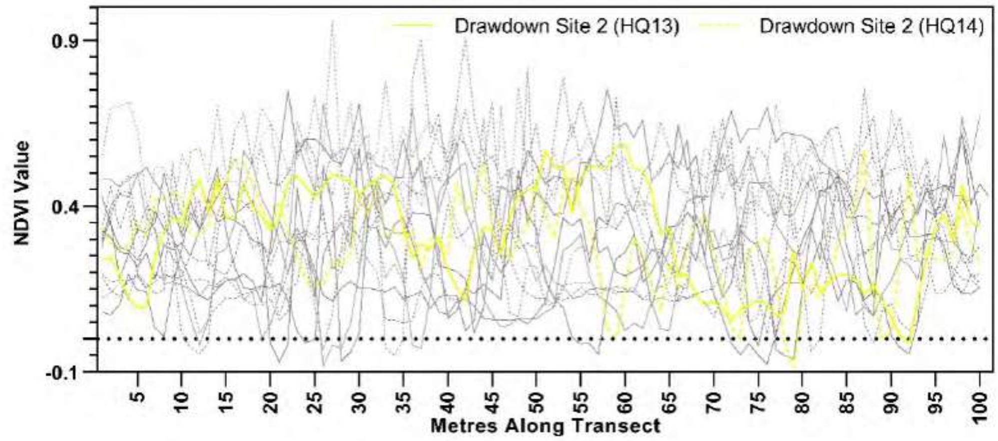
## *Appendix E6. Raw NDVI data plots from permanent transects.*


NDVI Transects _Downstream Control

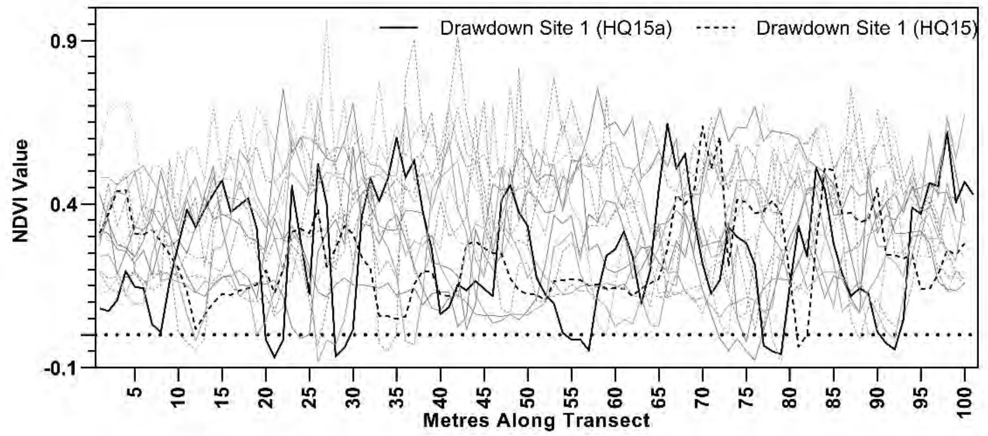

NDVI Transects _Drawdown Site 4


NDVI Transects _Drawdown Site 3

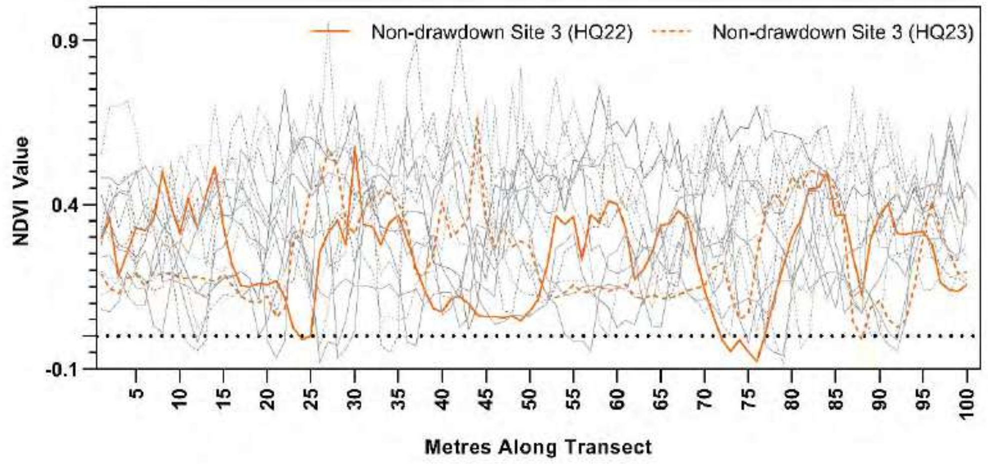
NDVI Transects _Drawdown Site 2

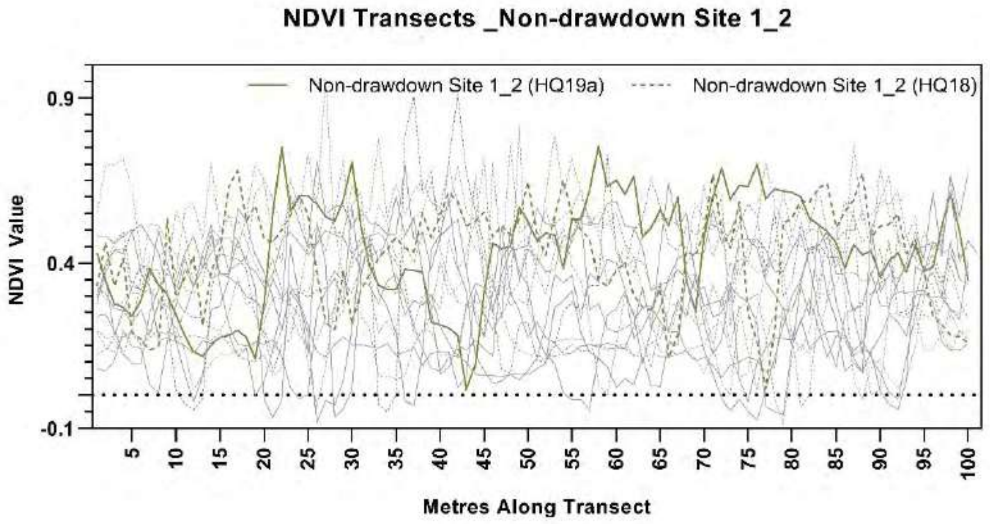


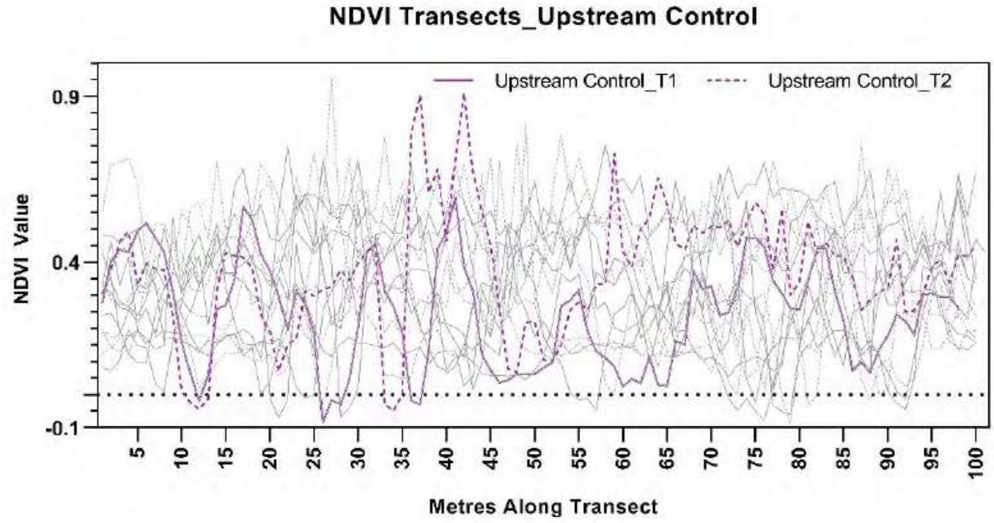
NDVI Transects _Drawdown Site 1



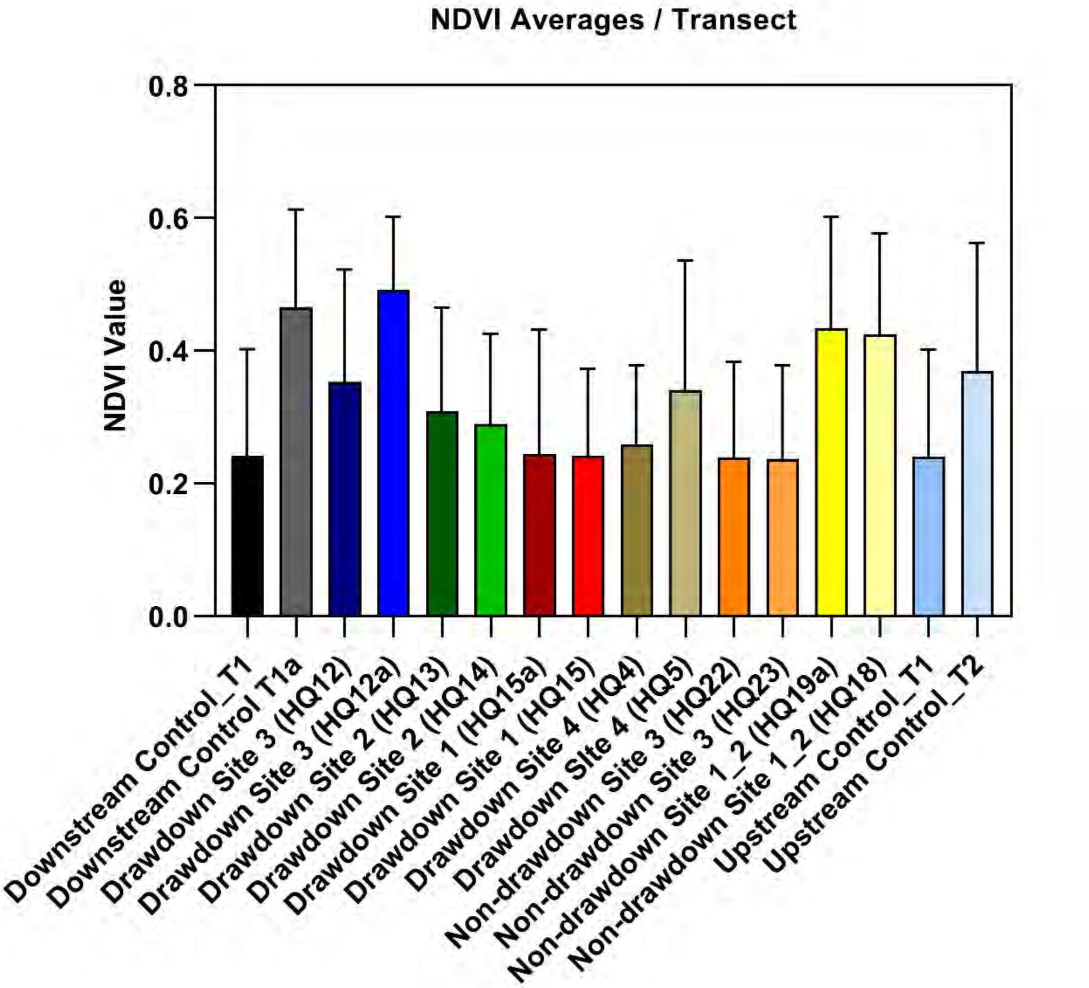
NDVI Transects _Non-drawdown Site 3



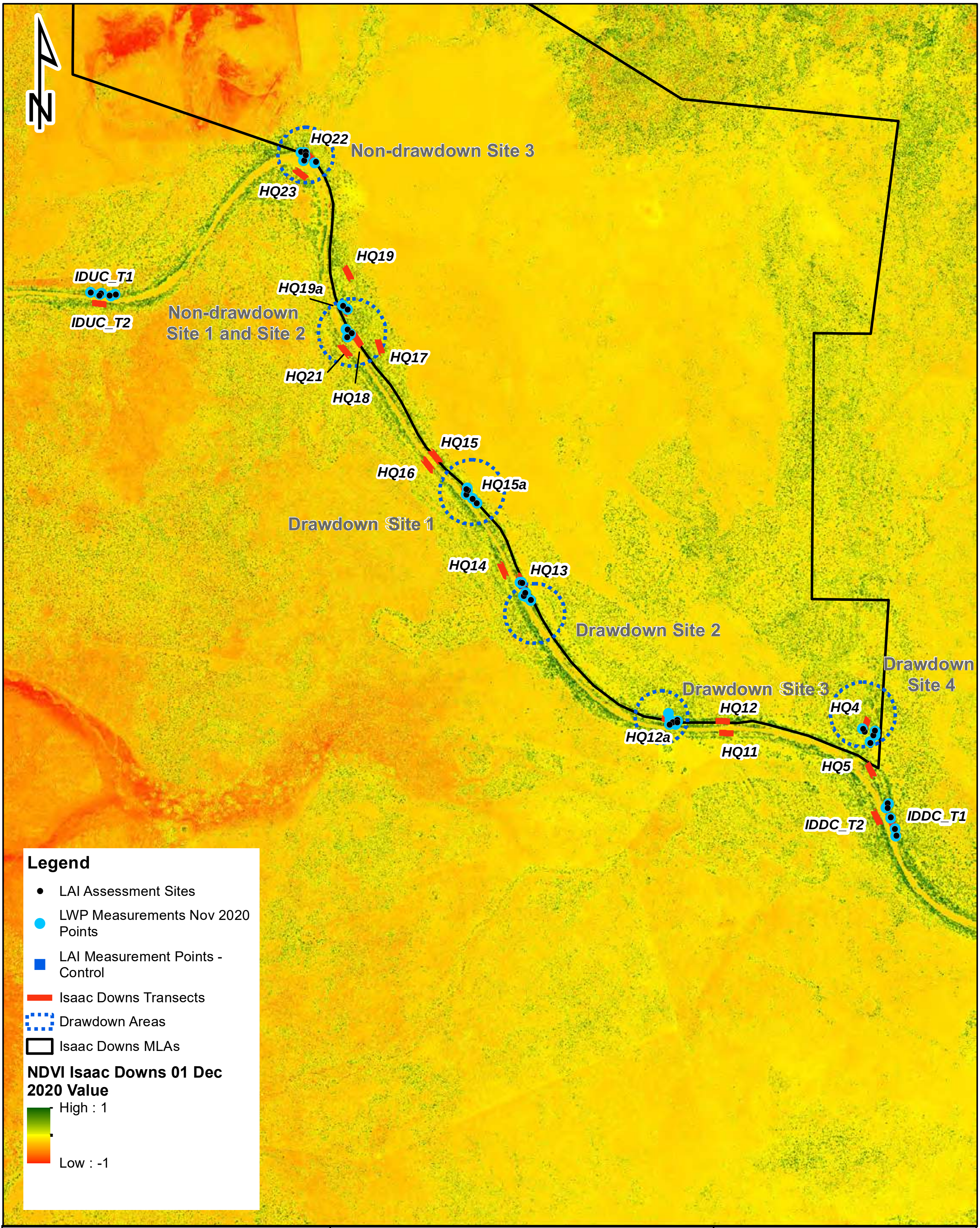

NDVI Transects _Non-drawdown Site 1_2
Non-drawdown Site 1_2 (HQ19a)
Non-drawdown Site 1_2 (HQ18)
NDVI Value
0.9
0.4
-0.1
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Metres Along Transect


NDVI Transects_Upstream Control
Upstream Control_T1
Upstream Control_T2
NDVI Value
0.9
0.4
-0.1
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Metres Along Transect

## *Appendix E7. Comparison of mean NDVI values for transects placed in each monitoring area.*



## *Appendix E8. Processed NDVI imagery shown in relation to LAI and LWP monitoring points, NDVI transects at each GDE monitoring area.*



**Appendix E8.** NDVI in relation to GDE monitoring areas and points

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**Client**

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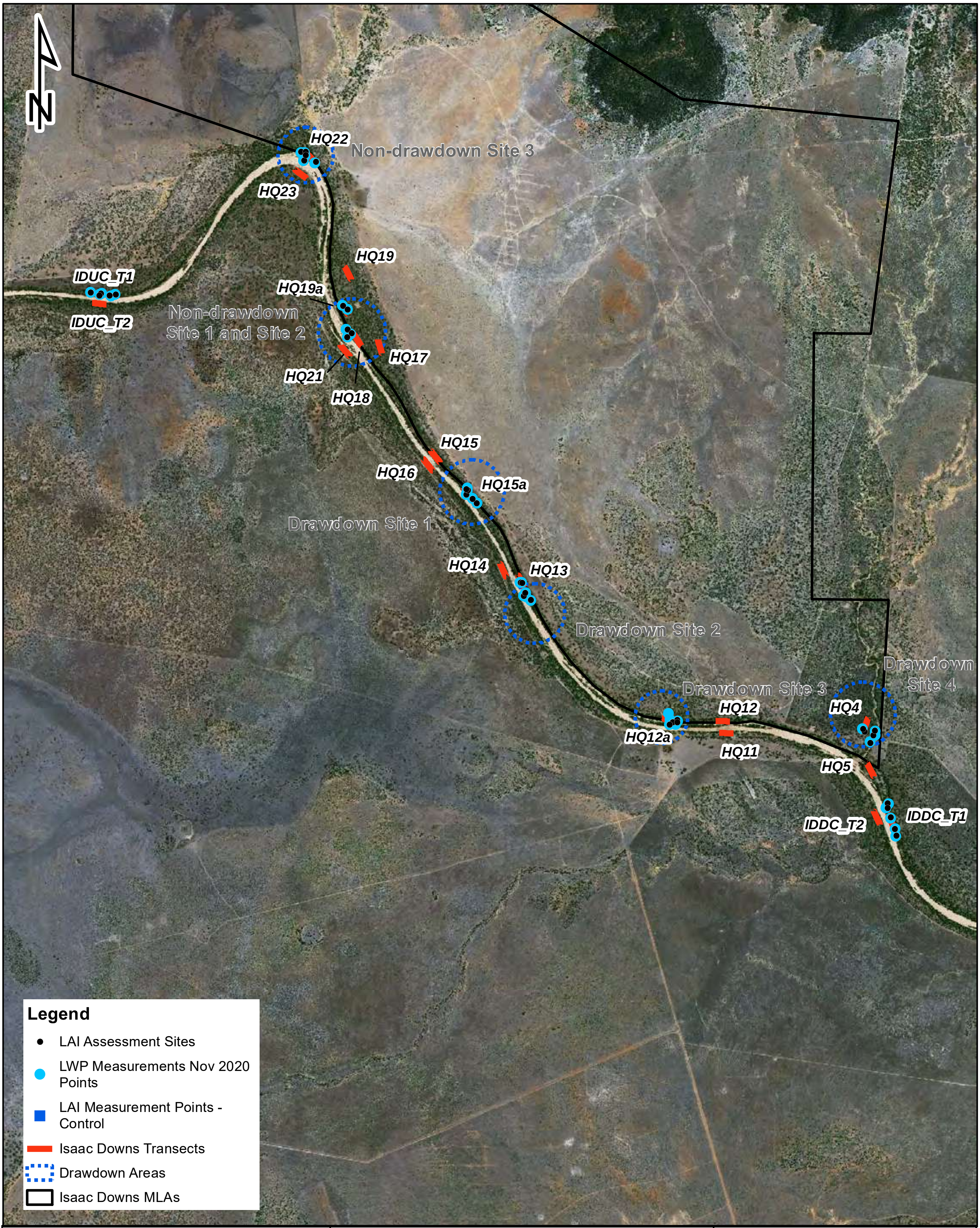
0 0.25 0.5 0.75 1
Kilometers

| Scale 1:35,000 | Drawn By DG | Checked DS | File Path | Date 17/02/2021 | A4 |
|---|---|---|---|---|---|

D:\Backup C Drive 26519\3D Environmental\Issac\Issac_NDVI.mxd

## *Appendix E9. Natural colour imagery shown in relation to LAI and LWP monitoring points, NDVI transects at each GDE monitoring area.*



**Appendix E9.** Worldview natural colour imagery in relation to GDE monitoring areas and points

**Client**

**Stanmore IP South Pty Ltd**

0 0.25 0.5 0.75 1
Kilometers

**3D Environmental**
Landscape & Vegetation Science

P. O. Box 959
Kenmore, Qld 4069
Mobile: 0447 822 119
www.3denvironmental.com.au

| **Scale** 1:35,000 | **Drawn By** DG | **Checked** DS | **File Path** | **Date** 17/02/2021 | A4 |
|---|---|---|---|---|---|

D:\Backup C Drive 26519\3D Environmental\Issac\Issac_NDVI.mxd

## Appendix F. GDE Monitoring Program for Initial Two Years

| Event | Timing | Areas for Monitoring | Parameters Measured | Additional Datasets / Techniques Recommended | Other Interacting Datasets / Data Collection Requirements | Outputs |
|---|---|---|---|---|---|---|
| Monitoring Survey 1 | Dry Season (October to December 2020) | • Isaac River GDE Area 2 - Drawdown Impact Area.<br>• Isaac River – GDE Area 1 and GDE 2, outside of Drawdown Impact Area.<br>• Isaac River – Northern and Southern Control Sites. | • LWP<br>• Stable isotopes (trees, soils, surface water and water in channel sands)<br>• Leaf Area Index | NDVI Imagery to coincide with the survey. | Groundwater monitoring data from identified monitoring bores (water quality and data from pressure transducers).<br>Stable isotope composition of groundwater from selected monitoring bores.<br>Stable isotope data from collected rainfall, if any.<br>Stable isotope data from surface water flows. If any.<br>Rainfall and climate data from automated weather station at IPM. | GDE Monitoring Report- Monitoring Event 1. |
| Monitoring Survey 2 | Wet Season (February to April 2021) | • Isaac River GDE Area 2 - Drawdown Impact Area.<br>• Isaac River – GDE Area 1 and GDE 2, outside of Drawdown Impact Area.<br>• Isaac River – Northern and Southern Control Sites. | • LWP<br>• Stable isotopes (trees, soils, surface water and water in channel sands)<br>• Leaf Area Index | NDVI Imagery to coincide with the survey. | Groundwater monitoring data from identified monitoring bores (water quality and data from pressure transducers).<br>Stable isotope composition of groundwater from selected monitoring bores.<br>Stable isotope data from collected rainfall, if any.<br>Stable isotope data from surface water flows, if any.<br>Rainfall and climate data from automated weather station at IPM. | GDE Monitoring Report- Monitoring Event 2. |
| Monitoring Survey 3 | Dry Season (October to | • Isaac River GDE Area 2 - | • LWP<br>• Stable isotopes | NDVI Imagery to coincide with the survey. | Groundwater monitoring data from identified | GDE Monitoring Report- Monitoring Event 3. |

| Event | Timing | Areas for Monitoring | Parameters Measured | Additional Datasets / Techniques Recommended | Other Interacting Datasets / Data Collection Requirements | Outputs |
|---|---|---|---|---|---|---|
| | December 2021) | Drawdown Impact Area.<br>• Isaac River – GDE Area 1 and GDE 2, outside of Drawdown Impact Area.<br>• Isaac River – Northern and Southern Control Sites. | (trees, soils, surface water and water in channel sands)<br>• Leaf Area Index | | monitoring bores (water quality and data from pressure transducers).<br>Stable isotope composition of groundwater from selected monitoring bores.<br>Stable isotope data from collected rainfall, if any.<br>Stable isotope data from surface water flows, if any.<br>Rainfall and climate data from automated weather station. | |
| Monitoring Survey 4 | Wet Season (February to April 2022) | • Isaac River GDE Area 2 - Drawdown Impact Area.<br>• Isaac River – GDE Area 1 and GDE 2, outside of Drawdown Impact Area.<br>• Isaac River – Northern and Southern Control Sites. | • LWP<br>• Stable isotopes (trees, soils, surface water and water in channel sands)<br>• Leaf Area Index | NDVI Imagery to coincide with the survey. | Groundwater monitoring data from identified monitoring bores (water quality and data from pressure transducers).<br>Stable isotope composition of groundwater from selected monitoring bores.<br>Stable isotope data from collected rainfall, if any.<br>Stable isotope data from surface water flows, if any.<br>Rainfall and climate data from automated weather station. | GDE Monitoring Report- Monitoring Event 4. |
| **2 Year GDE Monitoring Review** | | | | | | |
| 2 Year Review - Baseline GDE Monitoring Assessment | At completion of Monitoring Survey 4 | NA | NA | NA | NA | – Compilation of data from all surveys<br>– Analysis of baseline ecohydrological function of Isaac River GDE sites<br>– Correlation between LAI and NDVI (plus other |

| Event | Timing | Areas for Monitoring | Parameters Measured | Additional Datasets / Techniques Recommended | Other Interacting Datasets / Data Collection Requirements | Outputs |
|---|---|---|---|---|---|---|
|  |  |  |  |  |  | parameters) to provide a baseline for ongoing annual vegetation monitoring.<br>– Identification of sources of water utilised by trees on a seasonal basis through analysis of stable isotope results for multiple parameters.<br>– Review of risk assessment and identification of areas where risk profile is increased / diminished.<br>– Revised GDEMMP issued based on results and outcomes of the 2-year baseline monitoring program. |

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