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08 October 2025

Ms Camilla Scott
Principal Environmental Officer, Energy and Extractive Resources
Department of Environment, Tourism, Science and Innovation
Level 7, 400 George Street
BRISBANE QLD 4001

Re: Application to Amend Environmental Authority P-EA-100178150

Dear Camilla

Santos QNT Pty Ltd (Santos), on behalf of its joint venture partners, has prepared the attached application to amend Environmental Authority (**EA**) P-EA-100178150 which relates to the Mahalo Project Area on Petroleum Leases (**PL 1082** and **PL 1083**).

The application:

- Has been prepared in accordance with Sections 226 and 226A of the *Environmental Protection Act 1994*.
- Has been prepared as a major amendment.

The following information is attached in support of the application:

- Attachment 1– EA Amendment Application Form.
- Attachment 2 –Supporting Information Report.

Please contact William Inonda, Environmental Advisor, at William.Inonda@santos.com should you have any questions in relation to the application.

Yours sincerely

William Inonda

A/Team Leader Environment - Eastern Queensland and NSW

Santos QNT Ltd

Santos

Attachment 1 – EA Amendment Application Form

Santos

Attachment 2 – Supporting Information Report

Application form

Environmental Protection Act 1994

Application to amend an environmental authority

This approved form is to be used when applying to amend an environmental authority under sections 222 to 227A of the Environmental Protection Act 1994 (EP Act) for an environmentally relevant activity (ERA).

If you are applying to amend a progressive rehabilitation and closure plan (PRCP) schedule and or applying for a joint PRCP schedule and EA amendment do not use this form. You should instead use the Application to amend a PRCP Schedule or joint PRCP Schedule and environmental form (ESR/2019/4956).

IMPORTANT NOTE:

For applications to the Department of the Environment, Tourism, Science and Innovation, you can apply through Online Services at: https://www.business.qld.gov.au/running-business/environment/online-services.

It is recommended that prior to making an amendment application, you read the information on what to provide with an application. This information is located on the Business Queensland website at www.business.qld.gov.au (use the search term "Environmental licence"). This website includes a diagnostic tool called a "Forms and fees finder" which will help identify fees and supporting information you need to make an application.

You are encouraged to have a pre-lodgement meeting before applying to amend your environmental authority (EA). If you would like to have a pre-lodgement meeting:

- for intensive animal industry ERAs (prescribed ERAs 2, 3 and 4)—contact the Department of Primary Industries by email at livestockregulator@dpi.qld.gov.au or by phone on 13 25 23.
- for any other ERAs —prior to lodging this application form, please fill and lodge the form Application for pre-lodgement services (ESR/2015/1664) with the Department of the Environment, Tourism, Science and Innovation.

If you require assistance in answering any part of this form or have any questions about your application, please contact the relevant department. Contact details are at the end of this form (Section 33).

Privacy statement

The Department of the Environment, Tourism, Science and Innovation (the department) is collecting the information on this form in accordance with and as authorised by Chapter 5 of the Environmental Protection Act 1994 *(EP Act). Some of the information may be disclosed to the Department of Natural Resources and Mines, Manufacturing, and Regional and Rural Development and Queensland Treasury for the purpose of processing this application.*

Pursuant to section 540 of the EP Act, the department is required to maintain a register of certain documents and information authorised under the EP Act. A copy of this document will be kept on the public register. The register is available for inspection by members of the public who are able to take extracts, or copies of the documents from the register. Documents that are required to be kept on the register are published in their entirety, unless alteration is required by the EP Act. There is no general discretion allowing the department to withhold documents or information required to be kept on the public register. For more information on the department's public register, search 'public register' at www.qld.gov.au. For queries about privacy matters please email privacy@detsi.qld.gov.au or telephone 13 74 68.

Queensland Government

Section 1 – Environmental authority number	
EA number for this application	P-EA-100178150 (Mahalo)

Section 2 – Applicant details	
Details of the applicant are to be provided in this section.	
NAME / COMPANY NAME SANTOS QNT PTY. LTD	TRADING NAME (IF An organisation) Santos Limited
REGISTERED BUSINESS ADDRESS / RESIDENTIAL ADDRESS (NOT A POST OFFICE BOX) Ground Floor, Santos Centre 60 Flinders Street Adelaide SA 5000	POSTAL ADDRESS (WHERE DIFFERENT) Level 22, Santos Place BRISBANE QLD 4000
ABN / ACN (IF An organisation) ABN 33 083 077 196	NAME OF APPLICATION CONTACT William Inonda
EMAIL William.Inonda@santos.com	TELEPHONE (07) 3838 3184
☒ INDICATE IF YOU WANT TO RECEIVE CORRESPONDENCE VIA EMAIL ☐ INDICATE IF THERE ARE JOINT HOLDERS OF THE ENVIRONMENTAL AUTHORITY. IF THERE ARE JOINT HOLDERS, PROVIDE THE ADDITIONAL CONTACT DETAILS AS AN ATTACHMENT.	

Section 2.1 – Agent details If there is an agent acting on behalf of the applicant, details of the agent are to be provided. An agent could be a consultant or contactor for the applicant.	
Is this form being completed by an agent for the applicant? * NOTE: If an agent is nominated, please provide evidence of appointment by the authority holder/s.	☐ Yes – Provide details below ☒ No – Go to next section
NAME / COMPANY NAME	TRADING NAME
REGISTERED BUSINESS ADDRESS / RESIDENTIAL ADDRESS (NOT A POST OFFICE BOX)	POSTAL ADDRESS (WHERE DIFFERENT)
ABN / ACN (IF AN ORGANISATION)	CONTACT NAME
EMAIL	TELEPHONE

Section 3 – Checklist questions An application to amend an EA is not appropriate in all circumstances. If you answer **Yes** to any of the preliminary questions below, you cannot use this application form. If you answer **No** to all of the preliminary questions, you may continue to use this application form.	
Is the amendment to correct a clerical or formal error?	☐ Yes ☒ No
If yes, you cannot use this form. This request should be made in writing directly to the administering authority (no fees apply).	
Is the amendment to add an ERA to an amalgamated project authority and the proposed activity does not form part of the single integrated operation conducted under the authority?	☐ Yes ☒ No
If yes, you cannot use this form. You will need to apply for a new EA.	
Is the amendment to add an ERA to the environmental authority and the addition of the ERA would result in the environmental authority not meeting the definition of an 'ERA project'?	☐ Yes ☒ No
If yes, you cannot use this form. You will need to apply for a new EA.	
Is the amendment to amalgamate two or more EA's?	☐ Yes ☒ No
If yes, you cannot use this form. Please use either the form Application to amalgamate two or more environmental authorities into an amalgamated corporate authority (ESR/2015/1734), or Application to amalgamate two or more environmental authorities into an amalgamated project or local government authority (ESR/2015/1735).	
Is the amendment to add an ERA to an amalgamated local government authority and there is not an appropriate degree of integration between the proposed activity and the existing activities on the authority?	☐ Yes ☒ No
If yes, you cannot use this form. You will need to apply for a new EA.	
Is the amendment to amend the financial assurance or estimated rehabilitation cost only?	☐ Yes ☒ No
If yes, you cannot use this form. Please use the form Application to amend or discharge financial assurance held for an environmental authority (ESR/2015/1752) or Application for a decision on the estimated rehabilitation cost (ESR/2018/4426) .	
Is the proposed amendment to add a resource activity to an EA for a prescribed ERA project?	☐ Yes ☒ No
If yes, you cannot add the resource activity to the EA. You will need to apply for a new EA.	
Is the proposed amendment to add a prescribed ERA, other than an ancillary activity, to an EA for a resource project?	☐ Yes ☒ No
If yes, you cannot use this form. You can apply using the standard, variation or site-specific application forms.	
Are you applying to extend the term of an EA that was issued to conduct research into, or test, technology or processes relating to an ERA, and for which information mentioned in section 125(1)(l)(i) and (ii) of the EP Act was not available at the time the authority was applied for?	☐ Yes ☒ No
If yes, you cannot use this form. You will need to apply for a new EA.	

Section 4 – Checklist questions for prescribed ERAs Does the application relate to an EA that is only for prescribed ERAs?	☐ Yes – Answer the questions in this section ☒ No – Go to next section
Does the proposed amendment involve changes to the relevant activity that require a new development application to be lodged under the *Planning Act 2016* and the application for the development application has not been lodged.	☐ Yes ☐ No
If yes, the development application must be lodged before an EA amendment application can be made. Under the EP Act, a development application for a material change of use of premises for an ERA is deemed to be also an application for an environmental authority. In this case, an EA amendment application should not be lodged.	
Is the proposed amendment solely to add or remove vehicles for ERA 57 (Regulated waste transport)?	☐ Yes ☐ No
If yes, you do not need to submit this application form. You can update vehicle details online through Online Services or use the form Details of regulated waste vehicles (ESR/2015/1851).	
Is the amendment for the holder of the EA to transfer all or part of the EA to a person?	☐ Yes ☐ No
If yes, you cannot use this form. Please use the form Request to transfer all or part of an environmental authority (prescribed environmentally relevant activities) (ESR/2015/1718).	
Is the amendment for the surrender of an EA?	☐ Yes ☐ No
If yes, you cannot use this form. Please use the form Application to surrender an environmental authority for a prescribed ERA (ESR/2015/1719) .	

Section 5 – Checklist for resource activities Is the application to amend an EA for a resource activity?	☒ Yes - Answer the questions in this section ☐ No – Go to next section
Is the amendment for a partial surrender of an EA for a mining, geothermal or petroleum resource activity?	☐ Yes ☒ No
If yes, you cannot use this form. Please use the form Application for surrender or partial surrender of an environmental authority (resource activity) (ESR/2015/1751).	
Is the amendment for an EA that has a PRCP schedule and approval of the amendment application would result in the EA to which the application relates being inconsistent with the relevant PRCP schedule?	☐ Yes ☒ No
If yes, you cannot use this form. The amendment to the EA must not be inconsistent with the PRCP Schedule otherwise you must apply to amend your PRCP Schedule. Please use the form Application to amend a progressive rehabilitation and closure plan schedule (PRCP schedule) or joint PRCP schedule and environmental authority (ESR/2019/4956) .	

Section 6 – Major or minor amendment Is the application for a major or minor amendment?
Your application is a minor amendment (condition conversion) if you want to convert all conditions of your EA to the standard conditions for the ERA to which the EA relates. By selecting this amendment type you are certifying that you have a complete and thorough understanding of, and can comply with, the ERA Standard (eligibility criteria and standard conditions).

For applications other than a minor amendment (condition conversion), the administering authority decides if an application is a minor amendment (threshold) or a major amendment and will send you a notice of the decision.

If the application is a major amendment, an assessment fee of 30% of the annual fee for your EA is required to be paid. The assessment of your amendment application will not proceed until the assessment fee is paid.

No additional assessment fees apply if your application is determined to be a minor amendment.

By considering what type of amendment your application is likely to be, you will have a better idea of whether the assessment fee will be payable.

For further information see the Guideline - Major and minor amendments (ESR/2015/1684) and s223 of the EP Act. If you have questions regarding whether your amendment will be a minor or major amendment you are encouraged to arrange a pre-lodgement meeting with the administering authority. Only an indication can be given as to whether the proposed changes are likely to be a minor or major amendment, at a pre-lodgement meeting as this decision can only be made when the actual application is submitted.

☒ Major amendment

☐ Minor amendment (threshold)

☐ Minor amendment (condition conversion)
For minor amendment (condition conversion) go to Section 31 (Payment of fees).

Section 7 – Amendment options

Complete this section for all applications, tick all that apply

I would like to amend the EA:	☒ Activities – includes changes to thresholds ☒ Locations – removal/addition of activity locations ☒ Conditions – includes conversions to standard conditions and variations

Section 8 – Describe the proposed amendment

Provide a detailed description of your proposed amendment.

Include justification of how your proposed amendment meets the criteria for a major or minor amendment and attach any supporting information to this application.

If the amendment is to add or delete a location, tenure or activity, or to change the threshold of an activity, provide details below.

Refer to section 3 and section 4 of Attachment 2 - Supporting Information

☒ I HAVE ATTACHED ADDITIONAL DETAILS FOR THIS SECTION.

Section 9 – Describe the land that will be affected by the proposed amendment

Describe if the activity will be carried out within the existing designated areas of the environmental authority, a new area, or if the activity is mobile or temporary.

Refer to section 4 and section 5 of Attachment 2 - Supporting Informationefer to Attachment 2 - Supporting Information

☒ I HAVE ATTACHED ADDITIONAL DETAILS FOR THIS SECTION.

Section 10 – Development permits and other land use approvals *(Prescribed ERAs only)*	
Does the EA only include a prescribed ERA/s?	☒ No – Go to next section ☐ Yes – Provide details below
Are there any development permits or other land use approvals in effect or have any development applications been made under the *Planning Act 2016* to carry out the proposed amendment?	☒ No – Go to next section ☐ Yes – Provide details below

Provide a list of applicable development permits or applications below.

Development permit / application number	Development permit / application name	Assessment manager	Date of application or approval	Expiry date

If a land use approval other than a development permit is in effect, provide details below.

☐ I HAVE ATTACHED ADDITIONAL DETAILS FOR THIS SECTION.

Section 11 – Amend activities	
Do you wish to amend activities under the EA, including removing ERAs, adding ERAs or changes to threshold(s)?	☐ No – Go to next section ☒ Yes – Provide details below
Section 11.1 – Removing ERA(s) Does the proposed amendment remove an ERA from the EA?	☒ No – Go to section 11.2 ☐ Yes – Continue on below

Provide a list of all the ERAs that are to be removed from the EA and identify whether the ERA has commenced.

ERA number	Threshold	Name of ERA	Has the ERA commenced?
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

☐ I HAVE ATTACHED DETAILS OF ADDITIONAL ERA(s) TO BE REMOVED.

Does your EA contain any rehabilitation conditions that are applicable to the ERA(s) that are requested to be removed from the EA?	☒ No – Go to section 11.2 ☐ Yes – Provide details below

A statement addressing compliance with EA conditions is to be completed by, or on behalf of, the EA holder. Attach a separate document to this application form which states the extent to which:

1. The ERAs being removed from the EA have complied with each relevant condition of approval; and
2. The final rehabilitation report is accurate (include the date of the final rehabilitation report).

PROVIDE DETAILS OF THE DATE, METHOD AND EVIDENCE USED TO VERIFY COMPLIANCE:

PROVIDE DETAILS OF THE NAME, POSITION AND CONTACT NUMBER OF THE PERSON SIGNING THE STATEMENT:

DESCRIBE THE QUALIFICATIONS AND EXPERIENCE OF THE PERSON SIGNING THE STATEMENT:

☐ I HAVE ATTACHED THE REQUIRED STATEMENT ADDRESSING COMPLIANCE WITH CONDITIONS.

For guidance on what a rehabilitation report should contain you may use the Final rehabilitation report with landowner statement (ESR/2015/1616). Methods to verify compliance may include a desktop assessment of documentation, an interview with the landowner/holder or a field operator or a site inspection. Evidence used may include photographs, statements and other documents such as maps, plans, approvals, monitoring results etc.

Section 11.2 – Adding ERA(s) Does the proposed amendment add an ERA to the EA?	☐ No – Go to next section ☒ Yes – Continue on below

Provide details of which ERA(s) you wish to add. If the ERA has eligibility criteria and standard conditions[1], identify whether you can comply with them. Select "N/A" where there are no eligibility criteria and standard conditions for that ERA. If you cannot comply with all of the applicable standard conditions, select "no" and attach details of the standard conditions you cannot comply with.

ERA number	Threshold	Name of ERA	I can comply with the eligibility criteria	I can comply with all the standard conditions
15	Using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour	Fuel Burning	☐ Yes ☒ N/A ☐ No	☐ Yes ☐ No
55	Operating a facility for receiving and either reprocessing or treating, in a year the following quantity of category 2 regulated waste	Other waste reprocessing or treatment	☐ Yes ☒ N/A ☐ No	☐ Yes ☐ No
62	Operating a facility for receiving and sorting, dismantling, baling or temporary storing category 2 regulated waste	Resource recovery and transfer facility operation	☐ Yes ☒ N/A ☐ No	☐ Yes ☐ No

[1] ERAs with eligibility criteria and standard conditions are listed at: www.business.qld.gov.au (use the search term "eligibility criteria").

63	Operating sewage treatment works, other than no-release works with a total daily peak design capacity of more than 100 but not more than 1,500EP if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme	Sewage Treatment	☒ Yes ☐ N/A ☐ No	☒ Yes ☐ No
8	Storing more than 500m3 of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	Chemical Storage	☐ Yes ☒ N/A ☐ No	☐ Yes ☐ No
			☐ Yes ☐ N/A ☐ No	☐ Yes ☐ No
			☐ Yes ☐ N/A ☐ No	☐ Yes ☐ No

☒ I HAVE ATTACHED DETAILS OF ADDITIONAL ERA(s) TO BE ADDED.
☐ I HAVE ATTACHED DETAILS OF THE STANDARD CONDITIONS THAT I CANNOT COMPLY WITH.

If you cannot comply with the eligibility criteria as a result of the proposed amendment, then an amendment to the relevant eligibility criteria condition will also be required. The department will only approve an amendment of the eligibility criteria condition if it is a result of factors beyond your control such as residential encroachment, rather than a change to the activity.

Section 12 – Single integrated operation confirmation

Will the activities be undertaken as a single integrated operation?	☐ No – Go to next section ☒ Yes – Provide details below

PROVIDE DETAILS OF THE ACTIVITIES THAT WILL BE OPERATED AS A SINGLE INTEGRATED OPERATION AND SUPPORTING INFORMATION SHOWING THEY ARE A SINGLE INTEGRATED OPERATION:

The proposed amendment will not introduce changes to the way the activities are being undertaken i.e. the activities will continue to be undertaken under the day-to-day management of a single responsible individual, for example, a site or operations manager..

Single integrated operation occurs when all of the below criteria are met:

(a) the activities are carried out under the day-to-day management of a single responsible individual, for example, a site or operations manager;
(b) the activities are operationally interrelated;
(c) the activities are, or will be, carried out at one or more places; and
(d) the places where the activities are carried out are separated by distances short enough to make feasible the integrated day-to-day management of the activities.

Section 13– Amend location(s)	
Does the proposed amendment relate to the location where the ERA(s) are undertaken, including adding a location, removing a location or changing a location? This section is not applicable to changes in monitoring locations, infrastructure locations ect. unless the new location is outside the currently authorised area for the environmental authority. Amendments to change the location of monitoring or infrastructure where the monitoring or infrastructure location is still within the currently authorised area are considered amendments to vary conditions.	☐ No – Go to Section 14 ☒ Yes – Provide details below

ERA number and threshold	Location (lot on plan(s), tenure(s) or mobile and temporary)	Add or remove
15 - using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour	PL1083	Add
63 - Operating sewage treatment works, other than no-release works with a total daily peak design capacity of more than 100 but not more than 1,500EP if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme	PL1083	Add
ERA - 55- Operating a facility for receiving and either reprocessing or treating, in a year the following quantity of category 2 regulated waste	PL1083	Add

ERA 62 - Operating a facility for receiving and sorting, dismantling, baling or temporary storing category 2 regulated waste	PL1083	Add
ERA - 8 -Storing more than 500m3 of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	PL1083	Add

☒ I HAVE ATTACHED DETAILS OF ADDITIONAL LOCATIONS FOR THIS SECTION.

Section 13.1 - Rehabilitation conditions *Are you proposing to remove locations from the EA?*	☒ No – Go to next section ☐ Yes – Continue on below
Does your EA contain any rehabilitation conditions that are applicable to the locations that are requested to be removed from the EA?	☐ No – Go to next section ☐ Yes – Continue on below
Has a statement addressing compliance with EA rehabilitation conditions been attached as per section 11.1?	☐ No – Go to next section ☐ Yes – Continue on below

PROVIDE DETAILS OF THE DATE, METHOD AND EVIDENCE USED TO VERIFY COMPLIANCE:

PROVIDE DETAILS OF THE NAME, POSITION AND CONTACT NUMBER OF THE PERSON SIGNING THE STATEMENT:

DESCRIBE THE QUALIFICATIONS AND EXPERIENCE OF THE PERSON SIGNING THE STATEMENT:

☐ I HAVE ATTACHED THE REQUIRED STATEMENT ADDRESSING COMPLIANCE WITH CONDITIONS.

For guidance on what a rehabilitation report should contain you may use the Final rehabilitation report with landowner statement (ESR/2015/1616). Methods to verify compliance may include a desktop assessment of documentation, an interview with the landowner/holder or a field operator or a site inspection. Evidence used may include photographs, statements and other documents such as maps, plans, approvals, monitoring results etc.

Section 14 – Seek to vary conditions	
Are you looking to vary the condition(s) of the EA?	☐ No – Go to next section ☒ Yes – Provide details below

IMPORTANT NOTE: The administering authority considers what is necessary or desirable when setting the conditions of an EA. Seeking to vary the conditions is likely to change the environmental risk of an activity and will require an assessment of the environmental values. If this is not provided, the application may not be valid.

Provide details of: (a) condition number(s); (b) proposed change; and (c) justification for the change.

Refer to Attachment 2 - Supporting Information

☒ I HAVE ATTACHED ADDITIONAL DETAILS FOR THIS SECTION.

If the activities were assessed as part of a coordinated project declared under the State Development and Public Works Organisation Act 1971, you are only able to amend Coordinator General conditions if the Coordinator General's evaluation report for the project has lapsed. If you are unsure if the Coordinator General's evaluation report has lapsed, contact the Department of State Development, Infrastructure and Planning for more information.

Section 15 – Compliance with any eligibility criteria	
Are there any eligibility criteria for the activity(s)?	☒ No – Go to next section ☐ Yes – Provide details below

State whether each relevant activity will, if the amendment is made, comply with any eligibility criteria for the activity.

Include a declaration (below) that the above statement is correct

I

(INSERT NAME, POSITION AND COMPANY NAME OF PERSON MAKING THE STATEMENT)

- make the statement by or for the holder of the EA;
- confirm that, to the best of my knowledge, all information provided as part of this statement, including attachments, is true, correct and complete.
- understand that under section 480 of the EP Act, it is an offence to give the administering authority or an authorised person a document that contains information that I know, or ought reasonably know, to be false or misleading in a material particular.

- understand that under section 480A of the EP Act, if I am required to give a document to the administrating authority, it is an offence to give a document that I know, or ought reasonably to know, contains incomplete information in a material particular.
- confirm that, to the best of my knowledge, this statement, including attachments, does not include false, misleading or incomplete information;
- confirm that, to the best of my knowledge, I have not knowingly failed to reveal any relevant information or document to the administering authority;
- confirm that, to the best of my knowledge, all information provided in this statement, including attachments, address the relevant matters and are factually correct;
- confirm that the opinions expressed in this statement, including attachments, are honestly and reasonably held; and
- understand that all information supplied as part of this statement, including attachments, can be disclosed publicly in accordance with the *Right to Information Act 2009* and the *Evidence Act 1977*.

SIGNATURE	DATE

Only a person with appropriate environmental expertise and/or experience in planning and executing site operations should sign this statement. This person may be the EA holder, a full time employee of the EA holder or a consultant to the EA holder.

Section 16 – Environmental values

Attach a document that provides an assessment of the likely impact of the proposed amendment on environmental values (EVs). Note: All fields below are mandatory, therefore a statement is required where there are no likely impacts to an EV.

Environmental Values

☒ Water	☒ Wetlands	☒ Land use	☒ Acoustic
☒ Groundwater	☒ Land	☒ Air	☒ Waste

☒ I HAVE ATTACHED A DOCUMENT THAT PROVIDES AN ASSESSMENT OF LIKELY IMPACTS ON EVs.

Note that the EP Act, s226A(1)(f) states the information required relating to impacts on EVs which include:

a) a description of the environmental values likely to be affected by the proposed amendment; and
b) details of any emissions or releases likely to be generated by the proposed amendment; and
c) a description of the risk and likely magnitude of impacts on the environmental values; and
d) details of the management practices proposed to be implemented to prevent or minimise adverse impacts; and
e) if a PRCP schedule does not apply for each relevant activity - details of how the land the subject of the application will be rehabilitated after each relevant activity ceases.

Section 17 – Environmental offsets	
Will the ERA(s) being applied for cause, or be likely to cause, a significant residual impact to a prescribed environmental matter (other than a matter of local environmental significance)?	☒ No – Go to next section ☐ Yes – Provide details below
☐ Yes - Attach supporting information that: • details the magnitude and duration of the likely significant residual impact on each prescribed environmental matter (other than matters of local environmental significance) for the entire activity; • demonstrates that all reasonable measures to avoid and minimise impacts on each of those matters will be undertaken; • includes a notice of election, if it has not already been submitted; and • if the activity is to be staged, details of how the activity is proposed to be staged.	
An environmental offset may be required for an ERA where despite all reasonable measures to avoid and minimise impacts on certain environmental matters, there is still likely to be a significant residual impact on one or more of those matters. You must verify the presence, whether temporary or permanent, of those environmental matters. For more information refer to the State Significant Impact Guideline at the Queensland Government website, at: www.qld.gov.au/environment/pollution/management/offsets/index.html.	

Section 18 – Matters of national environmental significance	
Would the carrying out of the proposed ERA, or where relevant the ERA project, be likely to have a significant impact on any matters of national environmental significance?	☒ No – Go to next section ☐ Yes – Provide details below
Are the impacts covered by transitional provisions for the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)?	☐ No – Go to next section ☐ Yes – Provide details in an attachment
Has the proposal been referred to the Federal Government Environment Minister or a delegate for formal assessment and approval?	☐ No – Go to next section ☐ Yes – Provide details below
If Yes - Has an approval issued under the EPBC Act required an environmental offset for the same, or substantially the same, impact and the same, or substantially the same, matters of national environmental significance?	☐ No – Go to next section ☐ Yes – Provide details below
If Yes - Are there any matters of national environmental significance which are assessed under the EPBC Act which are the same, or substantially the same as any matters of national environmental significance, but that were not conditioned in the approval?	☐ No – Go to next section ☐ Yes – Provide details below
☐ I HAVE ATTACHED DETAILS OF MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE INCLUDING ANY APPLICABLE TRANSITIONAL PROVISIONS. ☐ I HAVE ATTACHED A COPY OF THE EPBC ACT APPROVAL.	
There are currently nine matters of national environmental significance (MNES) which have been defined in the *EPBC Act*. To determine whether the proposed ERA(s) will have a significant impact on MNES and for referral requirements, please refer to the guidance provided by the Federal Government's Department of Environment on www.australia.gov.au and www.dcceew.gov.au/.	

Section 19 – Waste

Attach a document that provides details of the proposed measures for minimising and managing waste generated by any amendment(s) to the relevant activity.

☒ I have attached a document that provides the required information; or

☐ If waste is to be managed according to an existing waste management plan, provide the name of the plan and the relevant page or section numbers below:

Section 20 – Regional interest areas *(Resource activities only)*

Is the activity a resource activity?	☐ No - Go to Section 26 ☒ Yes - Continue below
Is the resource activity located anywhere within an area of regional interest?	☐ No – Go to next section ☒ Yes – Provide details below

If yes - Which area of regional interest, has or will require a regional interest development approval (RIDA)?

- ☒ Priority agricultural areas (PAAs)
- ☐ Priority living areas (PLAs)
- ☐ Strategic environmental areas (SEAs)
- ☒ Strategic cropping area (SCA)
- ☐ No RIDA required, I am an exempt activity.

If you have applied or been approved for a RIDA, provide the application reference:	

A regional interests development approval (RIDA) is required when a resource activity is proposed in an area of regional interest under the *Regional Planning Interests Act 2014*. Further information, including application forms, can be found on the Department of State Development, Infrastructure and Planning website at www.planning.qld.gov.au.

Section 21 – ANZSIC code *(Resource activities only)*

Provide the ANZSIC code for the resource activity.

- ☐ 1101 Black coal mining
- ☐ 1102 Brown Coal Mining
- ☐ 1311 Iron ore mining
- ☐ 1312 Bauxite mining
- ☐ 1317 Silver-lead-zinc ore mining
- ☒ 1200 Oil and gas extraction
- ☐ 1313 Copper ore mining
- ☐ 1314 Gold ore mining
- ☐ 1315 Mineral sand mining
- ☐ 1316 Nickel ore mining
- ☐ 1319 Metal ore mining (other metallic mineral ores)
- ☐ Other (provide details): _____

The Australian and New Zealand Industrial Classification (ANZSIC) is used by the Australian Bureau of Statistics. It is required to be displayed in the public register.

Section 22 – Environmental impact statement (EIS)* *(Resource activities only)*	
Has an application been made for a decision on whether an EIS would be required for the proposed amendment activity?	☒ No ☐ Yes
Has a decision been made on the application on whether an EIS would be required for the proposed amendment activity?	☐ Yes, a decision was made that an EIS is required – Attach decision. ☐ Yes, a decision was made that an EIS is **not** required – Attach decision. ☐ No, a decision has not yet been made. ☒ NA – No application has been made.
☐ I HAVE ATTACHED THE DECISION.	
Has an EIS process that includes the proposed amendment been completed?	☒ No - Go to next section ☐ Yes
If yes - Has the EIS assessment report lapsed under section 59A of the EP Act?	☐ No - Provide details below ☐ Yes – Go to next section
I have assessed the environmental risks of the proposed amendment and consider them to be: ☐ The same as was assessed in the EIS process ☐ Different to what was assessed in the EIS process	
☐ I HAVE ATTACHED THE ASSESSMENT OF THE ENVIRONMENTAL RISKS OF THE PROPOSED AMENDMENT.	
* EIS refers to both the EIS process under the *EP Act* and the EIS process under the *State Development and Public Works Organisation Act 1971*. * For further information about the EIS process is available at www.qld.gov.au, using the search term 'environmental impact statements'.	

Section 23 – Environmental impact statement triggers*	
Is the application to amend/alter an existing mine?	☒ No - Continue below ☐ Yes - Answer questions 1-6
Is the application for petroleum and gas activities?	☐ No – Go to next section ☒ Yes – Answer questions 7-9
For proposals to amend/alter an existing mine	
1. Is the proposed amendment for an increase in the annual extraction of more than 100% or 5 million tonnes per year (whichever is the lesser)? *NOTE: Only answer this question if the current ERA project is for an existing mine extracting between 2–10 million tonnes per year of run of mine (ROM) ore or coal; otherwise select N/A.*	☐ Yes ☐ No ☐ N/A
2. Is the proposed amendment for an increase in annual extraction of more than 50% or 10 million tonnes per year (whichever is the lesser)? *NOTE: Only answer this question if the current ERA project is for an existing mine extracting over 10 million tonnes per year of ROM ore or coal; otherwise select N/A.*	☐ Yes ☐ No ☐ N/A

3. Is the proposed amendment for an increase in annual extraction of greater than 25%? *NOTE: Only answer this question if the current ERA project is for an existing mine extracting over 20 million tonnes per year of ROM ore or coal extraction; otherwise select N/A.*	☐ Yes ☐ No ☐ N/A
4. Would the proposed amendment involve an extension into and significant impact on a Category A or B environmentally sensitive area, which is not already authorised by the State?	☐ Yes ☐ No
5. Would the proposed amendment involve a substantial change in mining operations—such as from underground to open cut, or (for underground mining) a change in operations from one causing little subsidence to one likely to cause substantial subsidence?	☐ Yes ☐ No
6. Would the proposed amendment introduce a novel or unproven resource removal process, technology or activity?	☐ Yes ☐ No
For petroleum and gas activities	
7. Would the proposed amendment involve a total disturbance area of greater than 2,000 hectares at any one time during the life of the proposed project? This includes areas occupied by well pads (single or multi-directional), access tracks and roads, water storages, and process plants?	☐ Yes ☒ No
8. Would the proposed amendment involve the construction of a high pressure pipeline over a distance of 300 kilometres or greater?	☐ Yes ☒ No
9. Would the proposed amendment involve the construction of a liquefied natural gas plant?	☐ Yes ☒ No
☐ I HAVE ATTACHED DETAILS OF HOW THE CRITERION IS TRIGGERED INCLUDING DETAILS OF THE IMPACT.	

* EIS refers to both the EIS process under the *EP Act* and the EIS process under the *State Development and Public Works Organisation Act 1971*.

* There are numerous criteria used to make the EIS decision, for further information about the EIS process is available at www.qld.gov.au, using the search term 'environmental impact statements'.

Section 24 – Coal seam gas (CSG) activities *(Resource activities only)*	
Does the application relate to an EA for a CSG activity that is an ineligible ERA?	☒ No – Go to next section ☒ Yes – Provide details below
Does the amendment change the way that CSG water is managed?	☐ No – Go to next section ☒ Yes – Provide details below
If the amendment will change the way that CSG water is managed the following information must be provided with this application.	
☒ I have attached a document that details:	
☒ The quantity of CSG water the applicant reasonably expects will be generated in connection with carrying out each relevant CSG activity.	
☒ The flow rate at which the applicant reasonably expects the water will be generated.	
☒ The quality of the water, including changes in the water quality the applicant reasonably expects will happen while each relevant CSG activity is carried out.	
☒ The proposed management of water including, for example, the use, treatment, storage and disposal of the water.	

☒	The measurable criteria ('management criteria') against which the applicant will monitor and assess the effectiveness of the management of the water, including, for example, criteria for each of the following: (i) the quantity and quality of the water used, treated, stored or disposed of; (ii) protection of the environmental values affected by each relevant CSG activity; and (iii) the disposal of waste, including, for example, salt, generated for the management of the water.
☒	The action proposed to be taken if any of the management criteria are not complied with, to ensure that the criteria will be able to be complied with in the future.
☒	If the application includes a CSG evaporation dam, an evaluation of the following must be provided: (i) best practice environmental management for managing CSG water; (ii) alternative ways for managing CSG water; and (iii) whether there is a feasible alternative to a CSG evaporation dam for managing the water. Note if the evaluation shows that there is a feasible alternative option, the CSG evaporation dam cannot form part of the water management for this amendment application.

Section 25 – Underground water rights *(Resource activities only)*	
Is the activity proposed to be undertaken on a mineral development licence (MDL), mining lease (ML) or petroleum lease (PL)?	☐ No – Go to next section ☒ Yes – Provide details below
Does the proposed amendment involve changes to the exercise of underground water rights?	☒ No – Go to next section ☐ Yes – Provide details below

☐	I have attached a document that details:
☐	The areas in which underground water rights are proposed to be exercised.
☐	For each aquifer affected, or likely to be affected, by the exercise of underground water rights: (i) a description of the aquifer; (ii) an analysis of the movement of underground water to and from the aquifer, including how the aquifer interacts with other aquifers and surface water; and (iii) a description of the area of the aquifer where the water level is predicted to decline because of the exercise of underground water rights; and. (iv) the predicted quantities of water to be taken or interfered with because of the exercise of underground water rights during the period in which resource activities are carried out.
☐	The environmental values that will, or may, be affected by the exercise of underground water rights and the nature and extent of the impacts on the environmental values.
☐	Any impacts on the quality of groundwater that will, or may happen because of the exercise of underground water rights during or after the period in which resource activities are carried out.
☐	Strategies for avoiding, mitigating or managing the predicted impacts on the environmental values of the impacts on the quality of groundwater.

For more information about exercising underground water rights or the associated requirements refer to the guideline Requirements for site-specific and amendment applications—underground water rights (detsi.qld.gov.au)

Section 26 – Financial assurance / estimated rehabilitation cost	
Do you currently have financial assurance or scheme assurance held for the approved EA?	☐ No – Go to next section ☒ Yes – Provide details below

☒	I will not need to change the financial assurance or scheme assurance in relation to this amendment.

☐ I will be changing the financial assurance and have attached the form Application to amend or discharge financial assurance held for an environmental authority (ESR/2015/1752).

☐ I will be applying for a new estimated rehabilitation cost decision if this amendment application is approved.

Section 27 – Compliance and enforcement tools or site management plan	
Is this land currently subject to an environmental enforcement order (EEO), environmental protection order (EPO), transitional environmental program (TEP) or a site management plan (SMP)?	☒ No – Go to next section ☐ Yes (EEO) - provide details below ☐ Yes (EPO) - provide details below ☐ Yes (TEP) - provide details below ☐ Yes (SMP) - provide details below
PROVIDE THE REFERENCE NUMBER AND BRIEF DETAILS INCLUDING: DESCRIPTION OF LAND; LOT AND PLAN NUMBERS; AND LOCAL GOVERNMENT AREA.	

Section 28 – Environmental management register	
Is any part of the land currently recorded in, or has previously been removed from, the environmental management register?	☒ No – Go to next section ☐ Yes – Provide details below

☐ The land is currently in the environmental management register.

☐ The land has been removed from the environmental management register.

You must attach evidence (e.g. Notice) advising that the details have been removed.

Section 29 - Website address		
Is the application for a mining activity on a mining lease, or a geothermal, petroleum, or greenhouse gas storage activity?	☐ No – Go to next section ☒ Yes – Provide details below	
Provide the website address for the application notice and application documents.	www.santos.com	
Provide details of the contact person if technical assistance is required.	NAME William Inonda	TELEPHONE
	EMAIL william.inonda@santos.com	

Section 30 – Site contact	
Would you like to nominate a site contact?	☐ No – Go to next section ☒ Yes – Provide details below
SITE CONTACT NAME William Inonda	POSITION Senior Environmental Adviser
EMAIL william.inonda@santos.com	TELEPHONE 07 38383184
☒ INDICATE IF YOU WANT THE SITE CONTACT TO RECEIVE CORRESPONDENCE VIA EMAIL	
A site contact is an alternative contact nominated by the legal entity which holds, or will in future hold, a relevant authority issued by the department. The department may direct correspondence relating to actual or potential compliance matters to the site contact.	

Section 31 – Payment of fees	
Application fee:	$ 367
For fees payable to the Department of the Environment, Tourism, Science and Innovation	
Preferred ☐ Apply using Online Services – submit the application online and pay by credit card. **Alternatively** ☒ Email the completed application with a request to pay the application fee by BPOINT. Please do not email your credit card details – we will send you a link to pay securely by credit card via BPOINT.	
For fees payable to the Department of Primary Industries	
☐ Payment by cheque or money order made payable to the Department of Primary Industries (attached). ☐ Please contact me (the applicant) for credit card payment: Phone number: Insert phone no.	
An application fee is payable at the time the application is made. Information on the fee can be located on the website Forms and fees for environmental authorities | Business Queensland. Where the proposed amendment is determined by the administering authority to be a major amendment, an assessment fee of 30% of the annual fee for the authority at the time of application, is also payable. The assessment fee is payable once notification of the assessment level decision is issued. The assessment fee must be paid before the assessment of the amendment application can proceed. The supplementary annual fee is payable where the amendment is approved and results in the aggregate environmental score (and hence the annual fee) for the EA increasing. The supplementary annual fee is a pro-rata adjustment to the annual fee for the period from when the amended EA takes effect to the next anniversary day for the EA. This is payable within 20 business days after the approval date. The supplementary annual fee can be calculated using the Fee calculator (ESR/2015/1731).	

Section 32 – Declaration

Note: If you have not told the truth in this application you may be prosecuted.

I declare that:

- I am the holder of the EA, or authorised signatory for the holder of the EA.
- The information provided is true and correct to the best of my knowledge.
- I understand that under section 480 of the EP Act, it is an offence to give the administering authority or an authorised person a document that contains information that I know, or ought reasonably know, to be false or misleading in a material particular.
- I understand that under section 480A of the EP Act, if I am required to give a document to the administrating authority, it is an offence to give a document that I know, or ought reasonably to know contains incomplete information in a material particular.
- I understand that failure to provide sufficient information may result in the application being refused. I understand that an incomplete application may be invalid. Invalid applications will be returned without processing and will only be processed if resubmitted with all invalidating issues addressed.
- I understand that all information supplied on or with this application form may be disclosed publicly in accordance with the *Right to Information Act 2009* and the *Evidence Act 1977*.
- If the proposed amendment is made, the relevant activities will continue to comply with the ERA Standard (eligibility criteria and standard conditions) for all eligible ERAs, or where they cannot comply, I have indicated otherwise in my application and provided the required supporting information.
- If the proposed amendment is a minor amendment (condition conversion), I can comply with the ERA Standard (eligibility criteria and standard conditions) for each of the ERAs authorised by the EA.
- If the proposed amendment is made, I will continue to comply with all conditions of my environmental authority as well as any relevant provisions in the EP Act.
- I understand that I am responsible for managing the environmental impacts of these activities, and that approval of this application is not an endorsement by the administering authority of the effectiveness of management practices proposed or implemented.

Where an agreement is in place between all holders of the EA, one holder can sign on behalf of the other joint holders. Please tick the checkbox below.

☒ I HAVE AUTHORITY TO SIGN THIS FORM ON BEHALF OF ALL THE JOINT HOLDERS OF THE EA.

Applicant's or authorised signatory's signature

FULL NAME	POSITION	COMPANY / ORGANISATION
David Gornall	Manager Environment - Eastern AU & PNG	Santos Limited
SIGNATURE 		DATE 09/10/2025

Joint holder(s) signature if applicable		
NAME, POSITION AND COMPANY NAME	SIGNATURE	DATE
NAME, POSITION AND COMPANY NAME	SIGNATURE	DATE
NAME, POSITION AND COMPANY NAME	SIGNATURE	DATE
OR ☐ I HAVE ATTACHED A DOCUMENT THAT PROVIDES THE REQUIRED INFORMATION FOR ALL JOINT HOLDERS.		
Where the EA holder is a company, this form must be signed by an authorised person for that company. Where there is more than one holder of the EA, this declaration is to be signed by all holders, unless there is an agreement between all holders that one can sign on behalf of the other(s).		

Section 33 - Submission

Please submit your completed application to:

For ERA 2, ERA 3 or ERA 4:

Post: Senior Environmental Scientist
Intensive Livestock Unit
Department of Primary Industries
PO Box 102
TOOWOOMBA QLD 4350

Enquiries: Phone: (07) 4688 1374
Fax: (07) 4529 4192
Email: livestockregulator@dpi.qld.gov.au

For a mining ERA where the proposed amendment impacts upon the resource tenure:

Enquiries: Mining Registrar
Department of Natural Resources and Mines, Manufacturing, and Regional and Rural Development
The Department of Natural Resources and Mines, Manufacturing, and Regional and Rural Development has a list of office locations for mining registrars on its website https://www.nrmmrrd.qld.gov.au.

For all other ERAs:

Post: Permit and Licence Management
Department of the Environment, Tourism, Science and Innovation
GPO Box 2454
BRISBANE QLD 4001

Enquiries: Website: www.business.qld.gov.au
Email: palm@detsi.qld.gov.au
Phone: 13 QGOV (13 74 68)

Applications and enquiries should not be submitted to individual officers. The latest version of this publication can be found at Application to amend an environmental authority (ESR/2015/1733).

Section 34 - Definitions to terms used in this form

(Where there is inconsistency between the definition of terms used here and the terms used in the EP Act, the terms in the EP Act apply)

Condition conversion	For an EA, means an amendment replacing all the conditions of the authority with the standard conditions for the environmentally relevant activity which the authority relates. The relevant eligibility criteria and standard conditions must be able to be met.
Eligibility criteria	For an environmentally relevant activity, means eligibility criteria that are in effect for the activity under – (a) An ERA standard; or (b) A code of environmental compliance; or (c) A regulation in respect of a mining activity.

Environmentally relevant activity (ERA)	A resource activity or a prescribed ERA.
ERA project	A prescribed ERA project or a resource project.
ERA standard	For an environmentally relevant activity, means the eligibility criteria and/ or the standard conditions set by the administering authority.
Major amendment	For an environmental authority, means an amendment that is not a minor amendment.
Material change of use of premises for an ERA	A category of assessable development requiring a development permit under the *Planning Act 2016*. Refer Schedule 10, Division 2, Item 8 of the Planning Regulation 2017.
Minor amendment	For an environmental authority, means an amendment that is – (a) a condition conversion; or (b) a minor amendment (threshold).
Minor amendment (threshold)	For an environmental authority, means an amendment that the administering authority is satisfied— (a) is not a change to a condition identified in the authority as a standard condition, other than— (i) a change that is a condition conversion; or (ii) a change that is not a condition conversion but that replaces a standard condition of the authority with a standard condition for the environmentally relevant activity to which the authority relates; or (iii) a change that will not result in a change to the impact of the relevant activity on an environmental value; and (b) does not significantly increase the level of environmental harm caused by the relevant activity; and (c) does not change any rehabilitation objectives stated in the authority in a way likely to result in significantly different impacts on environmental values than the impacts previously permitted under the authority; and (d) does not significantly increase the scale or intensity of the relevant activity; and (e) does not relate to a new relevant resource tenure for the authority that is— (i) a new mining lease; or (ii) a new petroleum lease; or (iii) a new geothermal lease under the Geothermal Energy Act; or (iv) a new GHG injection and storage lease under the GHG storage Act; and

	(f) involves an addition to the surface area for the relevant activity of no more than 10% of the existing area; and (g) for an environmental authority for a petroleum activity— (i) if the amendment involves constructing a new pipeline—the new pipeline does not exceed 150km; and (ii) if the amendment involves extending an existing pipeline—the extension does not exceed 10% of the existing length of the pipeline; and (h) if the amendment relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit—the amendment application under section 224 seeks an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit.
Mobile and temporary ERA	A prescribed ERA, other than an activity that is dredging material, extracting rock or other material, or the incinerating of waste: (a) carried out at various locations using transportable plant or equipment, including a vehicle (b) that does not result in the building of any permanent structures or any physical change of the landform at the locations (other than minor alterations solely necessary for access and setup including, for example, access ways, footings and temporary storage areas) (c) carried out at any one of the locations: (iii) for less than 28 days in a calendar year, or (iv) for 28 or more days in a calendar year only if the activity is necessarily associated with, and is exclusively used in, the construction or demolition phase of a project.
Prescribed ERA	An environmentally relevant activity that is not a resource activity and is prescribed under section 19 of the EP Act.
Prescribed ERA project	All prescribed ERAs carried out, or proposed to be carried out, as a single integrated operation.
Registered suitable operator	A person who, or a corporation which, under section 318I of the EP Act has been assessed as being suitable to carry out an ERA and has been listed on the suitable operator register.
Resource activity	An activity that is any of the following: (a) a geothermal activity (b) a greenhouse gas (GHG) storage activity (c) a mining activity (d) a petroleum activity.

Resource project	Resource activities carried out, or proposed to be carried out, under 1 or more resource tenures, in any combination, as a single integrated operation.
Single integrated operation	Occurs when all of the below criteria are met: (a) the activities are carried out under the day-to-day management of a single responsible individual, for example, a site or operations manager; (b) the activities are operationally interrelated; (c) the activities are, or will be, carried out at one or more places; and (d) the places where the activities are carried out are separated by distances short enough to make feasible the integrated day-to-day management of the activities.
Underground water rights	Means any of the following: (a) underground water rights within the meaning of the *Mineral Resources Act 1989*; (b) underground water rights within the meaning of the *Petroleum and Gas (Production and Safety) Act 2004*; (c) underground water rights within the meaning of the *Petroleum Act 1923*, section 87(3).

Santos

Environmental Authority P-EA-100178150 (Mahalo) Amendment Application - Supporting Information Report

October 2025

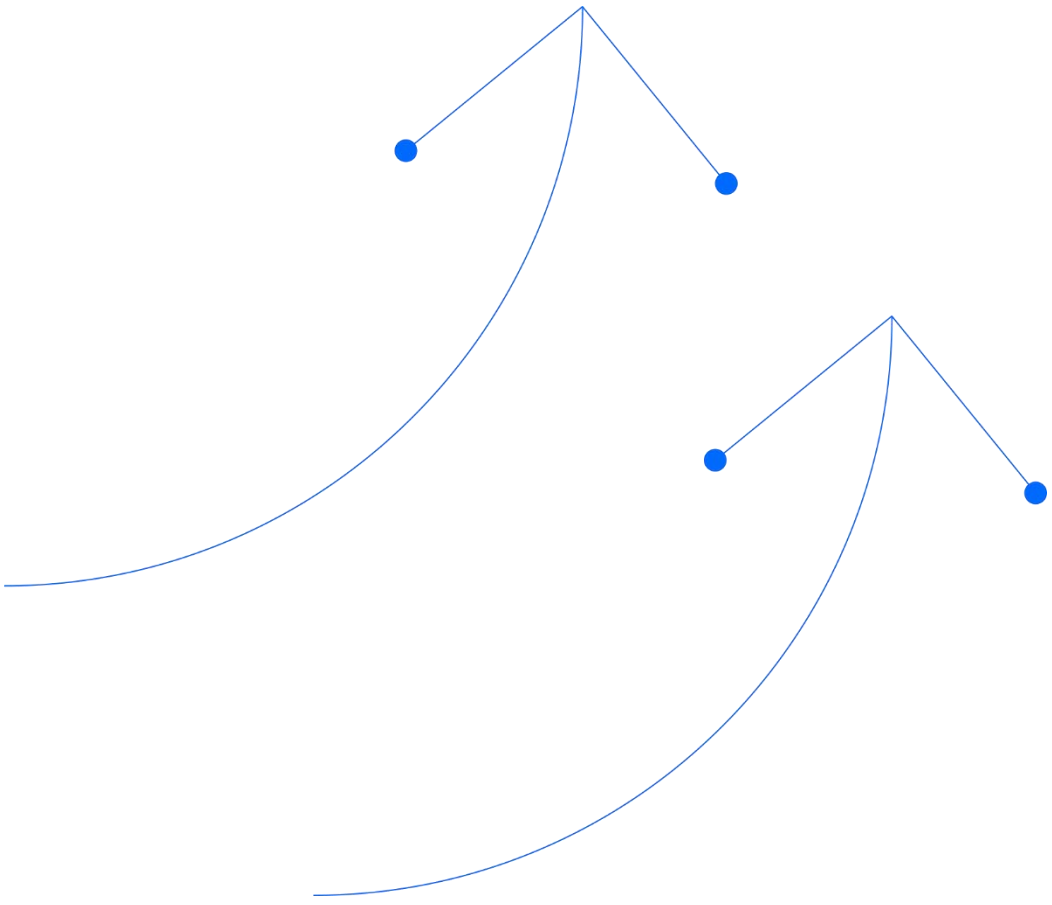


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1. Introduction

This document is the supporting information Report (**the Report**) for an application under the *Environmental Protection Act 1994* (**EP Act**) to amend Environmental Authority (**EA**) P-EA-100178150 issued by the Department of Environment, Tourism, Science and Innovation (**DETSI**) which took effect on 16 December 2021. The EA authorises petroleum activities on Petroleum Leases (PLs) 1082 and 1083 for the Mahalo gas Project (the Project). Santos QNT Pty Ltd (**Santos**), and Comet Ridge Mahalo Pty Ltd (Comet) are the joint holders of the EA.

This Report has been prepared in accordance with the DETSI Guideline: *Application Requirements for petroleum activities* (ESR/2016/2357 version 4.01) and the following technical guidelines:

- application requirements for activities with impacts to air (ESR/2015/1840)[1]
- application requirements for activities with impacts to land (ESR/2015/1839)[2]
- application requirements for activities with noise impacts (ESR/2015/1838)[3]
- application requirements for activities with impacts to water (ESR/2015/1837)[4]
- application requirements for activities with waste impacts – (ESR/2015/1836)[5]
- requirements for site-specific and amendment applications – underground water rights (ESR/2016/3275)[6]
- greenhouse gas emissions (ESR/2024/6819)[7]
- streamlined model conditions for petroleum activities (ESR/2016/1989 • Version 2.04)[8].

1.1. Purpose

The purpose of this Report is to:

- Identify Environmental Values (EV) to be enhanced and protected under the EP Act, its subordinate legislation and policies; and
- Assess potential risks and impacts on each EV that may arise from the proposed amendment for the Project; and
- Demonstrate that all potential risks and impacts to all EVs have been assessed and mitigated to the full extent possible.

A risk assessment has also been completed for the identified EVs, with reasonable and appropriate mitigation measures proposed to manage any likely residual impacts (**section 7** and **Appendix J**). The results of the risk assessment indicate that residual risks to EVs as a result of the proposed amendment are classified as 'Low'.

2. Legislative Considerations

2.1. Environmental Protection Act 1994 (EP Act)

2.1.1. General Requirements for an EA Amendment Application (s226 and s226A EP Act)

Section 226 and 226A of the EP Act specifies the requirements for an EA amendment application. **Table 1** of this Report contains a summarised checklist of the EP Act requirements for the proposed amendment application.

[1] https://www.des.qld.gov.au/policies?a=272936:policy_registry/era-gl-air-impacts.pdf
[2] https://www.des.qld.gov.au/policies?a=272936:policy_registry/era-gl-land-impacts.pdf
[3] https://www.des.qld.gov.au/policies?a=272936:policy_registry/era-gl-noise-impacts.pdf
[4] https://www.des.qld.gov.au/policies?a=272936:policy_registry/era-gl-water-impacts.pdf
[5] https://www.des.qld.gov.au/policies?a=272936:policy_registry/era-gl-waste-impacts.pdf
[6] https://www.des.qld.gov.au/policies?a=272936:policy_registry/rs-gl-requirements-underground-water-rights.pdf
[7] https://www.detsi.qld.gov.au/policies?a=272936%3Apolicy_registry%2Fera-gl-greenhouse-gas-emissions.pdf
[8] https://www.des.qld.gov.au/policies?a=272936:policy_registry/rs-gl-streamlined-model-conditions-petroleum.pdf

Table 1: General Requirements EA Amendment Application (s226 and s226A EP Act)

Section of the EP Act	Relevance to amendment application
s226(1)(a) be made to the administering	The EA amendment application has been made to DETSI who is the administering authority for the EP Act.
s226(1)(b) be made in the approved form	The application has been made using the current version of the DETSI approved EA amendment application form.
s226(1)(c) be accompanied by the fee prescribed under a regulation	The applicable fee was paid at lodgement of the amendment application.
s226(1)(d) describe the proposed amendment	The full details of the proposed amendment and justification is discussed in detail in this Report. The proposed amendment involves: Amending environmentally relevant activity and location details to include: • Schedule 3 – 06 - a site containing a high hazard dam or a significant hazard dam on PL1083 • Ancillary 08 - Chemical Storage on PL1083 • Ancillary 15 – fuel burning on PL1083 • Ancillary 55 – other waste reprocessing or treatment on PL1083 • Ancillary 62 - Resource recovery and transfer facility operation on PL1083 • Ancillary 63 - Sewage Treatment on PL1083 Amending Schedule A Table 1 – Scale and intensity for the activities to include: • Access roads • Gathering and transmission lines • Compressor station • Communication tower • Regulated structures • Vehicle washdown and laydown areas • Treated effluent and CSG water irrigation areas • Water treatment (reverse osmosis) Amending condition D2 to authorise fuel burning and combustion activities Amending condition I4 to authorise regulated structures Amending Schedule B to authorise: • Re-use of residual drilling material • Irrigation of treated effluent; and • Irrigation of CSG water Refer to **section 4** of this Report.
s226(1)(e) describe the land that will be affected by the proposed amendment	The Project will be undertaken on Petroleum Leases PL1083 and PL1082 as shown in **section 3.1** of this Report (proposed land). The proposed land has a history of significant disturbance due to agricultural and resource activities, including exploration for coal and petroleum. Cattle grazing and cropping are the predominant land uses. This prior disturbance means that the potential

Section of the EP Act	Relevance to amendment application
	environmental impact from the proposed amendment is very low. The proposed activities have been sited to avoid impact on protected matters and existing land use. Refer to **section 4** and **section 5** of this Report for additional details. The proposed maximum disturbance is provided in **Table 7** of this Report**.**
s226(1)(f) include any other document relating to the application prescribed under a regulation.	Under section 28 of the Environmental Protection Regulation 2019 (EP Regulation) a prescribed document for an application for an EA for a CSG activity include documents dealing with whether the proposed management of CSG water, brine and salt is consistent with the coal seam gas water management policy[9], including the prioritisation hierarchy for managing SCG water and reverse osmosis concentrate waste. Refer to **section 4** and **5** of this Report for comprehensive details on the proposed management measures for CSG water and brine.
s226A(1)(a) describe any development permits in effect under the Planning Act for the carrying out of the relevant activity for the authority; and	Not applicable - No development permits are in effect under the *Planning Act 2016* for the activities for the proposed amendment.
s226A(1)(b) state whether each relevant activity will, if the amendment is made, comply with any eligibility criteria for the activity	Not applicable – There are currently no eligibility criteria for the activity as the proposed amendment relates to a site-specific EA for an ineligible ERA.
s226A(1)(c) if the application states that each relevant activity will, if the amendment is made, comply with any eligibility criteria for the activity— include a declaration that the statement is correct	Not applicable – There are currently no eligibility criteria relevant to the activities proposed by the amendment application.
s226A(1)(d) state whether the application seeks to change a condition identified in the authority as a standard condition	Not applicable – The proposed amendment is not seeking to amend a standard condition.
s226A(1)(e) if the application relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit— state whether the applicant seeks an amended environmental authority hat is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit.	Not applicable - The application does not relate to a new resource tenure.
s226A(1)(f) include an assessment of the likely impact of the proposed amendment on the environmental values, including—	An assessment of the likely impact of the proposed amendment has been undertaken and is discussed in **section 5** of this Report. A description of risks, management (control) strategies, risk sources, potential impacts on each environmental value is summarised in

[9] https://www.des.qld.gov.au/policies?a=272936:policy_registry/rs-po-csg-water-management-policy.pdf

Section of the EP Act	Relevance to amendment application
	Appendix J. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed activities are classified as 'Very Low'. Impacts on EVs before this amendment will not increase as a result of the proposed amendment.
s226(A)(1)(f)(i) a description of the environmental values likely to be affected by the proposed amendment;	Environmental values likely to be impacted by the proposed amendment include: • Air • Noise • Land resources • Threated Ecological Communities • Regional Ecosystems • Flora and Fauna • Matters of State Environmental Significance • Matters of National environmental Significance • Water (surface and groundwater) • Waste A detailed description of each environmental value likely to be affected by the proposed amendment and management measures to avoid, prevent and minimise the impacts are discussed in **section 5** and **Appendix J** of this Report.
s226A(1)(f)(ii) details of any emissions or releases likely to be generated by the proposed amendment	Examples of emissions likely to be generated and released by the proposed amendment include: • Releases to air – dust, light, oxides of Nitrogen • Greenhouse gas emissions • Noise – noise emissions from construction activities, fuel burning equipment for power generation, gas compression, vehicles, plant and machinery movement • Waste – CSG water, brine, general waste • Land – application of treated effluent, irrigation of CSG water, water from low point drains and residual drilling material A detailed description of each emission, applicable environmental value and management strategies to avoid, prevent and minimise impact on EVs are discussed in **section 5** of this Report. A description of risks, management (control) strategies, risk sources, potential impacts associated with the proposed amendment are summarised in **Appendix J**. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed amendment are classified as 'Very Low'. Impacts on EVs before this amendment will not increase as a result of the proposed amendment.
s226A(1)(f)(iii) a description of the risk and likely magnitude of impacts on the environmental values;	A description of risks, management (control) strategies, risk sources, potential impacts associated with the proposed amendment on each environmental value are discussed in **section 5** and summarised in **Appendix J** of this Report. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed activities are classified as 'Very Low'. Impacts on EVs before this

Section of the EP Act	Relevance to amendment application
	amendment will not increase as a result of the proposed amendment.
s266(A)(1)(f)(iv) details of the management practices proposed to be implemented to prevent or minimise adverse impacts;	A description management (control) strategies, risk sources, potential impacts associated with the proposed amendment are discussed in **section 5** and summarised in **Appendix J** of this Report. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed activities are classified as 'Very Low'. Impacts on EVs before this amendment will not increase as a result of the proposed amendment.
s226A(1)(f)(v) if a PRCP schedule does not apply for each relevant activity - details of how the land the subject of the application will be rehabilitated after each relevant activity ends;	Refer to **section 5** of this Report
s226A(1)(g) include a description of the proposed measures for minimising and managing waste generated by any amendments to the relevant activity	Waste from the authorised activities will continue to be managed in accordance with existing waste requirements of the EA P-EA100178150. **Section 4** and **5** of this report describes how waste from the proposed amendment will be managed.
s226A(1)(h) include details of any site management plan or environmental protection order that relates to the land the subject of the application;	Not applicable – There is no relevant site management plan or current Environmental Protection Orders relating to land located within the Project Area.

2.1.1. Requirements for an EA Amendment Application (s227 EP Act) and a227AA underground water rights

Section 227 of the EP Act specifies an application must state the matters mentioned in section 126(1) and comply with section 126(2), if the application:

- Relates to an environmental authority
- The proposed amendment would result in changes to the management of produced water
- The activity in an ineligible ERA.

Table 2 of this Report contains a summarised checklist of the requirements of sections 227 and 126 of the EP Act.

Section 227AA of the EP Act specifies that an amendment application must state the matters mentioned in s.126A(2) of the EP Act, if the amendment application:

- Relate to a site-specific environmental authority for certain resource authorities, including petroleum leases; and
- The proposed amendment involves changes to the exercise of underground water rights.

The proposed amendment does not include changes to the exercise of underground water rights authorised by the existing EA. The exercise of underground water rights that existed before this amendment will not change or increase due to the proposed amendment. Consequently, the information required under section 227AA[10] of the EP Act does not apply, and specific information required under that section for amendment applications for an EA

[10] https://www.des.qld.gov.au/policies?a=272936:policy_registry/rs-gl-requirements-underground-water-rights.pdf

relating to CSG activities has not been provided. The proposed amendment does not change the potential impacts to underground water rights under Chapter 3 of the *Water Act 2000* (**Water Act**) because it:

- Does not change the Tenure type (e.g., Authority to Prospect to a Petroleum Lease)
- Does not add a new Tenure to the EA
- Does not significantly change the nature or scale of activities affecting underground water rights
- Does not involve changes to the volumes of water to be extracted
- Will not create different impacts on environmental values.

Table 2: s126(1)/(2) EP Act Application Requirements

Application requirement (s126)(1)	Where addressed in application material
(a) the quantity of CSG water the applicant reasonably expects will be generated in connection with carrying out each relevant CSG activity;	Refer to **section 4** and **5** for details Up to approximately 1,350 ML of CSG water is expected to be generated for the life of the Project which is approximately the end of 2060.
(b) the flow rate at which the applicant reasonably expects the water will be generated;	Refer to **section 4** and **5** for details. Peak flowrate is expected to be approximately 0.75 ML/day which is expected to occur in October 2028.
(c) the quality of the water, including changes in the water quality the applicant reasonably expects will happen while each relevant CSG activity is carried out;	Refer to **section 4** and **5** for details. The project is located in the Bandanna formation in the Bowen basin. Groundwater chemistry in the Bowen basin varies depending on the underlying geology. A total of seven water quality samples has been collected from seven pilot wells within the Project area. For example, electrical conductivity (EC) was recorded ranging between 12,000 µS/cm to 14,000 µS/cm, pH between 7.00 to 7.88, Potassium 12 milligrams per litre (mg/l) to 320mg/l. The average typical expected water quality based on the sampling data is pH of 7.3, total dissolved solids of 7534 mg/L, EC of 12,935 µS/cm @ 25°C.Based on sampling data within the Project area, the water quality is not expected to significantly change during the operation.
(d) the proposed management of the water including, for example, the use, treatment, storage or disposal of the water;	Refer to **section 4** and **5** for details. Water volumes associated with the Project will be managed via the existing conditions of the EA and irrigation of treated blended water in accordance with the proposed new conditions B11, B12 and B13. Water management beneficial uses authorised by these approvals include: • dust suppression and construction • irrigation for pasture or crop • landscaping and revegetation for rehabilitation • stock watering Produced water may also be provided to a third party in accordance with proposed new conditions B14 and B15 of the amended EA.
(e) the measurable criteria (the management criteria) against which the applicant will	The measurable criteria are listed in **section 4** and **section 5** of this supporting Report. The

Application requirement (s126)(1)	Where addressed in application material
monitor and assess the effectiveness of the management of the water, including, for example, criteria for each of the following— i. the quantity and quality of the water used, treated, stored or disposed of; ii. protection of the environmental values affected by each relevant CSG activity; iii. the disposal of waste, including, for example, salt, generated from the management of the water;	produced water will be monitored in accordance with the proposed new conditions condition B11, B12 of the amended EA.
(f) the action proposed to be taken if any of the management criteria are not complied with, to ensure the criteria will be able to be complied with in the future.	Refer to **section 4** and **section 5** of this Report. A review and update of the water management scheme for the Project will be undertaken throughout a continuous improvement cycle that may be triggered by the failure to meet the management criteria. Proposed new condition B12 proposes measures to be undertaken if the management criteria for irrigation is not met.
(2) The proposed management of the water can not provide for using a CSG evaporation dam in connection with carrying out a relevant CSG activity unless— (a) the application includes an evaluation of— i. best practice environmental management for managing the CSG water; and ii. alternative ways for managing the water; and	Not applicable - Evaporation Dams are not authorised on Petroleum Leases.
(b) the evaluation shows there is no feasible alternative to a CSG evaporation dam for managing the water.	Not applicable

3. Assessment Level Decision for Amendment Application

This amendment application is determined to be a major amendment under section 228 of the *Environmental Protection Act 1994* (EP Act). The application does not meet one or more of the criteria for a minor amendment outlined in section 223 of the EP Act.

An assessment of the proposed amendment against the minor amendment (threshold) criteria is provided in **Table 3**. Based on this assessment, the amendment is considered to:

- Significantly increase the intensity or scale of the activity;
- Involve an addition to the surface area of more than 10% of the existing surface area; and
- Alter the rehabilitation objectives or scale of the activity in a way that may result in materially different impacts on environmental values.

Therefore, the amendment triggers a major amendment process, which requires a more detailed assessment and possibly public notification.

Table 3: Assessment Level Decision

s.223 EP Act Minor Amendment (threshold)	Relevant Information
a) Is not a change to a condition identified in the authority as a standard condition;	Not appliable. The authority is a site-specific authority with no standard conditions.
b) Does not significantly increase the level of environmental harm caused by the relevant activity;	The proposed amendment seeks to increase the number of activities and significant disturbance to land but it does not increase the level of environmental harm authorised by the relevant activity as measures including avoidance have been applied to minimise impact on EVs. A detailed description of each emission, applicable environmental value and management strategies to avoid, prevent and minimise impact on EVs are discussed in **section 5** of this Report. A description of risks, management (control) strategies, risk sources, potential impacts associated with the proposed amendment are summarised in **Appendix J**. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed activities are classified as 'Very Low'. Impacts on EVs before this amendment will not change or increase by the proposed amendment.
c) Does not change any rehabilitation objectives stated in the authority in a way likely to result in significantly different impacts on environmental values than the impacts previously permitted under the authority;	The addition of significant infrastructure (e.g., brine dam, produced water storage) will require new or amended rehabilitation objectives than the impacts permitted under the existing authority.
d) Does not significantly increase the scale or intensity of the relevant activity;	The inclusion of a gas compression facility regulated structures constitutes a significant increase in scale and intensity of the activity in relation to existing authorised activity.
e) Does not relate to a new relevant resource tenure for the authority that is (i) a new mining lease; or (ii) a new petroleum lease; or (iii) a new geothermal lease under the Geothermal Energy Act; or (iv) a new GHG injection and storage lease under the GHG storage Act	N/A – The proposed amendment does not involve a new mining or petroleum lease.
f) Involves an addition to the surface area for the relevant activity of no more than 10% of the existing area	The proposed amendment involves addition of more than 10% of the existing area of the relevant activity.
g) For an environmental authority for a petroleum activity— (i) if the amendment involves constructing a new pipeline—the new pipeline does not exceed 150km; and (ii) if the amendment involves extending an existing pipeline—the extension does not exceed 10% of the existing length of the pipeline	Not applicable. No new or extended pipelines proposed in this amendment.

s.223 EP Act Minor Amendment (threshold)	Relevant Information
h) If the amendment relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit—the amendment application under section 224 seeks an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit.	Not applicable

3.1. Project description and Location

The Project is located in the Central Highlands Regional Council Area, approximately 40km north of Rolleston in Central Queensland (**Table 4, Table 5 and Figure 1**). The Project is undertaken on petroleum tenures, PL 1082 and PL1083 which covers a combined geographical area of approximately 470km². Refer to **section 4.0** for the proposed amendment scope.

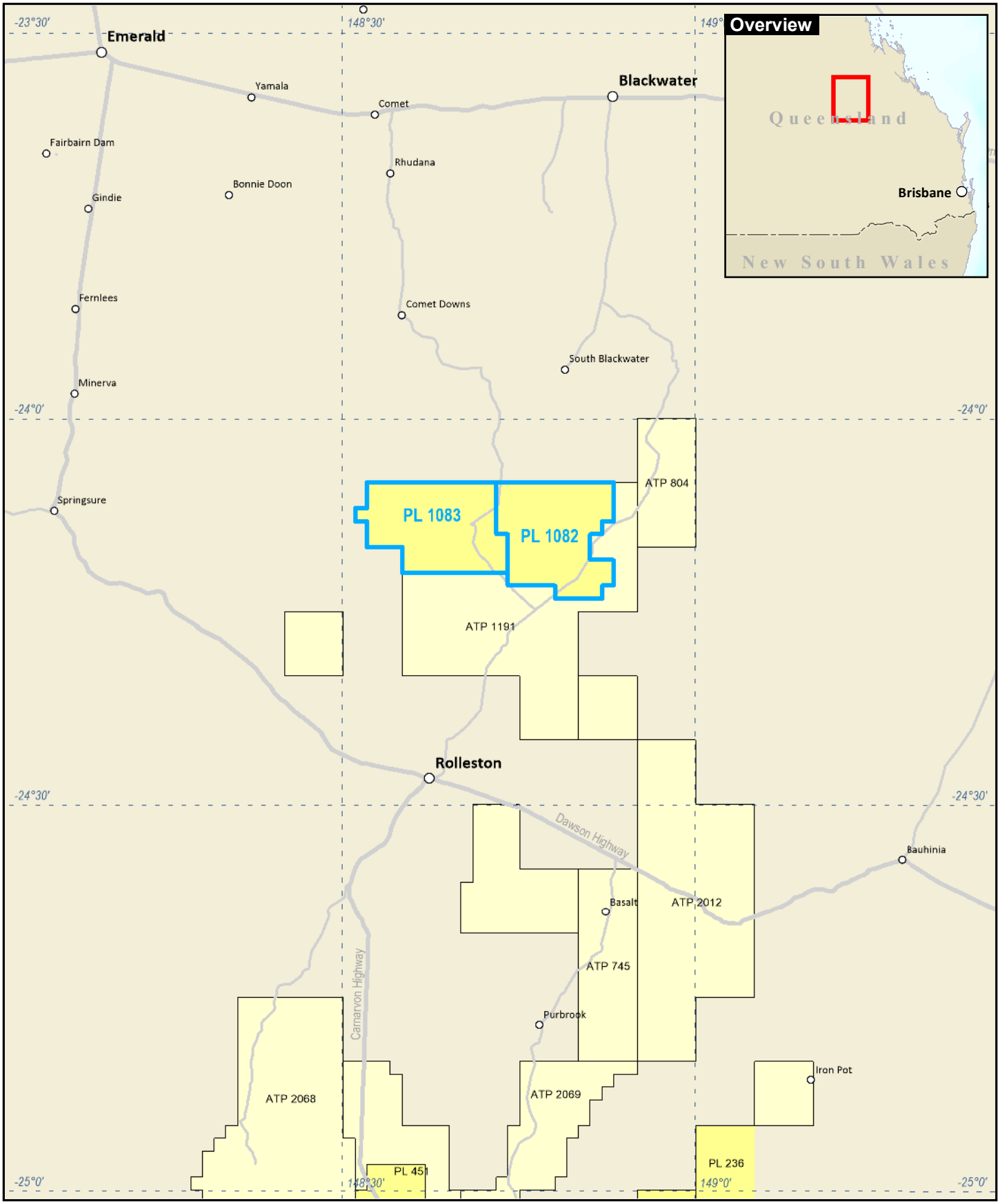
Table 4: Lot and Plans

Lot and Plan	Land Use
PL1082	
7SP187934	Freehold
13WNA75	
1SP168790	
4RP616573	
4WNA74	
7SP291957	
8SP291957	
1SP203781	
PL1083	
7SP224243	Freehold
42SP266020	
6SP291744	
1SP203781	
5WNA106	
1CP845876	
10WNA115	
7SP187934	

Table 5: Identification of relevant blocks/sub-blocks.

Tenure Details			
Tenure Number	**PL1083**		
Sub-blocks	BIM: Charleville	BLOCK: 129	D, E, J, K, O, P, T, U, Z
		BLOCK: 130	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, Q, R, S, T, U, W, X, Y, Z
		BLOCK: 131	A, B, C, F, G, H, L, M, N, Q, R, V
		BLOCK: 201	E, K, P
		BLOCK:202	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, T, U
		BLOCK: 203	A, F, G, H, L, M, N, Q, R
Tenure Number	**PL1082**		

Sub-blocks	BIM: Charleville	BLOCK: 127	C, D, E, H, J, K, M, N, O, P, S, T, U, X, Y, Z
		BLOCK: 128	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z
		BLOCK: 129	A, B, C, F, G, H, L, M, N, Q, R, S, V, W, X, Y
		BLOCK: 200	A, B, C, D, E, F, G, H, J, K
		BLOCK: 201	A, B, C, D, F, G, H, J



Legend

- Principal road
- Secondary road
- Environmental Authority 100178150

Santos Tenements

- Exploration Permit
- Production Licence

Certain information in this map is provided under license from third parties and is subject to intellectual property rights. Santos has made every effort to ensure that information is accurate and up-to-date but does not guarantee or warrant the accuracy, completeness or currency of, and takes no responsibility for any error or omission relating to, this map. Santos and its related bodies corporate accept no responsibility for any errors or omissions. The "User" acknowledges that information and maps are in a constant state of change and accepts all limitations. To the maximum extent permitted by law, Santos and its related bodies corporate will not be liable for any cost, loss or damage arising out of the use of this map.

Santos

Queensland

Mahalo

EA Amendment Regional Location

0 25

kilometres

Rev 1 Date: 10/06/2025 File No. ENVIR 1078a.WOR

GDA 2020

Figure 1: Mahalo Regional Location

3.2. Authorised activities

The authorised activities are described in **Table 6** below.

Table 6 Existing authorised activities, scale, intensity and location

Environmental relevant activity/activities	Scale (no. of activities)	Tenure Numbers	Intensity (maximum size in total
Schedule 3 – 08 – A petroleum or GHG storage activity, other than items 1 to 7, that includes an activity from Schedule 2 with an AES	N/A	PL1082, PL1083	N/A
Coal seam gas development wells	190		228ha
Ancillary 63 - Sewage treatment – operating sewage treatment works, other than no release works	N/A		<100 equivalent persons
Stimulation activities	All wells		All wells
Seismic survey activities	N/A		N/A
Incidental petroleum activities that are not otherwise specified relevant activities	N/A		N/A

In addition to the activities listed in Table 6 there is approximately 191 ha of existing disturbance associated with exploration activities on former ATP1191 including concept tanks, exploration wells and access tracks. This information was provided to DETSI in the 2024-25 annual environmental return Report and will not be discussed further in this Report.

4. Proposed Amendment

4.1.1. Proposed activities

The proposed amendment seeks to add new petroleum activities for phase one of the Project including:

- Water treatment plant (reverse osmosis) – capable of treating approximately 1.0 Megalitre (ML) of raw water in a day
- Coal seam gas water (CSG) storage facilities including:
  - brine storage dam A – 90ML storage capacity
  - brine storage dam B – 90ML storage capacity
  - produced water storage dam – 60ML storage capacity
  - blended water storage dam (irrigation water) - 60ML storage capacity
- Gas compression facility
- Helipad
- Accommodation camp
- Vehicle wash bay and laydown areas
- Onsite re-use of residual drilling material
- Ancillary Environmentally relevant activity (ERA) 8 – chemical storage
- Ancillary Environmentally relevant activity (ERA) 15 – fuel burning
- Ancillary Environmentally relevant activity (ERA) 55 – other waste reprocessing or treatment
- Ancillary Environmentally relevant activity (ERA) 62 – resource recovery and transfer facility operation
- Ancillary Environmentally relevant activity (ERA) 63 – water treatment services

- Ancillary linear infrastructure including gas and water flowlines, access tracks, power and communication lines.

The proposed activities, their location and the associated disturbance are described in **Table 7**. The proposed amended EA including proposed changes is provided as **Appendix K** of this Report.

Table 7: Proposed activities, scale, intensity and location

Environmentally relevant Activity	Scale (no. of activities)	Tenure/s	Intensity (size in total)
Gathering, communication and powerlines	As required	PL1082, PL1083	As required
Access tracks	As required		As required
Ancillary 62 - Resource recovery and transfer facility operation - 1(c) - Operating a facility for receiving and sorting, dismantling, baling or temporarily storing category 2 regulated waste		PL1083	22.473 ha
Schedule 3:6 a petroleum activity carried out on a site that contains a high consequence dam or a significant consequence dam if the dam forms part of the activity (required to authorise proposed regulated structures)	4	PL1083	
Ancillary ERA 15 - Fuel Burning: Operating fuel-burning equipment with a design capacity of 500kW or more.	1	PL1083	
Compressor station	1	PL1083	10.42 ha
Irrigation area – CSG water and treated effluent	As required	PL1083	As required
Communication tower	1	PL1083	0.0626 ha
laydown areas	3	PL1083	18.5 ha
Helipad	1	PL1083	0.31ha
Water treatment plant (reverse osmosis)	1	PL1083	Co-located with compressor station
Accommodation camp and effluent irrigation	1	PL1083	13 ha
Ancillary ERA 55 (2)(b) Other waste reprocessing or treatment – For reprocessing brine waste for disposal or for generation into a useable product (more than 5000 t but less than 10,000t)	2	PL1083	
Ancillary ERA 63 – Sewage Treatment (1(b) - Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of more than 100 but not more than 1,500 EP if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme	1	PL1083	
Ancillary 08 - Chemical Storage - 3 - Storing more than 500 cubic metres of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	As required	PL1083	
Ancillary ERA 63 – Sewage Treatment (1(b) - Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of 21 to 100 EP if treated	As required	PL1083, PL1082	

Environmentally relevant Activity	Scale (no. of activities)	Tenure/s	Intensity (size in total)
effluent is discharged from the works to an infiltration trench or through an irrigation scheme			
Total disturbance footprint			**64.7656 ha**

4.1.2. Proposed petroleum activity details and justification

1. **Schedule 3, Item 6 – Regulated structures for brine and water storage**

CSG water processing and storage is an integral part of the water management system for petroleum activities[11], providing operational storage or water balance capacity to ensure the containment of CSG water. CSG is a natural gas that is found in coal deposits[12]. CSG is extracted through wells drilled into coal seams. Production involves the initial extraction of water from the coal seams to reduce the pressure and release gas from the coal. The water and the gas are separated when the CSG is brought to the surface. The water extracted from coal seams in Queensland may be available for a range of uses or require treatment prior to reuse depending on the quality.

Under the proposed amendment, CSG water produced from each gas producing well and reverse osmosis concentrate generated from the reverse osmosis treatment plant will be stored in storage dams that will be constructed and operated in compliance with:

- DETSI guideline structures which are dams or levees constructed as part of environmentally relevant activities (ESR/2016/1934 version 9.04)
- DETSI manual for assessing consequence categories and hydraulic performance of structures (ESR/2026/1933 version 5.03)
- The Queensland Dam Safety Management Guidelines and classification criteria under the Water Supply (Safety and Reliability) Act 2008 to ensure dam integrity and risk mitigation.

The existing EA (**condition I4**) states that regulated structures are not authorised for the Project. This application is seeking to amend condition I4 to allow for the construction and operation of regulated structures to contain, store, or manage CSG water and brine.

A water balance assessment has been undertaken using deterministic calculations that incorporate the CSG water production profile, beneficial re-use, available surface area, average rainfall and evaporation rates. Based on the CSG water production profile, a total of approximately 1,350 megaliters (ML) of CSG water is expected to be generated during the life of the Project (December 2060) with peak flowrate at 0.75ML/day occurring in October 2028. Based on available sampling data, the average/typical water quality of the CSG water to be generated from the Project including any variations is expected to be:

- pH 7.93
- Total dissolved solids (TDS) - 7534 mg/L
- Electrical conductivity (EC) = 12,935 µS/cm @ 25oC.

CSG water storage dams need sufficient volume and depth to buffer short-term flow peaks whilst also maintaining a minimum depth and detention time to achieve the pretreatment requirements of precipitation and settling of solids. The results of the water balance modelling indicate that the Project will require CSG water storage and brine dams as detailed in **Table 8** below:

[11] https://www.des.qld.gov.au/policies?a=272936:policy_registry/rs-po-csg-water-management-policy.pdf
[12] https://www.dcceew.gov.au/water/coal-and-coal-seam-gas/about

Table 8: storage dams

No of structures	Description	Location - MGA2020Zone55
1 x 90ML	Brine dam 1	N7330871 E665454
1 x 90ML	Brine dam 2	N7330899 E665306
1 x 60ML	Produced water storage	N7330639 E665224
1 x 60ML	Blended (treated) water storage for beneficial reuse	N7330611 E665429

Beneficial reuse of treated and blended CSG water will occur through:

- Construction and operational use
  - Drilling
  - Dust suppression
- Water for revegetation during progressive rehabilitation
- Stock-water supply to local landholders
- Irrigation of blended treated water for improved pasture or other suitable crops
- Third party supply.

Beneficial reuse will be optimised to maintain sufficient wet weather storage capacity, especially preceding the summer wet season period. The estimated storage requirements are dependent on the available production rates, rainfall and evaporation data. Rainfall in the Project area can be highly variable and sustained higher than average rainfall may necessitate extra storage capacity. Therefore, CSG water storage capacity and Projected future storage volumes will be continually assessed throughout the life of the Project.

Environmental risks associated with storing brine and CSG water in dams include:

- seepage through the dam walls
- overtopping of dams due to excessive rainfall events
- release due to structural failure
- vertical seepage to groundwater

The proposed structures will be assessed using the *Manual for assessing consequence categories and hydraulic performance of structures ESR/2016/1933, version 5.04* (the manual) as being in one of three consequence categories:

- low
- significant or
- high.

Where categorised as a significant or high consequence, the structure is referred to as a regulated structure. The manual stipulates that a consequence category of a structure must be assessed by a suitably qualified and experienced person (SQEP) and include:

- Documentation of the assessment, including the methodology used, of each of the following failure event scenarios:
  - 'Failure to contain – seepage' – spills or releases to ground and/or groundwater via seepage from the floor and/or sides of the structure
  - 'Failure to contain – overtopping' – spills or releases from the structure that result from loss of containment due to overtopping of the structure
  - 'Dam break' – collapse of the structure due to any possible cause.

At the time of this application, the consequence category for each of the proposed dams has not yet been assessed by a Suitably Qualified and Experienced Person (SQEP). This is because the Project is currently progressing through the Front-End Engineering Design (FEED) phase, and it is not yet known whether any of the proposed structures will meet the definition of a *regulated structure* under the manual.

Santos will engage a SQEP during the FEED phase to undertake the consequence category assessment and provide certification in accordance with the manual. Santos acknowledges the model conditions applicable to regulated structures, specifically dams and levees constructed as part of ERAs, as outlined in the *Guideline: Structures which are dams and levees constructed as part of ERAs* (ESR/2016/1934, version 9.04). Notwithstanding this, Santos is seeking approval to depart from the prescribed model conditions by proposing

alternative conditions I1, I2 and I3 (Appendix K). These alternative conditions are intended to ensure a consistent and standardised approach to the management of regulated structures across all Santos-operated gas fields. Based on operational experience, Santos anticipates that these dams will meet the definition of regulated structures under the manual. Santos is seeking to amend the EA to include additional conditions (I14 to I23). The proposed amended EA is attached as **Appendix K** of this Report.

The locations of the proposed dams (see figure 2) have been selected to avoid impacts on local EVs and to meet landholder requirements. Management (control) strategies, risk sources, potential impacts and the level of risk associated with the proposed amendment are discussed in **section 5** and summarised in **Appendix J** of this Report. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed amendment are classified as 'Very Low'.

2. Ancillary ERA 62: Resource recovery and transfer facility operation

CSG water is a waste that is produced as a by-product of CSG production[13] processes. CSG brine is the waste that is produced as a result of treating CSG water using reverse osmosis (RO) technologies[14]. The proposed RO plant will be used to treat CSG water generated from the Project to a quality required for beneficial reuse. Brine is unsuitable for release to the environment and must be appropriately managed in a dedicated brine dam.

Schedule 9 of the *Environmental Protection Regulation 2019* (EP Reg) identifies brine as a category 2 regulated waste[15]. The proposed amendment is seeking to add ERA 62(1 c) - operating a facility for temporarily storing category 2 regulated waste so that brine can be stored lawfully at the site at an interim basis until a long-term disposal strategy is adopted.

Legislative considerations include:

- *Environmental Protection Act 1994* (EP Act)
- *Waste Reduction and Recycling Act 2011(*WRR Act) and relevant guidelines for the management
- *Environmental Protection Regulation 2019* (EP Reg)
- *Waste Reduction and Recycling Regulation 2023* (WRR Reg)
- Promoting principles of circular economy - Implementation of the *Queensland government's Waste Management and Resource Recovery Strategy*[16] (the waste strategy*)* 2050 targets –
    - 90% of waste is recovered and does not go to landfill
    - 75% recycling rates across all waste types.

The proposed storage dams will be designed, constructed, operated and decommissioned in accordance with the provisions of the EP Act, the manual and the conditions of the EA. This activity forms part of the broader environmental management framework by enabling the safe and lawful temporary handling of Category 2 regulated waste, in compliance with Queensland's waste management and environmental protection legislation. Management (control) strategies, risk sources, potential impacts and the level of risk associated with the proposed amendment are discussed in **section 5** and summarised in **Appendix J** of this Report. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed amendment are classified as low.

3. Ancillary ERA 15 - Fuel burning

Condition D2 of the EA states that a fuel burning or combustion facility must not be operated on any of the tenures related to the EA. The proposed amendment is seeking to amend condition D2 to authorise a fuel burning and combustion facility on PL1083.

The ERA is necessary for the Project and involves combustion of natural gas to generate electricity for gas compression and site operations. Alternative power supply options for the Project were investigated; however, were determined to be unfeasible.

Three Caterpillar industrial gas generator sets (G3512E) will be used to generate approximately 3 megawatts of electricity for the Project. A back up diesel generator is also required to supply power when the generators are offline or during maintenance.

Legislative considerations include:

[13] https://www.detsi.qld.gov.au/policies?a=272936:policy_registry/wr-eowc-irrigation-associated-water.pdf
[14] https://environment.des.qld.gov.au/__data/assets/pdf_file/0025/306466/csg-brine-management-action-plan-2023-33.pdf
[15] Item 40 - non-toxic salts, including, for example saline effluent
[16] Waste Management and Resource Recovery Strategy

- Air quality management in accordance with the *Environmental Protection (Air) Policy 2019*, ensuring emissions are within acceptable limits and do not cause environmental nuisance
- Greenhouse gas emissions and energy Reporting obligations under the *National Greenhouse and Energy Reporting Act 2007 (Cth)*[17], where applicable based on fuel usage thresholds.

Management (control) strategies, risk sources, potential impacts and the level of risk associated with the proposed amendment are discussed in **section 5** and summarised in **Appendix J** of this Report. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed amendment are classified as 'Very Low'.

4. Ancillary ERA 55: Other waste reprocessing or treatment

The proposed amendment is seeking to add ERA 55 operating a facility for receiving and either reprocessing or treating, in a year of more than 10,000t of waste. This ERA is necessary for storing and reprocessing brine waste either for disposal or conversion into a useable product.

Several potential options for managing and reprocessing brine have been investigated by the CSG industry including the following:

- selective salt recovery (reuse)
- ocean outfall (release)
- salt encapsulation (disposal)
- brine injection (disposal).

Each of these options have been considered on their merits regarding environmental, economic, and social benefits. In 2020, an independent review[18] of an industry Report[19] on the management of brine in Queensland identified salt encapsulation i.e. crystalisation of brine into a solid and placement into a purpose-built disposal facility as the most feasible option for long-term CSG brine waste management at that time. In 2023, DETSI in consultation with industry, community groups and academia developed a long-term approach for the management of CSG brine waste 2023 – 2033[20] (the action plan). Under the action plan, industry is expected to continue exploring opportunities to create a more circular economy to reduce, manage and reuse CSG brine.

Accordingly, Santos is applying to authorise ERA 55 on the EA to facilitate ongoing research into other viable long-term options for managing CSG brine from the Project including:

- Research/investigating the viability of waste re-use or recycling through chemically processing or treating brine or salt residues to create useable or saleable products
- Research/investigating the viability of the injection of brine and CSG water into a natural underground structure that is geologically isolated.

If the research/investigation finds these activities to be viable, Santos will apply to amend the EA for these activities to be authorised for the Project.

Legislative considerations include:

- *Environmental Protection Act 1994* (EP Act)
- *Waste Reduction and Recycling Act 2011(*WRR Act) and relevant guidelines for the management
- *Environmental Protection Regulation 2019* (EP Reg)
- *Waste Reduction and Recycling Regulation 2023* (WRR Reg)
- Promoting principals of circular economy - Implementation of the Queensland government's 2050 waste strategy targets –
    - 90% of waste is recovered and does not go to landfill
    - 75% recycling rates across all waste types.

Management (control) strategies, risk sources, potential impacts and the level of risk associated with the proposed amendment are discussed in **section 5** and summarised in **Appendix J** of this Report. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed amendment are classified as low.

5. Ancillary ERA 63: Sewage treatment

[17] https://www.dcceew.gov.au/climate-change/emissions-reporting/national-greenhouse-energy-reporting-scheme
[18] https://environment.des.qld.gov.au/__data/assets/pdf_file/0018/240318/independent-review-brine-salt-management-report.pdf
[19] Queensland Gas: end-to-end water use, supply and management - Report - 2018: the voice of Australia's oil and gas industry
[20] https://environment.des.qld.gov.au/__data/assets/pdf_file/0025/306466/csg-brine-management-action-plan-2023-33.pdf

The proposed amendment is seeking to add ERA 63 which involves the operation of sewage treatment works with a total daily peak design capacity of more than 100 but not more than 1,500 equivalent persons (EP), where treated effluent is discharged to an infiltration trench or through a land irrigation scheme. This category is relevant to the proposed sewage treatment plant (STP) servicing the 300 EP accommodation camp associated with the Project.

This ERA involves the treatment of domestic wastewater from toilets and showers that will be generated on site, with the treated effluent released to land via an above ground irrigation (sprinkler) system. Land-based effluent application is currently the preferred disposal option to manage wastewater in Queensland[21] with irrigation being the most recommended method. Poorly planned and managed effluent irrigation schemes can result in significant environmental degradation. Potential adverse environmental impacts[22] include the following:

- Soil contamination
- Increased soil salinity and sodicity
- Degradation of soil structure
- Environmental nuisance to neighbours from odours
- Contamination to waterways from runoff or overflows from storages
- Contamination to groundwater from leaching of contaminants
- Public health risks due to the presence of pathogenic microorganisms.

Legislative considerations include:

- Effluent quality and discharge management under the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP Water)[23], ensuring protection of environmental values of receiving environments
- Design, monitoring, and operational standards for land-based effluent application in accordance with the Queensland *Water Quality Guidelines for Recycled Water Schemes*[24] and Model Operating Conditions for STPs
- Technical guideline – *Disposal of effluent using irrigation*[25] (Science & Technology, Environmental Monitoring and Assessment Sciences Division, Department of Environment and Science)
- The need for appropriate infrastructure sizing, effluent monitoring, and contingency planning to manage system failures or peak loading events.

The key aspects of the land application scheme include proper design to prevent environmental harm, a monitoring program to track effluent quality and environmental impacts. The Model for Effluent Disposal using Land Irrigation (MEDLI) will be used to design and maintain the effluent disposal scheme. MEDLI will identify the sizing of the irrigation area, soil suitability, daily application rates, wet weather storage and the parameters to be monitored and frequency. Santos is seeking to undertake this activity in accordance with condition PML013 and PML014 of the model operating conditions for ERA 63[26]. These conditions were developed by DETSI in consultation with industry and community groups and are accepted to be sufficient to manage environmental risks associated with disposal of treated effluent to land. Water saving measures will be developed to reduce the volume of effluent generated for disposal.

Waste sludge (biosolids) generated from the proposed STP will be transported offsite for disposal or beneficial reuse[27]. The location of the proposed STP and irrigation area is away from sensitive receptors. Irrigation in accordance with the proposed conditions and MEDLI will ensure that the treated effluent will be sustainably irrigated to land so it does not affect the land or the surrounding environment and allows crops to be grown on the irrigated area. Management (control) strategies, risk sources, potential impacts and the level of risk associated with the proposed amendment are discussed in **section 5** and summarised in **Appendix J** of this Report. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed amendment are classified as 'Very Low'.

6. Re-use of residual drilling material on site

To access resources such as coal seam gas, a well must be drilled from the surface of the earth through layers of soil and rock to the underground resource[28]. In undertaking drilling, waste drill mud is produced. Waste drill mud is

[21] IDisposal of effluent using irrigation, Technical Guideline
[22] https://environment.desi.qld.gov.au/__data/assets/pdf_file/0024/87333/sewage-treatment-plants-factsheet.pdf
[23] https://www.legislation.qld.gov.au/view/pdf/inforce/current/sl-2019-0156
[24] Water quality guidelines for recycled water schemes
[25] Disposal of effluent using irrigation, Technical Guideline
[26] Model operating conditions ERA 63 - Sewage Treatment
[27] Microsoft Word - Biosolids Guidelines Edited - Final 2 with logo.doc
[28] https://environment.desi.qld.gov.au/management/activities/non-mining/coal-seam-gas

a mixture of clay, water and a variety of specialty chemicals called 'additives' as well as material from the parent soil and rock[29]. Drilling fluids in the CSG industry are used to aid tools during the drilling of wells. The main functions of drilling fluids are:

- carrying cuttings from the hole
- cooling and cleaning the drill bit
- reducing friction
- maintaining the stability of the bore
- maintaining down-hole hydrostatic pressure
- to be non-damaging to the formation.

It is expected that about 500 cubic meters of wet cuttings (clay, sand, soil and rock) and 50 cubic meters of drill muds (water and additives) will be generated from the Project.

Santos' operational experience in disposing residual drilling muds to land in other gas fields shows that residual drilling muds contain beneficial micro and macro nutrients such as Potassium that are essential for soils and plant growth. Environmental monitoring has shown no adverse impacts on the soil or crops in relation to the baseline conditions.

The proposed amendment is therefore seeking approval to dispose residual drill muds on PL1082 and PL1083 via an approved method. To manage this activity, Santos is requesting conditions (B23) and (B24) be imposed on the amended EA (see Appendix K). The proposed conditions are consistent with the conditions Waste 16 and Waste 17 (**residual drilling material**) in the DETSI guideline *streamlined model conditions for petroleum activities (ESR/2016/1989 - Version 2.04)*[30]. Condition Waste 16 and Waste 17 are based on standard conditions PESCC 32 and PESCC 33 from the ERA standard for petroleum exploration activities[31]. These conditions were developed by DETSI in consultation with industry and community groups and are accepted to be sufficient to manage environmental risks associated with the beneficial re-use of residual drilling material.

The proposed conditions will ensure that residual drilling muds can only be disposed of onsite if it is certified by an independent suitably qualified third party (SQP) as being of an acceptable quality for disposal to land by a particular method and environmental harm will not result. The assessment by the SQP will include an assessment of environmental risk including:

- chemical composition
- chemical -physical properties (such as pH, solids content, emulsive properties, solubility in water)
- environmental fate and transport
- ecotoxicity (including chronic and acute)
- biodegradation (under anaerobic and aerobic conditions) and consideration of the risk of any metabolites
- potential bioaccumulation
- potential pathway to sensitive receptors and the receiving environment including migration to surface water, groundwater.

The specific location/s where residual drilling muds will be applied are subject to landholder considerations, existing land use/s, cultural heritage and baseline soil surveys. Furthermore, an assessment of residual drilling muds against the criteria in the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (the ASC NEPM)[32] will be undertaken to determine whether the material is suitable for intended use/reuse. If the assessment determines that the material is not suitable for re-use, residual drilling muds will be removed and transported for disposal at a licensed landfill.

The reuse of residual drilling material promotes:

- Compliance with the waste and resource management hierarchy under section 9 of the *Waste Reduction and Recycling Regulation Act 2020* (WRR Act) and relevant guidelines for the management of regulated wastes, including storage time limits and segregation requirements
- Reduction in greenhouse gas emissions from transportation to other facilities
- The principles of circular economy - implementation of the Queensland government's 2050 waste strategy targets –

[29] Characterisation and Management of Drilling Fluids and Cuttings in the Petroleum Industry Characterisation and Management of Drilling Fluids and Cuttings in the Petroleum Industry
[30] https://www.des.qld.gov.au/policies?a=272936:policy_registry/rs-gl-streamlined-model-conditions-petroleum.pdf
[31] https://www.des.qld.gov.au/policies?a=272936:policy_registry/rs-es-petroleum-exploration.pdf
[32] https://www.legislation.gov.au/F2008B00713/latest/text

- 90% of waste is recovered and does not go to landfill
- 75% recycling rates across all waste types.

Management (control) strategies, risk sources, potential impacts and the level of risk associated with the proposed amendment are discussed in **section 5** and summarised in **Appendix J** of this Report. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed amendment are classified as low.

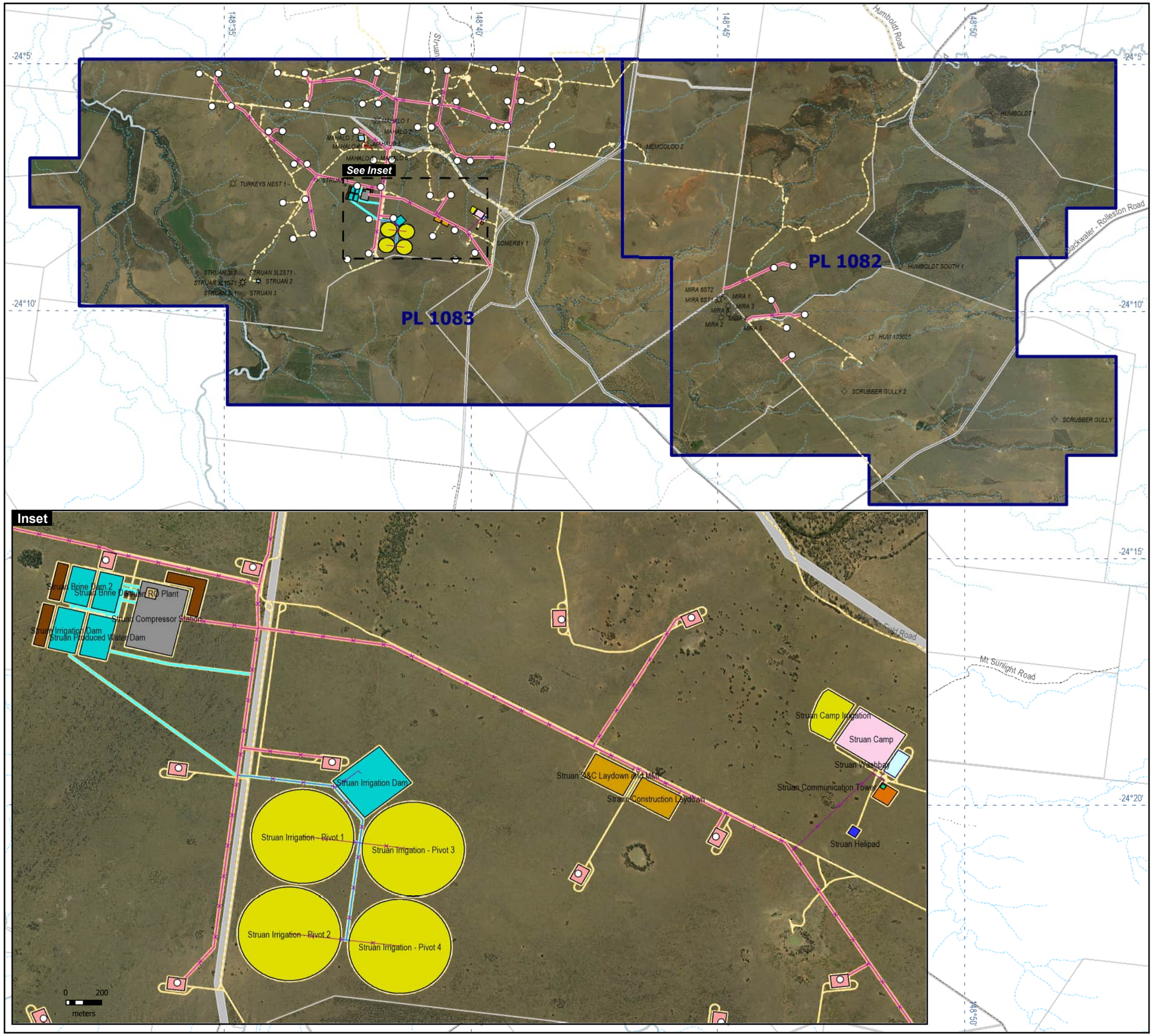
7. Ground disturbance - facilities and infrastructure

The proposed amendment is seeking to authorised ground disturbance associated with the construction of:

- Compressor station
- Accommodation camps
- New access tracks and gathering lines for water, gas, communication and power lines
- Communication tower
- Laydown areas
- Water treatment plant
- Regulated structures.

The Project will require camps, offices, laydown and washdown facilities to support the development and operational phases of the Project. The proposed locations have been carefully selected to avoid impact on EVs by utilising existing pre-disturbed areas. Management (control) strategies, risk sources, potential impacts and the level of risk associated with the proposed amendment are discussed in **section 5** and summarised in **Appendix J** of this Report. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed amendment are classified as 'Very Low'.

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Proposed Infrastructure

- Well
- Access road
- Pipeline
- Powerline
- Water pipeline
- Camp Site
- Communication Tower
- Compressor station
- Concept Tank
- Dam / pond
- Helipad
- Irrigation Area
- Laydown yard
- RO plant
- Tempoary work area
- Topsoil stockpile
- Washdown pad
- Well pad

Authorised Infrastructure

- Well
- Gas Pipeline
- Water Pipeline
- Sealed Road
- Unsealed Road
- Track

Other

- Non-perennial minor watercourse
- Environmental Authority 100178150
- Cadastral Parcel
- Proposed disturbance footprint

Santos

Queensland

Mahalo

EA Amendment

Authorised and proposed Infrastructure

0 5

kilometers

Scale 1:125,000

Rev 2 Date: 26/06/2025 File No. ENVIR 1078b.WOR

GDA 2020

Figure 2: Proposed Infrastructure location

5. Environmental Values

This section provides an overview of the EVs likely to be impacted by the proposed amendment. The EVs identified in this section will be used to inform the assessment of potential impacts from the proposed amendment and management strategies that will be implemented to protect, maintain, or enhance these values.

There is 228 ha of disturbance already allocated within the EA for well pads. The proposed amendment is not expected to have significant impacts on the identified environmental values. Desktop methods and ground truthing surveys were used to assess the presence of EVs within the Project area which included database searches and government environmental Reports (**Appendix A**, **B** and **C**). The EVs identified for the proposed amendment include:

- Air
- Noise
- Land resources
- Threated Ecological Communities
- Regional Ecosystems
- Flora and Fauna
- Matters of State Environmental Significance
- Matters of National environmental Significance
- Water (surface and groundwater)
- Waste
- Greenhouse gas.

Section 9 of the EP Act, defines an EV as:

- a quality or physical characteristic of the environment that is conducive to ecological health; or
- a quality or physical characteristic of the environment that is conducive to public health, safety or amenity; or
- a quality or physical characteristic of the environment that contributes to its biological diversity and integrity, intrinsic or attributed scientific value or interest, amenity, harmony and sense of community; or
- another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation.

Section 5.1 to **5.7** of this Report discusses each EV to be enhanced or protected; the expected risk of impact and measures proposed to mitigate or minimise any impacts.

5.1. Air

Air emissions associated with CSG activities are regulated under the EP Act and the subordinate legislation being the *Environmental Protection (Air Policy) 2019* (EPP Air) and *Environmental Protection Regulation 2019* (EP Reg). Section 6 of the EPP Air 2019 sets the EVs of air to be protected or enhanced. These are:

- Protecting the health and biodiversity of ecosystems
- Human health and wellbeing
- Protecting the aesthetics of the environment, including the appearance of buildings, structures and other property
- Protecting agricultural use of the environment.

Schedule 8 part 3 of the EP Reg identifies the performance outcomes that will achieve the Environmental Objective of operating the activity in a way that protects the environmental values of air. The performance outcomes are:

1. The is no discharge to are of contaminants that may cause an adverse effect on the environment form the operation of the activity; or
2. All of the following:
    a. fugitive emissions of contaminants from storage, handling and processing of materials and transporting materials within the site are prevented or minimised

b. contingency measures will prevent or minimise adverse effects on the environment from unplanned emissions and shut down and start up emissions of contaminants to air

c. releases of contaminants to the atmosphere for dispersion will be managed to prevent or minimise adverse effects on environmental values.

5.1.1. Risks and impacts

If not properly managed, the proposed amendment has potential to impact on the EVs for air by causing environmental harm including nuisance. Section 14 of the EP Act defines environmental harm as any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) an EV and includes environmental nuisance. Section 15 of the EP Act defines environmental nuisance as unreasonable interference or likely interference with an EV caused by:

- Aerosols, fumes, light, noise, odour, particles or smoke or
- An unhealthy, offensive or unsightly condition because of contamination; or
- Another way prescribed by regulation.

Air emissions associated with the proposed amendment area are expected to primarily comprise:

- Exhaust emissions from temporary use of diesel generators, vehicle movement, construction activities involving earth moving machinery
- Stack emissions from the operation of the fuel burning equipment
- Fugitive emissions from wells and associated infrastructure
- Dust generated by machinery operation and vehicle movements during construction
- Greenhouse gas emissions (discussed separately in this Report).

Schedule 1 of the EPP Air, sets the air quality objectives and indicators to be achieved for each EV. Under the EPP Air, the EVs likely to be affected by the proposed amendment includes:

- Protecting human health and wellbeing from emissions such as nitrogen dioxide (NO_2) and carbon monoxide (CO)
- Protecting aesthetic environment from visibility reducing particles such as dust and smoke.

Potential impacts from the proposed amendment during construction and operation includes environmental nuisance from dust, fumes, light and general aesthetic and visual amenity on local roads due to increased traffic movements and vehicle movements in and out of the Project area. Landholders and property owners immediately adjacent to the Project area could notice an increase in traffic movements and vehicles during daylight hours. During nighttime vehicle movements would be reduced and impacts temporary in nature. The nearest sensitive receptor is a commercial facility located 2.4km form the proposed compressor facility. The nearest residential dwelling is located approximately 5.4km form the proposed compressor facility. Impacts from construction activities are expected to be of short duration and management practices will be implemented in accordance with the existing EA to minimise any potential impacts.

Santos engaged Katestone Environmental Australia Pty Ltd (Katestone) to undertake an air quality assessment for the Project. Katestone undertook a comprehensive air quality impact assessment using detailed dispersion modelling of nitrogen dioxide (NO_2) and carbon monoxide (CO) emissions during routine operations and emergency upset conditions (**Appendix I**).

The results indicate that incremental contributions to pollutant concentrations at the nearest sensitive receptors are minimal, remaining well below relevant EPP Air objectives and National Environment Protection Measure (NEPM) standards. Specifically, the highest cumulative NO_2 concentrations at receptors are less than 6% of the 1-hour average criterion, with annual average NO_2 concentrations during routine operations below 14% of the annual standard. CO concentrations are similarly low, with cumulative levels under 3% of the 8-hour average standard.

The Project is situated within a remote rural environment characterised by sparse sensitive receptors, as confirmed by QLD Globe spatial data, and generally good baseline air quality due to limited local pollution sources (Globe, 2025). During construction, the primary air emissions will arise from machinery exhaust and dust generated by vehicle movements, whereas operational emissions are predicted to be minimal due to the use of electrically powered equipment and effective control of fugitive emissions.

During the night, impacts from lighting around the facilities such as warehouse, camps and the compressor station would be noticeable with visible night glow due to little to no other sources of light in a rural environment. However, lighting can be directed down and shielded to reduce light spill into the surrounding environment. Given the distance from the nearest sensitive receptors and that landholders would likely be inside during the night, impacts from lighting from the proposed infrastructure is unlikely to impact on the visual amenity. Whilst there will be a noticeable

night glow from the flare due to the lack of other light sources in the rural environment at night, the selection of a ground flare means that the likelihood of impact further afield is very low, the frequency of which flaring would occur under normal operating conditions is also very low.

With implementation of the air quality management measures detailed below, the residual risk of adverse air quality impacts is assessed to be low, with no significant deviation from baseline conditions expected in either magnitude or duration. Annual monitoring for point source emissions for oxides of Nitrogen (NOx) as Nitrogen dioxide mass emission rates will be undertaken on annual basis to assess compliance.

5.1.2. Management practices

Section 8 of the EPP Air outlines the management hierarchy for an activity involving air emissions that affect or may affect an EV to be enhanced or protected. To the extent that is reasonable to do so, the EPP Air requires:

- Firstly – avoid air emissions, for example by using technology that avoids air emissions
- Secondly – recycle air emissions for example by re-using air emissions in another industrial process,
- Thirdly – minimise air emissions for example by using technology, materials or industrial process that minimise air emissions; and
- Fourthly – managing air emissions for example, by:
    i. locating a thing that releases air emissions in a suitable area to minimise the impact of the air emissions
    ii. treating air emissions before release
    iii. dispersing air emissions to minimise the impact of the air emissions.

The operation of the compressor station and the fuel burning equipment are expected to be the main source of emissions to air. The air emissions from the proposed amendment cannot be avoided, however, during the planning stage, several locations in the Project area were investigated (E669646, N7329930, E666583, N7331403 and E665723, N7330716) for siting the gas compression facility and fuel burning equipment to avoid impact on EVs for air. Following air impact modelling, field surveys and landowner considerations, the proposed location (E665723, N7330716) was identified as a suitable area that meets the objectives of EPP Air by minimising the impact of the air emissions on EVs.

A ground flare (instead of elevated flare) was selected to avoid the impacts from light, aesthetic amenity and air emissions. The equipment selected for the fuel combustion and gas compression is in accordance with current industry standards and best practice technology. The proposed activities will be managed in accordance with the conditions A5, A15, A20 (existing conditions), D2 and D3 (proposed new conditions) of the EA to ensure that the release of odour, dust, light or any other air borne contaminants will not have an impact on EVs.

The proposed development and associated infrastructure will be managed to minimise impacts to air quality throughout both construction and operational phases. The following additional measures have been implemented to reduce air emissions and manage environmental risk:

- Electrically driven motors powered by the local transmission network will be used for well operation and ancillary infrastructure, eliminating the need for on-site fuel-burning equipment
- The facility has been sited away from sensitive receptors and environmentally sensitive areas. Environmental constraints, GIS mapping, and landholder input has guided infrastructure placement to avoid or minimise exposure to these areas
- Use of a ground enclosed flare instead of an elevated flare to reduce light and smoke emissions
- Emissions from vehicles, plant, and equipment will be minimised through strict maintenance schedules, ensuring all machinery operates efficiently and within design specifications. Equipment will be kept in good working order to prevent excessive emissions
- Fugitive emissions will be controlled through best-practice well design and construction methods. All works will be conducted in line with applicable industry standards, including the Queensland Code of Practice for the Construction and Abandonment of Petroleum Wells[33] and the Code of Practice for Leak Management, Detection and Reporting[34]
- Dust control will be managed using suppression methods such as water application
- Disturbance to land will be carefully managed and minimised through phased construction and progressive rehabilitation, reducing the overall footprint and duration of exposure to wind erosion.
- Annual monitoring of mass emission rates for NOx
- Any waste gas generated during operations will be flared in accordance with Condition D1 of the EA.

[33] https://www.resources.qld.gov.au/__data/assets/pdf_file/0006/1461093/code-of-practice-petroleum-wells-bores.pdf
[34] https://www.rshq.qld.gov.au/resources/documents/petroleum-and-gas/safety-and-health/code-of-practice-leak-management.pdf

While the proposed amendment introduces new emissions to air, the implementation of the management strategies means that the potential impacts to EVs for air will not change beyond those authorised by the existing EA. Management (control) strategies, risk sources, potential impacts and the level of risk associated with the proposed amendment are summarised in **Appendix J**. The results of the risk assessment indicate that residual risks to air EVs as a result of the proposed activities are classified as 'Very Low'.

All activities will be undertaken in accordance with the operational and monitoring conditions of the EA. Impacts on EVs for air from the Project before this amendment will not change or increase due to the proposed amendment.

5.1.3. Rehabilitation and Maintenance Commitments

The following rehabilitation and maintenance commitments will be adhered to for the duration of the Project:

- Exposed and disturbed land will be rehabilitated at the earliest practicable opportunity to reduce dust generation and wind erosion risks
- All machinery and vehicles will be equipped with appropriate emission control systems and maintained as part of a preventative maintenance program to ensure continued operational efficiency
- Where feasible, low-emissions technologies will be prioritised during Project planning and execution
- In response to any air quality complaints or suspected environmental nuisance incidents, prompt investigation and Reporting will occur in line with EA requirements. All air quality-related complaints will be documented and addressed in a timely and compliant manner.

5.2. Noise

Noise emissions associated with CSG activities are regulated under the EP Act and the subordinate legislation being the Environmental Protection (Noise) Policy 2019 (EPP noise) and EP Reg. Section 6 the EPP Noise describes the EVs that are to be protected or enhanced are:

- The qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystem
- The qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to do any of the following:
    - Sleep
    - study or learn
    - be involved in recreation, including relaxation and conversation
- The qualities of the acoustic environment that are conducive to protecting the amenity of the community.

Schedule 8 part 3 of the EP Reg sets the performance outcomes that will achieve the Environmental Objective of operating the activity in a way that protects the EVs of the acoustic environment. These are:

1. Sound from the activity is not audible at a sensitive receptor; or
2. The release of sound to the environment from the activity is managed so that adverse effects on environmental values, including health and wellbeing and sensitive ecosystems, are prevented or minimised.

5.2.1. Risks and impacts

If not properly managed, the proposed amendment has potential to impact on the EVs for noise by causing environmental harm, including nuisance. Section 14 of the EP Act defines environmental harm as any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) an EV and includes environmental nuisance. Section 15 of the EP Act defines environmental nuisance as unreasonable interference or likely interference with an EV caused by:

- Aerosols, fumes, light, noise, odour, particles or smoke; or
- An unhealthy, offensive or unsightly condition because of contamination; or
- Another way prescribed by regulation.

Schedule 1 of the EPP noise, sets the acoustic quality objectives at sensitive receptors and the EV to be protected. The acoustic EVs identified for the proposed amendment include:

- Residential receptors (indoor and outdoor) – daytime, evening and night-time
- Commercial and retail activity – when the activity is open for business.

Acoustic impacts from the proposed amendment during construction and operation includes environmental nuisance. Impacts from construction activities are expected to be minimal and of short duration. The operation of the compressor station and flare are expected to be the main source of noise emissions during operation.

Santos engaged Patching Associates Acoustical Engineering Pty Ltd (Patching) (see **Appendix E**) to undertake a noise impact assessment Report for the operation phase of the proposed compressor station facility and the flare. To meet the EPP noise objectives, noise emissions from several locations (E669646, N7329930, E666583, N7331403 and E665723, N7330716) were modelled to understand the impacts on sensitive receptors (**Figure 3**). The chosen location ((E665723, N7330716) is away from sensitive receptors and will not result in adverse noise impacts under normal or upset conditions. Noise modelling demonstrates that predicted sound pressure levels will remain below the permissible sound level (PSL) of 28 dBA for night-time noise between 10pm and 6 am at all identified sensitive receptors for all routine and non-emergency scenarios, ensuring the protection of environmental values related to acoustic amenity.

Alternative arrangements will be in place for a noise scenario where the PSL is exceeded in accordance with condition A15 of the existing EA. Overall, the facility is expected to operate in accordance with current EA conditions, with negligible risk of impacts to surrounding sensitive receptors. No blasting is proposed under the proposed amendment.

5.2.2. Management strategies

Section 8 of the EPP Noise outlines the management hierarchy for an activity involving noise that affects or may affect an environmental value to be enhanced or protected under the policy. To the extent that is reasonable to do so, the EPP Noise requires that noise emissions must be dealt with in the following order of preference:

- Firstly – avoid noise, for example by locating an industrial activity in an area that is not near a sensitive receptor
- Secondly – minimise the noise in the following order
    - Firstly – orientate an activity to minimise the noise for example by facing a part of an activity to minimise the noise
    - Secondly – use best available technology to minimise the noise
- Thirdly – manage the noise for example by using heavy machinery only during business hours.

Section 9 of the EPP Noise outlines the management intent for an activity involving noise that affects or may affect an EV to be enhanced or protected under the policy. To the extent it is reasonable to do so, noise must be dealt with in a way that ensures:

- The noise does not have any adverse effect, or potential adverse effect on an EV
- Background creep (general gradual increase in the total amount of background noise) in an area or place is prevented or minimised.

Operation of camps and other incidental activities such offices may have minor noise sources associated with their operations such as diesel generators. These noise sources will be selected to avoid noise by using less noisy equipment and inclusion of appropriate noise abatement technology (e.g. exhaust silencers). Sources of noise from incidental activities are also located with sufficient separation distances to sensitive receptors to avoid amenity noise impact.

The operation of the compressor station and the associated flare is expected to be the main source of noise emissions to be managed. These emissions cannot be avoided, however, during the planning stage, several locations in the Project area were investigated (E669646, N7329930, E666583, N7331403 and E665723, N7330716) for siting the gas compression facility and flare to avoid or minimise impact on EVs for noise.

Following noise impact modelling, field surveys and landowner feedback, the proposed location (E665723, N7330716) was identified as a suitable area that meets the objectives of EPP Noise. Key design measures include:

- Locating the facility away from sensitive receptors
- Use of a ground flare instead of an elevated flare.

The equipment selected for the fuel combustion and gas compression is in accordance with current industry standards and best practice technology. To ensure compliance with the acoustic objectives under the EPP Noise during normal operations, the facility has been designed to comply with condition A15, C1 and C2 of the existing EA. Noise modelling confirms that these measures are sufficient to meet acoustic objectives under all routine and upset operating scenarios.

During maximum flaring events however, which are expected to be infrequent (once or twice a year) and short in duration (less than 15 minutes), cumulative Sound Pressure Levels may exceed the EA Permissible Sound Levels

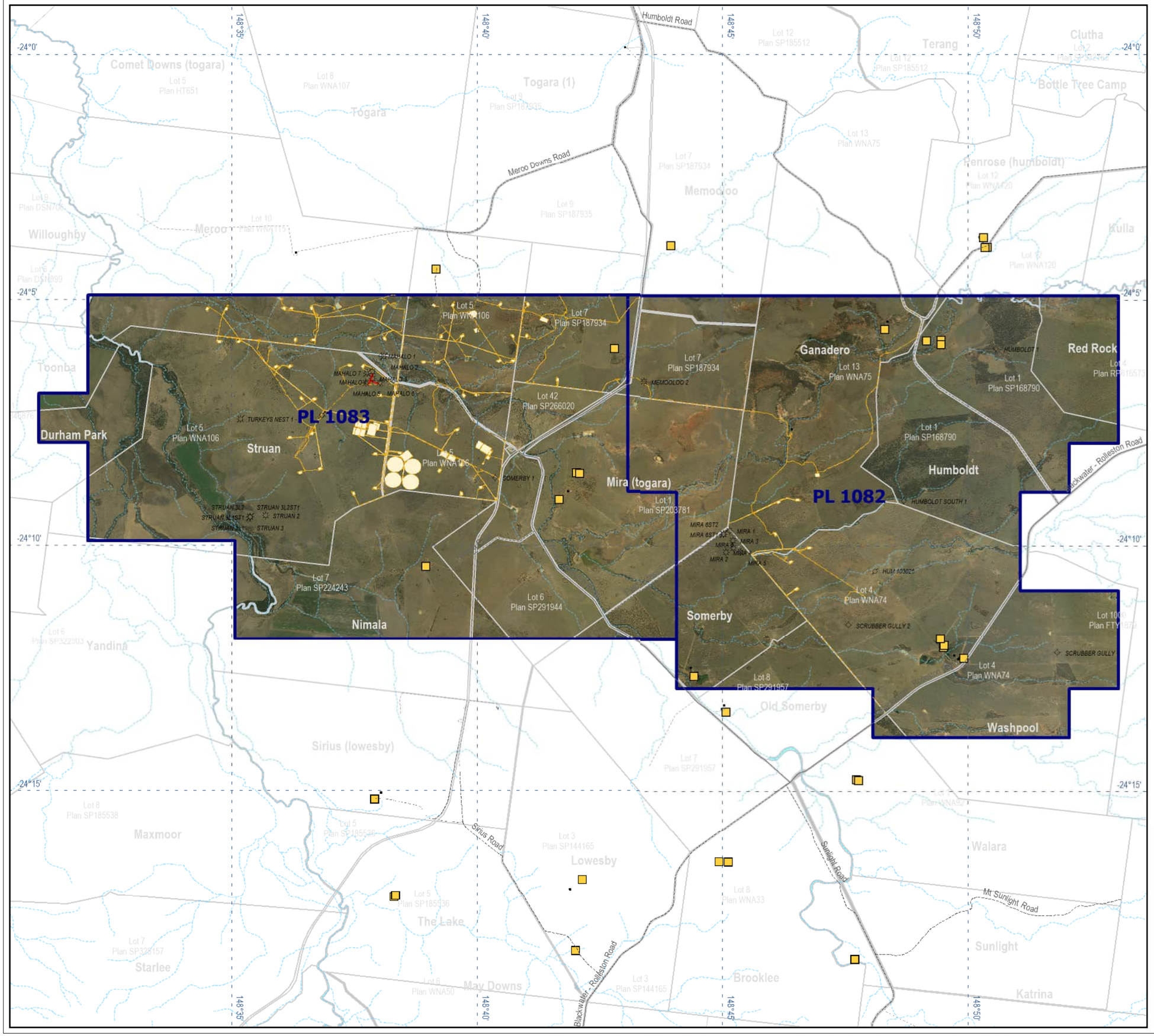
at some receptors. Although these exceedances are allowable under the EA provided their duration remains under 15 minutes and is infrequent, the following management controls will be implemented to minimise potential impacts:

- Limit flaring to the shortest duration required for safe operation
- Undertake flaring during periods of low sensitivity such as avoiding nighttime flaring where practicable
- Maintain equipment to manufacturer's specifications to avoid unnecessary noise generation
- Respond to and investigate any noise complaints in accordance with Santos' environmental incident and complaints management procedure.

While the proposed amendment introduces new noise emissions, the implementation of the management strategies means that the potential impacts to EVs for noise will not change beyond those authorised by the existing EA. Management (control) strategies, risk sources, potential impacts and the level of risk associated with the proposed amendment are summarised in **Appendix J**. The results of the risk assessment indicate that residual risks to noise EVs as a result of the proposed activities are classified as 'Very Low'.

These measures collectively ensure that the facility continues to operate in compliance with environmental authority conditions and maintains the acoustic amenity of the surrounding area. All activities will be undertaken in accordance with the operational and monitoring conditions of the EA. Impacts on EVs for noise from the Project before this amendment will not change or increase due to the proposed amendment.

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Overview



Legend

- Building
- Principal place of residence
- Well
- Gas Pipeline
- Water Pipeline
- Sealed Road
- Unsealed Road
- Track
- Non-perennial minor watercourse
- Environmental Authority 100178150
- Cadastral Parcel
- Proposed disturbance footprint

Santos

Queensland

Mahalo

EA Amendment
Sensitive Receptors

0 5

kilometers

Scale 1:125,000

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Figure 3: Sensitive Noise receptors in relation to proposed activities

5.3. Land

Under the DETSI guideline – *application requirements for activities with impacts to land (ESR/2015/1839)*[35], land includes characteristics of the landscape, such as topography or vegetation and ecosystems that it supports as well as the chemical and physical properties of soils.

Schedule 8 part 3 of the EP Reg, sets the performance outcomes for achieving the Environmental Objective of carrying out the activity in a way that protects the EVs of land, including soils, subsoils, landforms and associated flora and fauna. These are:

1. There is no actual or potential disturbance or adverse effect to the EVs of land as part of carrying out the activity; or
2. All of the following apply –
    a. activities that disturb land, soils, subsoils, landforms and associated flora and fauna will be managed in a way that prevents or minimises adverse effects on the EVs of land;
    b. areas disturbed will be rehabilitated or restored to achieve sites –
        i. that are safe and stable; and
        ii. where no environmental harm is being caused by anything on or in the land; and
        iii. that are able to sustain an appropriate land use after rehabilitation or restoration;
    c. the activity will be managed to prevent or minimise adverse effects on the EVs of land due to unplanned releases or discharges, including spills and leaks of contaminants;
    d. he application of water or waste to the land is sustainable and is managed to prevent or minimise adverse effects on the composition or structure of soils and subsoils.

The Project area has been subject to extensive historical disturbance as a result of broad scale clearing and ongoing agricultural operations. Approximately 93% of the Project tenures area has been cleared of vegetation with some relatively small areas of remnant vegetation present across watercourses. The current land use across the Project area and its surrounds includes predominantly grazing of native vegetation, with areas also used for cropping, residential purposes, water storage (reservoirs/dams), nature conservation, and managed resource protection.

5.3.1.1. Soils

The Project area encompasses a range of landforms, including alluvial floodplains, gently to moderately undulating plains, and elevated mesa-like features. These landforms are associated with a variety of soil types that influence land use capability, vegetation patterns, and rehabilitation planning. Dominant soils include uniform cracking clays, duplex profiles with hard-setting surface horizons, and gradational red soils. Key characteristics such as drainage, texture, and subsoil mottling vary across the landscape. A summary of the mapped soil units and their dominant characteristics is provided in **Table 8** below and show in **Figure** 5.

Table 8: Soils PL1083 and PL1082

Map Code	Map Code Description	Dominant soil Description
CC21	Gently undulating or level plains	Uniform fine cracking, smooth faced peds, grey clay horizon underlain by grey/mottled clay
CC23	Level alluvial flood-plains associated with major streams often dissected by numerous braided channels & mostly subject to irregular flooding	Uniform fine cracking, smooth faced peds, grey clay horizon underlain by grey/mottled clay
My21	Undulating elevated plains with some steep-scarped dissected margins & occasional low mesa-like residual hills	Gradational red, no A2 horizon, neut massive earth whole col B horizon
Ub67	Gentle to moderately undulating plains	Dduplex yellow-grey, hard setting A horizon, A2 horizon conspic

[35] https://www.des.qld.gov.au/policies?a=272936:policy_registry/era-gl-land-impacts.pdf

Map Code	Map Code Description	Dominant soil Description
		bleached, neut pedal mottled B horizon
Kd8	Gentle or moderately undulating lands	Uniform fine cracking, smooth faced peds, dark clay horizon underlain by brown/mottled clay
Oc24	Gently undulating to undulating lands with occasional low gravelly rises	Duplex red, hard setting A horizon, A2 horizon sporadic bleached, alk pedal whole col B horizon
MM7	Moderate to gently undulating lowlands & plains	Uniform fine cracking, smooth faced peds, brown clay horizon redder than 1.5m deep

The proposed amendment has the potential to impact land environmental values, particularly soil condition, structure, and stability. In accordance with the *Land Guideline* (ESR/2015/1839) and the existing EA, appropriate soil management and rehabilitation practices will be implemented to avoid or mitigate these impacts and to ensure that disturbed land is returned to a stable and non-polluting condition. While the proposed amendment introduces new significant disturbance to land and land releases, the implementation of the management strategies means that the potential impacts to EVs for land will not change beyond those authorised by the existing EA.

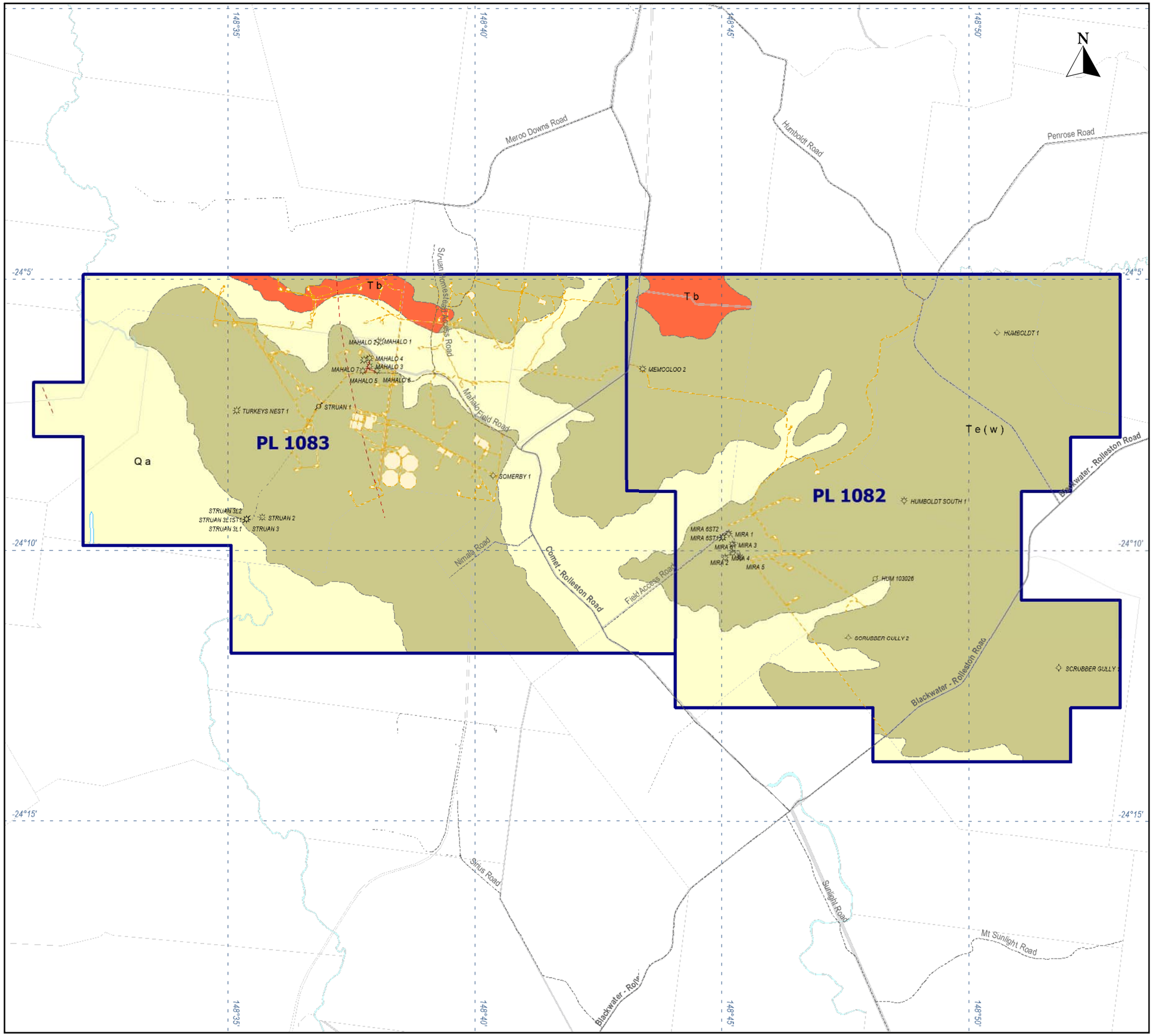
Management (control) strategies, risk sources, potential impacts and the level of risk associated with the proposed amendment are summarised in **Appendix J**. The results of the risk assessment indicate that residual risks to land EVs as a result of the proposed activities are classified as 'Very Low'.

5.3.1.2. Geological setting

The Detailed surface geology – Queensland (2015) spatial database mapping layer

Figure 4) identifies the Survey area as being dominated by quaternary alluvium associated with the local Creeks running in a north-westerly direction across the centre of the Survey area (Qa-QLD) (land zone 3) (Appendix A Table 3.1). Either side of this relatively young soils are derived from deeply weathered fluviatile and lacustrine claystone and siltstone, quartzose sandstone, pebbly sandstone, gravel, lignite, oil shale, interbedded basalt (Emerald Formation) that give rise to large flat plains of deep vertosol clays that variously supplied gilgai formations (Land zone 5). There minor occurrences of soils derived from a tertiary basalt flow that gives rise to a gently undulating landscape of black clay soils Tb-QLD (Land zone 8).

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Legend

- Well
- Gas Pipeline
- Water Pipeline
- Sealed Road
- Unsealed Road
- Track
- Environmental Authority 100178150
- Cadastral Parcel
- Proposed disturbance footprint

Detailed structure

- Anticline concealed
- Geological boundary approximate
- Lake, lagoon or waterhole

Detailed surface geology

- Mostly olivine basalt flows and some plugs; some areas of nephelinite, basanite etc
- Clay, silt, sand and gravel; flood-plain alluvium
- Deeply weathered fluviatile and lacustrine claystone and siltstone, quartzose sandstone, pebbly sandstone, gravel, lignite, oil shale, interbedded basalt (possibly a correlative of the Duaringa Formation)

Santos

Queensland

Mahalo

EA Amendment Geology

0 5

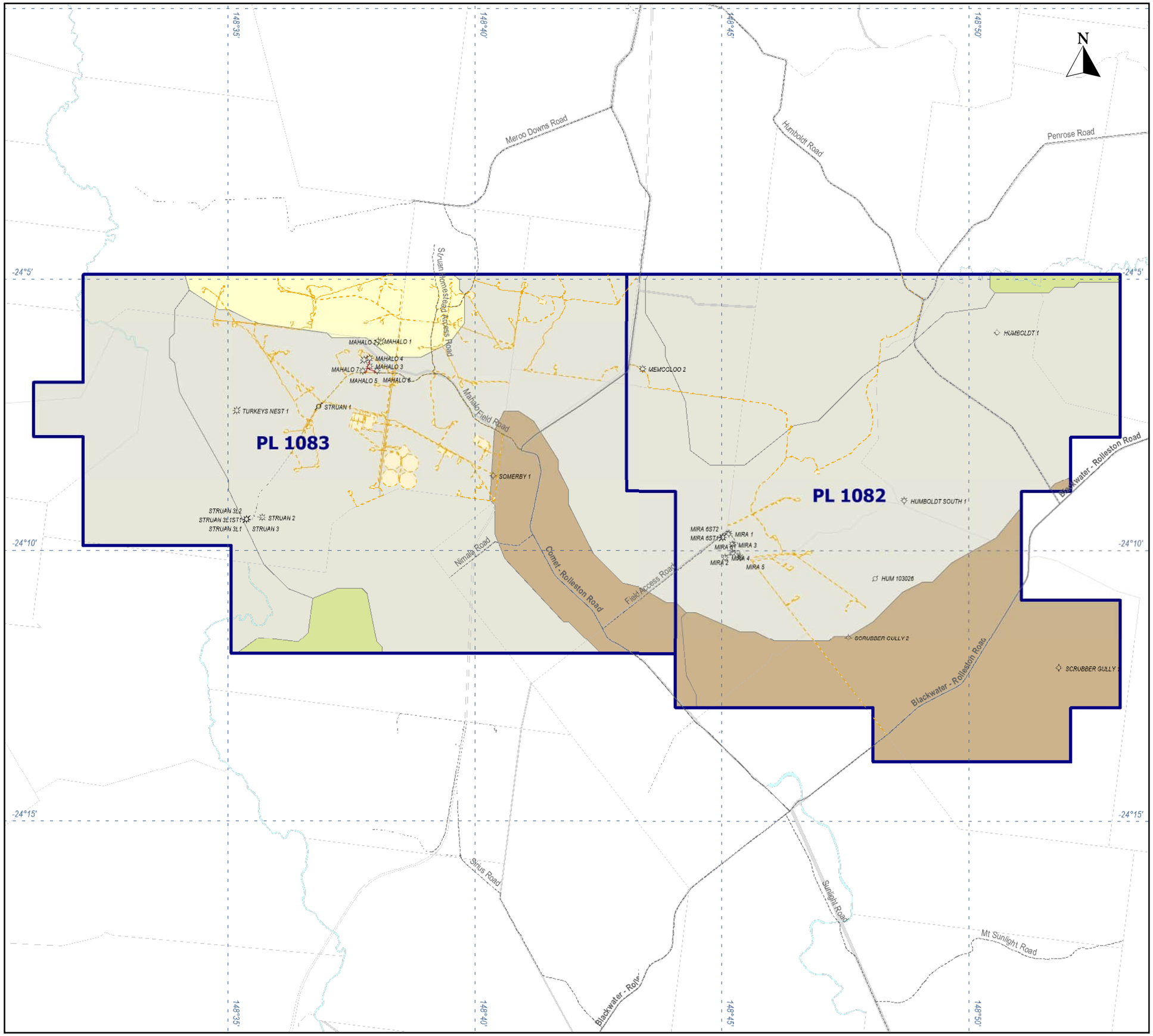
kilometers

Scale 1:125,000

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Figure 4: Geology



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Legend

- Well
- Gas Pipeline
- Water Pipeline
- Sealed Road
- Unsealed Road
- Track
- Environmental Authority 100178150
- Cadastral Parcel
- Proposed disturbance footprint

Soils

- Dermosol
- Kandosol
- Sodosol
- Vertosol

Santos

Queensland

Mahalo

EA Amendment Soils

0 5

kilometers

Scale 1:125,000

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Figure 5: Soils

5.3.2. Risks and impacts

The EVs identified that are likely to be impacted by the proposed amendment include:

- Existing land use/s
- Soil health and function and the ability for soil to sustain growth of native vegetation, crops and other flora
- Flora including vegetation communities
- Natural interaction of the affected land with other ecosystems including surface and groundwater
- Fauna including fauna present, pest species
- Regioncal ecosystem distribution
- Prescribed environmental matters

Activities that have the potential to impact on land EVs associated with the proposed amendment includes clearing and significant disturbance to land through the construction and operation of:

- Brine and CSG water storage structures
- Accommodation camp
- Irrigation of treated CSG water and treated sewage effluent
- Access tracks and gathering lines
- Re-use of residual drilling material through application to land
- Laydown areas.

Proposed disturbance may temporarily reduce the availability of land for agriculture. However, these impacts would be managed by commercial agreements between Santos and the affected landholder in accordance with the land access code[36] made under section 36 of the *Mineral and Energy Resources (Common provisions) act 2014*[37].

The potential impacts to land resource environmental values resulting from the amendment may include:

- soil erosion, topsoil loss, inversion and compaction
- disturbance to land use and suitability changes
- re-use of residual drilling material
- release of pipeline wastewater from low point drains
- disposal of CSG water to land through irrigation
- release of treated sewage effluent
- introduction of pests and weeds
- reduction in agricultural productivity
- release of contaminated stormwater
- changes to natural overland flow.

[36] https://www.nrmmrrd.qld.gov.au/__data/assets/pdf_file/0004/442633/land-access-code-2023.pdf
[37] https://www.legislation.qld.gov.au/view/html/inforce/current/act-2014-047

5.3.2.1. Management strategies

Through desktop assessments, field surveys and discussion with the landholder, the location of the proposed infrastructure avoids significant impact on Matters of National Environmental Significance (MNES), Matters of State Environmental Significance (MSES), threatened ecological communities (TECs), Regional Ecosystems and endangered fauna habitat. While the final configuration and location may change due to unforeseen constraints (e.g. cultural heritage sites) or engineering requirements, any new locations will be selected to avoid or minimise any impact on protected matters.

Potential direct impact to land will be of a short duration associated with clearing and construction activities. To minimise soil degradation and promote recovery of land values, the following measures will be implemented:

- Stripping and stockpiling of topsoil and subsoil separately to preserve soil structure and biological integrity
- Stabilisation of long-term stockpiles via groundcover seeding or mulching to minimise erosion
- Erosion and sediment control structures will be designed, installed and maintained in accordance with *International Erosion Control Association Best Practice Erosion and Sediment Control Guidelines*[38](IECA)
- Restricted vehicle access to designated areas to reduce compaction
- Progressive rehabilitation of disturbed areas, with minimal delay following cessation of construction or operational use
- Dust suppression measures will be applied to minimise dust generation
- Unauthorised releases of contaminants cleaned up as soon as reasonably practicable
- Construction activities shall be planned to minimise disturbances to natural vegetation cover
- Cut-off drains and bunds will be constructed as early as possible to prevent erosion during construction
- Re-establishment of surface drainage lines
- Application of residual drilling material to land will be undertaken in accordance with:
    - the proposed new conditions B24
    - landholder requirements
    - minimum application rates to minimise leaching and runoff
    - weather conditions - for example no application during or after rainfall events
- Treated effluent will be applied to land in accordance with MEDLI
- Residual drilling material and drilling fluids will be stored in accordance with condition B3
- Pipeline wastewater from low point drains will be released to land in accordance with condition B6
- Treated CSG water will be reused in accordance with the proposed conditions by ensuring:
    - Soil structure, stability and productive capacity can be maintained or improved
    - Toxic effects to crops do not result
    - Yields and produce quality are maintained or improved
- Release of treated effluent to land will be in accordance with the proposed new conditions B18 to B21
- Significant disturbance to land and the proposed land releases will be in accordance with condition A14, B1 (existing conditions), B11, B12, B19, B20, B21 and B24 (proposed new conditions).
- Chemicals and fuels will be stored and effectively contained to meet the Australian standard where such a standard is applicable

Management (control) strategies, risk sources, potential impacts and the level of risk associated with the proposed amendment are discussed and summarised in **Appendix J** of this Report. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed amendment are classified as 'Very Low'.

5.3.2.2. Rehabilitation

Land disturbance for the proposed additional disturbance activities would be rehabilitated in accordance with Condition J2 of the EA to conserve soil resources and re-establish existing contours consistent with surrounding landforms:

> *Transitional rehabilitation*
>
> *(J2) Significantly disturbed areas that are no longer required for the on-going petroleum activities, must be rehabilitated within 12 months (unless an exceptional circumstance in the area to be rehabilitated (e.g. a flood event) prevents this timeframe being met) and be maintained to meet the following acceptance criteria:*
>
> *(a) contaminated land resulting from petroleum activities is remediated and rehabilitated*

[38] https://www.austieca.com.au/documents/item/1138

(b) the areas are:

i) non-polluting

ii) stable landform

iii) re-profiled to contours consistent with the surrounding landform

(c) surface drainage lines are re-established

(d) topsoil is reinstated; and

(e) either:

i) groundcover, that is not a declared pest species, is growing; or

ii) an alternative soil stabilisation methodology that achieves effective stabilisation is implemented and maintained.

5.4. Waste

Waste management is an integral part of the Project and is taken into consideration during construction, operation and through the eventual decommissioning of the Project's activities. Santos is committed to the reduction of waste generated through recovering, re-using, recycling and efficient utilisation of all resources. Santos aims to promote best practice disposal methods for CSG water, residual drilling material and treated effluent through appropriate maintenance of waste disposal areas and off-site through utilising environmentally responsible waste management contractors. This section provides a summary of likely waste streams to be generated by the Project, and proposed waste management and mitigation measures to prevent or minimise impact on EVs.

In Queensland waste associated with CSG activities are regulated under key pieces of legislation including:

- *Environmental Protection Act 1994* (EP Act)[39]
- Environmental Protection Regulation 2019 (EP Regulation)[40]
- *Waste Reduction and Recycling Act 2011* (WRR Act)[41]
- Waste Reduction and Recycling Regulation 2023 (WRR Regulation)[42]
- Coal seam gas water management policy 2012[43]
- Queensland government's coal seam gas brine action plan 2023-2033[44]
- The National Environment Protection (movement of controlled waste between States and Territories) Measure (NEPM)[45]

The EP Act aims to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (being ecologically sustainable development). The WRR Act aims to promote waste avoidance and reduction and to encourage resource recovery and efficiency.

Under section 8AA of the WRR Act;

- 'Waste' is defined as anything that
  - is left over, or is unwanted by-product from an industrial, commercial or other activity
  - is surplus to industrial, commercial, domestic or other activity generating the waste,
- however, waste does not include a resource, or a thing prescribed by regulation not to be a waste
- waste can be a gas, liquid, solid or energy, or a combination of any of them.

Schedule 8 part 3 of the EP Reg sets the performance outcome that will achieve the Environmental Objective that any waste generated, transported or received as part of an activity is managed in a way that protects all EVs. Under this section, both of the following apply:

- waste generated, transported or received is managed in accordance with the waste and resource management hierarchy under the WRR Act; and

[39] https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-1994-062
[40] https://www.legislation.qld.gov.au/view/pdf/inforce/current/sl-2019-0155
[41] https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-2011-031
[42] https://www.legislation.qld.gov.au/view/pdf/inforce/current/sl-2023-0127
[43] https://www.des.qld.gov.au/policies?a=272936:policy_registry/rs-po-csg-water-management-policy.pdf
[44] https://environment.des.qld.gov.au/__data/assets/pdf_file/0025/306466/csg-brine-management-action-plan-2023-33.pdf
[45] https://www.nepc.gov.au/sites/default/files/2022-09/mcw-nepmvar-mcw-nepm-varied-final-200412.pdf

- if waste is disposed of, it is disposed of in a way that prevents or minimises adverse effects on EVs.

The NEPM provides a basis for ensuring that controlled wastes which are to be moved between States and Territories are properly identified, transported, and otherwise handled in ways which are consistent with environmentally-sound practices for the management of these wastes. The existing EA includes conditions that govern waste management for the Project. The proposed amendment includes a change to waste management practices during construction and operation, including the reuse of residual drilling material, CSG water irrigation and treated effluent disposal. A waste management plan for the Project will be developed in accordance with the EA, the EP Act and the WRR Act.

Waste generation

Waste generation will occur throughout construction, operation and decommissioning of each of the Project activity. The principal waste generating activities from the proposed amendment can be broadly classified as:

- Project construction activities
- CSG well drilling
- CSG production/extraction
- Gas processing
- Water treatment by reverse osmosis
- Sewage treatment
- Pipeline waste water from low point drains
- Activities incidental to construction and operation such as camps, office facilities
- Asset decommissioning and abandonment activities.

Each of these activities generate a variety of waste products that can be categorised as being one of the following three categories:

- **Regulated waste** – wastes listed schedule 9[46] of the EP Regulation. Regulated wastes are subject to specific storage, transport and Reporting requirements and require careful on-site management due to the hazards associated with them. Regulated wastes may be recyclable or disposable. The EP Regulation also defines 'limited regulated waste'. Up to 10% of the total amount of waste received at a general waste disposal facility in a year can be limited regulated waste. The definition of limited regulated waste includes the following specific regulated waste types:
    - animal effluent and residues, including abattoir effluent and poultry and fish processing waste
    - asbestos
    - food processing waste
    - quarantine waste that has been rendered non-infectious
    - sewage sludge or residue produced in carrying out an ERA to which an environmental authority for sewage treatment applies
    - tyres
- **General recyclable waste** – wastes that are not regulated and able to be reused, reconditioned, or reprocessed.
- **General waste** – wastes that are not regulated and cannot be recycled. General disposal waste is comprised of two main waste streams: putrescible (i.e., something that can decay) and non-putrescible.

The waste types expected to be generated as part of the Project are listed in **Appendix G**:

5.4.1.1. Risks and impacts

The environmental hazards and risks on EVs from different waste types vary considerably. Generally, the necessary level of management needed reflects the potential risks from the waste. For example, inert construction and demolition waste such as uncontaminated concrete, soil and rubble has potential to cause dust nuisance. Chemical waste such as paints, oils can potentially threaten both surface and ground water if not properly contained. Greenhouse gas emissions (GHG) from manufacturing and transport of waste to and from the Project.

EVs to that are to be protected or enhanced that can potentially be impacted by waste from the proposed amendment include:

- Water – contamination of surface and groundwater can potentially occur if:
    - waste is not stored and contained appropriately
    - unauthorised release of contaminants such as brine and untreated CSG water

[46] https://www.legislation.qld.gov.au/view/html/inforce/current/sl-2019-0155#sch.9

  - stormwater is not appropriately managed before release
  - unplanned spills of produced water, hydrocarbons, chemicals are not cleaned appropriately
  - effluent is not appropriately treated before releasing to land
- Land – contamination of soils can potentially occur if:
  - waste is not stored and contained properly
  - unauthorised release of contaminants such as brine and untreated CSG water
  - stormwater is not appropriately managed before release
  - effluent is not appropriately treated before releasing to land
  - excessive nutrient loading from the treated effluent
  - irrigation of CSG water that does not comply with the release criteria
- Health and wellbeing – health and wellbeing can potentially be impacted where:
  - dust, excessive noise, and other airborne contaminants including offensive odours that can cause nuisance at a sensitive receptor
  - waterborne human disease-causing microorganisms in the treated effluent
  - unauthorised release of contaminants such as brine and CSG water
- Flora and fauna – Flora and fauna can potentially be impacted if:
  - waste is not stored and contained properly
- General aesthetic and amenity – the general aesthetic of the environment can potentially be impacted where:
  - Waste stockpiles are not covered causing litter and dust emissions
  - Waste stockpiles exceed certain heights
- Impact on air quality from emissions including dust, GHG, NOx

5.4.1.2. Management strategies

Santos is committed to the reduction of waste generated by its operation and has a comprehensive companywide waste management policy focused on reducing waste generation, maximising resource recovery through reuse and recycling, and promoting responsible disposal methods. Waste generated, transported or received by the proposed amendment will be managed in accordance with the waste and resource management hierarchy under the WRR Act through:

- **Waste avoidance** – careful Project planning including development of purchasing policy that assess the environmental impacts of stock items will be undertaken to ensure that the amount of material brought on site for the construction and operation is minimised, resulting in a cost saving and reduction in the volume of waste going to landfill. Any excess materials and used chemical containers will, where practical be returned to the supplier or other local users. Santos will also consider packaging issues when purchasing resources for the Project and will encourage bulk purchasing to reduce the amount of packaging waste. The implementation of appropriate waste management strategies and monitoring will be actioned to prevent unauthorised releases of fuels, or other chemical spills during the construction, operation and decommissioning for the Project. In general waste will be avoided by:
  - Adoption of best practice procurement and construction methodologies to ensure minimal waste is generated during construction
  - Contracts with construction companies to encourage all contractors to adopt best practice waste minimisation procedures
  - Purchase of materials cut to standard sizes
  - Separate skips will be provided to maintain segregation and maximise economic re-use and recycling
  - Adoption of container for change scheme to promote recycling of aluminium cans and glass bottles
  - Selection of energy efficient equipment for the Project
  - Education and training program to encourage employees to recycle and reuse waste
  - Provision of appropriate recycling bins and correct labelling
- **Waste recycling and reuse** – waste where practicable and considering the health and hygiene issues will be segregated and stored in appropriate containers for removal to licenced facilities for recycling or reuse. An assessment will be undertaken to identify market demand of recyclable and re-use scheme for example treated CSG water for irrigation or stock water by adjacent landholders. The following are examples of how materials have potential for reuse and recycling:
  - Where possible vegetation and soil waste from site clearing and excavation will be stockpiled, mulched and reused for rehabilitation purposes
  - Residual drilling materials will be reused through land application in accordance with the proposed conditions of the EA.
  - Where possible recyclable materials will be purchased for use throughout the Project
  - Recovering solvents, metals or oil and re-using them for secondary purpose

    - Recyclable building wastes will be collected separately and re-used or recycled for example:
        - Wood from concrete formwork will be recovered ad reused
        - Scrap metal steel and off-cuts will be recycled
        - Wood pallets will be reused of recycled
        - Paper and cardboard will be recycled
        - Oils will be collected and sent for recycling
    - CSG water will be reused on-site for dust suppression, ground compaction, drilling and completions, and other operational purposes
    - Avoiding disposable goods or single-use materials.
- Treatment – CSG water will be treated before disposal via irrigation, treated effluent will also be disposed of onsite through irrigation in accordance with MEDLI. Desalination is used to remove total dissolved solids from water extracted from coal seams so that it may be used. Desalination of this water typically has five steps:
    - Pre-treatment
    - Filtration
    - Ion exchange (as required)
    - Desalination
    - Further treatment as required by final water use.
- Crystallisation and encapsulation of brine may be undertaken on site or transferred for disposal to a licenced landfill
- As a last resort, waste will be disposed of only if there is no viable alternative for recycling or reuse.

5.4.1.3. Chemical and fuel management

All chemicals and fuels used for the Project will be stored, transported and handled on-site will be effectively contained and where relevant, meet the relevant Australian Standards (e.g. AS 1940:2017 for the storage and handling of flammable and combustible liquids.

5.4.1.4. CSG water management

Water production is required as part of the CSG production process. Groundwater is removed via production wells to depressurise the coal seams. This depressurisation is what generates gas flow and maintains production operation pressure. The rate of groundwater extracted from coal seams occurs incrementally at first until it peaks, then reduced significantly. The development cycle for the Project includes exploration, appraisal, production well and infrastructure construction, production operations and then decommissioning and rehabilitation. New information gained form ongoing exploration, appraisal and production activities will be used to inform future field development planning.

The *CSG Water Management Policy 2012* (ESR/2016/2381) (version 2.02)[47] (the policy) was developed by the Queensland government to:

- Clearly state the government's position on the management and use of CSG water
- Guide CSG operators in managing CSG water under their environmental authority
- Ensure community understanding about the government's preferred approach to managing CSG water.

Other legislation that may control the use of CSG water, depending upon how it is to be managed and used, includes:

- The *Water Supply (Safety and Reliability) Act 2008* (Water Supply Act)—where operators undertake a water supply service such as supplying treated CSG water for the purposes of a municipal drinking water supply
- The WRR Act — for authorising particular and general beneficial uses of CSG water and what would otherwise be CSG-related waste.

The objective of the policy is to encourage the beneficial use of CSG water in a way that protects the environment and maximises its productive use as a valuable resource. This objective is met when CSG water and brine waste are consistent with the following prioritisation hierarchies:

Prioritisation hierarchy for managing and using CSG water under the policy

Under the policy, the following hierarchy for managing CSG water is preferred.

Priority 1 – CSG water is used for a purpose that is beneficial to one or more of the following:

[47] https://www.des.qld.gov.au/policies?a=272936:policy_registry/rs-po-csg-water-management-policy.pdf

- The environment
- Existing or new water users; and
- Existing or new water-dependent industries.

Priority 2 – after feasible beneficial use options have been considered, treating and disposing CSG water in a way that:

- Firstly avoids; and then
- Minimises and mitigates impacts on EVs.

To meet the objective of the policy, Santos has conducted a detailed assessment of local environmental settings, local land use and local water demands to ensure that the proposed management options are achievable and realistic. Accordingly, Santos has adopted the management option, principle and criteria as outlined in the **Table 9** below:

Table 9: CSG water management

Management option	Management principles	Management criteria	Management hierarchy
Beneficially use of CSG water for one or more of the following: • The environment • Existing or new water users • Existing or new water dependent industries	Whenever feasible CSG water will include: • Irrigation use for pasture or suitable crops • Supplementary water for existing irrigation schemes • Construction, dust suppression and rehabilitation • New irrigation uses with a focus on sustainable irrigation Projects • Livestock watering • Use in construction, dust suppression and rehabilitation • Urban and industrial water supplies • Drilling and wellhole activities	• Compliance with proposed new conditions B11 to B15 (refer to **Appendix K**) • Continue to review and refine the CSG water production profile • No valid dust nuisance complaint • No surface runoff from dust suppression and irrigation areas • CSG water is applied using spray irrigation methods	Priority 1

The proposed management principles align with the DETSI *Information Sheet: CSG water management: measurable criteria* (ESR/2016/1902) (Version 1.03)[48], and the conditions of the EA including conditions B8. Produced water may be used for dust suppression in alignment with condition B8, B9 (existing) and conditions B11 -B16 (proposed new conditions) of the EA.

Prioritisation hierarchy for managing brine waste under the policy

CSG brine is the waste that is produced as a result of treating CSG water using reverse osmosis (RO) technologies. Brine is generally unsuitable for release to the environment and must be appropriately managed in a dedicated CSG brine dam. The concentration and composition of salts and minerals in the brine depends on the characteristics of the CSG water and the treatment process. The volume and concentrations of total dissolved solids (TDS) in CSG water vary significantly across individual fields. DETSI defines brine as water with a TDS concentration greater than 40,000 milligrams per litre which is a category 2[49] regulated waste.

Under the policy, the following hierarchy for managing brine is preferred.

Priority 1 – brine or salt residues are treated to create useable products wherever possible.

Priority 2 – after assessing the feasibility of treating the brine of solid salt residues to create useable and saleable products, disposing of the brine and salt residues in accordance with strict standards that protect the environment.

In 2023, DETSI in collaboration with industry community groups and academia developed a long-term approach for the management of CSG brine 2023-2033[50] (the action plan). Under the action plan it is recognised that while

[48] https://www.detsi.qld.gov.au/policies?a=272936:policy_registry/rs-is-csg-water-measurable-criteria.pdf
[49] https://www.legislation.qld.gov.au/view/html/inforce/current/sl-2019-0155#sch.9
[50] https://environment.des.qld.gov.au/__data/assets/pdf_file/0025/306466/csg-brine-management-action-plan-2023-33.pdf

the most feasible option is encapsulation of brine waste, research and investigation of alternative options for brine management must be continued in keeping with circular economy principles. A feasible option for managing brine for the Project is still to be determined. Brine will be stored within the two proposed dams and will continue to be managed in accordance with the conditions of the EA. Santos is proposing a new condition B16. The proposed condition will allow for further investigation into alternative viable options for managing brine from the Project.

5.4.1.5. Emissions and releases to land

The proposed amendment involves activities associated with petroleum well development and operation, including construction, drilling, and operational infrastructure. These activities may result in emissions to air or releases to land, including:

- Reuse of residual drill cuttings and drilling fluids
- Re-use of low point drains water through release to land
- Reuse of produced water through beneficial reuse via irrigation
- low point drains – release of water to land

A summary of the potential emissions source, risk and impacts and associated management strategies are provided in **Table 10**.

Residual risk has been assessed and is provided in **Appendix J**. The assessment is based on emission sources' expected impacts and associated control measures. The results of the risk assessment indicate that residual risks to EVs as a result of the proposed amendment are classified as 'Very Low'.

Table 9: Emissions risk and impacts and management strategies

Emission Source	Risk and Impacts	Management Strategies
Residual drill cuttings and drilling fluids	Localised contamination	Controlled application on site in accordance with, proposed condition (B24) and SQP recommendation
Treated Sewage Effluent (STP) Irrigation	Nutrient loading or salinity	Controlled application to approved irrigation areas in accordance with MEDLI modelling
CSG water use	Soil degradation, salinization	Use restricted to authorised purposes and quality limits under EA and End of Waste (EOW) code
Seepage, leachate or overtopping from regulated storage brine dams, waste storage facilities	Mobilisation of contaminants leading to degradation of soil quality, potential offsite migration and harm to surrounding land uses or vegetation	• Engineered containment systems • Design and operation in accordance with Santos process • Regular inspection and maintenance

Any unauthorised releases to land will be managed and assessed in accordance with Santos' internal spill response protocols and Reported to the administering authority as required by the existing EA.

5.5. Flora and Fauna

Santos engaged Terrestria Ecological Management (Terrestria) to undertake an ecological impact assessment of the proposed amendment on Matters of National Environmental Significance (MNES) and Matters of State Environmental Significance (MSES) in accordance with the relevant guidelines. Terrestria prepared an ecological impact Report which is attached to this Report as **Appendix A**.

A review of available ecological data, supported by field assessments, indicates that no Matters of National Environmental Significance (MNES) or Matters of State Environmental Significance (MSES) listed threatened flora species occur within the proposed disturbance area. The site has been subject to previous disturbance from

historical land uses, and the proposed infrastructure is predominantly located outside remnant vegetation and regrowth areas known to support threatened flora species. As such, the likelihood of impacting threatened flora species is considered very low.

Furthermore, given the degraded condition of the disturbance footprint and its position largely outside mapped high-quality habitat areas, no direct impacts to high-value habitat for threatened fauna species are expected. The proposed disturbance avoids remnant and regrowth vegetation that may provide key habitat features such as nesting or breeding sites.

5.5.1.1. Matters of National Environmental Significance (MNES)

Threatened Ecological Communities (TECs)

The proposed amendment will not have a direct impact on TECs. While there will be an impact to approximately 0.3 hectares of endangered regional ecosystem (RE) 11.3.1 that is prescribed regional ecosystem (regulated vegetation), approximately 0.27 hectares occurs in linear strips that are less than 10 metres wide with mid-dense and therefore will not result in a significant impact on the TEC (See Appendix A).

Diamond Firetail

The Diamond Firetail (*Stagonopleura guttata*) is listed as vulnerable under both the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* (EPBC Act) and the *Nature Conservation Act 1992 (Qld)* (NC Act).

An estimated 1.7 hectares of medium-quality habitat for the Diamond Firetail (*Stagonopleura guttata*) will be impacted by the proposed amendment. However, this impact is not considered likely to result in a significant impact for the following reasons:

- The Diamond Firetail is a largely sedentary species and has not been recorded within the locality.
- The species is considered unlikely to occur within the proposed impact area, and the habitat is not known to support breeding activity.
- The proposed impact area comprises several narrow slivers of vegetation located on the periphery of larger, mapped habitat patches.
- Given the limited extent, marginal habitat quality, and low likelihood of species presence, the proposed amendment is not expected to reduce the extent or quality of important habitat, fragment habitat critical to survival, or interfere with the lifecycle of an ecological population.

Therefore, the proposed amendment is not considered likely to have a significant impact on the Diamond Firetail under the EPBC Act.

Painted Honeyeater

An estimated 1.3 hectares of potential foraging habitat for the Painted Honeyeater (*Grantiella picta*), a species listed as Vulnerable under the EPBC Act and under the state NC Act, may be impacted by the proposed amendment. However, a significant impact is not expected for the following reasons:

- The species is very unlikely to breed within the locality, and there are no records indicating the presence of nesting or breeding behaviour in the area.
- The proposed impacts are restricted to small, narrow slivers of vegetation situated along the edges of substantially larger, mapped habitat patches.
- The affected habitat does not constitute important habitat nor is it critical to the survival of the species at the local or regional scale.
- The proposed amendment is not expected to fragment, degrade, or significantly modify available habitat, nor interfere with the lifecycle of an ecological population of the species.

Accordingly, the proposed amendment is not considered likely to have a significant impact on the Painted Honeyeater under the EPBC Act (see **Appendix A**).

Latham's Snipe and Australian Painted Snipe

The proposed amendment may impact approximately 6.6 hectares of potential foraging habitat for the Latham's Snipe (*Gallinago hardwickii*) and the Australian Painted Snipe (*Rostratula australis*), both of which are listed as migratory species under the EPBC Act, with the Painted Snipe also listed as endangered under both the EPBC Act and the NC Act and Latham's snipe listed as vulnerable under both Acts. The impact will occur within non-remnant gilgai areas.

However, the impact is not considered likely to be significant for the following reasons:

- The affected area constitutes a small proportion of the total extent of non-remnant gilgai habitat available in the local area.
- Both species are wide-ranging, seasonal visitors that use a variety of wetland habitats across large geographical areas.
- Neither species is known to breed in the locality, and the impacted habitat is not considered important habitat or critical to their survival.
- The proposed amendment will not substantially modify or isolate an area of important habitat, nor is it likely to disrupt the lifecycle of an ecological population of either species.

Accordingly, the proposed amendment is not expected to result in a significant impact on Latham's Snipe or the Australian Painted Snipe under the EPBC Act (see **Appendix A**).

Ornamental snake

Due to the known presence of the Ornamental Snake (*Denisonia maculata*) within the local landscape and the potential for its occurrence within the proposed disturbance footprint, the following measures will be implemented to minimise potential impacts associated with the clearing of approximately 7.5 hectares of low-quality potential **habitat**, located in non-remnant gilgai areas. The Ornamental snake is listed as vulnerable under the EPBC Act and is a class 2 animal under the NC Act.

Mitigation measures will include:

- Limiting the extent of open trenching at night, when the species is more likely to be active and at risk of entrapment;
- Installing escape ramps or egress structures in open trenches overnight, to allow trapped fauna, including snakes, to exit safely; and
- Engaging a qualified fauna spotter-catcher to be present at all times during vegetation clearing and ground disturbance activities to undertake pre-clearance inspections and fauna relocation if required.

These measures are expected to effectively mitigate potential impacts, ensuring the proposed amendment is unlikely to result in significant impacts on the ornamental snake (see **Appendix A**).

Overall, the disturbance associated with the proposed amendment will not have a significant impact on MNES.

5.5.1.2. Matters of State Environmental Significance (MSES)

Koala

The Koala (*Phascolarctos cinereus*) is listed as Endangered under the EPBC Act and the NC Act. The proposed amendment may result to 0.2ha of medium habitat for this species. Some of this impact is expected to be temporary. There will be no impact on connectivity. During construction and operations, measures will be put in place to prevent the spread of invasive species or diseases that are harmful to the species. The proposed disturbance will not cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species. As a result, the proposed amendment will not result in significant residual impact on this species (See **Appendix A**).

Squatter Pigeon (southern)

The Squatter Pigeon -southern (Geophaps scripta scripta) is listed as vulnerable under the EPBC Act and NC Act. There are no records of this species within the project area and it was not observed during the field surveys. The proposed amendment may impact 1.8ha of medium potential habitat for this species. Some of the impact is temporary. There will be no impacts on connectivity as such the proposed amendment will not cause a significant residual impact on the species population (See **Appendix A**).

Northern Greater Glider and the Central Greater Glider

The Northern Greater Glider (Petauroides minor) is listed as vulnerable under the EPBC and NC Acts. While the Central Greater Glider (Petauroides armillatus) is listed as endangered under the EPBC Act and the NC Act. The proposed amendment may impact 0.1ha of medium potential habitat for these species. Some of this impact will be temporary. The proposed amendment will not have an impact to connectivity on the species habitat. The proposed disturbance will not result in a long-term decrease in the size of the population of these species. As a result, the proposed amendment will not result in significant residual impact on the species (See **Appendix A**).

Native vegetation

There are several MSES and *Water Act 2000* (Water Act) water crossing sites where disturbance to native vegetation may occur. Disturbance to this vegetation has been avoided by utilising existing cleared corridor instead of creating new disturbance. The proposed amendment will not result in a significant residual impact on native vegetation (See **Appendix A**).

Prescribed Environmental Matters (PEMS)

Cumulative impacts on PEMs identified in Schedule 2 of the Environmental Offsets Regulation 2014 located within the Project area are discussed in Table 4.1 of **Appendix A**. The assessment concludes that the disturbance associated by the proposed amendment will not have a significant residual impact on PEMs. Consequently, environmental offsets under the *Offsets Act 2014* are not required.

Overall, the disturbance associated with the proposed amendment will not have a significant residual impact on MSES.

5.5.1.3. Pest species

Wildnet pest Reports were generated for PL1082 and 1083 (**Appendix B**). The identified pests within the tenures are presented in **Table 11**.

Table 11: Pest species present within PL1082 and PL1083 and a 1km buffer

Scientific Name	Records
Fauna	
Canis familiaris	1
Felis catus	1
Bos taurus	1
Flora	
Harrisia pomanensis	1
Bryophyllum delagoense	1
Stylosanthes scabra	1
Cenchrus ciliaris	2
Megathyrsus maximus var. pubiglumis	1
Melinis repens	1

5.5.1.4. Risks and Impacts

Declared pest flora and fauna may occur within the Project area, as identified in **Appendix J**. These include invasive species that are typical of disturbed and/or fragmented landscapes and are a potential biosecurity risk. The proposed activities have the potential to exacerbate this risk through vegetation clearing, ground disturbance, and the movement of vehicles, machinery, and materials across and between properties.

5.5.1.5. Management Strategies

To mitigate these risks, Santos will implement its existing Biosecurity Management Plan and associated procedures. Under Santos biosecurity management plan, a biosecurity survey is required prior to commencing works on a property where vehicles, equipment and personnel may encounter vegetation and/or actual or potential biosecurity matter. When assessing the potential biosecurity risks for an asset, special consideration is given to the following known risk areas:

- Access tracks and gates, particularly those shared with other property users
- Watercourses;
- Stockyards, feeding areas, dams, where there is typically a high density of livestock present.
- Information recorded include species and infestation areas.

Where invasive plants and/or environmental weeds are identified, the location is recorded utilising a Global Positioning System (GPS) device including the extent of the infestation. When a weed management area is established, works are planned to:

- Avoid the weed management area where practical
- Where avoidance is not possible, works are planned to minimise biosecurity spread.

In some cases, a landholder's Conduct and Compensation Agreement (CCA) may require Santos to develop a property specific management plan or implement specific biosecurity requirements, such as:

- Sign in and out procedures, including provision of copies of vehicle hygiene Reports to the landholder
- Locations of weed management areas
- Restrictions to direction of travel; and/or
- Requirements for weed treatment and monitoring.

Santos activities generally pose a low risk of exacerbating invasive animal impacts. General management measures to avoid invasive animal impacts associated with Santos' activities include:

- Good housekeeping practices to restrict the access of pest animals to waste, potential food items and new water sources, and
- Install fit-for-purpose fencing, particularly if exclusion fencing is required.

The proposed activities will also be undertaken in accordance with the *Biosecurity Act 2014* (Qld), including the General Biosecurity Obligation (GBO), which requires all persons to take reasonable and practical steps to prevent or minimise biosecurity risks within their control.

The primary mechanisms for managing pest spread during the Project will include, vehicle and machinery hygiene protocols managed through risk-based clean-down and inspection, with hygiene Reports maintained. Clean-downs will be mandatory for high-risk activities involving contact with vegetation or weed-infested areas. Any new weed infestations identified during construction will be geo-referenced and Reported in accordance with internal procedures, with treatment undertaken by licensed personnel as required.

The potential for pest spread as a result of Project activities is considered low, with risks managed through standard controls implemented in accordance with Santos' Biosecurity Management Plan and associated procedures. A risk assessment on pest impacts and mitigation measures has been completed using Santos' risk matrix, with long-term impacts of pests being determined as Low Risk (**Appendix J**).

5.6. Water

The Project is located within the Comet River catchment of the Fitzroy Drainage Basin. The Fitzroy drainage basin is 142,480 km^2 in area, containing approximately 13,572.5km of streams. Major watercourses within the Project area include the Comet River and Humboldt Creek, along with several minor watercourses such as Shotover Creek and Scrubbers Gully. The tenure also contains multiple areas of High Ecological Significance (HES) and a referable wetland.

The current EA limits activities within wetlands, lakes, springs and watercourses. The proposed amendment does not change the potential impacts to the environmental values for water and wetlands beyond what is currently authorised. Impacts on EVs for surface water before this amendment will not change or increase due to the proposed amendment.

The *Comet River Sub-basin Environmental Values and Water Quality Objectives*[51] defines the EVs likely to be impacted by the proposed amendment including:

- protection of the aquatic ecosystems;
- primary industries;
  - irrigation;
  - farm use; and
  - stock watering.
- recreation and aesthetics;
  - primary and secondary recreation; and
  - visual appreciation.
- drinking water;
- industrial use; and
- cultural and spiritual values.

Under the EPP Water, the Comet River catchment is moderately disturbed waters. The 2023-24 Fitzroy River health Report card for the Comet catchment is an overall B (good) rating indicating that most water quality and biological health indicators meet desired levels.

5.6.1. Surface Water Risk and Impacts

The linear infrastructure works associated with gathering lines and power cables will intersect two unnamed drainage pathways (not listed under the Water Act) leading to Humbolt Creek as shown in **Figure 6.** These drainage pathways are ephemeral to intermittent in nature and are only expected to contain flows during or shortly after rainfall events. The disturbance from the proposed infrastructure is expected to be temporary in nature, only occurring during construction activities. All linear infrastructure will be installed via trenching and buried underground. The construction footprint will be reinstated and rehabilitated in accordance with the current EA rehabilitation conditions (*Rehabilitation Conditions J1 – J8).*

In addition to linear infrastructure impacts, a number of production wells and well pads are proposed across the tenures with some sites occurring within 30 m of drainage features and watercourses (see **Figure 2**). While no direct disturbance to the watercourses is proposed, proximity to these features may present a risk to surface water quality if spills, leaks, or uncontrolled run-off were to occur.

5.6.2. Surface Water Management strategies

Section 14 of the EPP water defines the management hierarchy for surface or groundwater. To the extent it is reasonable to do so, release of wastewater or contaminants to waters must be dealt with in the following order of preference:

- Firstly—reduce the production of wastewater or contaminants by reducing the use of water;

[51] https://environment.desi.qld.gov.au/__data/assets/pdf_file/0034/88792/fitzroy_comet_river_wqo_290911.pdf

- Secondly—prevent waste and implement appropriate waste prevention measures;
- Thirdly—evaluate treatment and recycling options and implement appropriate treatment and recycling;
- Fourthly—evaluate the following options for waste water or contaminants in the order in which they are listed –
    - appropriate treatment and release to a waste facility or sewer;
    - appropriate treatment and release to land;
    - appropriate treatment and release to surface waters or groundwaters.

To meet the objectives under EPP Water, the following will be undertaken:

- Sediment and erosion control measures (e.g., silt fences, diversion drains) will be developed in accordance with the Best Practice Erosion and Sediment Control guidelines[52]
- Progressive rehabilitation to re-establish ground cover and minimise run-off
- Construction activities occurring within watercourses will be completed in accordance with EA conditions G7
- All disturbed areas will then be reshaped and stabilised following trenching and revegetated where required to support natural hydrology and ecological recovery
- Effluent released to land will be in accordance with MDELI
- Clean up of unauthorised releases as soon as practicable
- Appropriate bunding and clean water diversions
- Use of sediment ponds to collect any contaminated stormwater
- CSG water released to land will be in accordance with the release criteria.

For well pads and other permanent infrastructure close to drainage lines and watercourses, areas will be bunded to contain spills and prevent run-off. Spill kits will be kept on-site, and all staff will follow spill response procedures. Cleared areas will be stabilised, and disturbed land will be rehabilitated after works are complete in alignment with current EA conditions and Santos internal procedure documents.

A risk assessment on surface water impacts has been completed using Santos' risk matrix and has been determined as Low Risk (see **Appendix J**).

5.6.3. Groundwater

Section 14 of the EPP water defines the management hierarchy for surface or groundwater. To the extent it is reasonable to do so, release of wastewater or contaminants to waters must be dealt with in the following order of preference:

- Firstly—reduce the production of wastewater or contaminants by reducing the use of water;
- Secondly—prevent waste and implement appropriate waste prevention measures;
- Thirdly—evaluate treatment and recycling options and implement appropriate treatment and recycling;
- Fourthly—evaluate the following options for wastewater or contaminants in the order in which they are listed –
    - appropriate treatment and release to a waste facility or sewer;
    - appropriate treatment and release to land;
    - appropriate treatment and release to surface waters or groundwaters.

A total of 31 registered water bores (RDMW and private) are located across the Mahalo tenures, supporting a combination of stock, domestic, and groundwater monitoring purposes. Terrestrial groundwater dependent ecosystems (GDEs) cover 1,729.79 ha within the tenure, indicating areas where vegetation may rely on subsurface water sources. While no known or derived Spring GDEs have been identified within 14 km of the Project area, a number of modelled surface expression GDEs are present within the tenure with moderate to high confidence (see **Figure 7**). The proposed amendment does not change the potential impacts to the environmental values of groundwater beyond what is currently authorised. Impacts on EVs for groundwater before this amendment will not change or increase due to the proposed amendment.

5.6.4. Groundwater Risks and impacts

Groundwater beneath the Mahalo tenures may be impacted by construction and operation of infrastructure, particularly production wells and associated facilities. A total of 31 registered groundwater bores are located across the tenures, supporting a range of stock, domestic, and monitoring uses. In addition, terrestrial GDEs are present across approximately 1,729.79 ha, where vegetation may rely on subsurface water sources. While no

[52] https://www.austieca.com.au/publications/best-practice-erosion-and-sediment-control-bpesc-document

known or derived spring GDEs are located within 14 km of the Project area, modelled surface expression GDEs are present within the tenure with moderate to high confidence.

Activities associated with trenching and well installation may alter local groundwater conditions, particularly if shallow groundwater is intercepted. Potential impacts include changes to groundwater flow, short-term drawdown, and risk of contamination through accidental spills or well integrity. However, the risk of adverse groundwater impacts is considered low due to the temporary nature of linear infrastructure installation, and the implementation of groundwater mitigation measures during well construction.

The proposed amendment does not change the potential impacts to the environmental values of groundwater beyond what is currently authorised. Impacts on EVs for groundwater before this amendment will not change or increase due to the proposed amendment. Groundwater drawdown modelling by OGIA and underground water impact modelling Report (UWIR) for the Project was provided to DETSI for the assessment and subsequent approval of the existing EA. The proposed amendment is not proposing any changes to the extraction of groundwater under the *Water Act 2000*.

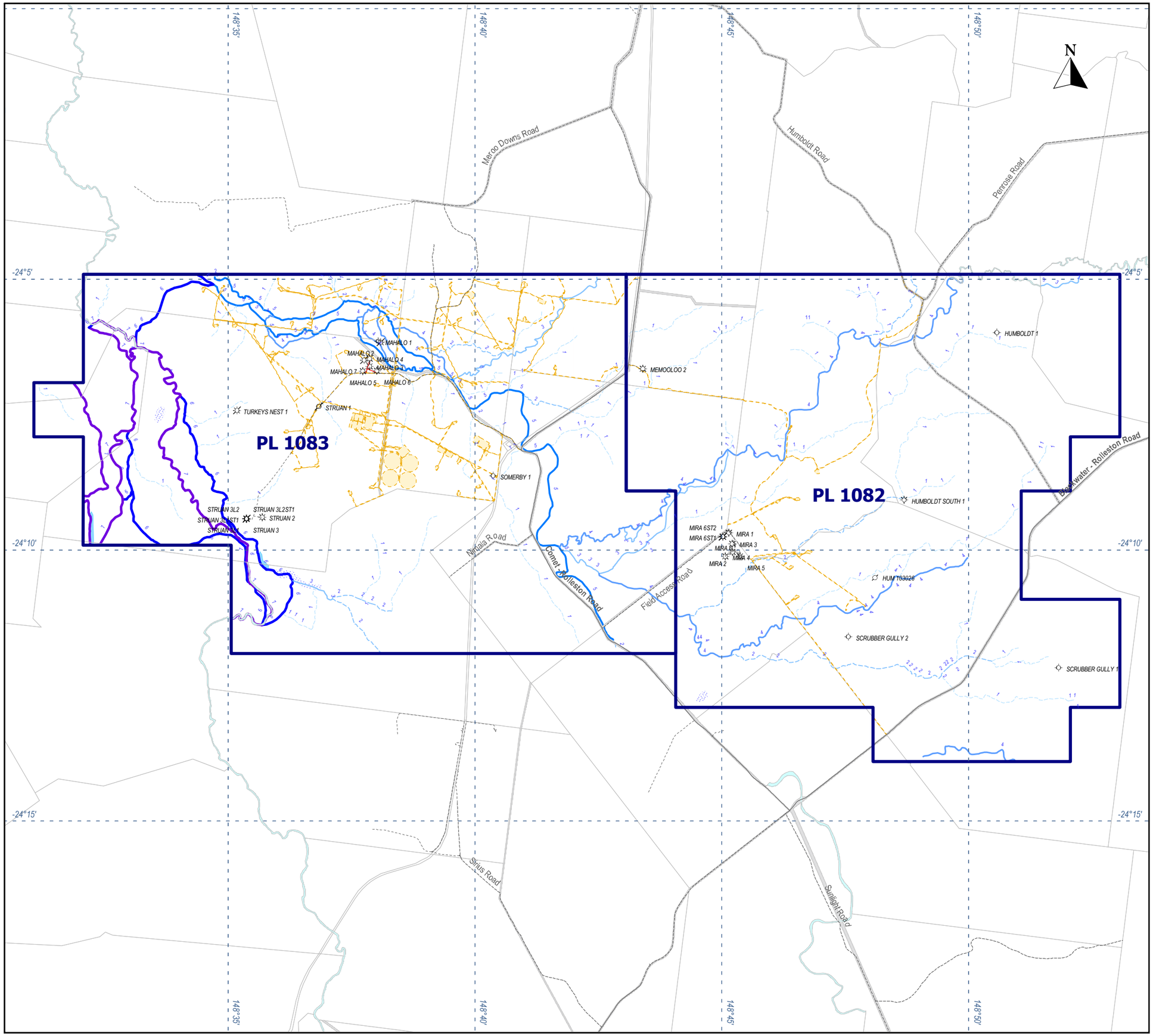
5.6.5. Groundwater Management Practices

All activities with the potential to interact with groundwater will be conducted in line with Santos' internal groundwater management procedures and the conditions of the existing EA. For linear infrastructure, trenching activities will avoid shallow groundwater areas where practicable. To avoid introducing contaminants to groundwater, fuels, chemical and other hazardous materials will be stored within bunded storage areas and spill kits will be made available. Groundwater monitoring will be undertaken in sensitive areas, such as near registered bores and GDEs, to verify that groundwater levels and quality are not adversely affected.

For production wells, all well construction will comply with industry standards and Santos' internal design specifications, including casing and cementing to isolate aquifers and prevent inter-aquifer mixing. Permanent infrastructure, including well pads and associated storage areas, will be bunded and designed to contain any spills or leaks, preventing infiltration to underlying groundwater systems. Spill kits and response procedures will be in place at all operational sites.

The proposed amendment does not change the potential impacts to the environmental values of groundwater beyond what is currently authorised. Impacts on EVs for groundwater before this amendment will not change or increase due to the proposed amendment. A risk assessment on groundwater impacts has been completed using Santos' risk matrix and has been determined as Low Risk (see **Appendix J**).

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Legend

- Well
- Gas Pipeline
- Water Pipeline
- Sealed Road
- Unsealed Road
- Track
- Environmental Authority 100178150
- Cadastral Parcel
- Proposed disturbance footprint

Stream Order

1 2 3 4 5 6 7

Santos

Queensland

Mahalo

EA Amendment Surface Water

0 5

kilometers

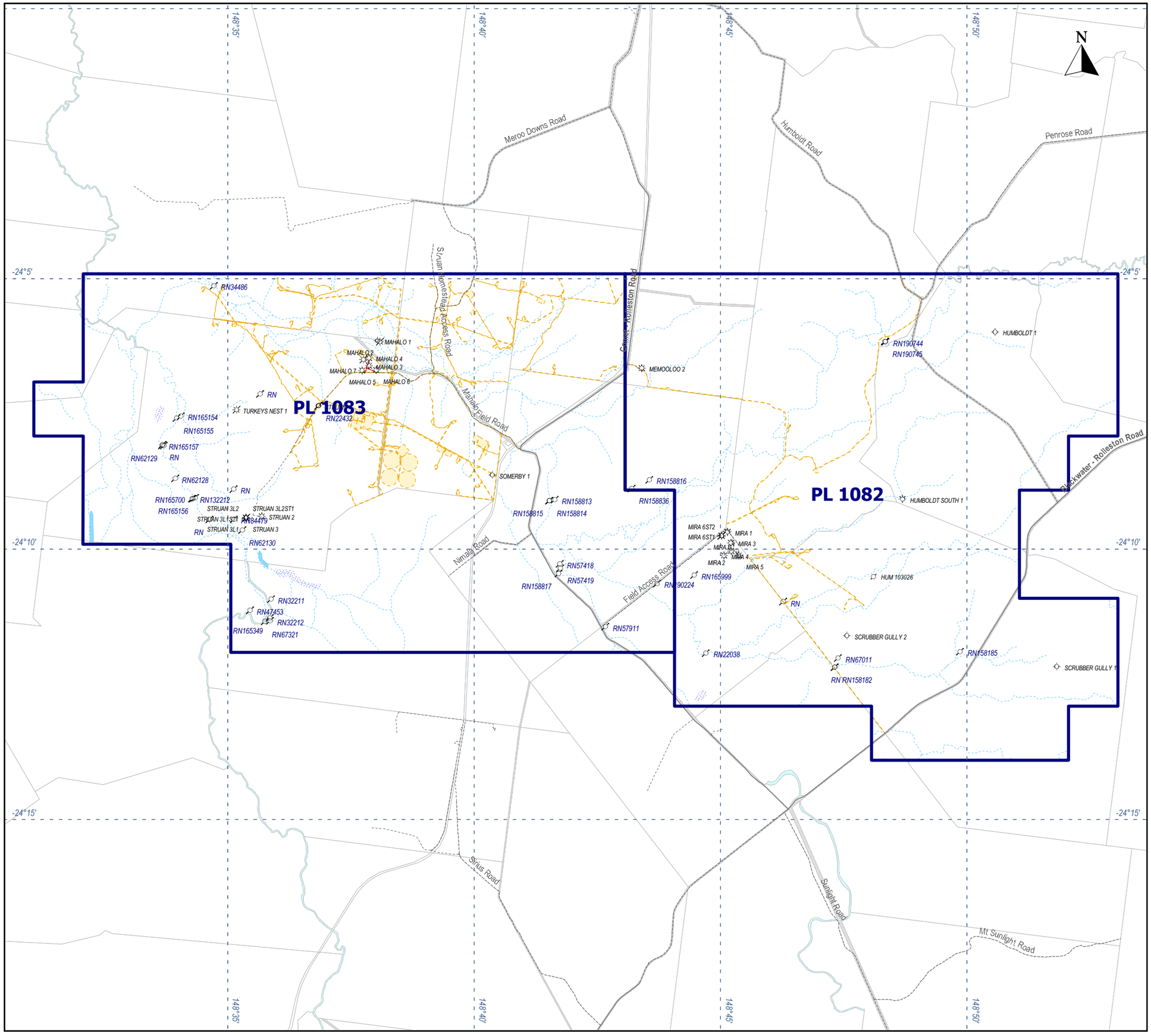
Scale 1:125,000

Rev 2 Date: 26/06/2025 File No. ENVIR 1078j.WOR

GDA 2020

Figure 6: Surface water across PL1082 and PL1083

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Legend

- Water Bore
- Well
- Gas Pipeline
- Water Pipeline
- Sealed Road
- Unsealed Road
- Track
- Drainage
- Environmental Authority 100178150
- Cadastral Parcel
- Proposed disturbances footprint

Santos

Queensland

Mahalo

EA Amendment Groundwater

0 5

kilometers

Scale 1:125,000

Rev 2 Date: 26/06/2025 File No. ENVIR 1078k.WOR

GDA 2020

Figure 7: Groundwater across PL1082 and PL1083

5.7. Areas of regional interest

The petroleum leases PL1082 and PL1083 include areas mapped as Priority Agricultural Area (PAA)[53] and Strategic cropping area (SCA).

PAA is an area of regional interest under the *Regional Planning Interest Act 2014* (RPI Act)[54] and is shown on a map in a regional plan or prescribed under the Regional Planning Interests Regulation 2014 (RPI Regulation) as a PAA. Within a PAA, high value intensive agricultural land uses are recognised as the priority land use over other land uses. These uses are termed Priority Agricultural Land Uses (PALUs) and are given priority in the consideration of applications for resource activities and regulated activities to ensure the continuation of the existing PALUs is not threatened. The activities in the proposed amendment will be located away from any and will not have a significant impact on a PALU.

An activity is not likely to have a significant impact on a PAA may be where the activity will not:

- result in a decrease in the particular agricultural product supplied from the PAA or region
- result in a decrease in the PAA or region's ability to undertake a particular PALU in the future.

A section of PL1082 and PL1083 is also mapped as Strategic Cropping Area (SCA)[55]. A SCA is an area of regional interest under the RPI Act.

The RPI Act restricts the carrying out of certain resource activities where the activity is not exempt from the provisions of the Act or a regional interests development approval (RIDA) has not been obtained. Resource activities are exempt from obtaining regional interests development approval where carried out with the agreement of the landowner (refer section 22 of RPI Act). This exemption provides for a resource activity in a SCA where:

- the applicant is not the owner of the land and
- the applicant has entered into a voluntary agreement with the landowner about the resource activity and
- the resource activity is not likely to have a significant impact on the land and
- the resource activity is not likely to have an impact on land owned by a person other than the landowner.

Santos will seek to obtain a RIDA if the exemptions under the RPI Act are not met.

Agricultural productivity may be affected by altered surface drainage patterns and interference with cropping schedules. The presence of construction equipment and a transient workforce introduces biosecurity risks, including the potential spread of invasive weeds and soil-borne pathogens. Overall, the impacts are anticipated to be localized and temporary, focused on the construction period with operational controls to limit long-term effects.

To minimize environmental impacts, Agricultural Impact Management Plans (AIMPs) will be implemented, including biosecurity protocols such as vehicle hygiene and weed management measures. Construction scheduling will avoid peak agricultural periods to reduce disruption to cropping activities. Infrastructure will be clustered and co-located where practicable to reduce the overall land disturbance. Soil protection techniques, such as the use of temporary track mats, will be applied to limit soil compaction and degradation. Post-construction rehabilitation will be undertaken in consultation with landholders to restore soil quality and agricultural productivity. Spill containment measures, onsite spill kits, and staff training will be employed to prevent contamination risks. Ongoing monitoring and adaptive management will ensure that mitigation measures effectively preserve the agricultural viability of the land throughout the Project lifecycle.

5.8. Rehabilitation

Rehabilitation of disturbed areas will be carried out in accordance with Schedule J of the EA (P-EA-100178150). A Rehabilitation Plan will be developed by a suitably qualified person, incorporating the required goals, procedures, monitoring, and maintenance strategies. Disturbed areas no longer required for petroleum activities will be rehabilitated within 12 months unless delayed by exceptional circumstances, and all works will aim to meet the transitional and final rehabilitation acceptance criteria outlined in conditions J2 to J4 of the EA. This includes establishing stable, non-polluting landforms, reinstating drainage, topsoil and ground cover, and meeting specified ecological benchmarks where applicable. Full rehabilitation details and criteria are provided in Schedule J of the EA.

[53] https://www.planning.qld.gov.au/__data/assets/pdf_file/0022/85180/02-14-statutory-guideline.pdf
[54] https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-2014-011
[55] https://dsdmipprd.blob.core.windows.net/general/rpi-guideline-03-14-activities-in-sca.pdf

6. Greenhouse Gas Emissions Inventory

6.1. Greenhouse Gas Emissions Category

All Greenhouse Gas (GHG) emissions from the Project activities have been assessed and determined to be confined to direct emissions (Scope 1) from the compressor station, its flare, the gas engine generators, and sewage treatment plant. The total Scope 1 emissions associated with the Project activities are detailed in **Table 10** and classify the Project as a low emitter under the GHG Guideline (i.e., < 25,000 t CO_2-e in all Project years). There are no Scope 2 or Scope 3 emissions associated with the Project activities.

Table 10 below summarises the Projected GHG emissions associated with the proposed development. See **Appendix I** for detailed Life of Plan (LOP) emissions data.

Table 10: GHG emissions associated with proposed development

Activity	Year 1 Emissions (t CO_2-e)	Year 2 Emissions (t CO_2-e)	Total LOP Emissions (t CO_2-e)
Gathering and Boosting Station	887	1,591	47,671
Flaring	1,002	1,002	40,072
Gas Combustion	4,553	13,658	295,919
Total	**6,441**	**16,251**	**383,661**

The total Life of Project (LOP) Scope 1 emissions have been estimated at 383,661 tonnes CO_2-e, with average annual emissions calculated at 6,441 t CO_2-e and a peak annual emission of 16,251 t CO_2-e expected in 2032. The broader Mahalo Gas Hub, inclusive of Phases 1 and 2 of gas exploration, development, and production, will be subject to mandatory National Greenhouse and Energy Reporting (NGER) obligations but will not trigger the Safeguard Mechanism threshold.

6.2. Methodology for calculating GHG Emissions

The greenhouse gas emissions assessment was conducted according to the *Guideline Greenhouse Gas Emissions ESR/2024/6819* (GHG Guideline) and the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (NGER Determination). Scope 1 emissions were calculated using activity data provided by Santos, employing emission factors stipulated in the NGER Determination.

Key emissions sources quantified include natural gas combustion for power generation, fugitive emissions from the gas gathering and boosting facility, and emissions associated with CSG flaring. Fugitive emissions were assessed using NGER Determination Method 1, specifically incorporating emissions from well completions, production activities, workovers, produced water, and pipeline infrastructure. Emissions from the sewage treatment plant were assessed using the Clean Energy Regulator's NGER wastewater domestic and commercial calculator, though these were found to be immaterial to the overall inventory.

Vegetation clearance was not included as activities occur on previously cleared land. Calculations assumed consistent emission factors, energy content factors, and gas compositions as detailed by the NGER Determination, with annual emissions Projections made according to the Project's schedules and infrastructure operational plans. Further details on methodology are detailed in **Appendix I**.

7. Risk Assessment

This section identifies and assesses potential impacts, mitigation measures (control strategies), and environmental risks to relevant environment values because of carrying out the proposed activities (as required by section 125 of the EP Act).

To assess residual risks associated with the proposed activities, a risk assessment for each relevant environmental value (as identified in section **4**) has been completed. The environmental risk assessment is based on risk factors associated with both the initial construction and ongoing operational phases of the proposed activities.

The risk assessment has been undertaken in accordance with Santos Risk Matrix (Figure 14) which is based on accepted principles and applicable Australian standards. Further detail on the risk assessment process is provided in **Appendix J**.

Santos Risk Matrix

Santos

Consequence							
Safety		**Negligible Harm** + No bodily damage or minimal harm or impairment (hours to days)	**Minor Harm** + Short term impairment (days to weeks)	**Moderate Harm** + Temporary disablement or medium-term impairment (weeks to months)	**Severe Harm** + Long term/life altering disablement or impairment	**Single Fatality OR Critical Life Threatening Injuries**	**Multiple Fatalities**
Environment		+ No impact to Environmental Value (EV).	+ Small-scale impact to EV(s) of conservation significance + Potential surface or groundwater impact.	+ Moderate-scale impact to EV(s) of conservation significance + Localised surface or groundwater impact.	+ Large-scale impact to EV(s) of conservation significance + Moderate-scale surface water impact; + Localised impact to groundwater with potential or known beneficial use.	+ Extensive population or community scale impact to EV(s) of conservation significance + Extensive impact to other EV(s).	+ Irreversible impact to EV(s).
Community & Reputation		+ No actual or potential community criticism + Details remain within Santos sites and/or offices	+ Minor level local community criticism (< week) + No reputation impact	+ Local community criticism (> week) or one-day community protest + Local company reputation impacted	+ State-level community criticism or protest over multiple days/locations + State-based company reputation impacted + Very short-term share price impact (< week)	+ National community criticism or large scale protest + Company reputation and approvals impacted + Shareholder intervention or short-term share price impact (< month)	+ Sustained national community criticism or widespread protest + Industry reputation and approvals impacted + Changes at executive/board level or long-term share price impact (> month)
Financial (A$)		< $100k	$100k to $1m	$1m to $10m	$10m to $100m	$100m to $500m	> $500m
Workforce		+ Will require some staff attention over several days. + No actual or potential impact to culture	+ Will require several days local management time. + Minor impact to employee engagement and limited staff turnover	+ Will require head office staff and take several weeks of site management time. + Moderate impact to employee engagement and staff turnover above industry average with some key roles	+ Will require several weeks of senior management time + Impact to employee engagement (< 6 months), moderate turnover of key roles and no succession	+ Will require several months of senior management time + Impact to employee engagement (< 18 months), high staff turnover and attraction issues	+ Will require more than a year of senior management involvement and operations severely disrupted + Impact to employee engagement (> 18 months), significant key role turnover and attraction issues
Compliance		+ Non-conformance with legislation, instruments (e.g. tenure licence) or contract + No regulatory or punitive action	+ Minor breach of legislation, instruments or contract + Notification/report to; request for information by; and/or administrative/ warning notice from the regulator + LOCI Tier 3 or non-hydrocarbon releases notifiable to the regulator	+ Limited number of minor breaches of legislation, instruments or contract + Statutory notice from the regulator + LOCI Tier 2 or non-hydrocarbon releases immediately reportable to the regulator	+ Systemic minor breaches (or one moderate breach) of legislation, instruments or contract + Company charged with an offence with minor penalty/fine + LOCI Tier 1 or cumulative regulator notification of non-hydrocarbon releases	+ Systemic moderate breaches (OR single material breach) of legislation, instruments or contract + Company charged with an offence with moderate penalty/fine	+ Material breaches of legislation, instruments or contract + Company or officers charged with an offence with material penalty/fine, or loss of tenure/operatorship
		I	**II**	**III**	**IV**	**V**	**VI**
Likelihood							
ALMOST CERTAIN (< 4 monthly) Occurs frequently	f	Low	Medium	High	Very High	Very High	Very High
LIKELY (4 monthly - 1 yearly) Could occur within the annual plan	e	Low	Medium	High	High	Very High	Very High
OCCASIONAL (1 - 3 yearly) Could occur within the 3-year plan	d	Low	Low	Medium	High	High	Very High
POSSIBLE (3 - 10 yearly) Could occur within the 10-year, long term plan	c	Very Low	Low	Low	Medium	High	Very High
UNLIKELY (10 - 30 yearly) Not expected to occur; known to have occurred elsewhere	b	Very Low	Very Low	Low	Low	Medium	High
REMOTE (30 - 100 yearly) Requires exceptional circumstances and is unlikely even in the long term	a	Very Low	Very Low	Very Low	Low	Medium	Medium

Explanatory Notes / Definitions

1 Not all elements within a consequence category require achievement; any single element within a category is sufficient.
2 For non-operated assessments use impacts to Santos or net quantities. For operated assessments use impacts to the entire joint venture or gross quantities.
3 Environment:
3.1 Environmental Values (EVs) includes flora & fauna species (terrestrial & aquatic), populations & habitats, vegetation, water resources (surface water, groundwater & marine), soils & landforms.
3.2 The assessment depends upon the nature of the receiving environment. Therefore, not all elements under each category will be applicable.
3.3 A conservation significant value is subject to legal protection through regulation or has been identified as a priority by government in terms of special protection or management.
3.4 The Environment category does not capture non-compliance with regulatory requirements or external reporting triggers. These should be assessed under the Compliance category.
3.5 For Environmental costs (including short-term clean up, Environmental Incident Response costs, penalties & fines, total/lifecycle rehabilitation, monitoring and remediation/disposal) use financial consequence.
4 Community & Reputation:
4.1 Definition of community criticism includes criticism by one or more individuals in person, public forums, traditional media or social media.
5 Financial:
5.1 Calculate current financial consequences using Free Cash Flow (FCF).
5.2 Calculate future or multi-year financial consequences using Net Present Value (NPV).
6 Compliance:
6.1 For Compliance costs (including contract breaches, fines, penalties, legal fees, etc.) use financial consequence.
6.2 Community criticism, protest and reputation impacts associated with Compliance assessment should use the Community & Reputation category.

Residual/Current Risk Level	Risk Acceptance / Tolerance
Very High	CEO Direct Report
High	CEO Direct Report
Medium (with Fatality Consequence)	VP/General Manager
Medium (all other risks)	Manager
Low	Team Leader / Supervisor
Very Low	Any Person (ALARP/SFAIRP)

Figure 6 : Measures of likelihood and consequence for risk matrix

Appendix A: Ecology Report

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ECOLOGICAL MANAGEMENT

MAHALO GAS FIELD INFRASTRUCTURE ECOLOGICAL IMPACT ASSESSMENT



Report prepared for
Santos QNT Pty Ltd

August 2025

Terrestria Pty Ltd, PO Box 328, Wynnum QLD 4178 – Email: admin@terrestria.com.au

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Project Manager: Andrew Daniel

Client: Santos QNT Pty Ltd

Report Title: Mahalo Gas Field Infrastructure Ecological Impact Assessment

Project location: Central Queensland

Project Author/s: Andrew Daniel

Project Summary: Mapping of potential MNES and MSES within the vicinity of proposed infrastructure across the Mahalo Gas Field

Document preparation and distribution history

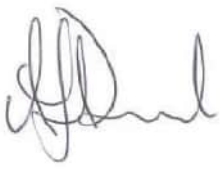
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Signed on behalf of Terrestria Pty Ltd



Dr Andrew Daniel
Managing Director

Date: August 2025

MAHALO GAS FIELD INFRASTRUCTURE ECOLOGICAL IMPACT ASSESSMENT

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Abbreviations

ALA	Atlas of Living Australia
CDF	Construction Disturbance Footprint
DAF	Department of Agriculture and Fisheries
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DETSI	Department of Environment, Tourism, Science and Innovation
EA	Environmental Authority
EO Act (2014)	*Environmental Offsets Act 2014*
EP Act (1994)	*Environmental Protection Act 1994*
EP Reg (2019)	*Environmental Protection Regulation 2019*
EPBC Act (1999)	*Environment Protection and Biodiversity Conservation Act 1999*
EPP (water)	*Environmental Protection (Water and wetland biodiversity) Policy 2019*
ERA	Environmentally relevant activities
ESA	Environmentally Sensitive Area
EVNT	Endangered, vulnerable, near threatened
GPS	Global Positioning System
HES	High Ecological Significance
DA	Development Assessment
MLES	Matters of Local Environmental Significance
MNES	Matters of National Environmental Significance
MSES	Matter of State Environmental Significance
NALL	*Natural Assets Local Law 2003*
NC Act (1992)	*Nature Conservation Act 1992*
NC Reg (2006)	*Nature Conservation (Wildlife Management) Regulation 2006*
P Act (2016)	Planning Act 2016
P Reg	*State Planning Regulation 2017*
PMST	EPBC Act Online Protected Matters Search Tool
QEO Reg (2014)	*Environmental Offsets Regulation 2014*
QEOP (2014)	*Environmental Offset's Policy 2014*
RE	Regional Ecosystem
SDAP	State Development Assessment Provisions
SMP	Species Management Program
SPP	*State Planning Policy 2017*
SPRP	State planning regulatory provisions
TEC	Threatened Ecological Community (EPBC Act)
WoNS	Weeds of National Significance

Executive Summary

Terrestria Pty Ltd has been engaged by Santos QNT Pty Ltd on behalf of the Mahalo Joint Venture to provide an independent assessment of the potential impacts to ecological values regulated under relevant federal and state legislation for the Infrastructure of the Mahalo Gas Field, Central Queensland (Survey area).

Mahalo Gas Project is located within the Central Highlands Regional Council, approximately 40 km north of Rolleston in Central Queensland. The Project is a joint venture between Santos QNT Pty Ltd and Comet Ridge Mahalo Pty Ltd, comprises two petroleum leases (PL1082 and PL1083) over a combined area of approximately 470 km^2 and will be constructed in two phases.

There is an Environmental Authority (EA) P-EA-100178150 from Department of Environment, Tourism, Science and Innovation (DETSI) over the two leases for a petroleum or GHG storage activity. The EA provides for the construction of up to 190 coal seam gas development wells and 228ha of associated disturbance.

The Survey Area runs NNW to SSE through heavy clay plains of old alluvial surfaces, young alluvial surfaces in the north to black soils derived from basalt flows in the south (**Figure 1.1**). This landscape is fertile and has been heavily cleared for cattle grazing. There are few large patches of remnant native vegetation. The old alluvial soils variously support gilgai formations that have mostly been cleared and often blade ploughed.

The assessment methodology involved a combination of desktop assessment using spatially explicit mapping and databases to define the likely distribution and condition of the survey area's native vegetation communities and associated habitats for federal and state threatened flora and fauna species that are thought likely to occur within the local landscape.

Field surveys were conducted using standard methods from the published guidelines to verify desktop assessments; culminating in the production of field verified project scale spatially explicit mapping of the extant ecological values across the survey area.

Threatened fauna habitat quality was modelled using an adapted version of the State's guide to determining terrestrial habitat quality version 1.3 that scored metrics that define the quality and availability of foraging and shelter habitat and the absence of threats for each threatened species that potential occurs within the landscape.

The resultant spatially explicit maps of federal and state significant ecological values informed Santos' project team's design of the gas infrastructure layout. The layout was designed to avoid or minimise impacts to ecologically significant communities and high/medium value threatened fauna habitats.

The final project construction disturbance footprint was then overlaid onto the field verified ecological values mapping to define the direct impacts to regulated ecological values. These data were then used to inform impact assessments made according to the federal significant impact and state significant residual impact guidelines.

The proposed layout will not directly impact federally threatened ecological communities, whilst there will be an impact to 0.1 ha of endangered RE 11.3.1 that is prescribed regional ecosystem (regulated vegetation) all this impact occurs in linear strips less than 10m wide with a mid-dense (structural category) regional ecosystem[1] and would not result in a significant residual impact. Indeed, impacts to field mapped regional ecosystems are very minor and all are less than 10m wide. There are no proposed areas of clearing of state mapped remnant vegetation within the defined distance of a state mapped wetland or watercourse.

No threatened plant species were located within the impact area, and none are predicted to occur. Impacts the threatened fauna habitats are limited to the areas provided in **Table A**, below.

Table A: Area and Quality of Threatened Fauna Habitat within the Alignment Survey Area

Habitat Quality	Squatter Pigeon	Ornamental/Grey Snake	Yakka Skink	Greater Glider	Koala	Painted Honeyeater	South-eastern Long-eared Bat	Painted Snipe	Latham's Snipe	Sharp-tailed Sandpiper
Low Quality Habitat Scores 0 – 4.9										
Total	4.0	5.5	5.5	5.5	5.38	4.1	5.5	1.5	1.6	5.5
Medium Quality Habitat Scores 5.0 – 6.5										
Total	1.4	0.1	0.1	0.0	0.0	1.4	0.0	3.9	3.9	0.0
Good Quality Habitat Sores 6.5 – 8.0										
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Significant residual impact assessments for the proposed disturbance to threatened wildlife habitat reveals that infrastructure is located almost entirely outside of remnant vegetation patches and regrowth that support high threatened fauna habitat values, resulting in no direct impacts to high value habitats and minimal impacts to medium values habitats for any threatened species. Moreover, impacts to these medium quality habitats will occur as multiple very small slithers on the edges of larger mapped habitat patches.

There is an estimated impact to 1.4 ha of medium quality Painted honeyeater foraging habitat. This species is very unlikely to breed within the locality, and the impacts would occur over several very small and narrow slithers on the edge of much larger mapped habitat patches and a significant residual impact to this species is also not anticipated.

Impacts to 3.9 ha of medium quality foraging habitat for the Painted and Latham's Snipes was not considered to represent a significant residual impact because of the availability of very large areas of similar cleared gilgai habitat within the locality and the low probability of occurrence of either species

[1] DEHP, 2014. Table 1, Section 2.1 Queensland Environmental Offsets Policy, Significant Residual Impact Guideline, Nature Conservation Act 1992 Environmental Protection Act 1994 Marine Parks Act 2004 December 2014

for significant periods of the year. This resource is thought likely to represent a vanishingly small proportion of the feeding habitat of this type available to both species.

In summary, it was determined that avoidance through design and available mitigation measures were sufficient to prevent significant residual impacts to the habitat for any of the threatened fauna species modelled to potentially occur within the local landscape or other environmentally sensitive areas. A referral under the EPBC Act for a controlled action is not required for impacts to MNES Threatened Wildlife.

1.0 Introduction

1.1 Background and Purpose

Terrestria Pty Ltd was engaged by Santos QNT Pty Ltd on behalf of the Mahalo Joint Venture to provide an independent assessment of the potential impacts to ecological values regulated under relevant federal and state legislation for the proposed development infrastructure of the Mahalo Gas Field, Central Queensland (Survey area) (**Figure 1.1**).

Terrestria Pty Ltd is a specialised ecological consultancy operating in the field of impact assessment for large projects since 2011. The Project assessment was headed up by Dr Daniel a Principal Ecologist with over 30 years' experience in ecological assessment. The field assessment crew was comprised of Mr Sharp an ex-herbarium botanist with over 15 years' experience in ecological consulting and Mr Neville an ecologist with over 20 years' experience in the ecology industry.

This ecological report is based on desktop and field surveys to ground truth the extent and distribution of native vegetation communities and associated fauna habitats that are Matters of National Environmental Significance (MNES) and Matters of State Environmental Significance (MSES). In addition to community and species presence, surveys included habitat condition assessments for threatened[2] species and communities used to inform impact assessments.

Impacts to potential MNES and MSES species habitat, environmentally sensitive areas, MSES communities and Threatened Ecological Communities (TEC) have been defined by intersecting the resulting field-verified spatially explicit habitat quality maps with the construction footprint. The resultant modelled impacts have been assessed against the significant impact[3] and significant residual impact guidelines[4] to determine the potential impacts to State and federally threatened species and communities are anticipated. These significant impact assessments determine whether referral to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC act) is warranted and

[2] Species listed as threatened under the *Environment Protection and Biodiversity Conservation Act, 1999*, *Environmental Protection Act, 1994* and *Nature Conservation Act, 1992*.
[3] DoE 2013, Matters of National Environmental Significance, Significant impact guidelines 1.1, Environment Protection and Biodiversity Conservation Act 1999.
[4] DEHP, 2014. Queensland Environmental Offsets Policy, Significant Residual Impact Guideline, Nature Conservation Act 1992 Environmental Protection Act 1994 Marine Parks Act 2004, December 2014

whether the project will trigger requirements for offsets under the State Offsets Policy[5] administered by the Queensland Department of Environment, Tourism, Science and Innovation (DETSI).

1.2 General Survey Area Description

The Survey Area runs NNW to SSE through heavy clay plains of old alluvial surfaces, young alluvial surfaces in the north to black soils derived from basalt flows in the south (**Figure 1.1**). This landscape is fertile and has been heavily cleared for cattle grazing. There are few large patches of remnant native vegetation. The old alluvial soils variously support gilgai formations that have mostly been cleared and often blade ploughed.

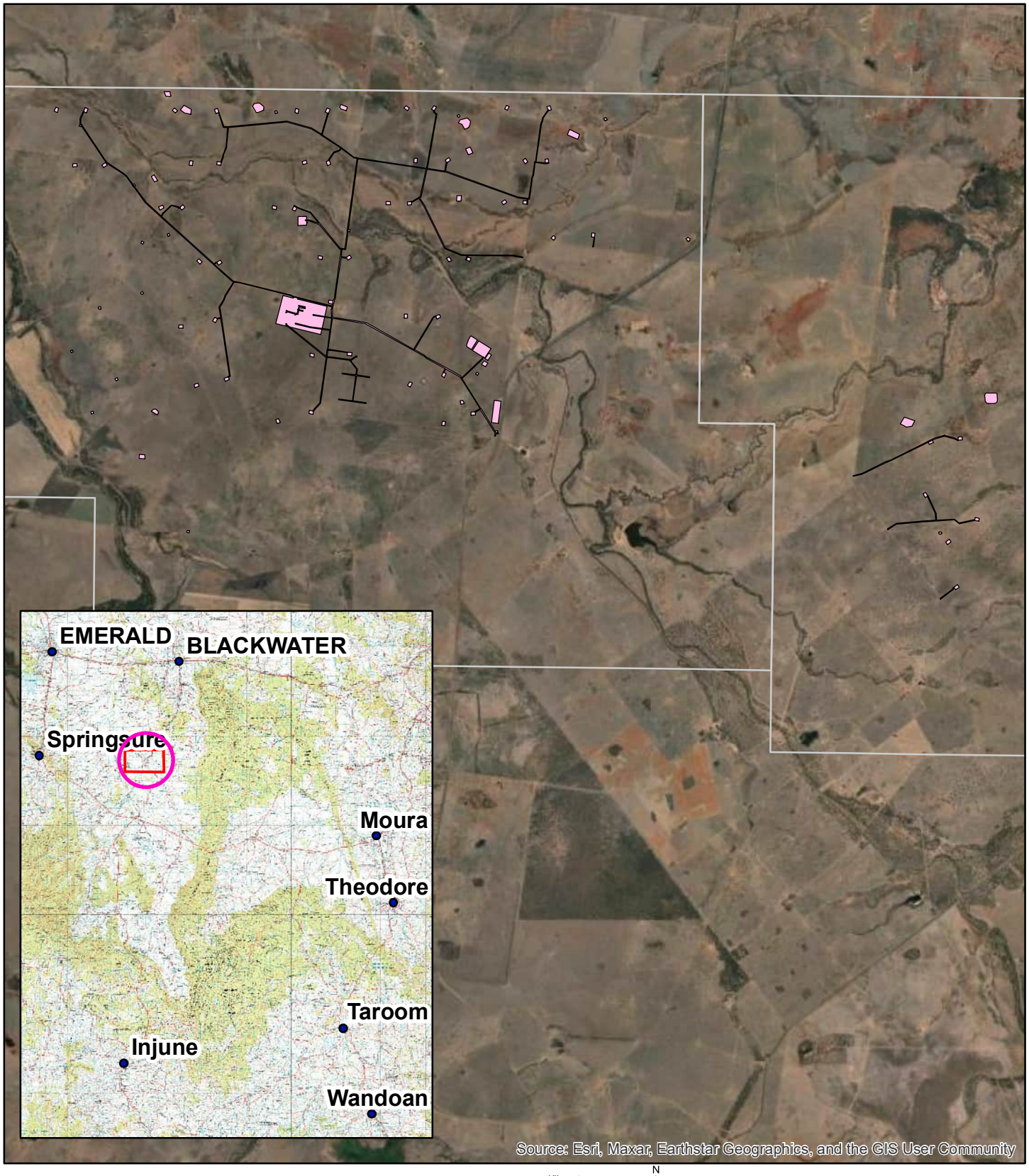
1.3 The Project

Mahalo Gas Project is located within the Central Highlands Regional Council, approximately 40 km north of Rolleston in Central Queensland. The Project is a joint venture between Santos QNT Pty Ltd and Comet Ridge Mahalo Pty Ltd, comprises two petroleum leases (PL1082 and PL1083) over a combined area of approximately 470 km2 and will be constructed in two phases.

There is an Environmental Authority (EA) P-EA-100178150 from Department of Environment, Tourism, Science and Innovation (DETSI) over the two leases for a petroleum or GHG storage activity. The EA provides for the construction of up to 190 coal seam gas development wells and 228ha disturbance. The proposed construction footprint for phase 1 will include:

- 68 gas producing wells
- Water management infrastructure including brine and produced water storage dams
- Ancillary linear infrastructure, including gas and water flow lines, access tracks, power and communication lines
- Laydown areas
- Accommodation camps
- And a communication tower

[5] DES, 2023, Queensland Environmental Offsets Policy, EPP/2015/1658, Version 1.14,Last Reviewed: 29/06/2023



Legend

- Construction Footprint
- Petroleum_leases

Figure 1.1

Survey Area Location and Extent

Mahalo Gas Field Facilities Infrastructure
Ecological Impact Assessment

AD 12/12/24
Job No. 0237

terrestria
ECOLOGICAL MANAGEMENT

2.0 Methodology

Field and desktop assessments were carried out in accordance with the following Santos procedures:

- Methodology for Assessing Ecological Values (0007-650-PRO-0007)
- Procedure for Conducting Vegetation Assessments, Document Number: 0007-650-PRO-0008,
- Procedure for Conducting Preliminary Ecological Desktop Assessments (0007-650-PRO-0009)
- Procedure for Conducting Wetland Assessments (3301-GLNG-4-1.3-0016)
- Guideline for Conducting Vegetation Community Assessments: A Guide to Using the 'Procedure for Vegetation Community Assessments' (0007-650-GDE-0002).

The field assessment identified the existence of these values on-ground and GIS mapping was sued to delineate the extent and distribution of these values across the Survey area. The field survey program was designed to establish likely presence/absence of species and assess the presence, condition and distribution of potential habitat for MNES and MSES threatened wildlife.

Spatially explicit maps depicting the distribution and condition of MNES and MSES communities and habitats were used to determine the likely impacts to these values brought about through the construction of the gas infrastructure. The impacts were then assessed against the impact guidelines[6] to determine whether a significant impact would occur, resulting in an offset liability.

2.1 Suitably Qualified Ecologists

The qualifications and experience of the report author, field assessment and impact assessment teams are provided in **Appendix E**.

2.2 Desktop Review

The identification of native vegetation communities that are MNES and MSES and/or hold habitat values for MNES and MSES flora and fauna was undertaken through desktop mapping, refined through field surveys. The results of this work have produced spatially explicit maps of likely and possible MNES and MSES communities and habitats. These data have been used to develop a wet-season program that:

- Determines threshold condition criteria within potential Threatened Ecological Communities;
- Determines the presence and condition of communities that are ESAs and/or MSES;
- adequately surveys for the presence of target MNES and MSES threatened species and
- defines the quality of habitats that would support these species.

The methods employed in these desktop mapping exercises are described below.

[6] Both, DoE 2013, Matters of National Environmental Significance, Significant impact guidelines 1.1, Environment Protection and Biodiversity Conservation Act 1999 and DEHP, 2014. Queensland Environmental Offsets Policy, Significant Residual Impact Guideline, Nature Conservation Act 1992 Environmental Protection Act 1994 Marine Parks Act 2004, December 2014

2.2.1 Native Vegetation Community Base Mapping

A base map of the likely vegetation communities and associated regional ecosystems was developed within ArcMap. The following State government mapping was downloaded and imported into the GIS platform to provide a basis for polygon attribution.

- Detailed Surface Geology 1:250,000 (DNR 2015) (**Figure 3.1**); and
- DES's VM Act Regional Ecosystem and Remnant Mapping-Version 12.2(**Figure 3.2**).
- High Value Regrowth Mapping (**Figure 3.2**).

Expert desktop mapping was conducted using state mapping layers over recent high quality colour aerial imagery. Line work for the 1:100,000 State mapping was refined, and areas of native vegetation not mapped by the small-scale State mapping were added at a scale of 1:3,000 (linework only). These maps were exported to android tablets for field validation.

2.2.2 Threatened Ecological Community Mapping

The potential occurrence of threatened ecological communities was provided through the PMST search (**Appendix A**). Conservation advice for the threatened ecological communities thought to occur were interrogated to derive a list of regional ecosystem equivalents. Review of the project desktop regional ecosystem mapping (**Section 2.1.1**) highlighted the potential distribution of threatened ecological communities within the Survey area. Review of historical aerial photographs on QGlobe was also used as a tool to assess the likelihood that regrowth communities would exhibit the structural characteristics and age benchmarks to qualify as a threatened ecological community as provided in the relevant published Conservation advice. These data were uploaded onto field tablets to inform field validation surveys.

2.2.3 Desktop Gilgai Delineation and Habitat Quality Assessment

Areas of gilgai were mapped using multiple remote imagery sources to identify their distribution and quality. Gilgai quality was assigned using expert interpretation of aerial imagery for the presence of likely micro-habitat features that could support native species and in particular threatened species. The categories assigned to mapped gilgai are provide below:

low quality	Larger and/or deeper in appearance and may hold water for longer periods but does not support shrub layers or fallen woody material, or moderate in dimensions but supports some shrubs/woody material to provide shelter for fauna.
Medium quality	Larger and/or deeper in appearance and support shrub layers or fallen woody mater.
High quality	Gilgais present within well developed open forest

These data were uploaded onto field tablets to inform field surveys.

2.2.4 Identification of Watercourse Crossing Points

Vegetation Management Act 1999 and *Water Act 2000* watercourse crossings were identified using GIS shapefiles sourced from QSpatial. The location of these crossings was identified on field tablets for assessment in the field. The location of watercourse crossing sites are presented along with site data.

2.2.5 Potential Occurrence of Threatened Species

The desktop assessments have provided a list of target species listed under the EPBC and NC Acts that may occur within the Survey area (target threatened species). Information gained from this phase of the study has been used to:

- Identify threatened species known from the locality;
- Determine which threatened species are likely to occur if suitable habitat is located within the Survey area; and
- Identify likely habitat within the Survey area based on available mapping and aerial photograph interpretation.

The likelihood of occurrence of Listed flora and fauna within the immediate vicinity of the Survey area were assessed using expert knowledge of the micro-habitat features required to sustain these species and detailed knowledge of the presence and distribution of these micro-habitat features within the Survey area. Six (6) categories of fauna and four (4) categories of flora were used to classify the likelihood of a species being present within the Survey area based on the desktop research and existing knowledge of the local environment. Where the possibility of occurrence cannot be ruled out but expert analysis suggests that this possibility is extremely low an extra prefix of "unlikely" has been added to the category, for example unlikely potential visitor. Categories were defined as:

- Present — confirmed during field assessments
- Likely — suitable habitat observed during field assessments, within known distribution and records of the species occurring within or around the Survey area
- Potential — possibility of suitable habitat, or limited records of the species within the local region
- Potential visitor (fauna only) — possibility of suitable feeding habitat that may be utilised on an infrequent basis or for a limited time
- Potential Fly over (fauna only) — Predominantly aerial species unlikely to land);
- Unlikely — no suitable habitat or not known to occur within the local region

The results of this exercise are presented in **Appendix C** and **D** for threatened flora and fauna respectively. This work was used to focus survey efforts and develop field work programs.

2.2.6 Identification of Potential Habitat for Threatened Species

Threatened fauna habitats within the Survey area were mapped using the mapping rules provided for Arcadia gas fields in Boobook (2021) and expert knowledge on habitat requirements applied to the desktop regional ecosystem mapping. Expert profiles of habitat requirements for species known to occur within the locality were undertaken and the likelihood of occurrence assessed (**Appendix C** and **D**). Habitat types were identified using the regional ecosystem classification system and habitat condition classes were identified as either remnant or regrowth. It was determined that there was insufficient variation in non-remnant regrowth patches to warrant division into advanced and young regrowth sub-categories. All areas of regrowth were identified as young and highly disturbed.

Desktop assessments were used to identify replicates of similar condition classes for on-ground condition assessment. These data were used to assign threatened species survey and habitat condition sites that incorporated replicate survey sites for all habitat types along the length of the alignment according to the Terrestrial Habitat Quality Guidelines[7]. The locations of the THQ field-based attribute assessment sites are given in **Appendix F.** These data were uploaded onto field tablets to inform field survey effort.

2.2.7 Threatened Ecological Community and MSES Regulated Vegetation Condition Assessment

Vegetation communities whose dominant floristics reflect those of threatened ecological communities were identified for field condition assessments to determine whether they meet condition thresholds required to qualify as a Threatened Ecological Community according to the relevant published conservation advice. Historical and contemporary aerial imagery were examined to gain an understanding of likely structural and floristic condition. Representative sites for field validation were selected, and the data was exported to field tablets for field validation.

2.2.8 Presence of and Proximity to Environmentally Sensitive Areas

Construction and operation of environmentally relevant activities, requires an assessment of environmental values[8] identified by the State as environmentally sensitive areas[9]. Environmentally sensitive areas include national parks, state forests, world heritage areas, Ramsar wetlands, nationally important wetlands, endangered and of concern regional ecosystems and essential habitat and include feature areas of significant natural and cultural values such as habitat for conservation significant flora and fauna and places of Aboriginal and European cultural heritage.

Gas projects are required to assess the risk that an environmentally relevant activity poses to environmentally sensitive areas [10]. The risks of various petroleum activities are classified and defined as.

[7] DEHP. 2014. Guide to determining terrestrial habitat quality. A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy. Version 1.2 April 2017
[8] Section 9 of the EP Act includes; *a quality or physical characteristic of the environment that is conducive to ecological health, public amenity or safety, as well as any other qualities of the environment identified and declared to be an environmental value under an environmental protection policy or regulation*
[9] Pursuant to sections 125 (for variation and site-specific applications) and section 226 (for amendment applications) of the Environmental Protection Act 1994 (EP Act)
[10] Environmental Protection Regulation (2008)

- Level1 Petroleum Activities, which are activities considered to have a high risk of causing significant environmental damage and
- Level 2 Petroleum Activities, which are activities considered to have low potential to cause environmental harm

In turn environmentally sensitive areas are also classified according to their sensitivity to environmental impacts into Category A, B and C environmentally sensitive areas.

Category A and B ESAs are defined under the Environmental Protection Regulation (2008). They are also provided within the *draft Code of Environmental Compliance for Level 2 Petroleum activities* (EPA 2008) part of the environmental compliance and condition framework. Level 2 petroleum activities must not cause harm to Category A and B ESAs. Authority for Level 1 petroleum activities may be granted in associated with an approved EM Plan assessed under the EIS framework.

Category C ESAs are listed in the *Draft Code of Environmental Compliance for Level 2 Petroleum Activities*. Category C ESAs are defined under the EA conditions for individual projects. Environmental Sensitive Areas considered in this assessment are provided in **Table 2.1**, below.

Mapping layers of individual ESAs were sourced from QSpatial and projected within a GIS along with the proposed gas field infrastructure. The resulting map was interrogated for the likely impacts based on the level of impact and the proximity of mapped ESAs to the activity.

Table 2.1: Environmental Sensitive Area Types

Category A Protected Areas
National Parks (Aboriginal Land)
National Parks (Torres Strait Islander Land)
National Park, National Park (scientific), National Park (Recovery)
Conservation Park
Forest Reserves
Wet Tropics World Heritage Areas
Greta barrier Reef Marine Park Area
Marine Parks (other than general use zones)
Category B Protected Areas
Coordinated Conservation Areas
Wilderness Areas
Areas of critical habitat, of major interest identified under a conservation plan or subject to an interim conservation order
World Heritage Management Areas
International Agreement Areas
Endangered Regional Ecosystems (Biodiversity Status)
Ramsar Wetlands
Protection of the World Cultural and National Heritage
Conservation of Migratory species
General use Zones of Marine Parks
Place of Cultural Heritage Significance (Registered Place, Protected Areas)
Aboriginal Cultural Heritage Areas
Torres Strait Islander Cultural Heritage Areas
Designated Landscape Areas – other than Stanbroke
Feature Protection Areas, State Forest Park or a Scientific Area
Fish habitat Areas and areas of Marine Plants
An Area to the Seaward Side of the Highest Astronomical Tide
Category C Protected Areas
Of Concern Regional Ecosystems (Biodiversity Status)
Declared areas
Nature refuges and Resource Reserves
Declared Catchment Areas
Declared irrigation Areas
Water supply Areas
Drainage Areas
River Improvement Areas
Stanbroke Designated Landscape Area
State Forests or Timber Reserves
Koala Habitat Area
Essential Habitat
Coastal Management Districts
Aboriginal and Torres Strait Islander owned land and identified interests
Referable wetlands
Reserves under the Land Act 1994
Bureau of Sugar Experimental Stations (research sites)
PI Research Site
Other Environmentally Sensitive Features
EPBC Matters of National Environmental Significance
Flora and Fauna Species Declared under the Nature Conservation Act 1992
Directory of Important Wetlands

2.3 Field Assessments

Field surveys focusing on the proposed gas infrastructure and immediate surrounds was undertaken on 16–26 March 2025. The qualifications and experience of the field survey ecologists are provided in **Appendix E**.

2.3.1 Nomenclature and Taxonomy

Scientific names of flora cited in this report follow Bostock and Holland 2017. Common names for plants are used where helpful and are cited before the scientific name where they are used. Fauna nomenclature follows the International Ornithological Committee checklist (for birds) and DEHP's WildNet database taxonomy (for all other fauna), unless otherwise noted. Some notable references include Churchill (2008), Debus (2012), Van dyck et al., (2013), Cogger (2000), Crome and Shields (1992), Marchant and Higgins (1993), Menkhorst and Knight (2004), Pizzey and Knight (2012), Wilsons (2015).

2.3.2 Vegetation Community Survey

Remnant vegetation in Queensland is mapped by DETSI using the regional ecosystem classification system. Regional ecosystems are defined[11] as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The conservation status (vegetation management class) under the VM Act of regional ecosystems is derived through estimating the proportion remaining since clearing commenced upon European settlement. The Biodiversity Status is assigned using expert driven models that assess pervading factors impacting community condition. The regional ecosystem mapping and classification system provides the basis for the state's ecological conservation framework formalised within the regulation framework and as such is adopted as the mapping system that supports this ecological assessment.

General descriptions of community structure, floristic composition and ecological condition were made within all areas shown in **Appendix F Figure**. The field assessment was conducted in accordance with the Queensland Herbarium's standard methodology (Neldner *et al*., 2022[12]). Where discrepancies were identified in the field between existing regional ecosystem mapping and field observations, such areas were traversed by foot to confirm the extent of the discrepancy. The field survey used standard floristic survey methods to describe vegetation type, structure and composition, as outlined below. Broad Survey areas were chosen based on an inspection of aerial imagery prior to the site visit. Further sites were selected during the survey based on changes in vegetation composition to ensure accurate characterisation of the vegetation communities present.

[11] Sattler, P.S. and Williams, R.D. (eds) (1999). The Conservation Status of Queensland's Bioregional Ecosystems. Environmental Protection Agency, Brisbane.
[12] Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F, Richter, D., Addicott, E.P. and Appelman, C.N. (2022) Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 6.0. Updated April 2022. Queensland Herbarium, Queensland Department of Environment and Science, Brisbane.

Survey sites were marked by waypoints on a hand-held GPS and accompanied by photographic evidence and site proformas/observations. Quaternary sites were used to confirm vegetation community types, vegetation community boundaries, land zones, and occurrence of creek lines.

Tertiary Code Sites

Tertiary Code Sites are used to aid in classification and detailed descriptions of regional ecosystems and vegetation communities. Data collected included location, and environmental information such as land zone. Structural information such as height and covers are estimated for all structural layers. Generally, only the dominant or conspicuous species that characterise each layer are recorded. Site dimensions are restricted to a commonly occurring vegetation type and condition.

Quaternary Assessments

Quaternary site assessments were used to rapidly assess REs and vegetation communities, using linear transects. Data was collected at regular intervals along each transect and where regional ecosystems and vegetation communities change in structure and composition.

Opportunistic Observations

In addition to the detailed survey plots, opportunistic flora data was collected while traversing roads and tracks and whilst travelling between the more detailed survey sites. This data was used to assist in confirmation of regional ecosystem mapping and to check relationships between classificatory units (such as vegetation associations, regional ecosystems, photo-patterns) and landscape features.

2.3.3 Threatened Ecological Community Condition Assessments

Threshold criteria provided in the relevant conservation advice were recorded in the field within areas mapped during the desktop dry season assessments as potentially being a threatened ecological community. Condition threshold criteria for vegetation communities that qualify as a Threatened Ecological Community are given in **Table 2.2**. Data recorded at the THQ field-based attribute sites were used to determine whether communities support values that meet the threshold criteria where patches are thought to possibly meet the criteria. Those patches that 'clearly' do not meet the criteria are documented within the quaternary and RE code site assessments undertaken in the dry-season survey and supplemented by data taken during the wet-season survey.

Table 2.2: Metrics for Threatened Ecological Community Determinations

Threatened Ecological Community	Metrics
Poplar Box Grassy Woodland on Alluvial Plains	• The crown cover of canopy trees in the patch is ≥10%. AND • ≥ 50% of perennial vegetation cover in ground layer** is native. AND EITHER • ≥ 20 perennial native plant species per patch in the ground layer, OR • ≥ 10 mature trees+ per ha with ≥ 30cm dbh*** (and/or hollows) Relevant REs 11.3.2
Brigalow (Acacia harpophylla dominant and co-dominant) ecological community	• vegetation that has not been comprehensively cleared (not just thinned) within the last 15 years; • vegetation in which exotic perennial plants have less than 50% cover, assessed in a minimum area of 0.5 ha (100 m by 50 m); and, • individual patches of Brigalow that are larger than 0.5 ha13. Relevant REs 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14 and 11.12.21;
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	• Number of native grass species • Number of tussocks per ha • Woody Shrub canopy cover • % cover of perennial non-woody introduced species
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Will not be present within Survey area
Weeping Myall Woodlands	Dominance of *Acacia pendula*, native understorey Will not be present within Survey area

2.3.4 Gilgai Field Habitat Quality Assessment

Non-remnant non-functional[14] gilgai habitats have the potential to provide habitat for some of the target threatened species, in particular the grey and ornamental snakes. These species are specialist frog predators and where gilgais still provide functional frog habitat and shelter sites the potential presence of these species requires assessment.

[13] Section1.6, Approved Conservation Advice for the Brigalow (*Acacia harpophylla* dominant and co-dominant) ecological community. 17 December 2017.
[14] Procedure for Conducting Vegetation Assessments, Document Number: 0007-650-PRO-0008

Dry season assessments of gilgai quality had recorded the following characteristics of habitat quality:

- Average Gilgai length
- Average Gilgai width
- Average Gilgai depth
- Fallen logs (>10cm diam.)
- Fallen logs (> 30cm)
- Presence of aquatic vegetation
- Soil cracks (ornamental snake)
- Presence of fringing native vegetation
- Estimate of water permanence
- Course litter (>2cm diam.)
- Fine litter (<2cm diameter)
- Bare ground
- Native Grass cover
- Exotic Grass cover
- Stones (20-60cm)
- Shrub layer
- Native Tree layer
- Gilgai density

The combination of these habitat factors was used to categorise gilgai habitat quality into the following three categories. These categories relate to the gilgai's ability to provide functional habitat for threatened species.

low quality	Larger and/or deeper in appearance and may hold water for longer periods but does not support shrub layers or fallen woody material, or moderate in dimensions but supports some shrubs/woody material to provide shelter for fauna.
Medium quality	Larger and/or deeper in appearance and support shrub layers or fallen woody mater.
High quality	Gilgais present within well developed open forest

Wet-season surveys were undertaken in summer under conditions that favour the detection of gilgai specialist threatened fauna species and additional assessment of gilgai habitat quality. Whilst most of the non-remnant non-functional gilgais were dry or drying out, aquatic plant growth was still present and assessment of gilgai quality. These data were used to update the field assessments conducted during the dry season surveys.

2.3.5 Watercourse Crossing Surveys

Where state mapped watercourses were located in the field and found to contain some native vegetation a cross-section of the watercourse crossing was sketched, along with the general location size and species of the larger native trees. The proposed location of the watercourse crossing was assessed in relation to the broader riparian values to ascertain whether the proposed location was the most appropriate place in terms of minimising impact to ecological values. Mapped *Vegetation Management Act 1999* watercourses where no discernible channelised flow or riparian vegetation occurred were not surveyed in detail.

2.3.6 Threatened Flora Surveys

There are no areas mapped as High Risk under the Protected Plants Flora Survey Trigger Map and therefore surveys that meet the Flora survey guidelines[15]. Despite that lack of necessity to perform formal threatened flora surveys targeted surveys were undertaken in likely habitats. Prior to the field investigation, Commonwealth and State wildlife databases were interrogated to develop a picture of the likely Threatened flora species occurring within the Project locality. A review of the Threatened species known to occur within the locality (as derived from database searches) was undertaken in light of known on-ground habitat and categories used to identify the likelihood of occurrence (**Appendix C**). The presence or potential presence of a species, and species habitat was used to provide target areas for threatened flora field surveys and provide a "search image[16]" for the surveying botanist. Threatened flora surveys were conducted during habitat quality and target fauna surveys with ecologists targeting likely habitats as they were encountered.

2.3.7 Threatened Fauna Surveys

A review of the Threatened species known to occur within the locality (as derived from database searches) was undertaken in light of known on-ground habitat. The results of this exercise are presented in **Appendix D**. The result of this exercise produced a list of 'target' threatened fauna species thought to possibly occur within the locality.

Base maps of potential habitat for target threatened fauna were produced according to the methods provided in **Section 2.2.6**. These maps were used to identify survey sites for the targeted wet season fauna surveys conducted in late summer (13 – 26 March 2025) when conditions were still conducive to high activity of many native amphibians and reptiles.

These surveys were conducted by suitably qualified personnel consistent with federal and state survey guidelines

Koala Spot Assessment Technique Searches

Spot Assessment Technique (SAT) surveys were conducted in areas with potential Koala food trees across the site. The aim was to assess Koala usage of the site. Spot Assessment Technique surveys follow the methodology designed by Phillips and Callaghan (2011). It involves a single ecologist combing the ground under Koala food plant trees (or non-food plant trees if necessary) for a 1-metre radius around the trunk searching for scats. Each tree searched must be greater or equal to 100 mm diameter at breast height (DBH) and search of each tree continues for up to 2 minutes. The searches are halted prior to the 2-minute limit if scats are detected. SAT surveys were conducted at all wet season survey sites where koala food trees were present.

Incidental surveys for the presence of Diamond Firetail, Squatter pigeon were conducted in the early mornings and later afternoons around permanent water sources. Scat and scratch surveys for the

[15] DES, 2020. Flora Survey Guidelines - Protected Plants, Nature Conservation Act 1992. Version 2.01 • Last reviewed: 22 August 2020
16 Tinbergen, L. (1960). The natural control of insects in pine woods I. Factors influencing the intensity of predation by songbirds. Archives Néerlandaises de Zoologie, 13, 265–343.

presence of koala were conducted in areas containing canopy eucalypts. The presence feeding Glossy Black-cockatoos were determined by active searches for orts where Allocasuarina specimens were located.

2.3.8 Threatened Species Habitat Condition Assessments

At the site scale, biodiversity indicators are either based on key or 'indicator' species or structural aspects of the vegetation that are known to be important for biodiversity values (Lindenmayer et al. 2000; Parkes et al. 2003; McElhinny et al. 2005) (**Table 2.3**)[17]. The structure and density of these micro-habitat attributes aid in determine habitat quality for the target threatened species that may occur within the project locality and may determine the likelihood of their presence. Estimates of the structural habitat features (from BioCondition) were recorded within RE Code and Habitat Quality assessment plots. These assessments were undertaken in potential habitat patches identified through the methods described in **Section 2.2.6**.

Table 2.3: Summary of the functional role of vegetation for biodiversity and indicators of those functions

Vegetation functions	Attributes that act as indicators of the functions
Provision of reliable foraging resources for wildlife (e.g. nectar, leaves, seeds)	Large trees Shrub cover Tree canopy cover Native perennial grass Coarse woody debris Organic leaf litter Ground cover
Provision of reliable sheltering resources and or breeding sites for wildlife	Large trees and/or hollow-bearing trees Coarse woody debris Tree canopy cover Shrub cover Organic litter Perennial grass cover

[17] Eyre et al., Section 4, page 12.

2.3.9 Supplementary Habitat Quality Attributes (Species habitat index)

Field-based species-specific micro-habitat and landscape functional attributes were also measured to further determine habitat quality for the target threatened fauna species. These attributes are divided into three key areas:

- Quality as foraging habitat (Food sources on site and approximate abundance)
- Quality as shelter, breeding habitat (Types and availability of shelter at site)
- Quality as mobility habitat (Species mobility capacity considerations)

Metrics that inform the quality and abundance of these attributes, were assessed at the THQ field-based attribute sites. The following metrics were recorded at each site.

- Litter cover.
- Hollows in trees & stags >10cm
- Hollows in trees & stags <10cm
- Fallen logs (>10cm diam.)
- Fallen logs (> 30cm)
- Logs with Hollows (>10cm)
- Large trees >18m
- Decorticating bark
- Soil cracks
- Termite mounds
- Termitaries
- Mistletoe
- Course litter (>2cm diam.)
- Fine litter (<2cm diameter)
- Bare ground
- Native Grass cover
- Exotic Grass cover
- Stones (20-60cm)
- Boulders (> 61cm)
- Rocks Embedded
- Rocks Loose
- Rock crevices
- Exfoliating rock
- Shrub layer

The locations of these survey sites are given in **Appendix F Figure.**

2.4 Post-Survey Assessments

Data obtained from field surveys were used to inform site-scale vegetation community (regional ecosystem and threatened ecological community) mapping and threatened fauna habitat base mapping produced within a GIS according to the methods described in **Sections 2.2.1 – 2.2.7**, above.

2.4.1 Vegetation Community Map Refinements

The site-scale vegetation community mapping was produced using field data and aerial photography interpretation within a GIS platform (see **Section 2.2.1**). This mapping was used to calculate the areas of regional ecosystems present within the Mahalo Gas Field Survey area. The linework was produced at 1:6,000 scale. Wet-season surveys presented an opportunity to gather more field data and further refine the regional ecosystem mapping.

The approach taken was considered conservative in including many patches that may not be structurally remnant or large enough to include on a field scale map. A conservative approach was adopted to include all areas of potential habitat for Threatened species. The habitat qualities of these mapped

vegetation communities were investigated as part of the wet-season survey to ascertain whether they provide sufficient micro-habitat values to supported target threatened species.

2.4.2 Threatened Ecological Community Mapping

Site-scale threatened ecological community mapping was produced using field data (see **Section 2.3.3** above) and aerial photography interpretation within a GIS platform (see **Section 2.2.7** above). This mapping was used to define the distribution of threatened ecological communities within Mahalo Gas Field Survey area.

2.4.3 Gilgai Mapping Refinements

Site-scale gilgai habitat condition mapping was produced using field data (see **Section 2.3.4** above) and aerial photography interpretation within a GIS platform (see **Section 2.2.3** above). Areas initially mapped and assessed during wet season surveys when aquatic macrophyte growth was most developed to produce final gilgai condition mapping.

2.4.4 Threatened Fauna Habitat Quality Mapping

Habitat quality was determined through a modified version of the Terrestrial Habitat Quality Methodology (v 1.3)[18] in which criteria contained within the 'Species habitat attributes' and 'Absence of threats' methods[19] were combined to produce a score for overall habitat quality. Within these methods, the presence of micro-habitat features at a field site (see **Section 2.2.6**) are scored against a possible total score for:

- Quality and availability of food and habitat required for foraging;
- Quality and availability of habitat required for shelter and breeding; and
- Quality and availability of habitat required for mobility.

The 'absence of threats' (scope and severity) was determined by:

- Loss of suitable habitat through land clearing and pasture improvement;
- Change in ground layer composition as a consequence of livestock grazing;
- Change in ground layer composition as a consequence of inappropriate fire regimes;
- Loss of feeding habitat by introduction of weed species;
- Predation by feral predators (e.g., cats, foxes, wild dogs)
- Trampling of nests by livestock.

Scores were combined to give a score out of 10. These values were applied to similar habitat types (Regional Ecosystem x Growth Status) for all polygons. to produce maps of habitat quality across the Survey area. This process was repeated for each species where initial evaluation had indicated the possible presence of suitable habitat and the likely presence of the species within the locality. The

[18] DES 2020. Guide to determining terrestrial habitat quality. Methods for assessing habitat quality under the Queensland Environmental Offsets Policy, Version 1.3 February 2020
[19] Section 2.4.4. Guide to determining terrestrial habitat quality, Methods for assessing habitat quality under the Queensland Environmental Offsets Policy, Version 1.3 February 2020.

quality of habitat was then categorised into Five (5) classes depending upon the presence and abundance of micro-habitat features known to be required for the survival and proliferation of each species. These categories are presented in **Table 2.4**, below.

Impact assessment was conducted by projecting the potential Construction Disturbance Footprint (CDF) over the resultant maps of habitat quality for each target threatened fauna species. These data were exported into excel and the total quantum of potential impact on each habitat type was calculated using pivot tables. The results of this planning exercise informed the assessment of potential significant impacts according to both the federal[20] and state[21] significant impact guidelines.

Table 2.4: Threatened Fauna Habitat Quality Classes

Low quality habitat	Habitat quality Scores 0 – 4.9	Most micro-habitat features that could support individuals of this species are largely absent. Scores are largely derived from presence of features that facilitate movement between other suitable patches of habitat (corridor values). High presence of threats.
Medium quality	habitat quality Scores 5.0 – 6.5.	Many of the micro-habitat features known to support this species are present but may be sparsely distributed or the habitat is isolated from other habitat patches. Threats are present.
Good Quality	habitat quality Sores 6.5 – 8.0	Most micro-habitat features known to support this species are present. Habitat patches are connected to habitat within the broader landscape. Threats are present
High Quality Habitat	habitat quality Sores 8.0 – 9.0	Almost all micro-habitat features known to support this species are present and generally abundant. Habitat patches are well connected to habitat within the broader landscape. Few threats are present
Very High Quality Habitat	habitat quality Sores 9.0 – 10.0	All micro-habitat features known to support this species are present and abundant. Habitat patches are large, well connected to habitat within the broader landscape. Threats are generally absent.

[20] DoE 2013, Matters of National Environmental Significance, Significant impact guidelines 1.1, Environment Protection and Biodiversity Conservation Act 1999.
[21] DEHP, 2014. Queensland Environmental Offsets Policy, Significant Residual Impact Guideline, Nature Conservation Act 1992 Environmental Protection Act 1994 Marine Parks Act 2004, December 2014.

3.0 Results

The results of this report are based on a combination of desktop and site investigations as detailed in **Section 2.0**, above. Desktop surveys were used to highlight the potential ecological values that may be present within the Survey area and to focus field survey efforts. These surveys included the integration of federal and state databases and current high-quality aerial photography, State regional ecosystem, watercourse, essential habitat and preclearance mapping to gain an understanding of the likely distribution of vegetation communities, associated regional ecosystems and threatened species habitat throughout the Survey area. Basemaps were initially field-validated during the dry-season for vegetation community type, condition and micro-habitat features along with opportunistic surveys for the presence of threatened species.

The field-validated vegetation community and gilgai mapping were loaded onto tablets and hand-held GPS to inform wet-season field surveys. Results of Threatened Ecological Community assessments and target threatened species habitat quality assessments were used to inform the quantification of impacts to threatened species and communities protected under the EPBC and EP Acts. The quantum of impacts was subsequently reviewed in relation to significant impact and significant residual impact assessment guidelines to determine whether the construction of the proposed gas infrastructure should be referred to the DCCEEW as a potential controlled action or whether State offsets would be required for impacts to MSES.

3.1 Summary of Desktop Results

3.1.1 Geology

The Detailed surface geology – Queensland (2015) spatial database mapping layer (**Figure 3.1**) identifies the Survey area as being dominated by quaternary alluvium associated with the local Creeks running in a north-westerly direction across the centre of the Survey area (Qa-QLD) (land zone 3) (**Table 3.1**). Either side of this relatively young soils are derived from deeply weathered fluviatile and lacustrine claystone and siltstone, quartzose sandstone, pebbly sandstone, gravel, lignite, oil shale, interbedded basalt (Emerald Formation) that give rise to large flat plains of deep vertosol clays that variously supplied gilgai formations (Land zone 5). There minor occurrences of soils derived from a tertiary basalt flow that gives rise to a gently undulating landscape of black clay soils Tb-QLD (Land zone 8).

Table 3.1: Major Geology Units Mapped from the Survey Area (source: Detailed Surface Geology – Queensland, 2015)

Map Symbol/Name	Age	Lithology Description	Land Zone
Emerald Formation(w)	Eocene	Deeply weathered fluviatile and lacustrine claystone and siltstone, quartzose sandstone, pebbly sandstone, gravel, lignite, oil shale, interbedded basalt (possibly a correlative of the Duaringa Formation)	9/4
Tb-QLD	Tertiary	Mostly olivine basalt flows and some plugs; some areas of nephelinite, basanite etc	8
Qa-QLD	Quaternary	Clay, silt, sand and gravel; flood-plain alluvium	3

3.1.2 Regional Ecosystem Distribution

The distribution of remnant (VM Act) regional ecosystems as mapped by the Queensland Herbarium (V12.2) at a scale of 1:100,000 is shown in **Figure 3.2**. Descriptions from the Regional Ecosystem Description Database (REDD) (version 12.1) for these regional ecosystems are presented in **Table 3.2.**

The Herbarium 1:100,000 regional ecosystem map shows that most of the Survey area has been cleared and supports exotic grass grazing paddocks. Retained vegetation along the margins of Humbolt Creek support poplar box (RE 11.3.2) and Coolabah (RE 11.3.3) woodland communities, whilst narrow strips of River-redgum/Forest red gum (RE 11.3.25) form narrow riparian open-forests along the edge of the Creek. Minor components of brigalow woodland mixed within these communities are mapped as RE 11.3.1. None of these communities are large enough to map as homogenous polygons at the 1:100,000 scale.

Away from the creek flats minor patches of retained vegetation support brigalow dominated communities (RE 11.4.9a). Where the canopy of these communities supports black-but (*Eucalyptus cambageana*) they are mapped as RE 11.4.8.

In the central northern section where small pockets of Tertiary basalts support black self-mulching clays small areas of Silver-leafed ironbark (*Eucalyptus melanophloia*) (RE 11.8.4) and Coolibah (*Eucalyptus orgadophila*) (RE 11.8.5) occur and are interspersed by very small areas of grassland (RE 11.8.11). There are also some small patches of retain Poplar box woodland on deeply weathered sandstones mapped as RE 11.5.3.

3.1.3 Desktop Vegetation Community Mapping

Desktop mapping confirmed the likely presence of State mapped regional ecosystems (**Table 3.2**) and removed heterogenous polygons by assignation of the most likely regional ecosystem based on aerial imagery interpretation. The increase in mapped scale has allowed for the identification of smaller patches of potentially remnant vegetation through production of finer scale linework. This process was conservative in its approach, including many patches that may not be structurally remnant or large enough to include on a field scale map. A conservative approach was adopted in order that no areas of potential habitat for listed species were overlooked. It was anticipated that field assessment will remove many of the patches mapped.

Table 3.2: State Mapped Regional Ecosystems within the Survey Area

RE	Biodiversity status	Vegetation Management Act Class	Description
11.3.1	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains
11.3.2	OC	OC	*Eucalyptus populnea* woodland on alluvial plains
11.3.3	OC	OC	Eucalyptus coolabah woodland on alluvial plains
11.3.25	OC	LC	Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines
11.4.8	E	E	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains
11.4.9a	E	E	*Acacia harpophylla, Lysiphyllum carronii* +/- *Casuarina cristata* open forest to woodland. Occurs on level to gently undulating Cainozoic plains, including weathered basalt. Associated soils are predominantly moderately deep to deep cracking clays that may be brown, red-brown or grey-brown, and with much surface gravel in some areas.
11.5.3	NCP	LC	*Eucalyptus populnea* +/- *E. melanophloia* +/- *Corymbia clarksoniana* woodland on Cainozoic sand plains and/or remnant surfaces
11.8.4	NCP	LC	Eucalyptus melanophloia woodland to open woodland on Cainozoic igneous rocks.
11.8.5	NCP	LC	Eucalyptus orgadophila open woodland on Cainozoic igneous rocks
11.8.11	OC	OC	Dichanthium sericeum grassland on Cainozoic igneous rocks
11.9.5	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on fine-grained sedimentary rocks
11.10.3	NCP	LC	Acacia shirleyi or A. catenulata open forest on coarse-grained sedimentary rocks. Crests and scarps
Non-rem			

- NCP = no concern at present, OC = Of concern, E = Endangered

3.1.4 Threatened Ecological Communities

There are five (5) Threatened Ecological Communities (TEC) predicted to occur within the Survey area by the Protected Matters Search Tool (**Appendix A**):

- Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin
- Brigalow (*Acacia harpophylla* dominant and codominant)
- Poplar Box Grassy Woodland on Alluvial Plains
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions
- Weeping Myall Woodlands.

The areas of mapped regional ecosystems within the Survey area that possibly qualify as a Threatened ecological community were identified using state regional ecosystem mapping and aerial photograph interpretation. These Threatened ecological community equivalents are:

- Areas mapped as RE 11.3.2 potentially qualify as Poplar Box Grassy Woodland on Alluvial Plains. The occurrence of this TEC is generally limited by the invasion of perennial exotic grasses within the ground layer.
- Areas mapped as RE 11.3.1, 11.4.8, 11.4.9, potentially qualify as Brigalow (*Acacia harpophylla* dominant and codominant)
- Areas mapped as RE 11.4.9a, potentially qualify as Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions

Threshold condition criteria that determine the presence of the threatened ecological communities were measured in the wet-season field survey program to determine the presence of these communities. The relevant threshold criteria measured during the survey program are presented in **Table 2.1**. The results of these assessments are presented in **Section 3.2.4**.

3.1.5 Desktop Gilgai Delineation and Habitat Quality Assessment

Desktop gilgai mapping was produced during the desktop assessment (see **Section 2.2.3** above) and field verified during the dry-season surveys (see **Section 2.3.4** above). The results of desktop gilgai mapping highlight potential areas of habitat for several threatened species including:

- Ornamental snake (*Denisonia maculata*) (Vulnerable EPBC and NC Acts); and
- Grey snake (*Hemiaspis damelii*) (Endangered EPBC and NC Acts).

Most desktop mapped areas were determined to be low quality; being highly disturbed, shallow and supporting almost no native tree or shrub layers.

3.1.6 Characterisation of Watercourse Crossing Points

No Watercourse crossings in the survey area were assessed against the *Vegetation Management Act 1999* and *Water Act 2000* watercourses during the field surveys.

3.1.7 Potential Occurrence of Threatened Flora Species

The results of database searches conducted for the desktop and dry season assessments[11] [12] identified seven (7) threatened[22] flora species as potentially occurring in the Survey area or within a 20 km radius. A complete inventory of Threatened flora species within the databases, together with a review of the possible occurrence of these species within the Survey area (based on extant habitats) is presented in **Appendix C.**

Potential habitat was identified using the results of the desktop mapping that provided information on the presence and likely condition of native vegetation communities and associated micro-habitat features (e.g. gilgais) that may support these species. The large expanses of heavy clay soils provide potential habitat for several Threatened flora species including:

- *Aristida annua* –on Land Zone 8
- *Cadellia pentastylis* – – Land zone 3, 4 and 9
- *Dichanthium setosum* – Land zone 3, 4 and 9
- *Dichanthium queenslandicum* – Land zone 3, 4 and 9
- *Solanum dissectum*– Land zone 3, 4 and 9

The highly disturbed nature of the Survey area limits the likelihood of occurrence of all these species. There is a higher potential for these to occur within road reserves where grazing is limited (**Appendix C**).

3.1.8 Potential Occurrence of Threatened Fauna Species

The results of database searches and expert local knowledge identified 25 terrestrial vertebrate conservation significant[23] fauna species as potentially occurring in the Survey area or within a 20 km radius. These include no amphibians, 12 birds, six (6) mammals and seven (7) reptiles. The likelihood of these species occurring within the Survey area based on known habitat preferences, contemporary local records, and species ecology are detailed in **Appendix D.**

There are seven (7) birds, three (3) reptiles, and three (3) mammals thought to possibly occur within the Survey area. A review of the likelihood of occurrence has been undertaken using field survey for the presence of essential micro-habitat features undertaken as part of the field surveys. The Threatened fauna species that have the potential to occur within the Survey area are presented in **Table 3.6.**

[22] Listed under the provisions of the EPBC Act
[23] Listed as Extinct, Critically Endangered, Endangered, Vulnerable under the provisions of the EPBC Act

3.1.9 Identification of Potential Threatened Fauna Habitat

Areas of mapped regulated vegetation –essential habitat / wildlife habitat are shown in **Figure 3.2**. Review of this mapping shows that there are large areas of remnant vegetation mapped as essential habitat of the riparian areas of the Comet River in the south-westernmost corner of the Survey area.

Areas of threatened fauna habitat were mapped using the mapping rules provided for Arcadia gas fields in Boobook (2021) and expert knowledge on habitat requirements applied to the baseline field verified regional ecosystem mapping. The resultant maps depict the distribution of potential habitats within the alignment and were used to inform field survey programs. Regional ecosystems assessed as providing habitat for threatened fauna are given in **Table 3.3**, below.

3.1.10 Presence of and Proximity to Environmentally Sensitive Areas

The presence of and proximity to state mapped environmentally sensitive areas is provided in **Figure 3.3**. Review of the mapped environmentally sensitive areas shows that the proposed Gas Field Infrastructure will not directly impact on any state mapped environmentally sensitive areas.

Table 3.3: General Habitat Types for Threatened Fauna Species that Potentially Occur

Common Name	General Habitat	Essential Habitat
Birds		
Geophaps scripta scripta Squatter Pigeon (southern)	11.3.2, 11.3.3, 11.3.25, 11.4.8, 11.5.3, 11.8.4, 11.8.5, 11.9.5a, 11.10.3	
Hirundapus caudacutus White-throated needletail	11.3.1, 11.3.2, 11.3.3, 11.3.25, 11.3.27b, 11.4.8, 11.4.9a, 11.5.3, 11.8.4, 11.8.5, 11.9.5a, 11.10.3	
Grantiella picta Painted Honeyeater	11.3.1, 11.3.2, 11.3.3, 11.3.25, 11.3.27b, 11.4.8, 11.4.9a, 11.5.3, 11.8.4, 11.8.5, 11.9.5a, 11.10.3	
Stagonopleura guttata Diamond Firetail	11.3.2, 11.3.25, 11.5.3, 11.8.4, 11.8.5, 11.10.3	
Rostratula australis Australian painted snipe	11.3.27b, 11.4.8, 11.4.9a gilgai	
Gallinago hardwickii Latham's Snipe, Japanese Snipe	11.3.27b, 11.4.8, 11.4.9a gilgai	
Calidris acuminata Sharp-tailed Sandpiper	11.3.27b, 11.4.8, 11.4.9a gilgai	
Reptiles		
Denisonia maculata Ornamental snake	11.3.1, 11.3.2, 11.3.3, 11.3.25, 11.3.27b, 11.4.8, 11.4.9a	
Egernia rugosa Yakka Skink	11.5.3, 11.8.4, 11.8.5, 11.9.5a, 11.10.3	11.3.1,

Common Name	General Habitat	Essential Habitat
Furina dunmalli *Dunmall's snake*	11.3.1, 11.3.2, 11.4.8, 11.4.9a, 11.5.3, 11.8.4, 11.8.5, 11.9.5a, 11.10.3	
Hemiaspis damelii *Grey Snake*	11.3.1, 11.3.2, 11.3.3, 11.3.25, 11.3.27b, 11.4.8, 11.4.9a	
Delma torquata Collared delma	11.3.2, 11.3.3, 11.4.9a, 11.5.3, 11.8.4, 11.8.5, 11.10.3	
Mammals		
Phascolarctos cinereus Koala	11.4.8, 11.5.3, 11.8.4, 11.8.5, 11.10.3	11.3.2, 11.3.3, 11.3.25,
Nyctophilus corbeni South-eastern long-eared bat	11.3.1, 11.3.2, 11.3.3, 11.3.25, 11.3.27b, 11.4.8, 11.4.9a, 11.5.3, 11.8.4, 11.8.5, 11.9.5a, 11.10.3	
Petauroides minor Greater Glider (northern)	11.3.2, 11.3.3, 11.3.25, 11.3.27b, 11.4.8, 11.5.3, 11.8.4, 11.8.5, 11.10.3	
Petauroides armillatus Central Greater glider	11.3.2, 11.3.3, 11.3.25, 11.3.27b, 11.4.8, 11.5.3, 11.8.4, 11.8.5, 11.10.3	

3.2 Field Results

Field results are based on field surveys undertaken between 13 — 26 March 2025. The qualifications and experience of the Terrestria field crews are provided in **Appendix E**.

3.2.1 Site Survey Conditions

The wet season surveys for the main alignment were undertaken in late March, at the end of summer, after summer rains when nighttime temperatures remained high. The BOM records for Rolleston airport recorded 220 mm rain in the preceding two months with mean nighttime temperatures of 29.3°C. These conditions were considered ideal for the detection of terrestrial vertebrate fauna and in particular reptiles and amphibians. The Moon Phase on 5th March was a wanning crescent moon moving through its darkest phases to a waxing crescent moon on Saturday 16th March. These conditions are considered ideal for spotlighting surveys.

3.2.2 Field Mapped Regional Ecosystems

Project-scale field-validated regional ecosystem mapping generally confirmed the State mapped vegetation with refinement of scale leading to heterogenous polygons being remapped as homogenous polygons of the constituent parts. The distributions of these ecosystems are provided in **Figures 3.4 A1 & A2**. The total areas of each individual regional ecosystem type are provided in **Table 3.4.**

In addition to remnant regional ecosystems the field mapping program identified areas of regrowth vegetation that do not meet the threshold criteria for remnant or 'Santos Functional' regional ecosystems but that may contain some micro-habitat features that could support Threatened flora or fauna species. These areas are not considered to be regulated Environmentally Sensitive Areas (ESA) as they do not possess the minimum ecological values. They may however be considered wildlife habitat if they are shown to support or provide sufficient habitat values to support Threatened species known from the locality. To this end these patches have been included as target areas for wet season Threatened fauna species surveys and their areas are provided along with mapped remnant[24] patches.

3.2.3 Functional Regrowth

Areas of regrowth native vegetation that possessed sufficient attributes to be regarded as functional according to Santos' *Thresholds for Assessing Regional Ecosystem Functionality*[25] were investigated. These functional regrowth patches can also represent an ESA or TEC if they contain the habitat factors for threatened species and possess biodiversity values that are worthy of protection. Patch of mapped regrowth 11.4.8 is remapped as functional regrowth 11.4.8 No areas of regrowth were identified as non-remnant but "functional" according to the Santos methodology however some areas of regrowth were mapped as worthy of investigation with regards to their potential to provide habitat for MNES fauna species. Vegetation community field survey data is presented in **Appendix F** with survey site locations shown on **Appendix F Figure.**

Table 3.4: Field Mapped Regional Ecosystems within the Survey Area

RE	Biodiversity status	VM Class	Description	State Mapped Area (ha)	Field Mapped Area (ha)
11.3.1	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	276.0	561.3
11.3.2	OC	OC	*Eucalyptus populnea* woodland on alluvial plains	838.3	179.4
11.3.25	OC	LC	*Eucalyptus tereticornis* or *E. camaldulensis* woodland to open forest. Other tree species, including *Casuarina cunninghamiana, E. coolabah, Melaleuca bracteata, Melaleuca viminalis, Livistona spp.* (in north), *Melaleuca spp.* and *Angophora floribunda*, may occur. A tall shrub layer may occur, including *Acacia salicina, A. stenophylla* and *Lysiphyllum carronii.* Low shrubs are present but rarely form a conspicuous layer. The ground layer is	1850.3	241.2

[24] Schedule dictionary – *Vegetation Management Act, 1999*
[25] Santos GLNG Upstream, Guideline for Conducting Vegetation Community Assessments (0007-650-GDE-0002).

RE	Biodiversity status	VM Class	Description	State Mapped Area (ha)	Field Mapped Area (ha)
			open to sparse and dominated by perennial grasses, sedges or forbs. Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays with or without some texture contrast. These are usually moderately deep to deep, soft or firm, acid, neutral or alkaline brown sands, loams or black cracking or non-cracking clays, and may be sodic at depth (Burgess 2003). Riverine		
11.3.27b	OC	LC	Vegetation ranges from open water +/- aquatics and emergents such as *Potamogeton crispus, Myriophyllum verrucosum, Chara* spp., *Nitella* spp. *Nymphaea violacea, Ottelia ovalifolia, Nymphoides indica, N. crenata*, *Potamogeton tricarinatus, Cyperus difformis, Vallisneria caulescens* and *Hydrilla verticillata*. Often with fringing woodland, commonly Eucalyptus camaldulensis or E. coolabah but also a wide range of other species including *Eucalyptus platyphylla, E. tereticornis, Melaleuca* spp., *Acacia holosericea* or other *Acacia* spp. Occurs on billabongs. Palustrine.	0.0	63.6
11.3.3	OC	OC	*Eucalyptus coolabah* woodland to open woodland. A secondary tree or shrub layer may occur, including *E. populnea, Melaleuca bracteata, Acacia stenophylla, Alectryon oleifolius, Terminalia oblongata* (in the north), *Acacia pendula, A. cambagei* and *Duma florulenta*. The ground layer is dominated by a range of grass and forb species depending on season. Occurs on Cainozoic alluvial plains or levees with clay or sometimes texture contrast soils.	260.3	65.1
11.4.8	E	E	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains	1226.1	66.3

RE	Biodiversity status	VM Class	Description	State Mapped Area (ha)	Field Mapped Area (ha)
11.4.9a	E	E	*Acacia harpophylla, Lysiphyllum carronii* +/- *Casuarina cristata* open forest to woodland. Occurs on level to gently undulating Cainozoic plains, including weathered basalt. Associated soils are predominantly moderately deep to deep cracking clays that may be brown, red-brown or grey-brown, and with much surface gravel in some areas.	84	37.4
11.5.3	NCP	LC	*Eucalyptus populnea* +/- *E. melanophloia* +/- *Corymbia clarksoniana* woodland on Cainozoic sand plains and/or remnant surfaces	160.1	14.1
11.8.11	E	OC	Grassland dominated by *Dichanthium sericeum, Aristida* spp., *Astrebla* spp. and *Panicum decompositum* with or without trees such as *Eucalyptus orgadophila*, *E. melanophloia, Corymbia erythrophloia* and *Acacia salicina*. However, dominance and cover may vary with seasonal and other environmental conditions. Frequently occurring and sometimes locally dominant, species include the grasses *Aristida lazaridis, A. ramosa, Bothriochloa ewartiana, Dichanthium sericeum, Chrysopogon fallax, Heteropogon contortus, Enneapogon gracilis, Themeda triandra* and *Tragus australianus* and the herbs *Brunoniella australis, Evolvulus alsinoides, Galactia tenuiflora and Indigofera linnaei*. Isolated emergent trees (tree height 12+/-4 m - species including *Eucalyptus orgadophila, E. melanophloia and Corymbia erythrophloia)* or small areas of open woodland may also be present. Occurs on Cainozoic igneous rocks, particularly fresh basalt, and is generally associated with undulating to gently undulating rises. It usually occurs on the crests and middle and upper slopes (slopes 2-6%), although also present on lower slopes and flat areas (slopes 0-2%). Associated soils are moderately shallow to deep cracking clay soils, dark brown to reddish	3.2	0.0

RE	Biodiversity status	VM Class	Description	State Mapped Area (ha)	Field Mapped Area (ha)
			brown in colour, often self-mulching, and with gravel, stone or linear gilgai sometimes present. Surface stone 10-15 cm diameter is present in the south-western remnants. Not a Wetland. (BVG1M: 30b).		
11.8.4	NCP	LC	*Eucalyptus melanophloia* and/or *E. crebra* +/- *E. orgadophila* +/- *Corymbia erythrophloia* woodland to open woodland. *Macrozamia moorei* is a conspicuous element of the mid layer in the Central Highlands. Localised patches of *Corymbia citriodora* occur on volcanic plugs such as Minerva Hills. Generally, occurs on slopes of mountains and hills formed from Cainozoic igneous rocks usually with shallow stony soils and extensive outcropping. Not a Wetland. (BVG1M: 11a).	9.5	15.9
11.8.5	NCP	LC	*Eucalyptus orgadophila* open woodland. *Eucalyptus orgadophila* predominates and forms a distinct but discontinuous canopy sometimes with other sub-dominant species such as *Corymbia erythrophloia, E. melanophloia* and occasionally *E. crebra*. Shrubs are usually scarce and scattered although a well-defined shrubby layer does develop in some areas. On the lower slopes at better sites, softwood scrub species may form tall and low shrub layers under the canopy of *Eucalyptus orgadophila*. The ground layer is moderately dense to dense, and dominated by species that include the grasses *Aristida lazaridis, A. ramosa, Bothriochloa ewartiana, Dichanthium sericeum, Chrysopogon fallax, Heteropogon contortus, Enneapogon gracilis, Themeda triandra* and *Tragus australianus* and the herbs *Brunoniella australis, Evolvulus alsinoides, Galactia tenuiflora* and *Indigofera linnaei*. Occurs on undulating plains, rises, low hills or sometimes flat tablelands on top of mountains, formed from basalt. Generally, soils are shallow to moderately shallow, often	3.2	5.4

RE	Biodiversity status	VM Class	Description	State Mapped Area (ha)	Field Mapped Area (ha)
			rocky or stony clays. Not a Wetland. (BVG1M: 11a).		
11.9.4a			Semi-evergreen vine thicket, generally dominated by a low tree layer (5-10m high) which is floristically diverse and variable. Common codominant species include *Croton insularis*, *Denhamia oleaster*. There is also a tall and low shrub layer (2-6m high) dominated by species such as *Ehretia membranifolia*, *Capparis anomala*, *Geijera parviflora*, *Capparis* spp., *Croton phebalioides*, *Erythroxylum australe*, *Alectryon diversifolius* and *Carissa ovata*. Emergents (16-25m high) are usually present including species such as *Cadellia pentastylis* and Brachychiton spp. Usually on better sites, and *Eucalyptus orgadophila* and Casuarina cristata on drier, poorer sites. Vines are frequent. The ground layer is very sparse and is most frequently composed of *Ancistrachne* uncinulata and *Eragrostis megalosperma*. Occurs on steep upper and middle slopes where heavy clay soils have formed from sediments. It may grade into *Acacia harpophylla*, softwood spp. (11.9.5a) on the lower slopes. It is prominent on the steep slopes of sandstone ranges, where shale has been exposed, and aspect, rainfall and runoff provide sufficient available water for its development. The soils are generally shallow, brown or grey-brown loams or light clays grading into medium or heavy clays. The soil reaction may become strongly acidic or alkaline at depth, depending on the acidity of parent material. May also occur on deep texture contrast soils, where a thin sandy colluvium overlies the clay subsoil. Loose fragments of sandstone may be present over the soil surface	10.6	0.00

RE	Biodiversity status	VM Class	Description	State Mapped Area (ha)	Field Mapped Area (ha)
11.9.5a	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on fine-grained sedimentary rocks	93.2	101.1
11.10.3	NCP	LC	Acacia shirleyi or A. catenulata open forest on coarse-grained sedimentary rocks. Crests and scarps	49.3	90.3
Regrowth 11.3.1	NA	NA	See remnant description above	0.0	93.3
Regrowth 11.3.2	NA	NA	See remnant description above		198.1
Regrowth 11.3.3	NA	NA	See remnant description above		29.6
Regrowth 11.4.8	NA	NA	See remnant description above	0.0	56.1
Regrowth 11.9.4a	E	E	See remnant description above	0.0	860.5
Regrowth 11.5.3	NA	NA	See remnant description above		109.7
Regrowth 11.7.2	NA	NA	See remnant description above		13.0
Regrowth 11.8.4	NA	NA	See remnant description above		16.1
non-rem 11.3.2	NA	NA	Scattered relicted canopy trees that do not meet the required 50% canopy cover of the ecologically dominant layer		4.7
non-rem 11.3.3	NA	NA	Scattered relicted canopy trees that do not meet the required 50% canopy cover of the ecologically dominant layer		0.8
non-rem 11.4.8	NA	NA	Scattered relicted canopy trees that do not meet the required 50% canopy cover of the ecologically dominant layer		1.9

RE	Biodiversity status	VM Class	Description	State Mapped Area (ha)	Field Mapped Area (ha)
non-rem 11.5.3	NA	NA	Scattered relicted canopy trees that do not meet the required 50% canopy cover of the ecologically dominant layer		106.3
non-remnant	NA	NA	Mostly cleared exotic pasture		27123.0

NCP = no concern at present, OC = Of concern, E = Endangered

3.2.4 Threatened Ecological Communities

Areas of vegetation that meet the definition of "Brigalow (*Acacia harpophylla* dominant and codominant)" were mapped as scattered small patches of Regional Ecosystems 11.3.1, 11.4.8, 11.4.9, 11.9.5 within the Survey area (**Figures 3.4**). The lack of field data dictates that all areas of remnant or HVR regional ecosystem equivalents are mapped as TEC until field assessment has been completed.

Again, areas of remnant or HVR RE 11.3.2 are assumed to meet the condition threshold for the TEC, Poplar Box Grassy Woodland on Alluvial Plains until field assessment has been completed. There were also no areas of Weeping Myall Woodlands and it is highly unlikely that patches of this vegetation community occur.

No areas of regional ecosystem equivalents for:

- Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions

It appears likely that direct impacts to Threatened Ecological Communities can be avoided regardless of the final alignment. Potential impacts to these communities are discussed in **Section 4.2.2**, below.

3.2.5 Gilgai Condition Mapping

Field surveys of gilgai condition were made during the end of the wet seasons and resulted in a map of gilgai condition / habitat quality. Areas of gilgai are presented on the regional ecosystem maps (**Figure 3.4**). Patches of high quality gilgai are rare with most having been cleared for grazing. These gilgai areas invariably occur on red clays that do not support significant amounts of deep cracking, fallen woody material is sparse and regrowth brigalow is patchily distributed. Gilgai habitat condition field survey data is presented in **Appendix H**.

3.2.6 Watercourse Crossing Surveys

There are a several *Vegetation Management Act, 1999* (MSES) and *Water Act 2000* watercourse sites, where native vegetation disturbance may result in impacts to MNES habitat for either koala, greater glider, ornamental and grey-snake. The locations of these sites are shown on the state regional ecosystem maps (**Figures 3.2**). Avoidance of impacts at these crossing points may be required avoid impacts to MNES threatened wildlife habitat. Many of the potential watercourse crossing points have been chosen as they do support native vegetation. It is understood that the north-south crossing of Humbolt Creek will follow an existing clearing. The disturbance at this point currently shows the removal of 0.14 ha of RE 11.3.25. It is understood that there are planned actions to avoid removal of this vegetation by utisiling an existing cleared corridor.

3.2.7 Threatened Flora Species Survey

Conditions were ideal for the growth of annual and perennial herbaceous threatened flora species with high rainfall over the summer, meant high levels of herbaceous growth and the likelihood that these species would detectable would be high if indeed they were present.

No evidence of the Threatened[26] flora species were observed during the field survey program. Habitat quality for threatened flora species was observed to be low, with few of the microhabitat features identified in **Appendix C** being present and high levels of threat identified due to agricultural activities throughout the alignment.

3.2.8 Potential Presence of Threatened Fauna

A review of the likelihood of occurrence of the suite of Threatened species that are thought to possibly occur within the Survey area is discussed in light of the known presence of micro-habitat features and connectivity of suitable habitat within the locality, known behavioural and biological characteristics of the individual species. The likelihood of occurrence of Threatened fauna is discussed below within the context of:

- Known contemporary records within the locality;
- Presence of essential micro-habitat features within the Survey area; and
- Ability of the species to access the Survey area's habitats.

Appendix D provides an assessment of the occurrence or likely presence/absence of Threatened fauna species.

Fourteen Threatened fauna species occur or are predicted to occur within the locality, including 7 seven (7) birds, three (3) reptiles, and four (4) mammals. Of these species, thirteen fauna are predicted to potentially occur within the Survey area, including seven (7) birds, three (3) reptiles, and three (3) mammals (**Table 3.5**).

[26] *Nature Conservation Act (1992)* or the *Environment Protection and Biodiversity Conservation Act (1999)*

Table 3.5: Threatened Fauna Species that may Possibly Occur within the Survey area

Species	NC Act	EPBC Act	Data base	Habitat preference	Likelihood of occurrence
Birds					
Rostratula australis Australian painted snipe	V	E	P	Terrestrial shallow wetlands, ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains. Most likely in alluvial areas but could also occur in gilgaied areas.	**Potential** Farm dams within the Survey area provide low quality habitat for this species. The lack of low shrub layers or tall reed beds makes the occurrence of this species less likely. No database records (predicted to occur on EPBC search tool).
Erythrotriorchis radiatus Red goshawk	E	V	P	Endemic to northern and eastern Australia in coastal and subcoastal areas with large home ranges of up to 200 km^2. Occurs in woodlands and forests and prefers mosaic habitats that hold a large population of birds and permanent water. Riparian areas are heavily favoured.	**Potential visitor** The Survey area offers a mosaic of woodlands and forest as foraging habitat for his species. Large expanses of timbered country associated with the neighbouring Expedition Ranges offer better quality habitat for this species. No database records (predicted to occur on EPBC search tool). This is an extremely uncommon species.
Geophaps scripta scripta Squatter Pigeon (southern)	NL	V	W/P	Dry grassy eucalypt woodlands and open forests, also Callitris and Acacia woodlands. Most birds live in sandy sites near permanent water.	**Potential** Habitat for this species occurs across the Survey area and there are within the surrounding landscape. No database records (predicted to occur on EPBC search tool). There is a local record on ALA in 1986.
Hirundapus caudacutus White-throated needletail	*V*	*V*	NB	Aerial birds and for a time it was commonly believed that they did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has	**Potential fly-over** This species potentially feeds in the sky above the Survey area

Species	NC Act	EPBC Act	Data base	Habitat preference	Likelihood of occurrence
				since confirmed that this is a regular activity	
Grantiella picta Painted Honeyeater	V	V	P	Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests.	**Potential** The woodlands of the Survey area provide low quality foraging habitat for this species. This species is very unlikely to breed within the locality. It may however occur as a vagrant especially along creek lines. No database records (predicted to occur on EPBC search tool).
Gallinago hardwickii Latham's Snipe, Japanese Snipe	V	V	P	Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity.	**Potential** There are low quality habitats within the Survey area that may provide temporary feeding habitat for this species. No database records (predicted to occur on EPBC search tool). Records on ALA particularly around Emerald
Calidris acuminata Sharp-tailed Sandpiper	V	V	P	Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland.	**Potential** There are low quality habitats within the Survey area that may provide temporary feeding habitat for this species. No database records (predicted to occur on EPBC search tool). Records on ALA particularly around Emerald
Reptiles					
Denisonia maculata Ornamental snake	V	V	P	In Brigalow (*Acacia harpophylla*), Gidgee (*Acacia cambagei*), Blackwood (*Acacia*	**Potential** Habitat for this species occurs within the

Species	NC Act	EPBC Act	Data base	Habitat preference	Likelihood of occurrence
				argyrodendron) or Coolibah (*Eucalyptus coolabah*)-dominated vegetation communities, or pure grassland associated with gilgais	Survey area. This species is known from the locality.
Egernia rugosa Yakka Skink	V	V	NB	A wide variety of vegetation types including poplar box, ironbark, brigalow, white cypress pine, mulga, bendee and lancewood woodlands and open forests. Substrates include rock, sand, clay and loamy red earth. They can persist in clearings where shelter sites such as tunnel erosion, rabbit warrens and log piles exist.	**Potential** There is some average quality habitat for this species associated with Eucalypt woodlands within the survey area. ALA database records suggest that this species is not common within the locality.
Hemiaspis damelii Grey Snake	*E*	*E*	P	Woodlands (typically brigalow *Acacia harpophylla* and belah Casuarina cristata), usually on heavier, cracking clay soils, particularly in association with water bodies or in areas with small gullies and ditches (gilgais)	**Potential** Habitat for this species occurs within the Survey area No database records (predicted to occur on EPBC search tool). The nearest ALA record (2004) is 50 km north of the Survey area
Mammals					
Phascolarctos cinereus koala	V	V	W/P	Koalas live over a range of open forest and woodland communities. Within the Site, some of the canopy eucalypts are suitable habitat for this species. The presence of main roads and low bushland density within the area makes it unlikely that the koala persists in this landscape	**Potential** Habitat for this species includes all woodlands and open forests dominated by eucalypts within the Survey area.
Petauroides Volans Greater Glider (southern and central)	E	E	W/P	Feeds exclusively on eucalypt leaves and requires up to 18 large hollows within a 1 – 3ha patch	**Potential** Low quality habitat for this species occurs within the Survey area
Tachyglossus aculeatus Short-beaked echidna	SL	NL	NB	Lives in forests and woodlands, heath, grasslands and arid environments. This species is found in disturbed environments where shelter and termites are present	**Likely** A very wide ranging and disturbance tolerant species it is likely to occur.

Species	NC Act	EPBC Act	Data base	Habitat preference	Likelihood of occurrence
Nyctophilus corbeni South-eastern long-eared bat	V	V	P	Occurs in a variety of dry forest habitats including River Red Gum, open woodland, mallee, brigalow and other arid and semi-arid habitats. The preferred habitat is mallee and Callitris woodlands and habitats that have a distinct canopy with a dense, cluttered understorey. It roosts in tree hollows or under bark. Surveys suggest the species requires large tracts of forest to occur .	**Potential** Habitat for this species is associated with the riparian woodlands and open forests within the Survey area. No database records (predicted to occur on EPBC search tool).

3.2.9 Threatened Fauna Habitat Mapping

The quality and distribution of habitat for target threatened fauna species identified in **Section 3.2.8** above was determined through assessment of site-based vegetation community structural and floristic attributes and the presence of essential micro-habitat features and absence of threats across the Survey area. The location of THQ field-based attribute sites survey sites is given in (**Appendix F Figure**).

Field validated regional ecosystem mapping (**Section 3.2.2**) provided the spatial explicit baseline information on which habitat types were created within a GIS. Mapped remnant vegetation and Functional ecological significant areas were considered likely to possess sufficient microhabitat habitat features to support the target threatened fauna species and were the focus of field surveys. In addition, non-functioning TECs and other habitat patches were assessed on a patch-by-patch basis in the field when they were encountered to gain an understanding of how likely they were to provide suitable habitat for MNES fauna species. A summary of the quality and distribution of habitat for the target threatened fauna species is provided in **Table 3.6.**

This exercise resulted in the mapping of areas of MNES and MSES fauna habitat mainly in associated with Comet River in the southwest and Humbolt Creek and its associated alluvial flats running in a north westerly to southeasterly direction across the centre of the Survey area.

Maps for all other target threatened fauna species thought likely to occur within the survey area are shown on **Figures 3.5 A1 – 3.14 A2.** There was no utility in providing figures for general habitat for Red Goshawk *Erythrotriorchis radiatus*, White-throated needletail *Hirundapus caudacutus* and Echidna *Tachyglossus aculeatus* as habitat is predicted to occur across the entire Survey area and so figures for these species have not been presented.

The total area and quality of habitat for each of the target species contained within the survey area are could not be determined because habitat quality data for the following regional ecosystem types was not available at the time of writing this report:

- Remnant RE 11.3.3;
- Remnant RE 11.4.9a;
- Remnant RE 11.8.4;
- Remnant RE 11.10.3;
- Regrowth RE 11.5.3; and
- Regrowth RE 11.8.4.

It is noted that due to the small number of patches confined to the margins of the Survey area, fauna habitat data has not been gathered for Remnant RE 11.10.3, RE 11.8.4, RE 11.8.5 and Regrowth 11.8.4 at this stage.

Review of the distribution of potential habitat reveals that habitat quality is low across most of the Survey area. The better quality habitats are associated with the riparian areas along the Comet River and Humbolt Creek. The total area and quality of habitat for each of the target species that will be disturbed by the CDF are presented in **Table 3.7**. Most of the high and medium value habitats can be avoided (see **Section 4.0**, below).

Table 3.6: Distribution of Habitat for Target Threatened Fauna Habitat

Species	Availability and Distribution of Habitat
Birds	
Geophaps scripta scripta Squatter Pigeon (southern)	Pasture lands immediately abutting tall native woodland canopies would provide feeding grounds for Squatter pigeon (*Geophaps scripta*). Habitat quality for this species is markedly impacted by the overwhelming dominance of exotic grasses, particularly Buffel. Surveys during the dry and wet season failed to detect this species within the alignment and whilst its presence cannot be ruled out it appears unlikely that the habitats within the alignment survey area provide good quality habitat for this species.
Hirundapus caudacutus White-throated needletail	Skies over the whole Survey area
Grantiella picta Painted Honeyeater	Painted honeyeater habitats are limited. Lack of large trees and mistletoe in most vegetation patches within the Survey area limit available habitat for this species. Tall riparian woodland within the Comet River and Humbolt Creek areas provide the only good quality feeding habitats within the Survey area. It is noted that the Survey area is toward the northern likely limit of this species.
Stagonopleura guttata Diamond Firetail	Diamond firetail (*Stagonopleura guttata*) records are limited to BirdLife Australia records uploaded in the year 2000 records being for surveys

Species	Availability and Distribution of Habitat
	conducted between 1977 and 1981. It is very unlikely that this species occurs within the locality.
Rostratula australis Australian painted snipe	Habitat for this species is associated with the vegetated swamps on the alluvial plains of the Comet River and Humbolt Creek as well as seasonal habitats within flooded gilgai areas. This species is very unlikely to breed within the locality and habitats are limited to seasonal feeding resources only.
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Habitat for this species is associated with the vegetated swamps on the alluvial plains of the Comet River and Humbolt Creek as well as seasonal habitats within flooded gilgai areas. This species does not breed within the locality and habitats are limited to seasonal feeding resources only.
Calidris acuminata Sharp-tailed Sandpiper	Habitat for this species is associated with the vegetated swamps on the alluvial plains of the Comet River and Humbolt Creek as well as seasonal habitats within flooded gilgai areas. This species does not breed within the locality and habitats are limited to seasonal feeding resources only.
Reptiles	
Denisonia maculata Ornamental snake	**Present.** Habitat for this species include cracking clays associated with brigalow woodland communities including remnant, regrowth and non-remnant vegetation and even low quality gilgais linked to higher quality habitats. Most of the higher quality habitats are associated with the Comet River and Humbolt Creek riparian open forests and woodlands. There are large areas of cleared gilgai country that provide low quality habitat as they are functionally isolated from better quality habitats, do not support significant areas of deep cracking clays, and contain low abundance of shelter sites.
Egernia rugosa Yakka Skink	Communities that support a good ground cover of coarse woody debris, low shrubs and litter provide habitat for Yakka skink (*Egernia rugosa*), Dunmall's snake (*Furina dunmalli*). These habitats are limited to the higher country in the north and northeast. Most of the survey area is low-lying and subject to seasonal flooding or waterlogging.
Furina dunmalli Dunmall's snake	Communities that support a good ground cover of coarse woody debris, low shrubs and litter provide habitat for Dunmall's snake (*Furina dunmalli*). Most of the higher quality habitats are associated with the Comet River and Humbolt Creek riparian open forests and woodlands.
Hemiaspis damelii Grey Snake	Habitat for this species include cracking clays associated with brigalow woodland communities including remnant, regrowth and non-remnant vegetation, vegetated palustrine swamps associated with the alluvial flats along the Comet River and Humbolt Creek and even low quality gilgais linked to higher quality habitats.

Species	Availability and Distribution of Habitat
Delma torquata Collared delma	Local records for the Collared delma (*Delma torquata*) are limited to isolated populations on the Expedition and Carnarvon Ranges. Habitat assessments suggest that this species does not occur within the Survey area.
Mammals	
Phascolarctos cinereus koala	Tall eucalypt open forest canopies that provide potential habitat for Koala (*Phascolarctos cinereus*) and Greater glider (sensu lato) are provided by the riparian and alluvial open forests along Comet River and Humbolt Creek with smaller more isolated patches of mixed eucalypt woodlands on land zone 5 and 8 scattered across the periphery of the Survey area.
Nyctophilus corbeni South-eastern long-eared bat	Good quality habitat for the South-eastern long-eared bat (*Nyctophilus corbeni*) occurs across most remnant woodland and open forest communities with lower quality habitats associated with regrowth of the same vegetation community types. These habitats are mainly associated with the Comet River and Humbolt Creek with smaller isolated patches scattered across the Survey area.
Petauroides minor Greater Glider (northern) and Greater glider *Petauroides armillatus* (central greater glider)	Tall eucalypt open forest canopies that provide potential habitat for Greater glider (sensu lato) are provided by the riparian and alluvial open forests along Comet River and Humbolt Creek with smaller more isolated patches of mixed eucalypt woodlands on land zone 5 and 8 scattered across the periphery of the Survey area.

Table 3.7: Area and Quality of Threatened Fauna Habitat within the Construction Footprint

Habitat Quality	Squatter Pigeon	Ornamental/Grey Snake	Yakka Skink	Greater Glider	Koala	Painted Honeyeater	South-eastern Long-eared Bat	Painted Snipe	Latham's Snipe	Sharp-tailed Sandpiper
0.4				3.9	3.9					
1.3										
1.4										
1.8										
1.9										
1.9										
2.1										
2.3					0.1					
2.4				0.2						
2.6										
2.7										
2.8							0.1			
2.9		1.3								
3.0										
3.1										
3.3					0.1		3.9			
3.4										
3.4		0.2								
3.5								1.3	1.4	1.4
3.6			1.4			3.9				
3.7										
3.8							1.4			
3.9										
4.0								0.1	0.2	0.2
4.1			4.0							
4.3										
4.4		3.9		0.1						
4.5										3.9
4.6	0.1		0.1					0.1		
4.8					1.37		0.1			
4.9	3.9	0.1		1.3		0.2				
Total	4.0	5.5	5.5	5.5	5.38	4.1	5.5	1.5	1.6	5.5
5.0										
5.1	0.1		0.1					3.9	3.9	
5.2										
5.3										
5.4		0.1								

Habitat Quality	Squatter Pigeon	Ornamental/Grey Snake	Yakka Skink	Greater Glider	Koala	Painted Honeyeater	South-eastern Long-eared Bat	Painted Snipe	Latham's Snipe	Sharp-tailed Sandpiper
5.5										
5.6	1.3					1.3				
5.7										
5.8						0.1				
5.9										
6.1										
6.1										
6.3										
Total	1.4	0.1	0.1	0.0	0.0	1.4	0.0	3.9	3.9	0.0
6.4										
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Low Quality Habitat	Scores 0 – 4.9
Medium Quality Habitat	Scores 5.0 – 6.5
Good Quality Habitat	Sores 6.5 – 8.0
High Quality Habitat	Sores 8.0 – 9.0
Very High Quality Habitat	Sores 9.0 – 10.0

3.2.10 Threatened Fauna Species Survey

Opportunistic fauna surveys were undertaken during habitat quality surveys, including bird watching and active searches such as active log rolling and bark peeling for reptiles and amphibians.

3.2.11 Review of Survey Adequacy

There has been limited field determination of threshold condition criteria for potential Threatened Ecological communities. Adopting the precautionary principle all remnant and HVR areas have been mapped as meeting the condition criteria until otherwise determined. Threatened ecological community condition surveys are likely to be required where impacts to these communities is likely.

Regional ecosystem type was assessed accurately by experienced ecologist in the field and sufficient Queensland Herbarium regional ecosystem code sites were undertaken to establish regional ecosystem type for both remnant and regrowth patches. These sites include estimates of median heights and ranges for all structural layers as well as recording of key species within each structural layer. Most of the current field survey has concentrated on the location of infrastructure and so there has been insufficient field data to accurately determine if the regional ecosystem mapping is fit-for-purpose at present.

There have been no meaningful field Threatened fauna assessment surveys undertaken and is and so the precautionary principal has therefore been employed. That is, the presence of a threatened species has been assumed where suitable habitat has been established along with knowledge of its presence within the local landscape. This approach is considered adequate given the lack of potential habitats for these species within the Survey area. A targeted field survey program that satisfies the State and federal; survey guidelines is likely to be required where impacts to high and medium quality habitats is likely to occur.

4.0 Post-survey Assessments

4.1 Degree of Impact to Ecological Values

Field-validated project-scale mapping of areas of federal and State ecological value were produced within a GIS using data collected during the wet season survey. This mapping provides the spatially explicit distribution of ecological values and combined with the Construction Disturbance Footprint allows for the identification of impacts resulting from installation and operation of the Gas infrastructure. Commitments by the Santos to avoid impacts to identified high quality habitats for threatened species and mapped conservation significant vegetation communities means that the total quantum of impacts will be minimised. An assessment of impacts to specific value types is provided below.

4.1.1 Impacts to Threatened Ecological Communities

There will be no direct impacts on areas of threatened ecological communities listed under the EPBC Act, 1999. A referral under the EPBC Act for a controlled action is not required for impacts to MNES Threatened Ecological Communities.

4.1.2 Impacts to State Regulated Vegetation Communities

There will be an impact to 0.1 ha of endangered RE 11.3.1 that is prescribed regional ecosystem (regulated vegetation). It is estimated that all of this clearing occurs in linear strips less than 10m wide with a mid-dense (structural category) regional ecosystem[27]. There are no other impacts to remnant vegetation communities that are regulated as prescribed regional ecosystems

4.1.3 Clearing within a Defined Distance of a Wetland or Watercourse

There are no areas of clearing of state mapped remnant vegetation within the defined distance of a state mapped wetland or watercourse[28].

[27] DEHP, 2014. Table 1, Section 2.1 Queensland Environmental Offsets Policy, Significant Residual Impact Guideline, Nature Conservation Act 1992 Environmental Protection Act 1994 Marine Parks Act 2004 December 2014

[28] DEHP, 2014. Table 1, Section 2.1 Queensland Environmental Offsets Policy, Significant Residual Impact Guideline, Nature Conservation Act 1992 Environmental Protection Act 1994 Marine Parks Act 2004 December 2014

4.1.4 Impacts to Threatened Flora

No MNES or MSES threatened flora species were found to occur within any of the alignments and given the highly disturbed condition throughout impacts to threatened flora are considered very unlikely.

4.1.5 Impacts to Threatened Fauna Habitat

Significant impact assessments for all threatened fauna thought to potentially occur within the locality are provided in **Appendix G**. It was determined that there were no significant impacts to any of the MNES threatened species thought to occur. Infrastructure is located almost entirely outside of remnant vegetation patches and regrowth that support high habitat values, resulting in no direct impacts to high value habitats for any threatened species.

There is an estimated impact to 1.4 ha of Painted honeyeater foraging habitat. This species is very unlikely to breed within the locality and the impacts would occur over several very small and narrow slithers on the edge of much larger mapped habitat patches that may or may not support mistletoe and a significant residual impact to this species is not anticipated.

There will be a direct impact to 3.9 ha of foraging habitat for the Painted and Latham's snipe resulting from the clearing of non-remnant gilgai areas. These impacts represent a very small proportion of the total area of non-remnant gilgai locally and is an impact to potential seasonal impact to two very wide-ranging migratory species that do not breed in Australia.

A referral under the EPBC Act for a controlled action is not required for impacts to MNES Threatened Wildlife.

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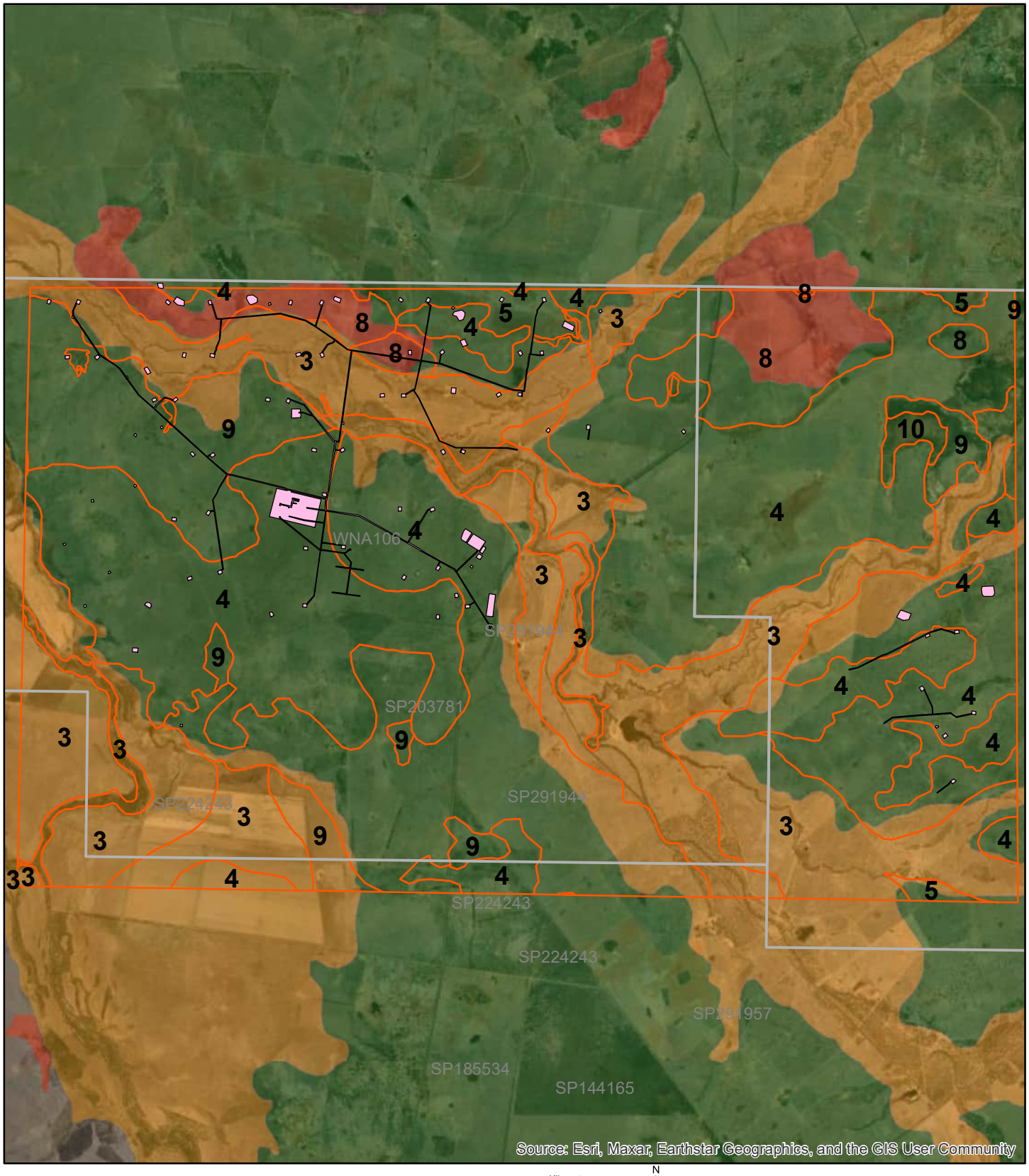
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Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- Emerald Formation(w)
- Qa-QLD
- Tb-QLD

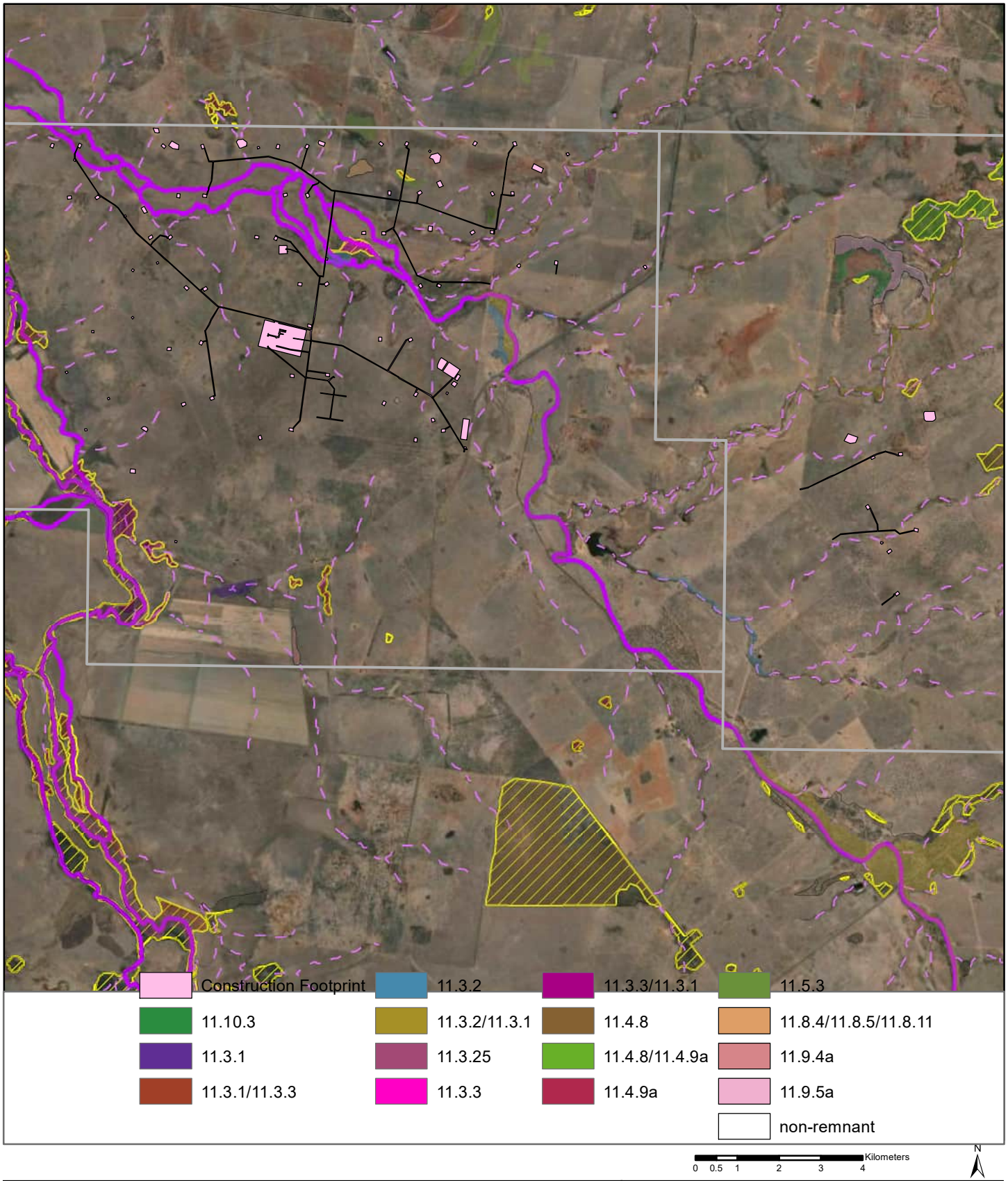
Figure 3.1

State Surface Geology

Mahalo Gas Field Facilities Infrastructure
Ecological Impact Assessment

AD 12/12/24
Job No. 0237

terrestria
ECOLOGICAL MANAGEMENT



Petroleum_Lease_Boundaries
Construction Footprint
Water Act Watercourse
MSES watercourse
Essential_habitat

Figure 3.2

State Regulated Vegetation Mapping Mapping

Mahalo Gas Field Facilities Infrastructure
Ecological Impact Assessment

AD 12/12/24
Job No. 0237

terrestria
ECOLOGICAL MANAGEMENT

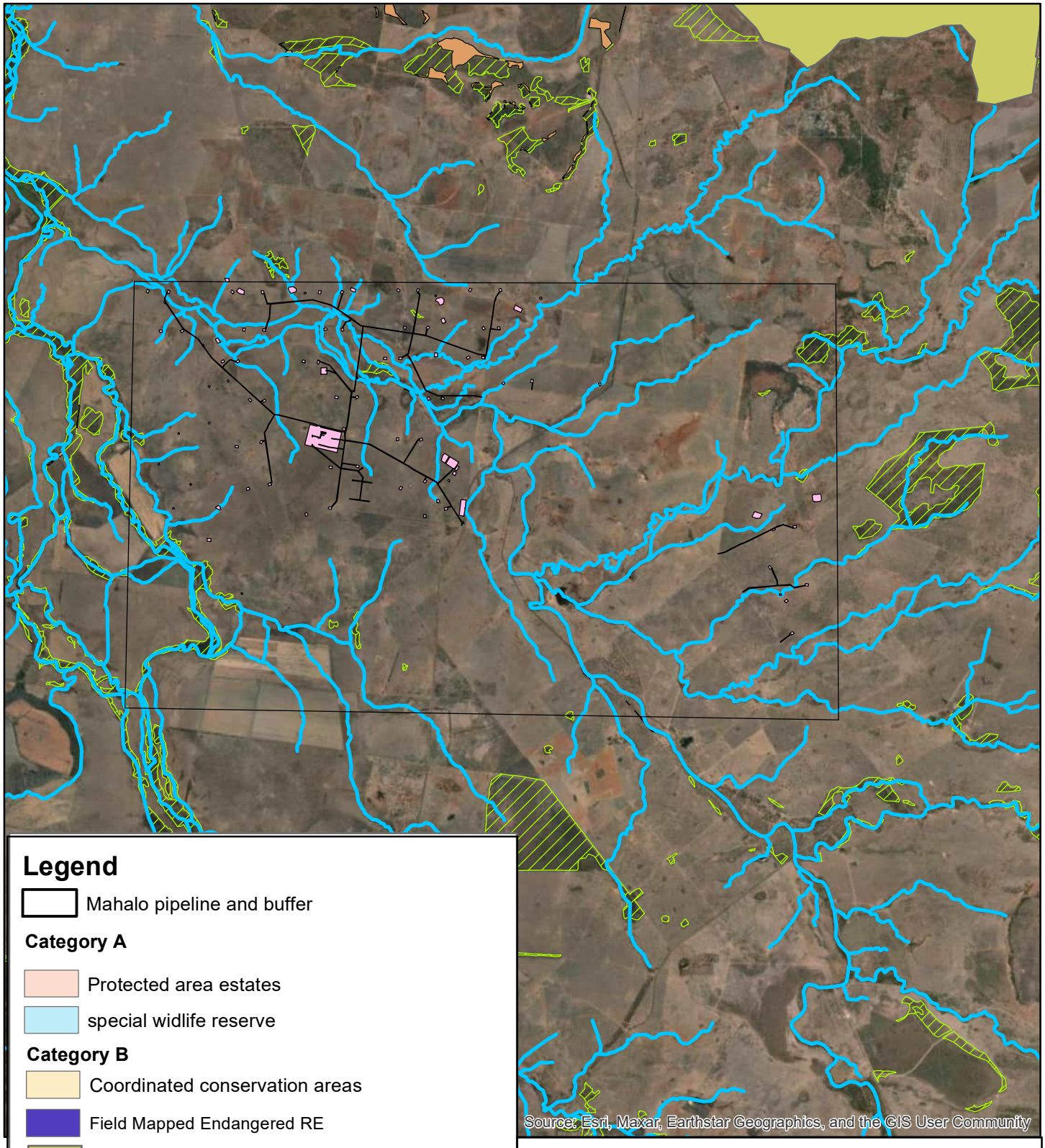


Figure 3.3

Ecologically Sensitive Areas

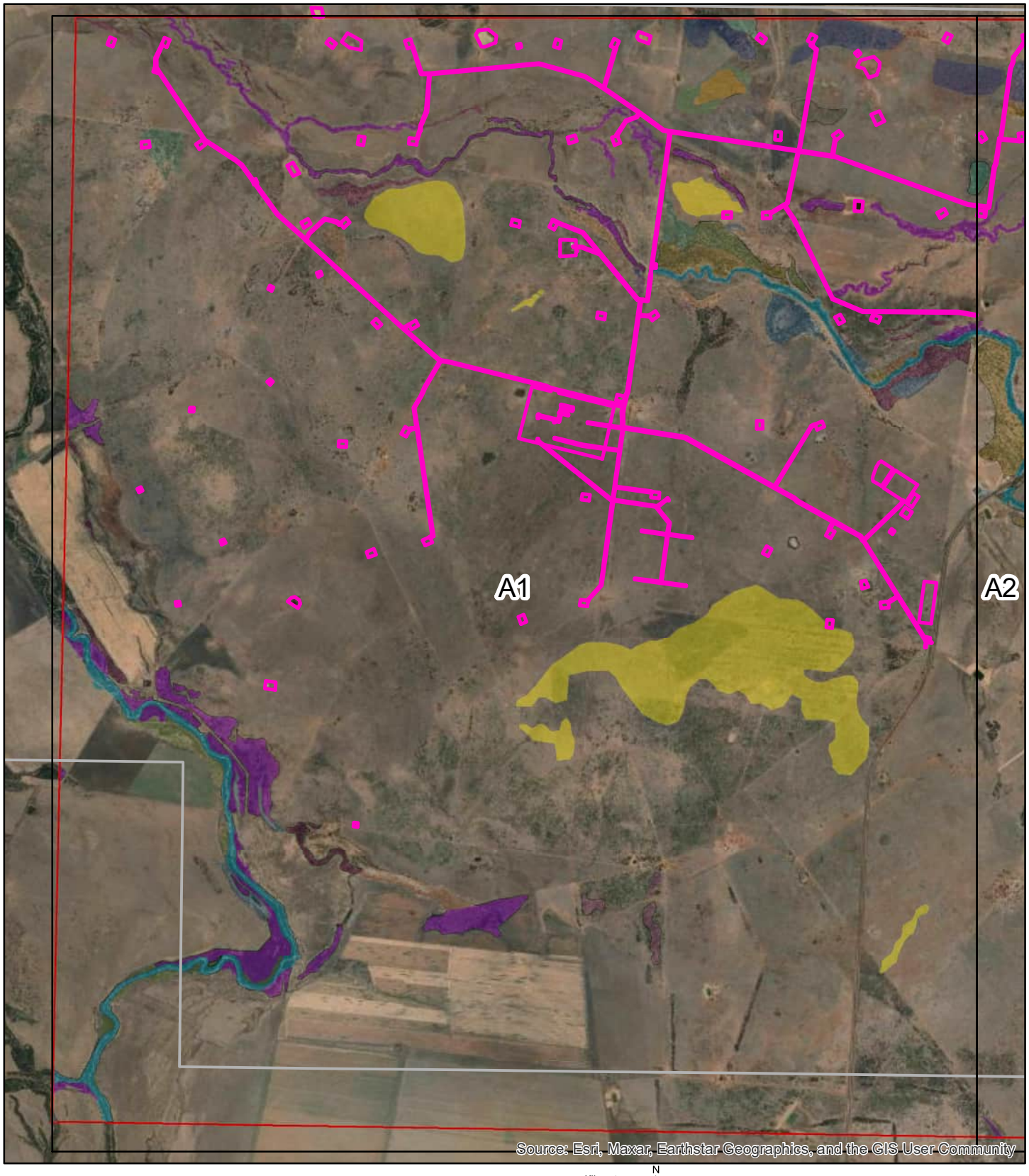
Mahalo Gas Field Facilities
Infrastructure Ecological
Impact Assessment

0 0.75 1.5 3 4.5 6 Kilometers

N

AD 02/02/2024
Job No. 0237

terrestria
ECOLOGICAL MANAGEMENT



11.10.3
11.3.1
11.3.2
11.3.25
11.3.27b
11.3.3
11.4.8
11.4.9a
11.5.3
11.8.4
11.8.5
11.9.5a
Regrowth 11.3.1
Regrowth 11.3.2
Regrowth 11.3.3
Regrowth 11.4.8
Regrowth 11.4.9a
Regrowth 11.5.3
Regrowth 11.7.2
Regrowth 11.8.4
non-rem 11.3.2
non-rem 11.3.3
non-rem 11.4.8
non-rem 11.5.3
non-remnant
Construction Footprint

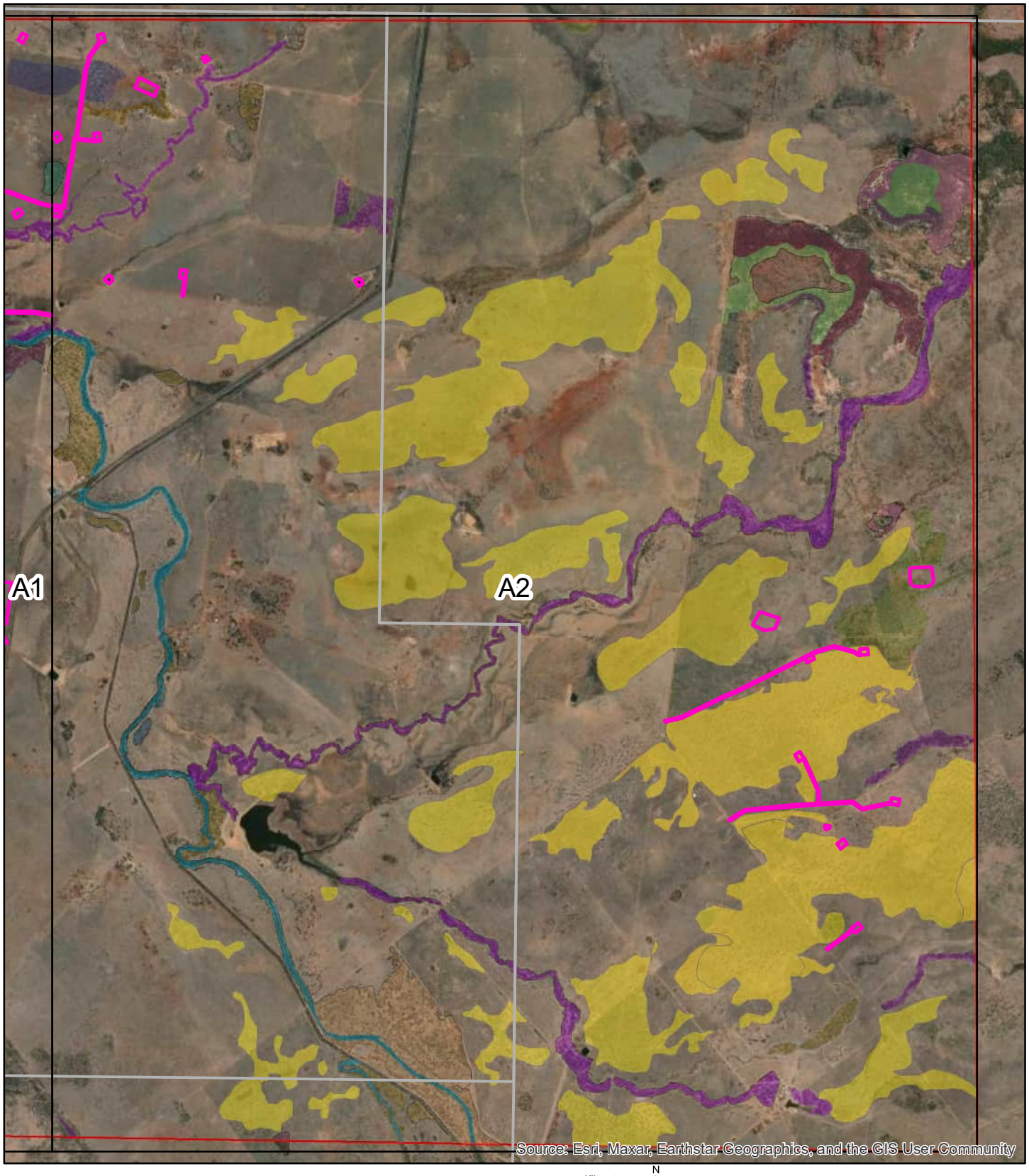
Figure 3.4 A1

Field Verified Regional Ecosystem Mapping

Mahalo Gas Field
Facilities Infrastructure
Ecological Impact Assessment

AD 11/06/25
Job No. 02357

terrestria
ECOLOGICAL MANAGEMENT



11.10.3	11.4.8	Regrowth 11.3.1	Regrowth 11.7.2
11.3.1	11.4.9a	Regrowth 11.3.2	Regrowth 11.8.4
11.3.2	11.5.3	Regrowth 11.3.3	non-rem 11.3.2
11.3.25	11.8.4	Regrowth 11.4.8	non-rem 11.3.3
11.3.27b	11.8.5	Regrowth 11.4.9a	non-rem 11.4.8
11.3.3	11.9.5a	Regrowth 11.5.3	non-rem 11.5.3
			non-remnant
			Construction Footprint

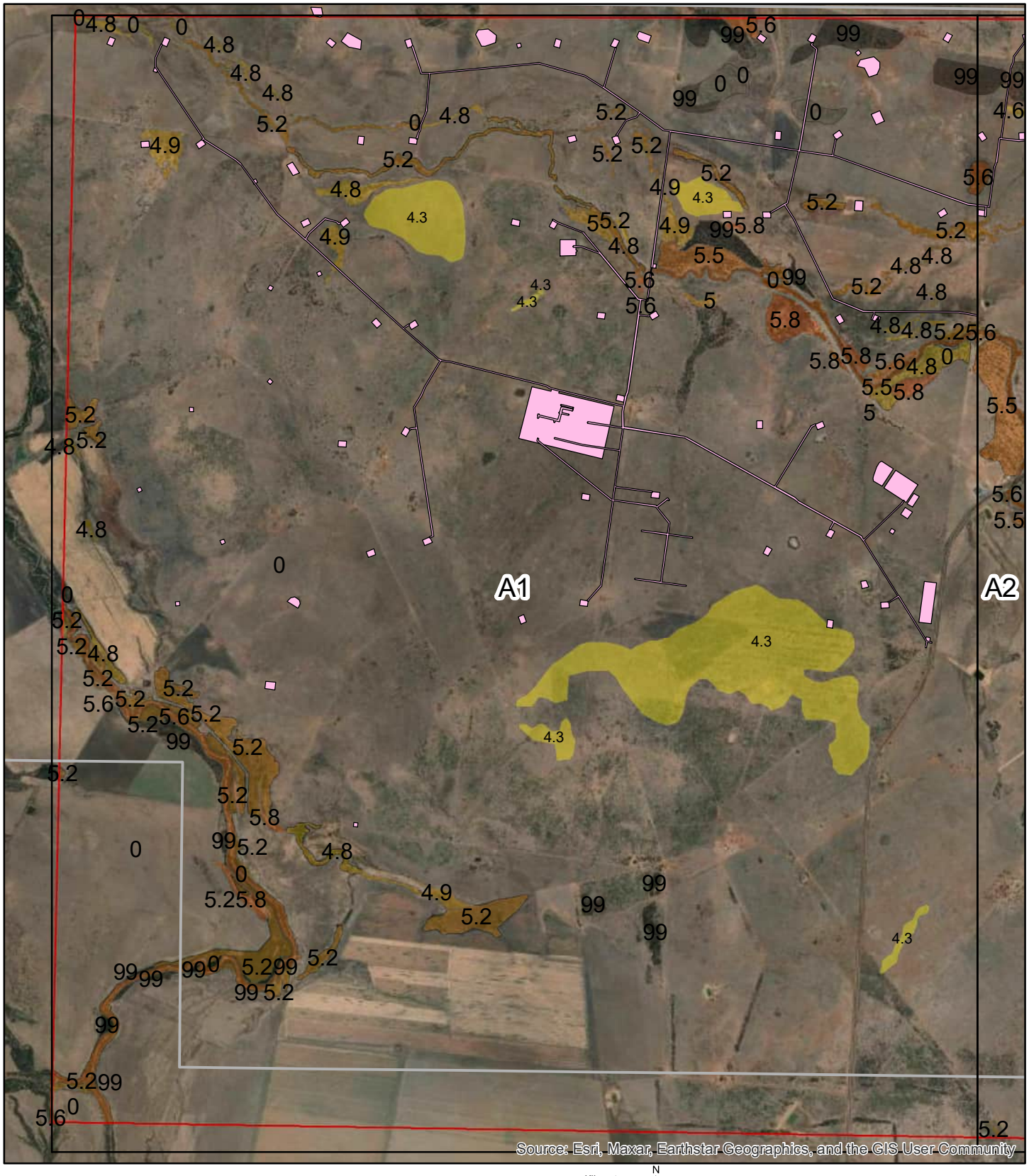
Figure 3.4 A2

Field Verified Regional Ecosystem Mapping

Mahalo Gas Field
Facilities Infrastructure
Ecological Impact Assessment

AD 11/06/25
Job No. 02357

terrestria
ECOLOGICAL MANAGEMENT



Legend

- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
- 3.3
- 3.4
- 3.5
- 3.8
- 3.9
- 4.0
- 4.1
- 4.3
- 4.4
- 4.5
- 4.6
- 4.8
- 4.9
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- 5.1
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- 5.3
- 5.4
- 5.5
- 5.6
- 5.8
- 5.9
- 6.1
- 6.3
- 99

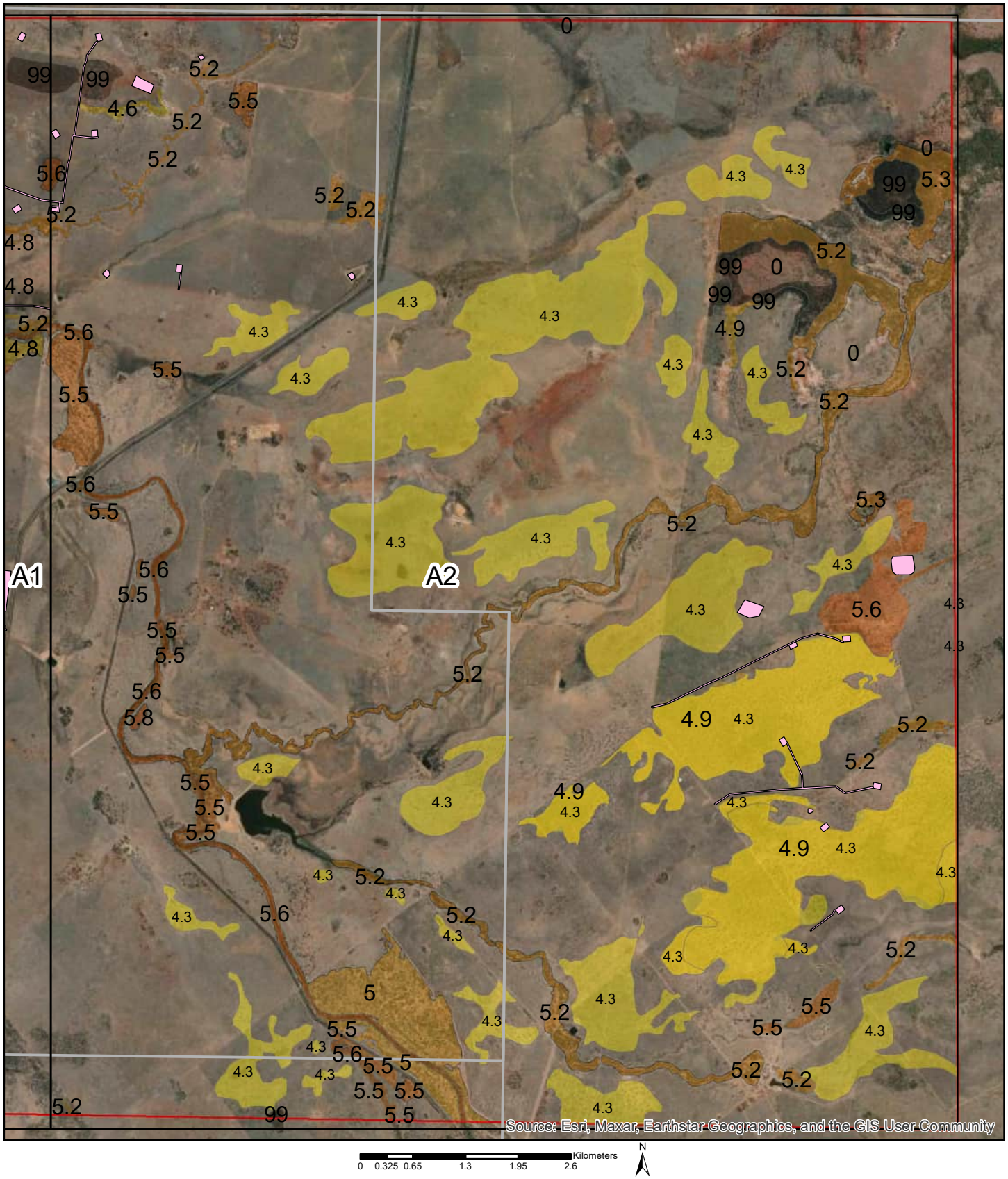
Figure 3.5 A1

Squatter Pigeon Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25
Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
- 3.3
- 3.4
- 3.5
- 3.8
- 3.9
- 4.0
- 4.1
- 4.3
- 4.4
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- 4.6
- 4.8
- 4.9
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- 5.9
- 6.1
- 6.3
- 99

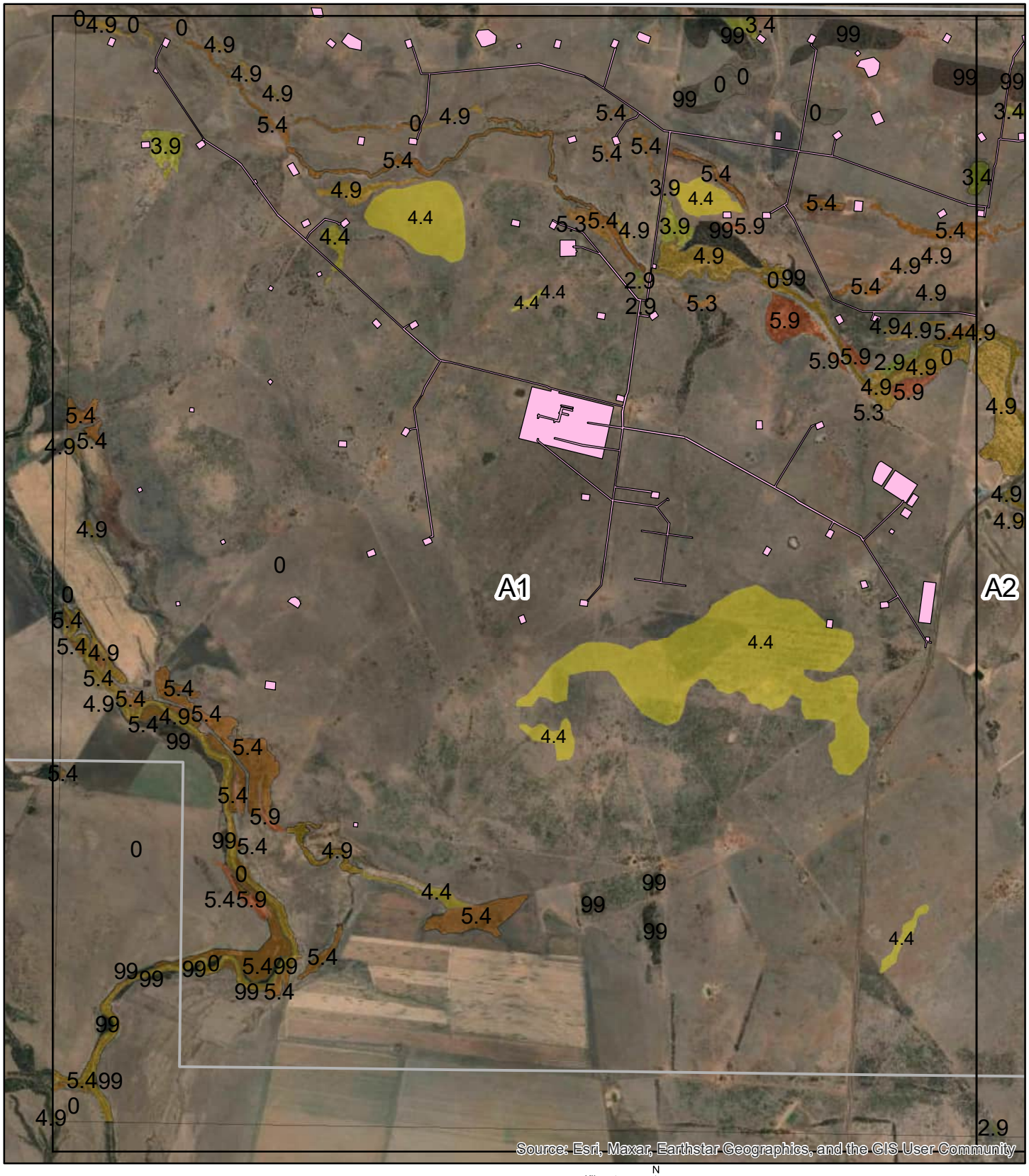
Figure 3.5 A2

Squatter Pigeon Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25
Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Construction Footprint
- Petroleum_Lease_Boundaries
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
- 3.3
- 3.4
- 3.5
- 3.8
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- 4.1
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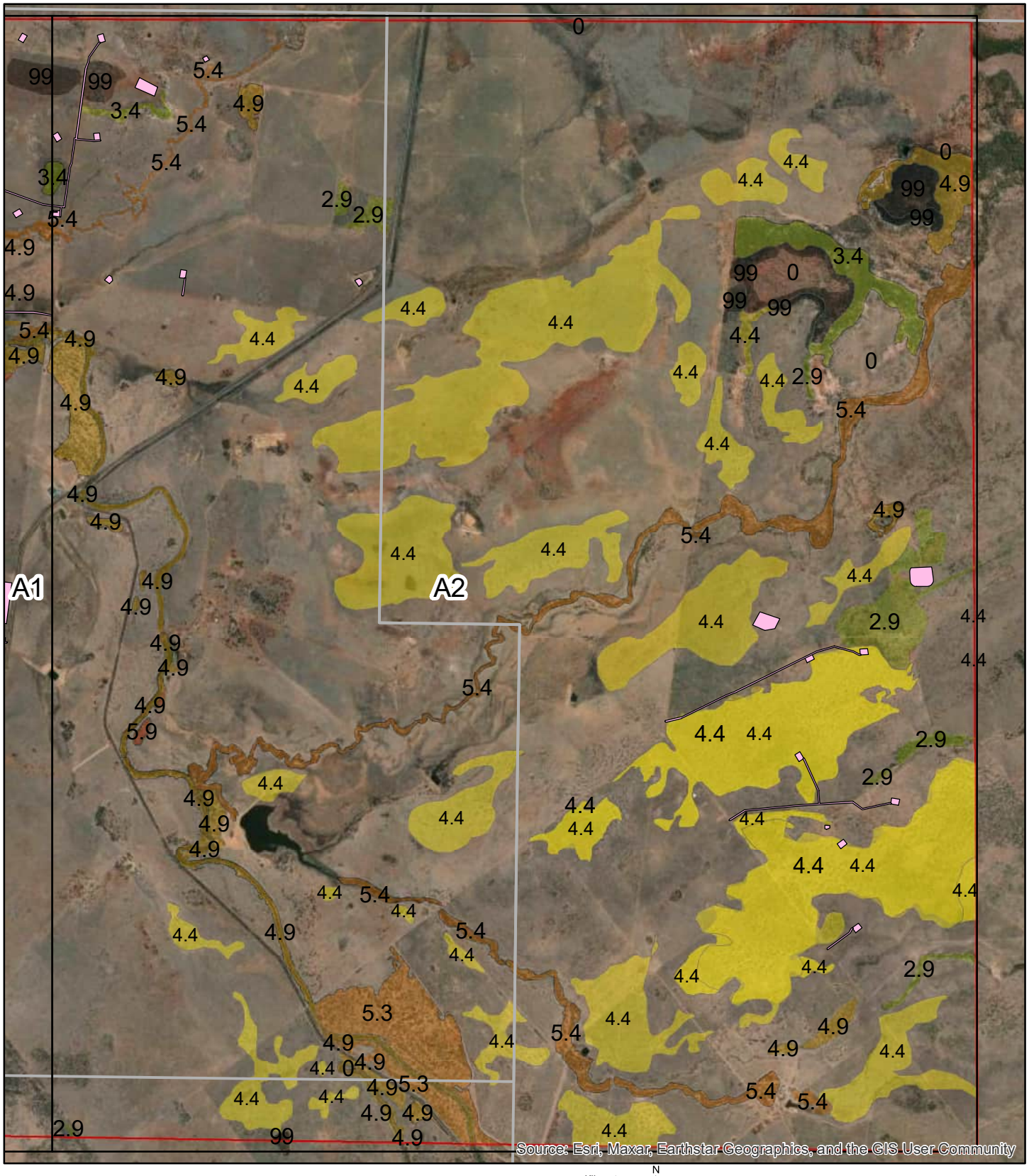
Figure 3.6 A1

Ornamental and Grey Snake Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25
Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
- 3.3
- 3.4
- 3.5
- 3.8
- 3.9
- 4.0
- 4.1
- 4.3
- 4.4
- 4.5
- 4.6
- 4.8
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- 99

Figure 3.6 A2

Ornamental and Grey Snake Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25
Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



0 0.325 0.65 1.3 1.95 2.6 Kilometers

N

Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
- 3.3
- 3.4
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- 3.9
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- 5.9
- 6.1
- 6.3
- 99

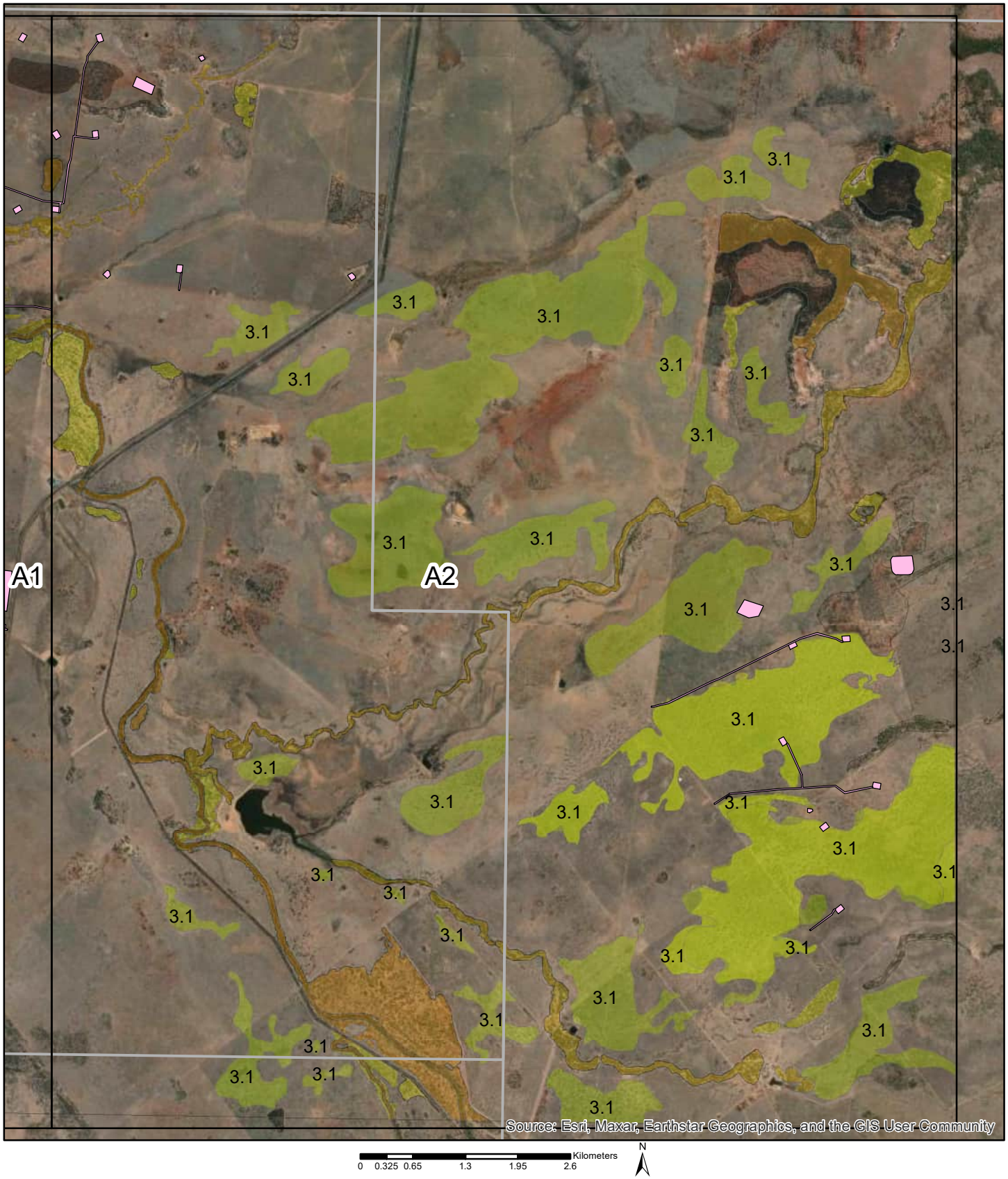
Figure 3.7 A1

Yakka Skink Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25
Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

Petroleum_Lease_Boundaries	1.9	3.3	4.3	5.1	5.9
Construction Footprint	2.1	3.4	4.4	5.2	6.1
0	2.3	3.5	4.5	5.3	6.3
0.3	2.4	3.8	4.6	5.4	99
0.4	2.8	3.9	4.8	5.5	
1.3	2.9	4.0	4.9	5.6	
1.8	3.1	4.1	5	5.8	

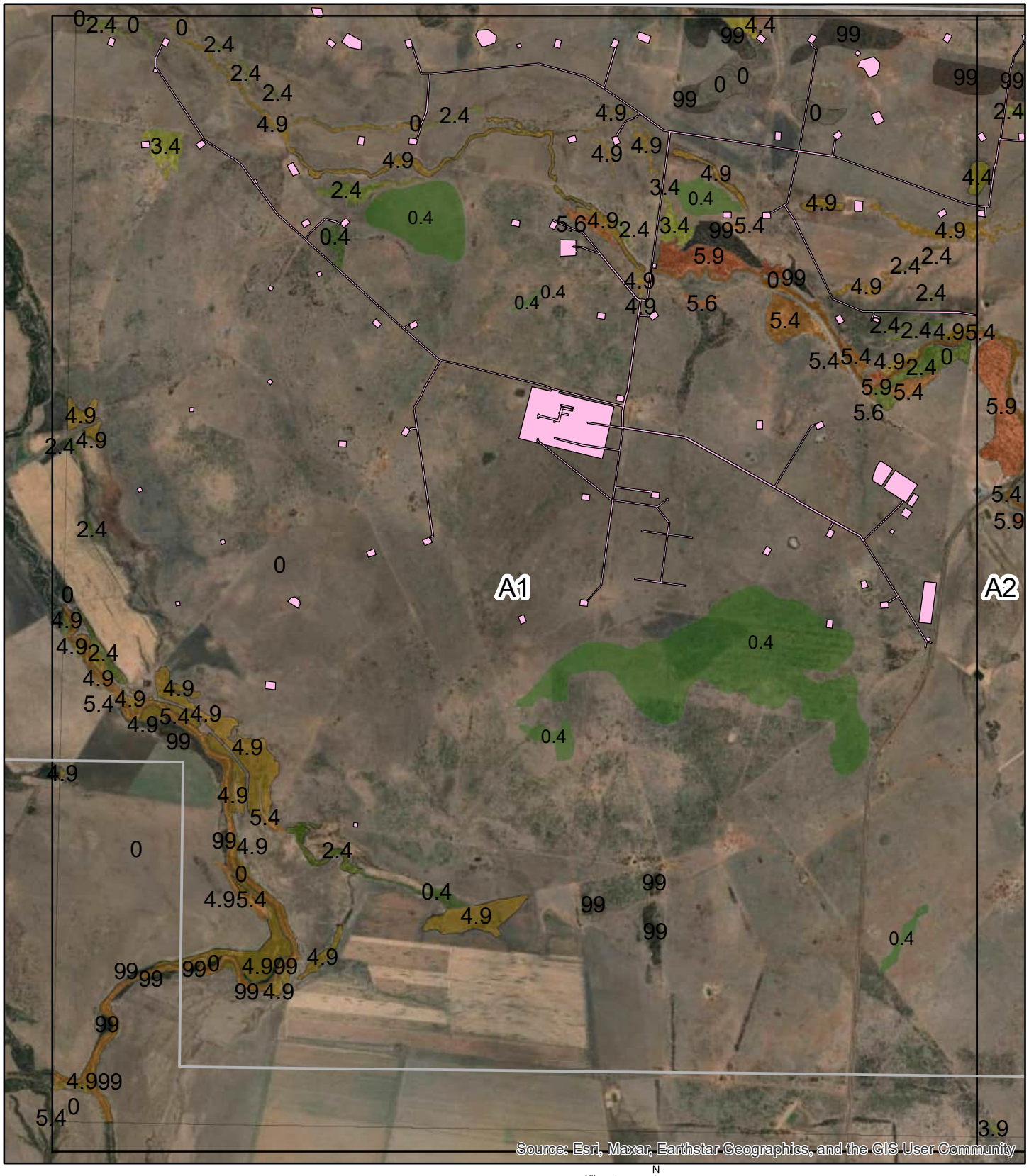
Figure 3.7 A2

Yakka Skink Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25
Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
- 3.3
- 3.4
- 3.5
- 3.8
- 3.9
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- 4.5
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- 4.8
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- 5.9
- 6.1
- 6.3
- 99

Figure 3.8 A1

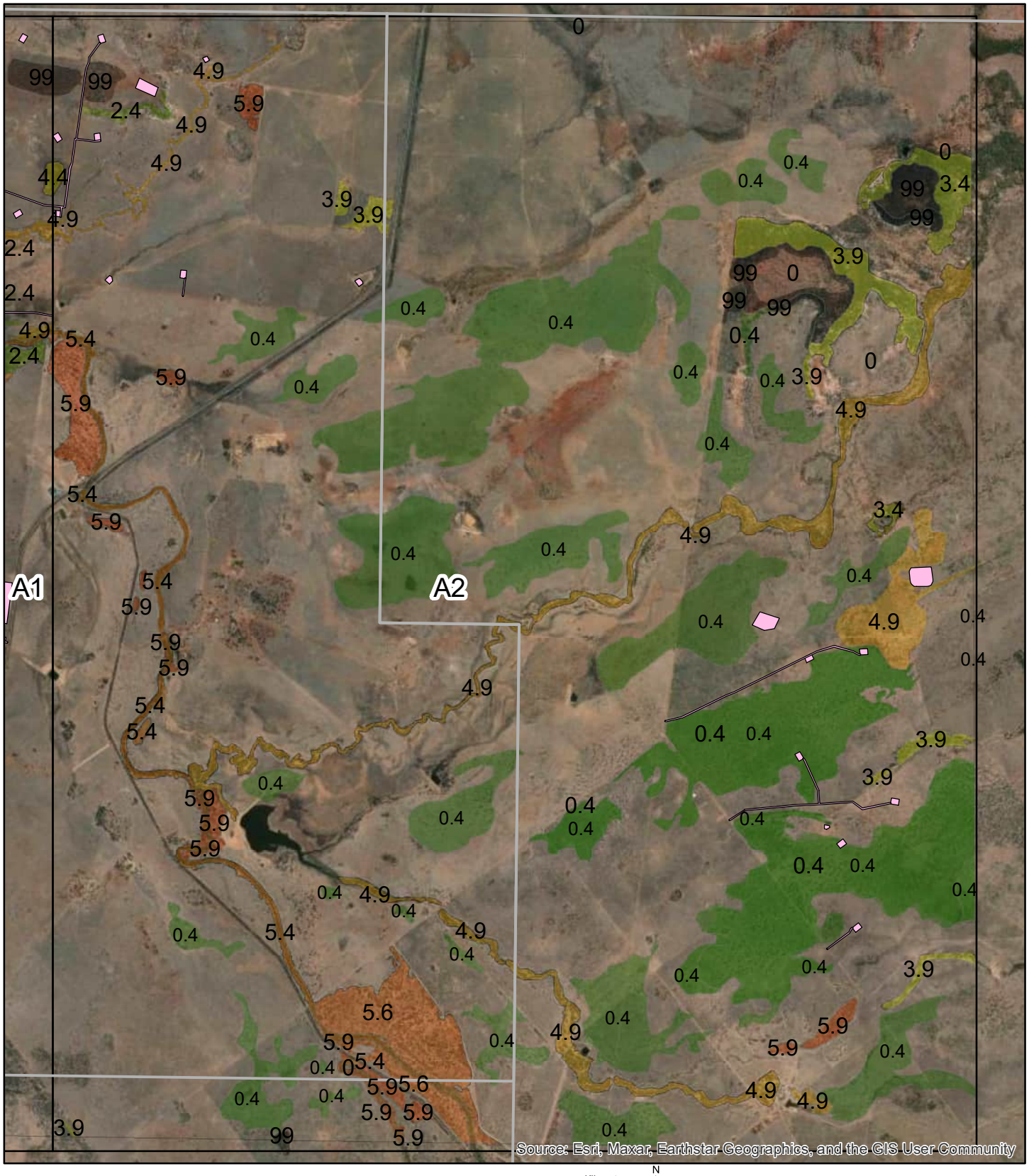
Greater Glider (Sunsu lato) Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
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Figure 3.8 A2

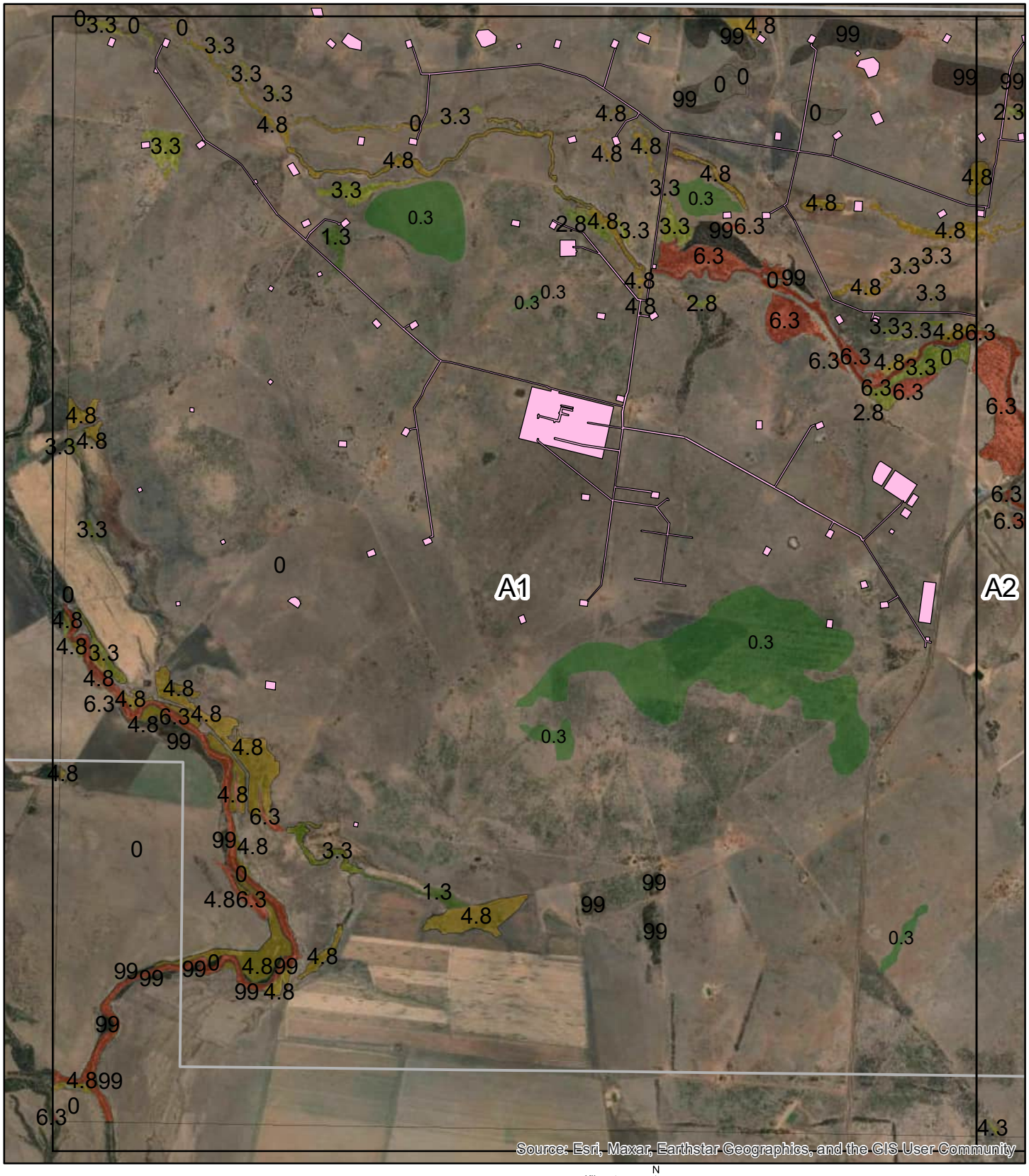
Greater Glider (Sunsu lato) Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
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Figure 3.9 A1

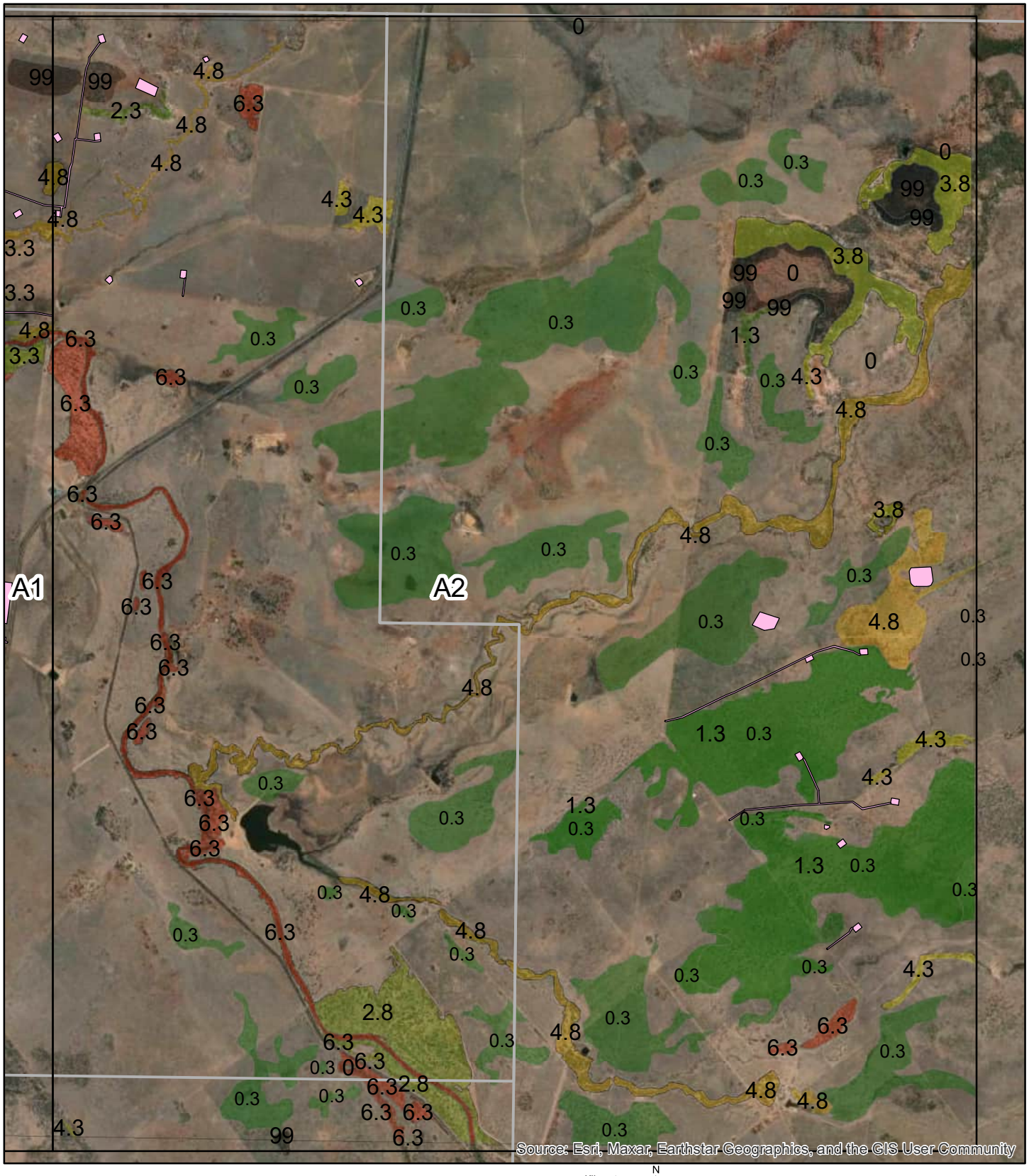
Koala Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
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Figure 3.9 A2

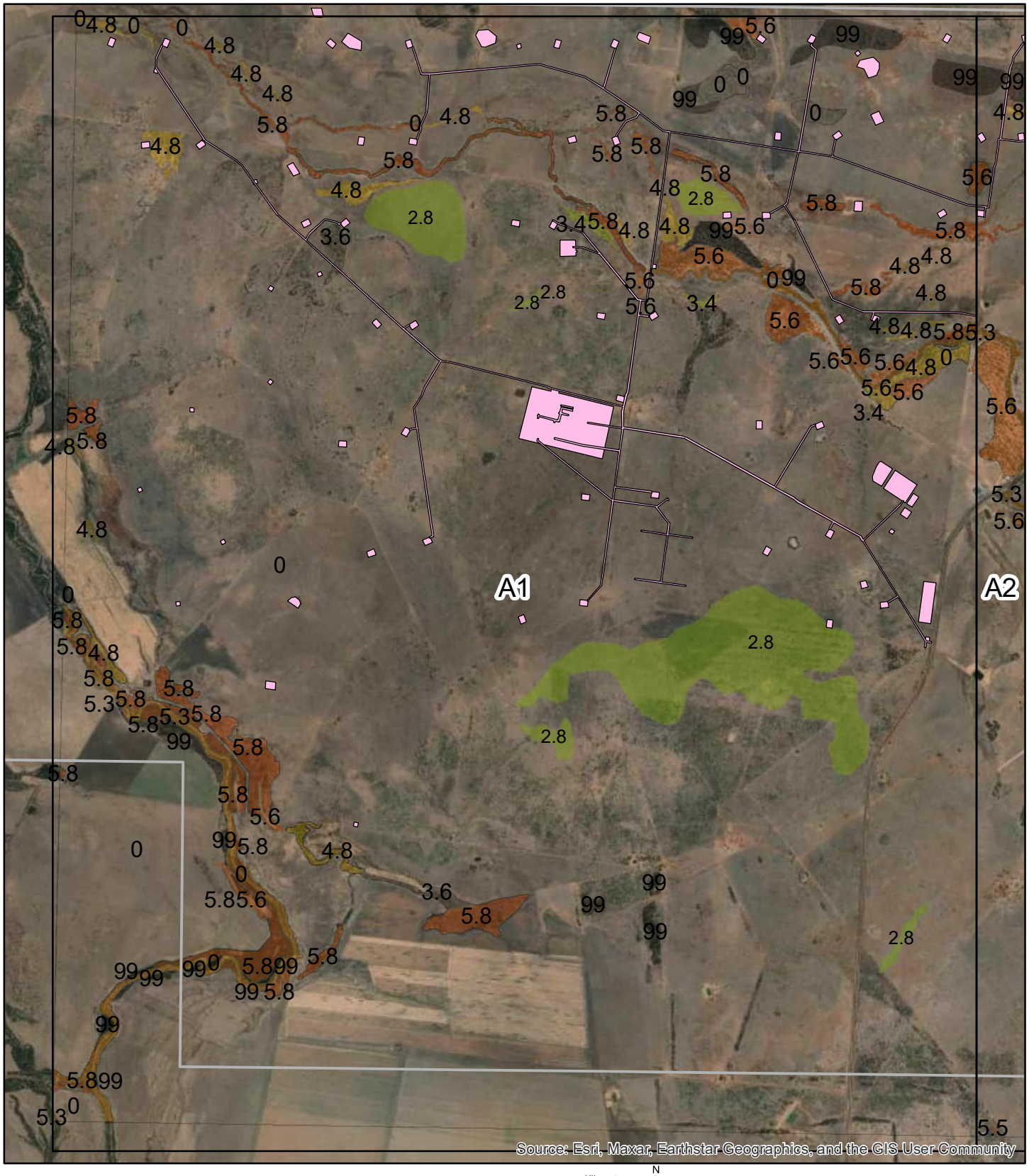
Koala Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
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Figure 3.10 A1

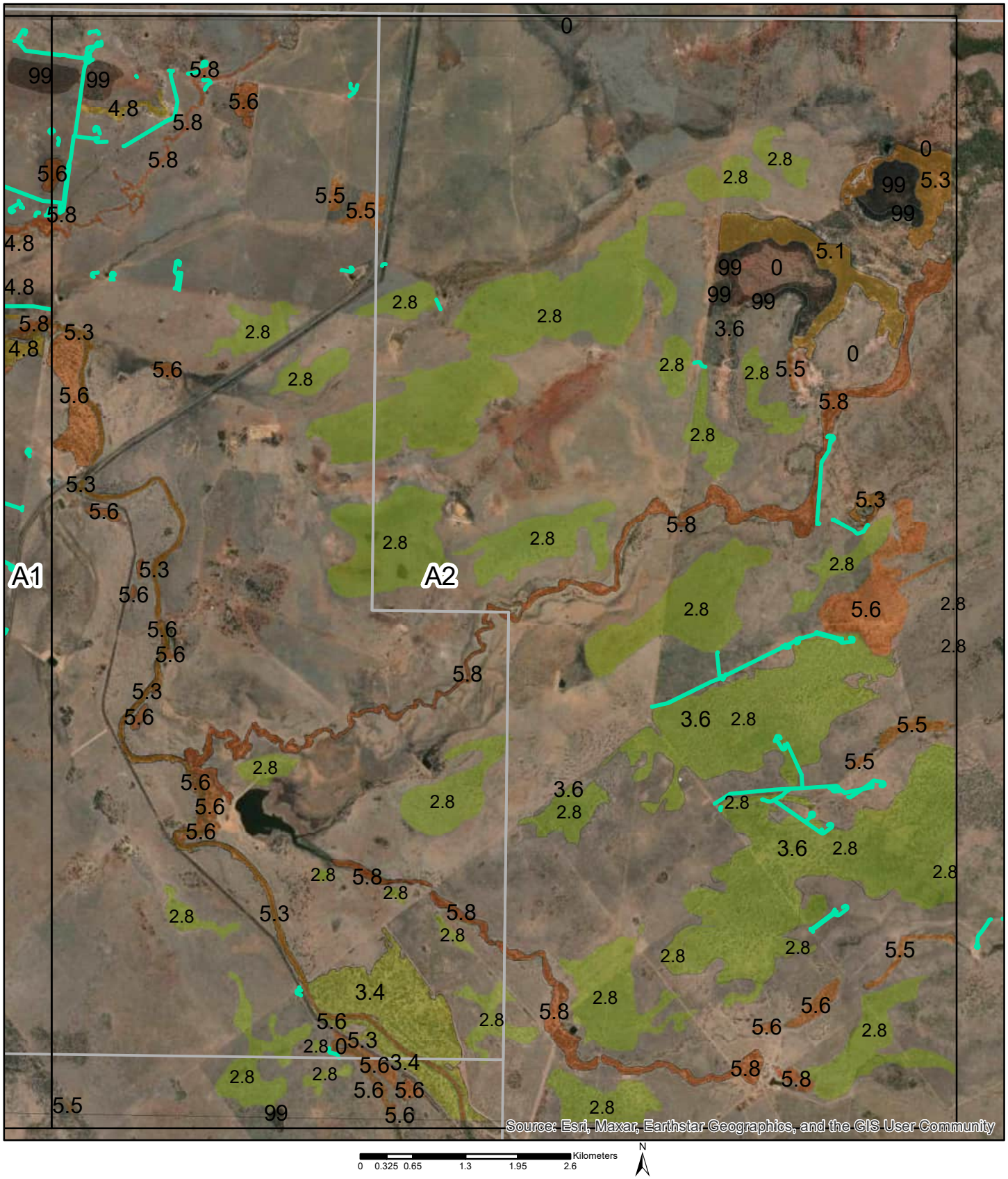
Painted Honeyeater Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Facilities and well pads
- Linear disturbance footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
- 3.3
- 3.4
- 3.5
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- 6.1
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- 99

Figure 3.10 A2

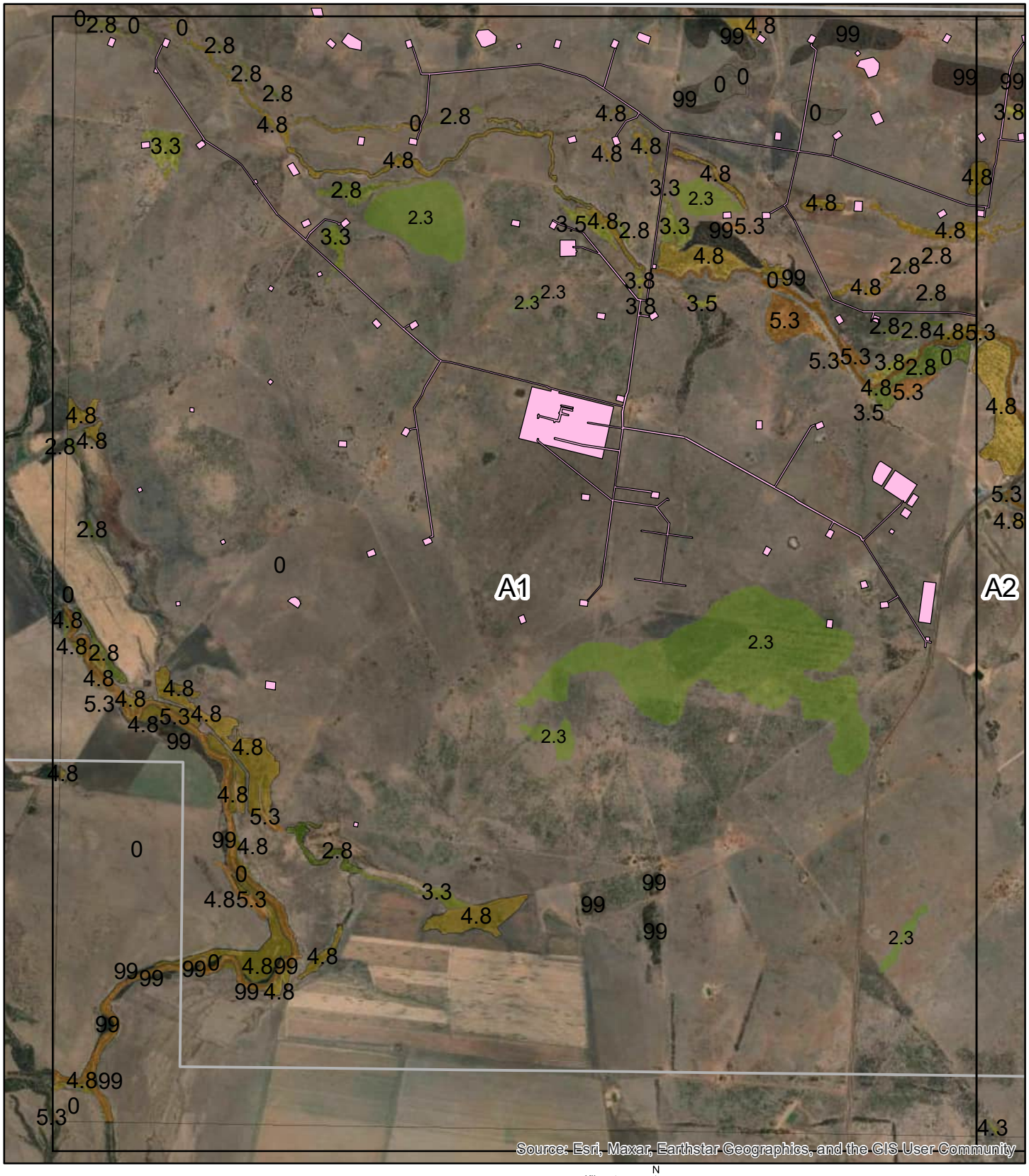
Painted Honeyeater Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
- 3.3
- 3.4
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- 3.8
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- 4.0
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- 4.3
- 4.4
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Figure 3.11 A1

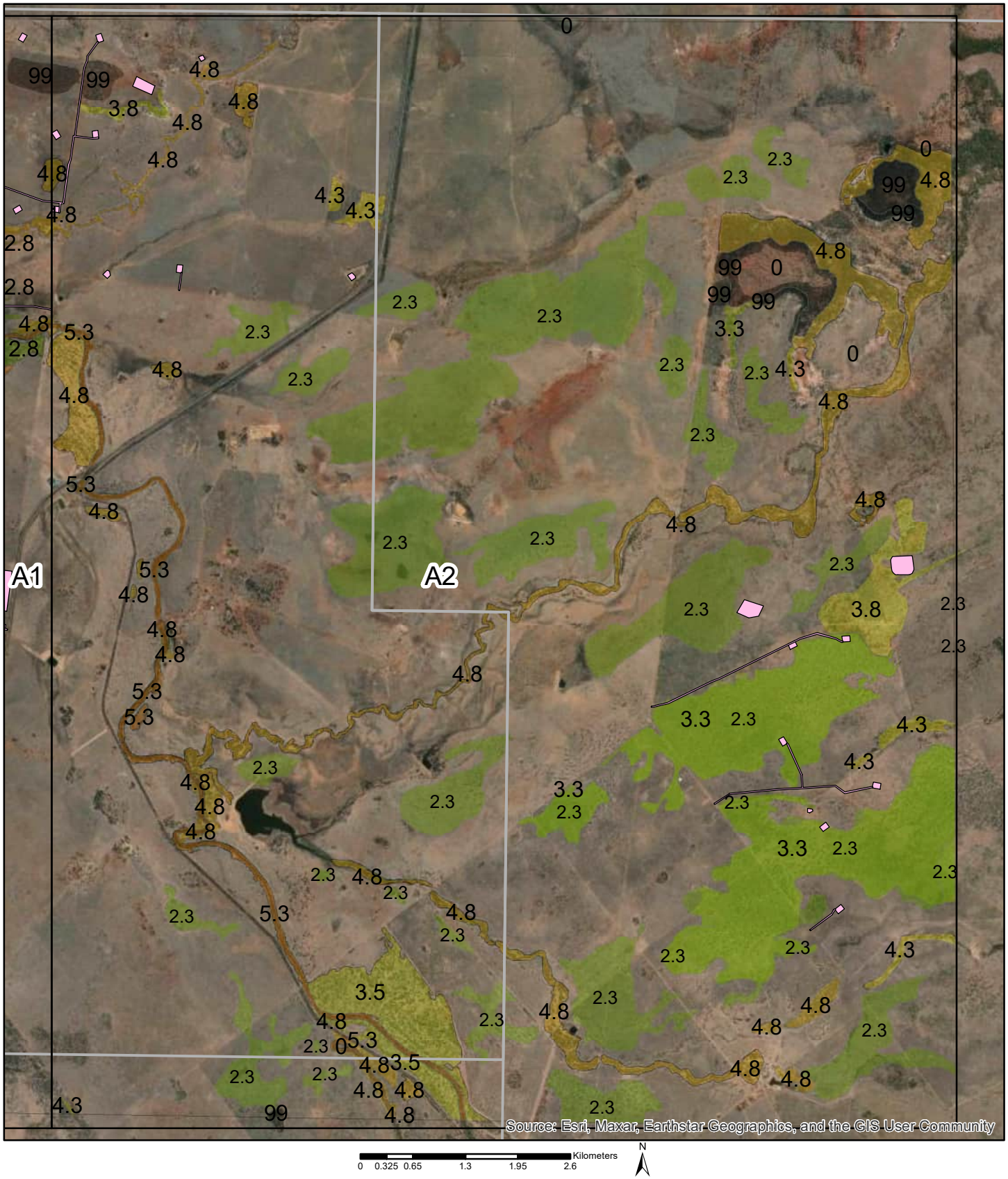
Eastern Long-eared Bat Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
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- 3.4
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Figure 3.11 A2

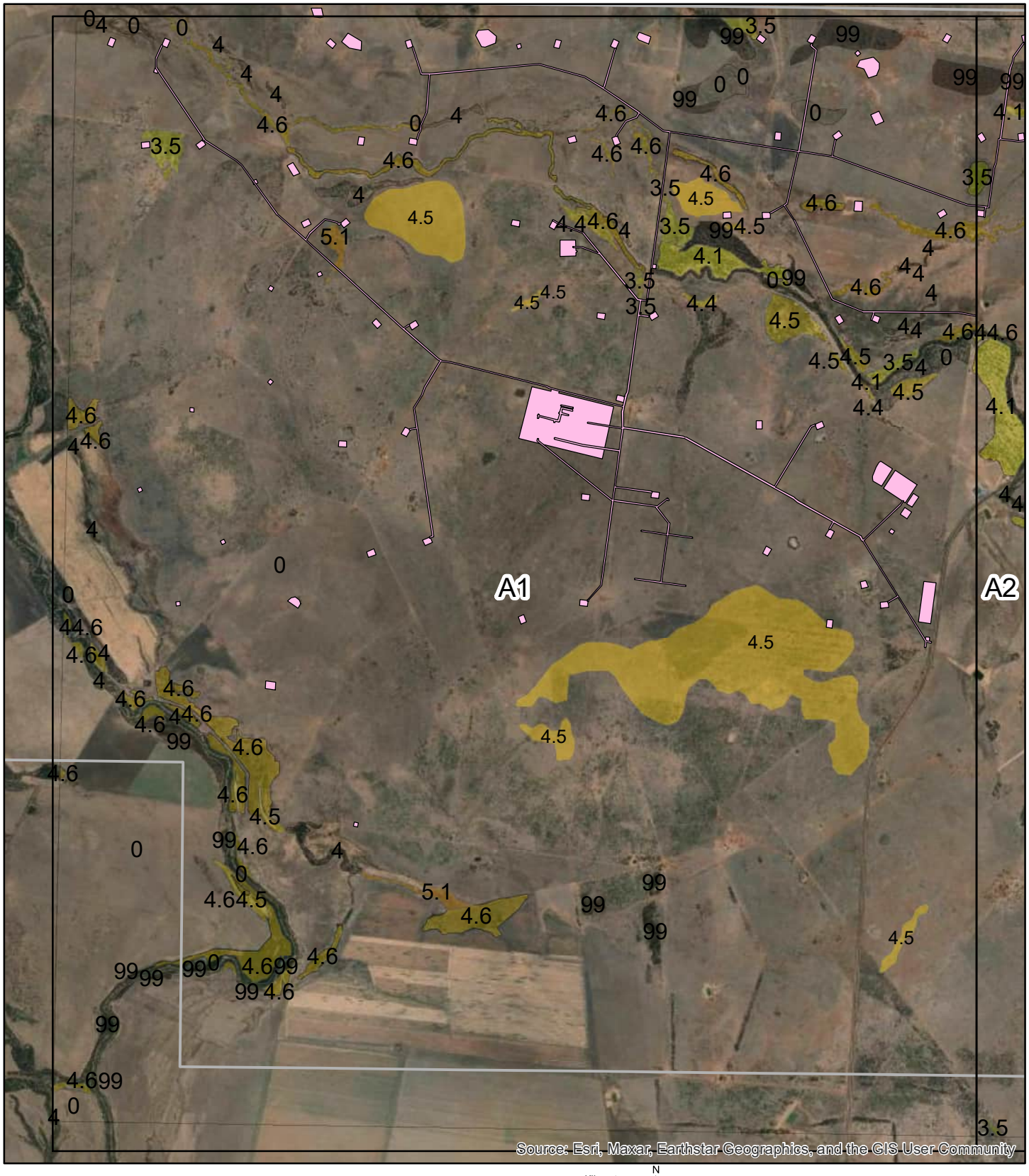
Eastern Long-eared Bat Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
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- 3.3
- 3.4
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- 3.8
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Figure 3.12 A1

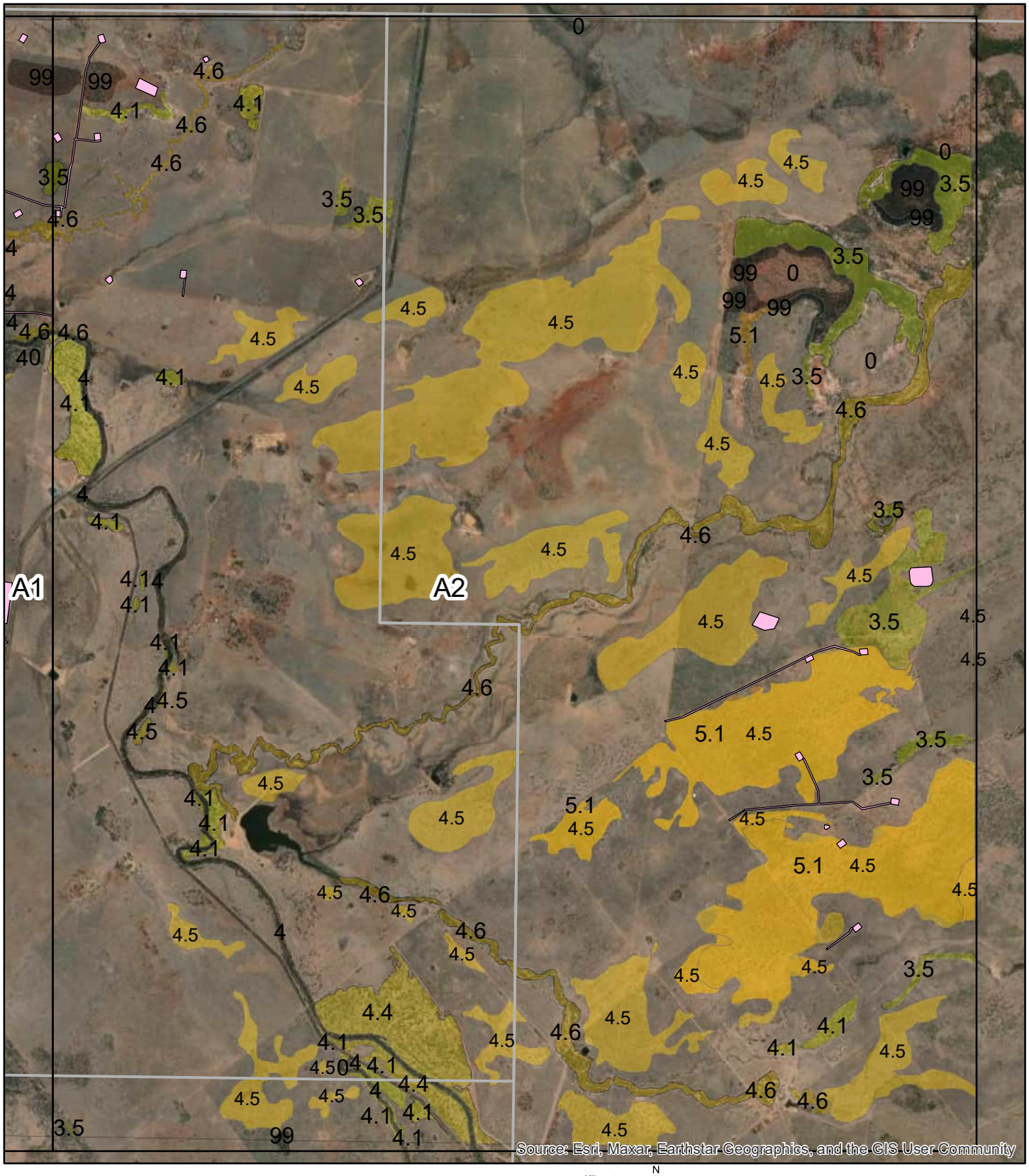
Painted Snipe Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
- 3.3
- 3.4
- 3.5
- 3.8
- 3.9
- 4.0
- 4.1
- 4.3
- 4.4
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- 5.9
- 6.1
- 6.3
- 99

Figure 3.12 A2

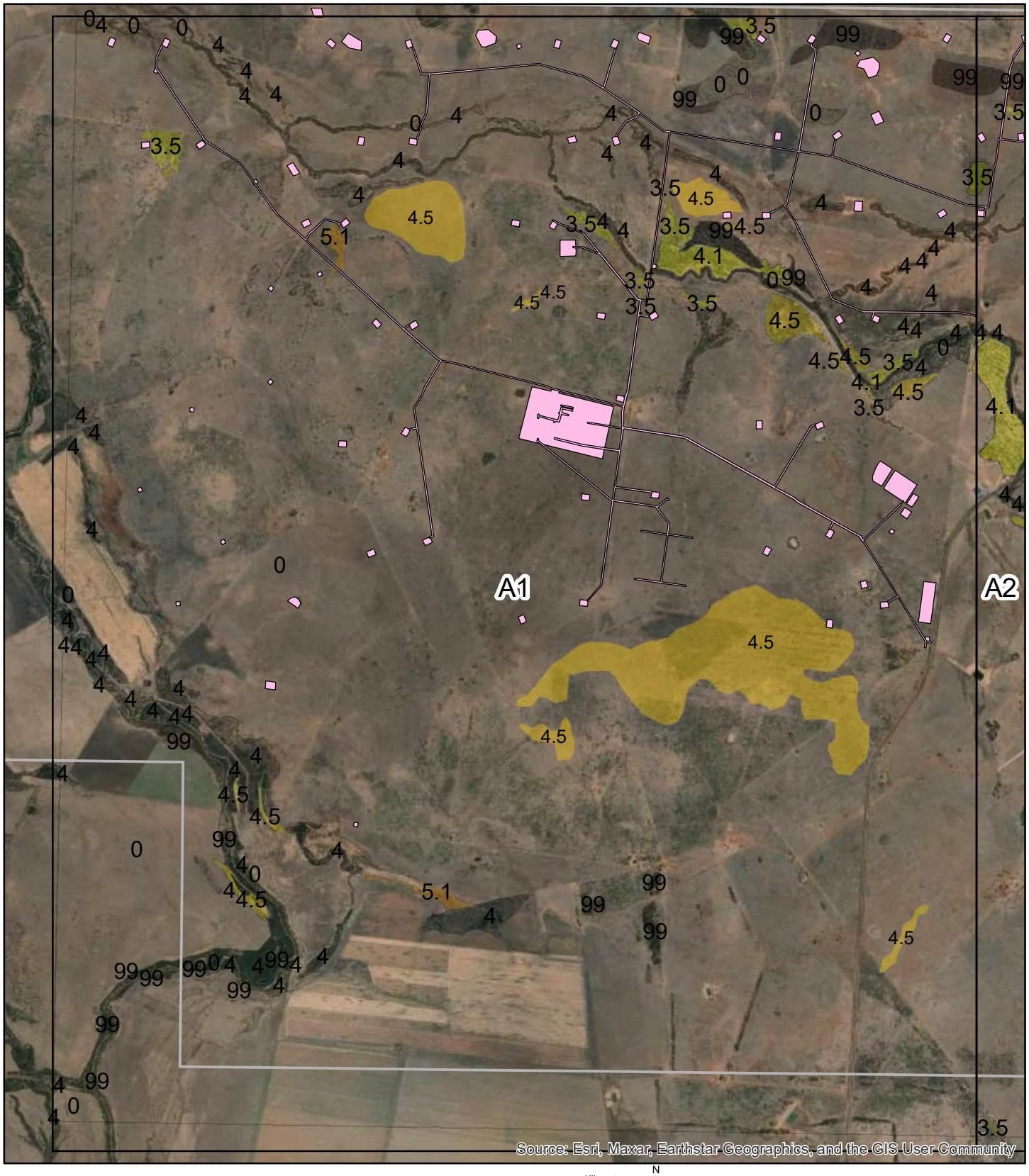
Painted Snipe Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
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- 5.6
- 5.8
- 5.9
- 6.1
- 6.3
- 99

Figure 3.13 A1

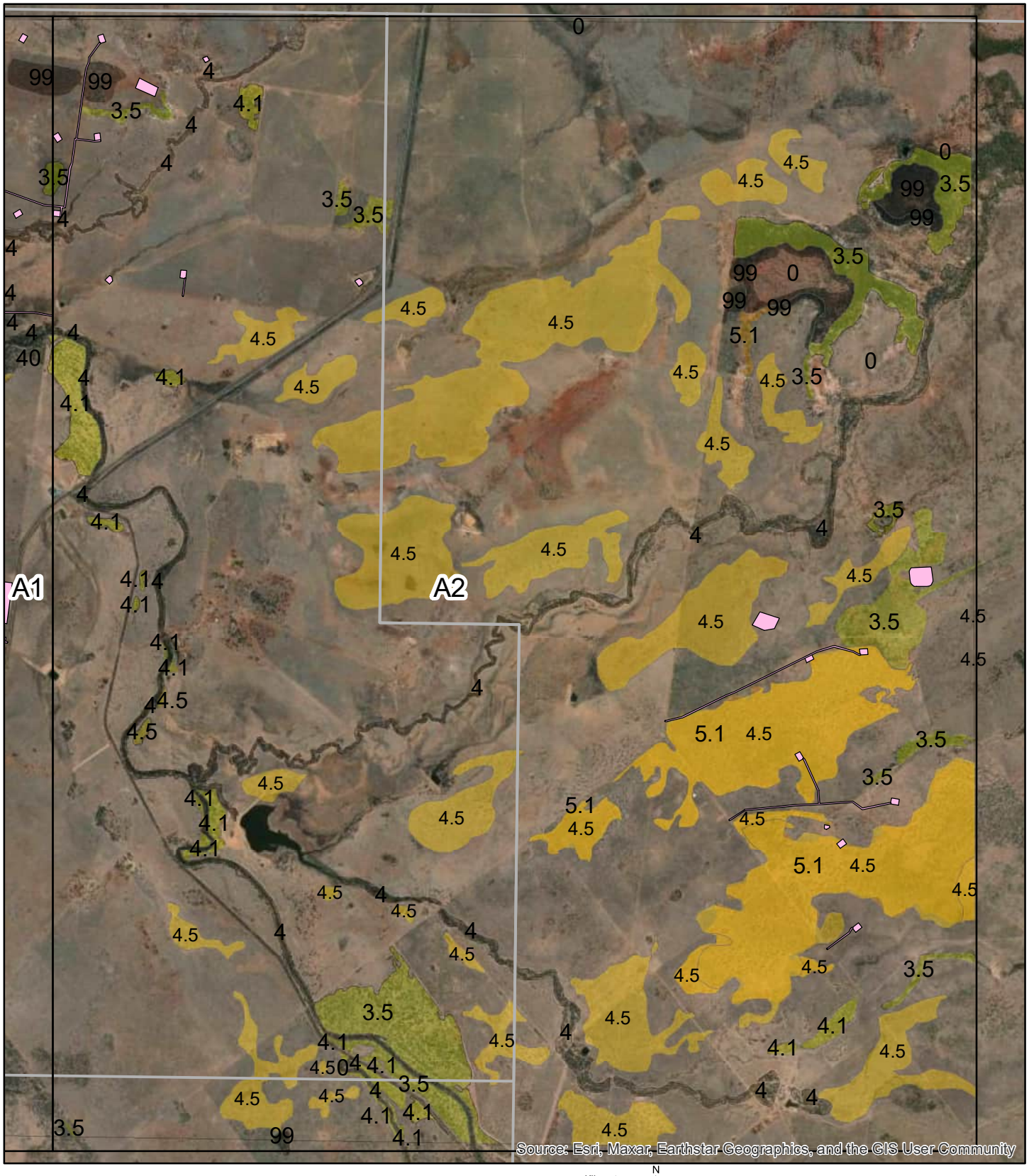
Latham's Snipe Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
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- 3.3
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- 3.5
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Figure 3.13 A2

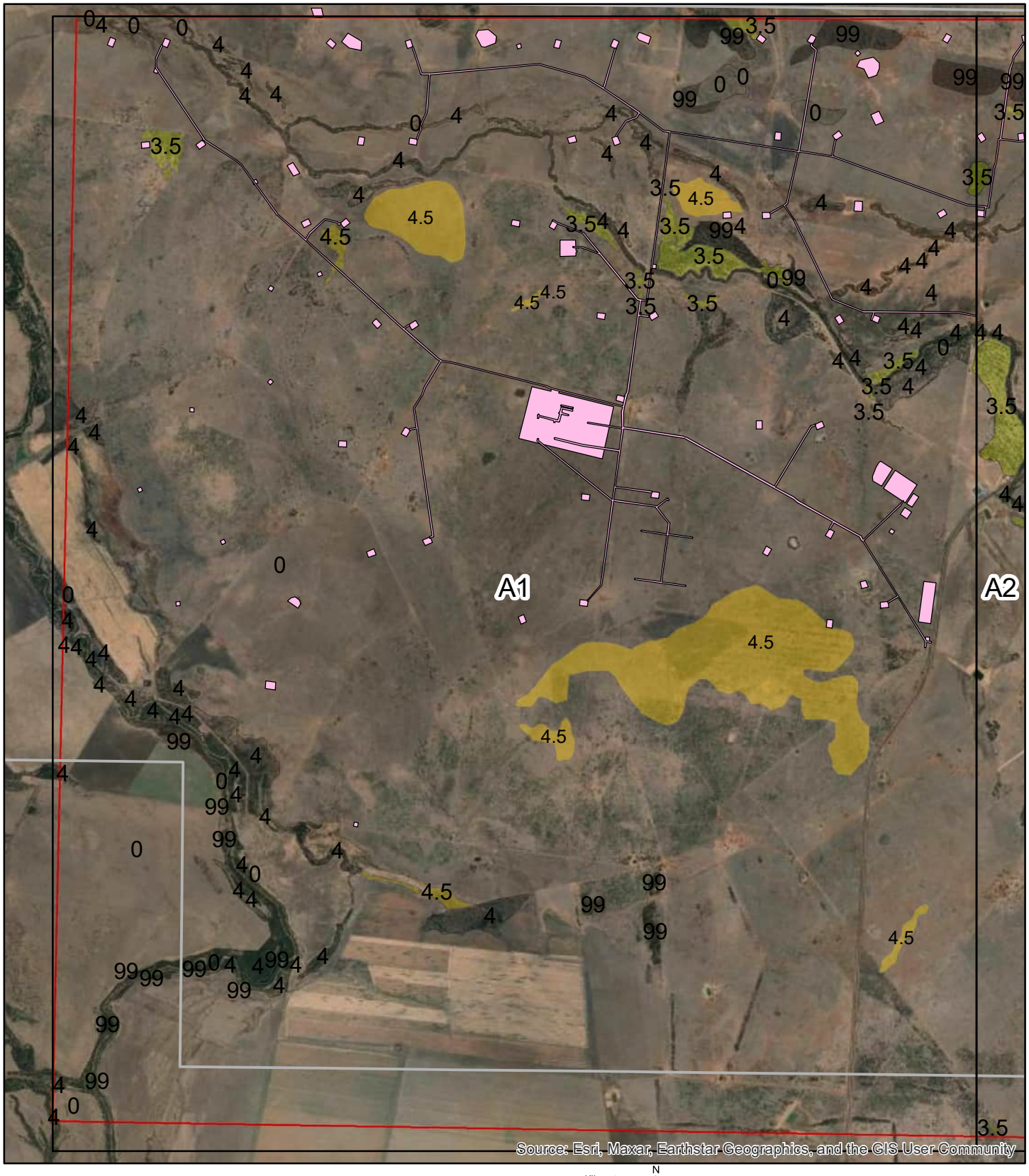
Latham's Snipe Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
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Figure 3.14 A1

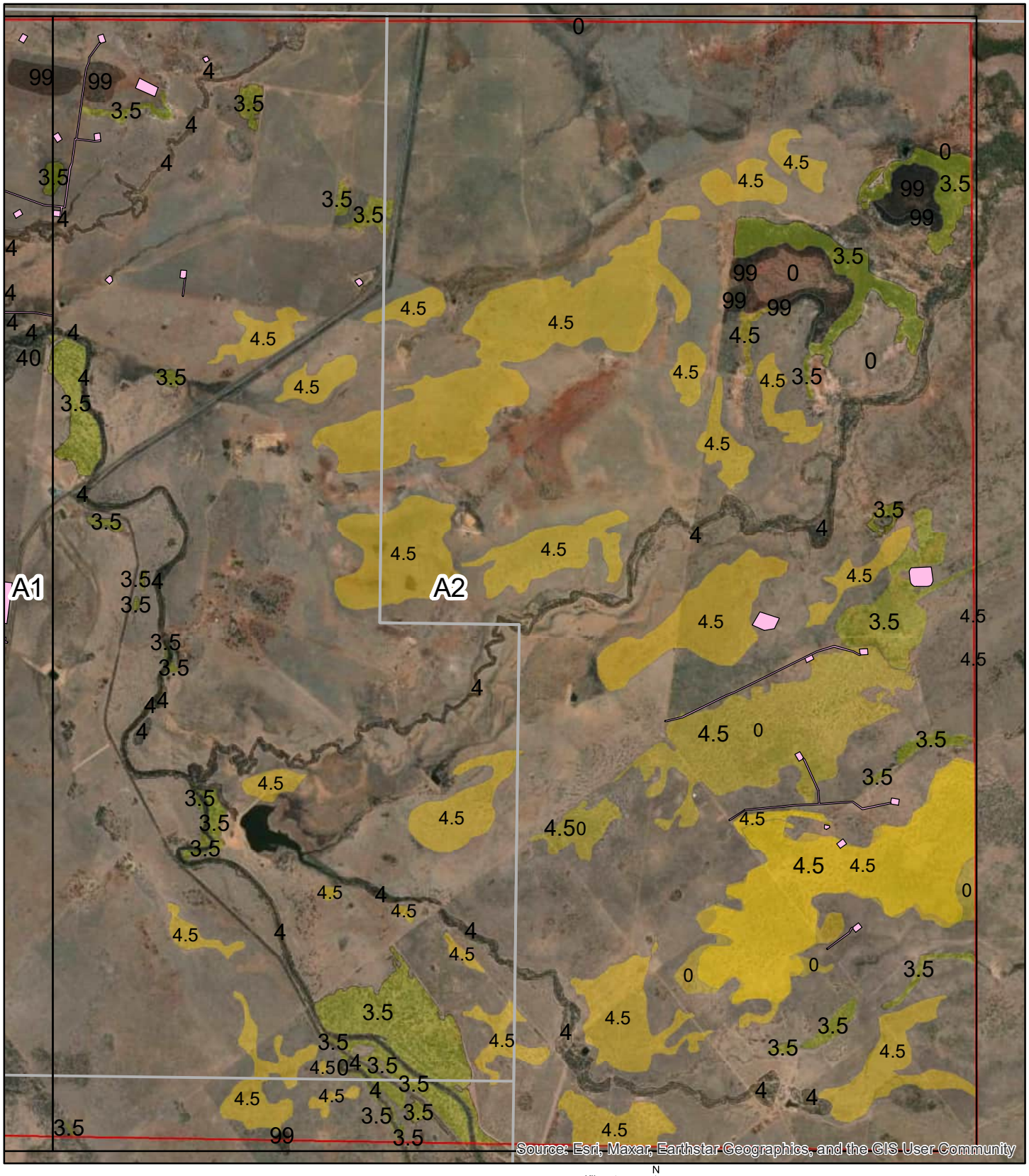
Sharp-tailed Sandpiper Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT



Legend

- Petroleum_Lease_Boundaries
- Construction Footprint
- 0
- 0.3
- 0.4
- 1.3
- 1.8
- 1.9
- 2.1
- 2.3
- 2.4
- 2.8
- 2.9
- 3.1
- 3.3
- 3.4
- 3.5
- 3.8
- 3.9
- 4.0
- 4.1
- 4.3
- 4.4
- 4.5
- 4.6
- 4.8
- 4.9
- 5
- 5.1
- 5.2
- 5.3
- 5.4
- 5.5
- 5.6
- 5.8
- 5.9
- 6.1
- 6.3
- 99

Figure 3.14 A2

Sharp-tailed Sandpiper Habitat Quality

Mahalo GAs Field Ecological Impact Assessment

AD 11/06/25

Job No. 02357

terrestria ECOLOGICAL MANAGEMENT

Appendix A

Protected Matters Search

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 18-Feb-2025

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	29
Listed Migratory Species:	8

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	12
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area	In feature area
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	Community likely to occur within area	In feature area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area	In feature area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area	In feature area
Weeping Myall Woodlands	Endangered	Community likely to occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Falco hypoleucos](#) Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat may occur within area	In feature area
[Geophaps scripta scripta](#) Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Grantiella picta](#) Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area	In feature area
[Neochmia ruficauda ruficauda](#) Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area	In feature area
[Poephila cincta cincta](#) Southern Black-throated Finch [64447]	Endangered	Species or species habitat may occur within area	In buffer area only
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area
[Stagonopleura guttata](#) Diamond Firetail [59398]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			
[Dasyurus hallucatus](#) Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area	In feature area
[Macroderma gigas](#) Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
[Nyctophilus corbeni](#) Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Petauroides volans](#)			
Greater Glider (southern and central) [254]	Endangered	Species or species habitat likely to occur within area	In feature area
[Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)](#)			
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area	In feature area
PLANT			
[Aristida annua](#)			
[17906]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Cadellia pentastylis](#)			
Ooline [9828]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Dichanthium queenslandicum](#)			
King Blue-grass [5481]	Endangered	Species or species habitat likely to occur within area	In feature area
[Dichanthium setosum](#)			
bluegrass [14159]	Vulnerable	Species or species habitat may occur within area	In feature area
[Leichhardtia brevifolia listed as Marsdenia brevifolia](#)			
[91893]	Vulnerable	Species or species habitat may occur within area	In feature area
[Polianthion minutiflorum](#)			
[82772]	Vulnerable	Species or species habitat may occur within area	In feature area
[Solanum dissectum](#)			
[75720]	Endangered	Species or species habitat may occur within area	In buffer area only
REPTILE			
[Delma torquata](#)			
Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area	In feature area
[Denisonia maculata](#)			
Ornamental Snake [1193]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Egernia rugosa			
Yakka Skink [1420]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Elseya albagula			
Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Hemiaspis damelii			
Grey Snake [1179]	Endangered	Species or species habitat may occur within area	In feature area
Rheodytes leukops			
Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Endangered	Species or species habitat likely to occur within area	In feature area

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus			
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Gallinago hardwickii			
Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Anseranas semipalmata			
Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis			
Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Extra Information

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Blackwater Mine South Coking Coal Project	2022/09279		Assessment	In feature area
Coal Seam Gas Field Development for Natural Gas Liquefaction Park, Curtis Island	2008/4059		Post-Approval	In feature area
Comet Ridge Mahalo North Coal Seam Gas Project	2023/09689		Assessment	In feature area
rail track to link the proposed MIM Rolleston coal mine to existing rail network	2002/637		Post-Approval	In feature area
Controlled action				
Arcturus Coal Project; A combined open cut and underground longwall coal mine	2010/5783	Controlled Action	Completed	In buffer area only
Santos GLNG Gas Field Development Project, QLD	2012/6615	Controlled Action	Post-Approval	In buffer area only
Springsure Creek Coal Project	2010/5782	Controlled Action	Post-Approval	In buffer area only
ZeroGen Integrated Gasification Combined Cycle Power Plant and CO2 Capture, Transport and Storage	2009/5195	Controlled Action	Completed	In feature area
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Mahalo Development Area CSG Project	2019/8534	Not Controlled Action	Completed	In feature area
Not controlled action (particular manner)				
Blackwater to Rolleston 132 kV transmission line	2002/880	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Clearing of regrowth Brigalow	2003/962	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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Appendix B

WildNet Database Search

Queensland Government

WildNet species list

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Queensland status: All
Records: All
Date: All
Latitude: -24.129
Longitude: 148.671
Distance: 20
Email: adaniel@terrestria.com.au
Date submitted: Tuesday 18 Feb 2025 12:35:48
Date extracted: Tuesday 18 Feb 2025 12:40:04

The number of records retrieved = 271

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Information about your Species lists request is logged for quality assurance, user support and product enhancement purposes only.
The information provided should be appropriately acknowledged as being derived from WildNet database when it is used. As the WildNet Program is still in a process of collating and vetting data, it is possible the information given is not complete. Go to the WildNet database webpage (https://www.qld.gov.au/environment/plants-animals/species-information/wildnet) to find out more about WildNet and where to access other WildNet information products approved for publication. Feedback about WildNet species lists should be emailed to wildlife.online@des.qld.gov.au.

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Bufonidae	*Rhinella marina*	cane toad	Y			1
animals	amphibians	Hylidae	*Cyclorana alboguttata*	greenstripe frog		C		2
animals	amphibians	Hylidae	*Cyclorana platycephala*	water holding frog		C		1
animals	amphibians	Hylidae	*Litoria caerulea*	common green treefrog		C		1
animals	amphibians	Hylidae	*Litoria inermis*	bumpy rocketfrog		C		2
animals	amphibians	Hylidae	*Litoria latopalmata*	broad palmed rocketfrog		C		1
animals	amphibians	Hylidae	*Litoria peronii*	emerald spotted treefrog		C		1
animals	amphibians	Hylidae	*Litoria rubella*	ruddy treefrog		C		1
animals	amphibians	Limnodynastidae	*Limnodynastes salmini*	salmon striped frog		C		2
animals	amphibians	Limnodynastidae	*Limnodynastes tasmaniensis*	spotted grassfrog		C		4
animals	amphibians	Limnodynastidae	*Platyplectrum ornatum*	ornate burrowing frog		C		1
animals	birds	Acanthizidae	*Acanthiza apicalis*	inland thornbill		C		1
animals	birds	Acanthizidae	*Gerygone olivacea*	white-throated gerygone		C		2
animals	birds	Acanthizidae	*Smicrornis brevirostris*	weebill		C		3
animals	birds	Accipitridae	*Haliastur sphenurus*	whistling kite		C		3
animals	birds	Accipitridae	*Milvus migrans*	black kite		C		2
animals	birds	Alaudidae	*Mirafra javanica*	Horsfield's bushlark		C		1
animals	birds	Alcedinidae	*Dacelo novaeguineae*	laughing kookaburra		C		3
animals	birds	Alcedinidae	*Todiramphus sanctus*	sacred kingfisher		C		2
animals	birds	Anatidae	*Anas superciliosa*	Pacific black duck		C		1
animals	birds	Anatidae	*Cygnus atratus*	black swan		C		1
animals	birds	Anatidae	*Dendrocygna arcuata*	wandering whistling-duck		C		1
animals	birds	Anhingidae	*Anhinga novaehollandiae*	Australasian darter		C		1
animals	birds	Ardeidae	*Ardea alba modesta*	eastern great egret		C		1
animals	birds	Artamidae	*Artamus leucorynchus*	white-breasted woodswallow		C		1
animals	birds	Artamidae	*Cracticus nigrogularis*	pied butcherbird		C		1
animals	birds	Artamidae	*Cracticus torquatus*	grey butcherbird		C		1
animals	birds	Artamidae	*Gymnorhina tibicen*	Australian magpie		C		2
animals	birds	Artamidae	*Strepera graculina*	pied currawong		C		1
animals	birds	Cacatuidae	*Cacatua galerita*	sulphur-crested cockatoo		C		3
animals	birds	Cacatuidae	*Eolophus roseicapilla*	galah		C		2
animals	birds	Campephagidae	*Coracina novaehollandiae*	black-faced cuckoo-shrike		C		4
animals	birds	Casuariidae	*Dromaius novaehollandiae*	emu		C		2
animals	birds	Charadriidae	*Vanellus miles*	masked lapwing		C		1
animals	birds	Cisticolidae	*Cisticola exilis*	golden-headed cisticola		C		1
animals	birds	Climacteridae	*Climacteris picumnus*	brown treecreeper		C		1
animals	birds	Columbidae	*Geopelia cuneata*	diamond dove		C		1
animals	birds	Columbidae	*Geopelia humeralis*	bar-shouldered dove		C		2
animals	birds	Columbidae	*Geopelia placida*	peaceful dove		C		3
animals	birds	Coraciidae	*Eurystomus orientalis*	dollarbird		C		1
animals	birds	Corcoracidae	*Struthidea cinerea*	apostlebird		C		2
animals	birds	Corvidae	*Corvus coronoides*	Australian raven		C		2
animals	birds	Corvidae	*Corvus orru*	Torresian crow		C		5
animals	birds	Cuculidae	*Centropus phasianinus*	pheasant coucal		C		3
animals	birds	Cuculidae	*Chalcites minutillus barnardi*	Eastern little bronze-cuckoo		C		1
animals	birds	Cuculidae	*Eudynamys orientalis*	eastern koel		C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Dicaeidae	*Dicaeum hirundinaceum*	mistletoebird		C		3
animals	birds	Estrildidae	*Lonchura castaneothorax*	chestnut-breasted mannikin		C		1
animals	birds	Estrildidae	*Taeniopygia bichenovii*	double-barred finch		C		4
animals	birds	Hirundinidae	*Hirundo neoxena*	welcome swallow		C		2
animals	birds	Locustellidae	*Cincloramphus timoriensis*	tawny grassbird		C		1
animals	birds	Maluridae	*Malurus cyaneus*	superb fairy-wren		C		1
animals	birds	Maluridae	*Malurus melanocephalus*	red-backed fairy-wren		C		4
animals	birds	Meliphagidae	*Entomyzon cyanotis*	blue-faced honeyeater		C		1
animals	birds	Meliphagidae	*Gavicalis virescens*	singing honeyeater		C		2
animals	birds	Meliphagidae	*Manorina melanocephala*	noisy miner		C		1
animals	birds	Meliphagidae	*Melithreptus albogularis*	white-throated honeyeater		C		2
animals	birds	Meliphagidae	*Melithreptus gularis gularis*	black-chinned honeyeater (eastern)		C		1
animals	birds	Meliphagidae	*Nesoptilotis leucotis*	white-eared honeyeater		C		1
animals	birds	Meliphagidae	*Philemon citreogularis*	little friarbird		C		1
animals	birds	Meliphagidae	*Plectorhyncha lanceolata*	striped honeyeater		C		1
animals	birds	Monarchidae	*Grallina cyanoleuca*	magpie-lark		C		3
animals	birds	Monarchidae	*Myiagra inquieta*	restless flycatcher		C		1
animals	birds	Monarchidae	*Myiagra rubecula*	leaden flycatcher		C		2
animals	birds	Oriolidae	*Oriolus sagittatus*	olive-backed oriole		C		1
animals	birds	Pachycephalidae	*Colluricincla harmonica*	grey shrike-thrush		C		1
animals	birds	Pachycephalidae	*Pachycephala rufiventris*	rufous whistler		C		4
animals	birds	Pardalotidae	*Pardalotus striatus*	striated pardalote		C		2
animals	birds	Petroicidae	*Eopsaltria australis*	eastern yellow robin		C		1
animals	birds	Petroicidae	*Microeca fascinans*	jacky winter		C		1
animals	birds	Psittaculidae	*Alisterus scapularis*	Australian king-parrot		C		1
animals	birds	Psittaculidae	*Aprosmictus erythropterus*	red-winged parrot		C		3
animals	birds	Psittaculidae	*Platycercus adscitus*	pale-headed rosella		C		3
animals	birds	Psittaculidae	*Trichoglossus moluccanus*	rainbow lorikeet		C		1
animals	birds	Ptilonorhynchidae	*Chlamydera maculata*	spotted bowerbird		C		2
animals	birds	Recurvirostridae	*Himantopus leucocephalus*	pied stilt		C		1
animals	birds	Rhipiduridae	*Rhipidura albiscapa*	grey fantail		C		3
animals	birds	Rhipiduridae	*Rhipidura leucophrys*	willie wagtail		C		4
animals	birds	Tytonidae	*Tyto javanica*	eastern barn owl		C		1
animals	birds	Zosteropidae	*Zosterops lateralis*	silvereye		C		1
animals	mammals	Bovidae	*Bos taurus*	European cattle	Y			1
animals	mammals	Canidae	*Canis familiaris (dingo)*	dingo				2
animals	mammals	Emballonuridae	*Saccolaimus flaviventris*	yellow-bellied sheathtail bat		C		1
animals	mammals	Macropodidae	*Macropus giganteus*	eastern grey kangaroo		C		2
animals	mammals	Molossidae	*Chaerephon jobensis*	northern freetail bat		C		1
animals	mammals	Muridae	*Hydromys chrysogaster*	water rat		C		1
animals	mammals	Muridae	*Melomys burtoni*	grassland melomys		C		2
animals	mammals	Muridae	*Mus musculus*	house mouse	Y			2
animals	mammals	Muridae	*Pseudomys mimulus*	eastern delicate mouse		C		1
animals	mammals	Muridae	*Rattus sordidus*	canefield rat		C		6/1
animals	mammals	Peramelidae	*Isoodon macrourus*	northern brown bandicoot		C		1
animals	mammals	Phalangeridae	*Trichosurus vulpecula*	common brushtail possum		C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	mammals	Phascolarctidae	*Phascolarctos cinereus*	koala		E	E	6
animals	mammals	Pseudocheiridae	*Petauroides volans volans*	southern greater glider		E	E	3
animals	mammals	Vespertilionidae	*Chalinolobus gouldii*	Gould's wattled bat		C		1
animals	mammals	Vespertilionidae	*Chalinolobus morio*	chocolate wattled bat		C		1
animals	mammals	Vespertilionidae	*Chalinolobus picatus*	little pied bat		C		1
animals	mammals	Vespertilionidae	*Scotorepens balstoni*	inland broad-nosed bat		C		1
animals	ray-finned fishes	Ambassidae	*Ambassis agassizii*	Agassiz's glassfish				7
animals	ray-finned fishes	Anguillidae	*Anguilla reinhardtii*	longfin eel				1
animals	ray-finned fishes	Atherinidae	*Craterocephalus stercusmuscarum*	flyspecked hardyhead				2
animals	ray-finned fishes	Clupeidae	*Nematalosa erebi*	bony bream				4
animals	ray-finned fishes	Eleotridae	*Hypseleotris klunzingeri*	western carp gudgeon				3
animals	ray-finned fishes	Eleotridae	*Hypseleotris sp.*					6
animals	ray-finned fishes	Eleotridae	*Hypseleotris species 1*	Midgley's carp gudgeon				1
animals	ray-finned fishes	Eleotridae	*Mogurnda adspersa*	southern purplespotted gudgeon				4
animals	ray-finned fishes	Eleotridae	*Oxyeleotris lineolata*	sleepy cod				1
animals	ray-finned fishes	Eleotridae	*Philypnodon grandiceps*	flathead gudgeon				1
animals	ray-finned fishes	Melanotaeniidae	*Melanotaenia splendida splendida*	eastern rainbowfish				6
animals	ray-finned fishes	Percichthyidae	*Macquaria ambigua*	golden perch				1
animals	ray-finned fishes	Plotosidae	*Neosilurus hyrtlii*	Hyrtl's catfish				4
animals	ray-finned fishes	Plotosidae	*Tandanus tandanus*	freshwater catfish				1
animals	ray-finned fishes	Terapontidae	*Leiopotherapon unicolor*	spangled perch				6
animals	ray-finned fishes	Terapontidae	*Scortum hillii*	leathery grunter				1
animals	reptiles	Agamidae	*Chlamydosaurus kingii*	frilled lizard		C		1
animals	reptiles	Agamidae	*Intellagama lesueurii*	eastern water dragon		C		1
animals	reptiles	Boidae	*Antaresia maculosa*	spotted python		C		1
animals	reptiles	Boidae	*Morelia spilota*	carpet python		C		1
animals	reptiles	Chelidae	*Chelodina longicollis*	eastern snake-necked turtle		C		1
animals	reptiles	Chelidae	*Emydura macquarii krefftii*	Krefft's river turtle		C		1
animals	reptiles	Chelidae	*Wollumbinia latisternum*	saw-shelled turtle		C		1
animals	reptiles	Colubridae	*Dendrelaphis punctulatus*	green tree snake		C		1
animals	reptiles	Colubridae	*Tropidonophis mairii*	freshwater snake		C		1
animals	reptiles	Diplodactylidae	*Diplodactylus platyurus*	eastern fat-tailed gecko		C		1
animals	reptiles	Diplodactylidae	*Diplodactylus vittatus*	wood gecko		C		1
animals	reptiles	Elapidae	*Hoplocephalus bitorquatus*	pale-headed snake		C		1
animals	reptiles	Gekkonidae	*Gehyra dubia*	dubious dtella		C		2
animals	reptiles	Gekkonidae	*Heteronotia binoei*	Bynoe's gecko		C		2
animals	reptiles	Scincidae	*Carlia pectoralis*	open-litter rainbow skink		C		2
animals	reptiles	Scincidae	*Carlia vivax*	tussock rainbow-skink		C		1
animals	reptiles	Scincidae	*Cryptoblepharus pulcher pulcher*	elegant snake-eyed skink		C		3
animals	reptiles	Scincidae	*Ctenotus ingrami*	unspotted yellow-sided ctenotus		C		1
animals	reptiles	Scincidae	*Ctenotus spaldingi*	straight-browed ctenotus		C		2
animals	reptiles	Scincidae	*Lerista fragilis*	eastern mulch slider		C		2
animals	reptiles	Scincidae	*Lerista punctatovittata*	eastern robust slider		C		2
animals	reptiles	Scincidae	*Morethia boulengeri*	south-eastern morethia skink		C		2
animals	reptiles	Varanidae	*Varanus tristis*	black-tailed monitor		C		1
plants	land plants	Acanthaceae	*Rostellularia adscendens*			C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Alismataceae	*Caldesia oligococca*			SL		1/1
plants	land plants	Amaranthaceae	*Achyranthes aspera*			C		1
plants	land plants	Amaranthaceae	*Alternanthera denticulata var. micrantha*			C		1/1
plants	land plants	Amaranthaceae	*Ptilotus polystachyus*			C		1/1
plants	land plants	Amaranthaceae	*Ptilotus psilorhachis*			C		1/1
plants	land plants	Amaranthaceae	*Ptilotus semilanatus*			C		1/1
plants	land plants	Amaryllidaceae	*Crinum flaccidum*	Murray lily		SL		1
plants	land plants	Apocynaceae	*Carissa ovata*	currantbush		C		2
plants	land plants	Aponogetonaceae	*Aponogeton queenslandicus*			SL		1/1
plants	land plants	Aristolochiaceae	*Aristolochia meridionalis subsp. centralis*			C		1/1
plants	land plants	Asteraceae	*Calotis*					1
plants	land plants	Asteraceae	*Calotis dentex*	white burr daisy		C		1/1
plants	land plants	Asteraceae	*Chrysocephalum apiculatum*	yellow buttons		C		1
plants	land plants	Asteraceae	*Eclipta platyglossa subsp. platyglossa*			C		1/1
plants	land plants	Asteraceae	*Minuria leptophylla*			C		1/1
plants	land plants	Asteraceae	*Peripleura hispidula var. setosa*			C		1/1
plants	land plants	Asteraceae	*Verbesina encelioides var. encelioides*		Y			1/1
plants	land plants	Asteraceae	*Vittadinia sulcata*	native daisy		C		1/1
plants	land plants	Bignoniaceae	*Pandorea pandorana*	wonga vine		C		1
plants	land plants	Brassicaceae	*Rorippa dietrichiana*			C		1/1
plants	land plants	Cactaceae	*Opuntia*					2
plants	land plants	Campanulaceae	*Wahlenbergia capillaris*			SL		1/1
plants	land plants	Chenopodiaceae	*Atriplex*					1
plants	land plants	Chenopodiaceae	*Einadia nutans subsp. linifolia*			C		1/1
plants	land plants	Chenopodiaceae	*Enchylaena tomentosa*			C		1
plants	land plants	Chenopodiaceae	*Maireana*					2
plants	land plants	Chenopodiaceae	*Sclerolaena calcarata*	red burr		C		1/1
plants	land plants	Combretaceae	*Terminalia oblongata*			C		1
plants	land plants	Combretaceae	*Terminalia oblongata subsp. oblongata*			C		2/2
plants	land plants	Convolvulaceae	*Evolvulus alsinoides var. villosicalyx*			C		1/1
plants	land plants	Convolvulaceae	*Polymeria calycina*	pink bindweed		C		1/1
plants	land plants	Crassulaceae	*Bryophyllum delagoense*		Y			1/1
plants	land plants	Cyperaceae	*Cyperus betchei subsp. betchei*			C		1/1
plants	land plants	Cyperaceae	*Cyperus concinnus*			C		2/2
plants	land plants	Cyperaceae	*Cyperus difformis*	rice sedge		C		1/1
plants	land plants	Cyperaceae	*Cyperus isabellinus*			C		1/1
plants	land plants	Cyperaceae	*Fimbristylis*					1
plants	land plants	Cyperaceae	*Scleria sphacelata*			C		1/1
plants	land plants	Erythroxylaceae	*Erythroxylum australe*	cocaine tree		C		4/1
plants	land plants	Euphorbiaceae	*Croton phebalioides*	narrow-leaved croton		C		1/1
plants	land plants	Euphorbiaceae	*Euphorbia tannensis subsp. eremophila*			C		1/1
plants	land plants	Goodeniaceae	*Goodenia glabra*			C		1/1
plants	land plants	Hydrocharitaceae	*Ottelia ovalifolia subsp. ovalifolia*			SL		1/1
plants	land plants	Lamiaceae	*Basilicum polystachyon*			C		1/1
plants	land plants	Lamiaceae	*Prostanthera suborbicularis*			C		1/1
plants	land plants	Leguminosae	*Acacia*					1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Leguminosae	*Acacia harpophylla*	brigalow		C		1
plants	land plants	Leguminosae	*Acacia julifera subsp. julifera*			C		1/1
plants	land plants	Leguminosae	*Acacia shirleyi*	lancewood		C		1/1
plants	land plants	Leguminosae	*Aeschynomene indica*	budda pea		C		1/1
plants	land plants	Leguminosae	*Cassia brewsteri*			C		3/2
plants	land plants	Leguminosae	*Heliodendron basalticum*			C		1
plants	land plants	Leguminosae	*Petalostylis labicheoides*			C		2/2
plants	land plants	Leguminosae	*Stylosanthes scabra*		Y			1
plants	land plants	Linderniaceae	*Lindernia procumbens*			C		1/1
plants	land plants	Lythraceae	*Ammannia multiflora*	jerry-jerry		C		2/2
plants	land plants	Lythraceae	*Rotala mexicana*			C		1/1
plants	land plants	Malvaceae	*Abelmoschus ficulneus*	native rosella		C		1/1
plants	land plants	Malvaceae	*Gossypium australe*			C		1/1
plants	land plants	Malvaceae	*Hibiscus divaricatus*			C		1/1
plants	land plants	Malvaceae	*Sida*					3
plants	land plants	Malvaceae	*Sida cordifolia*		Y			1/1
plants	land plants	Malvaceae	*Sida fibulifera*			C		1/1
plants	land plants	Meliaceae	*Owenia acidula*	emu apple		C		1
plants	land plants	Myrtaceae	*Backhousia angustifolia*	narrow-leaved backhousia		C		1/1
plants	land plants	Myrtaceae	*Blakella tessellaris*			C		2
plants	land plants	Myrtaceae	*Corymbia clarksoniana*			C		2
plants	land plants	Myrtaceae	*Eucalyptus camaldulensis*			C		1
plants	land plants	Myrtaceae	*Eucalyptus cambageana*	Dawson gum		C		1
plants	land plants	Myrtaceae	*Eucalyptus melanophloia*			C		2
plants	land plants	Myrtaceae	*Eucalyptus populnea*	poplar box		C		1
plants	land plants	Myrtaceae	*Eucalyptus tereticornis*			C		1
plants	land plants	Myrtaceae	*Eucalyptus thozetiana*			C		3/3
plants	land plants	Myrtaceae	*Lysicarpus angustifolius*	budgeroo		C		1/1
plants	land plants	Myrtaceae	*Micromyrtus capricornia*			C		3/3
plants	land plants	Oleaceae	*Jasminum didymum subsp. didymum*			C		2
plants	land plants	Oxalidaceae	*Oxalis perennans*			C		1/1
plants	land plants	Phrymaceae	*Glossostigma diandrum*			C		1/1
plants	land plants	Phrymaceae	*Peplidium foecundum*			C		1/1
plants	land plants	Phyllanthaceae	*Phyllanthus carpentariae*			C		1/1
plants	land plants	Phyllanthaceae	*Phyllanthus maderaspatensis*			C		1/1
plants	land plants	Picrodendraceae	*Petalostigma pubescens*	quinine tree		C		2
plants	land plants	Pittosporaceae	*Bursaria incana*			C		2/1
plants	land plants	Poaceae	*Ancistrachne uncinulata*	hooky grass		C		1/1
plants	land plants	Poaceae	*Aristida calycina*			C		1
plants	land plants	Poaceae	*Aristida latifolia*	feathertop wiregrass		C		1
plants	land plants	Poaceae	*Aristida ramosa*	purple wiregrass		C		1
plants	land plants	Poaceae	*Bothriochloa ewartiana*	desert bluegrass		C		1
plants	land plants	Poaceae	*Cenchrus ciliaris*		Y			3
plants	land plants	Poaceae	*Chloris divaricata var. divaricata*	slender chloris		C		1
plants	land plants	Poaceae	*Chloris virgata*	feathertop rhodes grass	Y			1
plants	land plants	Poaceae	*Cymbopogon refractus*	barbed-wire grass		C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Poaceae	*Dinebra decipiens var. decipiens*			C		1/1
plants	land plants	Poaceae	*Diplachne fusca var. fusca*			C		1/1
plants	land plants	Poaceae	*Enneapogon gracilis*	slender nineawn		C		3/1
plants	land plants	Poaceae	*Enneapogon lindleyanus*			C		1/1
plants	land plants	Poaceae	*Eragrostis*					1
plants	land plants	Poaceae	*Eragrostis sororia*			C		1/1
plants	land plants	Poaceae	*Eriachne mucronata*			C		1
plants	land plants	Poaceae	*Eriachne mucronata forma (Alpha C.E.Hubbard 7882)*			C		1/1
plants	land plants	Poaceae	*Heteropogon contortus*	black speargrass		C		2
plants	land plants	Poaceae	*Megathyrsus maximus var. pubiglumis*		Y			1/1
plants	land plants	Poaceae	*Melinis repens*	red natal grass	Y			2
plants	land plants	Poaceae	*Panicum effusum*			C		1/1
plants	land plants	Poaceae	*Paspalidium*					1
plants	land plants	Poaceae	*Paspalidium caespitosum*	brigalow grass		C		1/1
plants	land plants	Poaceae	*Paspalum*					1
plants	land plants	Poaceae	*Perotis rara*	comet grass		C		1
plants	land plants	Poaceae	*Sporobolus actinocladus*	katoora grass		C		1
plants	land plants	Poaceae	*Sporobolus caroli*	fairy grass		C		1
plants	land plants	Poaceae	*Themeda triandra*	kangaroo grass		C		1
plants	land plants	Poaceae	*Thyridolepis mitchelliana*	mulga mitchell grass		C		1
plants	land plants	Poaceae	*Tragus australianus*	small burr grass		C		1
plants	land plants	Pontederiaceae	*Pontederia cyanea*			C		1/1
plants	land plants	Portulacaceae	*Portulaca oleracea*	pigweed	Y			1
plants	land plants	Proteaceae	*Hakea purpurea*			C		1/1
plants	land plants	Pteridaceae	*Cheilanthes sieberi*			C		1
plants	land plants	Pteridaceae	*Pellaea*					1/1
plants	land plants	Rhamnaceae	*Alphitonia excelsa*	soap tree		C		1
plants	land plants	Rubiaceae	*Everistia vacciniifolia var. vacciniifolia*			C		1/1
plants	land plants	Rubiaceae	*Psydrax odorata forma subnitida*			C		1/1
plants	land plants	Rutaceae	*Flindersia dissosperma*			C		2
plants	land plants	Rutaceae	*Geijera parviflora*	wilga		C		3
plants	land plants	Rutaceae	*Philotheca difformis subsp. difformis*			C		1/1
plants	land plants	Scrophulariaceae	*Eremophila latrobei subsp. glabra*			C		1/1
plants	land plants	Scrophulariaceae	*Eremophila latrobei subsp. latrobei*			C		1/1
plants	land plants	Scrophulariaceae	*Eremophila mitchellii*			C		2
plants	land plants	Solanaceae	*Solanum dissectum*			E	E	1/1
plants	land plants	Solanaceae	*Solanum elachophyllum*			E		2/2
plants	land plants	Sparrmanniaceae	*Corchorus tomentellus*			C		1/1
plants	land plants	Sparrmanniaceae	*Grewia latifolia*	dysentery plant		C		2
plants	land plants	Sterculiaceae	*Brachychiton x turgidulus*			SL		1/1
plants	land plants	Zygophyllaceae	*Roepera apiculata*			C		1/1

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.*
The codes are Extinct (EX), Extinct in the Wild (PE), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern (C).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.*
The values of EPBC are Extinct (EX), Extinct in the Wild (XW), Critically Endangered (CE), Endangered (E), Vulnerable (V) and Conservation Dependent (CD).

Records - The first number indicates the total number of records of the taxon (wildlife records and species listings for selected areas).
This number is output as 99999 if it equals or exceeds this value. A second number located after a / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Appendix C

Threatened Flora Species Likelihood of Occurrence

Species	NC Act	EPBC Act	Database	Habitat Preference	Assessment of Occurrence
Aristida annua	V	V	P	Grows on black earth, basalt and sandy, red loamy soils. The species occurs in eucalypt woodland with *Eucalyptus orgadophila*. The species also occurs in disturbed sites such as roadsides with pasture grass	**Potential** Suitable habitat for this species occur within the Survey area, particularly on land zone 8. Known to occur in disturbed areas this species may occur.. No database records (predicted to occur on EPBC search tool).
Cadellia pentastylis *ooline*	V	V	P	Occurs on ridge slopes and undulating plains within Brigalow (*Acacia harpophylla*) woodland - open forest and semi-evergreen vine thicket	**Potential** There are areas of suitable habitat for this species within the Survey area. This species is known from the locality and is often retained as a "paddock" tree. No database records (predicted to occur on EPBC search tool).
Dichanthium setosum	LC	V	P	Associated with heavy basaltic black soils and stony red-brown hard-setting loam with clay subsoil	**Potential** The large areas of suitable habitat for this species are heavily grazed within the Survey area. No database records (predicted to occur on EPBC search tool).
Dichanthium queenslandicum	V	E	W/P	Occurs in heavy soils (predominantly cracking clays or alluvium, often in gilgai) in woodland or open woodland usually dominated by Acacia (brigalow) and/or Eucalyptus species. The climate is tropical to subtropical and markedly seasonal with the habitat drying out for part of the year	**Potential** The large areas of suitable habitat for this species are heavily grazed within the Survey area. No database records (predicted to occur on EPBC search tool).
Leichhardtia brevifolia *(Marsdenia brevifloia)*	V	V	P	Grows in artesian springs and wetlands and is threatened by the drainage of this habitat.	**Unlikely** Artesian habitats are absent from the Survey area. No database records (predicted to occur on EPBC search tool).
Solanum dissectum	E	E	P	Occurs in open forest and woodland of brigalow (*Acacia*	**Potential**

Species	NC Act	EPBC Act	Database	Habitat Preference	Assessment of Occurrence
				harpophylla) or *Eucalyptus thozetiana* on solodic clay soils.	Areas of suitable habitat for this species are heavily grazed within the Survey area.
Polianthion minutiflorum	V	V	P	Usually found in forest and woodland on sandstone slopes and gullies with skeletal soil, or sometimes deeper sands adjacent to deeply weathered laterite. Associated species and vegetation includes: open woodland of *Acacia shirleyi, Lysicarpus angustifolius, Corymbia aureola*; woodland of *Eucalyptus corynodes, Corymbia trachyphloia, E. cloeziana* on sandy soil over sandstone.; sandstone plateau with *Eucalyptus dura, E. fibrosa, Angophora leiocarpa, E. major*	**Unlikely** There are no areas of suitable habitat for this species within the Survey area. No database records (predicted to occur on EPBC search tool).

Abbreviations: *Status*
NC Act: E=Endangered; V=Vulnerable; NT=Near Threatened; SL Special Least Concern; LC=Least Concern.
EPBC Act: CE=Critically Endangered; E=Endangered; V=Vulnerable; M=Migratory. NL = not listed *Data source*
W= DEHP Wildlife Online database; P =Protected Matters Search Tool.

Appendix D

Threatened Fauna Species Likelihood of Occurrence

Species	NC Act	EPBC Act	Data base	Habitat preference	Likelihood of occurrence
Birds					
Rostratula australis Australian painted snipe	V	E	P	Terrestrial shallow wetlands, ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains. Most likely in alluvial areas but could also occur in gilgaied areas.	**Potential** Farm dams within the Survey area provide low quality habitat for this species. The lack of low shrub layers or tall reed beds makes the occurrence of this species less likely. No database records (predicted to occur on EPBC search tool).
Erythrotriorchis radiatus Red goshawk	E	V	P	Endemic to northern and eastern Australia in coastal and subcoastal areas with large home ranges of up to 200 km^2. Occurs in woodlands and forests and prefers mosaic habitats that hold a large population of birds and permanent water. Riparian areas are heavily favoured.	**Potential visitor** The Survey area offers a mosaic of woodlands and forest as foraging habitat for his species. Large expanses of timbered country associated with the neighbouring Expedition Ranges offer better quality habitat for this species. No database records (predicted to occur on EPBC search tool). This is an extremely uncommon species.
Geophaps scripta scripta Squatter Pigeon (southern)	NL	V	W/P	Dry grassy eucalypt woodlands and open forests, also Callitris and Acacia woodlands. Most birds live in sandy sites near permanent water.	**Potential** Habitat for this species occurs across the Survey area and there are within the surrounding landscape. No database records (predicted to occur on EPBC search tool). There is a local record on ALA in 1986.
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern)	LC	E	P	Mainly in grasslands and grassy woodlands that are located close to bodies of fresh water. also occurs in cleared or suburban areas such as along roadsides and in towns	**Unlikely** Poor quality habitat for this species occurs across the Survey area.

Species	NC Act	EPBC Act	Data base	Habitat preference	Likelihood of occurrence
					No database records (predicted to occur on EPBC search tool). There are records from 1986 close to the survey area This is an extremely uncommon species.
Hirundapus caudacutus White-throated needletail	*V*	*V*	NB	Aerial birds and for a time it was commonly believed that they did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has since confirmed that this is a regular activity	**Potential fly-over** This species potentially feeds in the sky above the Survey area
Falco hypoleucos Grey Falcon	V	V	P	Widely but sparsely distributed in woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses, of mainland Australia	**Unlikely** The Survey area offers limited areas of woodlands and forest as foraging habitat for his species. No database records (predicted to occur on EPBC search tool). This is an extremely uncommon species that usually occurs in drier regions west of the Survey area.
Grantiella picta Painted Honeyeater	V	V	P	Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests.	**Potential** The woodlands of the Survey area provide low quality foraging habitat for this species. This species is very unlikely to breed within the locality. It may however occur as a vagrant especially along creek lines. No database records (predicted to occur on EPBC search tool).
Stagonopleura guttata Diamond Firetail	V	V	P	This species has a patchy distribution and generally occupies drier forests and grassy woodlands west of the Great Dividing Range	**Unlikely** Small areas of low quality habitat for this species occur within the Survey area.

Species	NC Act	EPBC Act	Data base	Habitat preference	Likelihood of occurrence
					No database records (predicted to occur on EPBC search tool). There are undated records for this species around the Rolleston area
Calidris ferruginea Curlew sandpiper	E	CE	P	Mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters	**Unlikely**. The Survey area offers very low quality habitats for this species No database records (predicted to occur on EPBC search tool).
Poephila cincta cincta Southern Black-throated Finch	V	E	P	Occurs mainly in grassy, open woodlands and forests, typically dominated by Eucalyptus, Corymbia and Melaleuca, and occasionally in tussock grasslands or other habitats (for example freshwater wetlands), often along or near watercourses, or in the vicinity of water	**Unlikely** The closet record (2004) is 90 km east of the alignment. The survey area is generally too far south for this species. No database records (predicted to occur on EPBC search tool).
Latham's Snipe, Japanese Snipe Gallinago hardwickii	V	V	P	Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity.	**Potential** There are low quality habitats within the Survey area that may provide temporary feeding habitat for this species. No database records (predicted to occur on EPBC search tool). Records on ALA particularly around Emerald
Sharp-tailed Sandpiper Calidris acuminata	V	V	P	Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and	**Potential** There are low quality habitats within the Survey area that may provide temporary

Species	NC Act	EPBC Act	Data base	Habitat preference	Likelihood of occurrence
				pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland.	feeding habitat for this species. No database records (predicted to occur on EPBC search tool). Records on ALA particularly around Emerald
Reptiles					
Denisonia maculata Ornamental snake	V	V	P	In Brigalow (*Acacia harpophylla*), Gidgee (*Acacia cambagei*), Blackwood (*Acacia argyrodendron*) or Coolibah (*Eucalyptus coolabah*)-dominated vegetation communities, or pure grassland associated with gilgais	**Potential** Habitat for this species occurs within the Survey area. This species is known from the locality.
Egernia rugosa Yakka Skink	V	V	NB	A wide variety of vegetation types including poplar box, ironbark, brigalow, white cypress pine, mulga, bendee and lancewood woodlands and open forests. Substrates include rock, sand, clay and loamy red earth. They can persist in clearings where shelter sites such as tunnel erosion, rabbit warrens and log piles exist.	**Potential** There is some average quality habitat for this species associated with Eucalypt woodlands within the survey area. ALA database records suggest that this species is not common within the locality.
Strophurus taenicauda golden-tailed gecko	*NT*		NB	Lives in dry open forest and woodlands, especially those with well-developed shrub layer where it shelters in tree hollows and splits, beneath exfoliating bark and within tree fissures on both live and dead timber. The main factors influencing presence and abundance of S. taenicauda were the average basal area of Callitris glaucophylla	**Unlikely** Poor quality habitat for this species occurs across the Survey area. *Callitris colluminaris* is uncommon. There are local ALA records in better quality habitats near the survey area.
Delma torquata collared delma	*V*	*V*	P	Occupies a range of eucalypt woodlands and open forests; lives under surface rock and large woody debris (Wilson 2015). The Survey area is within the species' known range.	**Unlikely** Habitats for this species are not present within the Survey area. No database records (predicted to occur on EPBC search tool).
Elseya albagula Southern Snapping Turtle, White-throated Snapping Turtle	*CR*	*CE*	P	Found only in Queensland in the Fitzroy, Mary and Burnett Rivers and associated smaller drainages in south eastern Queensland.	**Unlikely** There is no suitable habitat for this species within the Survey area

Species	NC Act	EPBC Act	Data base	Habitat preference	Likelihood of occurrence
				Permanent flowing water. Prefers clear, flowing, well-oxygenated waters.	No database records (predicted to occur on EPBC search tool).
Hemiaspis damelii *Grey Snake*	*E*	*E*	P	Woodlands (typically brigalow *Acacia harpophylla* and belah Casuarina cristata), usually on heavier, cracking clay soils, particularly in association with water bodies or in areas with small gullies and ditches (gilgais)	**Potential** Habitat for this species occurs within the Survey area No database records (predicted to occur on EPBC search tool). The nearest ALA record (2004) is 50 km north of the Survey area
Rheodytes leukops Fitzroy River Turtle		V	P	Occurs in flowing rivers with large deep pools with rocky, gravelly or sandy substrates, connected by shallow riffles	**Unlikely** There is no suitable habitat for this species within the Survey area No database records (predicted to occur on EPBC search tool).
Mammals					
Phascolarctos cinereus koala	V	V	W/P	Koalas live over a range of open forest and woodland communities. Within the Site, some of the canopy eucalypts are suitable habitat for this species. The presence of main roads and low bushland density within the area makes it unlikely that the koala persists in this landscape	**Potential** Habitat for this species includes all woodlands and open forests dominated by eucalypts within the Survey area.
Nyctophilus corbeni eastern long-eared bat	*V*	*V*	P	Occurs in a variety of dry forest habitats including River Red Gum, open woodland, mallee, brigalow and other arid and semi-arid habitats. The preferred habitat is mallee and Callitris woodlands and habitats that have a distinct canopy with a dense, cluttered understorey. It roosts in tree hollows or under bark. Surveys suggest the species requires large tracts of forest to occur .	**Potential** Habitat for this species is associated with the riparian woodlands and open forests within the Survey area. No database records (predicted to occur on EPBC search tool).
Dasyurus hallucatus Northern quoll	LC	E	P	This mammal occurs in a range of habitats but is most abundant in hilly or rocky areas close to permanent water.	**Unlikely** Poor quality habitat for this species occurs across the Survey area.

Species	NC Act	EPBC Act	Data base	Habitat preference	Likelihood of occurrence
					Over 1 km from potential rock shelter sites. No database records (predicted to occur on EPBC search tool).
Petauroides volans Greater Glider (southern and central)	E	E	W/P	Feeds exclusively on eucalypt leaves and requires up to 18 large hollows within a 1 – 3ha patch	**Potential** Low quality habitat for this species occurs within the Survey area
Macroderma gigas Ghost Bat	E	V	W/P	roost in caves, old mine tunnels and in deep cracks in rocks.	**Unlikely** The Carnarvon and Exhibition Ranges provide roosting sites for this species. No database records (predicted to occur on EPBC search tool). There is a record (1997) for this species at Rolleston
Tachyglossus aculeatus Short-beaked echidna	SL	NL	NB	Lives in forests and woodlands, heath, grasslands and arid environments. This species is found in disturbed environments where shelter and termites are present	**Likely** A very wide ranging and disturbance tolerant species it is likely to occur.

Abbreviations: *Status*
NC Act: E=Endangered; V=Vulnerable; NT=Near Threatened; S+ Special Least Concern; LC=Least Concern.
EPBC Act: CE=Critically Endangered; E=Endangered; V=Vulnerable; M=Migratory NL = not listed
Data source
W= DEHP Wildlife Online database; P=Protected Matters Search Tool, NB = No database records

Appendix E

Suitably Qualified Persons

Dr Andrew Daniel — Principal Ecologist

Project Role: – Flora and Fuana Assessment, Vegetation Community Mapping, Ecological Impact Assessment and Report Writing

Andrew is a Principal Ecologist with over 30 years' experience in providing leadership and technical expertise in environmental impact assessments, environmental legislation, and approvals including many years of experience as an expert witness in the Queensland legal system.

Andrew is highly experienced in flora and fauna survey, mapping and assessments for State and federal environmental impact statements and local government approvals, including both baseline and monitoring studies. Andrew's experience has been gained through work for both State, local governments and private consultancy. Andrew's field experience includes extensive experience within the Northwest Highlands, Mitchell Grass Downs, Central Queensland Coast, Einasleigh Uplands, Desert Uplands, Brigalow Belt and Southeast Queensland bioregions.

Andrew has a long history of preparing monitoring, management and rehabilitation plans, including weed and vegetation management, rehabilitation strategies and 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*.

Adrian Caneris — Principal Ecologist

Project Role: – Lead Fauna Survey Consultant

Adrian has extensive experience and expertise in ecological consultancy and specifically vertebrate fauna assessment, assessment of terrestrial habitats, ecological monitoring, wildlife management, biodiversity planning, feral species management and community liaison and facilitation. He has been involved in research, management, consulting, tertiary teaching and community based studies of terrestrial ecology, particularly vertebrate fauna for over 30 years.

Adrian is a recognised ecological expert who has undertaken specialist consultancy work for all levels of government and private organisations. Adrian has provided specialist advice for numerous major infrastructure projects. His commitment to wildlife management solutions is highly valued by policy-makers, land use planners, land managers, community organisations and project managers.

He has been involved in numerous Planning & Environment and Land Court actions and regularly provides advice to Courts as an expert on ecological matters. He also advises clients on their appeals and issues of significance before the court proceedings.

Adrian has worked specifically on numerous major infrastructure projects and advising on relevant legislative and policy requirements and impact mitigation and offset strategies. Adrian's balanced approach and understanding of issues and legislative requirements allows effective timely responses to all aspects of ecological management

Adrian has been involved in over 80 resource related assessments from large scale mining through to small quarry applications, including referral and coordination of project referrals under the EPBC Act.

Conor Neville — Senior Ecologist

Project Role: – Field Flora and Fauna Assessment

Conor has extensive experience in managing environmental matters, demonstrated through his career over the last 20 years in Queensland. Conor has worked on a wide range of conservation projects including Weeds of National Significance, National Heritage Trust Restoring Rainforests, Koala habitat protection, Coxen's Fig Parrot, Glossy Black Cockatoo, Greater Glider, Giant Barred Frog, lung fish, Mary River cod and turtle.

Conor's broad and considerable on-ground knowledge of environmental restoration and his robust understanding of environmental legislation have contributed to being successful in secure over $1 million of developer's contributions for koala offsets, 1,200 hectares of land for environmental purposes, numerous environmental covenants and voluntary conservation agreements and developer land contributions.

Conor's extensive and practical field knowledge has led to the development and implementation of bushfire management plans for protected areas, community bushfire recovery programs and his expertise and practical outlook has been sought to contribute to the development of bushfire overlay mapping and development codes.

Conor has broad field knowledge in the identification of fauna habitats and flora, in particular threatened species. Conor has surveyed vast areas in remote locations for major projects design and continues to provide expert fauna habitat assessments and targeted protected flora surveys.

Conor's broad and well-developed knowledge in environmental planning legislation, his practical on-ground land rehabilitation skills and his fauna habitat and flora identification skills provides a solid foundation on which to base sound environmental decisions.

Donovan Sharp Senior Ecologist

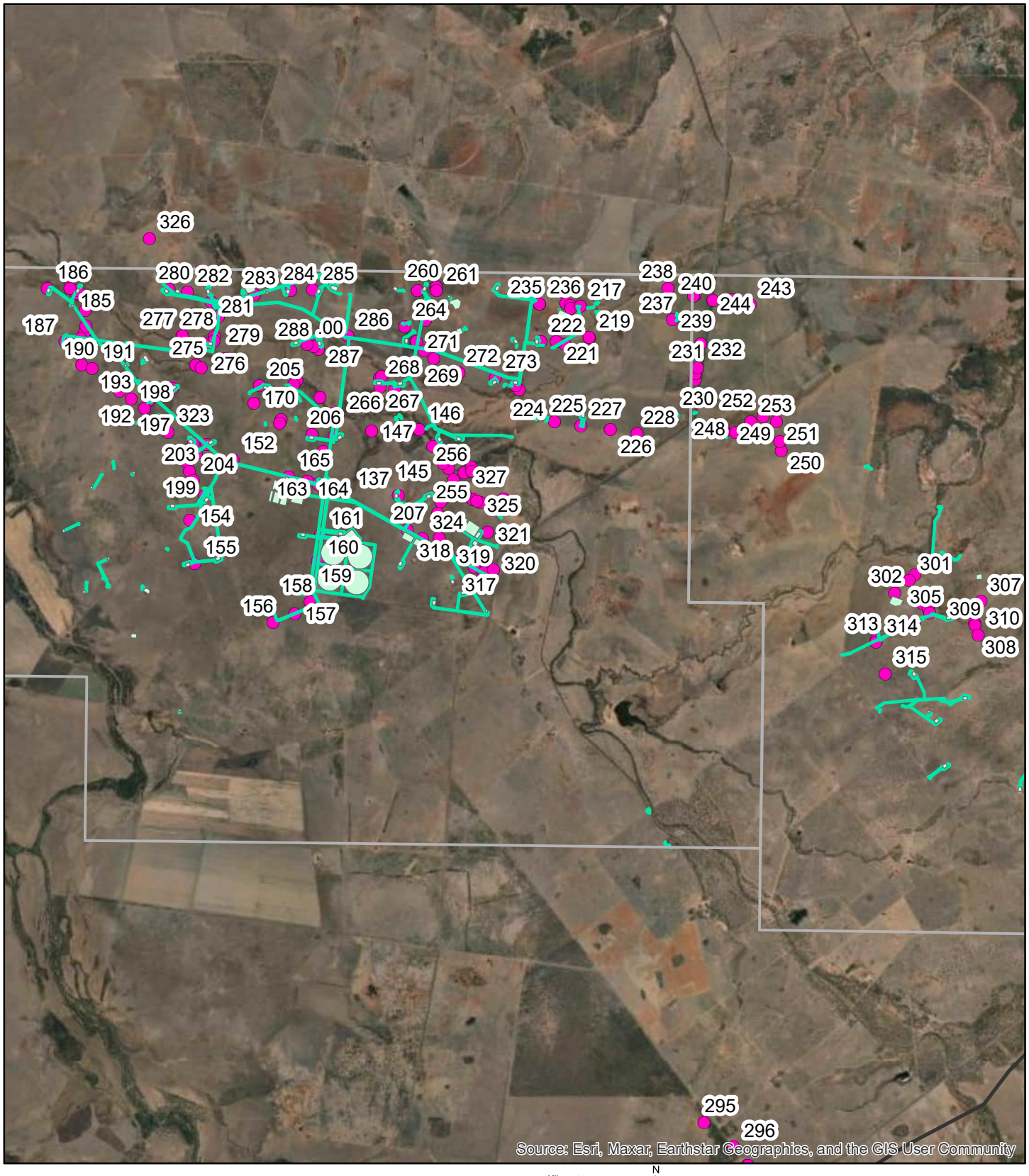
Project Role: – Field Flora and Fauna Assessment

Donovan has very extensive experience in ecological assessment work. His background includes work with the Herbarium as a Queensland Government botanist where he developed botanical keys and conducted plant identification work. He is a co-author of both the AusGrass, computer key to the grasses of Australia, and 'Flora of Stradbroke Island'.

Over the past 15 years Donovan has developed broad and considerable on-ground knowledge of Queensland flora, vegetation communities and fauna habitats, particularly threatened species habitats. This knowledge stretches across the Northwest Highlands, Mitchell Grass Downs, Central Queensland Coast, Einasleigh Uplands, Desert Uplands, Brigalow Belt and Southeast Queensland obtain through assessments conducted for a wide variety of projects, including coal, gas, dams, powerlines, pipelines and rail lines.

Appendix F

Site Survey Data



Legend

- Petroleum_Lease_Boundaries
- Facilities and well pads
- Linear disturbance footprint
- Field survey locations March 2025

Appendix F Figure

Survey Site Locations

Mahalo Gas Field Facilities Infrastructure
Ecological Impact Assessment

AD 12/12/24
Job No. 0237

terrestria
ECOLOGICAL MANAGEMENT

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No. 136 Recorder: Dilup, Neville Day/Date: 17-3/25

Purpose Compressor Station

Locality: (inc. distance/direction to nearest town)

GPS: [ ][ ] [6][6][6][2][9][2] [7][3][3][1][6][6][7] D 136

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E	~~2~~	~~2 - 4~~	~~3~~
T1	2	2 - 4	5
T2		-	
T3		-	
S1	1	0.5 - 1.5	5
S2		-	
G	0.3	0 - 0.4	D

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1		Atalya hemiglauca
		E. populnea
		Acacia harpophylla
S1		Carissa ovata
		Senna artemisioides
G		Cenchrus ciliaris

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes:

Landzone:

RE code changes

Existing RE code:

Proposed RE code:

END

Fauna Habitat Characters

Site No. 26 **Recorder:** C Neville D Sharp **Day/Date:** 17/3/25

Purpose Mahala Camp Habitat

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0666792 N 7331667 **Datum:**

Photo Numbers **Waypoint:**

Habitat Description Photos 5833–5837

Paddock - Minor regrowth.

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	0	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	1
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	1	Rocks Loose	0
Native Grass cover	0	Rock crevices	0
Exotic Grass cover	4	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	1

Notes

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No . 142 Recorder: D. Stanley C. Neville Day/Date: 17-3-25

Purpose Stream

Locality: (inc. distance/direction to nearest town)

GPS: [ ][ ] 0669127 7331277 D

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	24	22-25	S
T2	7	6-8	S
T3	7	6-8	
S1	1.5	1-2	VS
S2		-	
G		0-0.2	VS

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1		E. teretcornis
		E. tesselaris
T2		Callistemon viminalis
		A. excelsa
		Owenia venosa
		Terminalia oblongata
G		Cardiospermum sp.
		Sida corrugata
		Murdannia graminea

5849
5850
5851
5852
5853

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types: S1 Cassia brewsteri, Lysiphyllum carronii

Land system:

Landform:

Soils:

Field observation and notes: Pathway Preset

Landzone:

RE code changes

Existing RE code: 11.3.1

Proposed RE code: 11.3.25

END

Fauna Habitat Characters

Site No. 142 **Recorder:** Neville Osborne **Day/Date:** 17/3/25

Purpose STRAIN

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0669127 N 7331277 **Datum:**

Photo Numbers Photos: 5849–5853 **Waypoint:**

Habitat Description

1 · RIPARIAN STRIP.

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	2	Decorticating bark	0
Hollows in trees & stags <10cm	2	Soil cracks	0
Fallen logs (>10cm diam.)	2	Termite mounds	0
Fallen logs (> 30cm)	1	Termitaries	0
Logs with Hollows (>10cm)	1	Mistletoe	1
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	3	Rocks Loose	0
Native Grass cover	1	Rock crevices	0
Exotic Grass cover	2	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	1

Notes

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No . 151 Recorder: _____ Day/Date: 17-5-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] [6][6][5][3][1][3] [7][3][3][2][9][9] D 151

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	5	4.5 - 8	S
T2		-	
T3		-	
S1		-	
S2		-	
G	0.4	0 - 0.5	M

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1		Acacia harpophylla
		Terminalia oblongata
G		Pathenium hysterophorus
		Cedrus citratus
		Parkeum calciatum
		Guilleminea densa

5868
5869
5870
5871
5872

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes:

Landzone:

RE code changes

Existing RE code: _____

Proposed RE code: _____

END

Gilgai Habitat Quality

Site No. 151 Recorder: _____ Day/Date: 17/3/2025

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS coordinates: Zone 5 E 0653 N 7332799 Datum: _____

Photo Numbers 5873, 5874 Waypoint: _____

Habitat Description

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Average Gilgai length	8m	Presence of fringing native vegetation	2
Average Gilgai width	3m		
Average Gilgai depth	0.2m		
Fallen logs (>10cm diam.)	0		
Fallen logs (> 30cm)	0		
Presence of aquatic vegetation	0		
Soil cracks (ornamental snake)	0	Estimate of water permanence	LOW

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	0	Shrub layer	0
Fine litter (<2cm diameter)	1	Native Tree layer	1
Bare ground	4	Gilgai density	2
Native Grass cover	0		
Exotic Grass cover	4		
Stones (20-60cm)	0		

Notes

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No . 176 Recorder: _____ Day/Date: 14/3/25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] 0661060 7334014 D 176

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1		-	
T2		-	
T3		-	
S1	1	1 - 15	V5
S2	0.8	0 - 1	V5
G	0.6	0 - 0.8	D

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
		Acacia hyophle-
S1		atalya hemiglauca
S2		Cassia ovata
G		Cenchrus ciliaris
		Melinis Melinis repens
		Heteropogon contortus
		Aristida latifolia

5917
5918
5919
5920
5921

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes: No canopy

Landzone:

RE code changes

Existing RE code: _____

Proposed RE code: _____

END

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No. 184 Recorder: _____ Day/Date: 14-3-25

Purpose wet

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] 6 6 0 7 6 4 7 3 5 2 9 2 D 184

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1		-	
T2		-	
T3		-	
S1	1	1 - 15	VS
S2		-	
G	0.7	0 - 0.7	

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
S		Acacia hopophylla
G		Cenchrus ciliaris
		Bothriochloa bladhii

Geology, landform, soils

Geology map/scale/year: 5939

Geology code and rock types: 5940

Land system: 5941

Landform: No canopy 5942

Soils: 5943

Field observation and notes:

Landzone:

RE code changes

Existing RE code: _____

Proposed RE code: _____

END

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No . 195 Recorder: _____ Day/Date: 17-7-21

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: ☐☐ ☐☐☐☐☐☐ ☐☐☐☐☐☐☐ D _____

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	15	14-17	S
T2	8	6-9	S
T3		-	
S1		-	
S2		-	
G	1	0-1.5	M

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1		E. Coolabah
T2		Callistemon viminalis
		Terminalia oblongata
G		Leptochloa digitata
		Cenchrus ciliaris
		Eriochloa spp 5952
		Acacia holosericea
		Pathenium hysterophorus
		Physalis peruviana

5953 5954

Tomato Leaf vine 5955

5947 5948 5949 5950 5951

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes: ADvanced regrowth ?

Landzone:

RE code changes

Existing RE code: 11.3.3

Proposed RE code: _____

END

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No . 195 Recorder: _____ Day/Date: 19-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] 0 6 6 2 7 6 7 7 3 3 6 7 6 D 195

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E	~~10~~	~~9 - 12~~	
T1	10	9 - 10	VS-S
T2	4.5	4 - 5	VS
T3	3.5	3 - 4	S
S1	1	1 - 1.5	VS
S2		-	
G	0.4	0 - 0.4	

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1	D	E. Populnea
T2		Eremophila dissectoi
T3		Cocculus Eyfrazylum a
		Santalum lanceolatu
S1		Carissa ovata
G		Cyclis cilicis

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: Advanced regolith

Field observation and notes:

Landzone:

RE code changes

Existing RE code: _____

Proposed RE code: _____

END

Fauna Habitat Characters

Site No. 195 Recorder: Neville Thorp. Day/Date: 18/3/25

Purpose STRAEN

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0662767 N 7333036 Datum:

Photo Numbers Waypoint:

Habitat Description Photo 5979

Paddock

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	0	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	2	Rocks Loose	0
Native Grass cover	1	Rock crevices	0
Exotic Grass cover	3	Exfoliating rock	0
Stones (20-60cm)	1	Shrub layer	0

Notes

Fauna Habitat Characters

Site No. 196 **Recorder:** [illegible] **Day/Date:** 18/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0662899 N 7332088 **Datum:**

Photo Numbers **Waypoint:**

Habitat Description 5980 - 5983

Paddock.

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	0	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	2	Rocks Loose	0
Native Grass cover	0	Rock crevices	0
Exotic Grass cover	3	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	0

Notes

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No . 216 Recorder: ~~GT & SH~~ Day/Date: 20/3/23

Purpose

Locality: (inc. distance/direction to nearest town)

GPS: [ ][ ] [0][6][7][1][8][7][7] [7][3][3][4][8][9][6] D 216

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E	10	-10	√S
T1	5	4 - 7	5
T2		-	
T3		-	
S1	1	1 - 1.5	5
S2		-	
G	0.3	0 - 0.3	5
Structural formation: (including height)			
Ecologically dominant layer:			

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
E		C. dallachyana
T1		Ac Leptophl
		Ac. shirleyi
		Geijera parviflora
S1		Erythroxylum ovatum
		Carissa ovata
G		Cenchrus ciliaris

Ruby saltbush
Enchylaena tomentosa

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: Can be avoided through 6021 6023 6023 6024 6025

Field observation and notes: Gilgai Reddock Easily dispersible soils 6026

Landzone:

RE code changes

Existing RE code:

Proposed RE code:

END

Fauna Habitat Characters

Site No. 46 **Recorder:** C Neille D Thorp **Day/Date:** 20/3/25

Purpose STRAHAN

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 55 E 0671877 N 7334896 **Datum:**

Photo Numbers **Waypoint:**

Habitat Description Photos 6021 – 6025

Lancewood Hillslope

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	0	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	3	Rocks Loose	0
Native Grass cover	1	Rock crevices	0
Exotic Grass cover	2	Exfoliating rock	0
Stones (20-60cm)	2	Shrub layer	1

Notes

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No . 219 Recorder: _____ Day/Date: 20-7-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] [0][6][7][2][8][9] [7][7][4][2][3][6] D 219

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E	8	10 - 13	VS
T1	6	7 - 9	S
T2		-	
T3		-	
S1		-	
S2		-	
G	0.5?	0 - 0.5	M
Structural formation: (including height)			
Ecologically dominant layer:			

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
E		~~E canaliculata~~
		C tessellaris
T1		Callitris virgata
		Terminalia oblongata
		Acacia holosericea
G		Paspalum scrobiculatum
		Megathyrsus maximus
		Cenchrus ciliaris

Geology, landform, soils

Geology map/scale/year: 6031

Geology code and rock types: 6033

Land system: 6034

Landform: 6035

Soils: 6036.

Field observation and notes: cambogeara on edge

Landzone:

RE code changes

Existing RE code: _____

Proposed RE code: _____

END

Fauna Habitat Characters

Site No. 219 **Recorder:** [illegible] **Day/Date:** 20/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0672289 N 7334236 **Datum:**

Photo Numbers **Waypoint:**

Habitat Description 6031 – 6036.

· Riparian Strip.

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	2	Decorticating bark	0
Hollows in trees & stags <10cm	1	Soil cracks	0
Fallen logs (>10cm diam.)	2	Termite mounds	0
Fallen logs (> 30cm)	1	Termitaries	0
Logs with Hollows (>10cm)	1	Mistletoe	1
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	2	Rocks Loose	0
Native Grass cover	0	Rock crevices	6
Exotic Grass cover	2	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	1

Notes

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No . 220 Recorder: _____ Day/Date: 20-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] [0][6][7][1][7][4][4] [7][3][3][4][0][6][9] D 220

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	10	8 - 12	VS
T2		-	
T3		-	
S1	1.5	1 - 2	VS
S2		-	
G	0.4	0 - 0.4	

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1		E. Carbangensis
S1		Cassia brewsteri
G		Cenchrus ciliaris
		Panicum coloratum
		Megathyrsus maximus
		Parthenium hysterophorus

Geology, landform, soils

Geology map/scale/year: 6036

Geology code and rock types: 6037

Land system: 6038

Landform: 6039

Soils:

Field observation and notes: 6040

Landzone:

RE code changes

Existing RE code: NA

Proposed RE code: _____

END

Fauna Habitat Characters

Site No. 220 **Recorder:** C Neville D Sheriff **Day/Date:** 20/3/25

Purpose STRAWN

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0671744 N 7334089 **Datum:**

Photo Numbers **Waypoint:**

Habitat Description 6036 – 6040

· Buffel Paddock w/ scattered trees ·

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	1	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	2	Rocks Loose	0
Native Grass cover	0	Rock crevices	0
Exotic Grass cover	4	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	0

Notes

Fauna Habitat Characters

Site No. 222 **Recorder:** C Davill D Sharp **Day/Date:** 20/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0677207 N 7334147 **Datum:**

Photo Numbers **Waypoint:**

Habitat Description Photo: 6043, 6044

Paddock.

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	0	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	1	Rocks Loose	0
Native Grass cover	0	Rock crevices	0
Exotic Grass cover	5	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	0

Notes

Fauna Habitat Characters

Site No. 223 **Recorder:** Neville Atherton **Day/Date:** 20/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0 N **Datum:**

Photo Numbers **Waypoint:**

Habitat Description Photos 6048 W, 6049 N

Paddock

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	0	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	2	Rocks Loose	0
Native Grass cover	0	Rock crevices	0
Exotic Grass cover	4	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	0

Notes

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No ~~223~~ Recorder: Day/Date: 20/3/25

Purpose

Locality: (inc. distance/direction to nearest town) ~~0670709~~

GPS: 0670627 7733162 ~~D 223~~

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	4	2-5	V
T2		-	
T3		-	
S1		-	
S2		-	
G	0.2	0-0.2	M

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
~~T1~~		Lysiphyllum carronii
G		Paraneurachne muelleri
		Cenchrus ciliaris

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types: 6018 W
6019 N

Land system:

Landform:

Soils:

Field observation and notes:

Landzone:

RE code changes

Existing RE code:

Proposed RE code:

END

224 0670627
7733162

Gilgai Habitat Quality

Site No. 226 Recorder: _____ Day/Date: 20-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS coordinates: Zone 5 E 0 6 7 3 7 7 5 N 7 3 3 2 0 6 4 Datum: 328

Photo Numbers Waypoint: ----------

Habitat Description

Poor Pasture & bitch

Connectivity Patch Characteristics

None

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Average Gilgai length	10	Presence of fringing native vegetation	0
Average Gilgai width	5		
Average Gilgai depth	20cm		
Fallen logs (>10cm diam.)	1		
Fallen logs (> 30cm)	0		
Presence of aquatic vegetation	0		
Soil cracks (ornamental snake)	0	Estimate of water permanence	

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	0	Shrub layer	1
Fine litter (<2cm diameter)	2	Native Tree layer	0
Bare ground	2	Gilgai density	2
Native Grass cover	0		
Exotic Grass cover	5		
Stones (20-60cm)	0		

Notes

6055 Gilgai N

6056 No Gilgai ~~5~~ 5 on Nimalla

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No. 229 Recorder: _____ Day/Date: 20-7-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] [0][0][7][4][6][7][0] [4][3][3][3][2][8][4] D _____

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	15	14 - 16	V S
T2		-	
T3		-	
S1	0.5	0.5 - 1	0.75
S2		-	
G	0.15	0 - 0.2	

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1		E. cambageana
S1		Ac harpophylla
G		Cenchrus ciliaris
		Paspalum scrobiculatum

Geology, landform, soils

Geology map/scale/year: 6057 W

Geology code and rock types: 6058 NW

Land system:

Landform:

Soils:

Field observation and notes:

Landzone:

RE code changes

Existing RE code: NR ?

Proposed RE code: _____

END

Fauna Habitat Characters

Site No. 729 Recorder: Marika Dhuya Day/Date: 20/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0674670 N 7333284 Datum:

Photo Numbers Waypoint:

Habitat Description Photos. 6057 W, 6058 NW

Paddock.

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	0	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	0	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	0	Rocks Embedded	0
Bare ground	1	Rocks Loose	0
Native Grass cover	0	Rock crevices	0
Exotic Grass cover	5	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	0

Notes

Fauna Habitat Characters

Site No. 230 Recorder: cDeirdre D'Hoop Day/Date: 20/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0 N Datum:

Photo Numbers Waypoint: ----------

Habitat Description Photo 6055

Paddock

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	0	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	0	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	0	Rocks Embedded	0
Bare ground	1	Rocks Loose	0
Native Grass cover	0	Rock crevices	0
Exotic Grass cover	5	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	0

Notes

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No . 235 Recorder: Day/Date: 21-3-25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS: 06 7 1 1 1 10 7 3 3 4 9 9 5 D 235

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	8	7 - 10	S
T2	3.5	3 - 5	VS
T3		-	
S1	0.5	0.5 - 1	VI
S2		-	
G	0.4	0 - 0.4	D

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1		E populnea
T2		Cassia brewsteri
		Terminalia oblongata
S1		Carissa ovata
G		Cenchrus ciliaris
		Chrysopogon
		Paspalum scrobiculatum

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

6069
6070
6071
6072
6073

Field observation and notes: very open advanced regrowth?

Landzone:

RE code changes

Existing RE code: 11.3.2

Proposed RE code:

END

Fauna Habitat Characters

Site No. 235 **Recorder:** Neille D'Hemp **Day/Date:** 21/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0 N **Datum:**

Photo Numbers **Waypoint:**

Habitat Description Photos 6069-6073.

Populus nova Woodland.

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	2	Decorticating bark	0
Hollows in trees & stags <10cm	1	Soil cracks	0
Fallen logs (>10cm diam.)	1	Termite mounds	0
Fallen logs (> 30cm)	1	Termitaries	0
Logs with Hollows (>10cm)	1	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	2	Rocks Embedded	0
Bare ground	1	Rocks Loose	0
Native Grass cover	1	Rock crevices	0
Exotic Grass cover	3	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	1

Notes

Gilgai Habitat Quality

Site No. 245 Recorder: _____ Day/Date: 21-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS coordinates: Zone 5 E 0671514 N 7332745 Datum: _____

Photo Numbers Waypoint: 245

Habitat Description

Paddock no cover ~~boot~~ echinochloa Pennisetum
Parthenium ophuiros Juncus
Buffel Navicula

Connectivity Patch Characteristics

Cynodon dactylon occ areas bigger to 1.5m
VVS

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Average Gilgai length	20	Presence of fringing native vegetation	0
Average Gilgai width	5		1
Average Gilgai depth	0.2m		
Fallen logs (>10cm diam.)	0		
Fallen logs (> 30cm)	0		
Presence of aquatic vegetation	1		
Soil cracks (ornamental snake)	6	Estimate of water permanence	

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	0	Shrub layer	0 <2%
Fine litter (<2cm diameter)	1	Native Tree layer	
Bare ground	1	Gilgai density	2
Native Grass cover	~~0~~ 1		
Exotic Grass cover	5		
Stones (20-60cm)	1		

Notes

6099
6100
6101
6102
6107

Fauna Habitat Characters

Site No. 249 Recorder: _____ Day/Date: 21-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS coordinates: Zone 5 E 0671627 N 7331686 Datum: _____

Photo Numbers _____ Waypoint: 249

Habitat Description

Paddock Big box regrowth generally 0.5-3m
4-6 around ~~gate~~ some grasses

Connectivity Patch Characteristics

Buffel Heptochloa digitata Patterson
Cynodon Panicum coloratum Pygalis

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	3
Fallen logs (>10cm diam.)	1	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	1
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	1	Rocks Loose	0
Native Grass cover	1	Rock crevices	0
Exotic Grass cover	4	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	1

Notes

6106
6107
6108
6109
6110

Gilgai Habitat Quality

Site No. 249 Recorder: _____ Day/Date: 21-3-23

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS coordinates: Zone 5 E 0676627 N 7331686 Datum: _____

Photo Numbers Waypoint: 249

Habitat Description

Grazed Buffel
Paddock vs bryalow regrowth 0.5-3m 3-6 round gilgai

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Average Gilgai length	60	Presence of fringing native vegetation	1
Average Gilgai width	20		
Average Gilgai depth	1m		
Fallen logs (>10cm diam.)	1		
Fallen logs (> 30cm)	0		
Presence of aquatic vegetation	1		
Soil cracks (ornamental snake)	3	Estimate of water permanence	

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Shrub layer	1
Fine litter (<2cm diameter)	1	Native Tree layer	0
Bare ground	1	Gilgai density	1
Native Grass cover	1		
Exotic Grass cover	4		
Stones (20-60cm)	0		

Notes

6106
6107
6108
6109
6110

Gilgai Habitat Quality

Site No. 249 Recorder: _____ Day/Date: 21-3-23

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS coordinates: Zone 5 E 0676627 N 7331686 Datum: _____

Photo Numbers Waypoint: 249

Habitat Description

Grazed Buffel
Paddock vs bryalow regrowth 0.5-3m 3-6 round gilgai

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Average Gilgai length	60	Presence of fringing native vegetation	1
Average Gilgai width	20		
Average Gilgai depth	1m		
Fallen logs (>10cm diam.)	1		
Fallen logs (> 30cm)	0		
Presence of aquatic vegetation	1		
Soil cracks (ornamental snake)	3	Estimate of water permanence	

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Shrub layer	1
Fine litter (<2cm diameter)	1	Native Tree layer	0
Bare ground	1	Gilgai density	1
Native Grass cover	1		
Exotic Grass cover	4		
Stones (20-60cm)	0		

Notes

6106
6107
6108
6109
6110

Gilgai Habitat Quality

Site No. 250 Recorder: _____ Day/Date: 21-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS coordinates: Zone 5 E 0671593 N 7731889 Datum: _____

Photo Numbers Waypoint: 250

Habitat Description

Paddock one bagalow 1-5

Connectivity Patch Characteristics

Leptochloa digitata
cynodon dactylon
Buffel

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Average Gilgai length	40	Presence of fringing native vegetation	1
Average Gilgai width	10		
Average Gilgai depth	80cm		
Fallen logs (>10cm diam.)	0		
Fallen logs (> 30cm)	0		
Presence of aquatic vegetation	1		
Soil cracks (ornamental snake)	2	Estimate of water permanence	

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Shrub layer	0
Fine litter (<2cm diameter)	1	Native Tree layer	1
Bare ground	1	Gilgai density	2
Native Grass cover	1		
Exotic Grass cover	4		
Stones (20-60cm)	0		

Notes

6111
6112
6113
6114
6115

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No. 254 Recorder: _____ Day/Date: 22-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] 0 6 9 4 6 7 7 3 3 1 1 8 8 D 254

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	25	22 - 25	S
T2	10	8 - 12	M
T3		-	
S1		-	
S2		-	
G	0.6	0 - 1	D

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1		E. tereticornis
T2		Callistemon viminalis
G		Megathyrsus maximus
		Lomandra longifolia
		Cenchrus ciliaris

Geology, landform, soils

Geology map/scale/year: 6120

Geology code and rock types: 6121

Land system: 6122

Landform: 6123

Soils: 6124

Field observation and notes:

Landzone:

RE code changes

Existing RE code: _____

Proposed RE code: _____

END

Fauna Habitat Characters

Site No. 254 Recorder: Maille D Sharp Day/Date: 22/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0669467 N 7331188 Datum:

Photo Numbers Waypoint:

Habitat Description Photos 6120, 6121, 6122, 6123, 6124.

RIPARIAN (15m Wide Between Banks)

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	1	Decorticating bark	0
Hollows in trees & stags <10cm	1	Soil cracks	0
Fallen logs (>10cm diam.)	3	Termite mounds	0
Fallen logs (> 30cm)	2	Termitaries	0
Logs with Hollows (>10cm)	2	Mistletoe	2
Large trees >18m	2		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	1	Rocks Loose	0
Native Grass cover	1	Rock crevices	0
Exotic Grass cover	3	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	1

Notes

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No 256 Recorder: _____ Day/Date: 22-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] 0696643 7331229 D 256

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	13	12 - 14	S
T2	8	6 - 9	S
T3	3	2 - 4	VS
S1	1	0.5 1	VS
S2		-	
G	0.2	0 - 0.3	M(1)

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name	
T1		E. coolabah	
T2		Ac. harpophylla	
		Lysiphlum cerorniì	
T3		Ac harpophylle	6126
			6127
S1		Ac harpophylle	6128
		E. coolabah	6129
			6130

G Cadaba aphaia

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes:

HVR

Parthenium hysterophorus
Paspalum scrobiculatum
Sporobolus creolii
Ahituton ~~Sida~~ oxycarpum
Tragus australe
Cyperus gracilis
Evolvulus alsinoides

Landzone:

RE code changes

Existing RE code: _____

Proposed RE code: _____

END

Fauna Habitat Characters

Site No. 256 Recorder: Adaille Dhaup. Day/Date: 22/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0669645 N 7131229 Datum:

Photo Numbers Waypoint:

Habitat Description Photos 6126 - 6130

Woodland

Connectivity Patch Characteristics

Adjacent to Riparian

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	1	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	2	Termite mounds	0
Fallen logs (> 30cm)	2	Termitaries	0
Logs with Hollows (>10cm)	2	Mistletoe	3
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	2	Rocks Embedded	0
Bare ground	2	Rocks Loose	0
Native Grass cover	1	Rock crevices	0
Exotic Grass cover	3	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	1

Notes

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No. 260 Recorder: _____ Day/Date: 22-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] 0 6 6 8 8 4 4 7 3 3 5 3 8 1 D 260

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E	17	- 17	VS
T1	12	8-13	S
T2	4	2 - 5	S/M
T3		-	
S1		-	
S2		-	
G	0.6	0 - 0.6	D

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
E		E trachyphloia
T1		E Melanophloia
		C. trachyphloia
		Alphitonia excelsa
T2		Acacia leiocalyx
		Petalostigma pubescens
		Erythroxylum australe
		Hovea lanceolata
G		Heteropogon contortus

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types: Cadros Colluvials

Land system: Thrasher

Landform: Stylosanthes scabra

Soils: Melaleuca repens

Field observation and notes: ~~Dogs Bath~~ Granulitic-olia

Landzone:

6136
6137
6138
6139
6140

RE code changes

Existing RE code: _____

Proposed RE code: _____

END

Fauna Habitat Characters

Site No. 260 **Recorder:** CNeville DSharp. **Day/Date:** 22/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0668844 N 7335381 **Datum:**

Photo Numbers Photos 6136 – 6140 **Waypoint:**

Habitat Description

B. Leaved IRON BK [illegible] roadside.

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	2	Decorticating bark	0
Hollows in trees & stags <10cm	2	Soil cracks	0
Fallen logs (>10cm diam.)	2	Termite mounds	3
Fallen logs (> 30cm)	1	Termitaries	1
Logs with Hollows (>10cm)	1	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	1	Rocks Loose	0
Native Grass cover	2	Rock crevices	0
Exotic Grass cover	2	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	2

Notes

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No. 265 Recorder: _____ Day/Date: 22-3-23

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] 0667547 7333137 D 265

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	4	3 - 6	VS
T2		-	
T3		-	
S1		-	
S2		-	
G	1.25	0 - 15	D

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1		A leptophlebia
G		Neuchyous marina
		Cymbastylis sp. 6152
		Sesbania cochlearis
		Leptochloa digitata

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types: 6147 6148 6149 6150 6151

Land system:

Landform:

Soils:

Field observation and notes:

Landzone:

RE code changes

Existing RE code: _____

Proposed RE code: _____

END

Fauna Habitat Characters

Site No. 265 **Recorder:** C Mendle D Thompson **Day/Date:** 22/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0667578 N 7333137 **Datum:**

Photo Numbers **Waypoint:**

Habitat Description Photos: 6147 – 6151

· Cailgi Paddock. Dead trees. Parthenium

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	4
Fallen logs (>10cm diam.)	0	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	0	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	1	Rocks Loose	0
Native Grass cover	1	Rock crevices	0
Exotic Grass cover	4	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	0

Notes

Fauna Habitat Characters

Site No. 766 Recorder: Neville Bilney Day/Date: 22/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0 N Datum:

Photo Numbers Waypoint:

Habitat Description Photos 6153-6156.

Buffel Paddock w/ Gilgis

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	0	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	0	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	2	Rocks Loose	0
Native Grass cover	0	Rock crevices	0
Exotic Grass cover	5	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	0

Notes

Gilgis found 2x1x0.2 → 10x2x0.5m.
RANGING.

Gilgai Habitat Quality

Site No. 267 Recorder: _____ Day/Date: 22-3-23

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS coordinates: Zone 5 E 0667609 N 7333357 Datum: _____

Photo Numbers Waypoint: 267

Habitat Description

Buffel Eragrostis Leptochloa digitata
Sesbania cunabra megathysus
Parthenium

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Average Gilgai length	30	Presence of fringing native vegetation	1
Average Gilgai width	5m		
Average Gilgai depth	60cm		
Fallen logs (>10cm diam.)	0		
Fallen logs (> 30cm)	0		
Presence of aquatic vegetation	1		
Soil cracks (ornamental snake)	1	Estimate of water permanence	

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Shrub layer	0-1
Fine litter (<2cm diameter)	2	Native Tree layer	0
Bare ground	1	Gilgai density	1
Native Grass cover	1		
Exotic Grass cover	4		
Stones (20-60cm)	0		

Notes

6154
6159
6160
6161
6162

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No 268 Recorder: _____ Day/Date: 22-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] 6668393 7334143 D 268

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E	11	10 - 11	VS
T1		-	
T2		-	
T3		-	
S1	2	0.5 - 3	VS
S2		-	
G	0.4	0.3 - 0.4	M
Structural formation: (including height)			
Ecologically dominant layer:			

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name	
E		C. carbagaei	
S		Acacia hapophylla	
G		Paturaria	
		Digitaria divaricatissima	
		Cenchrus ciliaris	
		Cynodon dactylon	6163
		Nephrolepis cordifolia	6164
		Aristida latifolia	6165
		Sporobolus creber	6166
			6167

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes: Aerial shows veg

NO veg

Landzone:

RE code changes

Existing RE code: _____

Proposed RE code: _____

END

Fauna Habitat Characters

Site No. 268 **Recorder:** CDeirdre DSharp **Day/Date:** 22/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 55 E 0668393 N 7334143 **Datum:**

Photo Numbers Photos 6163 – 6167 **Waypoint:**

Habitat Description

Paddock. w' Parethium R

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	0	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	0	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	2	Rocks Loose	0
Native Grass cover	1	Rock crevices	0
Exotic Grass cover	4	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	1

Notes

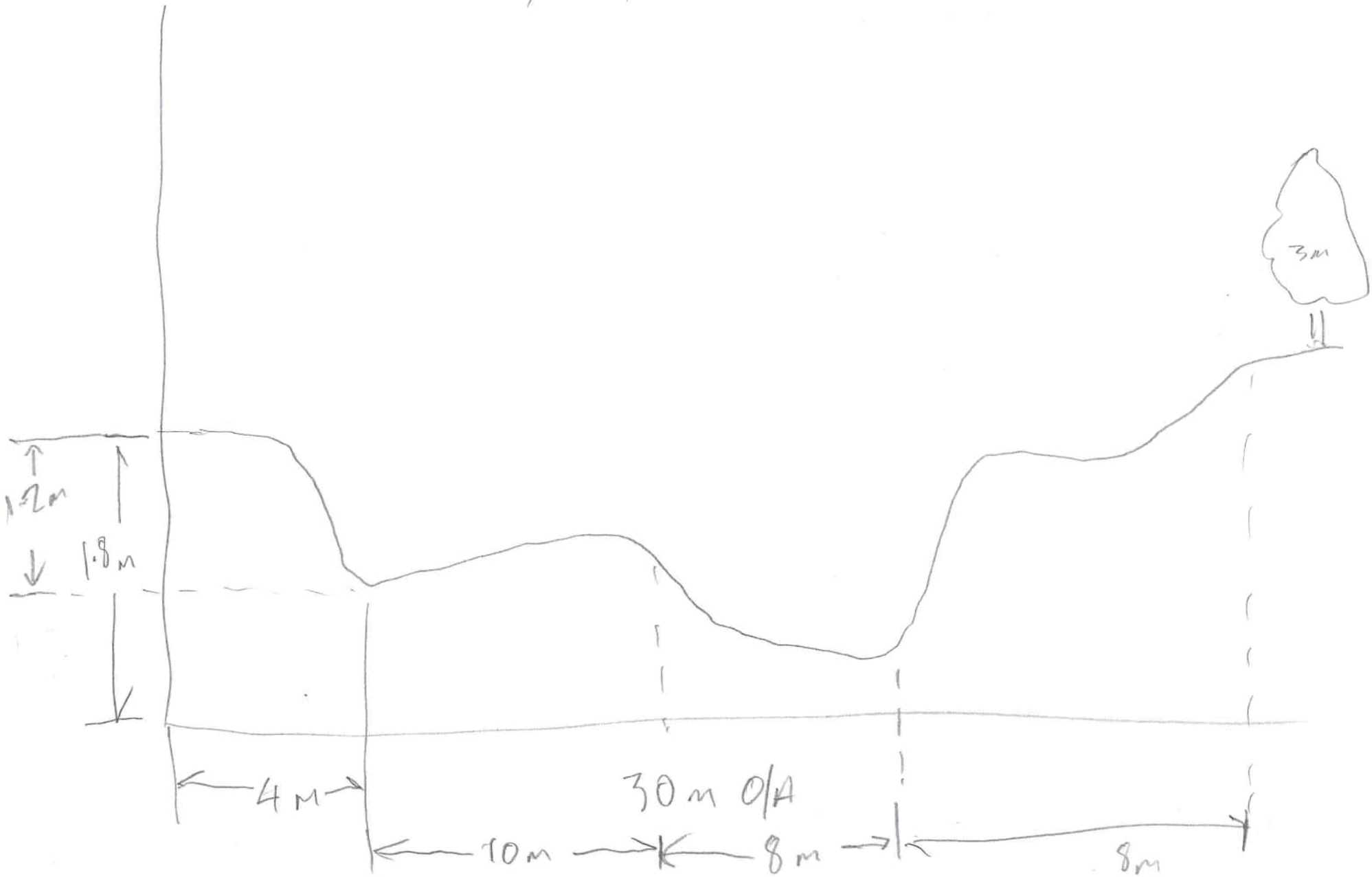
Site: 274

Photo 6181, 82, 83, 84.

Neville Dalrymple.

23/3/25

XING AT FENCELINE - CLEARED TO 15m Wide.



A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No 278 Recorder: _____ Day/Date: 23-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] [0][6][6][3][1][2][5] [7][3][3][4][2][8][2] D 278

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E	~~18~~	~~16 - 18~~	
T1	14	16 - 18	S
T2	10	8 - 10	M
T3		-	
S1		-	
S2		-	
G		0 - 0.4	S

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1		E. coolabah
T2		Callistemon viminalis
		Terminalia oblongata
		Acacia harpophylla
G		Cenchrus ciliaris
		Eimbristylis sp.
		Megathyrsus maximus

6193 S
6194 N
6195 E
6196 W
6197 C

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes:

Landzone:

RE code changes

Existing RE code: _____

Proposed RE code: _____

END

Fauna Habitat Characters

Site No. 278 Recorder: C Deitle D Thomas Day/Date: 23/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0663125 N 7334282 Datum:

Photo Numbers Waypoint:

Habitat Description Photos: 6193–6197.

RIPARIAN (40m – TOB.)

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	2	Decorticating bark	0
Hollows in trees & stags <10cm	2	Soil cracks	0
Fallen logs (>10cm diam.)	3	Termite mounds	0
Fallen logs (> 30cm)	2	Termitaries	2
Logs with Hollows (>10cm)	2	Mistletoe	0
Large trees >18m	2		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	2	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	2	Rocks Loose	0
Native Grass cover	0	Rock crevices	0
Exotic Grass cover	2	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	1

Notes

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No. 290 Recorder: _____ Day/Date: 23-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] 0 6 6 6 4 0 6 7 3 3 4 4 2 9 D 290

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E	13	12 - 14	V S
T1	6	5 - 7	M
T2		-	
T3		-	
S1	1.5	0.5 -	1 V S
S2		-	
G	1	0 - 1.1	S
Structural formation: (including height)			
Ecologically dominant layer:			

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
E		E. coolabah
T1		Ac hapgophylla
		Terminalia oblongata
S1		Ac hapgophylla
		Lysiphyllum carronii
G		Cenchrus ciliaris
		Leptochloa fusca
		Aristrachne uncinulata

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes:

Landzone:

231 S
232 P
236
234 W
235 C

RE code changes

Existing RE code: 11.3.1

Proposed RE code: _____

END

Gilgai Habitat Quality

Site No. 296 Recorder: _____ Day/Date: 23-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS coordinates: Zone 5 E 0675553 N 7315971 Datum: 296

Photo Numbers Waypoint: 2

Habitat Description

Brigalow 11.4'8' Eucalyptus to 10m
4m 7m presents

Connectivity Patch Characteristics

Buffel Diplachne fusca
Rhodes

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Average Gilgai length	50	Presence of fringing native vegetation	5
Average Gilgai width	20		
Average Gilgai depth	1m		
Fallen logs (>10cm diam.)	2		
Fallen logs (> 30cm)	1		
Presence of aquatic vegetation	1		
Soil cracks (ornamental snake)	2	Estimate of water permanence	

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Shrub layer	0
Fine litter (<2cm diameter)	1	Native Tree layer	5
Bare ground	3	Gilgai density	3
Native Grass cover	2		
Exotic Grass cover	3		
Stones (20-60cm)	0		

Notes

6245 6246
6247

Gilgai Habitat Quality

Site No. 299 Recorder: _____ Day/Date: 23-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS coordinates: Zone 5 E 0675914 N 7314820 Datum: _____

Photo Numbers Waypoint: 299

Habitat Description

Connectivity Patch Characteristics

Brigalow 6m road VS Dplachne fusca
Buffel scrobic Parkinsonia

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Average Gilgai length	15	Presence of fringing native vegetation	1
Average Gilgai width	5		
Average Gilgai depth	0.3m		
Fallen logs (>10cm diam.)	1		
Fallen logs (> 30cm)	0		
Presence of aquatic vegetation	0		
Soil cracks (ornamental snake)	1	Estimate of water permanence	

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Shrub layer	1
Fine litter (<2cm diameter)	1	Native Tree layer	2
Bare ground	2	Gilgai density	2
Native Grass cover	1		
Exotic Grass cover	4		
Stones (20-60cm)	0		

Notes

6248
6249
6250

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No . 300 Recorder: _____ Day/Date: 24-3-23

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] 0 6 7 9 6 3 7 7 3 2 8 6 7 8 D 300

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	3	2 - 4	VS
T2		-	
T3		-	
S1		-	
S2		-	
G	0-3	0 - 0·3	D

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1		Lysiphyllum carronii
		Citrus glauca
G		Cenchrus ciliaris

Geology, landform, soils

Geology map/scale/year: 6251

Geology code and rock types: 6252

Land system: 6253

Landform: 6254

Soils: 6255

Field observation and notes:

Landzone:

RE code changes

Existing RE code: _____

Proposed RE code: _____

END

Fauna Habitat Characters

Site No. 300 Recorder: Cleville D'Arcy Day/Date: 24/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0679634 N 7328878 Datum:

Photo Numbers Waypoint:

Habitat Description Photos: 6251 – 6255

Buffel

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	0	Termite mounds	0
Fallen logs (> 30cm)	0	Termitaries	0
Logs with Hollows (>10cm)	0	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	0	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	1	Rocks Loose	0
Native Grass cover	0	Rock crevices	0
Exotic Grass cover	4	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	1

Notes

Gilgai Habitat Quality

Site No. 302 Recorder: _____ Day/Date: 24-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS coordinates: Zone 5 E 0679190 N 7328474 Datum: _____

Photo Numbers Waypoint: 302

Habitat Description

Very shallow highly disturbed

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Average Gilgai length	7	Presence of fringing native vegetation	0
Average Gilgai width	5		
Average Gilgai depth	20cm		
Fallen logs (>10cm diam.)	0		
Fallen logs (> 30cm)	0		
Presence of aquatic vegetation	0		
Soil cracks (ornamental snake)	0	Estimate of water permanence	

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	0	Shrub layer	1
Fine litter (<2cm diameter)	1	Native Tree layer	1
Bare ground	0	Gilgai density	1
Native Grass cover	0		
Exotic Grass cover	5		
Stones (20-60cm)	0		

Notes

6257
6258

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No. 304 Recorder: _____ Day/Date: 24-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] [0][6][7][9][9][4][1] [7][3][2][8][1][1][0] D 304

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	5	3 - 15	S
T2		-	
T3		-	
S1	1	0.5 - 1	S
S2		-	
G	0.3	0 - 0.4	D

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1		Acacia polyphylla
		Terminalia oblongata
		Cassia brewsteri
S1		Grewia latifolia
		Carissa ovata
		Grewia retusa ?
		Antidesma diandrum ?
G		Cenchrus ciliaris

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types: Mistaka Calcaria formation

Land system:

Landform:

Soils:

Field observation and notes:

Landzone:

6261
6262
6263
6264
6265

RE code changes

Existing RE code: _____

Proposed RE code: _____

END

Fauna Habitat Characters

Site No. 304 Recorder: Neville Oliver Day/Date: 24/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0679941 N 7328110 Datum:

Photo Numbers Photos 6261 – 6265 Waypoint:

Habitat Description

Buffel Paddock w/ scattered Brigalow
No Gidgees

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	1	Termite mounds	0
Fallen logs (> 30cm)	1	Termitaries	0
Logs with Hollows (>10cm)	1	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	0	Rocks Embedded	0
Bare ground	2	Rocks Loose	0
Native Grass cover	1	Rock crevices	0
Exotic Grass cover	4	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	1

Notes

Fauna Habitat Characters

Site No. 307 **Recorder:** Michelle D'Souza **Day/Date:** 24/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0681132 N 7328284 **Datum:**

Photo Numbers Photos 6270 – 6274 **Waypoint:**

Habitat Description

Buffel Paddock

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	2	Decorticating bark	0
Hollows in trees & stags <10cm	2	Soil cracks	0
Fallen logs (>10cm diam.)	3	Termite mounds	0
Fallen logs (> 30cm)	3	Termitaries	0
Logs with Hollows (>10cm)	2	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	0	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	1	Rocks Loose	0
Native Grass cover	0	Rock crevices	0
Exotic Grass cover	5	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	0

Notes

Gilgai Habitat Quality

Site No. 309 Recorder: _____ Day/Date: 24-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS coordinates: Zone 5 E 0681002 N 7327749 Datum: _____

Photo Numbers Waypoint: 309

Habitat Description

Brigalow Lysp Allum VS/S To 6 m

Connectivity Patch Characteristics

Leptochloa digitata Present

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Average Gilgai length	40	Presence of fringing native vegetation	1
Average Gilgai width	10		
Average Gilgai depth	0.5 m		
Fallen logs (>10cm diam.)	0		
Fallen logs (> 30cm)	0		
Presence of aquatic vegetation	1		
Soil cracks (ornamental snake)	0	Estimate of water permanence	

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	0	Shrub layer	1
Fine litter (<2cm diameter)	2	Native Tree layer	1
Bare ground	2	Gilgai density	1
Native Grass cover	2		
Exotic Grass cover	3		
Stones (20-60cm)	0		

Notes

6276
6277

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No. 315 Recorder: _____ Day/Date: 24/3/25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS: [ ][ ] 6 6 7 8 9 7 4 7 3 2 6 6 4 4 D 315

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	8	5 - 9	S
T2		-	
T3		-	
S1	0.5	0.2 - 0.6	VS
S2		-	
G	0.25	0 - 0.3	M/D

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1		Acacia shirleyi
S		Eremophila tenuifolia
		Citrus glauca
		Carissa ovata
G		Cenchrus ciliaris
		Sporobolus caroli

6285
6286
6287
6288
6289

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Gatton 5 through Bolgalow regrowth

Field observation and notes: Gilgai Poroet

Landzone:

RE code changes

Existing RE code: 11.4.8 Advanced regrowth

Proposed RE code: _____

END

Fauna Habitat Characters

Site No. 315 **Recorder:** Neville D Thorp **Day/Date:** 24/3/25

Purpose

Locality: (inc. distance/direction to nearest town)

GPS coordinates: Zone 5 E 0678974 N 7326649 **Datum:**

Photo Numbers Photos 6285 – 6289 **Waypoint:**

Habitat Description

Buffel Paddock with Cirlyi & A. harp.
No Soil Cracks

Connectivity Patch Characteristics

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Hollows in trees & stags >10cm	0	Decorticating bark	0
Hollows in trees & stags <10cm	0	Soil cracks	0
Fallen logs (>10cm diam.)	2	Termite mounds	0
Fallen logs (> 30cm)	1	Termitaries	0
Logs with Hollows (>10cm)	1	Mistletoe	0
Large trees >18m	0		

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	1	Boulders (> 61cm)	0
Fine litter (<2cm diameter)	1	Rocks Embedded	0
Bare ground	2	Rocks Loose	0
Native Grass cover	1	Rock crevices	0
Exotic Grass cover	4	Exfoliating rock	0
Stones (20-60cm)	0	Shrub layer	1

Notes

Gilgai Habitat Quality

Site No. 318 Recorder: _____ Day/Date: 24-3-25

Purpose _____

Locality: (inc. distance/direction to nearest town) _____

GPS coordinates: Zone 55 E 0669400 N 7329218 Datum: _____

Photo Numbers _____ Waypoint: 318

Habitat Description

No canopy Popla Terminalia Brigalow

Connectivity Patch Characteristics

Parkland

Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6= >100. In a 1 ha area

Average Gilgai length	100	Presence of fringing native vegetation	0
Average Gilgai width	50		
Average Gilgai depth	10 cm		
Fallen logs (>10cm diam.)	0		
Fallen logs (> 30cm)	0		
Presence of aquatic vegetation	1		
Soil cracks (ornamental snake)	0	Estimate of water permanence	

Density scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100% abundance.

Course litter (>2cm diam.)	0	Shrub layer	1
Fine litter (<2cm diameter)	1	Native Tree layer	0
Bare ground	0	Gilgai density	2
Native Grass cover	1		
Exotic Grass cover	4		
Stones (20-60cm)	0		

Notes

6296 N

Appendix G

Significant Impact Assessments for MNES and MSES Threatened Fauna

Significant residual impact assessment for Squatter Pigeon (southern) *Geophaps scripta scripta* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – lead to a long-term decrease in the size of a local population. MNES – lead to a long-term decrease in the size of an Important population of a species	**Potential Significant Impact** Most of the survey area occurs on heavy clay soils dominated by a dense cover of exotic grasses, mainly buffel. The lack of tall, wooded areas within close proximity to the CDF, limits the quality of foraging habitat for this species. The CDF zone and surrounds does not hold good quality habitats for this species. There are no contemporary local records for this species on the old alluvial clay terraces (LZ 4) or quaternary alluvials (LZ 3) that dominate the CDF, and Squatter pigeons were not observed during summer or winter surveys. Disturbance to 1.8 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. It is unlikely that the proposed action will have any meaningful impact on Squatter Pigeon populations.
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of an important population	**No Significant Impact** There are no contemporary local records for this species on the old alluvial clay terraces (LZ 4) or quaternary alluvials (LZ 3) that dominate the CDF, and it was not observed during Summer or winter surveys. The CDF occurs on heavy clay soils dominated by a dense cover of exotic grasses, mainly buffel. The lack of tall, wooded areas within close proximity, limits the quality of foraging habitat for this species for large parts of the CDF. The CDF zone and surrounds does not hold good quality habitats for this species. Disturbance to 1.8 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. It is unlikely that the proposed action will reduce the area of occupancy for a population of this species.
MSES – fragmentation of an existing population	**No Significant Impact** The Squatter Pigeon is a highly mobile bird species that frequently crosses large expanses of open ground. The proposed action is narrow

Significant residual impact assessment for Squatter Pigeon (southern) *Geophaps scripta scripta* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MNES – fragment an existing population into two or more populations	in extent. It is unlikely that the action will fragment a population of this species.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No Significant Impact** The Squatter Pigeon is a highly mobile bird species that frequently crosses large expanses of open ground. The proposed action is narrow in extent. It is unlikely that the action will result in genetically distinct populations forming as a result of habitat isolation.
MNES – Adversely affect habitat critical to the survival of a species.	**No Significant Impact** The potential habitats for this species are limited to foraging habitat with no areas of sandy surfaces within 1 km of permanent water and close to tall timbered country suitable for breeding. To the extent that there is potential disturbance to low/medium value potential foraging habitat for this species the impact the habitat is not critical habitat. It is unlikely that the proposed action will adversely affect habitat critical to the survival of a species.
MNES – Disrupt the breeding cycle of an important population.	**No Significant Impact** The lack of tall, wooded areas within close proximity to the CDF limits the quality of foraging habitat for this species. The soils are invariably heavy clays throughout and some of the CDF is covered in very dense. Mainly exotic grasses, especially buffel. There are no contemporary local records for this species, and it was not observed during Summer or winter surveys. To the extent that there is disturbance to potential low/medium value foraging habitat for this species the impact will not disrupt the breeding cycle of a population.
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or	**Potential Significant Impact** The lack of tall, wooded areas within close proximity to the CDF limits the quality of foraging habitat for this species. The soils are invariably heavy clays throughout and some of the CDF is covered in very dense. Mainly exotic grasses, especially buffel. There are no contemporary local records for this species, and it was not observed during Summer or

Significant residual impact assessment for Squatter Pigeon (southern) *Geophaps scripta scripta* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
decrease the availability or quality of habitat to the extent that the species is likely to decline	winter surveys. To the extent that there is disturbance to potential low/medium value foraging habitat for this species the impact will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
MSES – Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat. MNES – Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	**No Significant Impact** Nearly all the CDF is covered in exotic grasses, mainly buffel. There was evidence of fox, cat and feral dogs across the landscape. With the implementation of feral animal control around the facilities, it is unlikely that the trenching of pipe and construction of well pads will result in the introduction of new invasive species or lead to an increase in existing invasive species that are harmful to this vulnerable species becoming established in the vulnerable species' habitat.
MSES – Introduce disease that may cause the population to decline. MNES – introduce disease that may cause the species to decline	**No Significant Impact** There are no known diseases that we are aware of that might be introduced by the proposed action.
MSES – Interfere with the recovery of the species. MNES – interfere substantially with the recovery of the species	**No Significant Impact** The lack of contemporary local records and lack of evidence from current survey suggests that it is unlikely that the species occurs within the locality. The clay soils, lack of neighbouring tall trees and very dense grass cover severally limits the quality of breeding habitat. The overwhelming dominance of dense exotic grass cover on clay plains with limited tall trees refuges severally limits the quality of foraging habitat for this species.

Significant residual impact assessment for Squatter Pigeon (southern) *Geophaps scripta scripta* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
	The proposed impacts to low/medium value potential foraging habitat for this species is very unlikely to interfere substantially with the recovery of the species

Significant residual impact assessment for Diamond Firetail *Stagonopleura guttata* (Vulnerable EPBC and NCA)	
Significant Impact Guideline Criteria.	**Response**
Lead to a long-term decrease in the size of an important population of a species	**No significant Impact** Towards the northerly extent of its known range (conservation advice Map 1). There are no contemporary local records for this species. This species is largely sedentary and unlikely to sporadically occur within the CDF. Preferred habitats of eucalypt, acacia or casuarina woodlands, open forests and other lightly timbered habitats do not occur within the CDF. The proposed impact will not meaningfully impact any population of this species.
Reduce the area of occupancy of an important population.	**No significant Impact** Towards the northerly extent of its known range (conservation advice Map 1). There are no contemporary local records for this species. There are no good quality habitats for this species within the CDF. It is unlikely to reduce the area of occupancy of a population.
Fragment an existing population into two or more populations	**No significant Impact** The diamond firetail is a highly mobile specie. Disturbance of marginal foraging habitat is unlikely to fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species.	**No significant Impact**

Significant residual impact assessment for Diamond Firetail *Stagonopleura guttata* (Vulnerable EPBC and NCA)	
Significant Impact Guideline Criteria.	**Response**
	It is unlikely that this species occurs within the locality and the disturbance of low-quality potential feeding habitat for this species is unlikely to adversely affect habitat critical to the survival of a species.
Disrupt the breeding cycle of a population.	**No significant Impact** This species is not known to occur within the CDF. Where it does occur, this species tends to nest under raptor stick nests or in prickly foliage of shrubs. The proposed disturbance is unlikely to disturb any potential nesting habitat for this species and the temporary disturbance of a small area of low-quality potential foraging habitat is unlikely to disrupt the breeding cycle of a population of this species.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No significant Impact** Towards the northerly extent of its known range (conservation advice Map 1). There are no contemporary local records for this species. This species is largely sedentary and unlikely to sporadically occur within the CDF. Preferred habitats of eucalypt, acacia or casuarina woodlands, open forests and other lightly timbered habitats do not occur within or immediately adjacent to the CD. The disturbance of some low quality potential foraging habitat will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**No significant Impact** With the implementation of a feral species management plan, it is unlikely that the construction of the facilities will introduce or encourage the proliferation of an invasive species that would be harmful to this vulnerable species.
Introduce disease that may cause the species to decline	**No significant Impact** It is unlikely that the construction of the facilities infrastructure will introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**No significant Impact** Towards the northerly extent of its known range (conservation advice Map 1). There are no contemporary local records for this species. This species is largely sedentary and unlikely to sporadically occur within the CDF. Its preferred habitats are rare and of low quality within the locality and there will be no impact to good quality habitat. It is unlikely that the

Significant residual impact assessment for Diamond Firetail *Stagonopleura guttata* (Vulnerable EPBC and NCA)	
Significant Impact Guideline Criteria.	**Response**
	construction of the facilities infrastructure will interfere substantially with the recovery of the species,

Conservation Advice effective date 31/03/2023

Significant residual impact assessment for Collared Delma *Delma torquata* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – lead to a long-term decrease in the size of a local population. MNES – lead to a long-term decrease in the size of an Important population of a species	**Potential Significant Impact** There are no contemporary local records for this species. Eucalypt dominated woodland and open forest with exposed rocky outcrops and a predominantly native grass ground layer do not occur within the CDF. This species is very unlikely to occur. The disturbance of very limited areas of very low quality habitat is unlikely to lead to a long-term decrease in the size of an important population of a species
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of an important population	**No Significant Impact** Habitat assessments have concluded that this species is very unlikely to occur within the CDF. The disturbance of very limited areas of very low quality habitat is unlikely to reduce the area of occupancy of an important population.
MSES – fragmentation of an existing population MNES – fragment an existing population into two or more populations	**Potential Significant Impact** This is a relatively small fossorial snake species that is unlikely to move across wide areas of open ground. The removal of low-quality habitat within open grazing paddocks will functionally isolate the remaining remnant habitats for this species.

Significant residual impact assessment for Collared Delma *Delma torquata* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – result in genetically distinct populations forming as a result of habitat isolation	**Potential Significant Impact** This is a relatively small fossorial snake species that is unlikely to move across wide areas of open ground. The removal of a relatively small area of open grazing paddock will functionally isolate the remaining remnant habitats for this species and may lead to the formation of genetically distinct populations.
MNES – Adversely affect habitat critical to the survival of a species.	**No Significant Impact** Habitat assessments have concluded that this species is very unlikely to occur within the CDF. The disturbance of very low quality habitat is unlikely to adversely affect habitat critical to the survival of this species.
MNES – Disrupt the breeding cycle of an important population.	**No Significant Impact** Habitat assessments have concluded that this species is very unlikely to occur within the CDF. The disturbance of very low quality habitat is unlikely to disrupt the breeding cycle of an important population.
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No Significant Impact** Habitat assessments have concluded that this species is very unlikely to occur within the CDF. The disturbance of very low quality habitat is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline
MSES – Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the	**No Significant Impact** It is unlikely that the proposed disturbance will result in invasive species that are harmful to this vulnerable species becoming established in the vulnerable species' habitat.

Significant residual impact assessment for Collared Delma *Delma torquata* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
endangered or vulnerable species' habitat. MNES – Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	
MSES – Introduce disease that may cause the population to decline. MNES – introduce disease that may cause the species to decline	**No Significant Impact** It is unlikely that the proposed disturbance will introduce disease that may cause the species to decline.
MSES – Interfere with the recovery of the species. MNES – interfere substantially with the recovery of the species	**No Significant Impact** Habitat assessments have concluded that this species is very unlikely to occur within the CDF. It is unlikely that the proposed disturbance is unlikely to interfere substantially with the recovery of the species
Lead to a long-term decrease in the size of an important population of a species	**Possible Significant Impact** Habitat assessments have concluded that this species is very unlikely to occur within the CDF. It is unlikely that the proposed disturbance is unlikely to lead to a long-term decrease in the size of an important population of this species

Significant residual impact assessment for Yakka Skink *Egernia rugosa* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – lead to a long-term decrease in the size of a local population. MNES – lead to a long-term decrease in the size of an Important population of a species	**Potential Significant Impact** There are a limited number of ALA records for this species within the wider area. This species occurs in open dry sclerophyll forest or woodland, and may persist where shelter sites such as tunnel erosion, rabbit warrens and log piles exist. This species is highly sedentary. The habitat values for this species are low and restricted to a few discrete patches within the north of the Survey area with no habitat values present within the CDF. Whilst disturbance to 0.8 ha of medium quality habitat for this species is proposed this habitat occurs on land subject to seasonal waterlogging and is unlikely to support this species; it is unlikely to lead to a long-term decrease in the size of an important population of a species
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of an important population	**No Significant Impact** Whilst disturbance to 0.8 ha of medium quality habitat for this species is proposed this habitat occurs on land subject to seasonal waterlogging and is unlikely to support this species; it is very unlikely to reduce the extent of occurrence of the species
MSES – fragmentation of an existing population MNES – fragment an existing population into two or more populations	**No Significant Impact** Whilst disturbance to 0.8 ha of medium quality habitat for this species is proposed this habitat occurs on land subject to seasonal waterlogging and is unlikely to support this species. The proposed disturbance will not fragment a population of this species.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No Significant Impact** Whilst disturbance to 0.8 ha of medium quality habitat for this species is proposed this habitat occurs on land subject to seasonal waterlogging and is unlikely to support this species. The proposed disturbance will not lead to genetically distinct populations forming.

Significant residual impact assessment for Yakka Skink *Egernia rugosa* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MNES – Adversely affect habitat critical to the survival of a species.	**No Significant Impact** Whilst disturbance to 0.8 ha of medium quality habitat for this species is proposed this habitat occurs on land subject to seasonal waterlogging and is unlikely to support this species. The proposed disturbance will not adversely affect habitat critical to the survival of this species.
MNES – Disrupt the breeding cycle of an important population.	**No Significant Impact** Whilst disturbance to 0.8 ha of medium quality habitat for this species is proposed this habitat occurs on land subject to seasonal waterlogging and is unlikely to support this species. The proposed disturbance will not result in the disruption to the breeding cycle of an important population of this species.
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Potential Significant Impact** Whilst disturbance to 0.8 ha of medium quality habitat for this species is proposed this habitat occurs on land subject to seasonal waterlogging and is unlikely to support this species. The proposed disturbance will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline.
MSES – Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat. MNES – Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	**No Significant Impact** It is unlikely that the construction of the facilities will result in invasive species that are harmful to this vulnerable species becoming established in the vulnerable species' habitat.

Significant residual impact assessment for Yakka Skink *Egernia rugosa* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – Introduce disease that may cause the population to decline. MNES – introduce disease that may cause the species to decline	**No Significant Impact** It is unlikely that the construction of the facilities will introduce disease that may cause the species to decline.
MSES – Interfere with the recovery of the species. MNES – interfere substantially with the recovery of the species	**Potential Significant Impact** Whilst disturbance to 0.8 ha of medium quality habitat for this species is proposed this habitat occurs on land subject to seasonal waterlogging and is unlikely to support this species. The proposed disturbance will not interfere substantially with the recovery of this species.
Lead to a long-term decrease in the size of an important population of a species	**Possible Significant Impact** Whilst disturbance to 0.8 ha of medium quality habitat for this species is proposed this habitat occurs on land subject to seasonal waterlogging and is unlikely to support this species. The proposed disturbance will not lead to a long-term decrease in the size of an important population of this species.

Conservation Advice effective date 29/04/2014

Significant residual impact assessment for Northern Greater Glider (*Petauroides minor*) (Vulnerable) and Central Greater Glider (*Petauroides armillatus*) (Endangered) (Endangered EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – lead to a long-term decrease in the size of a local population MNES – a long-term decrease in the size of a population.	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not lead to a long-term decrease in the size of a population of a species
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of the species	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not reduce the area of occupancy of an important population of this species.
MSES – fragmentation of an existing population MNES – fragment an existing population into two or more populations	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not fragment an existing population of this species.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not result in genetically distinct populations forming as a result of habitat isolation
MNES – Adversely affect habitat critical to the survival of a species.	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not adversely affect habitat critical to the survival of this species.

Significant residual impact assessment for Northern Greater Glider (*Petauroides minor*) (Vulnerable) and Central Greater Glider (*Petauroides armillatus*) (Endangered) (Endangered EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MNES – Disrupt the breeding cycle of an important population.	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not impact breeding habitat and will not disrupt the breeding cycle of a population of this species.
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
MSES – Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or Critically endangered species' habitat. MNES – result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat	**No Significant Impact** With the implementation of a feral species management plan, it is unlikely that the construction and operation of the facilities will result in invasive species that are harmful to this Endangered species becoming established in the vulnerable species' habitat.

Significant residual impact assessment for Northern Greater Glider (*Petauroides minor*) (Vulnerable) and Central Greater Glider (*Petauroides armillatus*) (Endangered) (Endangered EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – Introduce disease that may cause the population to decline. MNES – introduce disease that may cause the species to decline	**No Significant Impact** The construction and operation of the facilities is unlikely to introduce disease that may cause the species to decline.
MSES – Interfere with the recovery of the species. MNES – Interfere with the recovery of the species.	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not interfere substantially with the recovery of the species.
Lead to a long-term decrease in the size of an important population of a species	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not lead to a long-term decrease in the size of an important population of a species.

Significant residual impact assessment for Koala *Phascolarctos cinereus* (Endangered EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – lead to a long-term decrease in the size of a local population	**No Significant Impact** Disturbance to 0.2 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to

Significant residual impact assessment for Koala *Phascolarctos cinereus* (Endangered EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MNES – a long-term decrease in the size of a population.	connectivity will result. The proposed disturbance will not lead to a long-term decrease in the size of a local population
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of the species	**No Significant Impact** Disturbance to 0.2 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not reduce the extent of occurrence of the species
MSES – fragmentation of an existing population MNES – fragment an existing population into two or more populations	**No significant Impact** Disturbance to 0.2 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not fragmentation of an existing population
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No Significant Impact** Disturbance to 0.2 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not result in genetically distinct populations forming as a result of habitat isolation.
MNES – Adversely affect habitat critical to the survival of a species.	**No Significant Impact** Disturbance to 0.2 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not adversely affect habitat critical to the survival of a species.
MNES – Disrupt the breeding cycle of an important population.	**No Significant Impact** Disturbance to 0.2 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not disrupt the breeding cycle of an important population.

Significant residual impact assessment for Koala *Phascolarctos cinereus* (Endangered EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No Significant Impact** Disturbance to 0.2 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species
MSES – Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or Critically endangered species' habitat. MNES – result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat	**No Significant Impact** With the implementation of a feral species management plan, it is unlikely that the construction and operation of the facilities will result in invasive species that are harmful to this vulnerable species becoming established in the vulnerable species' habitat.
MSES – Introduce disease that may cause the population to decline. MNES – introduce disease that may cause the species to decline	**No Significant Impact** *Chlamydia pneumoniae* and *Chlamydia pecorum* are endemic in wild koala populations and will not be introduced through the proposed construction and operation of the facilities. There are no other known diseases that could be introduced by the construction and operation of the facilities.
MSES – Interfere with the recovery of the species.	**No Significant Impact** Disturbance to 0.2 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to

Significant residual impact assessment for Koala *Phascolarctos cinereus* (Endangered EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MNES – Interfere with the recovery of the species.	connectivity will result. The proposed disturbance will not interfere with the recovery of the species.

Significant residual impact assessment for Painted Honeyeater *Grantiella picta* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – lead to a long-term decrease in the size of a local population. MNES – lead to a long-term decrease in the size of an Important population of a species	**No Significant Impact** Disturbance to 1.8 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not meaningfully impact any population of this species.
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of an important population	**No Significant Impact** Disturbance to 1.8 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not reduce the area of occupancy of an important population of this species.
MSES – fragmentation of an existing population MNES – fragment an existing population into two or more populations	**No Significant Impact** The Painted Honeyeater is a highly mobile bird species that frequently crosses large expanses of open ground. It is unlikely that the action will fragment a population of this species.

Significant residual impact assessment for Painted Honeyeater *Grantiella picta* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No Significant Impact** The Painted honeyeater is migratory bird species. The proposed action is unlikely to lead to genetically distinct populations forming
MNES – Adversely affect habitat critical to the survival of a species.	**No Significant Impact** Disturbance to 1.8 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not adversely affect habitat critical to the survival of this species
MNES – Disrupt the breeding cycle of an important population.	**No Significant Impact** Disturbance to 1.8 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not disrupt the breeding cycle of a population of this species.
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No Significant Impact** The lack of large mature trees and mistletoe infestations limits the quality of feeding and breeding habitats for this species within and surrounding the CDF. This species is also known to be rare in upland environments, and it is unlikely to breed this far north. Disturbance to 1.8 ha of medium potential habitat for this species is proposed. The proposed disturbance will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
MSES – Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat.	**No Significant Impact** With the implementation of a feral species management plan, it is unlikely that the construction and operation of the facilities will result in invasive species that are harmful to this Vulnerable species becoming established in the vulnerable species' habitat.

Significant residual impact assessment for Painted Honeyeater *Grantiella picta* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MNES – Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	
MSES – Introduce disease that may cause the population to decline. MNES – introduce disease that may cause the species to decline	**No Significant Impact** It is unlikely that the action will introduce disease that may cause the species to decline.
MSES – Interfere with the recovery of the species. MNES – interfere substantially with the recovery of the species	**No Significant Impact** Disturbance to 1.8 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not interfere substantially with the recovery of the species

Conservation Advice effective date 08/07/2015.

Significant residual impact assessment for Golden-tailed gecko *Strophurus taenicauda* (Near Threatened NC Act)	
Significant Residual Impact Guideline Criteria.	**Response**
MSES – lead to a long-term decrease in the size of a local population.	**No Significant Impact** There are no contemporary records for this species within or close to the Survey area. There will be no disturbance to medium or high

Significant residual impact assessment for Golden-tailed gecko *Strophurus taenicauda* (Near Threatened NC Act)	
Significant Residual Impact Guideline Criteria.	**Response**
	quality habitat for this species. The proposed disturbance will not lead to a long-term decrease in the size of a local population.
MSES – a reduced extent of occurrence of the species	**No Significant Impact** There are no contemporary records for this species within or close to the Survey area. There will be no disturbance to medium or high quality habitat for this species. The proposed disturbance will not reduce the extent of occurrence of the species or area of occupancy of an important population.
MSES – fragmentation of an existing population	**No Significant Impact** There are no contemporary records for this species within or close to the Survey area. There will be no disturbance to medium or high quality habitat for this species. The proposed disturbance will not fragment and existing population.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No Significant Impact** There are no contemporary records for this species within or close to the Survey area. There will be no disturbance to medium or high quality habitat for this species. The proposed disturbance will not result in genetically distinct populations forming as a result of habitat isolation
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species	**No Significant Impact** There are no contemporary records for this species within or close to the Survey area. There will be no disturbance to medium or high quality habitat for this species. The proposed disturbance will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline or cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species.
MSES – Introduce disease that may cause the population to decline.	**No Significant Impact** The proposed installation of a pipeline and associated tracks is unlikely to introduce disease that may cause this species to decline.

Significant residual impact assessment for Golden-tailed gecko *Strophurus taenicauda* (Near Threatened NC Act)	
Significant Residual Impact Guideline Criteria.	**Response**
MSES – Interfere with the recovery of the species.	**No Significant Impact** There are no contemporary records for this species within or close to the Survey area. There will be no disturbance to medium or high quality habitat for this species. The proposed disturbance will not interfere with the recovery of the species.

Significant residual impact assessment for Ornamental snake *Denisonia maculata* (Vulnerable)	
MSES – lead to a long-term decrease in the size of a local population. MNES – lead to a long-term decrease in the size of an Important population of a species	**Potential Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity and it is unlikely to lead to a long-term decrease in the size of an important population of a species
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of an important population	**No Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary and therefore it is very unlikely to reduce the extent of occurrence of the species
MSES – fragmentation of an existing population MNES – fragment an existing population into two or more populations	**No Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary. The proposed disturbance will not fragment a population of this species.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary. The proposed

Significant residual impact assessment for Ornamental snake *Denisonia maculata* (Vulnerable)	
	disturbance will not lead to genetically distinct populations forming.
MNES – Adversely affect habitat critical to the survival of a species.	**No Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary. The proposed disturbance will not adversely affect habitat critical to the survival of this species.
MNES – Disrupt the breeding cycle of an important population.	**No Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary. The proposed disturbance will not disruption to the breeding cycle of an important population of this species does not occur.
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Potential Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary. The proposed disturbance will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline.
MSES – Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat. MNES – Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	**No Significant Impact** It is unlikely that the construction of the facilities will result in invasive species that are harmful to this vulnerable species becoming established in the vulnerable species' habitat.
MSES – Introduce disease that may cause the population to decline. MNES – introduce disease that may cause the species to decline	**No Significant Impact** It is unlikely that the construction of the facilities will introduce disease that may cause the species to decline.

Significant residual impact assessment for Ornamental snake *Denisonia maculata* (Vulnerable)	
MSES – Interfere with the recovery of the species. MNES – interfere substantially with the recovery of the species	**Potential Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary. The proposed disturbance will not interfere substantially with the recovery of this species.
Lead to a long-term decrease in the size of an important population of a species	**Possible Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary. The proposed disturbance will not lead to a long-term decrease in the size of an important population of this species.

Significant residual impact assessment for Dunmall's snake *Furina dunmalli* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – lead to a long-term decrease in the size of a local population. MNES – lead to a long-term decrease in the size of an Important population of a species	**Potential Significant Impact** Disturbance to 0.6 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result and it is unlikely to lead to a long-term decrease in the size of an important population of a species
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of an important population	**No Significant Impact** Disturbance to 0.6 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result and therefore it is very unlikely to reduce the extent of occurrence of the species

Significant residual impact assessment for Dunmall's snake *Furina dunmalli* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – fragmentation of an existing population MNES – fragment an existing population into two or more populations	**No Significant Impact** Disturbance to 0.6 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not fragment a population of this species.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No Significant Impact** Disturbance to 0.6 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not lead to genetically distinct populations forming.
MNES – Adversely affect habitat critical to the survival of a species.	**No Significant Impact** Disturbance to 0.6 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not adversely affect habitat critical to the survival of this species.
MNES – Disrupt the breeding cycle of an important population.	**No Significant Impact** Disturbance to 0.6 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not result in the disruption to the breeding cycle of an important population of this species
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Potential Significant Impact** Disturbance to 0.6 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline.

Significant residual impact assessment for Dunmall's snake *Furina dunmalli* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat. MNES – Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	**No Significant Impact** It is unlikely that the construction of the facilities will result in invasive species that are harmful to this vulnerable species becoming established in the vulnerable species' habitat.
MSES – Introduce disease that may cause the population to decline. MNES – introduce disease that may cause the species to decline	**No Significant Impact** It is unlikely that the construction of the facilities will introduce disease that may cause the species to decline.
MSES – Interfere with the recovery of the species. MNES – interfere substantially with the recovery of the species	**Potential Significant Impact** Disturbance to 0.6 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not interfere substantially with the recovery of this species.

Significant residual impact assessment for Grey snake *Hemiaspis damelii* (Endangered) (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – lead to a long-term decrease in the size of a local population. MNES – lead to a long-term decrease in the size of an Important population of a species	**Potential Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary and it is unlikely to lead to a long-term decrease in the size of an important population of a species
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of an important population	**No Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary and therefore it is very unlikely to reduce the extent of occurrence of the species
MSES – fragmentation of an existing population MNES – fragment an existing population into two or more populations	**No Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary. The proposed disturbance will not fragment a population of this species.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary. The proposed disturbance will not lead to genetically distinct populations forming.
MNES – Adversely affect habitat critical to the survival of a species.	**No Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary. The proposed disturbance will not adversely affect habitat critical to the survival of this species.

Significant residual impact assessment for Grey snake *Hemiaspis damelii* (Endangered) (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MNES – Disrupt the breeding cycle of an important population.	**No Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary. The proposed disturbance will not result in the disruption to the breeding cycle of an important population of this species.
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Potential Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary. The proposed disturbance will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline.
MSES – Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat. MNES – Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	**No Significant Impact** It is unlikely that the construction of the facilities will result in invasive species that are harmful to this vulnerable species becoming established in the vulnerable species' habitat.
MSES – Introduce disease that may cause the population to decline. MNES – introduce disease that may cause the species to decline	**No Significant Impact** It is unlikely that the construction of the facilities will introduce disease that may cause the species to decline.

Significant residual impact assessment for Grey snake *Hemiaspis damelii* (Endangered) (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – Interfere with the recovery of the species. MNES – interfere substantially with the recovery of the species	**Potential Significant Impact** Disturbance to 9.4 ha of low quality potential habitat for this species is proposed some of which is temporary. The proposed disturbance will not interfere substantially with the recovery of this species.

Significant residual impact assessment for South-eastern Long-eared Bat *Nyctophilus corbeni* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – lead to a long-term decrease in the size of a local population. MNES – lead to a long-term decrease in the size of an Important population of a species	**Potential Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result and it is unlikely to lead to a long-term decrease in the size of an important population of a species
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of an important population	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result and therefore it is very unlikely to reduce the extent of occurrence of the species

Significant residual impact assessment for South-eastern Long-eared Bat *Nyctophilus corbeni* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – fragmentation of an existing population MNES – fragment an existing important population into two or more populations	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not fragment a population of this species.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not lead to genetically distinct populations forming.
MNES – Adversely affect habitat critical to the survival of a species.	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not adversely affect habitat critical to the survival of this species.
MNES – Disrupt the breeding cycle of an important population.	**No Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not result in the disruption to the breeding cycle of an important population of this species.
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of	**Potential Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline.

Significant residual impact assessment for South-eastern Long-eared Bat *Nyctophilus corbeni* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
habitat to the extent that the species is likely to decline	
MSES – result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat MNES – Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	**No Significant Impact** It is unlikely that the construction of the facilities will result in invasive species that are harmful to this vulnerable species becoming established in the vulnerable species' habitat.
MSES – Introduce disease that may cause the population to decline. MNES – introduce disease that may cause the species to decline	**No Significant Impact** It is unlikely that the construction of the facilities will introduce disease that may cause the species to decline.
MSES – Interfere with the recovery of the species. MNES – interfere substantially with the recovery of the species	**Potential Significant Impact** Disturbance to 0.1 ha of medium potential habitat for this species is proposed some of which is temporary, and no impacts to connectivity will result. The proposed disturbance will not interfere substantially with the recovery of this species.

Significant residual impact assessment for Short-beaked echidna (Tachyglossus aculeatus) (SLC NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – a long-term decrease in the size of a local population	**No Significant Impact** The locality provides large expanses of habitat for this species. Echidnas are highly mobile and have large home ranges and are known to forage in highly disturbed habitats as long as their preferred prey of ants and termites are present. The habitat within the CDF is very low quality habitat for this species and the facilities do not represent a barrier to movement and will not cause fragmentation of habitats. It is unlikely that the proposed action will lead to a long-term decrease in the size of the local population.
MSES – a reduced extent of occurrence of the species	**No Significant Impact** Echidnas are known form almost all habitats across the entire Australian continent. It is one of the most wide-ranging Australian vertebrates. The proposed action is unlikely to reduce the extent of occurrence of this species.
MSES – fragmentation of an existing population	**No Significant Impact** Echidnas are highly mobile and have large home ranges and are known to forage in highly disturbed habitats as long as their preferred prey of ants and termites are present. The proposed removal of discrete patches of very low-quality habitat does not represent a barrier to movement and will not cause fragmentation of an existing population.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No Significant Impact** Echidnas are highly mobile and have large home ranges and are known to forage in highly disturbed habitats as long as their preferred prey of ants and termites are present. The proposed removal of discrete patches of very low-quality habitat will not result in genetically distinct populations forming as a result of habitat isolation
MSES – disruption to ecologically significant	**No Significant Impact**

Significant residual impact assessment for Short-beaked echidna (Tachyglossus aculeatus) (SLC NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
locations (breeding, feeding or nesting sites) of a species	The locality provides large expanses of habitat for this species. Echidnas are highly mobile and have large home ranges and are known to forage in highly disturbed habitats as long as their preferred prey of ants and termites are present. The proposed removal of discrete patches of very low-quality habitat will lead to a long-term decrease in the size of the local population.

Significant residual impact assessment for Red goshawk *Erythrotriorchis radiatus* (Vulnerable EPBC & Endangered NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – lead to a long-term decrease in the size of a local population MNES – a long-term decrease in the size of a population.	**No Significant Impact** This is an extremely rare species that is very unlikely to nest within the Survey area. The proposed removal of discrete patches of very low-quality habitat is unlikely to have any meaningful impact on this species and will not lead to a long-term decrease in the size of a local population.
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of the species	**No Significant Impact** This is an extremely rare species that is very unlikely to nest within the Survey area. The proposed removal of discrete patches of very low-quality habitat is unlikely to the extent of occurrence of the species or area of occupancy of an important population.
MSES – fragmentation of an existing population	**No Significant Impact**

Significant residual impact assessment for Red goshawk *Erythrotriorchis radiatus* (Vulnerable EPBC & Endangered NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MNES – fragment an existing population into two or more populations	This is an extremely rare species that is very unlikely to nest within the Survey area. The proposed removal of discrete patches of very low-quality habitat will not fragment and existing population.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No Significant Impact** This is a large raptor capable of travelling many kilometres a day at altitude whilst foraging. This is an extremely rare species that is very unlikely to nest within the Survey area. The proposed removal of discrete patches of very low-quality habitat will not result in genetically distinct populations forming as a result of habitat isolation
MNES – Adversely affect habitat critical to the survival of a species.	**No Significant Impact** This is a large raptor capable of travelling many kilometres a day at altitude whilst foraging. The Red Goshawk is unlikely to nest in or near the Survey area The proposed removal of discrete patches of very low-quality habitat is unlikely to adversely affect habitat critical to the survival of a species.
MNES – Disrupt the breeding cycle of an important population.	**No Significant Impact** The Red Goshawk is unlikely to nest in or near the Survey area. The proposed removal of discrete patches of very low-quality habitat is unlikely to disrupt the breeding cycle of an important population.
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No Significant Impact** The Red Goshawk is unlikely to nest in or near the Survey area. The proposed removal of discrete patches of very low-quality habitat is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline or cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species.
MSES – Result in invasive species that are harmful to an	**No Significant Impact**

Significant residual impact assessment for Red goshawk *Erythrotriorchis radiatus* (Vulnerable EPBC & Endangered NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
endangered or vulnerable species becoming established in the endangered or Critically endangered species' habitat. MNES – result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat	Feral predators are already present within the local landscape. The proposed removal of discrete patches of very low-quality habitat will not result in new invasive species that are harmful to this species becoming established in its habitat.
MSES – Introduce disease that may cause the population to decline. MNES – introduce disease that may cause the species to decline	**No Significant Impact** The proposed removal of discrete patches of very low-quality habitat is unlikely to introduce disease that may cause the species to decline.
MSES – Interfere with the recovery of the species. MNES – Interfere with the recovery of the species.	**No Significant Impact** This is a large raptor capable of travelling many kilometres a day at altitude whilst foraging. The Red Goshawk is unlikely to nest in or near the Survey area. The proposed removal of discrete patches of very low-quality habitat from within landscape that contains very large areas of foraging habitat is unlikely to interfere with the recovery of the species.

Significant residual impact assessment for White-throated Needletail *Hirundapus caudacutus* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – lead to a long-term decrease in the size of a local population. MNES – lead to a long-term decrease in the size of an Important population of a species	**No Significant Impact** This is a very highly mobile aerial species that is unlikely to directly utilise the habitats within the CDF. The proposed removal of discrete patches of very low-quality habitat from within landscape that contains very large areas of foraging habitat is unlikely to lead to a long-term decrease in the size of an important population of a species
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of an important population	**No Significant Impact** This is a very highly mobile aerial species that is unlikely to directly utilise the habitats within the CDF. It may forage in the skies overhead. The proposed removal of discrete patches of very low-quality habitat from within landscape that contains very large areas of foraging habitat is unlikely to reduce the area of occupancy of an important population.
MSES – fragmentation of an existing population MNES – fragment an existing population into two or more populations	**No Significant Impact** The White-throated Needletail is a highly mobile bird species that frequently crosses large expanses of open ground. The proposed removal of discrete patches of very low-quality habitat from within landscape that contains very large areas of foraging habitat is unlikely to fragment a population of this species.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No Significant Impact** The White-throated Needletail is migratory bird species. The proposed removal of discrete patches of very low-quality habitat from within landscape that contains very large areas of foraging habitat is unlikely to lead to genetically distinct populations forming
MNES – Adversely affect habitat critical to the survival of a species.	**No Significant Impact** This is a very highly mobile aerial species that is unlikely to directly utilise the habitats within the CDF. It may forage in the skies overhead. The proposed removal of discrete patches of very low-quality habitat from within landscape that contains very large areas of foraging habitat is unlikely to adversely affect habitat critical to the survival of a species

Significant residual impact assessment for White-throated Needletail *Hirundapus caudacutus* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MNES – Disrupt the breeding cycle of an important population.	**No Significant Impact** This is a very highly mobile aerial species that is unlikely to directly utilise the habitats within the CDF. It may forage in the skies overhead. The proposed removal of discrete patches of very low-quality habitat from within landscape that contains very large areas of foraging habitat is unlikely to disrupt the breeding cycle of an important population
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No Significant Impact** This is a very highly mobile aerial species that is unlikely to directly utilise the habitats within the CDF. It may forage in the skies overhead. The proposed removal of discrete patches of very low-quality habitat from within landscape that contains very large areas of foraging habitat is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
MSES – Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat. MNES – Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	**No Significant Impact** This is a very highly mobile aerial species that is unlikely to directly utilise the habitats within the CDF. If may forage in the skies overhead and is unlikely to land within the CDF. Disturbance to habitat over which this species may forage unlikely to result in an invasive species that are harmful to a vulnerable species becoming established.
MSES – Introduce disease that may cause the population to decline.	**No Significant Impact** This is a very highly mobile aerial species that is unlikely to directly utilise the habitats within the CDF. It may forage in the skies overhead

Significant residual impact assessment for White-throated Needletail *Hirundapus caudacutus* (Vulnerable EPBC & NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MNES – introduce disease that may cause the species to decline	but is unlikely to land. It is unlikely to introduce disease that may cause the species to decline
MSES – Interfere with the recovery of the species. MNES – interfere substantially with the recovery of the species	**No Significant Impact** This is a very highly mobile aerial species that is unlikely to directly utilise the habitats within the CDF. It may forage in the skies overhead but is unlikely to land. The proposed action is unlikely to interfere substantially with the recovery of the species

Significant residual impact assessment for Australian painted snipe *Rostratula australis* (Endangered EPBC & Vulnerable NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – lead to a long-term decrease in the size of a local population. MNES – Lead to a long-term decrease in the size of a population	**No significant Impact** This is a migratory/dispersive species that would only utilise the habitats within the Survey area as a temporary refuge and feeding area when moving to and from their breeding grounds. This species has not been recorded within 75 km (Roma) of the Survey area. The loss of 7.1 ha of medium quality potential habitat from a very large area of mapped gilgai will not have any meaningful impact on a population of this species. It is unlikely that the proposed action will have any meaningful impact on local population of this species.
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of the species	**No significant Impact** This is a migratory/dispersive species that ranges over approximately 1000 km of the eastern states of Australia. It is very unlikely that there are any "resident" individuals of this species within the Survey area and it is likely that they would only use the local habitats as a temporary refuge and feeding area when moving to better habitats. The loss of 7.1 ha of medium quality potential habitat from a very large area of mapped gilgai will not have any meaningful impact on this species. It is unlikely that the proposed action will reduce the area of occupancy for a population of this species.
MSES – fragmentation of an existing population MNES – fragment an existing population into two or more populations	**No significant Impact** This is a migratory/ disperse bird species capable of moving large distances between habitats. The proposed action is narrow in extent. It is unlikely that the action will fragment a population of this species.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No significant Impact** This is a migratory/ disperse bird species capable of moving large distances between habitats. The proposed action is narrow in extent. It is unlikely that the action will result in genetically distinct populations forming as a result of habitat isolation.

Significant residual impact assessment for Australian painted snipe *Rostratula australis* (Endangered EPBC & Vulnerable NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MNES – Adversely affect habitat critical to the survival of a species.	**No significant Impact** This is a migratory species that would only use the habitats within the Survey area as a temporary refuge and feeding area when moving to and from their breeding grounds. This species is very unlikely to breed within the locality and the loss of 7.1 ha of medium quality potential habitat from a very large area of mapped gilgai will not have any meaningful impact on this species. It is unlikely that the proposed action will significantly affect habitat critical to the survival of this species.
MNES – Disrupt the breeding cycle of an important population.	**No significant Impact** The habitats within the Survey area only provide temporary refuge and feeding habitats for this species. It is very unlikely to breed locally. It is unlikely that the proposed action will significantly disrupt the breeding cycle of an important population.
MSES – cause disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No significant Impact** This is a migratory/dispersive species that would only use the habitats within the Survey area as a temporary refuge and feeding area when moving to and from their breeding grounds. The loss of 7.1 ha of medium quality potential habitat from a very large area of mapped gilgai will not have any meaningful impact on this species. It is unlikely that the action will lead to a decline in a local population of this species.
MSES – Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat. MNES – result in invasive species that are harmful to a	**No significant Impact** Foxes and feral cats and dogs are known to occur within the local landscape and it unlikely that the proposed action will lead to an increase in cover or density of any invasive plant species that would materially impact the availability of feeding resources for this species. It is unlikely that the action will lead to any meaningful impact from invasive species on this endangered species.

Significant residual impact assessment for Australian painted snipe *Rostratula australis* (Endangered EPBC & Vulnerable NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat	
MSES – Introduce disease that may cause the population to decline. MNES – introduce disease that may cause the species to decline	**No significant Impact** There are no known diseases that we are aware of that might be introduced by the proposed action and that might cause a decline in a population of this species.
MSES – Interfere with the recovery of the species. MNES – Interfere with the recovery of the species.	**No significant Impact** This is a migratory species that would only use the habitats within the Survey area as a temporary refuge and feeding area when moving to and from their breeding grounds. Th closet record of this species is 75 km away (Roma) and it is unlikely that a resident population of this species occurs within the locality. The loss of 7.1 ha of medium quality potential habitat from a very large area of mapped gilgai will not have any meaningful impact on this species. There will be no impacts to connectivity, or breeding habitat and the action will not lead to the introduction of harmful invasive species or disease. It is unlikely that the proposed action will interfere substantially with the recovery of the species.

Significant residual impact assessment for Latham's Snipe *Gallinago hardwickii* (Vulnerable EPBC & SL NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – a long-term decrease in the size of a local population MNES – a long-term decrease in the size of a population.	**No significant Impact** This is a migratory species that would only utilise the habitats within the Survey area as a temporary refuge and feeding area when moving to and from their breeding grounds. The loss of 7.1 ha of medium quality potential habitat from a very large area of mapped gilgai will not have any meaningful impact on this species. It is unlikely that the proposed action will have any meaningful impact on a population of this species.
MSES – a reduced extent of occurrence of the species MNES – reduce the area of occupancy of an important population	**No significant Impact** This is a migratory species that flies 1,000 kms between breeding and wintering grounds and does not breed in Australia. This species would only use the habitats within the Survey area as a temporary refuge and feeding area when migrating. It appears unlikely that the loss of temporary refuge wetlands is the main threat to this species. The loss of 7.1 ha of medium quality potential habitat from a very large area of mapped gilgai will not have any meaningful impact on this species. It is unlikely that the proposed action will reduce the area of occupancy for a population of this species.
MSES – fragmentation of an existing population MNES – fragment an existing population into two or more populations	**No significant Impact** This is a migratory species that travels vast distances. The proposed action will not directly impact habitat important to this species. It is unlikely that the action will fragment a population of this species.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No significant Impact** This is a migratory species that travels vast distances and does not breed in Australia. The proposed action will not impact habitat important to this species. It is unlikely that the action will result in genetically distinct populations forming as a result of habitat isolation.
MNES – Adversely affect habitat critical to the survival of a species.	**No significant Impact** This is a migratory species that would only use the habitats within the Survey area as a temporary refuge and feeding area when moving to

Significant residual impact assessment for Latham's Snipe *Gallinago hardwickii* (Vulnerable EPBC & SL NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
	and from their breeding grounds. This species does not breed in Australia. The removal of 7.1 ha of medium quality feeding habitat is unlikely to significantly affect habitat critical to the survival of this species.
MNES – Disrupt the breeding cycle of an important population.	**No significant Impact** This species does not breed in Australia. It is unlikely that the proposed action will significantly disrupt the breeding cycle of an important population.
MSES – disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No significant Impact** This species does not breed in Australia. This species would only use the habitats within the Survey area as a temporary refuge and feeding area when moving to and from their breeding grounds. It appears unlikely that the loss of temporary refuge wetlands is the main threat to this species. The loss of 7.1 ha of medium quality potential habitat from a very large area of mapped gilgai will not have any meaningful impact on this species. It is unlikely that the action will lead to a decline in a local population of this species.
MSES – N/A. MNES – result in invasive species that are harmful to a critically endangered or endangered species becoming established in the vulnerable species' habitat	**No significant Impact** Foxes and feral cats and dogs are known to occur within the local landscape and it unlikely that the proposed action will lead to an increase in cover or density of any invasive plant species that would materially impact the availability of feeding resources for this species. It is unlikely that the action will lead to any meaningful impact from invasive species on this species.
MSES – N/A. MNES – introduce disease that may cause the species to decline	**No significant Impact** There are no known diseases that we are aware of that might be introduced by the proposed action and that might cause a decline in a population of this species.
MSES – N/A.	**No significant Impact**

Significant residual impact assessment for Latham's Snipe *Gallinago hardwickii* (Vulnerable EPBC & SL NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MNES – interfere substantially with the recovery of the species	This is a migratory species that would only use the habitats within the Survey area as a temporary refuge and feeding area when moving to and from their breeding grounds. It appears unlikely that the loss of temporary refuge wetlands is the main threat to this species. The loss of 7.1 ha of medium quality potential habitat from a very large area of mapped gilgai will not have any meaningful impact on this species. There will be no impacts to connectivity, or breeding habitat and the action will not lead to the introduction of harmful invasive species or disease. It is unlikely that the proposed action will interfere substantially with the recovery of the species.

Significant residual impact assessment for Sharp-tailed Sandpiper *Calidris acuminata* (Vulnerable EPBC & SL NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MSES – a long-term decrease in the size of a local population MNES – a long-term decrease in the size of a population.	**No significant Impact** This is a migratory species that would only utilise the habitats within the Survey area as a temporary refuge and feeding area when moving to and from their breeding grounds. The loss of 9.4 ha of low quality potential habitat from a very large area of mapped gilgai will not have any meaningful impact on this species. It is unlikely that the proposed action will have any meaningful impact on a population of this species.
MSES – a reduced extent of occurrence of the species	**No significant Impact** This is a migratory species that flies 1,000 kms between breeding and wintering grounds and does not breed in Australia. This species would

Significant residual impact assessment for Sharp-tailed Sandpiper *Calidris acuminata* (Vulnerable EPBC & SL NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
MNES – reduce the area of occupancy of an important population	only use the habitats within the Survey area as a temporary refuge and feeding area when migrating. It appears unlikely that the loss of temporary refuge wetlands is the main threat to this species. The loss of 9.4 ha of low quality potential habitat from a very large area of mapped gilgai will not have any meaningful impact on this species. It is unlikely that the proposed action will reduce the area of occupancy for a population of this species.
MSES – fragmentation of an existing population MNES – fragment an existing population into two or more populations	**No significant Impact** This is a migratory species that travels vast distances. The proposed action will not directly impact habitat important to this species. It is unlikely that the action will fragment a population of this species.
MSES – result in genetically distinct populations forming as a result of habitat isolation	**No significant Impact** This is a migratory species that travels vast distances and does not breed in Australia. The proposed action will not impact habitat important to this species. It is unlikely that the action will result in genetically distinct populations forming as a result of habitat isolation.
MNES – Adversely affect habitat critical to the survival of a species.	**No significant Impact** This is a migratory species that would only use the habitats within the Survey area as a temporary refuge and feeding area when moving to and from their breeding grounds. This species does not breed in Australia. The removal of 9.4 ha of low quality feeding habitat is unlikely to significantly affect habitat critical to the survival of this species.
MNES – Disrupt the breeding cycle of an important population.	**No significant Impact** This species does not breed in Australia. It is unlikely that the proposed action will significantly disrupt the breeding cycle of an important population.
MSES – disruption to ecologically significant	**No significant Impact** This species does not breed in Australia. This species would only use the habitats within the Survey area as a temporary refuge and feeding area

Significant residual impact assessment for Sharp-tailed Sandpiper *Calidris acuminata* (Vulnerable EPBC & SL NC Act)	
Significant Impact and Significant Residual Impact Guideline Criteria.	**Response**
locations (breeding, feeding or nesting sites) of a species MNES – Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	when moving to and from their breeding grounds. It appears unlikely that the loss of temporary refuge wetlands is the main threat to this species. The loss of 9.4 ha of low quality potential habitat from a very large area of mapped gilgai will not have any meaningful impact on this species. It is unlikely that the action will lead to a decline in a local population of this species.
MSES – N/A. MNES – result in invasive species that are harmful to a critically endangered or endangered species becoming established in the vulnerable species' habitat	**No significant Impact** Foxes and feral cats and dogs are known to occur within the local landscape and it unlikely that the proposed action will lead to an increase in cover or density of any invasive plant species that would materially impact the availability of feeding resources for this species. It is unlikely that the action will lead to any meaningful impact from invasive species on this species.
MSES – N/A. MNES – introduce disease that may cause the species to decline	**No significant Impact** There are no known diseases that we are aware of that might be introduced by the proposed action and that might cause a decline in a population of this species.
MSES – N/A. MNES – interfere substantially with the recovery of the species	**No significant Impact** This is a migratory species that would only use the habitats within the Survey area as a temporary refuge and feeding area when moving to and from their breeding grounds. It appears unlikely that the loss of temporary refuge wetlands is the main threat to this species. The loss of 9.4 ha of low quality potential habitat from a very large area of mapped gilgai will not have any meaningful impact on this species. There will be no impacts to connectivity, or breeding habitat and the action will not lead to the introduction of harmful invasive species or disease. It is unlikely that the proposed action will interfere substantially with the recovery of the species.

CDF = Construction disturbance footprint (17m in width buffer to linear infrastructure)

Appendix B: WildNet Species List

WildNet Records
Species List

For the selected area of interest 23453.62 PL: 1083
Current as at 24/03/2025 WildNetSpeciesList

Summary Information
The following table provides an overview of the area of interest: PL: 1083

Table 1. Area of interest details

Size (ha)	
23,453.62	
Local Government(s)	
Central Highlands Regional	
Catchment(s)	
Fitzroy	
Bioregion(s)	**Subregion(s)**
Brigalow Belt	Isaac - Comet Downs

Protected Area(s)
No estates or reserves are located within the area of interest.

World Heritage Area(s)
No World Heritage Areas are located within the area of interest.

Ramsar Area(s)
No Ramsar Areas are located within the area of interest.

Introduction
This WildNet report is derived from a spatial layer that is generated from the WildNet database, managed by the Department of the Environment, Tourism, Science and Innovation. The layer, which is generated weekly, contains a subset of WildNet wildlife records that are not classed as erroneous or duplicate, that have a location precision equal to or less than 10000 metres and do not have a count of zero. It does not include aspatial data such as some baseline species lists created for some protected areas.

The WildNet dataset is constantly being enhanced and the taxonomic and status information revised. If a species is not listed in this report, it does not mean it doesn't occur there and listed species may also no longer inhabit the area. It is recommended that you also access other internal and external data sources for species information in your area of interest.

The Species List Application may provide additional information on species occurence within your area of interest.

Species data

Contextual location information is presented in Map 1.

Table 2 lists the animals recorded within the area of interest and its one kilometre buffer.

Table 3 lists the plants recorded within the area of interest and its one kilometre buffer.

Table 4 lists the fungi recorded within the area of interest and its one kilometre buffer.

Table 5 lists the other species recorded within the area of interest and its one kilometre buffer.

Map 1. Locality Map

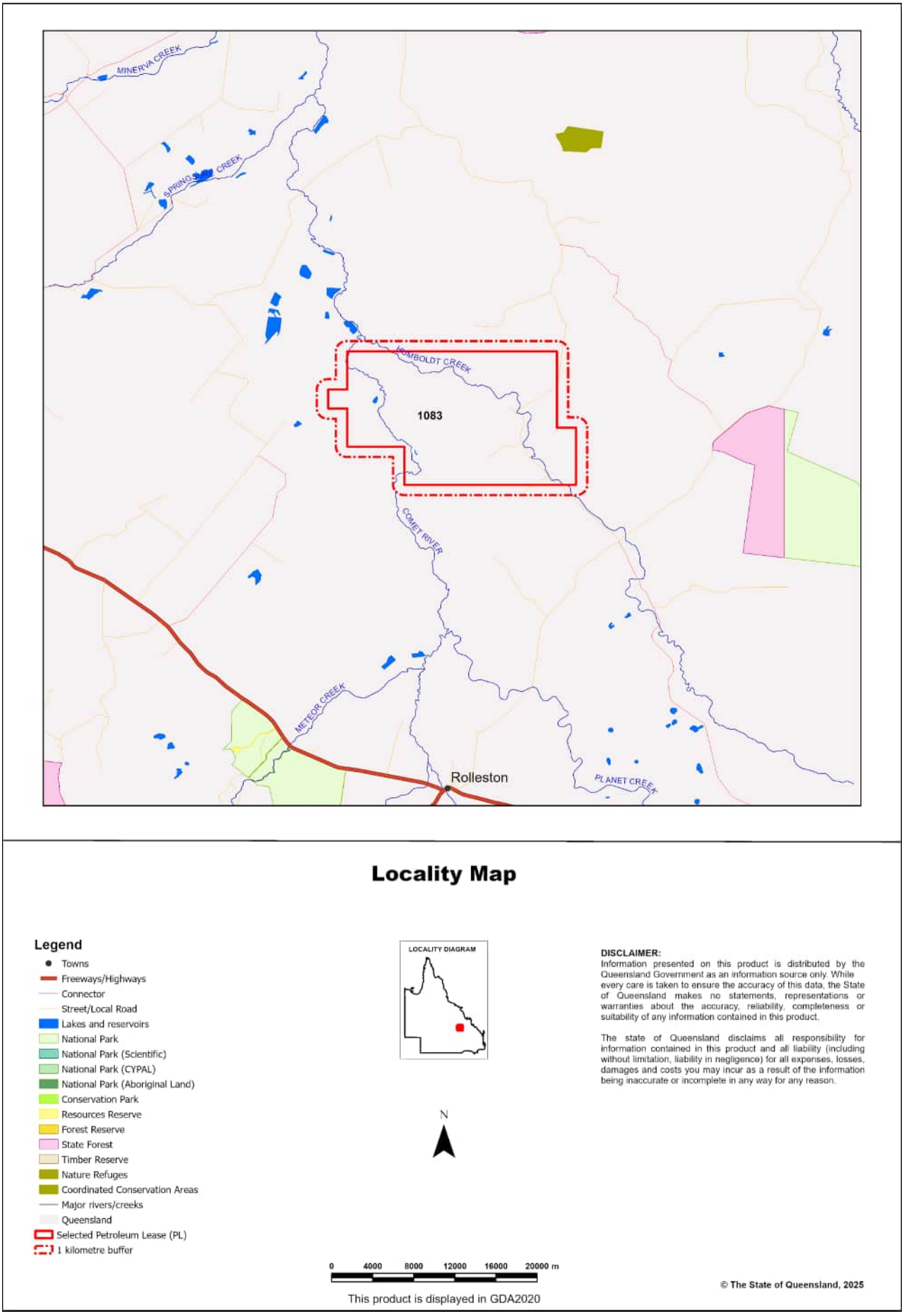


Table 2. Animals recorded within the area of interest and its one kilometre buffer

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
26896	Actinopterygii	Ambassidae	*Ambassis agassizii*	Agassiz's glassfish			0	1	5/28/2020
26941	Actinopterygii	Clupeidae	*Nematalosa erebi*	bony bream			0	1	5/28/2020
33897	Actinopterygii	Eleotridae	*Hypseleotris sp.*				0	1	5/28/2020
18168	Actinopterygii	Eleotridae	*Mogurnda adspersa*	southern purplespotted gudgeon			0	1	5/28/2020
26965	Actinopterygii	Eleotridae	*Oxyeleotris lineolata*	sleepy cod			0	1	5/28/2020
27029	Actinopterygii	Melanotaeniidae	*Melanotaenia splendida splendida*	eastern rainbowfish			0	1	5/28/2020
27048	Actinopterygii	Plotosidae	*Neosilurus hyrtlii*	Hyrtl's catfish			0	1	5/28/2020
27089	Actinopterygii	Terapontidae	*Leiopotherapon unicolor*	spangled perch			0	1	5/28/2020
624	Amphibia	Hylidae	*Cyclorana alboguttata*	greenstripe frog	C		0	1	5/23/2013
612	Amphibia	Hylidae	*Litoria inermis*	bumpy rocketfrog	C		0	1	5/23/2013
1707	Aves	Accipitridae	*Haliastur sphenurus*	whistling kite	C		0	1	5/23/2013
1714	Aves	Accipitridae	*Milvus migrans*	black kite	C		0	1	5/23/2013
1660	Aves	Artamidae	*Artamus leucorynchus*	white-breasted woodswallow	C		0	1	1/21/2012
1644	Aves	Artamidae	*Gymnorhina tibicen*	Australian magpie	C		0	2	5/23/2013
1645	Aves	Artamidae	*Strepera graculina*	pied currawong	C		0	1	1/21/2012
1191	Aves	Cacatuidae	*Cacatua galerita*	sulphur-crested cockatoo	C		0	1	5/23/2013
1193	Aves	Cacatuidae	*Eolophus roseicapilla*	galah	C		0	1	1/21/2012
1636	Aves	Campephagidae	*Coracina novaehollandiae*	black-faced cuckoo-shrike	C		0	2	5/23/2013
1089	Aves	Casuariidae	*Dromaius novaehollandiae*	emu	C		0	1	1/21/2012
1628	Aves	Climacteridae	*Climacteris picumnus*	brown treecreeper	C		0	1	5/23/2013
1605	Aves	Corcoracidae	*Struthidea cinerea*	apostlebird	C		0	2	5/23/2013
1609	Aves	Corvidae	*Corvus orru*	Torresian crow	C		0	1	5/23/2013
1365	Aves	Estrildidae	*Poephila cincta cincta*	black-throated finch (white-rumped subspecies)	E	E	0	1	12/31/1986

1342	Aves	Estrildidae	*Taeniopygia bichenovii*	double-barred finch	C		0	1	5/23/2013
1572	Aves	Hirundinidae	*Hirundo neoxena*	welcome swallow	C		0	1	1/21/2012
1570	Aves	Maluridae	*Malurus cyaneus*	superb fairy-wren	C		0	1	1/21/2012
1558	Aves	Maluridae	*Malurus melanocephalus*	red-backed fairy-wren	C		0	1	1/21/2012
1539	Aves	Meliphagidae	*Entomyzon cyanotis*	blue-faced honeyeater	C		0	1	5/23/2013
22457	Aves	Meliphagidae	*Melithreptus gularis gularis*	black-chinned honeyeater (eastern)	C		0	1	1/21/2012
1516	Aves	Meliphagidae	*Nesoptilotis leucotis*	white-eared honeyeater	C		0	1	5/23/2013
1589	Aves	Monarchidae	*Grallina cyanoleuca*	magpie-lark	C		0	1	5/23/2013
1600	Aves	Monarchidae	*Myiagra inquieta*	restless flycatcher	C		0	1	5/23/2013
1437	Aves	Pachycephalidae	*Pachycephala rufiventris*	rufous whistler	C		0	1	5/23/2013
1347	Aves	Petroicidae	*Eopsaltria australis*	eastern yellow robin	C		0	1	5/23/2013
1339	Aves	Petroicidae	*Microeca fascinans*	jacky winter	C		0	1	5/23/2013
1180	Aves	Psittaculidae	*Alisterus scapularis*	Australian king-parrot	C		0	1	1/21/2012
1136	Aves	Psittaculidae	*Platycercus adscitus*	pale-headed rosella	C		0	1	5/23/2013
1575	Aves	Rhipiduridae	*Rhipidura albiscapa*	grey fantail	C		0	1	5/23/2013
1576	Aves	Rhipiduridae	*Rhipidura leucophrys*	willie wagtail	C		0	1	5/23/2013
1084	Mammalia	Bovidae	*Bos taurus*	European cattle			0	1	5/23/2013
901	Mammalia	Macropodidae	*Macropus giganteus*	eastern grey kangaroo	C		0	2	5/23/2013
784	Mammalia	Peramelidae	*Isoodon macrourus*	northern brown bandicoot	C		0	1	5/23/2013
860	Mammalia	Phascolarctidae	*Phascolarctos cinereus*	koala	E	E	0	2	5/23/2013
34646	Reptilia	Scincidae	*Carlia pectoralis*	open-litter rainbow skink	C		0	1	5/23/2013
31898	Reptilia	Scincidae	*Cryptoblepharus pulcher pulcher*	elegant snake-eyed skink	C		0	1	5/23/2013
60	Reptilia	Varanidae	*Varanus tristis*	black-tailed monitor	C		0	1	10/2/1974

Table 3. Plants recorded within the area of interest and its one kilometre buffer

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
16262	Equisetopsida	Acanthaceae	*Rostellularia adscendens*		C		0	1	6/2/1995
18101	Equisetopsida	Amaranthaceae	*Achyranthes aspera*		C		0	1	6/2/1995
12416	Equisetopsida	Amaryllidaceae	*Crinum flaccidum*	Murray lily	SL		0	1	6/2/1995
9698	Equisetopsida	Apocynaceae	*Carissa ovata*	currantbush	C		0	1	6/2/1995
8398	Equisetopsida	Asteraceae	*Chrysocephalum apiculatum*	yellow buttons	C		0	1	6/2/1995
13842	Equisetopsida	Cactaceae	*Opuntia*				0	1	6/2/1995
10093	Equisetopsida	Chenopodiaceae	*Atriplex*				0	1	6/2/1995
21031	Equisetopsida	Chenopodiaceae	*Maireana*				0	1	6/2/1995
16395	Equisetopsida	Convolvulaceae	*Polymeria calycina*	pink bindweed	C		1	1	4/6/2013
9750	Equisetopsida	Cyperaceae	*Cyperus betchei subsp. betchei*		C		1	1	5/4/2005
17288	Equisetopsida	Erythroxylaceae	*Erythroxylum australe*	cocaine tree	C		0	1	6/2/1995
13040	Equisetopsida	Malvaceae	*Abelmoschus ficulneus*	native rosella	C		1	1	4/6/2013
16151	Equisetopsida	Malvaceae	*Sida*				0	1	6/2/1995
42283	Equisetopsida	Myrtaceae	*Blakella tessellaris*		C		0	1	6/2/1995
6534	Equisetopsida	Myrtaceae	*Corymbia clarksoniana*		C		0	1	6/2/1995
17247	Equisetopsida	Myrtaceae	*Eucalyptus camaldulensis*		C		0	1	6/2/1995
17221	Equisetopsida	Myrtaceae	*Eucalyptus melanophloia*		C		0	1	6/2/1995
17188	Equisetopsida	Myrtaceae	*Eucalyptus populnea*	poplar box	C		0	1	6/2/1995
11518	Equisetopsida	Poaceae	*Aristida latifolia*	feathertop wiregrass	C		0	1	6/2/1995
15540	Equisetopsida	Poaceae	*Cenchrus ciliaris*				0	1	6/2/1995
15403	Equisetopsida	Poaceae	*Enneapogon gracilis*	slender nineawn	C		0	1	6/2/1995
15320	Equisetopsida	Poaceae	*Heteropogon contortus*	black speargrass	C		0	1	6/2/1995
9154	Equisetopsida	Poaceae	*Melinis repens*	red natal grass			0	1	6/2/1995
21234	Equisetopsida	Poaceae	*Paspalum*				0	1	6/2/1995

15144	Equisetopsida	Poaceae	*Perotis rara*	comet grass	C		0	1	6/2/1995
11356	Equisetopsida	Poaceae	*Tragus australianus*	small burr grass	C		0	1	6/2/1995
17085	Equisetopsida	Rutaceae	*Geijera parviflora*	wilga	C		0	1	6/2/1995
17049	Equisetopsida	Sparrmanniaceae	*Grewia latifolia*	dysentery plant	C		0	1	6/2/1995

Table 4. Fungi recorded within the area of interest and its one kilometre buffer

No species found within the area of interest and its one kilometre buffer.

Table 5. Other species recorded within the area of interest and its one kilometre buffer

No species found within the area of interest and its one kilometre buffer.

Species table headings and codes
Taxon Id: Unique identifier of the taxon from the WildNet database.
NCA: Queensland conservation status of the taxon under the *Nature Conservation Act 1992* (Least Concern (C), Critically Endangered (CR), Endangered (E), Extinct (EX), Near Threatened (NT), Extinct in the Wild (PE), Special Least Concern (SL), and Vulnerable (V)).
EPBC: Australian conservation status of the taxon under the *Environment Protection and Biodiversity Conservation Act 1999* (Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Vulnerable (V), and Extinct in the Wild (XW)).
Specimens: The number of specimen-backed records of the taxon.
Records: The total number of records of the taxon.
Last record: Date of most recent record of the taxon.

Links and Support

Other sites that deliver species information from the WildNet database include:

- Species profile search - access species information approved for publication including species names, statuses, notes, images, distribution maps and records
- Species lists - generate species lists for Queensland protected areas, forestry areas, local governments and areas defined using coordinates
- Biomaps - view biodiversity information, including WildNet records approved for publication, and generate reports
- Queensland Globe - view spatial information, including WildNet records approved for publication
- Qld wildlife data API - access WildNet species information approved for publication such as notes, images and records etc.
- Wetland*Maps* - view species records, survey locations etc. approved for publication
- Wetland*Summary* - view wildlife statistics, species lists for a range of area types, and access WildNet species profiles
- WildNet wildlife records - published - Queensland - spatial layer of WildNet records approved for publication generated weekly
- Generalised distribution and densities of Queensland wildlife - Queensland species distributions and densities generalised to a 10 km grid resolution
- Conservation status of Queensland wildlife - access current lists of priority species for Queensland including nomenclature and status information
- Queensland Confidential Species - the list of species flagged as confidential in the WildNet database.

Please direct queries about this report to the WildNet Team WildNet@des.qld.gov.au.

Other useful sites for accessing Queensland biodiversity data include:

- Useful wildlife resources
- Queensland Government Data
- Atlas of Living Australia (ALA)
- Online Zoological Collections of Australian Museums (OZCAM)
- Australia's Virtual Herbarium (AVH)
- Protected Matters Search Tool

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government, to the maximum extent permitted by law, makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.

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WildNet Records
Species List

For the selected area of interest 23451.41 PL: 1082
Current as at 24/03/2025 WildNetSpeciesList

Summary Information
The following table provides an overview of the area of interest: PL: 1082

Table 1. Area of interest details

Size (ha)	
23,451.41	
Local Government(s)	
Central Highlands Regional	
Catchment(s)	
Fitzroy	
Bioregion(s)	**Subregion(s)**
Brigalow Belt	Isaac - Comet Downs

Protected Area(s)
No estates or reserves are located within the area of interest.

World Heritage Area(s)
No World Heritage Areas are located within the area of interest.

Ramsar Area(s)
No Ramsar Areas are located within the area of interest.

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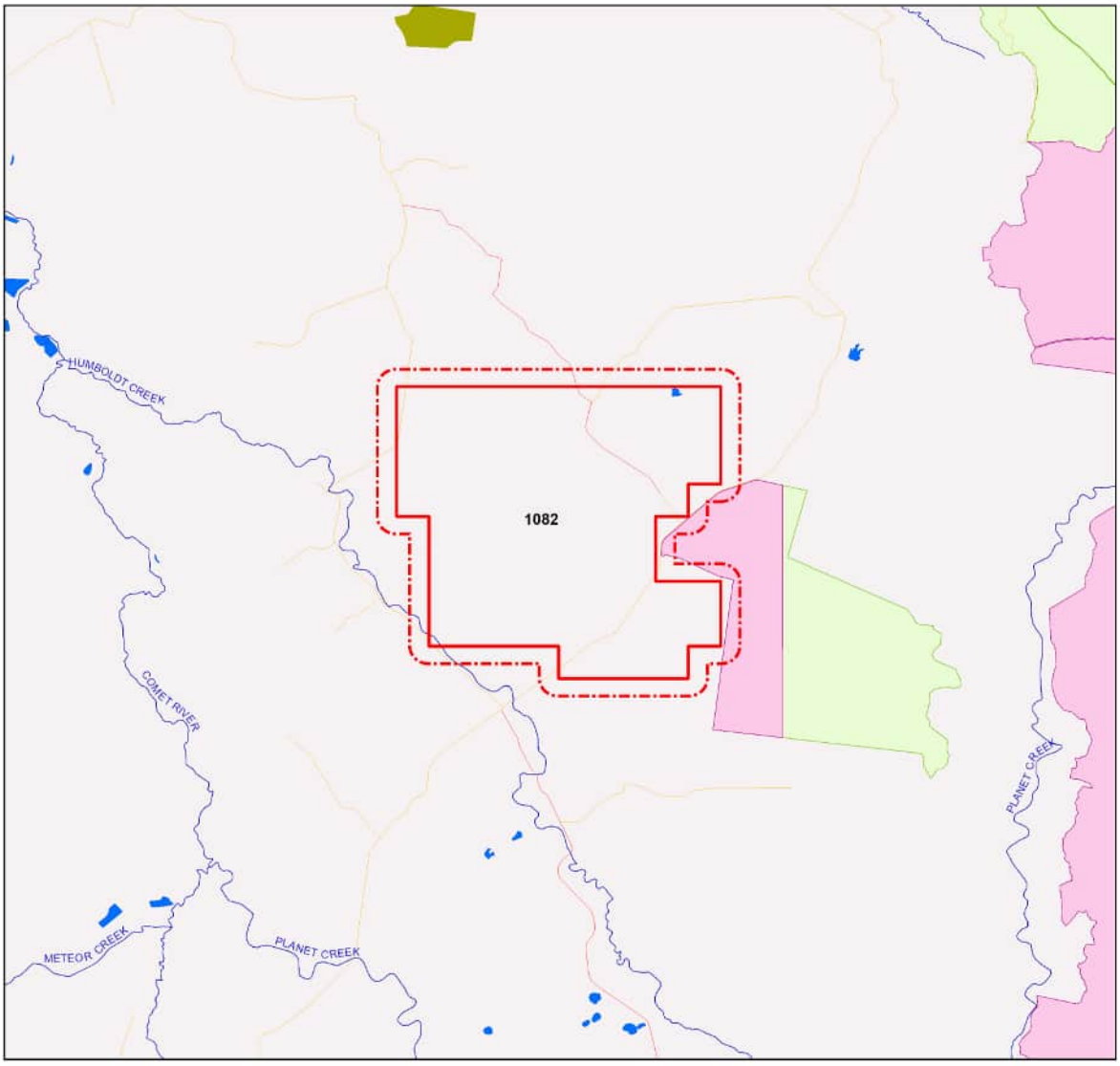
Table 2 lists the animals recorded within the area of interest and its one kilometre buffer.

Table 3 lists the plants recorded within the area of interest and its one kilometre buffer.

Table 4 lists the fungi recorded within the area of interest and its one kilometre buffer.

Table 5 lists the other species recorded within the area of interest and its one kilometre buffer.

Map 1. Locality Map

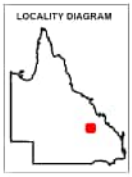


Locality Map

Legend

- Towns
- Freeways/Highways
- Connector
- Street/Local Road
- Lakes and reservoirs
- National Park
- National Park (Scientific)
- National Park (CYPAL)
- National Park (Aboriginal Land)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland
- Selected Petroleum Lease (PL)
- 1 kilometre buffer

LOCALITY DIAGRAM



N

0 3000 6000 9000 12000 15000 m

This product is displayed in GDA2020

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Table 2. Animals recorded within the area of interest and its one kilometre buffer

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
26896	Actinopterygii	Ambassidae	*Ambassis agassizii*	Agassiz's glassfish			0	6	5/28/2020
26920	Actinopterygii	Atherinidae	*Craterocephalus stercusmuscarum*	flyspecked hardyhead			0	1	5/26/2020
26941	Actinopterygii	Clupeidae	*Nematalosa erebi*	bony bream			0	3	5/28/2020
26956	Actinopterygii	Eleotridae	*Hypseleotris klunzingeri*	western carp gudgeon			0	2	12/15/2019
33897	Actinopterygii	Eleotridae	*Hypseleotris sp.*				0	6	5/28/2020
18168	Actinopterygii	Eleotridae	*Mogurnda adspersa*	southern purplespotted gudgeon			0	3	5/28/2020
26965	Actinopterygii	Eleotridae	*Oxyeleotris lineolata*	sleepy cod			0	1	5/28/2020
27029	Actinopterygii	Melanotaeniidae	*Melanotaenia splendida splendida*	eastern rainbowfish			0	5	5/28/2020
27048	Actinopterygii	Plotosidae	*Neosilurus hyrtlii*	Hyrtl's catfish			0	3	5/28/2020
27089	Actinopterygii	Terapontidae	*Leiopotherapon unicolor*	spangled perch			0	5	5/28/2020
621	Amphibia	Hylidae	*Cyclorana platycephala*	water holding frog	C		0	2	9/26/2012
1732	Aves	Accipitridae	*Aquila audax*	wedge-tailed eagle	C		0	1	5/25/2012
1767	Aves	Alcedinidae	*Dacelo novaeguineae*	laughing kookaburra	C		0	1	5/25/2012
1998	Aves	Anatidae	*Anas superciliosa*	Pacific black duck	C		0	1	5/25/2012
1279	Aves	Anhingidae	*Anhinga novaehollandiae*	Australasian darter	C		0	1	5/25/2012
1654	Aves	Artamidae	*Cracticus nigrogularis*	pied butcherbird	C		0	2	5/25/2012
1644	Aves	Artamidae	*Gymnorhina tibicen*	Australian magpie	C		0	1	5/25/2012
1810	Aves	Columbidae	*Geopelia humeralis*	bar-shouldered dove	C		0	2	5/25/2012
1603	Aves	Corcoracidae	*Corcorax melanorhamphos*	white-winged chough	C		0	1	5/25/2012
1605	Aves	Corcoracidae	*Struthidea cinerea*	apostlebird	C		0	2	5/25/2012
1342	Aves	Estrildidae	*Taeniopygia bichenovii*	double-barred finch	C		0	1	5/25/2012
1558	Aves	Maluridae	*Malurus melanocephalus*	red-backed fairy-wren	C		0	1	5/25/2012
1500	Aves	Meliphagidae	*Manorina melanocephala*	noisy miner	C		0	2	5/25/2012

1392	Aves	Pardalotidae	*Pardalotus striatus*	striated pardalote	C		0	1	5/25/2012
1318	Aves	Pomatostomidae	*Pomatostomus temporalis*	grey-crowned babbler	C		0	1	5/25/2012
1182	Aves	Psittaculidae	*Aprosmictus erythropterus*	red-winged parrot	C		0	1	5/25/2012
1136	Aves	Psittaculidae	*Platycercus adscitus*	pale-headed rosella	C		0	2	5/25/2012
1575	Aves	Rhipiduridae	*Rhipidura albiscapa*	grey fantail	C		0	1	5/25/2012
1108	Aves	Tytonidae	*Tyto javanica*	eastern barn owl	C		0	1	5/25/2012
1067	Mammalia	Canidae	*Canis familiaris*	dog			0	1	5/25/2012
1056	Mammalia	Felidae	*Felis catus*	cat			0	1	5/25/2012
747	Mammalia	Muridae	*Pseudomys mimulus*	eastern delicate mouse	C		0	1	11/3/2019
859	Mammalia	Phalangeridae	*Trichosurus vulpecula*	common brushtail possum	C		0	3	5/25/2012
860	Mammalia	Phascolarctidae	*Phascolarctos cinereus*	koala	E	E	0	2	5/25/2012
973	Mammalia	Vespertilionidae	*Chalinolobus morio*	chocolate wattled bat	C		0	1	11/3/2019
948	Mammalia	Vespertilionidae	*Chalinolobus picatus*	little pied bat	C		0	1	11/3/2019
35618	Reptilia	Diplodactylidae	*Diplodactylus platyurus*	eastern fat-tailed gecko	C		0	1	11/3/2019
429	Reptilia	Diplodactylidae	*Diplodactylus vittatus*	wood gecko	C		0	1	11/3/2019
460	Reptilia	Elapidae	*Brachyurophis australis*	coral snake	C		0	1	9/26/2012
479	Reptilia	Elapidae	*Hoplocephalus bitorquatus*	pale-headed snake	C		0	1	5/25/2012
420	Reptilia	Gekkonidae	*Gehyra dubia*	dubious dtella	C		0	1	11/3/2019
413	Reptilia	Gekkonidae	*Heteronotia binoei*	Bynoe's gecko	C		0	1	11/3/2019
34646	Reptilia	Scincidae	*Carlia pectoralis*	open-litter rainbow skink	C		0	1	11/3/2019
31898	Reptilia	Scincidae	*Cryptoblepharus pulcher pulcher*	elegant snake-eyed skink	C		0	1	11/3/2019
240	Reptilia	Scincidae	*Ctenotus spaldingi*	straight-browed ctenotus	C		0	1	11/3/2019
167	Reptilia	Scincidae	*Lerista fragilis*	eastern mulch slider	C		0	1	11/3/2019
157	Reptilia	Scincidae	*Lerista punctatovittata*	eastern robust slider	C		0	1	11/3/2019

134	Reptilia	Scincidae	*Morethia boulengeri*	south-eastern morethia skink	C		0	1	11/3/2019

Table 3. Plants recorded within the area of interest and its one kilometre buffer

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
14761	Equisetopsida	Alismataceae	*Caldesia oligococca*		SL		1	1	1/26/1996
32727	Equisetopsida	Amaranthaceae	*Alternanthera denticulata var. micrantha*		C		1	1	1/7/1997
11267	Equisetopsida	Aponogetonaceae	*Aponogeton queenslandicus*		SL		1	1	1/26/1996
14768	Equisetopsida	Asteraceae	*Calotis*				0	1	8/13/2009
15566	Equisetopsida	Asteraceae	*Calotis dentex*	white burr daisy	C		1	1	1/7/1997
8398	Equisetopsida	Asteraceae	*Chrysocephalum apiculatum*	yellow buttons	C		1	1	12/2/1998
34823	Equisetopsida	Asteraceae	*Eclipta platyglossa subsp. platyglossa*		C		1	1	1/26/1996
6542	Equisetopsida	Asteraceae	*Peripleura hispidula var. setosa*		C		1	1	1/30/1996
26359	Equisetopsida	Cactaceae	*Harrisia pomanensis*				0	1	8/13/2009
18013	Equisetopsida	Casuarinaceae	*Allocasuarina luehmannii*	bull oak	C		1	2	8/13/2009
11389	Equisetopsida	Chenopodiaceae	*Sclerolaena calcarata*	red burr	C		1	1	1/7/1997
8913	Equisetopsida	Combretaceae	*Terminalia oblongata*		C		0	1	8/13/2009
16395	Equisetopsida	Convolvulaceae	*Polymeria calycina*	pink bindweed	C		1	1	4/6/2013
21934	Equisetopsida	Crassulaceae	*Bryophyllum delagoense*				1	1	11/5/2004
11060	Equisetopsida	Cyperaceae	*Cyperus concinnus*		C		2	2	1/7/1997
17515	Equisetopsida	Cyperaceae	*Cyperus difformis*	rice sedge	C		1	1	1/26/1996
9953	Equisetopsida	Cyperaceae	*Cyperus isabellinus*		C		1	1	1/7/1997
17288	Equisetopsida	Erythroxylaceae	*Erythroxylum australe*	cocaine tree	C		1	1	11/23/2005
17166	Equisetopsida	Euphorbiaceae	*Euphorbia tannensis subsp. eremophila*		C		1	1	1/30/1996
3021	Equisetopsida	Hydrocharitaceae	*Ottelia ovalifolia subsp. ovalifolia*		SL		1	1	1/26/1996
15618	Equisetopsida	Lamiaceae	*Basilicum polystachyon*		C		1	1	1/26/1996
15664	Equisetopsida	Leguminosae	*Aeschynomene indica*	budda pea	C		1	1	1/26/1996

21988	Equisetopsida	Leguminosae	*Cassia brewsteri*		C		1	2	8/13/2009
12876	Equisetopsida	Leguminosae	*Stylosanthes scabra*				0	1	8/13/2009
36239	Equisetopsida	Linderniaceae	*Lindernia procumbens*		C		1	1	1/26/1996
11979	Equisetopsida	Lythraceae	*Ammannia multiflora*	jerry-jerry	C		2	2	1/7/1997
16264	Equisetopsida	Lythraceae	*Rotala mexicana*		C		1	1	1/26/1996
13040	Equisetopsida	Malvaceae	*Abelmoschus ficulneus*	native rosella	C		1	1	4/6/2013
16197	Equisetopsida	Malvaceae	*Sida fibulifera*		C		1	1	1/7/1997
16557	Equisetopsida	Meliaceae	*Owenia acidula*	emu apple	C		0	1	8/13/2009
42283	Equisetopsida	Myrtaceae	*Blakella tessellaris*		C		0	1	8/13/2009
17204	Equisetopsida	Myrtaceae	*Eucalyptus tereticornis*		C		0	1	8/13/2009
14521	Equisetopsida	Phrymaceae	*Glossostigma diandrum*		C		1	1	1/26/1996
8630	Equisetopsida	Phrymaceae	*Peplidium foecundum*		C		1	1	1/26/1996
9602	Equisetopsida	Phyllanthaceae	*Phyllanthus maderaspatensis*		C		1	1	1/7/1997
16505	Equisetopsida	Picrodendraceae	*Petalostigma pubescens*	quinine tree	C		0	1	8/13/2009
15652	Equisetopsida	Poaceae	*Aristida holathera var. holathera*		C		1	1	12/2/1998
15540	Equisetopsida	Poaceae	*Cenchrus ciliaris*				0	2	8/13/2009
34493	Equisetopsida	Poaceae	*Dinebra decipiens var. decipiens*		C		1	1	1/7/1997
34499	Equisetopsida	Poaceae	*Diplachne fusca var. fusca*		C		1	1	1/26/1996
15403	Equisetopsida	Poaceae	*Enneapogon gracilis*	slender nineawn	C		1	1	1/7/1997
15373	Equisetopsida	Poaceae	*Eragrostis sororia*		C		1	1	1/7/1997
27900	Equisetopsida	Poaceae	*Megathyrsus maximus var. pubiglumis*				1	1	1/7/1997
9154	Equisetopsida	Poaceae	*Melinis repens*	red natal grass			0	1	8/13/2009
13607	Equisetopsida	Poaceae	*Panicum effusum*		C		1	1	1/7/1997
15184	Equisetopsida	Poaceae	*Paspalidium caespitosum*	brigalow grass	C		1	1	1/7/1997

42262	Equisetopsida	Pontederiaceae	*Pontederia cyanea*		C		1	1	1/26/1996
22354	Equisetopsida	Proteaceae	*Hakea lorea subsp. lorea*		C		1	1	8/18/1998
17012	Equisetopsida	Proteaceae	*Hakea purpurea*		C		1	1	8/18/1998
11695	Equisetopsida	Pteridaceae	*Pellaea*				1	1	9/24/1990
17085	Equisetopsida	Rutaceae	*Geijera parviflora*	wilga	C		0	1	8/13/2009
17278	Equisetopsida	Scrophulariaceae	*Eremophila mitchellii*		C		0	1	8/13/2009
13541	Equisetopsida	Solanaceae	*Solanum elachophyllum*		E		1	1	4/10/2024
9179	Equisetopsida	Sterculiaceae	*Brachychiton x turgidulus*		SL		1	1	1/3/1996
28973	Equisetopsida	Zygophyllaceae	*Roepera apiculata*		C		1	1	1/7/1997

Table 4. Fungi recorded within the area of interest and its one kilometre buffer

No species found within the area of interest and its one kilometre buffer.

Table 5. Other species recorded within the area of interest and its one kilometre buffer

No species found within the area of interest and its one kilometre buffer.

Species table headings and codes
Taxon Id: Unique identifier of the taxon from the WildNet database.
NCA: Queensland conservation status of the taxon under the *Nature Conservation Act 1992* (Least Concern (C), Critically Endangered (CR), Endangered (E), Extinct (EX), Near Threatened (NT), Extinct in the Wild (PE), Special Least Concern (SL), and Vulnerable (V)).
EPBC: Australian conservation status of the taxon under the *Environment Protection and Biodiversity Conservation Act 1999* (Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Vulnerable (V), and Extinct in the Wild (XW)).
Specimens: The number of specimen-backed records of the taxon.
Records: The total number of records of the taxon.
Last record: Date of most recent record of the taxon.

Links and Support

Other sites that deliver species information from the WildNet database include:

- Species profile search - access species information approved for publication including species names, statuses, notes, images, distribution maps and records
- Species lists - generate species lists for Queensland protected areas, forestry areas, local governments and areas defined using coordinates
- Biomaps - view biodiversity information, including WildNet records approved for publication, and generate reports
- Queensland Globe - view spatial information, including WildNet records approved for publication
- Qld wildlife data API - access WildNet species information approved for publication such as notes, images and records etc.
- Wetland*Maps* - view species records, survey locations etc. approved for publication
- Wetland*Summary* - view wildlife statistics, species lists for a range of area types, and access WildNet species profiles
- WildNet wildlife records - published - Queensland - spatial layer of WildNet records approved for publication generated weekly
- Generalised distribution and densities of Queensland wildlife - Queensland species distributions and densities generalised to a 10 km grid resolution
- Conservation status of Queensland wildlife - access current lists of priority species for Queensland including nomenclature and status information
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Please direct queries about this report to the WildNet Team WildNet@des.qld.gov.au.

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- Online Zoological Collections of Australian Museums (OZCAM)
- Australia's Virtual Herbarium (AVH)
- Protected Matters Search Tool

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Appendix C: Pest List Report

WildNet Records
Pest List

For the selected area of interest 23453.62 PL: 1083
Current as at 23/04/2025 WildNetPestList

Summary Information

The following table provides an overview of the area of interest: PL: 1083

Table 1. Area of interest details

Size (ha)	
23,453.62	
Local Government(s)	
Central Highlands Regional	
Catchment(s)	
Fitzroy	
Bioregion(s)	**Subregion(s)**
Brigalow Belt	Isaac - Comet Downs

Protected Area(s)

No estates or reserves are located within the area of interest.

World Heritage Area(s)

No World Heritage Areas are located within the area of interest.

Ramsar Area(s)

No Ramsar Areas are located within the area of interest.

Introduction

This WildNet report is derived from a spatial layer that is generated from the WildNet database, managed by the Department of the Environment, Tourism, Science and Innovation. The layer, which is generated weekly, contains a subset of WildNet wildlife records that are not classed as erroneous or duplicate, that have a location precision equal to or less than 10000 metres and do not have a count of zero. It does not include aspatial data such as some baseline species lists created for some protected areas.

The WildNet dataset is constantly being enhanced and the taxonomic and status information revised. If a species is not listed in this report, it does not mean it doesn't occur there and listed species may also no longer inhabit the area. It is recommended that you also access other internal and external data sources for species information in your area of interest.

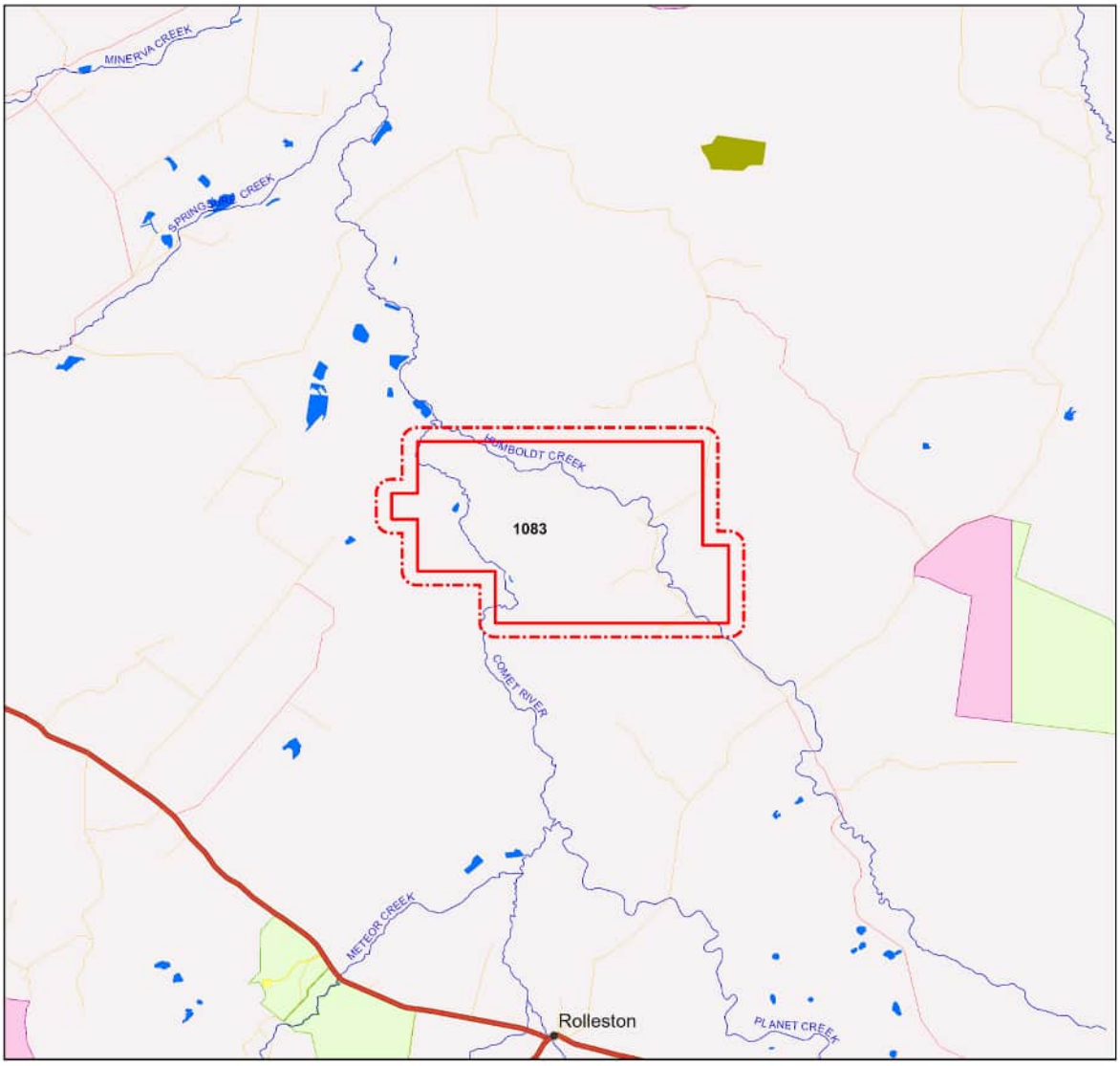
The Species List Application may provide additional information on species occurence within your area of interest.

Species data

Contextual location information is presented in Map 1.

A summary of the pests recordede within the area of interest and its one kilometre buffer is presented in Table 2.

Map 1. Locality Map



Locality Map

Legend

- Towns
- Freeways/Highways
- Connector
- Street/Local Road
- Lakes and reservoirs
- National Park
- National Park (Scientific)
- National Park (CYPAL)
- National Park (Aboriginal Land)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland
- Selected Petroleum Lease (PL)
- 1 kilometre buffer

LOCALITY DIAGRAM

N

0 4000 8000 12000 16000 20000 m

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Table 2. Pests recorded within the area of interest and its one kilometre buffer

Taxon Id	Kingdom	Class	Family	Scientific Name	Common Name	Specimens	Records	Last record	Endemicity
1084	Animalia	Mammalia	Bovidae	*Bos taurus*	European cattle	0	1	5/23/2013	II
15540	Plantae	Equisetopsida	Poaceae	*Cenchrus ciliaris*		0	1	6/2/1995	IU
9154	Plantae	Equisetopsida	Poaceae	*Melinis repens*	red natal grass	0	1	6/2/1995	IU

Taxon Id: Unique identifier of the taxon from the WildNet database.
Specimens: The number of specimen-backed records of the taxon.
Records: The total number of records of the taxon.
Last record: Date of most recent record of the taxon.
Endemicity: The endemicity code for the taxon (Introduced (Intranational) (IA), Introduced (International) (II), Introduced (Unknown), Exotic (Intranational) (XA), Exotic (International) (XI), Exotic (Unknown) (XU)).

Links and Support

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WildNet Records
Pest List

For the selected area of interest 23451.41 PL: 1082
Current as at 23/04/2025 WildNetPestList

Summary Information

The following table provides an overview of the area of interest: PL: 1082

Table 1. Area of interest details

Size (ha)	
23,451.41	
Local Government(s)	
Central Highlands Regional	
Catchment(s)	
Fitzroy	
Bioregion(s)	**Subregion(s)**
Brigalow Belt	Isaac - Comet Downs

Protected Area(s)

No estates or reserves are located within the area of interest.

World Heritage Area(s)

No World Heritage Areas are located within the area of interest.

Ramsar Area(s)

No Ramsar Areas are located within the area of interest.

Introduction

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The WildNet dataset is constantly being enhanced and the taxonomic and status information revised. If a species is not listed in this report, it does not mean it doesn't occur there and listed species may also no longer inhabit the area. It is recommended that you also access other internal and external data sources for species information in your area of interest.

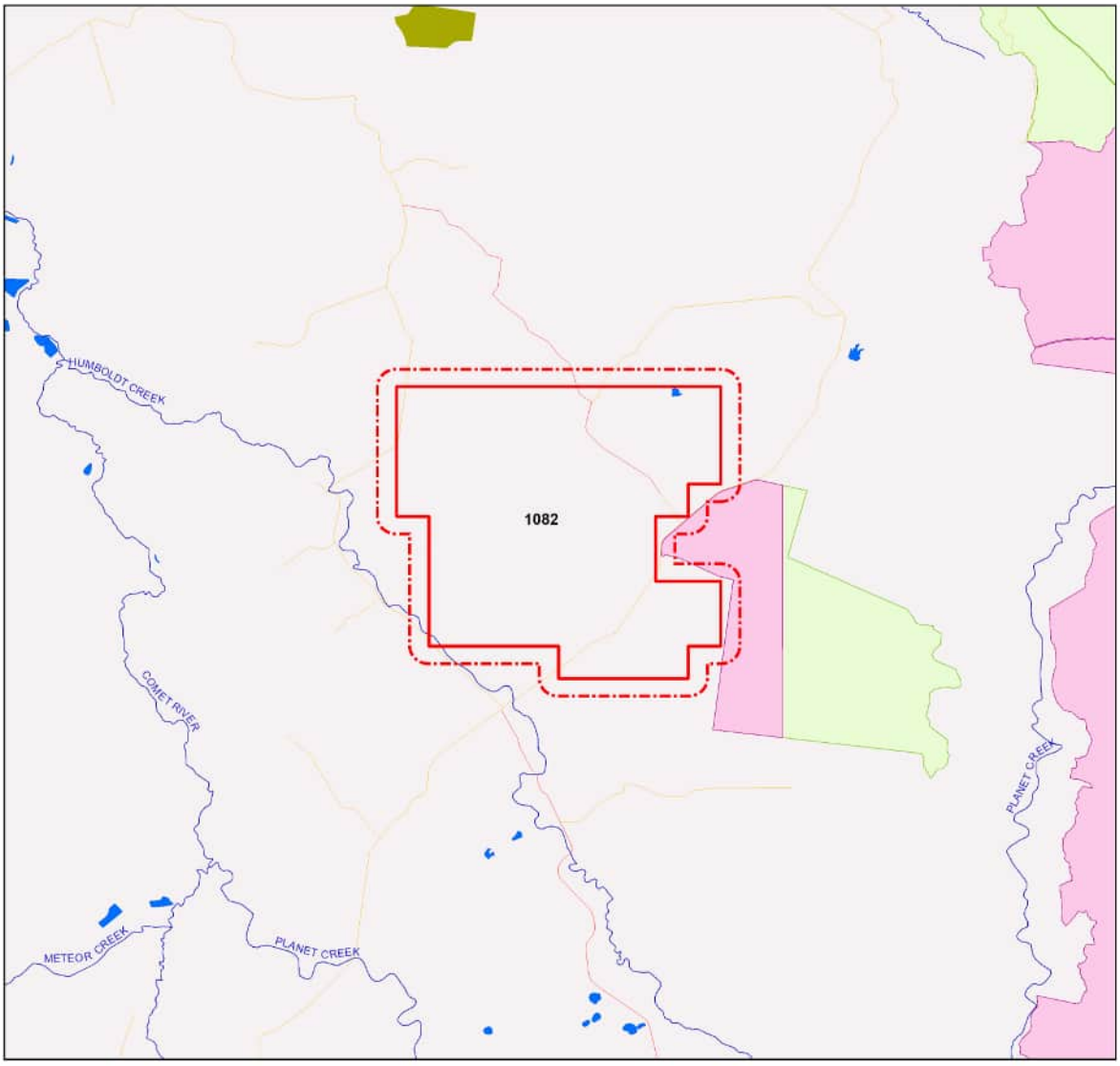
The Species List Application may provide additional information on species occurence within your area of interest.

Species data

Contextual location information is presented in Map 1.

A summary of the pests recordede within the area of interest and its one kilometre buffer is presented in Table 2.

Map 1. Locality Map

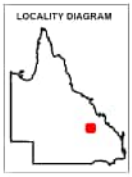


Locality Map

Legend

- Towns
- Freeways/Highways
- Connector
- Street/Local Road
- Lakes and reservoirs
- National Park
- National Park (Scientific)
- National Park (CYPAL)
- National Park (Aboriginal Land)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland
- Selected Petroleum Lease (PL)
- 1 kilometre buffer

LOCALITY DIAGRAM



N

0 3000 6000 9000 12000 15000 m

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Table 2. Pests recorded within the area of interest and its one kilometre buffer

Taxon Id	Kingdom	Class	Family	Scientific Name	Common Name	Specimens	Records	Last record	Endemicity
1067	Animalia	Mammalia	Canidae	*Canis familiaris*	dog	0	1	5/25/2012	II
1056	Animalia	Mammalia	Felidae	*Felis catus*	cat	0	1	5/25/2012	II
26359	Plantae	Equisetopsida	Cactaceae	*Harrisia pomanensis*		0	1	8/13/2009	IU
21934	Plantae	Equisetopsida	Crassulaceae	*Bryophyllum delagoense*		1	1	11/5/2004	IU
12876	Plantae	Equisetopsida	Leguminosae	*Stylosanthes scabra*		0	1	8/13/2009	IU
15540	Plantae	Equisetopsida	Poaceae	*Cenchrus ciliaris*		0	2	8/13/2009	IU
27900	Plantae	Equisetopsida	Poaceae	*Megathyrsus maximus var. pubiglumis*		1	1	1/7/1997	IU
9154	Plantae	Equisetopsida	Poaceae	*Melinis repens*	red natal grass	0	1	8/13/2009	IU

Taxon Id: Unique identifier of the taxon from the WildNet database.
Specimens: The number of specimen-backed records of the taxon.
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Appendix D: Air Report

Mahalo Gas Project: Air Quality Assessment

Prepared for:

Santos

June 2025

Final

Prepared by:

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Reviewed by:	Natalie Shaw
Approved by:	
	Natalie Shaw
	4 June 2025

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Glossary

Term	Definition
µg/m^3	micrograms per cubic metre
%	percent
°	degrees
°C	degrees Celsius
g/s	grams per second
ha	hectares
km	kilometres
kPa	kilopascals
m	metres
MMscfd	million standard cubic feet per day
m/s	metres per second
m^2	square metres
m^3	cubic metres
m^3/s	cubic metres per second
Nm^3/s	normalised cubic metres per second
Nomenclature	**Definition**
CO	carbon monoxide
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
O_2	oxygen
Abbreviation	**Definition**
Air EPP	*Environmental Protection (Air) Policy 2019 and Environmental Protection (Air) Amendment Policy 2024*
Air NEPM	*National Environmental Protection (Ambient Air Quality) Measure 2021*
AWS	Automatic Weather Station
BoM	Bureau of Meteorology
CSG	Coal Seam Gas
CSIRO	The Commonwealth Scientific and Industrial Research Organisation
DEM	Digital Elevation Model
DETSI	Department of Environment, Tourism, Science and Innovation
EA	Environmental Authority
EP Act	*Environmental Protection Act 1994*
ERA	Environmentally Relevant Activity
EU	European Union
GCF	Gas Compression Facility
NPI	National Pollutant Inventory database
NSW	New South Wales
PL	Petroleum Lease
QLD	Queensland
TAPM	The Air Pollution Model
TEG	Triethylene glycol
UTM	Universal Transverse Mercator

EXECUTIVE SUMMARY

Katestone Environmental Australia Pty Ltd (Katestone) was commissioned by Santos to complete an Air Quality Assessment of the Mahalo Gas Project (the Project), a proposed gas compression facility (GCF) and coal seam gas (CSG) field in the Mahalo Gas Hub in Queensland.

The Mahalo Gas Project is located within the Central Highlands Regional Council, approximately 40 km north of Rolleston in Central Queensland. The Project is a joint venture between Santos QNT Pty Ltd and Comet Ridge Mahalo Pty Ltd, comprises two petroleum leases (PL1082 and PL1083) over a combined area of approximately 470 km^2 and will be constructed in two phases. The Project has Environmental Authority (EA) P-EA-100178150 from Department of Environment, Tourism, Science and Innovation (DETSI). The EA provides for the construction of up to 190 coal seam gas development wells. The current EA does not permit fuel burning or a combustion facility.

The proposed development will include:

- The construction of up to 68 wells (to be electrified)
- A compressor station package
- Triethylene glycol (TEG) regeneration boilers
- Gas engine generators
- Backup diesel generator
- Enclosed ground flare

An air quality assessment is required to support an application for an Environmentally Relevant Activity (ERA) 15 – fuel burning. A dispersion modelling assessment has been conducted using the CALPUFF model to predict ground-level concentrations of nitrogen dioxide (NO_2) and carbon monoxide (CO) from the Project during routine and non-routine (upset) operations. Key sources of air pollutant emissions to air that have been assessed include the following sources at the compressor station:

- 3 x G3612 gas compressor engines
- 3 x G3512 gas engines for power generation
- 1 x enclosed ground flare used for emergency or upset operations

The following operational scenarios have been considered in the assessment:

- Routine operations: 3 x compressor engines (G3612) and 3 x power generation engines (G3512) operating at 100% load
- Upset operations: 3 x power generation engines (G3512) and 1 x enclosed ground flare

Ground-level concentrations of these air pollutants have been predicted at nearby residential sensitive receptors and across a Cartesian grid of receptors and assessed against the relevant air quality objectives in the *Environment Protection (Air) Policy 2019* and the *Environmental Protection (Air) Amendment Policy 2024* (Air EPP) and air quality standards specified in the *National Environment Protection (Ambient Air Quality) Measure 2021* (Air NEPM). A cumulative assessment has been conducted including the addition of ambient background concentrations of NO_2 and CO from measurements collected at air quality monitoring stations at locations with intensive CSG extraction activities.

The results show that the incremental change in concentrations of NO_2 and CO at nearby sensitive receptors due to the Project are minimal and the maximum cumulative concentrations at a receptor due to the Project plus

ambient background comply with the relevant criteria at sensitive receptors under both routine and emergency upset conditions. In particular,

- Cumulative predicted concentrations of NO_2 during both routine and emergency upset operations **comply** with the relevant 1-hour average Air EPP objective and Air NEPM standard of 164 µg/m³, with the highest cumulative concentration at any sensitive receptor less than 6 % of the criteria.
- Cumulative predicted concentrations of NO_2 during routine operations **comply** with the relevant annual average Air EPP objective and Air NEPM standard of 31 µg/m³, with the highest cumulative concentration at any sensitive receptor less than 14 % of the criteria.
- Cumulative predicted concentrations of CO during both routine and emergency upset operations **comply** with the relevant 8-hour average Air EPP objective and Air NEPM standard of 11,000 µg/m³, with the highest cumulative concentration at any sensitive receptor less than 3 % of the criteria.

The emission concentration of oxides of nitrogen (NO_X) for the G3612 and G3512 units at the GCF associated with the Project are 185 mg/Nm³ and 438 mg/Nm³, respectively (at 7% oxygen (O_2)). This is below the emission limit specified in the *Protection of the Environment Operations (Clean Air) Regulation 2022* (New South Wales (NSW)) of 450 mg/Nm³ at 7% O_2.

1. INTRODUCTION

Katestone Environmental Australia Pty Ltd (Katestone) was commissioned by Santos to complete an Air Quality Assessment of the Mahalo Gas Project (the Project), a proposed gas compression facility (GCF) and coal seam gas (CSG) field in the Mahalo Gas Hub in Queensland.

The Project will consist of the construction of up to 68 wells (to be electrified), a compressor station with a flare vent for emergency releases, accommodation camp, reverse osmosis facility, and sewage treatment plant. The development is to be located in the Dension Trough approximately 240 kilometres (km) west of Gladstone in the southern Bowen Basin, on land that is covered by Petroleum Lease (PL) 1082 and 1083. An air quality assessment is required to support an application for an Environmentally Relevant Activity (ERA) 15 – fuel burning.

A dispersion modelling assessment has been conducted using the CALPUFF dispersion model to predict ground-level concentrations of nitrogen dioxide (NO_2) and carbon monoxide (CO) from the Project during routine and non-routine (upset) operations. Predicted concentrations at nearest residential sensitive receptors have been assessed against the relevant air quality objectives in the *Environmental Protection (Air) Policy 2019* and the *Environmental Protection (Air) Amendment Policy 2024* (Air EPP) and air quality standards specified in the *National Environment Protection (Ambient Air Quality) Measure 2021* (Air NEPM).

2. PROJECT DESCRIPTION

The Mahalo Gas Project is located within the Central Highlands Regional Council, approximately 40 km north of Rolleston in Central Queensland. The Project is a joint venture between Santos QNT Pty Ltd and Comet Ridge Mahalo Pty Ltd, comprises two petroleum leases (PL1082 and PL1083) over a combined area of approximately 470 km^2 and will be constructed in two phases.

There is an Environmental Authority (EA) P-EA-100178150 from Department of Environment, Tourism, Science and Innovation (DETSI) over the two leases for a petroleum or GHG storage facility. The EA provides for the construction of up to 190 coal seam gas development wells. The current EA does not permit fuel burning or a combustion facility.

The proposed development will include:

- A compressor station package
- Triethylene glycol (TEG) regeneration boilers
- Gas engine generators
- Backup diesel generator
- Enclosed ground flare

Key sources of air pollutant emissions to air that have been assessed include the following sources at the compressor station:

- 3 x G3612 gas compressor engines during routine operations
- 3 x G3512 gas engines for power generation during routine operations (will continue to operate during emergency or upset operations)
- 1 x enclosed ground flare used for emergency or upset operations

The enclosed ground flare will also operate continuously in pilot/purge mode; however, emissions to air are minimal during this operation so has not been included in the dispersion modelling assessment. The backup diesel generator is expected to only be required in rare circumstances (less than 1% of the time) and consequently has also not been included in the assessment.

The up to 68 gas extraction wells, reverse osmosis facility, and sewage treatment plant will be operated using power generated at the compressor station. Consequently, there are no combustion emissions associated with these sources.

The location and setting of the Project is shown in Figure 1.



Figure 1 **The Mahalo Gas Project setting**

3. LEGISLATIVE FRAMEWORK FOR AIR QUALITY

3.1 Relevant policy

The Environmental Protection Act 1994 (EP Act) provides for the management of the air environment in Queensland. The EP Act gives DETSI the power to create Environmental Protection Policies that identify, and aim to protect, environmental values of the atmosphere that are conducive to the health and well-being of humans and biological integrity. The National Environment Protection Council (NEPC) also defines national ambient air quality standards and goals in consultation with, and with agreement from, all Australian state and territory governments.

The *Environmental Protection (Air) Policy* (Air EPP) was made under the EP Act and gazetted in 1997. The Air EPP was revised and reissued in 2019. The *Environmental Protection (Air) Amendment Policy 2024* (EPP Air Amendment 2024) commenced on 29 August 2024 and made amendments to the *Environmental Protection (Air) Policy 2019* (EPP Air) to ensure Queensland remains consistent with the NEPC *National Environmental Protection (Ambient Air Quality) Measure* (Air NEPM). The amendments to the EPP Air reflect the changes that were made to the standards for ozone, nitrogen dioxide, sulfur dioxide and particulate matter ($PM_{2.5}$) in the Air NEPM in April 2021. The changes to standards reflect the latest scientific evidence about the health impacts of these pollutants.

Collectively the *Environmental Protection (Air) Policy 2019* and the *Environmental Protection (Air) Amendment Policy 2024* are referred to as the Air EPP.

The objective of the Air EPP is to identify the environmental values of the air environment to be enhanced or protected and to achieve the objective of the Environmental Protection Act 1994, i.e., ecologically sustainable development. The environmental values to be enhanced or protected under the Air EPP are the qualities of the environment that are conducive to protecting the health and biodiversity of ecosystems, human health and wellbeing, the aesthetics of the environment, including the appearance of building structures and other property, and protecting agricultural use of the environment.

The administering authority must consider the requirements of the Air EPP when it decides an application for an environmental authority, amendment of a licence or approval of a draft environmental management plan. Schedule 1 of the Air EPP specifies air quality indicators and objectives for specific air pollutants for enhancing or protecting the environmental values.

Also relevant is DETSI' *Application requirements for activities with impacts to air* (ESR/2015/1840, version 5.0.3, October 2024), which outlines the information to be provided as part of the application process for environmentally relevant activities and how the information is used. The air quality assessment has been conducted in accordance with the requirements stipulated in the EP Act that are outlined by DETSI, including:

- A description of the site and surrounding areas, including topography, prevailing winds, and ambient air quality (Section 5)
- Any nearby sensitive places must be identified and assessed appropriately (Section 5.2)
- Possible impacts on air quality must be identified and evaluated (Section 7)

3.2 Air quality objectives

The air quality objectives for NO_2 and CO, the key air pollutants generated by the Project, are presented in Table 1.

Table 1 Ambient air quality objectives

Pollutant	Environmental value [(a)]	Averaging period	Air quality objective or standard (µg/m³) [(b)]	Reference
NO_2	Health and wellbeing	1-hour	164	Air EPP and Air NEPM
		1-year	31	Air EPP and Air NEPM
	Health and biodiversity of ecosystems	1-year	33	Air EPP
CO	Health and wellbeing	8-hour [(c)]	11,000	Air EPP and Air NEPM

Table notes:
[(a)] As prescribed by the Air EPP
[(b)] Reported at 0°C and 1 atm
[(c)] Rolling 8-hour average based on 1-hour averages

3.3 Existing Environmental Authority P-EA-100178150

The Project has existing P-EA-100178150 from DETSI providing for the following resource activities across PL1082 and PL1083:

- *the petroleum activities listed in Schedule A Table 1 – Scale and Intensity for the Activities* (reproduced in Table 2) *to the extent they are carried out in accordance with the activity's scale and intensity; and*
- *the following specified relevant activity(ies):*
    - *Sewage treatment – operating sewage treatment works, other than non-release works; and*
    - *Stimulation activities;*
- *seismic survey activities; and*
- *incidental petroleum activities that are not otherwise specified relevant activities*

Table 2 P-EA-100178150 Schedule A Table 1 Scale and Intensity for the Activities

Tenure Number(s)	***Petroleum Activity***	***Scale of activities***	***Intensity (maximum size in total)***
PL1082 *PL1083*	*Coal seam gas development wells*	*190 wells*	*228 ha*

Schedule D of existing P-EA-100178150 relates to air as follows:

Venting and flaring

(D1) Unless venting is authorised under the Petroleum and Gas (Production and Safety) Act 2004 or the Petroleum Act 1923, waste gas must be flared in a manner that complies with all of (D1) (a) and (D1) (b) and (D1) (c), or with (D1) (d):

(a) an automatic ignition system is used, and

(b) a flame is visible at all times while the waste gas is being flared, and

(c) there are no visible smoke emissions other than for a total period of no more than 5 minutes in any 2 hours, or

(d) it uses an enclosed flare.

Fuel burning and combustion activities

(D2) A fuel burning or combustion facility must not be operated on any of the petroleum tenures related to this environmental authority.

4. AIR QUALITY ASSESSMENT METHODOLOGY

4.1 Existing environment

The assessment includes an analysis of the characteristics of the existing environment (Section 5) in the Project area that are important for the dispersion of air pollutants and that may influence the level of air pollutants at sensitive receptors. Characteristics include terrain features, regional land uses, existing sources of emissions, existing ambient pollutant concentrations and the locations of sensitive receptors relative to the sources.

4.2 Construction

The construction phase activities can be described broadly as structure and plant erection and installation, drilling, and minor site clearance where needed. The primary air pollutant emitted to air during the construction phase is likely to be dust (i.e. particulate matter). Minor levels of combustion air pollutants may be associated with vehicle and machinery activity. Emissions to air from these activities are expected to be minimal.

Notwithstanding this, adoption of dust mitigation measures such as reducing vehicle speed on unsealed roads, watering of unsealed roads used by construction vehicles, application of sprays on drills, and minimising cleared areas will assist in minimising dust associated with construction. Potential impacts to air during the construction phase will be managed through a site-specific risk assessment and a construction environmental management plan.

4.3 Operational emissions

Key sources of air pollutant emissions to air that have been assessed include the following sources at the compressor station:

- 3 x G3612 gas compressor engines
- 3 x G3512 gas engines for power generation
- 1 x enclosed ground flare used for emergency or upset operations

The following operational scenarios have been considered in the assessment:

- Routine operations: 3 x compressor engines (G3612) and 3 x power generation engines (G3512) operating at 100% load
- Upset operations: 3 x power generation engines (G3512) and 1 x enclosed ground flare

Emission rates for the engines and flare as well as parameters relating to the emission stacks have been gathered from specifications sheets provided by the manufacturer of the engines and information provided by Santos. The specification of the engines and their associated emission rates are detailed in Section 6.

4.4 Meteorology

The dispersion modelling assessment was conducted using the most recent versions of the TAPM (version 4.0.5) and CALMET (version 6.5.0) models at the time of undertaking the study. A site-specific meteorological data file was generated for the project site by coupling the prognostic model TAPM with the diagnostic metrological model CALMET.

The coupled TAPM/CALMET modelling system was developed to enable high resolution modelling capabilities for regulatory and environmental assessments. The modelling system incorporates synoptic, mesoscale, and local

atmospheric conditions, detailed topographic and land use categorisation schemes to simulate synoptic and regional scale meteorology for input into pollutant dispersion models such as CALPUFF.

Technical details of the TAPM and CALMET model configurations are provided in Appendix A.

Local meteorology is of paramount importance for dispersion of air pollutants generated by the Project's activities; key features are wind speed, wind direction, atmospheric stability and boundary layer mixing height. Conditions in the local area, as derived from the meteorological modelling carried out for the assessment, are discussed in detail in Section A1.4 of Appendix A.

4.5 Dispersion modelling

The CALPUFF model (version 7.2.1) was used for dispersion modelling. CALPUFF is an advanced non-steady-state air quality modelling system. Twelve months of modelled meteorological data was used as input for the dispersion model in order to include all weather conditions likely to be experienced in the region during a typical year, as described in Appendix A.

Emission sources were configured in CALPUFF based on the information for each source detailed in Section 6.

Details of the model configuration are provided in Section A2 of Appendix A.

4.6 Nitric oxide to nitrogen dioxide conversion

NO_X in exhaust plumes is made up of both nitric oxide (NO) and nitrogen dioxide (NO_2). Typical NO/NO_2 ratios at the point of release to the atmosphere are around 90%/10%. Once in the atmosphere NO can undergo chemical transformation to form NO_2. The rate at which this conversion occurs depends on the solar reactivity of the atmosphere, presence of other molecules such as ozone, and time since release from the source.

NO_2 is more toxic than NO and is the reason why NO_2 has air quality assessment criteria rather than NO. As NO_X emitted from the project is primarily NO, it is important to adequately quantify the transformation of NO to NO_2 for comparison with assessment criteria.

There are various methods for estimating NO_2 concentrations from model predictions of NO_X as the plume disperses from the emission point. A simple and common approach has been taken for this assessment. It has been conservatively assumed that, for annual averaging periods, all NOx converts to NO_2. This will result in an over-prediction of actual annual average NO_2 concentrations. For 1-hour averaging periods, a more realistic approach has been taken, assuming that 30% of NOx is NO_2 (Bofinger et al., 1986).

4.7 Presentation of results

Modelling results are presented as maximum ground-level concentrations for NO_X and CO for the relevant averaging periods at nearest sensitive receptor locations in Section 7. Results are also presented as maximum ground-level concentrations across a Cartesian grid of receptors at 250 m resolution. The conversion of NO_X to NO_2 has assumed 100% for annual average periods, and 30% for 1-hour average periods. All results at sensitive receptors are presented in isolation and with ambient background as determined in Section 5.3.3. Contours are provided for cumulative impacts across the Cartesian grid.

4.8 Cumulative impacts

For all pollutants (NO_2 and CO), the contributions of all modelled sources have been combined. Ambient background concentrations (see Table 4) have also been added to the modelled contributions to determine the total cumulative concentrations.

4.9 Limitations and uncertainty

This study relies on the accuracy of a number of data sets that feed into the dispersion model, all of which will have uncertainties associated with them. The input data sets include:

- Meteorological monitoring observations from the Bureau of Meteorology
- Air quality monitoring observations from DETSI
- Emissions data provided by Santos
- Emissions data and source characteristics of the enclosed ground flare
- Synoptic and surface information datasets from CSIRO.

It is also important to note that numerical models are based on an approximation of governing equations and will inherently be associated with some degree of uncertainty. The more complex the physical model, the greater the number of physical processes that must be included. There will be physical processes that are not explicitly accounted for in the model and, in general, these approximations tend to lead to an over prediction of air pollutant levels. The dispersion model has been configured with conservative assumptions and, therefore, the assessment is likely to overpredict potential impacts of the Project.

5. EXISTING ENVIRONMENT

5.1 Local terrain and land-use

The Project is located in Central Queensland, approximately 78 km southeast of Emerald and 40 km north of Rolleston. Figure 2 displays a terrain map of the area surrounding the GCF and the gas extraction wells (electrified). The GCF and extraction wells are in a mid-lying area, between 180 m and 230 m Australian Height Datum (AHD). The terrain surrounding the increases in areas to the north to east, reaching a peak of around 260 m AHD.

Land-use around the GCF and extraction wells of interest primarily consists of grazing and agricultural land. Mining activity, including coal mining and associated practices, also occurs in the wider region.

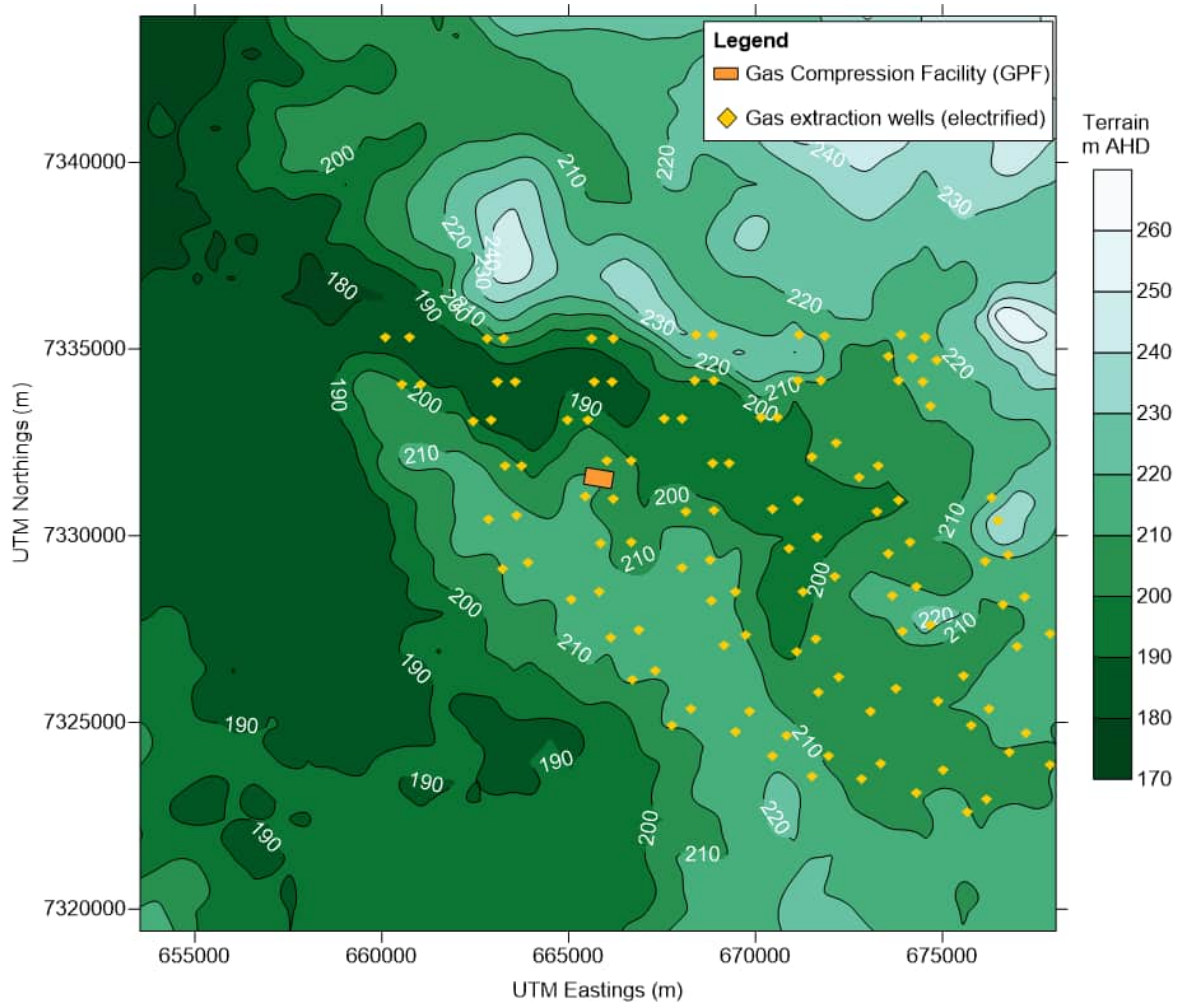


Figure 2 Terrain surrounding the GCF and surrounding gas extraction wells (electrified)

5.2 Sensitive receptors

Receptors in the vicinity of the GCF were identified and provided by Santos, representative of those nearest to the sources at the GCF. These are shown in Figure 3. The nearest receptor (R10) that is located approximately 2.3 km southwest of the GCF has been identified as a commercial facility (cattle yard) that is used occasionally. Pollutant concentrations have also been predicted at ground level across a Cartesian grid of receptors (at 250 m resolution) to enable the production of contour plots of concentrations across the study area.

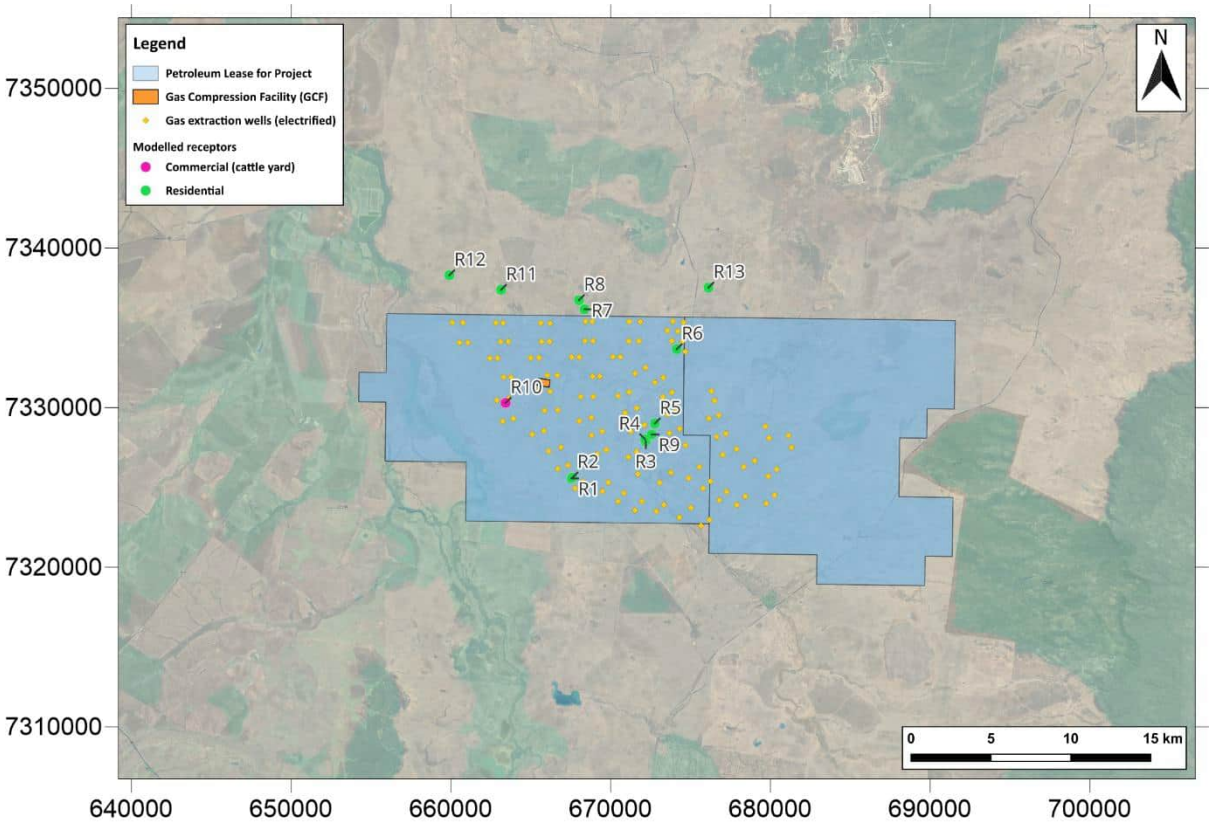


Figure 3 Selected modelled sensitive receptors

5.3 Existing air quality

5.3.1 Existing sources of emissions

All facilities reporting emissions of NO_X and CO to the National Pollutant Inventory (NPI) for the 2023/2024 reporting period within a 50 km radius of the GCF are detailed in Table 3. The NO_X and CO emissions, as kg per year, are also provided. Though these facilities operate in the regional airshed, there are no sources large enough to report to the NPI within the model domain of this assessment (25 km radius of the GCF). Thus, it can be concluded that the existing ambient air quality is generally good.

Table 3 Existing emissions sources and their emissions (kg) reported to NPI in financial year 2023/2024 within 50 km of the GCF

Facility name	Main activities	Reported emissions (kg)		Distance from GCF (km) [a]
		NO_X	CO	
Meteor Downs South Mine	Coal mining	364,000	197,000	42
Glencore Coal Rolleston Open Cut Mine	Coal mining	1,318,273	593,520	38
Cook Colliery	Coal mining	21,100	6,270	51
North Denison	Natural gas production and processing	273,090	33,877	41
Blackwater Mine	Coal mining	2,617,100	1,666,900	35

Table note:
[a] GCF located approximately 665,533 easting 7,331,697 northing (MGA Zone 55)

5.3.2 Proposed sources of emissions

Multiple petroleum leases cover the Mahalo Gas Hub where the Project is located (Figure 4). Currently existing operations within the Mahalo Gas Hub are exploratory; however, multiple greenfield CSG developments are proposed for the region and are in various stages of the approval process. Consequently, neighbouring developments within the Mahalo Gas Hub are likely to influence the future ambient air quality at the Project site.

An assessment of the potential for cumulative impacts from the Project operating in addition to any potential future CSG developments within the Mahalo Gas Hub has been carried out using ambient air quality monitoring data from a site representative of intensive CSG production. This is detailed in the following section.

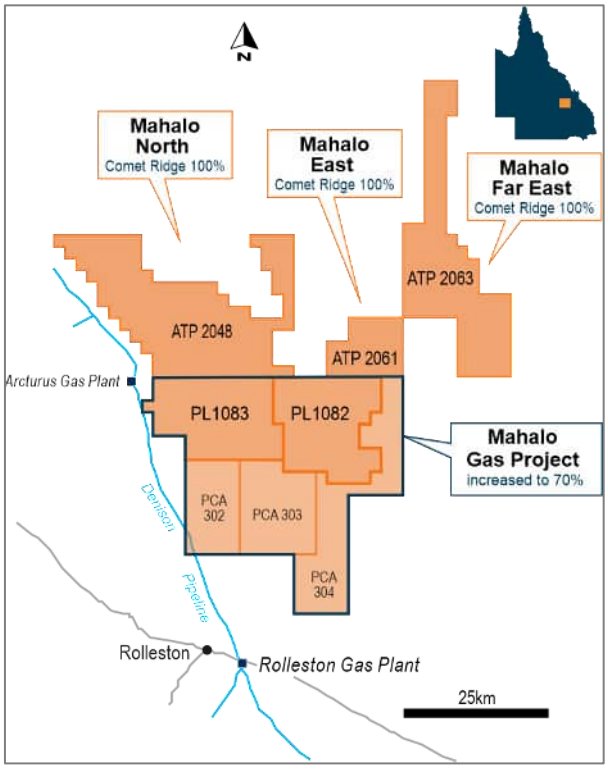


Figure 4 Mahalo Gas Hub projects (source: https://cometridge.com.au)

5.3.3 Existing ambient air quality

DETSI is responsible for undertaking ambient air quality monitoring in Queensland. DETSI conducts monitoring at several monitoring stations in the region, as shown in Figure 5. Each monitoring station is located for a specific purpose such as measuring air quality near industry, measuring air quality at roadside, or to demonstrate compliance with the requirements of the Air NEPM.

Ambient monitoring of NO_2 is not undertaken at any of the three stations identified in Figure 5. Each of the sites identified only monitors particulate matter data (PM_{10} and $PM_{2.5}$), which is not relevant to the operational modelling conducted in this assessment. As shown in Table 3, there are currently no sources of emissions within the model domain of the assessment (25 km) and as such, it is unlikely that existing concentrations of NO_X will be significant. However, as discussed in Section 5.3.2, proposed intensive CSG production within the Mahalo Gas Hub is likely to influence future ambient air quality at the Project site.

To gain insight into potential (future) background levels of air pollutants due to CSG fields, the ambient air quality data from the DETSI station at Hopeland in Southeast Queensland has been analysed for the 2018 to 2022 period. Whilst located 360 km away from the Project, the Hopeland station was located near to intensive CSG production

with coal mines operating in the region and will therefore serve as a conservative representation of ambient air quality at the Project site. The Hopeland monitoring station was decommissioned in July 2023.

A summary of the Hopeland air quality monitoring data and the background air quality levels used in this assessment are presented in Table 4. Five years of monitoring data have been analysed for 1-hour (NO_X) and 8-hour (CO) averaging periods, the 70th percentile value has been presented in the table. The maximum annual average (NO_2) is also presented.

The highest concentration for each air pollutant over the five years (relevant to each averaging period) has been used as the background value in this assessment.

Table 4 Background air quality measured at DETSI Hopeland monitoring station

Pollutant	Averaging Period [a]	Assessment criterion (µg/m³)	Concentration (µg/m³)					
			2018	2019	2020	2021	2022	Used in assessment
NO_2	1-hour	**164**	4.1	4.1	4.1	4.1	2.1	**4.1**
	Annual	**31**	4.0	3.8	3.7	3.4	2.9	**4.0**
CO	8-hour	**11,000**	176	250	196	143	125	**250**

Table note:
[a] Concentrations derived as the 70th percentile of data

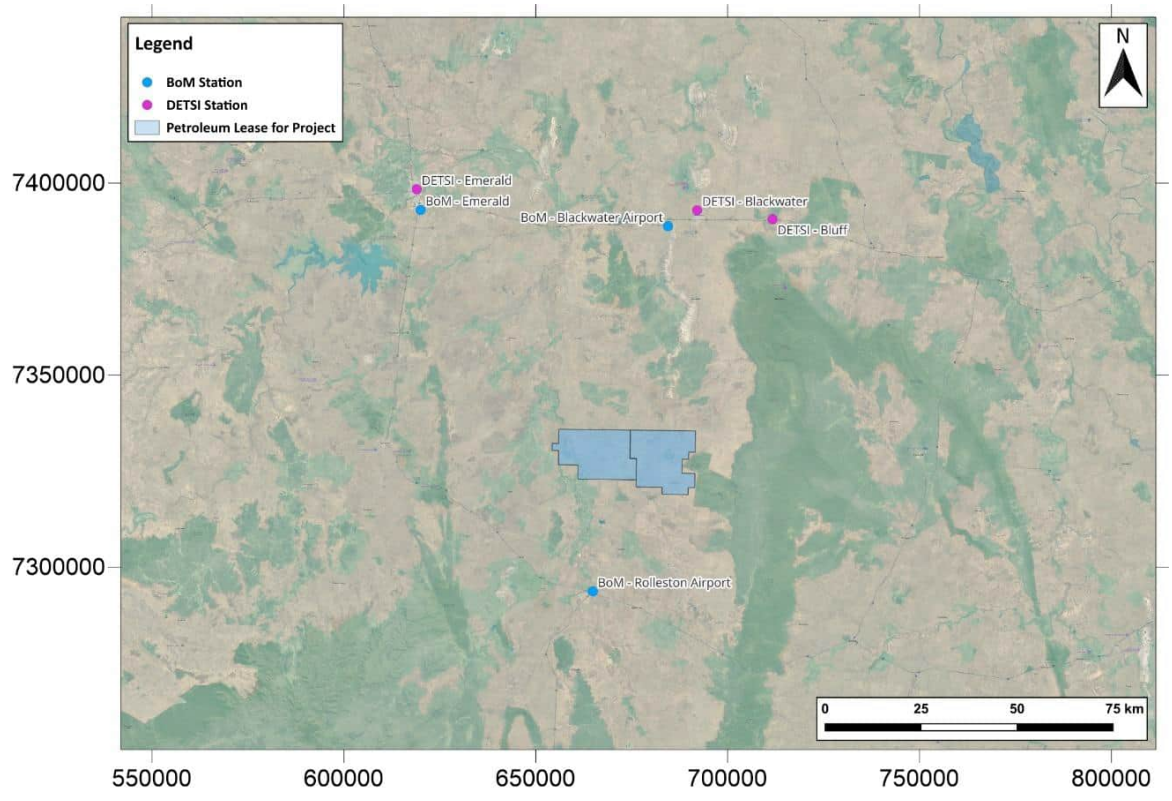


Figure 5 Air quality monitoring locations in the study area

6. OPERATIONAL EMISSIONS TO THE ATMOSPHERE

6.1 Routine operations

The emission parameters for routine operations used in the dispersion modelling are described in Table 5, including:

- Three G3612 gas engines used for gas compression
- Three G3512 gas engines used for power generation

All sources have been assumed to be operating at 100% load for the assessment.

Table 5 Emission parameters for the G3612 and G3512 gas engines during routine operation used in the dispersion modelling

Parameter	Unit	Value	
		G3612	G3512
Stack X coordinate	m (MGA Zone 55)	665533 [a, b, g]	665533 [a, b, g]
Stack Y coordinate	m (MGA Zone 55)	7331697 [a, b, g]	7331697 [a, b, g]
Number of units	number	3 [b]	3 [b]
Stack height	m	10.9 [b]	10.0 [b]
Stack diameter	m	1.5 [b]	0.45 [b]
Stack area	m^2	1.8 [c]	0.16 [c]
Exhaust temperature	°C	426.7 [d]	442.0 [d]
Exit velocity	m/s	6.8 [c]	19.8 [c]
Actual exhaust volume flow rate	m^3/s	12.0 [d]	3.1 [d, e]
Moisture content	%	0.9 [d]	1.0 [d]
Normalised exhaust volume flow rate (273.15°K,101.3 kPa, dry, 7% O_2)	Nm^3/s	3.10 [c]	1.01 [c]
NO_X concentration	g/bhp/hr	0.5 [d]	-
	mg/Nm³ dry @0% O_2	-	657 [d]
	mg/Nm³ dry @7% O_2	185 [c]	438 [c, f]
CO concentration	g/bhp/hr	1.69 [d]	-
	mg/Nm³ dry @0% O_2	-	1,425 [d]
	mg/Nm³ dry @7% O_2	625 [c]	950 [c, f]
NOx emission rate	g/s	0.57 [c]	0.44 [c]
CO emission rate	g/s	1.94 [c]	0.96 [c]

Table notes:

[a] All stacks have been assumed to be located at same location for purposes of the assessment

[b] Supplied by Santos

[c] Calculation

[d] As per manufacturer specifications (100% load operation)

[e] As per manufacturer specifications, corrected for temperature

[f] Converted for comparison with New South Wales Protection of the Environment Operations (Clean Air) Regulation 2022 emission concentration standard for NO_X of 450 mg/Nm³ @7% O_2

[g] Since modelling of the GCF sources was completed, Santos has advised the new location of the plant approximately 1 km to the south at 665723 m Easting, 7330716 m Northing. The changed location will not change the outcome of the air quality impact assessment (see Section 8)

6.2 Emergency upset operations

The emission parameters for the flare during emergency or upset operations used in the dispersion modelling are presented in Table 6. The flare is proposed to be a 4-stage ground flare with a peak design capacity of 50 MMscfd (million standard cubic feet per day) during a plant trip or emergency shutdown. It is proposed that the ground flare will have four horizontal exhaust stacks, each with a nominal diameter of 150 mm, enclosed within an approximately 8 m high wind shield enclosure. An image providing an example configuration of the proposed enclosed ground flare is provided in Appendix A2.

The emissions from the ground flare horizontal stacks within the high wind shield enclosure during emergency or upset operations have been modelled in CALPUFF as a buoyant area source using the configurations provided in Table 6.

During emergency or upset operations the three G3512 gas engines used for power generation will also be in operation, as per the emission parameters presented in Table 5 for routine operations.

Table 6 Emission parameters for the flare operating in emergency/upset mode during non-routine operation used in the dispersion modelling

Parameter	Unit	Value
Source centre X coordinate	m (MGA Zone 55) [g]	665533 [a, b, g]
Source centre Y coordinate	m (MGA Zone 55) [g]	7331697 [a, b, g]
Number of flare units	number	1 [b]
Source height	m	1.0 [b, c]
Plume temperature	°C	1,000 [d]
Peak energy out	MMscfd	50 [b]
Effective rise velocity (W_p)	m/s	1.42 [e]
Radius of area source	m	22.6 [e]
Initial sigma-z	m	0.5 [e]
NO_X concentration	g/GJ	29.2 [f]
CO concentration	g/GJ	133.3 [f]
NOx emission rate	g/s	18.1 [f]
CO emission rate	g/s	82.3 [f]

Table notes:

[a] All sources/stacks have been assumed to be located at same location for purposes of the assessment

[b] Supplied by Santos

[c] Horizontal stack tip height above ground

[d] Assumption

[e] Calculation based on assuming 40m x 40m area for enclosed flare

[f] Calculation based on emission factor (Source: AP42: 13.5 Emission Factors (2018 version))

[g] Since modelling of the GCF sources was completed, Santos has advised the new location of the plant approximately 1 km to the south at 665723 m Easting, 7330716 m Northing. The changed location will not change the outcome of the air quality impact assessment (see Section 8).

6.3 Comparison to emission standards

There is no legislation in force in Queensland that specifies emission concentration limits for plant and equipment however, DETSI commonly considers the emission standards set in other jurisdictions. For example, in NSW the *Protection of the Environment Operations (Clean Air) Regulation 2022* (Clean Air Regulation) provides standards of emission concentrations for premises that are required to be licenced. DESTI also considers the European Union (EU) Directive on the limitation of emissions of certain pollutants into the air from medium combustion plants (2015).

Emission standards of NO_X are as follows:

- EU Directive – 190 mg/Nm³ @ 15% O_2 (443 mg/Nm³ @ 7% O_2)
- Clean Air Regulation – 450 mg/Nm³ @ 7% O_2

The emission limit of NO_X proposed for the G3612 and G3512 gas engines (Table 5) satisfies these limits.

7. RESULTS

7.1 Routine operations

Results at nearest sensitive receptor locations due to routine operations are presented in Table 7. The resulting contour plots with background are shown in Plate 1 to Plate 3.

The results show that the incremental change in concentrations of NO_2 and CO at nearby sensitive receptors due to the Project are minimal and the maximum cumulative concentrations at a receptor due to the Project plus ambient background comply with the relevant criteria at sensitive receptors under routine operations. In particular,

- Cumulative predicted concentrations of NO_2 during routine operations **comply** with the relevant 1-hour average Air EPP objective and Air NEPM standard of 164 µg/m³, with the highest cumulative concentration at any sensitive receptor less than 6 % of the criteria.
- Cumulative predicted concentrations of NO_2 during routine operations **comply** with the relevant annual average Air EPP objective and Air NEPM standard of 31 µg/m³, with the highest cumulative concentration at any sensitive receptor less than 14 % of the criteria.
- Cumulative predicted concentrations of CO during routine operations **comply** with the relevant 8-hour average Air EPP objective and Air NEPM standard of 11,000 µg/m³, with the highest cumulative concentration at any sensitive receptor less than 3 % of the criteria.

Table 7 Maximum modelled concentrations at each receptor for routine operations

Receptor	NO_2 (µg/m³)				CO (µg/m³)	
	Isolation		Cumulative		Isolation	Cumulative
	1-hour	Annual	1-hour	Annual	8-hour	8hour
R1	2.3	0.03	6.4	4.03	4.6	255
R2	2.4	0.03	6.5	4.03	4.4	254
R3	0.8	0.01	4.9	4.01	1.8	252
R4	0.8	0.01	4.9	4.01	1.8	252
R5	0.9	0.01	5.0	4.01	1.7	252
R6	1.0	0.01	5.1	4.01	4.5	254
R7	1.9	0.01	6.0	4.01	3.1	253
R8	1.2	0.01	5.3	4.01	3.6	254
R9	0.9	0.01	5.0	4.01	1.5	251
R10 (commercial)	5.4	0.14	9.5	4.14	15.2	265
R11	5.3	0.30	9.4	4.30	28.7	279
R12	2.9	0.07	7.0	4.07	14.3	264
R13	0.4	0.003	4.5	4.00	0.7	251
Guideline	**-**	**-**	**164**	**31**	**-**	**11,000**

7.2 Emergency upset operations

Results at nearest sensitive receptor locations due to emergency or upset operations are presented in Table 8. The resulting contour plots with background are shown in Plate 4 and Plate 5.

The results show that the incremental change in concentrations of NO_2 and CO at nearby sensitive receptors due to the Project are minimal and the maximum cumulative concentrations at a receptor due to the Project plus ambient background comply with the relevant objectives at sensitive receptors under emergency upset conditions. In particular,

- Cumulative predicted concentrations of NO_2 during emergency upset operations **comply** with the relevant 1-hour average Air EPP objective and Air NEPM standard of 164 µg/m³, with the highest cumulative concentration at any sensitive receptor less than 6 % of the criteria.
- Cumulative predicted concentrations of CO during emergency upset operations **comply** with the relevant 8-hour average Air EPP objective and Air NEPM standard of 11,000 µg/m³, with the highest cumulative concentration at any sensitive receptor less than 3 % of the criteria.

Table 8 Maximum modelled concentrations at each receptor for emergency upset operations

Receptor	NO_2 (µg/m³)		CO (µg/m³)	
	Isolation	Cumulative	Isolation	Cumulative
	1-hour	1-hour	8-hour	8hour
R1	1.6	5.7	5.5	255
R2	1.6	5.7	5.6	255
R3	1.4	5.5	5.8	256
R4	1.4	5.5	5.6	256
R5	0.9	5.0	3.5	253
R6	1.0	5.1	3.5	253
R7	1.9	6.0	7.1	257
R8	2.6	6.7	9.6	259
R9	1.8	5.9	5.5	255
R10 (commercial)	4.4	8.5	12.2	262
R11	4.9	9.0	28.2	279
R12	2.1	6.2	13.8	264
R13	0.5	4.6	2.6	253
Guideline	**-**	**164**	**-**	**11,000**

8. NEW LOCATION OF GCF

The location of the proposed GCF has changed since the dispersion modelling was completed. Figure 6 illustrates the location of the GCF included in the modelling and its new location. The new location for the GCF is approximately 1 km to the south of the location used in the modelling. The change in location is not anticipated to change the outcome of the assessment (as presented in Section 7 and Section 11) for routine and non-routine operations as:

- The location of the GCF included in the modelling was 2.55 km from the nearest sensitive receptor (R24). The new location for the GCF is 2.34 km from the nearest receptor.
- The dispersion modelling demonstrated that, at most, predicted cumulative concentrations of NO_2 and CO were 14% and 3%, respectively, of the relevant air quality objectives
- Of the maximum cumulative concentration predicted at a receptor, background concentrations accounted for:
    - 43% of the 1-hour average and 93% of the annual average NO_2 concentration
    - 90% of the 8-hour average CO concentration

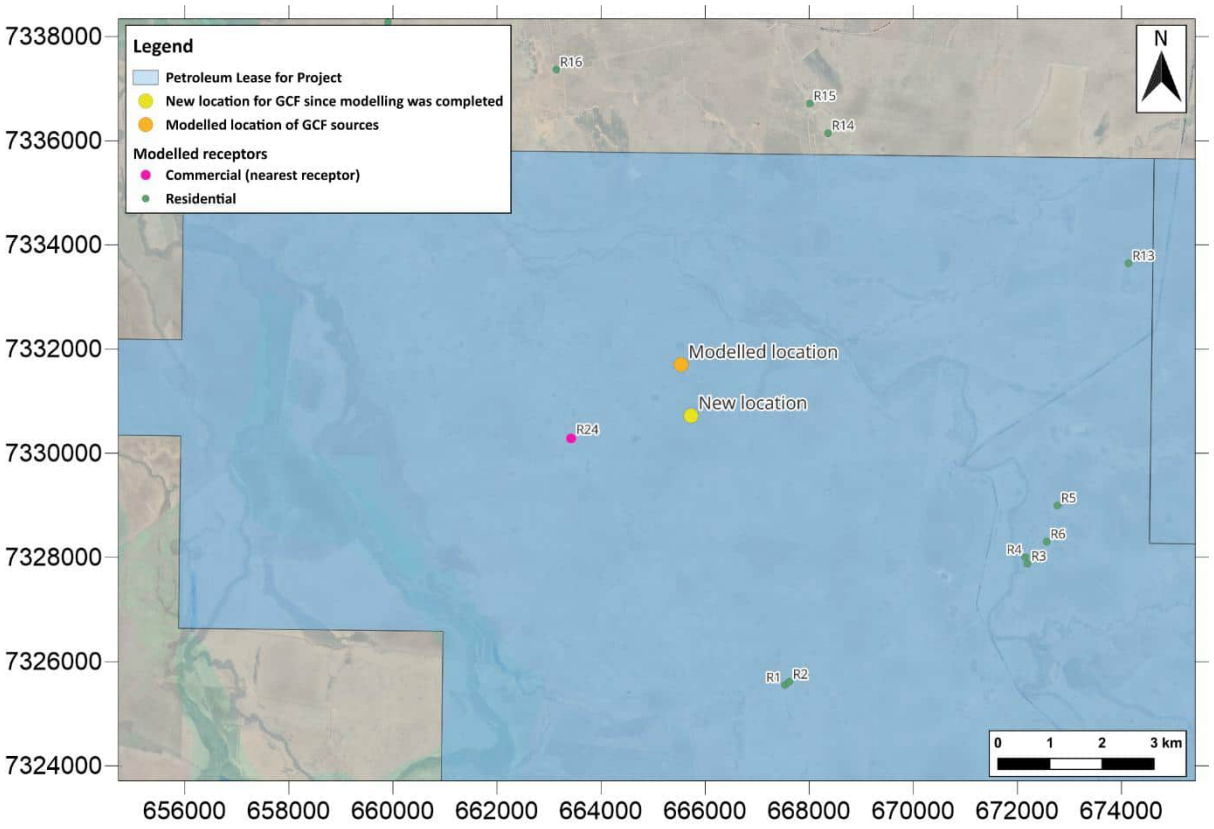


Figure 6 Location of sources at the GCF included in the dispersion modelling and new proposed location

9. CONCLUSIONS

Katestone was commissioned by Santos to complete an Air Quality Assessment of a proposed GCF and CSG field in the Mahalo Gas Hub in Queensland (the Project).

A dispersion modelling assessment has been conducted using the CALPUFF dispersion model to predict ground-level concentrations of NO_2 and CO from the Project during routine and non-routine (upset) operations. Predicted incremental and cumulative concentrations at nearest residential sensitive receptors have been assessed against the relevant air quality objectives in the Air EPP and air quality standards specified in the Air NEPM.

The results show that the incremental change in concentrations of NO_2 and CO at nearby sensitive receptors due to the Project are minimal and the maximum cumulative concentrations at a receptor due to the Project plus ambient background comply with the relevant objectives at sensitive receptors under both routine and emergency upset conditions. In particular,

- Cumulative predicted concentrations of NO_2 during both routine and emergency upset operations **comply** with the relevant 1-hour average Air EPP objective and Air NEPM standard of 164 µg/m³, with the highest cumulative concentration at any sensitive receptor less than 6 % of the criteria.
- Cumulative predicted concentrations of NO_2 during routine operations **comply** with the relevant annual average Air EPP objective and Air NEPM standard of 31 µg/m³, with the highest cumulative concentration at any sensitive receptor less than 14 % of the criteria.
- Cumulative predicted concentrations of CO during both routine and emergency upset operations **comply** with the relevant 8-hour average Air EPP objective and Air NEPM standard of 11,000 µg/m³, with the highest cumulative concentration at any sensitive receptor less than 3 % of the criteria.

10. REFERENCES

Bofinger, N.D, Best P.R., Cliff D.I., and Stumer L.J, (1986). The oxidation of nitric oxide to nitrogen dioxide in power station plumes. Proceedings of the Seventh World Clean Air Congress, 384-392.

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Department of Environment, Tourism, Science and Innovation, Queensland Government, 2025, Open Data Portal, available online: https://www.data.qld.gov.au/

11. CONTOUR PLOTS

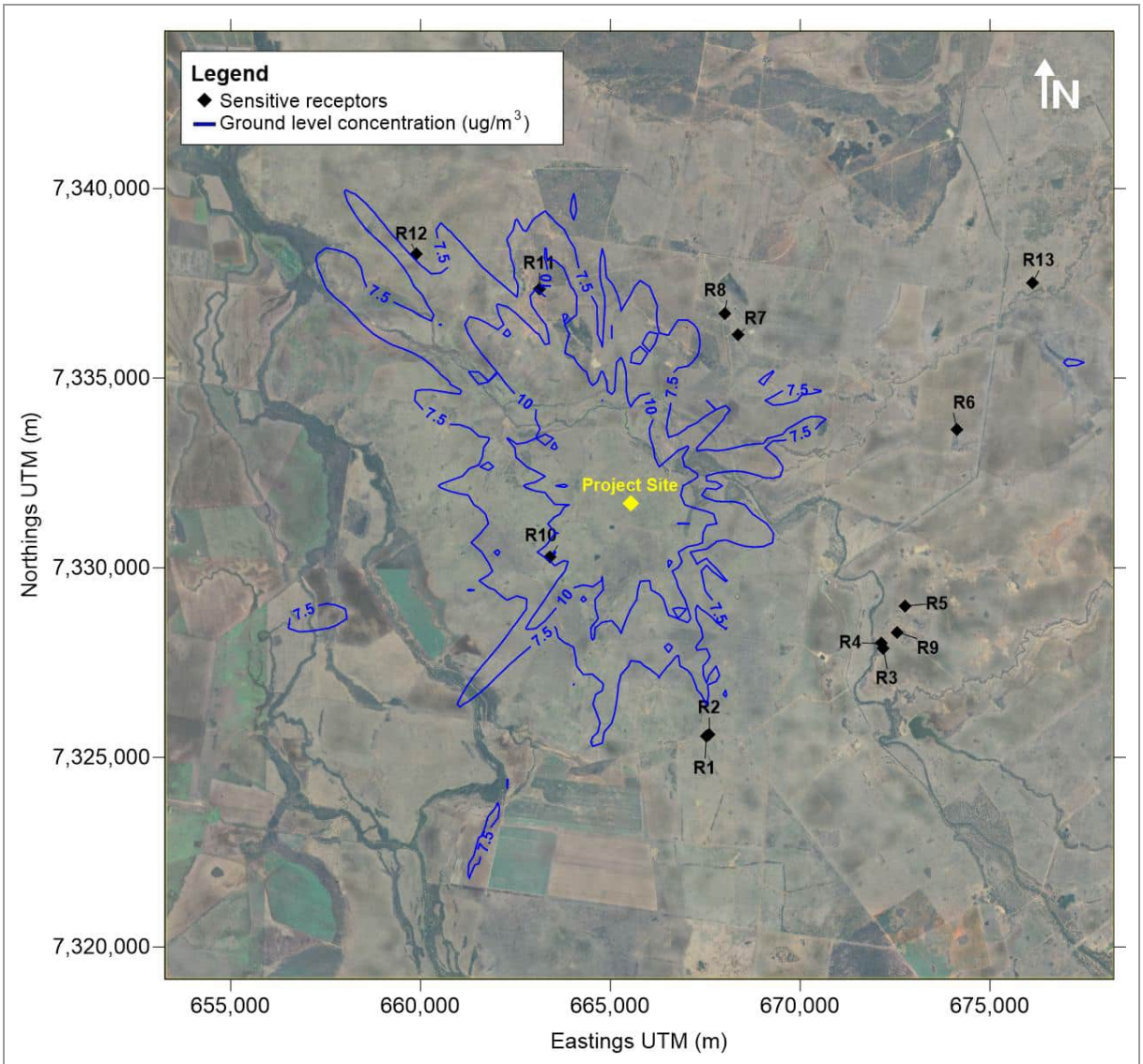


Plate 1 **Routine operations: Predicted 1-hour average ground-level concentrations of NO_2 due to Project with background**

Location: Mahalo Gas Hub, Queensland	**Averaging period:** 1-hour	**Data source:** CALPUFF	**Units:** µg/m^3
Type: Maximum	**Objective:** 164 µg/m^3 (Air EPP and Air NEPM)	**Prepared by:** Alexander Scholten	**Date:** May 2025

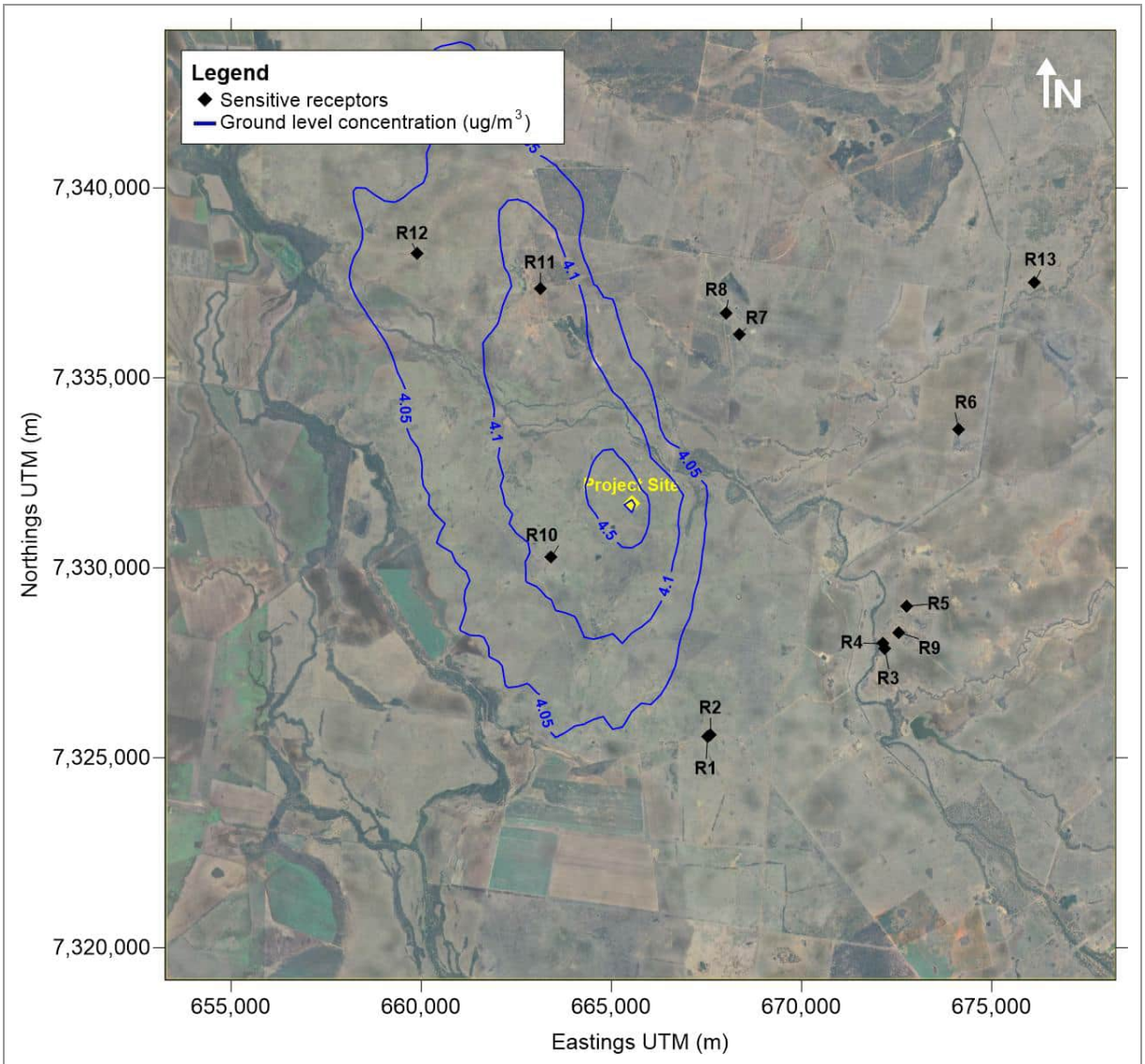


Plate 2 **Routine operations: Predicted annual average ground-level concentrations of NO_2 due to emissions from the Project with background**

Location: Mahalo Gas Hub, Queensland	**Averaging period:** Annual	**Data source:** CALPUFF	**Units:** µg/m^3
Type: Average	**Objective:** 31 µg/m^3 (Air EPP and Air NEPM)	**Prepared by:** Alexander Scholten	**Date:** May 2025

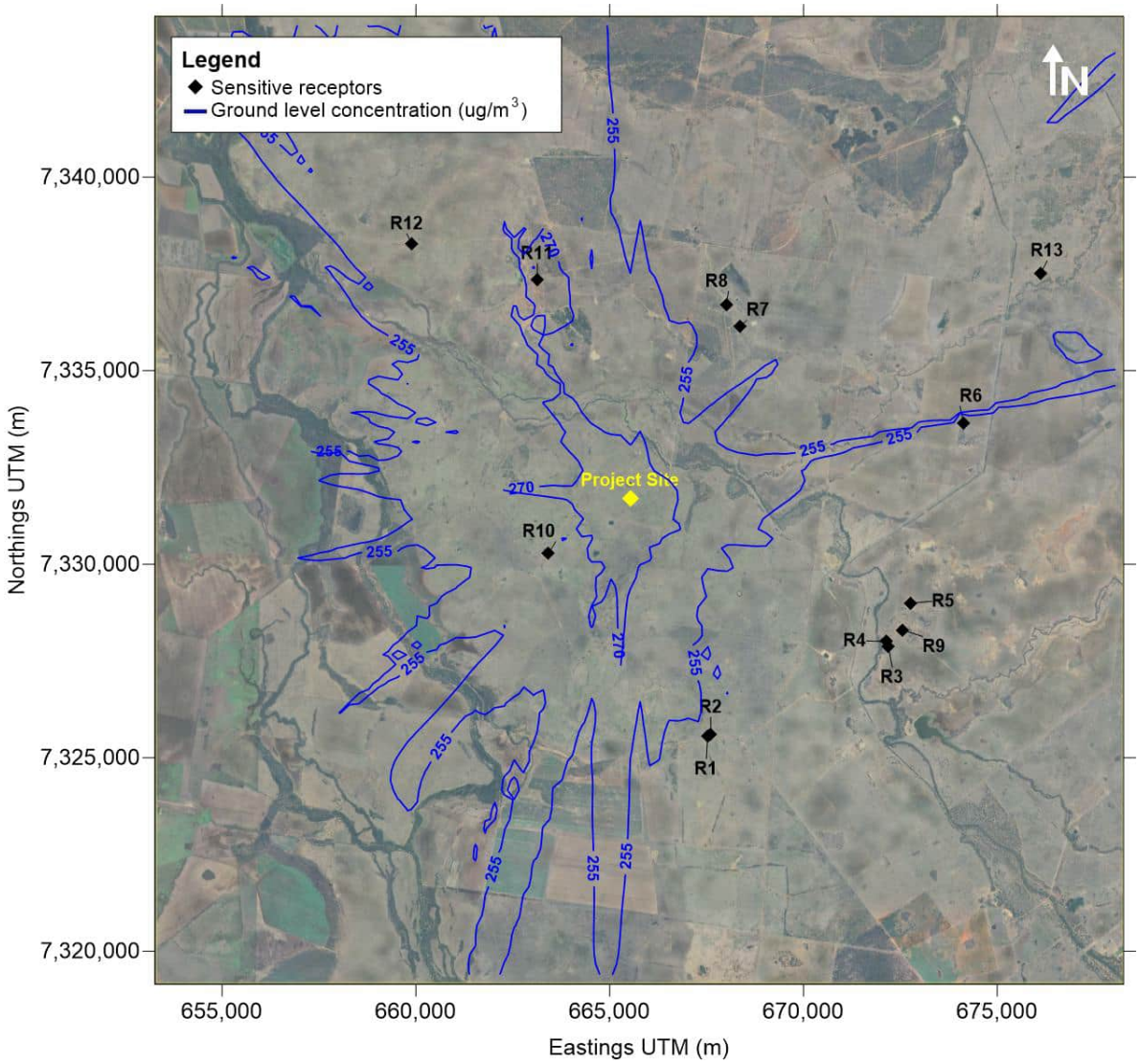


Plate 3 **Routine operations: Predicted 8-hour average ground-level concentrations of CO due to emissions from the Project with background**

Location: Mahalo Gas Hub, Queensland	**Averaging period:** 8-hour	**Data source:** CALPUFF	**Units:** µg/m^3
Type: Maximum	**Objective:** 11,000 µg/m^3 (Air EPP and Air NEPM)	**Prepared by:** Alexander Scholten	**Date:** May 2025

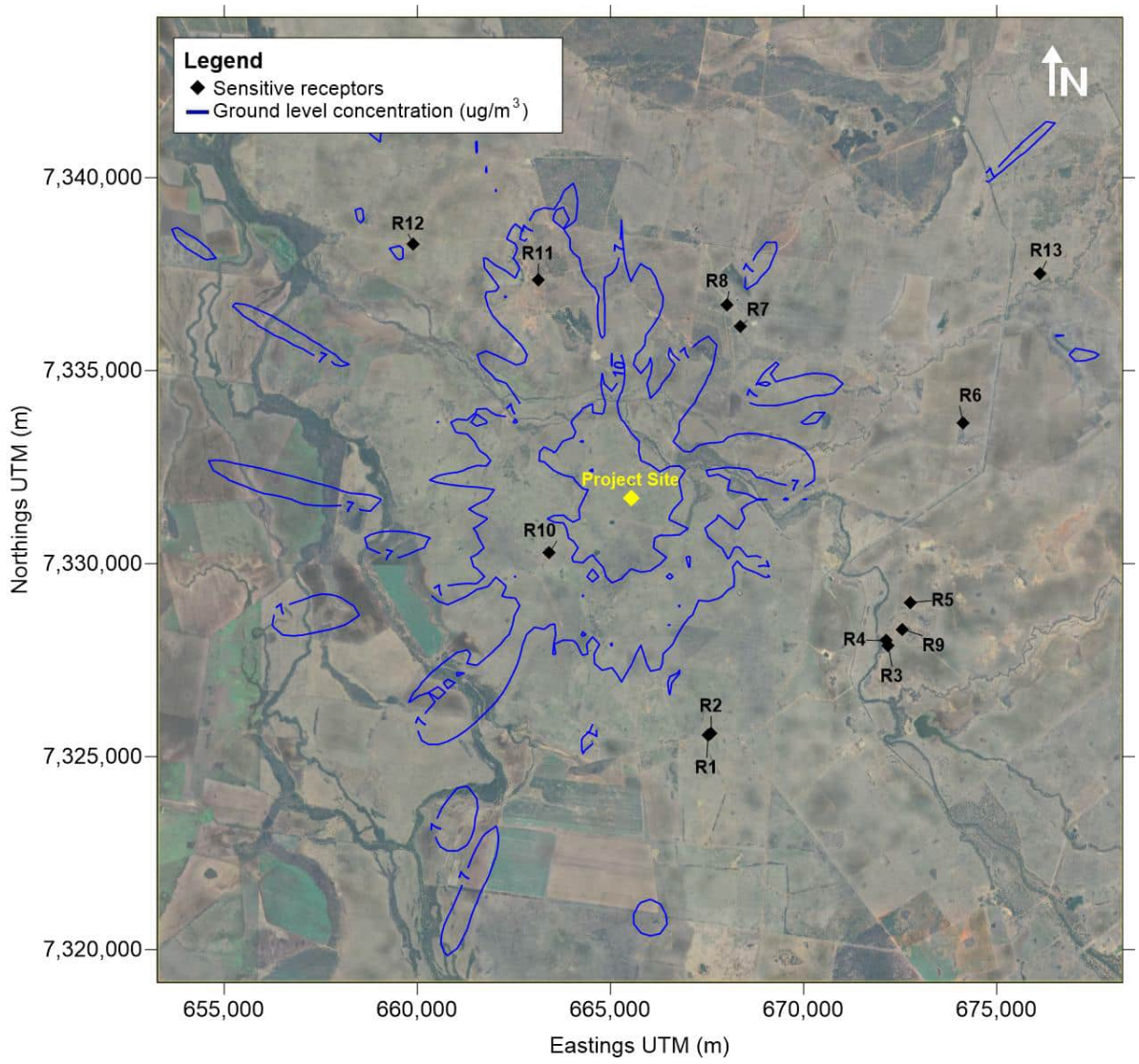


Plate 4 **Non-routine (emergency or upset) operations: Predicted 1-hour average ground-level concentrations of NO_2 due to emissions from the Project with background**

Location: Mahalo Gas Hub, Queensland	**Averaging period:** 1-hour	**Data source:** CALPUFF	**Units:** µg/m^3
Type: Maximum	**Objective:** 164 µg/m^3 (Air EPP and Air NEPM)	**Prepared by:** Alexander Scholten	**Date:** May 2025

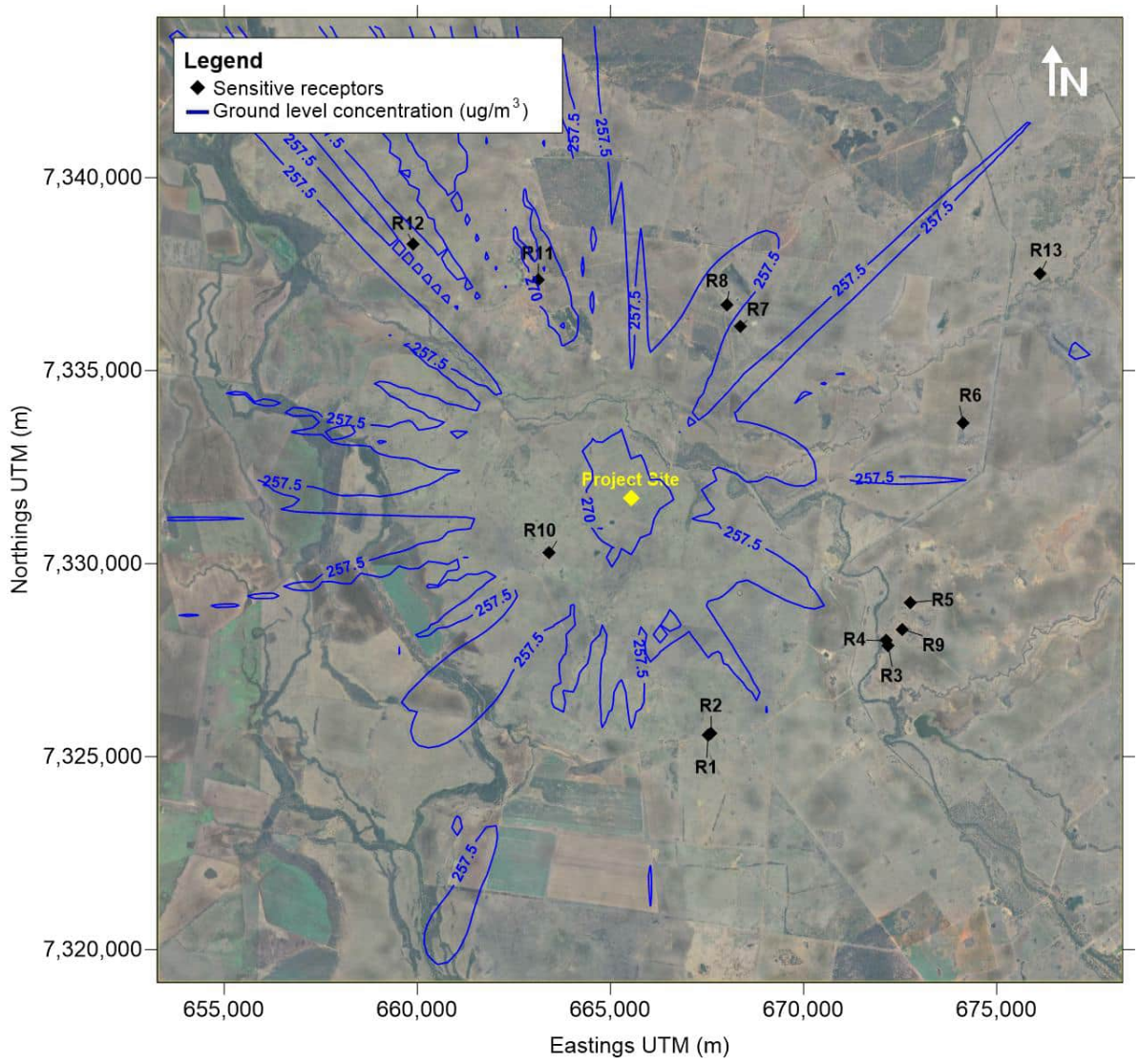


Plate 5 **Non-routine (emergency or upset) operations: Predicted 8-hour average ground-level concentrations of CO due to emissions from the Project with background**

Location: Mahalo Gas Hub, Queensland	**Averaging period:** 8-hour	**Data source:** CALPUFF	**Units:** µg/m^3
Type: Maximum	**Objective:** 11,000 µg/m^3 (Air EPP and Air NEPM)	**Prepared by:** Alexander Scholten	**Date:** May 2025

APPENDIX A METEOROLOGICAL AND DISPERSION MODELLING METHODOLOGY

A1 Meteorology

The meteorological modelling methodology for the Project included the following steps:

- Selection of a representative year
- TAPM modelling and validation
- CALMET modelling

The following sections describe each step of the meteorological modelling conducted for the Project. A summary of the meteorological data generated is provided in Section A1.4.

A1.1 Selection of representative year

A representative year is required to be selected at the beginning of the meteorological modelling process. Using a representative year in the air quality assessment ensures that the typical conditions experienced at the Project site are reflected in the model.

Selection of a representative year has been done through statistical analysis of historical meteorological observations at the Bureau of Meteorology automatic weather stations located at Emerald, Blackwater, and Rolleston. The data from three stations were chosen to be used to give a better representation of the typical weather at the site. Meteorological observations from the 2017 to 2022 six-year period at each of the three stations were analysed to assess the inter-annual variability. The locations of the BoM stations relative to the site are shown in Figure 5.

For reporting purposes, only results from the Rolleston station are presented. However, for determining the representative year, results from all three stations have been considered. Figure A1 presents annual wind roses for the six years and shows that inter-annual conditions are typically very similar. Figure A2 presents frequency distribution plots for humidity, wind direction, wind speed and temperature, with the year 2021 highlighted, and demonstrates that there is relatively little variation in the distribution of these variables year-on-year. Figure A3 presents Z-Scores for each variable for each year, these being a measure of the variation of values in each individual year against the mean of values across all years.

The calendar year 2021 has been used for the modelling as it is judged to be the year with the least variation from the mean when averaged across all the parameters considered.

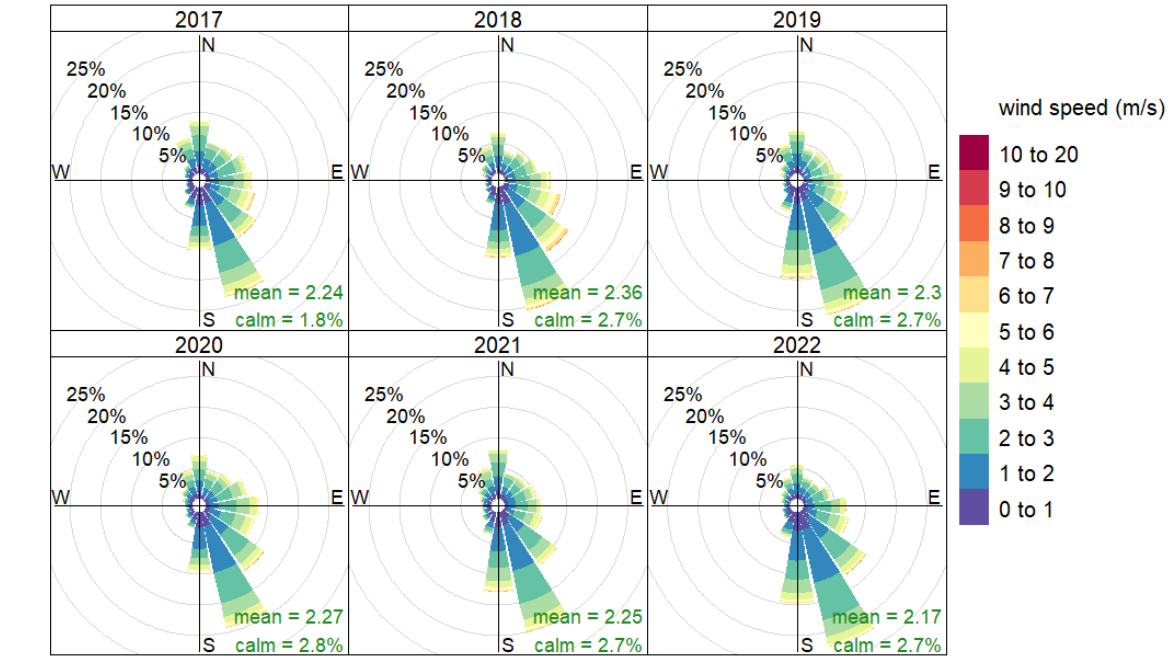


Figure A1 Annual wind roses for Rolleston between 2017 and 2022

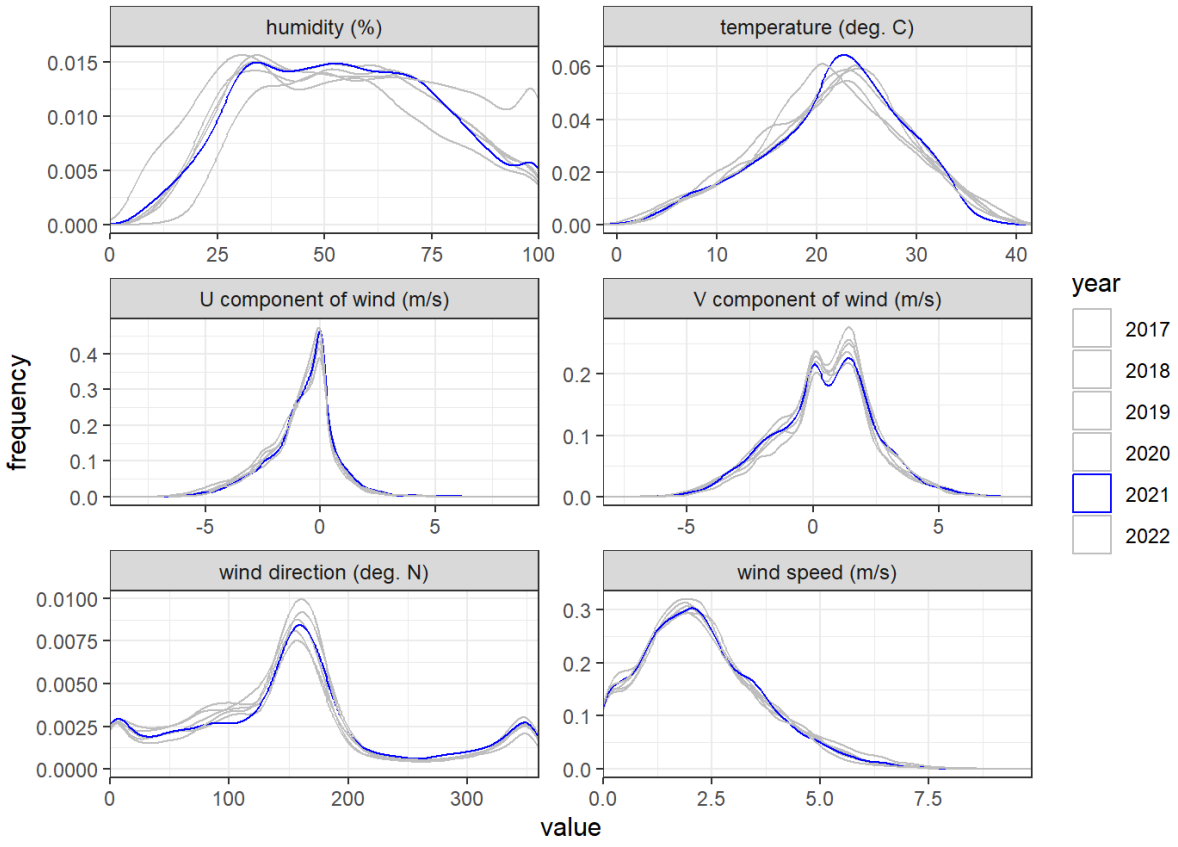


Figure A2 Annual frequency distributions plots for Rolleston between 2017 and 2022 (2021 highlighted)

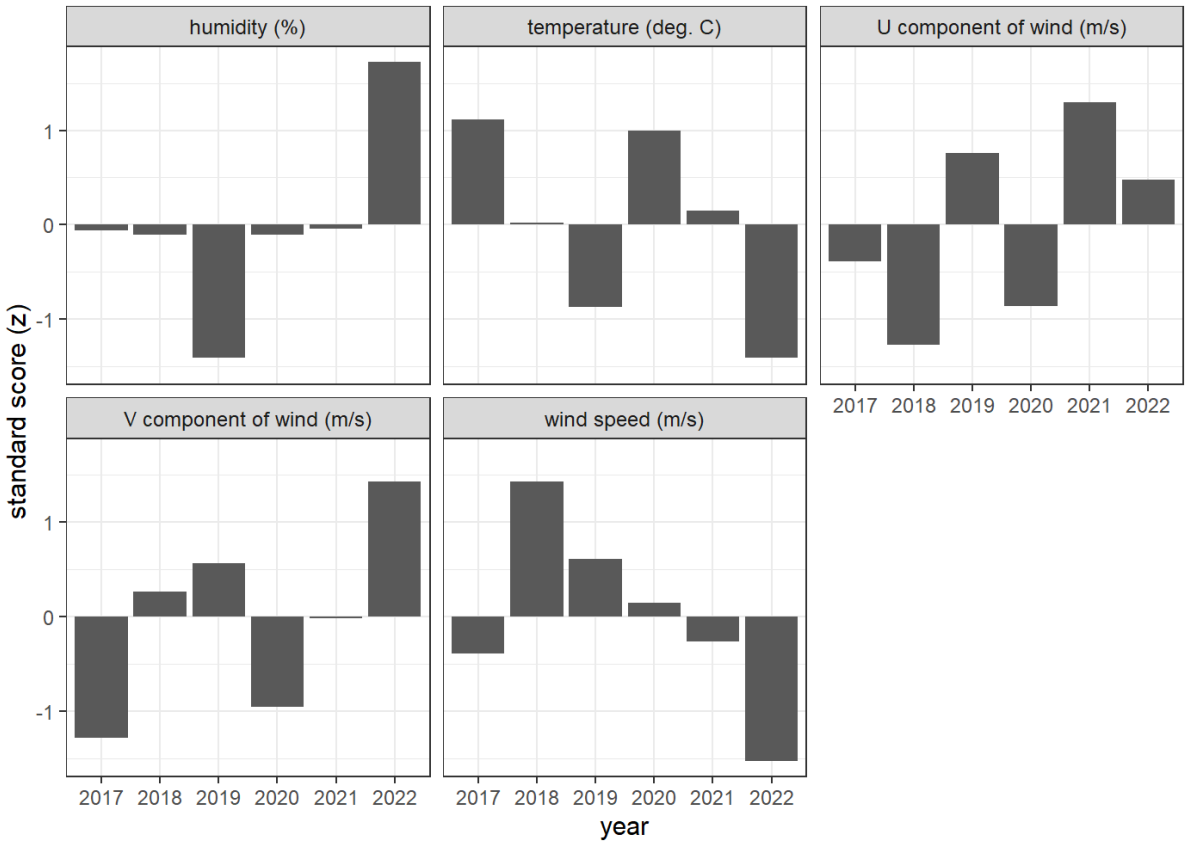


Figure A3 Z-Scores for Rolleston between 2017 and 2022

A1.2 TAPM meteorological modelling configuration

TAPM (The Air Pollution Model) was developed by the CSIRO and has been validated by the CSIRO, Katestone and others for many locations in Australia, in south-east Asia and in North America (CSIRO, 2008). Katestone has extensive experience with TAPM for sites throughout Australia and in parts of America, Bangladesh, New Caledonia and Vietnam. The model performs well in simulating regional wind patterns and has proven to be a useful tool for simulating meteorology in locations where monitoring data providing the vertical distribution of meteorological parameters are unavailable.

TAPM is a prognostic meteorological model which predicts the flows important to regional and local scale meteorology, such as sea breezes and terrain-induced flows from the larger-scale meteorology provided by the synoptic analyses. TAPM solves the fundamental fluid dynamics equations to predict meteorology at a mesoscale (20 km to 200 km) and at a local scale (down to a few hundred metres). TAPM includes parameterisations for cloud/rain micro-physical processes, urban/vegetation canopy, soil type and radiative fluxes.

TAPM requires synoptic meteorological information for the region. This information is generated by a global model similar to the large-scale models used to forecast the weather. The data were supplied on a grid resolution of approximately 75km, and at elevations of 100m to 5km above the ground. TAPM uses this synoptic information, along with specific details of the location such as surrounding terrain, land-use, soil moisture content and soil type to simulate the meteorology of a region as well as at a specific location.

TAPM version 4.0.5 was configured with the following parameters:

- Modelling period from 1 January 2021 to 31 December 2021
- 48 x 48 grid point domain with nesting resolutions of 30 km, 10 km, 3 km, and 1 km

- 25 vertical levels
- Grid centred on latitude -24° 4.0', longitude 148° 38.0'
- Geoscience Australia 9 second DEM terrain data
- TAPM default land cover data edited to be consistent with aerial imagery
- Default options selected for advanced meteorological inputs

A1.3 CALMET meteorological modelling configuration

CALMET is an advanced non-steady-state diagnostic 3D meteorological model with micro-meteorological modules for overwater and overland boundary layers. The model is the meteorological pre-processor for the CALPUFF modelling system. CALMET is capable of reading hourly meteorological data as data assimilation from multiple sites within the modelling domain; it can also be initialised with the gridded three-dimensional prognostic output from other meteorological models such as TAPM. This can improve dispersion model output, particularly over complex terrain as the near surface meteorological conditions are calculated for each grid point.

CALMET version 6.5.0 was used to simulate meteorological conditions in the region. The CALMET simulation was initialised with the gridded TAPM 3D wind field data from the 1 km grid. CALMET treats the prognostic model output as the initial guess field for the CALMET diagnostic model wind fields. The initial guess field is then adjusted for the kinematic effects of terrain, slope flows, blocking effects and 3D divergence minimisation.

CALMET was configured with default options and parameters, with the following selections:

- Modelling period from 1 January 2021 to 31 December 2021
- 50 x 50 grid point domain with 250 m resolution, nested within the TAPM inner domain
- 12 vertical levels at heights of 20, 60, 100, 150, 200, 250, 350, 500, 800, 1600, 2600 and 4600 metres
- Prognostic wind fields generated by TAPM input as MM5/3D.DAT at surface and upper air for "initial guess" field (no-observations mode)
- Gridded cloud cover from prognostic relative humidity at all levels
- No extrapolation of surface wind observations to upper layers
- Terrain radius of influence of 3 km.

A1.4 CALMET meteorological outputs

The following sections provide a description of the CALMET outputs as utilised in the CALPUFF dispersion modelling for the meteorological parameters that are important for the dispersion of air pollutants in the atmosphere, namely wind speed, wind direction, atmospheric stability, mixing layer height, and temperature. These parameters have been extracted from the TAPM/CALMET dataset at the GCF site.

A1.4.1 Wind speed and wind direction

The annual distribution of winds predicted by TAPM/CALMET for 2021 is presented in Figure A4. The seasonal and diurnal distribution of winds is presented in Figure A5 and Figure A6.

Winds across the study area are predominantly light to moderate (up to around 5 m/s) and from the north through to south-southeast direction. Winds are less frequent from the southwest and northwest sectors.

The seasonal breakdown of winds shows that the predominant north to south-southeast winds are strongest and most common during the spring and summer months. During autumn winds from the east-southeast to south-southeast are most frequent, while winds from the south-southeast dominate during winter.

The diurnal breakdown of winds shows that the strongest winds are predicted during the afternoon (midday to 6pm) when winds are predominantly from the northeast and southeast sectors. Winds are lightest during the evening and through the night.

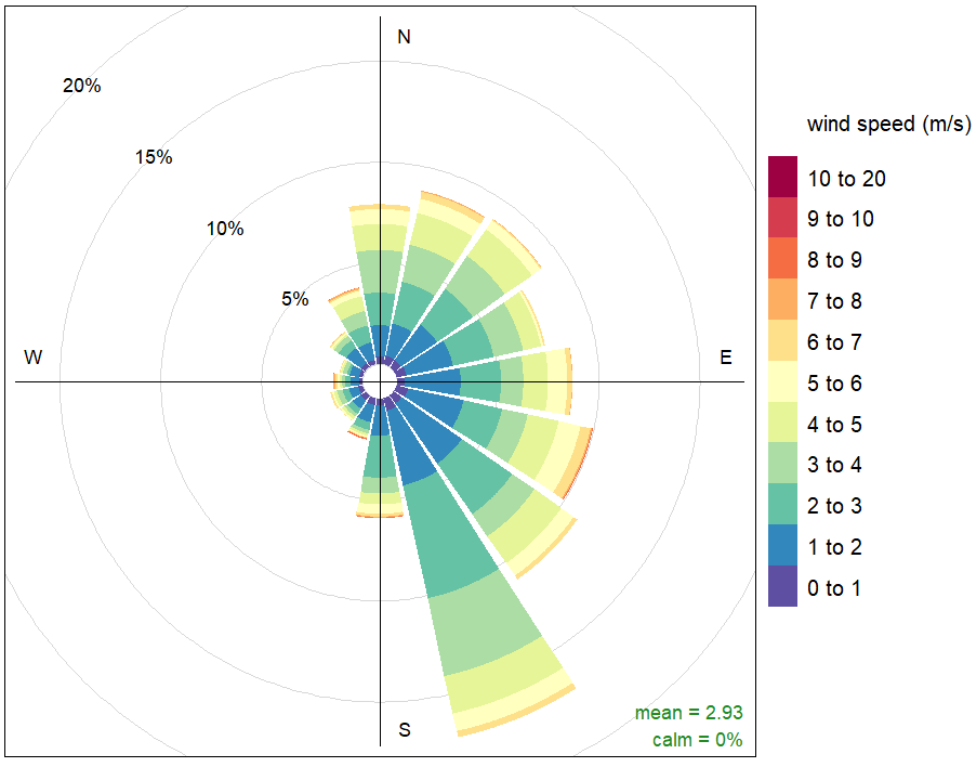


Figure A4 2021 Annual distribution of winds predicted by TAPM/CALMET

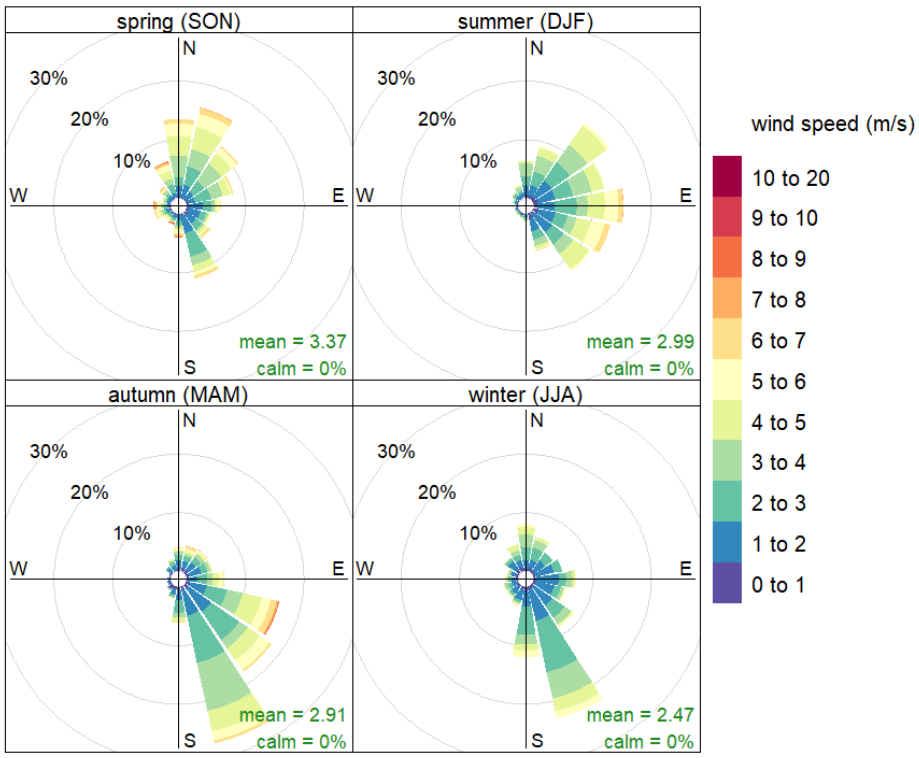


Figure A5 2021 Seasonal distribution of winds predicted by TAPM/CALMET

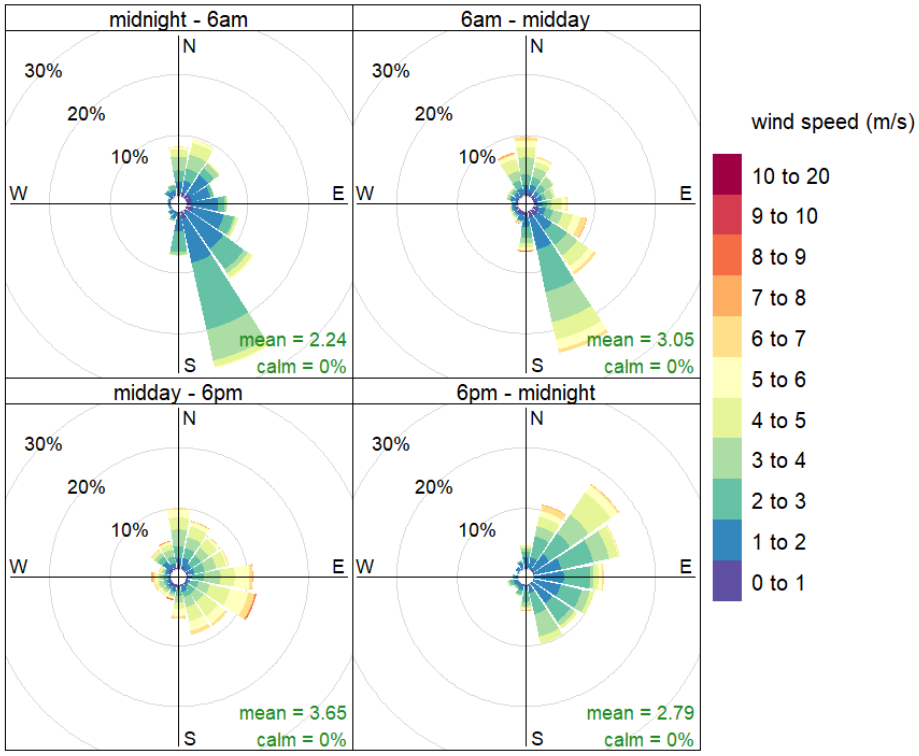


Figure A6 2021 Diurnal distribution of winds predicted by TAPM/CALMET

A1.4.2 Atmospheric stability

Stability classification is a measure of the stability of the atmosphere and can be determined from wind measurements and other atmospheric observations. The stability classes range from A Class, which represents very unstable atmospheric conditions that may typically occur on a sunny day, to F Class, which represents very stable atmospheric conditions that typically occur during light wind conditions at night. Unstable conditions (Classes A to C) are characterised by strong solar heating of the ground that induces turbulent mixing in the atmosphere close to the ground. This turbulent mixing is the main driver of dispersion during unstable conditions. Dispersion processes for Class D conditions are dominated by mechanical turbulence generated as the wind passes over irregularities in the local surface. During the night, the atmospheric conditions are generally stable (often Classes E and F).

Figure A7 shows the distribution of stability classes extracted from the TAPM/CALMET dataset, where Class A represents the most unstable conditions and Class F represents the most stable. Neutral (D class) conditions are present throughout the day, comprising 34% of total time. Stable (E class) and very stable (F class) conditions are the next most frequent, comprising 42% of total time, and only occur between 5 pm and 7 am.

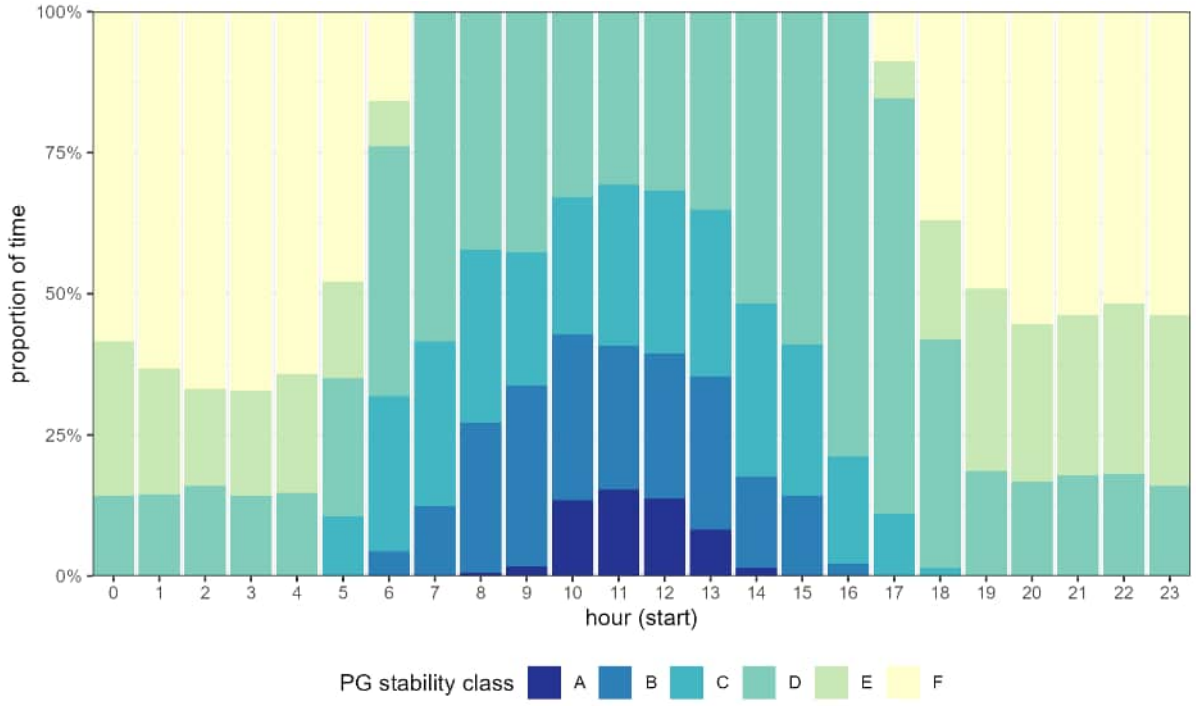


Figure A7 2021 Frequency distribution of atmospheric stability conditions predicted by TAPM/CALMET

A1.4.3 Mixing height

The mixing height defines the height of the mixed atmosphere above the ground (mixed layer), which varies diurnally. Air pollutants released at or near the ground will become dispersed within the mixed layer. During stable atmospheric conditions, the mixing height is often quite low, and dispersion is limited to within this layer. During the day, solar radiation heats the ground and causes the air above it to warm, resulting in convection and an increase to the mixing height. The growth of the mixing height is dependent on how well the warmer air from the ground can mix with the cooler upper-level air and, therefore, depends on meteorological factors such as the intensity of solar radiation and wind speed. Strong winds cause the air to be well mixed, resulting in a high mixing height.

Mixing height information extracted from the TAPM/CALMET dataset are presented as a diurnal frequency (box and whisker) plot in Figure A8. The plot shows that, on average, the mixing height begins to increase around 6am and peaks around 4pm before descending rapidly into the evening.

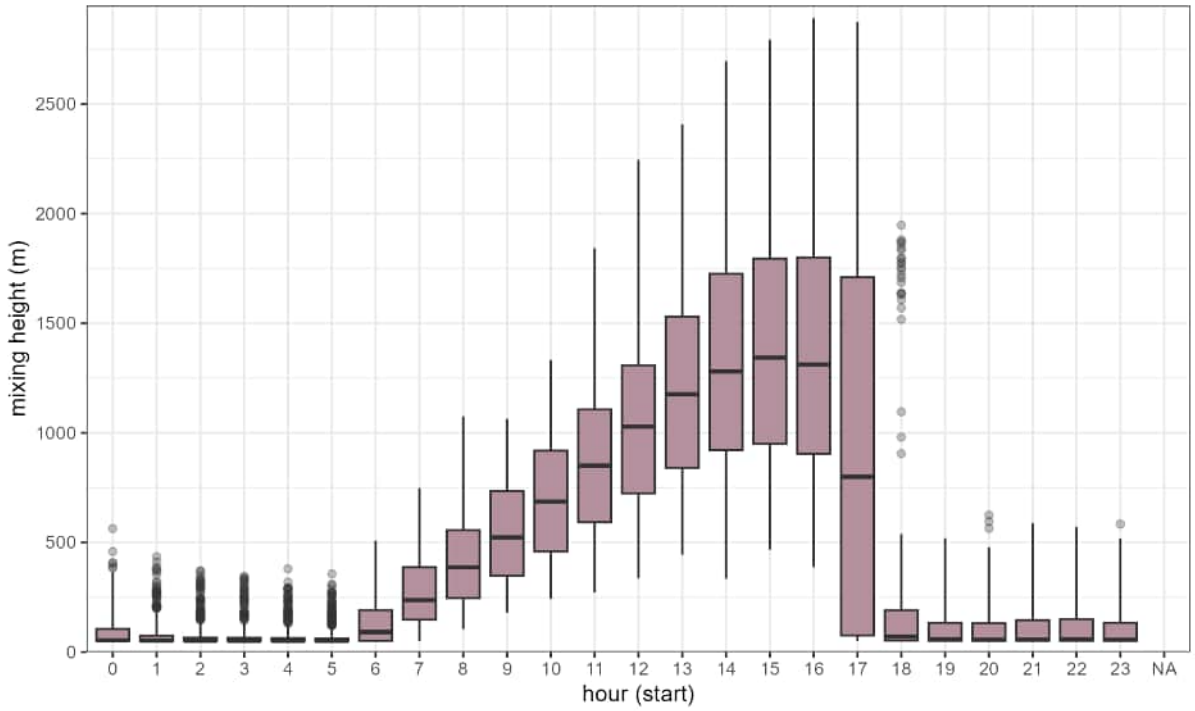


Figure A8 2021 Diurnal profile of mixing height predicted by TAPM/CALMET

A2 Dispersion modelling

A2.1 Input parameters

CALPUFF simulates the dispersion of air pollutants to predict ground-level concentration and deposition rates across a network of receptors spaced at regular intervals, and at identified discrete locations. CALPUFF is a non-steady-state Lagrangian Gaussian puff model containing parameterisations for complex terrain effects, overwater transport, coastal interaction effects, building downwash, wet and dry removal, and simple chemical transformation. CALPUFF employs the 3D meteorological fields generated from the CALMET model by simulating the effects of time and space varying meteorological conditions on pollutant transport, transformation, and removal.

CALPUFF takes into account the geophysical features of the study area that affect dispersion of pollutants and ground-level concentrations of those pollutants in identified regions of interest. CALPUFF contains algorithms that can resolve near-source effects such as building downwash, transitional plume rise, partial plume penetration, sub-grid scale terrain interactions, as well as the long-range effects of removal, transformation, vertical wind shear, overwater transport and coastal interactions. Emission sources can be characterised as arbitrarily varying point, area, volume and lines or any combination of those sources within the modelling domain.

Key features of CALPUFF used to simulate dispersion:

- Domain area of 50 by 50 grids at 0.5 km spacing nested within the CALMET domain
- 365 days modelled (1 January 2021 to 31 December 2021)
- Gridded 3D hourly-varying meteorological conditions generated by CALMET
- Partial plume path adjustment for terrain modelled

- Dispersion coefficients calculated internally from sigma v and sigma w using micrometeorological variables
- Stack tip downwash, transitional plume rise, and PDF used for dispersion under convective conditions

All other options set to default.

A2.2 Source configuration

The configuration of the 4-stage ground flare enclosed within an approximately 8 m high wind shield enclosure will be similar to the design shown in Figure A9. The emissions from this source have been represented in the CALPUFF model as a buoyant area source with an emissions area of 40 m by 40 m.

The three G3612 and three G3512 gas engines have been configured as point sources in the CALPUFF dispersion model.



Figure A9 Example of the 4-stage ground flare proposed for the Project

Appendix E: Noise Report

Noise Impact Assessment
Santos Limited
Mahalo Compressor Station Preliminary Assessment

Revision 4

Prepared for:

William Inonda, Senior Environmental Advisor

Santos Limited

Prepared by:

Patching Associates Acoustical Engineering Pty. Ltd.

Consultants in Acoustics, Noise Control and Vibration

2025-06-03

PAAE Document ID: 006915-NIA-004

Santos Document No: 5149-650-STU-0001



Notice

This report has been prepared by Patching Associates Acoustical Engineering Ltd (PAAE) in response to a specific request for service from, and for the exclusive use of, the Client to whom it is addressed. The findings contained in this report are based, in part, upon information provided by others. The information contained in this study is not intended for the use of, nor is it intended to be relied upon, by any person, firm, or corporation other than the Client to whom it is addressed, except for the applicable regulating authority to whom this document may be submitted. PAAE accepts no liability or responsibility for any damages that may be suffered or incurred by any third party because of the use of, reliance on, or any decision made based on this report.

Professional Authentication

Project Role: Engineer of Record	Project Role: Validating Responsible Member
Date: 2025-06-03	Date: 2025-06-03
Patching Associates Acoustical Engineering Ltd.	Patching Associates Acoustical Engineering Ltd.
Name: Justin Caskey, P.Eng. RPEQ#31520	Name: Justin Caskey, P.Eng. RPEQ#31520

Prepared by:

Technical Lead: Sumita Biswas, Ph.D.
Project Engineer: Justin Caskey, P.Eng.

Executive Summary

Santos Limited retained Patching Associates Acoustical Engineering Ltd. to conduct a Noise Impact Assessment (NIA) for the operation phase of the Mahalo Compressor Station (Subject Facility) located approximately 41 km north of Rolleston QLD, Australia. This NIA was conducted in accordance with the requirements of the Environmental Protection (Noise) Policy 2019 (EPP noise) for Rolleston where applicable and the Environmental Authority P-EA-100178150 (the EA).

In this Noise Impact Assessment (NIA), Santos has selected an alternative location to the west of the original site to relocate the equipment and evaluate its impact on the surrounding receivers. A new location was investigated after the original location failed to meet the objectives of EPP noise and the EA at all sensitive receivers. Additionally, a new compressor of a different make and model is proposed to replace the originally selected one. Furthermore, a water treatment plant has been included on the south side of the facility, as indicated in a previous model for another similar facility (Document ID: 005344-NIA-001).

The purpose of this assessment is to understand the extent of noise emissions from the compressor facility including the flare and suggest best practice control/management measures if the emissions do not meet the EA conditions. Moreover, a second operating condition with no-wind has been included in this report. The target level is to achieve 28dBA at the nearest sensitive receiver including background noise. Seven operating scenarios were included in this study:

- S1E: Maximum Flare Elevated
- S1G: Maximum Flare Ground
- S2A: Normal Operation no Enclosures
- S2B: Normal Operation with Enclosures
- S3AG: Upset without Enclosures Ground Flare
- S3BE: Upset with Enclosures Elevated Flare
- S3BG: Upset with Enclosures Ground Flare

The table below summarizes overall Sound Pressure Levels (SPL) predictions from the model. The Facility SPL is the overall SPL from all the facilities in the study area for the seven operating scenarios. The Permissible Sound Level (PSL) is the permissible or targeted sound level for the given receiver.

Overall Sound Pressure Levels, As Proposed

Receiver	Scenario S1E			Scenario S1G			Scenario S2A		
	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL
R03	29.5	**30.8**	No	14.2	**25.3**	Yes	20.4	**26.3**	Yes
R04	29.2	**30.6**	No	14.0	**25.3**	Yes	20.0	**26.2**	Yes
R05	33.8	**34.3**	No	13.8	**25.3**	Yes	21.2	**26.5**	Yes
R06	34.4	**34.9**	No	23.3	**27.2**	Yes	23.8	**27.5**	Yes
R08	33.7	**34.2**	No	23.2	**27.2**	Yes	23.4	**27.3**	Yes
R12	29.6	**30.9**	No	8.2	**25.1**	Yes	19.1	**26.0**	Yes
R15	23.4	**27.3**	Yes	16.2	**25.5**	Yes	15.9	**25.5**	Yes
R16	30.1	**31.3**	No	18.5	**25.9**	Yes	21.7	**26.7**	Yes

*Assumes ambient baseline noise level of 25 dBA.

Overall Sound Pressure Levels, As Proposed

Receiver	Scenario S2B			Scenario S3BE		
	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL
R03	9.3	**25.1**	Yes	14.5	**25.4**	Yes
R04	9.1	**25.1**	Yes	14.3	**25.4**	Yes
R05	11.7	**25.2**	Yes	18.4	**25.9**	Yes
R06	13.4	**25.3**	Yes	19.3	**26.0**	Yes
R08	12.3	**25.2**	Yes	18.6	**25.9**	Yes
R12	9.8	**25.1**	Yes	14.6	**25.4**	Yes
R15	5.9	**25.1**	Yes	9.0	**25.1**	Yes
R16	10.2	**25.1**	Yes	15.3	**25.4**	Yes

*Assumes ambient baseline noise level of 25 dBA.

Overall Sound Pressure Levels, As Proposed

Receiver	Scenario S3BG			Scenario S3AG		
	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL
R03	9.6	**25.1**	Yes	17.1	**25.7**	Yes
R04	9.5	**25.1**	Yes	16.5	**25.6**	Yes
R05	10.0	**25.1**	Yes	19.1	**26.0**	Yes
R06	14.5	**25.4**	Yes	23.2	**27.2**	Yes
R08	14.3	**25.4**	Yes	23.0	**27.1**	Yes
R12	9.1	**25.1**	Yes	20.7	**26.4**	Yes
R15	7.8	**25.1**	Yes	14.7	**25.4**	Yes
R16	11.1	**25.2**	Yes	17.7	**25.7**	Yes

*Assumes ambient baseline noise level of 25 dBA.

Overall Sound Pressure Levels, As Proposed (No wind condition)

Receiver	Scenario S1E			Scenario S1G			Scenario S2A		
	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL
R03	21.3	**26.5**	Yes	5.8	**25.1**	Yes	12.7	**25.2**	Yes
R04	21.0	**26.5**	Yes	5.6	**25.0**	Yes	12.3	**25.2**	Yes
R05	25.5	**28.3**	No	5.3	**25.0**	Yes	13.5	**25.3**	Yes
R06	27.0	**29.1**	No	15.6	**25.5**	Yes	16.8	**25.6**	Yes
R08	26.1	**28.6**	No	15.4	**25.5**	Yes	16.3	**25.5**	Yes
R12	20.7	**26.4**	Yes	-0.8	**25.0**	Yes	10.8	**25.2**	Yes
R15	15.2	**25.4**	Yes	8.0	**25.1**	Yes	8.4	**25.1**	Yes
R16	22.2	**26.8**	Yes	10.4	**25.1**	Yes	14.2	**25.3**	Yes

*Assumes ambient baseline of 25 dBA.

Overall Sound Pressure Levels, As Proposed (No wind condition)

Receiver	Scenario S2B			Scenario S3BE		
	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL
R03	2.4	**25.0**	Yes	6.6	**25.1**	Yes
R04	2.2	**25.0**	Yes	6.4	**25.1**	Yes
R05	4.6	**25.0**	Yes	10.3	**25.1**	Yes
R06	6.9	**25.1**	Yes	12.1	**25.2**	Yes
R08	5.9	**25.1**	Yes	11.2	**25.2**	Yes
R12	2.5	**25.0**	Yes	6.0	**25.1**	Yes
R15	-0.6	**25.0**	Yes	1.4	**25.0**	Yes
R16	3.4	**25.0**	Yes	7.6	**25.1**	Yes

*Assumes ambient baseline noise level of 25 dBA.

Overall Sound Pressure Levels, As Proposed (No wind condition)

Receiver	Scenario S3BG			Scenario S3AG		
	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL
R03	2.3	**25.0**	Yes	9.4	**25.1**	Yes
R04	2.1	**25.0**	Yes	8.7	**25.1**	Yes
R05	2.8	**25.0**	Yes	11.3	**25.2**	Yes
R06	7.4	**25.1**	Yes	16.1	**25.5**	Yes
R08	7.1	**25.1**	Yes	15.9	**25.5**	Yes
R12	1.8	**25.0**	Yes	12.4	**25.2**	Yes
R15	0.6	**25.0**	Yes	7.1	**25.1**	Yes
R16	4.0	**25.0**	Yes	10.3	**25.1**	Yes

*Assumes ambient baseline noise level of 25 dBA.

The above results indicate that the Cumulative SPL is expected to exceed the PSL at some of the receivers in the study area for the maximum flaring event and meet the PSL for all other scenarios. The most impacted receiver is R06 located approximately 5440m SSE from the subject facility. Additional noise control is not required for the subject facility to comply with the requirements at the Sensitive Receivers.
The results also indicate that- a) ground flare is necessary; b) compressor enclosures are not required.

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Acronyms

Acronym	Description
ASL	Ambient Sound Level
dB	Decibel
dBA	A-Weighted Decibel
dBC	C-Weighted Decibel
dBZ	Z-Weighted Decibel or Linear Decibel
DIL	Dynamic Insertion Loss
ISO	International Organization for Standardization
L_{eq}	Energy Equivalent Sound Level
LFN	Low Frequency Noise
NIA	Noise Impact Assessment
NC	Noise Control
NR	Noise Reduction
PSL	Permissible Sound Level
PWL	Sound Power Level
SPL	Sound Pressure Level
TL	Transmission Loss
UTM	Universal Transverse Mercator

Introduction

Santos Limited retained Patching Associates Acoustical Engineering Ltd. to conduct a Noise Impact Assessment (NIA) for the operation phase of the Mahalo Compressor Station (Subject Facility) located approximately 41 km north of Rolleston QLD, Australia. This NIA was conducted in accordance with the requirements of the Environmental Protection (Noise) Policy 2019 (EPP noise) for Rolleston where applicable and the Environmental Authority P-EA-100178150 (the EA).

In this Noise Impact Assessment (NIA), Santos has selected an alternative location to the west of the original site to relocate the equipment and evaluate its impact on the surrounding receivers. A new location was investigated after the original location failed to meet the objectives of EPP noise and the EA at all sensitive receivers. Additionally, a new compressor of a different make and model is proposed to replace the originally selected one. Furthermore, a water treatment plant has been included on the south side of the facility, as indicated in a previous model for another similar facility (Document ID: 005344-NIA-001).

The scope of this assessment is to understand the extent of noise emissions from the compressor facility including the flare and suggest best practice control/management measures if the emissions do not meet the EA conditions. Additionally, a second operating condition with no-wind has been included in this report. The target level is to achieve 28dBA at the nearest sensitive receiver including background noise. The target is to achieve a sound pressure level of 28dBA at the nearest sensitive receiver including background noise. Six running scenarios were included in this study:

- S1E: Maximum Flare Elevated
- S1G: Maximum Flare Ground
- S2A: Normal Operation no Enclosure
- S2B: Normal Operation Enclosure
- S3AG: Upset with no Enclosures Ground Flare
- S3BE: Upset Enclosure Elevated Flare
- S3BG: Upset Enclosure Ground Flare

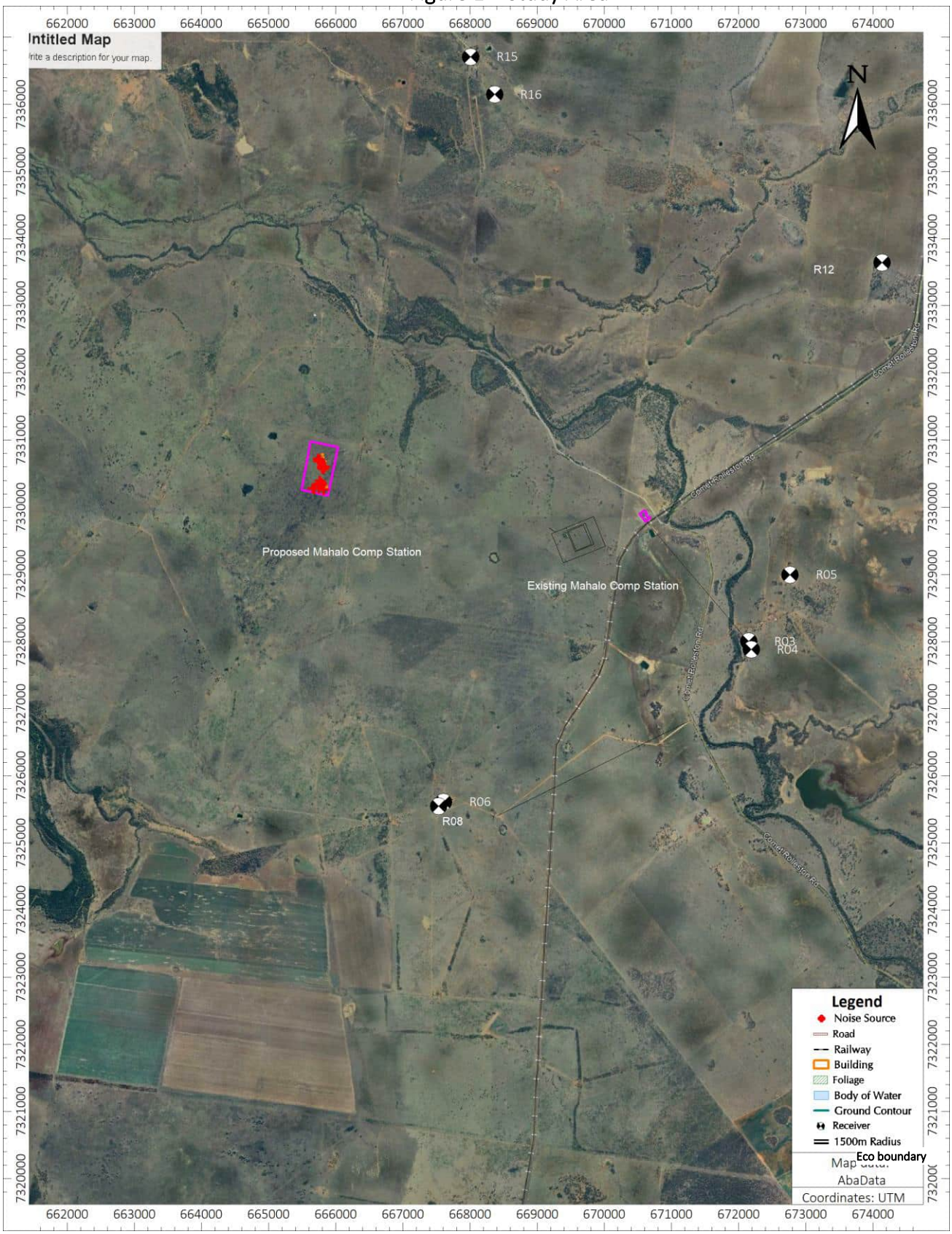
Study Area

The subject facility is located approximately 40 km north from north of Rolleston QLD, Australia at 148.630811 Longitude and -24.127293 Latitude.

In this study, there exist eight (8) potentially sensitive receivers in the study area. The locations of these receivers were obtained from Santos supplied data. The nearby proposed water treatment plant (WTP) and substation were incorporated into this assessment. The terrain cover is mainly flat grassland.

Figure 1 shows a map of the study area. The locations of these receivers were obtained from information supplied by Santos.

Figure 1 – Study Area



Noise Criteria

The noise criteria were set out by the client according to the environmental authority for the area at the residential locations.

The criteria (Permissible Sound Level, PSL) for the assessment is to maintain facility sound pressure levels at or below 25 dBA at the residential sensitive receivers (28 dBA overall with an ambient of 25 dBA), based on the extract below obtained from the environmental authority P-EA-100178150. This assessment considered continuous steady state noise and does not include potential adjustments for impulsiveness, tonality, or low frequency noise. PAAE measured the sound pressure level at the fence line of a facility similar to Mahalo (ACS-03, Document ID:006612-NIA-000 ACS-03 Arcadia Valley NIA-DRAFT) in August 2024. Sound pressure level data were recorded for ten consecutive nights and analyzed from that site. The analysis result indicates that no tonal components were present at the facility. Since the Mahalo compressor station has equipment similar to that of ACS-03, tonality has not been considered in this study.

The ambient 25dBA referring to the EA background (10 pm to 6 am) suggests this is the baseline environmental noise level expected during nighttime hours. If the standard specifies compliance during these hours, it implies that noise levels will not exceed the Permissible limit during the remaining hours as well.

3 SCHEDULE C - NOISE

(C1) Notwithstanding condition (A18), emission of noise from the petroleum activity(ies) at levels less than those specified in *Schedule C, Table 1—Noise nuisance limits at a sensitive receptor* are not considered to be environmental nuisance.

Schedule C, Table 1—Noise nuisance limits at a sensitive receptor

Time period	Metric	Short term noise event	Medium term noise event	Long term noise event
7:00am—6:00pm	$L_{Aeq,adj,15\ min}$	45 dBA	43 dBA	40 dBA
6:00pm—10:00pm	$L_{Aeq,adj,15\ min}$	40 dBA	38 dBA	35 dBA
10:00pm—6:00am	$L_{Aeq,adj,15\ min}$	28 dBA	28 dBA	28 dBA
	Max $L_{pA,\ 15\ mins}$	55 dBA	55 dBA	55 dBA
6:00am—7:00am	$L_{Aeq,adj,15\ min}$	40 dBA	38 dBA	35 dBA

1. The noise limits in Table 1 have been set based on the following deemed background noise levels (L_{ABG}):
7:00am—6:00 pm: 35 dBA
6:00pm—10:00 pm: 30 dBA
10:00pm—6:00 am: 25 dBA
6:00am—7:00 am: 30 dBA

This study does not consider occupational health and safety noise levels.

Major Equipment

Table 1A gives details of the major equipment modeled for Mahalo Compressor Station. The details were obtained from the client. See Appendix C for a plot plan showing the subject facility equipment layout.

Table 1A List of All Subject Facility Equipment with Equipment Details

Equipment Name	Number of Units	Equipment Details
Elevated Flare	1	• 50 TJ flare, 37' high, sound power level estimated based on operating measurement of ACS-02 flare at 10 TJ as well as sound emissions data obtained from the manufacturer see Appendix B.
Ground Flare	1	• The noise model for the flare is based on the sound power level from Zeeco, 6 flares, stack height of 1.49 m. (Ref: 005389-LTR-003)The flare wall height is 8m.
TEG Dehydration Packages	1	• Noise emissions were obtained from a previous noise model for the ACS-02 facility provided by Santos (Santos Document number 5158-650-STU-0001).
Main Compressor Packages #1, #2, #3	3	For each unit: • Compressor: Ariel JDG/4, reciprocating, • Engine: Caterpillar 3612, 1,000 RPM, 4125 HP. The Sound power level is scaled up according to the Power rating change from Caterpillar 3608. For 3608, it is assumed that the engine exhaust silencer, engine air intake, building walls and vents will have a design similar to the ACS-03. Noise emissions of CAT 3608 were obtained from ACS-03 facility during field measurement by PAAE staff in 2024. A photo of the unit is provided in Appendix B. • Noise emission of the compressor and driver engine without any enclosure was derived from theoretical calculation • Cooling Unit: AXH 168-2ZF, 24.5 HP, 14' fan diameter. AXH 132-2ZF, two (2) 30kW motors • Enclosure: Insulated metal building with perforated liner
Transformer #3, #4	2	• Noise emissions were obtained from a previous noise model for the ACS-02 facility provided by the client (Santos Document number 5158-650-STU-0001).
HV VSD Transformer #1, #2, #3	3	• Noise emissions were obtained from a previous study on similar equipment.
Gas Engine Generator Set	3	• Noise emissions were obtained from measurement carried out by Patching at ACS-02 facilities • Engine: caterpillar G3512E, 984 kW, Unknown make and model of muffler. A photo of the unit is provided in Appendix B to support design/procurement of the new units. • Typical resistive load bank. Noise emissions were obtained from a previous study on the equipment by PAAE staff.
Diesel Engine Generator Set	1	• For emergency use only and excluded from the analysis
Compressor Air Package	1	• Assumed electric motor driven compressor, <300 HP, 3600RPM • Located in a typical building, with doors and windows open
Modeled Operating Scenarios		
Scenario S1E		• Elevated flare with maximum Flaring (ESD) -Full capacity flare rate of 50MMSCFD, all other equipment shut down, including the water treatment plant, only flare operating, maximum duration 5 min.
Scenario S1G		• Ground flare with maximum flaring (ESD) -Full capacity flare rate of 50MMSCFM, all other equipment shut down, including the water treatment plant, maximum duration 5 min.
Scenario S2A		• Normal Maximum Operation - Main compressor units operating without building, typical fans, no flaring.
Scenario S2B		• Normal Maximum Operation - Main compressor units operating with building, typical fans, no flaring.
Scenario S3AG		• Machine Trip - One flare firing (ground flare), main compressor units operating without buildings, typical fans, one compressor shut down and balance of the plant running

Equipment Name	Number of Units	Equipment Details
Scenario S3BE		• Machine Trip - 3MMSCFD flaring (elevated flare), Main compressor units operating with building, typical fans, one compressor shut down and balance of the plant running.
Scenario S3BG		• Machine Trip - One flare firing (ground flare), main compressor units operating with buildings, typical fans, one compressor shut down and balance of the plant running.

Table 1B lists the adjacent facilities that are included in the NIA. The facility information was obtained from the client and previous study carried out by PAAE (5344-NIA-000, Santos D 1724-650-REP-0001 dated 26-11-2019) Detailed equipment description is outlined in Appendix B.

Table 1B: Adjacent Facility Water Treatment Plant Equipment Details

Equipment Name	Operation	Equipment Details
Water Treatment Plant	Various	• Pumps • Blowers • Small scale compressors • See **Appendix B** for equipment details • Pre-treatment plant excluded

Method

The method used in the NIA follows the requirements set forth in the regulations.

- The study area and facility physical layouts were determined from drawings obtained by the client and satellite images.
- The Sound Power Levels (PWLs) were determined for the major facility noise sources through theoretical calculations, manufacturer's data, and previous study on similar units. See Appendix D for a list of all the calculated PWLs.
- It is assumed that the facility operating conditions do not change significantly between the daytime and the nighttime period. As such, the NIA analysis focuses solely on the nighttime period, as the permissible sound level is more stringent during the nighttime than during the daytime.
- Sound propagation calculations were undertaken using the noise modeling software package CadnaA to determine the facility SPL at the receivers. All calculations were undertaken in linear octave bands.
- The resulting SPL were compared to the PSL to determine if the subject facility complies with the regulations. Where the Facility SPL exceed the PSL, then noise control recommendations are designed to bring the facility SPL down to meet the PSL for all the receivers in the study area.

Environmental conditions are modelled using the same weather conditions and modelling parameters from the Subject Facility, that of 3 m/s wind in "worst case direction", which allows down-wind from each source to each receiver.

Modeling Parameters

Table 2 lists the major parameters used in the noise model. These parameters meet the guideline set forth in EPP (Noise) 2019. The modeled conditions produce results representative of meteorological conditions favoring sound propagation (e.g., downwind or mild temperature inversion conditions) during the summer nighttime.

These conditions do not occur all the time at the receiver and the resulting SPL are expected to be lower than those predicted for most of the time. Therefore, the environmental conditions modelled represent "close-to-worst-case" sound propagation conditions.

Table 2: Modeling Parameters

Parameter	Value	Description
Modeling software	CadnaA by Datakustik Version 2025 MR1	Advanced noise propagation model considering geometric spreading, atmospheric sound absorption, ground impedance, site topography and geometry, vegetation and environmental conditions. CadnaA models calculate the contributing level of each noise source at the receiver location in octave bands as well as calculating the overall facility sound level.
Standard adopted	Concawe	Specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources.
Wind Condition	3 m/s Downwind Factor D	Concawe uses a slight downwind condition from each noise source to each receiver. Wind speed is measured at a height of 3 m to 11 m above ground. The Pasquill Stability factor considered is D
Ground Factor	0.0 for water bodies and roads 0.3 within all facility limits 0.6 everywhere else	The ground factor G is a property of the ground material, with value ranging from 0 to 1. The typical values below were determined from several standards and values, including ISO 9613, Commission Directive EU 2015/996, and Nord 2000. G = 0.0 is suitable for asphalt, concrete, pavement, water G = 0.3 is suitable for compacted dense ground, gravel road, hard soil G = 0.6 is suitable for sand, compacted field and gravel, roadside dirt G = 0.8 is suitable for cultivated land, such as farmland G = 1.0 is suitable for uncultivated land, such as forest floor and loose ground
Order of Reflection	3	The model calculates reflection effects from the reflective surfaces included in the model.
Foliage	Not Included	Not included based on conservative considerations due to the presence of human dwellings in the study area.
Temperature	0ºC	Represents typical winter night-time temperature.
Relative Humidity	100%	Represents typical winter night-time relative humidity.
Topography	Included	Topographical data obtained from Queensland Spatial. Resolution: 10m.

Results

Overall Sound Pressure Levels

Tables 3A-3F summarize the overall Sound Pressure Levels (SPL) predictions from the model for each receiver in the study area for the three running scenarios. The Facility SPL is the overall SPL from all the facilities in the study area. The Cumulative SPL includes the contribution of the Facility SPL and the Ambient Sound Pressure Levels (ASL).

Table 3A: Overall Sound Pressure Levels - As Proposed (Scenario S1E)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBC-dBA
R03	6970 m ESE	28.0	25.0	29.5	**30.8**	No	3.1
R04	7060 m ESE	28.0	25.0	29.2	**30.6**	No	3.1
R05	7250 m ESE	28.0	25.0	33.8	**34.3**	No	3.1
R06	5440 m SSE	28.0	25.0	34.4	**34.9**	No	2.8
R08	5480 m SSE	28.0	25.0	33.7	**34.2**	No	2.8
R12	8910 m ENE	28.0	25.0	29.6	**30.9**	No	3.4
R15	6410 m NNE	28.0	25.0	23.4	**27.3**	Yes	3.4
R16	6040 m NNE	28.0	25.0	30.1	**31.3**	No	3.2

Table 3B: Overall Sound Pressure Levels - As Proposed (Scenario S1G)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBC-dBA
R03	6970 m ESE	28.0	25.0	14.2	**25.3**	Yes	3.6
R04	7060 m ESE	28.0	25.0	14.0	**25.3**	Yes	3.7
R05	7250 m ESE	28.0	25.0	13.8	**25.3**	Yes	3.6
R06	5440 m SSE	28.0	25.0	23.3	**27.2**	Yes	3.4
R08	5480 m SSE	28.0	25.0	23.2	**27.2**	Yes	3.4
R12	8910 m ENE	28.0	25.0	8.2	**25.1**	Yes	3.9
R15	6410 m NNE	28.0	25.0	16.2	**25.5**	Yes	3.6
R16	6040 m NNE	28.0	25.0	18.5	**25.9**	Yes	3.5

Table 3C: Overall Sound Pressure Levels - As Proposed (Scenario S2A)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBC-dBA
R03	6970 m ESE	28.0	25.0	20.4	**26.3**	Yes	8.7
R04	7060 m ESE	28.0	25.0	20.0	**26.2**	Yes	8.9
R05	7250 m ESE	28.0	25.0	21.2	**26.5**	Yes	8.2
R06	5440 m SSE	28.0	25.0	23.8	**27.5**	Yes	7.6
R08	5480 m SSE	28.0	25.0	23.4	**27.3**	Yes	7.8
R12	8910 m ENE	28.0	25.0	19.1	**26.0**	Yes	9.4
R15	6410 m NNE	28.0	25.0	15.9	**25.5**	Yes	10.9
R16	6040 m NNE	28.0	25.0	21.7	**26.7**	Yes	8.5

Table 3D: Overall Sound Pressure Levels - As Proposed (Scenario S2B)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBC-dBA
R03	6970 m ESE	28.0	25.0	9.3	**25.1**	Yes	15.0
R04	7060 m ESE	28.0	25.0	9.1	**25.1**	Yes	15.1
R05	7250 m ESE	28.0	25.0	11.7	**25.2**	Yes	14.5
R06	5440 m SSE	28.0	25.0	13.4	**25.3**	Yes	14.3
R08	5480 m SSE	28.0	25.0	12.3	**25.2**	Yes	14.7
R12	8910 m ENE	28.0	25.0	9.8	**25.1**	Yes	15.0
R15	6410 m NNE	28.0	25.0	5.9	**25.1**	Yes	16.7
R16	6040 m NNE	28.0	25.0	10.2	**25.1**	Yes	15.1

Table 3E: Overall Sound Pressure Levels - As Proposed (Scenario S3BE)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBC-dBA
R03	6970 m ESE	28.0	25.0	14.5	**25.4**	Yes	8.5
R04	7060 m ESE	28.0	25.0	14.3	**25.4**	Yes	8.5
R05	7250 m ESE	28.0	25.0	18.4	**25.9**	Yes	6.1
R06	5440 m SSE	28.0	25.0	19.3	**26.0**	Yes	7.1
R08	5480 m SSE	28.0	25.0	18.6	**25.9**	Yes	7.4
R12	8910 m ENE	28.0	25.0	14.6	**25.4**	Yes	8.4
R15	6410 m NNE	28.0	25.0	9.0	**25.1**	Yes	12.2
R16	6040 m NNE	28.0	25.0	15.3	**25.4**	Yes	9.2

Table 3F: Overall Sound Pressure Levels - As Proposed (Scenario S3BG)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBC-dBA
R03	6970 m ESE	28.0	25.0	9.6	**25.1**	Yes	13.6
R04	7060 m ESE	28.0	25.0	9.5	**25.1**	Yes	13.6
R05	7250 m ESE	28.0	25.0	10.0	**25.1**	Yes	13.8
R06	5440 m SSE	28.0	25.0	14.5	**25.4**	Yes	11.7
R08	5480 m SSE	28.0	25.0	14.3	**25.4**	Yes	11.7
R12	8910 m ENE	28.0	25.0	9.1	**25.1**	Yes	14.6
R15	6410 m NNE	28.0	25.0	7.8	**25.1**	Yes	14.2
R16	6040 m NNE	28.0	25.0	11.1	**25.2**	Yes	13.5

Table 3G: Overall Sound Pressure Levels - As Proposed (Scenario S3AG)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBC-dBA
R03	6970 m ESE	28.0	25.0	17.1	**25.7**	Yes	9.8
R04	7060 m ESE	28.0	25.0	16.5	**25.6**	Yes	10.1
R05	7250 m ESE	28.0	25.0	19.1	**26.0**	Yes	8.5
R06	5440 m SSE	28.0	25.0	23.2	**27.2**	Yes	7.2
R08	5480 m SSE	28.0	25.0	23.0	**27.1**	Yes	7.2
R12	8910 m ENE	28.0	25.0	20.7	**26.4**	Yes	8.9
R15	6410 m NNE	28.0	25.0	14.7	**25.4**	Yes	10.7
R16	6040 m NNE	28.0	25.0	17.7	**25.7**	Yes	10.1

The above results indicate that the Cumulative SPL is expected to exceed the PSL at some of the receivers in the study area for the maximum flaring and meet the PSL for all other scenarios. In this study duration of 1E, 1G scenarios are less than 15 min, scenario 2A and 2B are continuous operation, scenario 3AG, 3BE, 3AG are less than 15 min long. The most impacted receiver is R06 approximately 5440m SSE from the subject facility. Additional noise control is not required for the subject facility to comply with the requirements at the Sensitive Receiver.

It is noted that dBC-dBA values are commonly used to indicate contribution of low frequency noise (LFN), the higher the difference, the greater contribution from low frequency noise, at levels exceeding 15-20 dB evaluation is required for the adjustments due to the low frequency noise contents. At results indicate the potential for low frequency noise impacts at the sensitive receivers, which will be evaluated in the event of a valid complaint.

Figures 2A-2G show the noise map of the area with Facility SPL contours for the seven operating scenarios, that is, the facility noise emissions contours excluding the ASL.

Figure 2A: Noise Contour Map – As Proposed – Facility SPL (Scenario S1E)

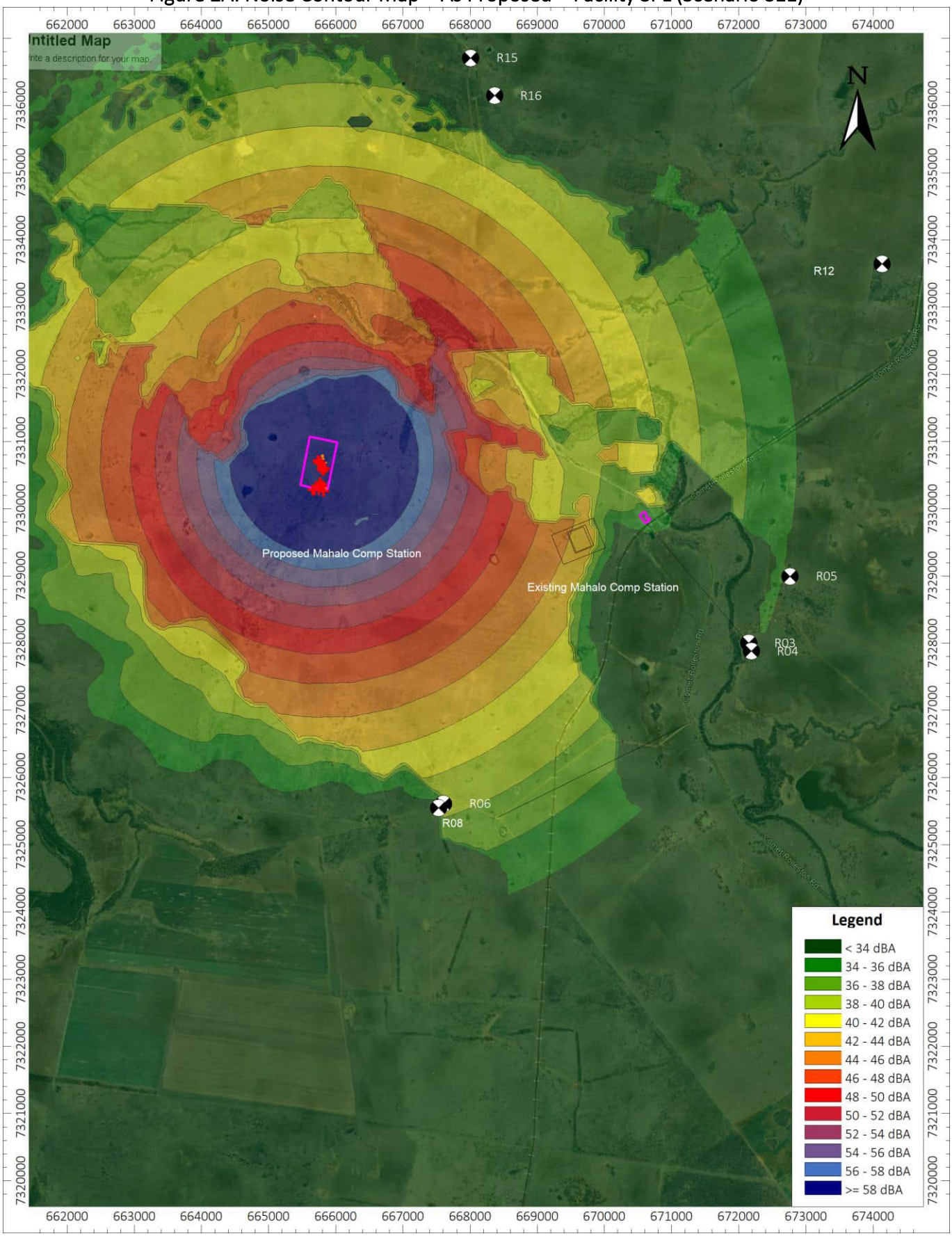


Figure 2B: Noise Contour Map – As Proposed – Facility SPL (Scenario S1G)

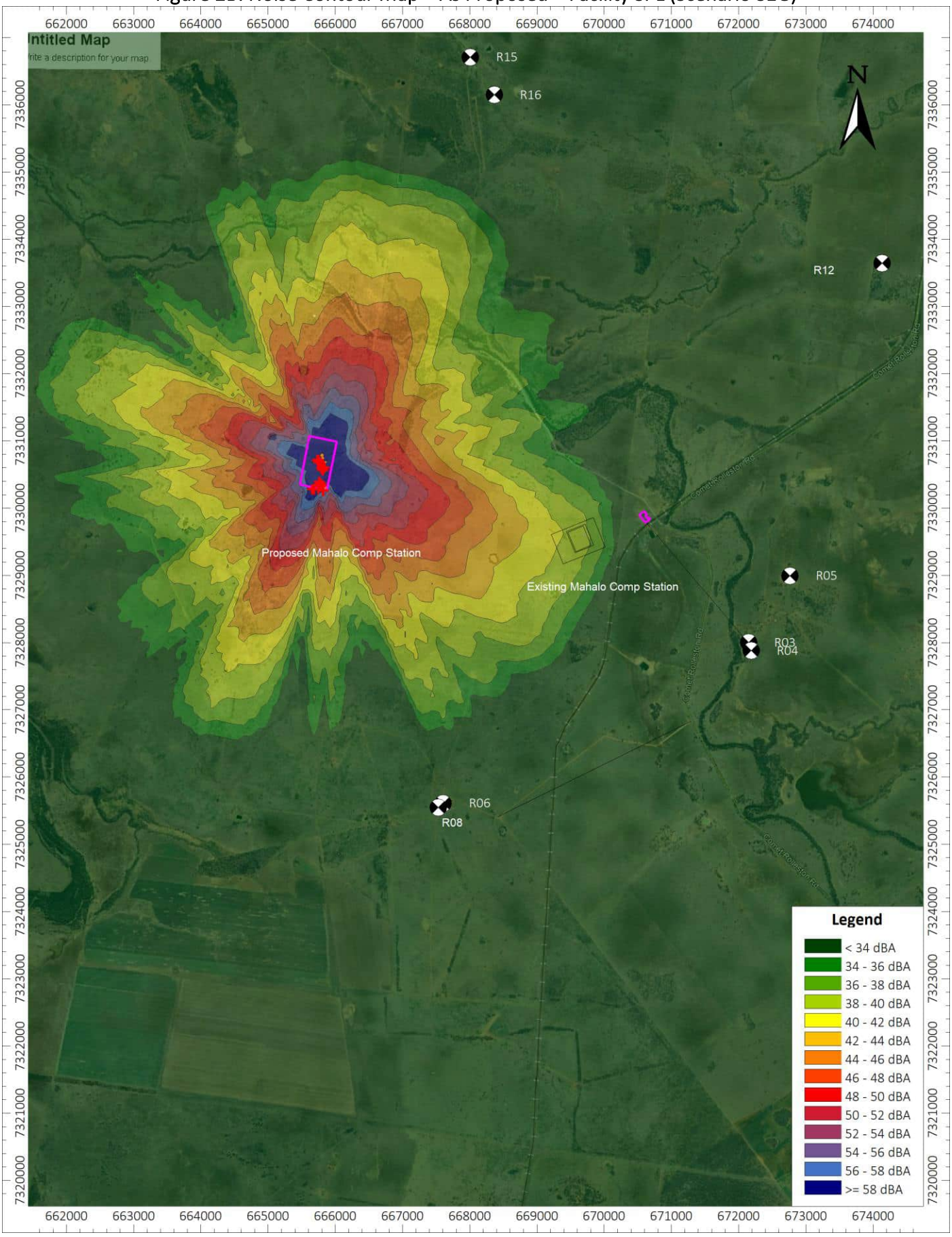


Figure 2C: Noise Contour Map – As Proposed – Facility SPL (Scenario S2A)

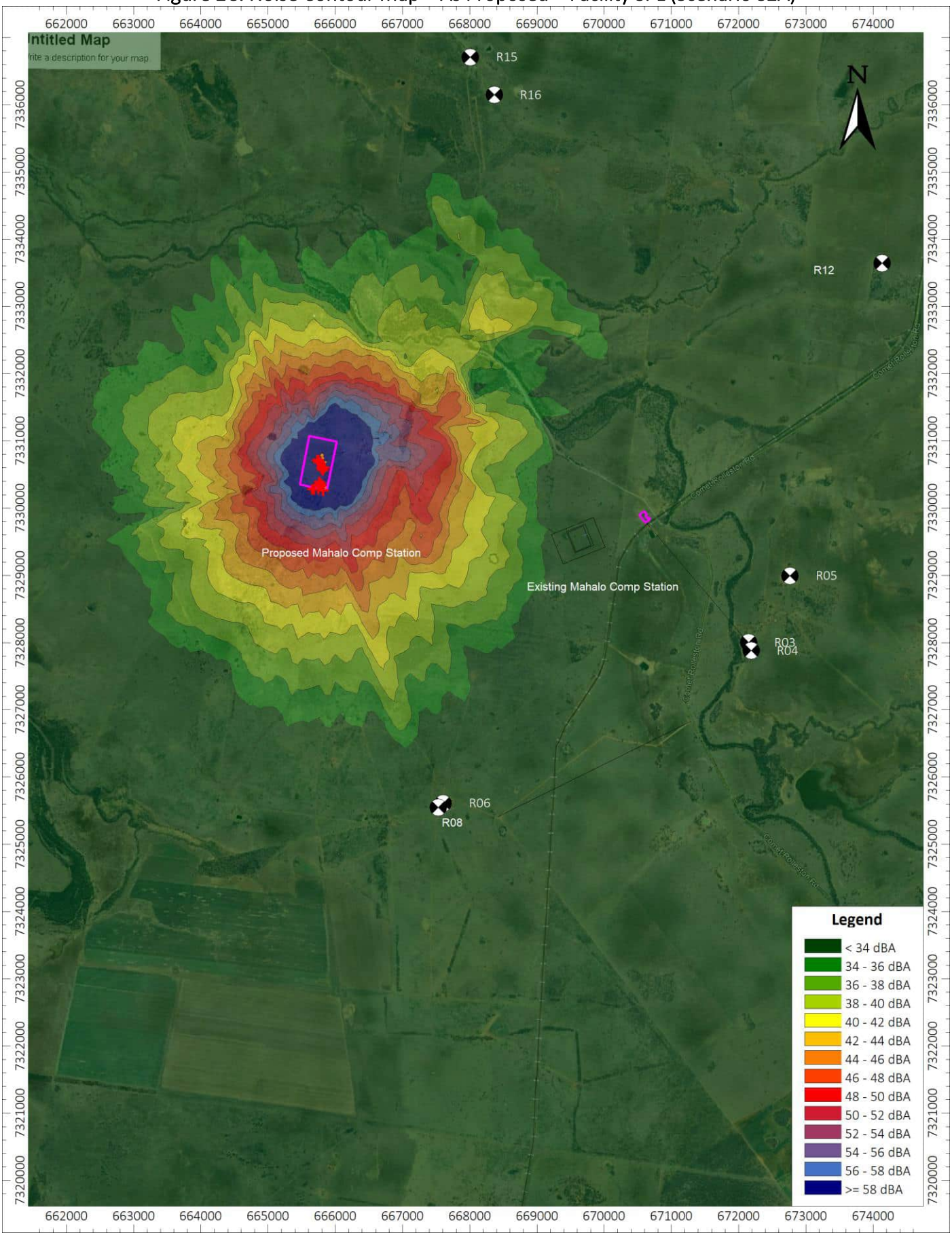


Figure 2D: Noise Contour Map – As Proposed – Facility SPL (Scenario S2B)

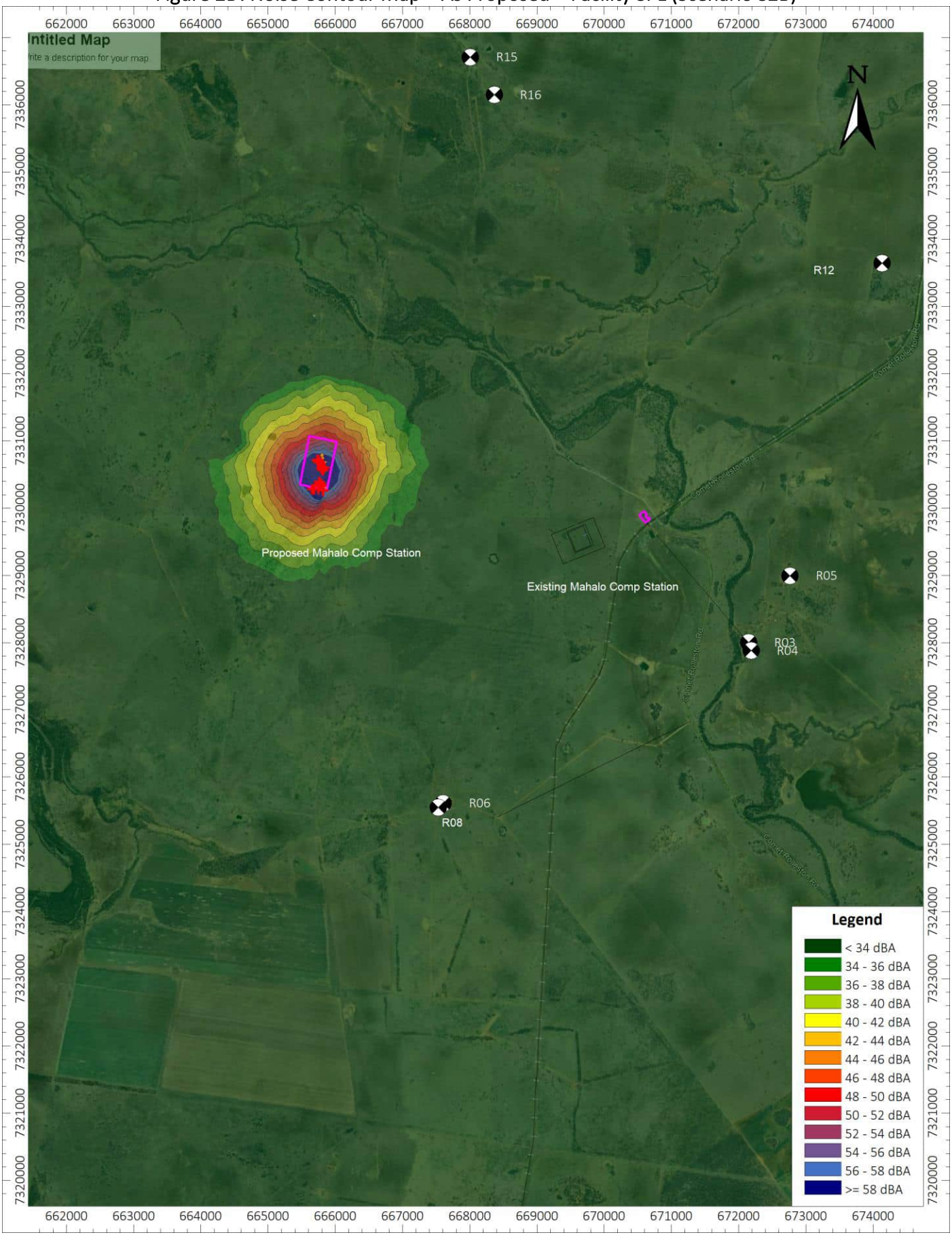


Figure 2E: Noise Contour Map – As Proposed – Facility SPL (Scenario S3BE)

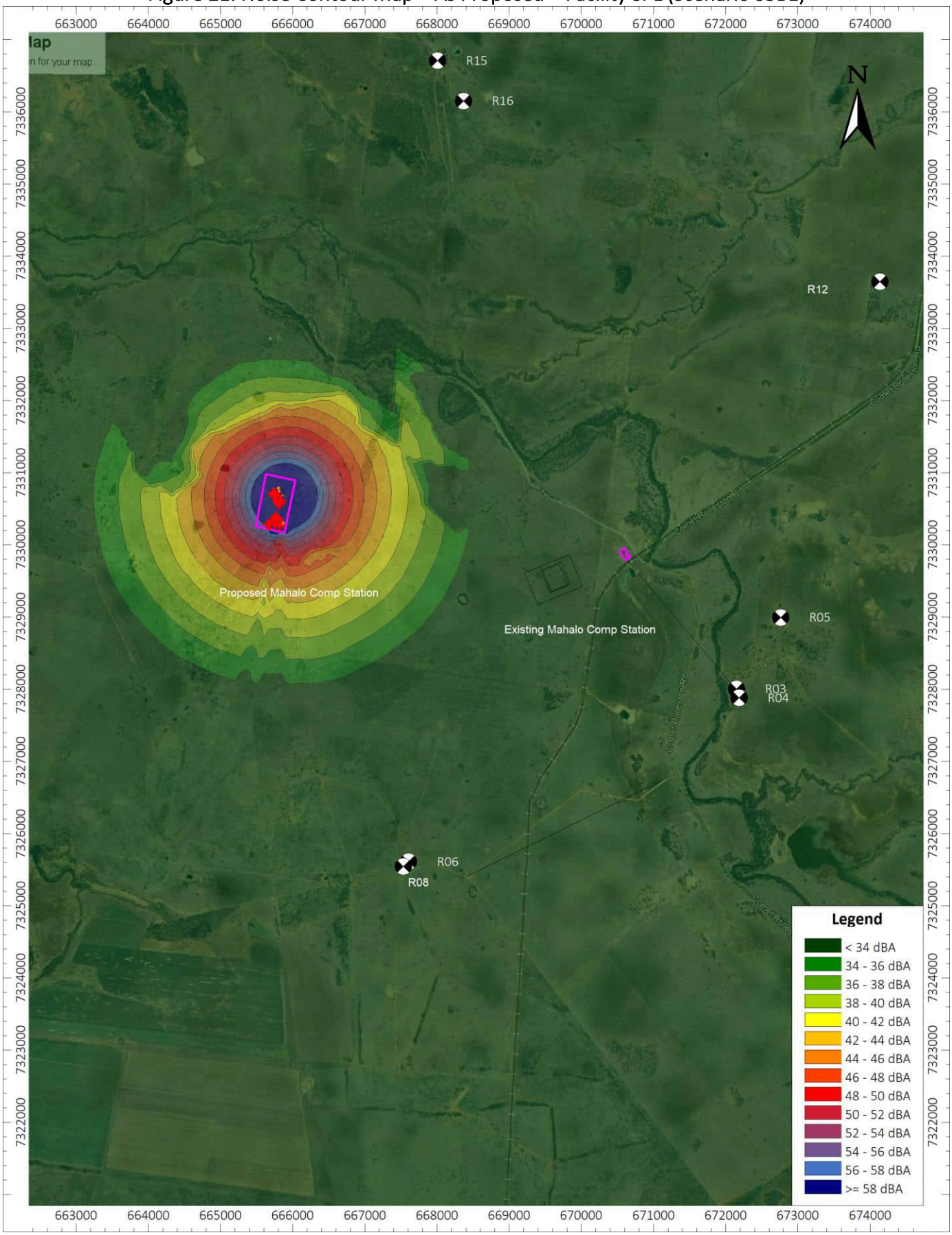


Figure 2F: Noise Contour Map – As Proposed – Facility SPL (Scenario S3BG)

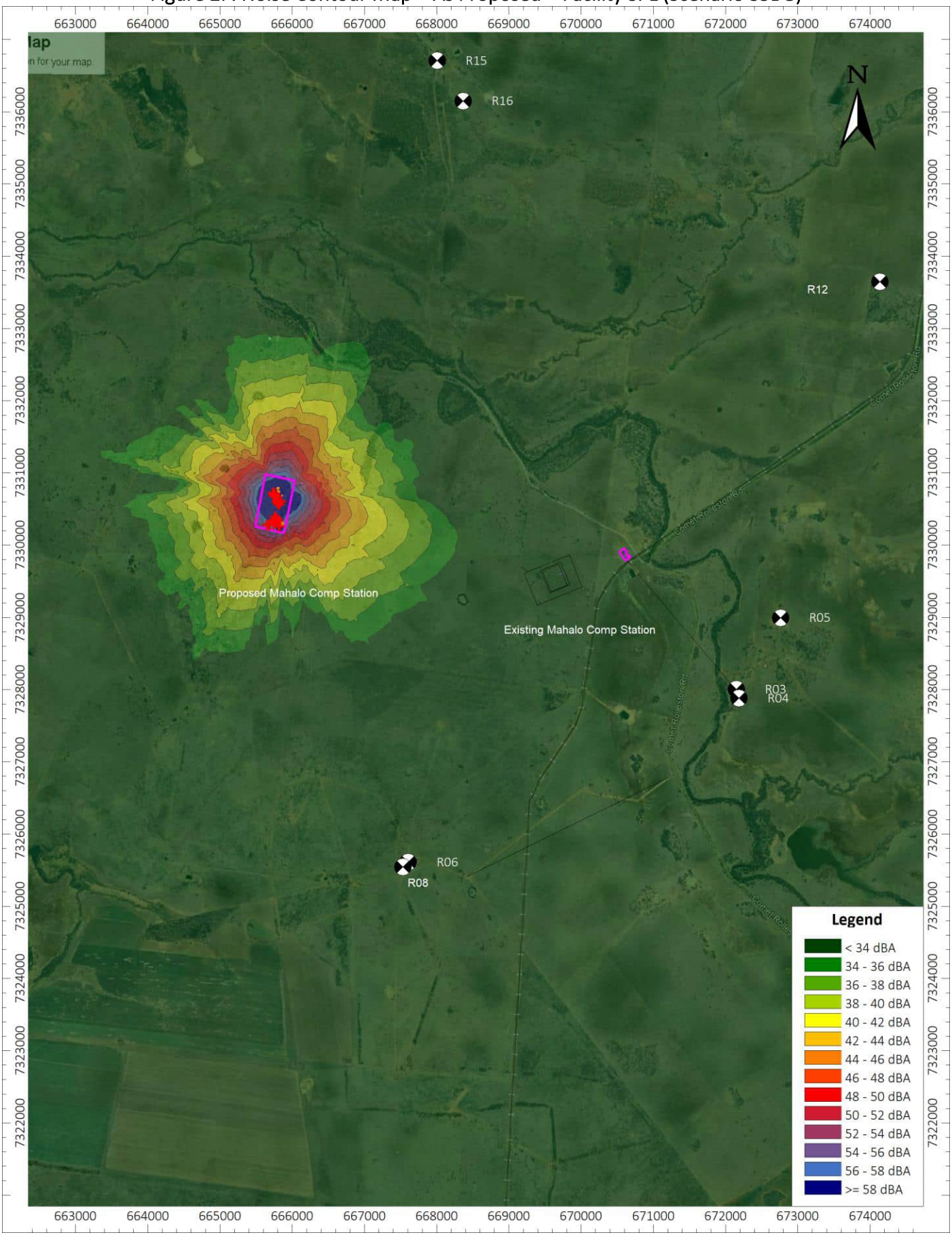
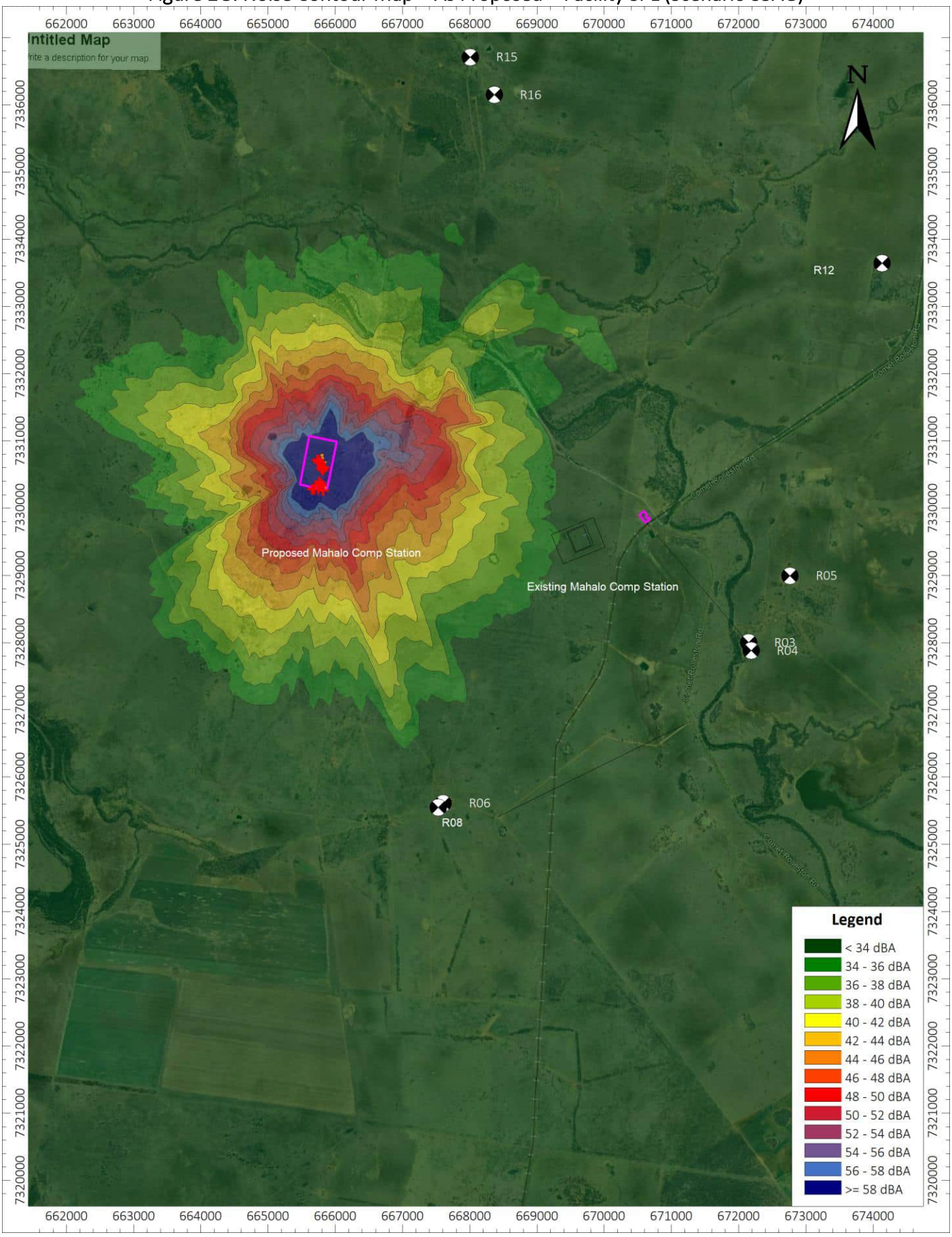


Figure 2G: Noise Contour Map – As Proposed – Facility SPL (Scenario S3AG)



Source Order Ranking

Tables 4A-4G list the top one or ten dominant noise sources received at the most impacted receiver R06 from the subject facility. See Appendix E for the complete source order ranking table.

Table 4A: Source Order Ranking - Receiver R06 (Scenario S1E)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Mahalo Flare Maximum flaring (Flare Rate of 50MMSCFM)	34.4	2.8
	Facility SPL	34.4	2.8
	ASL	25.0	-
	Cumulative SPL	34.9	-
	PSL	28.0	-

Table 4B: Source Order Ranking - Receiver R06(Scenario S1G)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Flare 5	16.6	3.4
002	Flare 3	16.2	3.5
003	Flare 1	15.8	3.4
004	Flare 2	15.3	3.5
005	Flare 4	14.8	3.5
011+	Flare 6	14.2	3.5
	Facility SPL	23.3	3.5
	ASL	25.0	-
	Cumulative SPL	27.3	-
	PSL	28.0	-

Table 4C: Source Order Ranking - Receiver R06 (Scenario S2A)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	CAT 3608 Compressor Engine unit no enclosure	21.1	5.7
002	CAT 3608 Compressor Engine unit no enclosure	16.4	7.5
003	CAT 3608 Compressor Engine unit no enclosure	15.9	7.4
004	CAT 3608 Compressor Casing No enclosure	8.9	10.0
005	CAT 3608 Compressor Casing No enclosure	7.9	10.3
006	CAT 3608 Compressor Casing No enclosure	6.5	10.7
007	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
008	Compressor 21-1319 (4) Exhaust Muffler	1.3	11.0
009	Compressor 21-1319 (4) Exhaust Muffler	1.3	11.0
010	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
011+	Cumulative Remaining 113 Noise Sources	7.7	15.6
	Facility SPL	23.8	7.7
	ASL	25.0	-
	Cumulative SPL	27.5	-
	PSL	28.0	-

Table 4D: Source Order Ranking - Receiver R06 (Scenario S2B)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Compressor 21-1319 (4) Bldg Wall	4.2	15.2
002	Compressor 21-1319 (4) Bldg Wall	3.4	15.2
003	Compressor 21-1319 (4) Bldg Wall	3.3	15.2
004	Compressor 21-1319 (4) Bldg Skid	2.5	13.2
005	Compressor 21-1319 (4) Bldg Skid	2.0	12.9
006	Compressor 21-1319 (4) Exhaust Muffler	1.6	11.0
007	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.1
008	Compressor 21-1319 (4) Exhaust Muffler	0.9	11.5
009	Compressor 21-1319 (4) Bldg Skid	-1.4	13.8
010	Compressor 21-1319 (4)C Cooler Inlet	-4.5	14.9
011+	Cumulative Remaining 143 Noise Sources	8.0	15.5
	Facility SPL	13.4	14.4
	ASL	25.0	-
	Cumulative SPL	25.3	-
	PSL	28.0	-

Table 4E: Source Order Ranking - Receiver R06 (Scenario S3BE)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Mahalo Flare Normal flaring	18.7	2.8
002	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
003	Compressor 21-1319 (4) Bldg Wall	1.0	15.2
004	Compressor 21-1319 (4) Exhaust Muffler	0.8	11.4
005	Compressor 21-1319 (4) Bldg Wall	0.1	15.3
006	Compressor 21-1319 (4) Bldg Skid	-4.1	13.8
007	Compressor 21-1319 (4) Bldg Skid	-5.0	13.5
008	Compressor 21-1319 (4) Exhaust Pipe	-6.4	11.5
009	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
010	Mahalo Generator Bldg Door ClosedEast2/west	-7.0	14.3
011+	Cumulative Remaining 118 Noise Sources	6.5	15.7
	Facility SPL	19.3	7.2
	ASL	25.0	-
	Cumulative SPL	26.0	-
	PSL	28.0	-

Table 4F: Source Order Ranking - Receiver R06 (Scenario S3BG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Flare 1	11.7	3.5
002	Compressor 21-1319 (4) Bldg Wall	3.5	15.2
003	Compressor 21-1319 (4) Bldg Wall	2.7	15.2
004	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
005	Compressor 21-1319 (4) Exhaust Muffler	0.7	11.5
006	Compressor 21-1319 (4) Bldg Skid	-1.6	13.8

Table 4F: Source Order Ranking - Receiver R06 (Scenario S3BG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
007	Compressor 21-1319 (4) Bldg Skid	-2.4	13.5
008	Compressor 21-1319 (4) Exhaust Pipe	-6.4	11.5
009	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
010	Mahalo Generator Exhaust Muffler	-7.1	12.6
011+	Cumulative Remaining 122 Noise Sources	6.9	15.7
	Facility SPL	14.5	11.8
	ASL	25.0	-
	Cumulative SPL	25.4	-
	PSL	28.0	-

Table 4G: Source Order Ranking - Receiver R06 (Scenario S3AG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	CAT 3608 Compressor Engine unit no enclosure	21.2	5.7
002	CAT 3608 Compressor Engine unit no enclosure	16.0	7.4
003	Flare 1	11.7	3.4
004	CAT 3608 Compressor Casing No enclosure	9.0	10.0
005	CAT 3608 Compressor Casing No enclosure	6.5	10.7
006	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
007	Compressor 21-1319 (4) Exhaust Muffler	1.3	11.0
008	Compressor 21-1319 (4) Exhaust Pipe	-6.4	11.5
009	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
010	Mahalo Generator Exhaust Muffler	-7.1	12.6
011+	Cumulative Remaining 102 Noise Sources	6.8	15.8
	Facility SPL	23.2	7.2
	ASL	25.0	-
	Cumulative SPL	27.2	-
	PSL	28.0	-

The above results indicate that for the nearest potentially sensitive receiver R06 the dominant noise stems from the flare and Compressor units. A full order ranking list is outlined in the Appendix E for each of the six running scenarios. Noise control should be aimed at attenuating the dominant noise sources.

For general technical details on sound pressure levels and analysis, as well as for a best practice approach, see Appendix G.

Conclusion

The results indicate that, as proposed, the Cumulative SPL is expected to exceed the PSL at some of the receivers in the study area for the maximum flaring event scenario. The most impacted receiver is at the receiver is R06, located approximately 5440m SSE from the subject facility.

The above results indicate that for the nearest potentially sensitive receiver, R06 the dominant noise stems from the flare and Compressor units.

Additional noise control is not required for the subject facility to comply with the requirements at the sensitive receiver.

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International Organization for Standardization (ISO) 1996. *Standard 9613-2, Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation*, Geneva Switzerland.

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Queensland Globe: https://qldglobe.information.qld.gov.au/

Queensland Spatial: http://qldspatial.information.qld.gov.au/catalogue/

Appendix A: Glossary

Table A: Glossary

Term	Description
A-weighted sound pressure level (dBA)	The sound pressure level as measured on a sound level meter using a setting that emphasizes the middle frequency components similar to the frequency response of the human ear at levels typical of rural backgrounds in mid frequencies.
Bands (full octave or 1/3 octave)	A series of electronic filters separate sound into discrete frequency bands, making it possible to know how sound energy is distributed as a function of frequency. Each octave band has a center frequency that is double the center frequency of the octave band preceding it. The 1/3 octave band analysis provides a finer breakdown of sound distribution as a function of frequency.
C-weighted sound pressure level (dBC)	The C-weighting approximates the sensitivity of human hearing at industrial noise levels (above about 85 dBA). The C-weighted sound pressure level (i.e., measured with the C-weighting) is more sensitive to sounds at low frequencies than the A-weighted sound level and is sometimes used to assess the low-frequency content of complex sound environments.
Daytime	Defined as the hours from 07:00 to 22:00.
Energy equivalent sound pressure level (Leq)	The average weighted sound level over a specified period of time. It is a single-number representation of the cumulative acoustical energy measured over a time interval. The time interval used should be specified in brackets following the Leq—e.g., Leq (9) is a 9-hour Leq. If a sound level is constant over the measurement period, the Leq will equal the constant sound level.
Facility SPL	The overall sound pressure level from all the facilities in the study area
Heavily Travelled Road	Generally includes highways and any other road where the average traffic count is at least 10 vehicles/hour over the night-time period. It is acknowledged that highways are sometimes lightly travelled during the night-time period, which is usually the period of greatest concern.
Night-time	Defined as the hours from 22:00 to 07:00.
Noise	Generally associated with the unwanted portion of sound.
Noise Impact Assessment (NIA)	An NIA identifies the expected sound level emanating from a facility as measured 15 m from the nearest or most impacted permanently or seasonally occupied dwelling. It also identifies what the permissible sound level is and how it was calculated.
Permanent facility	A facility that is in operation for more than two months.
Permissible Sound Level (SPL)	The maximum SPL that a facility must not exceed at receivers.
Receiver	The location of the residences existing in the NIA study area for which the SPL is determined.
Representative conditions	Those conditions typical for an area and/or the nature of a complaint. For ASLs, these are conditions that portray the typical activities for the area, not the quietest time. For CSLs, these do not constitute absolute worst-case conditions or the exact conditions the complainant has highlighted if those conditions are not easily duplicated. Sound levels must be taken only when representative conditions exist; this may necessitate a survey of extensive duration (two or more consecutive nights).
Sound Power Level (PWL)	The sound power level emitted. The decibel equivalent of the rate of energy (or power) emitted in the form of noise. The sound power level is given by: $PWL = 10 \times LOG_{10}\left(\frac{Sound\ as\ Power}{W_0}\right)$ Where $W_0 = 10^{-12}$ watts (or 1 pW)
Sound Pressure Level (SPL)	The sound level received. The decibel equivalent of the pressure of sound waves at a specific location, which is measured with a microphone. The sound pressure level is given by: $SPL = 10 \times LOG_{10}\left(\frac{Sound\ as\ Pressure}{P_0}\right)$ Where $P_0 = 2 \times 10^{-5}$ Pa (or 20 μPa)
Subject facility	The ventilation facility which is the object of the NIA.
Tonal component	A pronounced peak clearly obvious within the sound level spectrum.

Appendix B: Equipment Details from Manufacturer



Figure B1: Generator from ACS-02 Site.



Figure B2: Compressor from ACS-03 Site.



Figure B3: Engine Exhaust Muffler (Maxim) from ACS-03 Site.

Table B: Water Treatment Plant Equipment Details

Equipment Name	Operation	ID	Equipment Details
P-1101 UF Feed Pump#1	Proposed 15/15min	-	Pump: Xylem e1610205B • Flow Rate: 156m^3/h • Motor: 30 kW @ 2955 RPM estimated 71dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1102 UF Feed Pump#2	Proposed 15/15min	-	Pump: Xylem e1610205B • Flow Rate: 156m^3/h • Motor: 30 kW @ 2955 RPM estimated 71dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
1724 KX-1003 Membrane Aeration Blower Skid 1	Proposed 02/15min	-	Blower: Pedro Gill CAPS Blower Fitted with Intake Acoustic Box, Sound Enclosure, Inlet and Discharge Silencer • Flow Rate: 242 Nm^3/h at 80 kPa (g) @0C • Motor: 11 kW @ 1460-3000 RPM estimated 80dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
1724 KX-1004 Membrane Aeration Blower skid 2	Proposed 02/15min	-	• Blower: Pedro Gill CAPS Blower Fitted with Intake Acoustic Box, Sound Enclosure, Inlet and Discharge Silencer • Flow Rate: 242 Nm^3/h at 80 kPa (g) @0C • Motor: 11 kW @ 1460-3000 RPM estimated 80dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1301 RO Feed Pump #1	Proposed 15/15min	504899-MA-02	• Pump: Xylem E1610-2.5B • Flow Rate: 94m^3/h • Motor: 18.5 kW @ 2940 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1301 RO Feed Pump #2	Proposed 15/15min	504899-MA-02	Pump: Xylem E1610-2.5B • Flow Rate: 94m^3/h • Motor: 18.5 kW @ 2940 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1411 Train # 1 RO Stage 1HP Pump	Proposed 15/15min	-	Pump: Xylem MPB 65.2/5 • Flow Rate: unknown • Motor: 90 kW @ 2975 RPM estimated 77dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1421 Train # 2 RO Stage 1 HP Pump	Proposed 15/15min	-	Pump: Xylem MPB 65.2/5 • Flow Rate: unknown • Motor: 90 kW @ 2975 RPM estimated 77dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1412 Train # 1 RO Stage 2 Feed Pump	Proposed 15/15min	-	Pump: FEDCO MS-70 • Flow Rate: unknown • Motor: 55 kW @ 2970 RPM estimated 74dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only

Equipment Name	Operation	ID	Equipment Details
P-1422 Train # 1 RO Stage 2 Feed Pump	Proposed 15/15min	-	Pump: FEDCO MS-70 • Flow Rate: unknown • Motor: 55 kW @ 2970 RPM estimated 74dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1413 Train # 1 RO Stage 3 Feed Pump	Proposed 15/15min	-	Pump • Flow Rate: unknown • Motor: 22 kW @ 2950 RPM estimated 74dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1423 Train # 2 RO Stage 3 Feed Pump	Proposed 15/15min	-	Pump • Flow Rate: unknown • Motor: 22 kW @ 2950 RPM estimated 74dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1511 RO Permeate Recycle Pump	Proposed 15/15min	504899-MA-5	Pump • Flow 130m3/h • Motor: 11 kW @ 2935 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1512 Flush / Backwash Pump	Proposed 02/15min	504899-MA-4	Pump • Flow Rate: 80m3/h • Motor: 11 kW @ 2935 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1513 Flush / Backwash Pump	Proposed 02/15min	504899-MA-4	Pump • Flow Rate: 80m3/h • Motor: 11 kW @ 2935 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1521 Backwash Waste Sump Pump	Proposed 0/15min infrequent operation and buried	-	Pump • Flow Rate: unknown • Motor: 15 kW @ 2935 RPM estimated 73dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1522 Backwash Waste Sump Pump	Proposed 0/15min infrequent operation and buried	-	Pump • Flow Rate: unknown • Motor: 15 kW @ 2935 RPM estimated 73dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1531 CIP Pump	Proposed 15/15min	504899-MA-03	Pump • Flow Rate: 45m^3/h • Motor: 11 kW @ 2935 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1532 CIP Pump	Proposed 15/15min	504899-MA-03	Pump • Flow Rate: 45m^3/h • Motor: 11 kW @ 2935 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only

Equipment Name	Operation	ID	Equipment Details
Combined Dosing Kit	Proposed 15/15min	-	Multiple Pumps modelled as single source • Flow Rate: unknown • Multiple Motors combined to: 15 kW @ 2935 RPM estimated 70dBA @ 1m • Cooling: N/A • Enclosure: enclosed, with roof
KX-1001 Air Compressor #1	Proposed 15/15min	-	Compressor: Caps Australia -CR11-13-500 • Flow Rate: 1.1 m3/min discharge @ 750-850 kPA • Motor: 11 kW @ 2935 RPM estimated 65dBA @ 1m from PAAE database • Cooling: N/A • Enclosure: not enclosed, roof only
DX1001 Desiccant Dryer	Proposed 15/15min	-	Adsorption Dryer DPS 10 • Flow Rate: 110m3/h • Motor: Operating pressure 4-16bar • Valve noise estimated 70dBA sound power • Cooling: N/A • Enclosure: not enclosed,
P-0003 Rain Water Pump	Proposed 0/15min infrequent operation	-	Pump • Flow Rate: unknown • Motor: 7.5 kW @ 2935 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,
Irrigation Pump #1 and #2	Proposed 15/15min	-	CRN 155-3-2_3*400V • Pump: Grundfos • Flow Rate: 38 lps • Motor: 37 kW estimated 67dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,.
Irrigation pump #3 and #4	Proposed 15/15min	-	CRN 45-4-2_3*400V • Pump: Grundfos • Flow Rate: 13.5 lps • Motor: 15 kW estimated 60dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,.
Irrigation pump #6	Proposed 0/15min infrequent operation	-	CRN 32-4-3*400V • Pump: Grundfos • Flow Rate: 7 lps • Motor: 7.5 kW estimated 60dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,
Irrigation Booster Pump	Proposed 15/15min	-	NBG 150-125-315/290_3*400V • Pump: Grundfos • Flow Rate: 45 lps • Motor: 22 kW estimated 66dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,
Truck Fill Pump #7 & #8	Proposed 15/15min	-	CRN95-2-2_3*400V • Pump: Grundfos • Flow Rate: 18 lps • Motor: 11 kW estimated 60dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,

Equipment Name	Operation	ID	Equipment Details
Dam Transfer pump	Proposed 15/15min	-	NBG 150-125-315/290_3*400V • Pump: Grundfos • Flow Rate: 45 lps • Motor: 22 kW estimated 66dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,
Air Conditioning	Proposed 15/15min	-	• Fujitsu – AOTG30KMTA 3 off • Capacity: Cooling 2.9-10.5, Heating: 2.2-11.2 • Compressor: Hermetic x1 • Motor: (W): 2200 • Sound Power: 67dB linear
Pre-Treatment Plant			
Clarifying Feed Pump	15/15min Duty / Standby		Xylem Pump • Feed Pump Centrifugal e1610 4A 4kW • Flow Rate: 115m^3/h at 2.39kW • Motor: 4 kW @ 1443 RPM estimated 57dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
Effluent Pump	15/15min Duty / Standby		Pump • Feed Pump Centrifugal e1610 4A 4kW • Flow Rate: 115m^3/h • Motor: 4 kW @ 1443 RPM estimated 57dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
Sludge Pump	15/15min Duty		Pump • Sludge Pump Monoflo NOV E14AF81RMA • Flow Rate: 6m^3/h • Motor: 3 kW @ 425 RPM estimated 51dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
Clarifier	15/15min Duty		• Flocculator Tank Mixer (two) 0.37kW @1305RPM 43dBA at 1m • Scraper driver – 0.18kW @1320RPM • Shear mixer driver – 11 kW @ 1445 RPM estimated 61dBA @ 1m • Rapid mixer driver – 0.55 kW @ 1445 RPM estimated 44dBA @ 1m
Containerized Dewatering Plant	15/15min Duty		• Rotamat Screw Press RoS Q - <70dBA • Rotamat Screw Conveyor - <70dBA • Sludge Feed Pump – BN 10-6L, 9m^3/h – Seepex Cavity Pump 2.2kW RPM 1449 Motor, Pump speed 349RPM • Sludge Feed Pump – BN 1-6L, 500l/h – Seepex Cavity Pump 0.55kW RPM 1375 Motor, Pump speed 300RPM Enclosed isolated • TECO AirCon Unit TSO27HFAMJBB outside Sound power 62dBA
Bentonite Slurry Mixer	15/15min Duty		Vertical Mixer • Mixtec – Vertical Mixer • Mixer: 1.24m dia • Motor:2.2 kW @ 1445 RPM estimated 53dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only

Equipment Name	Operation	ID	Equipment Details
Bentonite Batching and Dosing Skid	15/15min Duty		• Feeder (Aug Feeder) – 0.37kW at 1405 RPM 50dBA at 1m • Hopper Motor (Agitator) – 0.37kW at 1405RPM 50dBA at 1m • Feed Bucket Elevator – 0.55kW at 1405RPM 48dBA at 1m • Makeup Tank Mixer – 3.0 kW at 1456 at 70dBA • Slurry Tank Mixer – 2.2kW at 1450 at 0dBA at 1m • Dosing Pump – 0.75kW, 1415RPM, 47dBA at 1m
Dosing Skid Ferric Chloride Ferric Sulphate Dosing Pump	15/15min Duty/Standby		Dosing Skid • IXOM Dosing Skid • Dosing Pumps Grundfos DDA30-4 FCM • Dosing Pump – 0.02kW – 15L/h • Enclosed in Dosing Cabinet on Skid • Not acoustically significant
Utility Water Pump Pumps Hydro MPC-E 2 CRNE15-4 5.5kw	15/15min Duty/Standby		• Grunfos Pump • Pump CRNE15-4 Pump • Flow Rate: • Motor: 5.5 kW @ 1443 RPM estimated 57dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
Hypochlorite Chemical Unloading & Dosing Skid	15/15min Duty/Standby		• IBC unloading Pump – 0.55 kW @ 1445 RPM estimated 44dBA @ 1m Dosing Pump Grundfos DDA30-4 FCM Enclosed in dosing cabinet on skid, 0.02kW not acoustically significant
Filtration Pump	15/15min Duty / Standby		Gorman RVPP, 0.75kW at 1415RPM, 47dBA at 1m
Generator DE200E	Intermittent operation only not modelled		• 97dBA Sound Power with 62dBA at 15m

Appendix C: Subject Facility Plot Plan

Appendix D: Sound Power Levels

The Sound Power Levels (PWL) were determined for all of the facility major noise sources. The PWL in linear octave band are presented in the table below. For each proposed noise source, the PWL was obtained from theory, manufacturer's data, and previous study on similar sources.

Table D-1: Source Octave Band Sound Power Levels

Noise Source	Data Source	Linear Octave Band Centre Frequency (dB)									Overall (dBA)	Overall (dBC)
		31.5	63	125	250	500	1000	2000	4000	8000		
Mahalo Flare Maximum flaring((Elevated)	Theory	115	115	123	132	140	138	135	132	129	142	144
Mahalo Flare Normal flaring(Elevated)	Theory	105	105	113	122	130	127	125	122	119	132	133
CAT 3612 Compressor Casing No enclosure	Previous Study	115	111	116	115	113	116	121	118	111	125	125
CAT 3612 Engine Unit no enclosure	Previous Study	110	115	117	116	117	117	115	111	105	121	124
Mahalo Comp Air Bldg Open Area (Doors Open)	Theory	96	95	99	101	102	103	106	103	94	110	111
Compressor 21-1319 (4) Exhaust Pipe	Previous Study	95	103	91	85	87	93	105	106	87	109	109
Compressor 21-1319 (4) Exhaust Muffler	Previous Study	101	110	100	96	96	101	99	96	81	105	111
Compressor 21-1319 (4) Bldg Skid	Previous Study	107	110	112	110	101	95	89	87	83	105	116
Load bank Air Intake	Field	91	95	103	99	98	97	92	85	81	101	107
Compressor 21-1319 (4) Bldg Wall	Previous Study	109	108	113	103	97	94	89	86	80	101	115
Compressor 21-1319 (4) Air Intake Pipe	Previous Study	101	102	99	95	87	86	90	97	85	100	106
Load bank Cooler Discharge	Field	88	92	99	97	95	94	89	82	74	98	103
Mahalo Generator Bldg Door ClosedEast2/west		92	95	105	100	92	87	78	71	65	95	107
Mahalo Generator Bldg Door ClosedEast2/west	Theory	92	95	105	100	92	87	78	71	65	95	107
Mahalo Generator Cooler Inlet	Theory	96	97	95	96	88	90	87	78	67	94	102
Mahalo Generator Cooler DischargeTop	Theory	112	108	98	92	85	87	89	80	73	94	111
Mahalo Water plant	Theory	97	88	84	85	87	89	86	83	85	93	98
Compressor 21-1319 (4)C Cooler Inlet	Previous Study	101	98	98	93	87	81	81	88	72	93	103
Mahalo Generator Exhaust Muffler	Theory	92	98	100	94	88	88	86	80	70	93	103
Mahalo Comp Air Bldg Wall and Roof	Theory	106	99	96	94	94	82	84	73	64	93	105
Mahalo Substation	Theory	88	94	97	93	92	87	82	77	70	93	101
Mahalo Generator Bldg Door Closed North	Theory	93	97	105	95	84	75	69	62	52	91	106

Table D-1: Source Octave Band Sound Power Levels

Noise Source	Data Source	Linear Octave Band Centre Frequency (dB)									Overall (dBA)	Overall (dBC)
		31.5	63	125	250	500	1000	2000	4000	8000		
Mahalo Generator Bldg Wall East/West	Theory	92	96	104	94	84	75	68	62	51	90	105
Mahalo Generator Air Intake Pipe West	Theory	97	96	102	90	81	76	79	82	75	90	103
Mahalo Generator Cooler HousingTop	Theory	90	92	90	95	81	82	76	65	57	89	98
Compressor 21-1319 (4) Exhaust Tip1.0	Previous Study	92	95	91	85	80	79	80	81	69	87	98
Mahalo Generator Bldg WallTop	Theory	97	94	95	90	84	75	73	64	56	86	99
Compressor 21-1319 (4) Exhaust Tip	Previous Study	95	98	94	88	83	82	82	83	70	89	100
Compressor 21-1319 (4)C Cooler Discharge	Previous Study	98	95	94	87	82	76	74	76	63	85	99
Mahalo Generator Bldg Door ClosedEast	Theory	85	87	91	89	81	76	66	57	50	84	95
Compressor 21-1319 (4)C Cooler Housing	Previous Study	94	93	94	88	80	74	68	71	60	84	98
Compressor 21-1319 (4) Bldg Door Closed E1	Previous Study	88	88	89	81	79	77	75	72	71	83	93
Mahalo Generator Bldg Fan Louver OpenSouth	Theory	94	93	96	83	76	74	71	70	72	83	98
Mahalo Generator Air IntakeNorth top	Theory	94	93	91	84	80	69	68	60	57	81	96
Mahalo Generator Exhaust Tip	Theory	96	94	86	78	75	71	73	67	54	79	96
Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	Previous Study	90	89	84	73	73	72	68	66	64	77	92
Mahalo TEG Dehydration Package Unit 1	Theory	85	74	73	69	70	71	66	63	61	74	83
Mahalo TEG Dehydration Package Unit 2	Theory	85	74	73	69	70	71	66	63	61	74	83
Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	Previous Study	85	85	84	74	69	64	62	61	54	73	88
Mahalo Transformer #3	Theory	61	67	70	66	65	60	55	50	43	66	74
Mahalo Transformer #4	Theory	61	67	70	66	65	60	55	50	43	66	74
Mahalo HV VSD Transformer #1	Theory	61	67	70	66	65	60	55	50	43	66	74
Mahalo HV VSD Transformer #2	Theory	61	67	70	66	65	60	55	50	43	66	74
Mahalo HV VSD Transformer #3	Theory	61	67	70	66	65	60	55	50	43	66	74

Table D-2: Source Octave Band Sound Power Levels (WTP)

Noise Source	Data Source	Linear Octave Band Centre Frequency (dB)									Overall (dBA)	Overall (dBC)
		31.5	63	125	250	500	1000	2000	4000	8000		
P-1411 Train # 1 RO Stage 1 HP Pump	Previous Study	82	83	88	88	91	86	85	80	77	92	95
P-1421 Train # 2 RO Stage 1 HP Pump	Previous Study	82	83	88	88	91	86	85	80	77	92	95
P-1412 Train # 1 RO Stage 2 Feed Pump	Previous Study	79	80	84	85	87	83	81	76	74	89	92
P-1422 Train # 2 RO Stage 2 Feed Pump	Previous Study	79	80	84	85	87	83	81	76	74	89	92
P-1413 Train # 1 RO Stage 3 Feed Pump	Previous Study	83	77	76	76	81	83	84	78	73	89	89
P-1423 Train # 2 RO Stage 3 Feed Pump	Previous Study	83	77	76	76	81	83	84	78	73	89	89
KX-1003 Membrane Aeration Blower Skid 1	Previous Study	82	83	78	90	82	83	79	78	69	88	93
KX-1004 Membrane Aeration Blower Skid 1	Previous Study	82	83	78	90	82	83	79	78	69	88	93
P-1101 UF Feed Pump #1	Previous Study	84	76	76	76	79	79	81	76	74	85	87
P-1102 UF Feed Pump #2	Previous Study	84	76	76	76	79	79	81	76	74	85	87
Combined Dosing Skid	Previous Study	82	75	75	74	80	81	79	73	70	85	87
P-1511 RO Permeate Recycle Pump	Previous Study	81	74	74	74	79	80	78	72	69	84	86
P-1531 CIP Pump	Previous Study	79	72	72	72	79	80	78	72	67	84	85
P-1532 CIP Pump	Previous Study	79	72	72	72	79	80	78	72	67	84	85
P-1301 RO Feed Pump # 1	Previous Study	82	74	73	73	77	77	79	74	72	84	85
P-1302 RO Feed Pump # 2	Previous Study	82	74	73	73	77	77	79	74	72	84	85
Irrigation Pumps #1 - CRN155 PW	Previous Study	83	81	77	79	76	75	75	71	74	81	87
Irrigation Pumps #2 - CRN155 PW	Previous Study	83	81	77	79	76	75	75	71	74	81	87
KX-1001 Air Compressor # 1	Previous Study	82	85	82	83	78	73	71	61	49	80	89
Irrigation Pumps Booster NBG150	Previous Study	77	70	69	69	73	74	76	70	68	80	81
Dam Transfer NBG150	Previous Study	77	70	69	69	73	74	76	70	68	80	81
Pre Tx Dewatering Bldg Open Area (Doors Open)	Previous Study	82	83	80	85	73	72	69	69	66	80	88
Pre Tx Dewatering Bld Ext Motor	Previous Study	73	66	65	65	70	72	69	65	67	76	78

Table D-2: Source Octave Band Sound Power Levels (WTP)

Noise Source	Data Source	Linear Octave Band Centre Frequency (dB)									Overall (dBA)	Overall (dBC)
		31.5	63	125	250	500	1000	2000	4000	8000		
P-1512 Flush / Backwash Pump	Previous Study	72	65	65	65	71	71	69	64	60	75	77
P-1513 Flush / Backwash Pump	Previous Study	72	65	65	65	71	71	69	64	60	75	77
Pre Tx Clarifier - Shear Mixer	Previous Study	71	64	63	63	68	70	66	63	65	74	75
Pre Tx Dewatering Bldg Wall and Roof	Previous Study	91	86	77	80	68	61	57	54	51	73	91
Truck Pumps #7 CRN 95	Previous Study	68	62	62	62	69	69	68	62	56	73	75
Truck Pumps #8 CRN 95	Previous Study	68	62	62	62	69	69	68	62	56	73	75
Pre Tx Clarifying Feed Pump	Previous Study	70	63	62	62	67	69	66	63	65	73	75
Irrigation Pumps #3 CRN 45 AW	Previous Study	74	64	63	67	70	69	64	62	60	73	76
Irrigation Pumps #4 CRN 45 AW	Previous Study	74	64	63	67	70	69	64	62	60	73	76
Desiccant Dryer DX1001	Manufacturer	43	42	40	46	52	60	64	65	64	70	69
Pre Tx Utility Water Pump	Previous Study	66	60	59	59	63	66	62	59	61	69	71
Pre Tx Effluent Pump	Previous Study	64	57	56	56	60	63	59	56	58	67	68
Pre Tx Sludge pump	Previous Study	62	55	54	54	59	61	58	55	57	65	67
Pre Tx Bentonite Slurry Mixer	Previous Study	62	55	54	54	59	61	57	54	56	65	66
Pre Tx Dewatering Bld Ext AirCon	Previous Study	82	72	70	65	60	54	47	44	42	62	80
Pre Tx Bentonite-Skid Feeder	Previous Study	59	52	51	51	56	58	54	51	53	62	63
Pre Tx Bentonite Skid Hopper	Previous Study	59	52	51	51	56	58	54	51	53	62	63
5344-Futjisu ASTG30KMTA #1	Manufacturer	54	57	61	63	58	55	51	46	41	60	67
5344-Futjisu ASTG30KMTA #2	Manufacturer	54	57	61	63	58	55	51	46	41	60	67
5344-Futjisu ASTG30KMTA #3	Manufacturer	54	57	61	63	58	55	51	46	41	60	67
Pre Tx Bentonite Skid Make up mixer	Previous Study	57	50	49	49	54	56	53	50	52	60	62
Pre Tx Bentonite Skid Feed Bucket	Previous Study	57	50	49	49	54	56	52	49	51	60	61
Pre Tx Clarifier - Scraper	Previous Study	56	50	49	49	53	56	52	49	51	60	61

Table D-2: Source Octave Band Sound Power Levels (WTP)

Noise Source	Data Source	Linear Octave Band Centre Frequency (dB)									Overall (dBA)	Overall (dBC)
		31.5	63	125	250	500	1000	2000	4000	8000		
Pre Tx Filtration Pump	Previous Study	56	49	48	48	53	55	51	48	50	59	60
Pre Tx Bentonite Skid Dosing Pump	Previous Study	56	49	48	48	53	55	51	48	50	59	60
Pre Tx Clarifier - Flocculator Tan Mixer (2)	Previous Study	55	48	47	47	52	54	50	47	49	58	59
Pre Tx Bentonite Skid Slurry mixer	Previous Study	55	48	47	47	52	54	50	47	49	58	59
Pre Tx Hypochlorite IBC unloading	Previous Study	53	46	45	45	50	52	48	45	47	56	57
Pre Tx Clarifier - Rapid Mixer	Previous Study	53	46	45	45	50	52	48	45	47	56	57

Appendix E: Source Order Ranking

Table E1: Source Order Ranking - Receiver R06 (Scenario S1E)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Mahalo Flare Maximum flaring (50MM)	34.4	2.8
	Facility SPL	34.4	2.8
	ASL	25.0	-
	Cumulative SPL	34.9	-
	PSL	28.0	-

Table E2: Source Order Ranking - Receiver R06 (Scenario S1G)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Flare 5	16.6	3.4
002	Flare 3	16.2	3.5
003	Flare 1	15.8	3.4
004	Flare 2	15.3	3.5
005	Flare 4	14.8	3.5
006	Flare 6	14.2	3.5
	Facility SPL	23.3	3.4
	ASL	25.0	-
	Cumulative SPL	27.3	-
	PSL	28.0	-

Table E3: Source Order Ranking - Receiver R06 (Scenario S2A)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	CAT 3608 Compressor Engine unit no enclosure	21.1	5.7
002	CAT 3608 Compressor Engine unit no enclosure	16.4	7.5
003	CAT 3608 Compressor Engine unit no enclosure	15.9	7.4
004	CAT 3608 Compressor Casing No enclosure	8.9	10.0
005	CAT 3608 Compressor Casing No enclosure	7.9	10.3
006	CAT 3608 Compressor Casing No enclosure	6.5	10.7
007	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
008	Compressor 21-1319 (4) Exhaust Muffler	1.3	11.0
009	Compressor 21-1319 (4) Exhaust Muffler	1.3	11.0
010	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
011	Compressor 21-1319 (4) Exhaust Pipe	-6.6	11.6
012	Compressor 21-1319 (4) Exhaust Pipe	-7.0	12.0
013	Mahalo Generator Bldg Door ClosedEast2/west	-7.1	14.3
014	Mahalo Generator Exhaust Muffler	-7.1	12.6
015	Mahalo Generator Exhaust Muffler	-7.2	12.6
015	Mahalo Generator Exhaust Muffler	-7.2	12.6
017	Compressor 21-1319 (4)C Cooler Inlet	-7.4	14.9
018	Compressor 21-1319 (4)C Cooler Inlet	-7.5	15.0
019	Mahalo Generator Cooler Inlet	-8.1	12.0
020	Compressor 21-1319 (4) Air Intake Pipe	-8.4	15.1
021	Compressor 21-1319 (4) Air Intake Pipe	-8.5	15.2
022	Mahalo Generator Bldg Door ClosedNorth	-8.6	15.9
023	P-1411 Train # 1 RO Stage 1 HP Pump	-8.8	5.2
023	Compressor 21-1319 (4)C Cooler Housing	-9.1	15.1
025	Compressor 21-1319 (4)C Cooler Housing	-9.2	15.1
026	Mahalo Generator Cooler DischargeTop	-9.2	22.0
027	Mahalo Generator Cooler DischargeTop	-9.2	21.9
027	Mahalo Generator Cooler DischargeTop	-9.2	21.9
029	Mahalo Generator Bldg WallEast/West	-9.3	15.9
030	Compressor 21-1319 (4) Air Intake Pipe	-10.0	16.3
031	Compressor 21-1319 (4)C Cooler Housing	-10.2	15.5
032	Mahalo Generator Bldg Door ClosedEast2/west	-10.3	14.4
033	Mahalo Generator Cooler Inlet	-10.5	13.4
034	Mahalo Generator Bldg Door ClosedEast2/west	-10.7	14.5
035	Mahalo Generator Cooler Inlet	-10.9	13.6
036	P-1412 Train # 1 RO Stage 2 Feed Pump	-10.9	4.8
037	Mahalo Generator Cooler HousingTop	-11.1	11.6
038	Mahalo Generator Air Intake PipeWest	-11.3	16.9
039	Compressor 21-1319 (4)C Cooler Discharge	-11.3	15.6
040	P-1421 Train # 2 RO Stage 1 HP Pump	-11.3	6.1
041	Compressor 21-1319 (4)C Cooler Discharge	-11.3	15.6
042	Compressor 21-1319 (4)C Cooler Discharge	-11.3	15.6
042	Compressor 21-1319 (4)C Cooler Housing	-11.4	15.6
044	Mahalo Generator Cooler HousingTop	-11.4	11.8
045	Compressor 21-1319 (4)C Cooler Housing	-11.5	15.6
046	Mahalo Generator Cooler HousingTop	-11.5	11.9
047	Compressor 21-1319 (4)C Cooler Housing	-11.6	15.7

Table E3: Source Order Ranking - Receiver R06 (Scenario S2A)

Rank	Noise Source	SPL (dBA)	dBC-dBA
048	Mahalo Generator Bldg Door ClosedNorth	-11.6	16.0
049	P-1422 Train # 2 RO Stage 2 Feed Pump	-11.9	5.1
050	Mahalo Generator Bldg Door ClosedNorth	-12.0	16.1
051	Mahalo Generator Bldg WallTop	-12.2	15.3
052	Compressor 21-1319 (4)C Cooler Discharge	-12.3	15.6
053	Mahalo Generator Bldg WallEast/West	-12.3	16.0
054	Compressor 21-1319 (4)C Cooler Discharge	-12.3	15.6
055	Compressor 21-1319 (4)C Cooler Discharge	-12.4	15.6
056	Compressor 21-1319 (4) Exhaust Tip	-12.5	14.9
056	Compressor 21-1319 (4) Exhaust Tip	-12.6	14.9
058	Compressor 21-1319 (4) Exhaust Tip	-12.6	14.9
058	Mahalo Generator Bldg WallEast/West	-12.7	16.1
060	Mahalo Generator Bldg WallTop	-13.5	15.9
061	Mahalo Generator Bldg WallTop	-13.6	16.0
062	Mahalo Generator Air IntakeNorth top	-14.3	15.7
063	Mahalo Generator Air IntakeNorth top	-14.4	15.7
064	Mahalo Generator Air IntakeNorth top	-14.4	15.7
065	P-1413 Train # 1 RO Stage 3 Feed Pump	-14.7	3.9
066	Load bank Air Intake	-14.8	12.4
067	P-1423 Train # 2 RO Stage 3 Feed Pump	-14.9	4.0
068	Compressor 21-1319 (4)C Cooler Inlet	-15.2	18.4
069	Compressor 21-1319 (4)C Cooler Inlet	-15.9	17.2
070	Compressor 21-1319 (4)C Cooler Inlet	-16.0	17.3
071	Compressor 21-1319 (4)C Cooler Inlet	-16.1	17.2
072	KX-1003 Membrane Aeration Blower Skid 1	-16.6	7.5
073	Combined Dosing Skid	-16.6	4.3
074	KX-1004 Membrane Aeration Blower Skid 1	-16.7	7.6
075	Mahalo Generator Air Intake PipeWest	-16.8	17.3
076	Load bank Air Intake	-17.3	12.5
077	Load bank Air Intake	-17.4	12.5
078	Mahalo Generator Air Intake PipeWest	-17.4	17.4
079	Mahalo Generator Bldg Fan Louver OpenSouth	-17.4	17.5
080	P-1101 UF Feed Pump #1	-17.9	5.7
081	P-1102 UF Feed Pump #2	-17.9	5.7
082	Load bank Cooler Discharge	-18.2	11.7
083	Compressor 21-1319 (4) Air Intake E	-18.7	24.3
084	Compressor 21-1319 (4) Air Intake E	-18.7	24.3
085	KX-1001 Air Compressor # 1	-19.4	10.2
086	Mahalo Generator Bldg Door ClosedEast	-19.4	14.2
087	P-1301 RO Feed Pump # 1	-19.9	5.6
088	P-1302 RO Feed Pump # 2	-19.9	5.6
089	Mahalo Generator Bldg Fan Louver OpenSouth	-20.5	17.8
090	Load bank Cooler Discharge	-20.5	11.9
091	Mahalo Comp Air Bldg Open Area (Doors Closed)	-20.5	5.3
092	Irrigation Pumps #2 - CRN155 PW	-20.6	8.5
093	P-1511 RO Permeate Recycle Pump	-20.6	5.7
094	Irrigation Pumps #1 - CRN155 PW	-20.7	8.6
095	Mahalo Generator Bldg Fan Louver OpenSouth	-20.8	17.9

Table E3: Source Order Ranking - Receiver R06 (Scenario S2A)

Rank	Noise Source	SPL (dBA)	dBC-dBA
096	Load bank Cooler Discharge	-20.9	11.9
097	Mahalo Generator Exhaust Tip	-21.1	19.2
098	Mahalo Generator Exhaust Tip	-21.1	19.2
099	Mahalo Generator Exhaust Tip	-21.1	19.2
100	Mahalo Comp Air Bldg Wall and Roof	-21.3	14.6
101	Compressor 21-1319 (4) Air Intake E	-22.0	26.3
102	Mahalo Generator Bldg Door ClosedEast	-22.6	14.6
103	Mahalo Generator Bldg Door ClosedEast	-23.1	14.6
104	P-1531 CIP Pump	-23.2	6.0
105	P-1532 CIP Pump	-23.4	6.1
106	Irrigation Pumps Booster NBG150	-23.4	5.2
107	Dam Transfer NBG150	-23.5	5.2
108	Irrigation Pumps #4 CRN 45 AW	-26.8	5.2
109	Irrigation Pumps #3 CRN 45 AW	-26.8	5.2
110	Mahalo TEG Dehydration Package Unit 1	-27.5	12.3
111	P-1512 Flush / Backwash Pump	-28.5	5.3
112	P-1513 Flush / Backwash Pump	-28.7	5.5
113	Truck Pumps #7 CRN 95	-29.9	4.3
113	Truck Pumps #8 CRN 95	-29.9	4.3
115	Mahalo HV VSD Transformer #1	-35.8	10.3
116	5344-Futjisu ASTG30KMTA #1	-36.3	7.7
116	5344-Futjisu ASTG30KMTA #2	-36.3	7.7
116	5344-Futjisu ASTG30KMTA #3	-36.3	7.7
119	Mahalo Transformer #4	-38.8	11.9
120	Mahalo Transformer #3	-39.5	12.1
121	Mahalo HV VSD Transformer #2	-43.6	12.8
122	Mahalo HV VSD Transformer #3	-43.8	12.9
123	Desiccant Dryer DX1001	-44.2	1.5
	Facility SPL	23.8	7.6
	ASL	25.0	-
	Cumulative SPL	27.5	-
	PSL	28.0	-

Table E4: Source Order Ranking - Receiver R06 (Scenario S2B)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Compressor 21-1319 (4) Bldg Wall	4.2	15.2
002	Compressor 21-1319 (4) Bldg Wall	3.4	15.2
003	Compressor 21-1319 (4) Bldg Wall	3.3	15.2
004	Compressor 21-1319 (4) Bldg Skid	2.5	13.2
005	Compressor 21-1319 (4) Bldg Skid	2.0	12.9
006	Compressor 21-1319 (4) Exhaust Muffler	1.6	11.0
007	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.1
008	Compressor 21-1319 (4) Exhaust Muffler	0.9	11.5
009	Compressor 21-1319 (4) Bldg Skid	-1.4	13.8

Table E4: Source Order Ranking - Receiver R06 (Scenario S2B)

Rank	Noise Source	SPL (dBA)	dBC-dBA
010	Compressor 21-1319 (4)C Cooler Inlet	-4.5	14.9
011	Compressor 21-1319 (4) Exhaust Pipe	-6.1	11.4
012	Compressor 21-1319 (4) Exhaust Pipe	-6.2	11.4
013	Compressor 21-1319 (4) Exhaust Pipe	-6.2	11.4
013	Mahalo Generator Exhaust Muffler	-7.0	12.6
015	Mahalo Generator Exhaust Muffler	-7.0	12.6
016	Mahalo Generator Exhaust Muffler	-7.0	12.6
017	Compressor 21-1319 (4)C Cooler Inlet	-7.3	14.9
018	Mahalo Generator Bldg Door ClosedEast2/west	-7.5	14.3
019	P-1411 Train # 1 RO Stage 1 HP Pump	-8.1	5.1
020	Compressor 21-1319 (4) Air Intake Pipe	-8.2	15.1
020	Mahalo Generator Cooler Inlet	-8.6	12.5
022	Mahalo Generator Bldg Door ClosedNorth	-8.9	16.0
023	Compressor 21-1319 (4)C Cooler Housing	-9.0	15.1
024	Compressor 21-1319 (4)C Cooler Housing	-9.0	15.1
025	Mahalo Generator Cooler DischargeTop	-9.1	22.1
026	Mahalo Generator Cooler DischargeTop	-9.1	22.0
026	Mahalo Generator Cooler DischargeTop	-9.1	22.0
028	Mahalo Generator Bldg WallEast/West	-9.6	16.0
029	Compressor 21-1319 (4) Air Intake Pipe	-9.9	16.4
030	P-1412 Train # 1 RO Stage 2 Feed Pump	-10.2	4.7
031	P-1421 Train # 2 RO Stage 1 HP Pump	-10.3	5.9
032	Mahalo Generator Bldg Door ClosedEast2/west	-10.5	14.5
033	Mahalo Generator Cooler Inlet	-10.7	13.7
034	Mahalo Generator Bldg Door ClosedEast2/west	-10.7	14.6
035	Mahalo Generator Cooler Inlet	-10.8	13.7
036	Compressor 21-1319 (4)C Cooler Housing	-11.0	15.4
037	Compressor 21-1319 (4)C Cooler Discharge	-11.1	15.6
038	Compressor 21-1319 (4)C Cooler Discharge	-11.1	15.6
039	Mahalo Generator Cooler HousingTop	-11.2	11.7
039	P-1422 Train # 2 RO Stage 2 Feed Pump	-11.2	5.0
041	Compressor 21-1319 (4)C Cooler Housing	-11.3	15.6
042	Compressor 21-1319 (4)C Cooler Housing	-11.4	15.6
043	Mahalo Generator Cooler HousingTop	-11.4	11.9
044	Compressor 21-1319 (4)C Cooler Housing	-11.4	15.7
045	Mahalo Generator Cooler HousingTop	-11.4	11.9
046	Mahalo Generator Air Intake PipeWest	-11.6	17.0
046	Mahalo Generator Bldg Door ClosedNorth	-11.7	16.1
048	Mahalo Generator Bldg Door ClosedNorth	-12.0	16.1
049	Compressor 21-1319 (4)C Cooler Discharge	-12.2	15.6
050	Compressor 21-1319 (4)C Cooler Discharge	-12.2	15.6
051	Compressor 21-1319 (4)C Cooler Discharge	-12.2	15.6
052	Compressor 21-1319 (4)C Cooler Discharge	-12.2	15.6
053	Compressor 21-1319 (4) Exhaust Tip	-12.4	14.9
054	Compressor 21-1319 (4) Exhaust Tip	-12.4	14.9
054	Mahalo Generator Bldg WallTop	-12.4	15.6
056	Compressor 21-1319 (4) Exhaust Tip	-12.4	14.9
057	Mahalo Generator Bldg WallEast/West	-12.4	16.1

Table E4: Source Order Ranking - Receiver R06 (Scenario S2B)

Rank	Noise Source	SPL (dBA)	dBC-dBA
058	Compressor 21-1319 (4)C Cooler Inlet	-12.6	16.7
059	Mahalo Generator Bldg WallEast/West	-12.7	16.1
060	Mahalo Generator Bldg WallTop	-13.5	16.0
061	Mahalo Generator Bldg WallTop	-13.6	16.1
062	Compressor 21-1319 (4)C Cooler Inlet	-13.8	16.5
063	Compressor 21-1319 (4)C Cooler Inlet	-13.8	16.6
063	P-1423 Train # 2 RO Stage 3 Feed Pump	-14.0	3.9
065	P-1413 Train # 1 RO Stage 3 Feed Pump	-14.0	3.9
066	Mahalo Generator Air IntakeNorth top	-14.2	15.8
067	Mahalo Generator Air IntakeNorth top	-14.2	15.7
068	Mahalo Generator Air IntakeNorth top	-14.2	15.7
069	Compressor 21-1319 (4) Bldg Door Closed E1	-14.9	12.7
070	Compressor 21-1319 (4) Bldg Door Closed E1	-15.0	12.8
071	Compressor 21-1319 (4) Bldg Door Closed E1	-15.0	12.8
072	Load bank Air Intake	-15.7	12.4
073	Combined Dosing Skid	-15.9	4.3
074	KX-1003 Membrane Aeration Blower Skid 1	-16.0	7.4
075	KX-1004 Membrane Aeration Blower Skid 1	-16.2	7.5
076	Load bank Air Intake	-16.7	12.5
077	Mahalo Generator Air Intake PipeWest	-16.9	17.4
078	Mahalo Generator Air Intake PipeWest	-17.0	17.4
079	P-1101 UF Feed Pump #1	-17.1	5.6
079	P-1102 UF Feed Pump #2	-17.1	5.6
081	Load bank Air Intake	-17.2	12.5
082	Compressor 21-1319 (4) Air Intake Pipe	-17.7	19.6
083	Mahalo Generator Bldg Fan Louver OpenSouth	-17.7	17.6
083	Compressor 21-1319 (4) Air Intake E	-18.4	24.3
085	KX-1001 Air Compressor # 1	-18.9	10.1
085	Load bank Cooler Discharge	-19.0	11.8
087	Compressor 21-1319 (4) Bldg Door Closed E2	-19.1	15.5
088	Compressor 21-1319 (4)C Cooler Inlet	-19.3	19.5
089	Compressor 21-1319 (4) Bldg Door Closed W	-19.5	15.8
089	Compressor 21-1319 (4) Bldg Door Closed W	-19.6	15.8
089	Mahalo Generator Bldg Door ClosedEast	-19.8	14.4
089	P-1511 RO Permeate Recycle Pump	-20.0	5.7
093	Irrigation Pumps #1 - CRN155 PW	-20.1	8.5
093	Compressor 21-1319 (4) Bldg Door Closed E2	-20.2	16.1
095	Load bank Cooler Discharge	-20.2	11.9
095	Irrigation Pumps #2 - CRN155 PW	-20.3	8.7
097	Load bank Cooler Discharge	-20.4	11.8
097	Mahalo Generator Bldg Fan Louver OpenSouth	-20.6	17.9
097	Mahalo Generator Bldg Fan Louver OpenSouth	-20.8	18.0
097	Mahalo Generator Exhaust Tip	-20.9	19.2
101	Mahalo Generator Exhaust Tip	-20.9	19.2
102	Mahalo Generator Exhaust Tip	-20.9	19.2
103	Mahalo Comp Air Bldg Open Area (Doors Closed)	-21.0	5.9
104	Mahalo Comp Air Bldg Wall and Roof	-21.1	14.9
105	P-1531 CIP Pump	-21.9	5.6

Table E4: Source Order Ranking - Receiver R06 (Scenario S2B)

Rank	Noise Source	SPL (dBA)	dBC-dBA
106	P-1532 CIP Pump	-22.1	5.7
107	Compressor 21-1319 (4) Air Intake E	-22.2	26.6
108	P-1301 RO Feed Pump # 1	-22.3	7.4
109	P-1302 RO Feed Pump # 2	-22.3	7.4
110	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.6	16.4
111	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.6	16.4
112	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.6	16.4
113	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.6	16.4
114	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.6	16.4
115	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.6	16.4
116	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.6	16.4
117	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.6	16.4
118	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.6	16.4
119	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.6	16.4
120	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.6	16.4
121	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.6	16.4
122	Irrigation Pumps Booster NBG150	-22.6	5.2
123	Mahalo Generator Bldg Door ClosedEast	-22.8	14.6
124	Mahalo Generator Bldg Door ClosedEast	-23.1	14.7
125	Dam Transfer NBG150	-23.1	5.2
126	Compressor 21-1319 (4) Bldg Door Closed N	-23.9	16.4
127	Compressor 21-1319 (4) Bldg Door Closed N	-23.9	16.3
128	Compressor 21-1319 (4) Bldg Door Closed E2	-25.0	17.4
129	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-25.2	20.3
130	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-25.2	20.3
131	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-25.2	20.3
131	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-25.2	20.3
133	Irrigation Pumps #4 CRN 45 AW	-26.1	5.1
134	Irrigation Pumps #3 CRN 45 AW	-26.2	5.1
135	Mahalo TEG Dehydration Package Unit 1	-26.8	11.9
136	P-1512 Flush / Backwash Pump	-27.9	5.3
137	P-1513 Flush / Backwash Pump	-28.1	5.4
138	Truck Pumps #7 CRN 95	-28.6	3.9
139	Truck Pumps #8 CRN 95	-28.6	3.9
139	Compressor 21-1319 (4) Bldg Door Closed W	-28.7	17.9
139	Compressor 21-1319 (4) Air Intake E	-29.9	27.9
142	Compressor 21-1319 (4) Bldg Door Closed N	-31.6	17.9
143	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-33.9	22.7
144	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-34.0	22.7
145	5344-Futjisu ASTG30KMTA #1	-35.8	7.6
146	5344-Futjisu ASTG30KMTA #2	-35.8	7.6
147	5344-Futjisu ASTG30KMTA #3	-35.8	7.6
148	Mahalo Transformer #4	-39.2	12.1
149	Mahalo Transformer #3	-39.9	12.3
150	Mahalo HV VSD Transformer #1	-43.4	12.8
151	Mahalo HV VSD Transformer #2	-43.6	12.8
152	Desiccant Dryer DX1001	-43.7	1.5
153	Mahalo HV VSD Transformer #3	-43.8	12.9

Table E4: Source Order Ranking - Receiver R06 (Scenario S2B)

Rank	Noise Source	SPL (dBA)	dBC-dBA
	Facility SPL	13.4	14.3
	ASL	25.0	-
	Cumulative SPL	25.3	-
	PSL	28.0	-

Table E5: Source Order Ranking - Receiver R06 (Scenario S3BE)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Mahalo Flare Normal flaring	18.7	2.8
002	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
003	Compressor 21-1319 (4) Bldg Wall	1.0	15.2
004	Compressor 21-1319 (4) Exhaust Muffler	0.8	11.4
005	Compressor 21-1319 (4) Bldg Wall	0.1	15.3
006	Compressor 21-1319 (4) Bldg Skid	-4.1	13.8
007	Compressor 21-1319 (4) Bldg Skid	-5.0	13.5
008	Compressor 21-1319 (4) Exhaust Pipe	-6.4	11.5
009	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
010	Mahalo Generator Bldg Door ClosedEast2/west	-7.0	14.3
011	Mahalo Generator Exhaust Muffler	-7.1	12.6
012	Mahalo Generator Exhaust Muffler	-7.1	12.6
012	Mahalo Generator Exhaust Muffler	-7.1	12.6
014	Mahalo Generator Cooler Inlet	-8.0	12.0
014	P-1411 Train # 1 RO Stage 1 HP Pump	-8.2	5.1
016	Compressor 21-1319 (4) Air Intake Pipe	-8.3	15.2
016	Mahalo Generator Bldg Door ClosedNorth	-8.6	15.9
018	Mahalo Water plant	-8.7	7.5
019	Mahalo Generator Cooler DischargeTop	-9.2	21.9
020	Mahalo Generator Cooler DischargeTop	-9.2	22.0
021	Mahalo Generator Cooler DischargeTop	-9.2	22.0
022	Mahalo Generator Bldg WallEast/West	-9.3	15.9
023	Compressor 21-1319 (4)C Cooler Inlet	-10.0	14.9
024	Mahalo Generator Bldg Door ClosedEast2/west	-10.4	14.4
025	P-1421 Train # 2 RO Stage 1 HP Pump	-10.5	5.9
026	P-1412 Train # 1 RO Stage 2 Feed Pump	-10.6	4.8
027	Mahalo Generator Bldg Door ClosedEast2/west	-10.6	14.5
028	Mahalo Generator Cooler Inlet	-10.8	13.5
029	Mahalo Generator Cooler Inlet	-10.8	13.6
030	Mahalo Generator Cooler HousingTop	-11.1	11.6
031	Mahalo Generator Air Intake PipeWest	-11.2	16.9
032	P-1422 Train # 2 RO Stage 2 Feed Pump	-11.3	5.0
033	Mahalo Generator Cooler HousingTop	-11.5	11.9
034	Mahalo Generator Cooler HousingTop	-11.6	11.9
035	Compressor 21-1319 (4)C Cooler Housing	-11.7	15.1
036	Mahalo Generator Bldg Door ClosedNorth	-11.8	16.0
037	Mahalo Generator Bldg Door ClosedNorth	-11.9	16.1

Table E5: Source Order Ranking - Receiver R06 (Scenario S3BE)

Rank	Noise Source	SPL (dBA)	dBC-dBA
038	Mahalo Generator Bldg WallTop	-12.2	15.3
039	Mahalo Generator Bldg WallEast/West	-12.5	16.0
040	Compressor 21-1319 (4) Exhaust Tip	-12.5	14.9
041	Load bank Air Intake	-12.6	12.5
042	Compressor 21-1319 (4) Exhaust Tip	-12.6	14.9
043	Mahalo Generator Bldg WallEast/West	-12.6	16.1
044	Compressor 21-1319 (4)C Cooler Housing	-12.8	15.5
045	Mahalo Generator Bldg WallTop	-13.6	16.0
046	Mahalo Generator Bldg WallTop	-13.6	16.0
047	Compressor 21-1319 (4)C Cooler Discharge	-13.8	15.6
048	Compressor 21-1319 (4)C Cooler Discharge	-13.9	15.6
048	P-1423 Train # 2 RO Stage 3 Feed Pump	-14.0	3.8
050	P-1413 Train # 1 RO Stage 3 Feed Pump	-14.1	3.8
051	Compressor 21-1319 (4)C Cooler Housing	-14.1	15.7
052	Compressor 21-1319 (4)C Cooler Housing	-14.1	15.7
053	Mahalo Generator Air IntakeNorth top	-14.3	15.7
054	Mahalo Generator Air IntakeNorth top	-14.3	15.7
055	Mahalo Generator Air IntakeNorth top	-14.3	15.7
056	Compressor 21-1319 (4)C Cooler Discharge	-14.9	15.6
056	Compressor 21-1319 (4)C Cooler Discharge	-14.9	15.6
058	Compressor 21-1319 (4) Bldg Door Closed E1	-15.4	13.0
059	Compressor 21-1319 (4) Bldg Door Closed E1	-15.4	13.0
060	Load bank Cooler Discharge	-15.5	11.7
061	Combined Dosing Skid	-15.9	4.3
062	Compressor 21-1319 (4)C Cooler Inlet	-16.0	17.2
063	KX-1003 Membrane Aeration Blower Skid 1	-16.1	7.4
064	KX-1004 Membrane Aeration Blower Skid 1	-16.3	7.5
065	P-1101 UF Feed Pump #1	-17.2	5.6
066	P-1102 UF Feed Pump #2	-17.2	5.6
067	Mahalo Generator Air Intake PipeWest	-17.3	17.4
068	Mahalo Generator Air Intake PipeWest	-17.3	17.4
069	Mahalo Generator Bldg Fan Louver OpenSouth	-17.4	17.5
070	Compressor 21-1319 (4) Air Intake Pipe	-17.9	19.6
070	Compressor 21-1319 (4)C Cooler Inlet	-18.5	17.2
072	Compressor 21-1319 (4) Air Intake E	-18.6	24.3
073	Compressor 21-1319 (4)C Cooler Inlet	-18.7	17.2
074	KX-1001 Air Compressor # 1	-19.0	10.1
074	Mahalo Generator Bldg Door ClosedEast	-19.3	14.2
076	P-1302 RO Feed Pump # 2	-19.5	5.6
076	Compressor 21-1319 (4) Bldg Door Closed W	-19.8	15.8
078	P-1511 RO Permeate Recycle Pump	-20.1	5.7
079	Irrigation Pumps #1 - CRN155 PW	-20.2	8.6
079	Irrigation Pumps #2 - CRN155 PW	-20.2	8.6
081	Mahalo Generator Bldg Fan Louver OpenSouth	-20.6	17.8
081	Mahalo Generator Bldg Fan Louver OpenSouth	-20.8	17.9
081	Mahalo Generator Exhaust Tip	-21.0	19.2
081	Mahalo Generator Exhaust Tip	-21.1	19.2
085	Mahalo Generator Exhaust Tip	-21.1	19.2

Table E5: Source Order Ranking - Receiver R06 (Scenario S3BE)

Rank	Noise Source	SPL (dBA)	dBC-dBA
085	Mahalo Comp Air Bldg Wall and Roof	-22.0	15.3
087	P-1531 CIP Pump	-22.1	5.7
088	P-1532 CIP Pump	-22.2	5.8
089	P-1301 RO Feed Pump # 1	-22.3	7.2
090	Mahalo Comp Air Bldg Open Area (Doors Closed)	-22.4	6.2
091	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.7	16.4
092	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.7	16.4
093	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.7	16.4
094	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.7	16.4
095	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.7	16.4
096	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.7	16.4
097	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.7	16.4
098	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.7	16.4
099	Mahalo Generator Bldg Door ClosedEast	-22.8	14.5
100	Irrigation Pumps Booster NBG150	-23.0	5.2
101	Mahalo Generator Bldg Door ClosedEast	-23.0	14.6
102	Dam Transfer NBG150	-23.1	5.2
103	Compressor 21-1319 (4) Bldg Door Closed N	-24.0	16.3
104	Compressor 21-1319 (4) Bldg Door Closed N	-24.0	16.4
105	Compressor 21-1319 (4) Bldg Door Closed E2	-25.2	17.3
106	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-25.4	20.3
107	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-25.4	20.3
108	Irrigation Pumps #4 CRN 45 AW	-26.2	5.1
109	Irrigation Pumps #3 CRN 45 AW	-26.2	5.1
110	Compressor 21-1319 (4) Bldg Door Closed E2	-26.6	17.6
111	Mahalo TEG Dehydration Package Unit 1	-27.4	12.2
112	P-1512 Flush / Backwash Pump	-28.0	5.3
113	P-1513 Flush / Backwash Pump	-28.2	5.4
114	Compressor 21-1319 (4) Bldg Door Closed W	-28.8	17.9
115	Truck Pumps #7 CRN 95	-29.5	4.3
117	Truck Pumps #8 CRN 95	-29.5	4.3
118	Compressor 21-1319 (4) Air Intake E	-30.0	27.9
119	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-34.0	22.6
120	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-34.1	22.6
121	5344-Futjisu ASTG30KMTA #3	-35.9	7.6
122	5344-Futjisu ASTG30KMTA #1	-35.9	7.6
122	5344-Futjisu ASTG30KMTA #2	-35.9	7.6
122	Mahalo HV VSD Transformer #1	-36.1	10.5
125	Mahalo Transformer #4	-38.7	11.9
126	Mahalo Transformer #3	-39.5	12.2
127	Mahalo HV VSD Transformer #2	-43.6	12.8
128	Desiccant Dryer DX1001	-43.7	1.5
	Facility SPL	19.3	7.1
	ASL	25.0	-
	Cumulative SPL	26.0	-
	PSL	28.0	-

Table E6: Source Order Ranking - Receiver R06 (Scenario S3BG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Flare 1	11.7	3.5
002	Compressor 21-1319 (4) Bldg Wall	3.5	15.2
003	Compressor 21-1319 (4) Bldg Wall	2.7	15.2
004	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
005	Compressor 21-1319 (4) Exhaust Muffler	0.7	11.5
006	Compressor 21-1319 (4) Bldg Skid	-1.6	13.8
007	Compressor 21-1319 (4) Bldg Skid	-2.4	13.5
008	Compressor 21-1319 (4) Exhaust Pipe	-6.4	11.5
009	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
010	Mahalo Generator Exhaust Muffler	-7.1	12.6
011	Mahalo Generator Exhaust Muffler	-7.1	12.6
012	Mahalo Generator Exhaust Muffler	-7.2	12.6
013	Mahalo Generator Bldg Door ClosedEast2/west	-7.2	14.3
014	Compressor 21-1319 (4)C Cooler Inlet	-7.4	14.9
015	Mahalo Generator Cooler Inlet	-8.1	12.0
016	P-1411 Train # 1 RO Stage 1 HP Pump	-8.4	5.1
016	Compressor 21-1319 (4) Air Intake Pipe	-8.4	15.1
018	Mahalo Generator Bldg Door ClosedNorth	-8.7	15.9
019	Compressor 21-1319 (4)C Cooler Housing	-9.1	15.1
019	Mahalo Generator Cooler DischargeTop	-9.2	21.9
021	Mahalo Generator Cooler DischargeTop	-9.2	22.0
022	Mahalo Generator Cooler DischargeTop	-9.2	21.9
023	Mahalo Generator Bldg WallEast/West	-9.4	15.9
023	Load bank Air Intake	-9.9	12.5
025	Load bank Air Intake	-9.9	12.5
026	Mahalo Generator Bldg Door ClosedEast2/west	-10.2	14.5
026	Compressor 21-1319 (4)C Cooler Housing	-10.2	15.5
028	Mahalo Generator Cooler Inlet	-10.3	13.4
029	P-1412 Train # 1 RO Stage 2 Feed Pump	-10.4	4.7
030	Mahalo Generator Bldg Door ClosedEast2/west	-10.5	14.5
031	P-1421 Train # 2 RO Stage 1 HP Pump	-10.6	5.9
032	Mahalo Generator Cooler Inlet	-10.8	13.5
033	Mahalo Generator Cooler HousingTop	-11.1	11.6
034	Compressor 21-1319 (4)C Cooler Discharge	-11.2	15.6
035	Compressor 21-1319 (4)C Cooler Discharge	-11.3	15.6
036	P-1422 Train # 2 RO Stage 2 Feed Pump	-11.4	5.0
037	Mahalo Generator Air Intake PipeWest	-11.4	16.9
038	Mahalo Generator Cooler HousingTop	-11.4	11.8
038	Mahalo Generator Bldg Door ClosedNorth	-11.5	16.1
040	Mahalo Generator Cooler HousingTop	-11.6	11.9
041	Compressor 21-1319 (4)C Cooler Housing	-11.6	15.7
042	Compressor 21-1319 (4)C Cooler Housing	-11.7	15.7
043	Mahalo Generator Bldg Door ClosedNorth	-11.8	16.0
044	Mahalo Generator Bldg WallEast/West	-12.2	16.0
045	Mahalo Generator Bldg WallTop	-12.2	15.3
046	Compressor 21-1319 (4)C Cooler Discharge	-12.3	15.6
047	Compressor 21-1319 (4)C Cooler Discharge	-12.3	15.6

Table E6: Source Order Ranking - Receiver R06 (Scenario S3BG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
048	Mahalo Generator Bldg WallEast/West	-12.5	16.0
049	Compressor 21-1319 (4) Exhaust Tip	-12.5	14.9
050	Compressor 21-1319 (4) Exhaust Tip	-12.6	14.9
051	Mahalo Generator Bldg WallTop	-13.3	15.9
052	Compressor 21-1319 (4)C Cooler Inlet	-13.4	17.2
053	Mahalo Generator Bldg WallTop	-13.6	16.0
053	P-1423 Train # 2 RO Stage 3 Feed Pump	-14.2	3.9
055	P-1413 Train # 1 RO Stage 3 Feed Pump	-14.2	3.8
056	Mahalo Generator Air IntakeNorth top	-14.3	15.7
057	Mahalo Generator Air IntakeNorth top	-14.3	15.7
058	Mahalo Generator Air IntakeNorth top	-14.4	15.7
059	Compressor 21-1319 (4) Bldg Door Closed E1	-15.1	12.8
060	Compressor 21-1319 (4) Bldg Door Closed E1	-15.4	13.0
061	Combined Dosing Skid	-16.0	4.3
062	Compressor 21-1319 (4)C Cooler Inlet	-16.2	17.2
063	Compressor 21-1319 (4)C Cooler Inlet	-16.2	17.2
064	KX-1003 Membrane Aeration Blower Skid 1	-16.2	7.5
065	Mahalo Generator Air Intake PipeWest	-16.2	17.3
066	KX-1004 Membrane Aeration Blower Skid 1	-16.3	7.5
067	P-1101 UF Feed Pump #1	-17.3	5.6
068	P-1102 UF Feed Pump #2	-17.3	5.6
069	Mahalo Generator Air Intake PipeWest	-17.3	17.4
070	Mahalo Generator Bldg Fan Louver OpenSouth	-17.5	17.5
071	Compressor 21-1319 (4) Air Intake Pipe	-17.9	19.6
072	Compressor 21-1319 (4) Air Intake E	-18.6	24.4
073	KX-1001 Air Compressor # 1	-19.0	10.1
074	Load bank Cooler Discharge	-19.1	11.8
075	Load bank Cooler Discharge	-19.1	11.8
076	Mahalo Generator Bldg Door ClosedEast	-19.5	14.3
077	P-1301 RO Feed Pump # 1	-19.5	5.6
078	P-1302 RO Feed Pump # 2	-19.5	5.6
079	Compressor 21-1319 (4) Bldg Door Closed W	-19.8	15.8
079	P-1511 RO Permeate Recycle Pump	-20.1	5.7
081	Irrigation Pumps #1 - CRN155 PW	-20.2	8.5
081	Irrigation Pumps #2 - CRN155 PW	-20.2	8.5
081	Load bank Cooler Discharge	-20.3	11.9
081	Load bank Cooler Discharge	-20.3	11.8
085	Mahalo Generator Bldg Fan Louver OpenSouth	-20.3	17.9
085	Mahalo Generator Bldg Fan Louver OpenSouth	-20.6	17.8
087	Mahalo Generator Exhaust Tip	-21.1	19.2
088	Mahalo Generator Exhaust Tip	-21.1	19.2
089	Mahalo Generator Exhaust Tip	-21.1	19.2
090	Mahalo Comp Air Bldg Wall and Roof	-22.1	15.2
091	P-1531 CIP Pump	-22.3	5.7
091	Mahalo Comp Air Bldg Open Area (Doors Closed)	-22.4	6.2
093	P-1532 CIP Pump	-22.5	5.8
093	Mahalo Generator Bldg Door ClosedEast	-22.5	14.6
095	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.7	16.4

Table E6: Source Order Ranking - Receiver R06 (Scenario S3BG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
096	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.7	16.4
097	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.7	16.4
098	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.7	16.4
099	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.8	16.4
100	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.8	16.4
101	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.8	16.4
102	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.8	16.4
103	Mahalo Generator Bldg Door ClosedEast	-22.8	14.5
104	Irrigation Pumps Booster NBG150	-23.0	5.2
105	Dam Transfer NBG150	-23.3	5.3
106	Compressor 21-1319 (4) Bldg Door Closed N	-24.0	16.3
107	Compressor 21-1319 (4) Bldg Door Closed N	-24.1	16.3
108	Compressor 21-1319 (4) Bldg Door Closed E2	-24.9	17.3
109	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-25.4	20.4
110	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-25.4	20.4
111	Irrigation Pumps #4 CRN 45 AW	-26.2	5.1
112	Irrigation Pumps #3 CRN 45 AW	-26.3	5.1
113	Compressor 21-1319 (4) Bldg Door Closed E2	-26.4	17.6
114	Mahalo TEG Dehydration Package Unit 1	-27.5	12.3
115	P-1512 Flush / Backwash Pump	-28.0	5.3
115	P-1513 Flush / Backwash Pump	-28.3	5.4
117	Compressor 21-1319 (4) Bldg Door Closed W	-28.8	17.9
118	Truck Pumps #7 CRN 95	-29.5	4.3
119	Truck Pumps #8 CRN 95	-29.5	4.3
120	Compressor 21-1319 (4) Air Intake E	-30.0	27.9
121	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-34.1	22.6
121	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-34.1	22.6
121	Mahalo HV VSD Transformer #1	-35.9	10.4
122	5344-Futjisu ASTG30KMTA #1	-35.9	7.6
123	5344-Futjisu ASTG30KMTA #2	-35.9	7.6
124	5344-Futjisu ASTG30KMTA #3	-35.9	7.6
124	Mahalo TEG Dehydration Package Unit 2	-36.6	19.2
124	Mahalo Transformer #4	-38.8	11.9
127	Mahalo Transformer #3	-39.5	12.1
128	Mahalo HV VSD Transformer #2	-43.6	12.8
129	Desiccant Dryer DX1001	-43.7	1.5
130	Mahalo HV VSD Transformer #3	-43.8	12.9
131	Flare 1	11.7	3.5
132	Compressor 21-1319 (4) Bldg Wall	3.5	15.2
	Facility SPL	14.5	11.7
	ASL	25.0	-
	Cumulative SPL	25.4	-
	PSL	28.0	-

Table E7: Source Order Ranking - Receiver R06 (Scenario S3AG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	CAT 3608 Compressor Engine unit no enclosure	21.2	5.7
002	CAT 3608 Compressor Engine unit no enclosure	16.0	7.4
003	Flare 1	11.7	3.4
004	CAT 3608 Compressor Casing No enclosure	9.0	10.0
005	CAT 3608 Compressor Casing No enclosure	6.5	10.7
006	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
007	Compressor 21-1319 (4) Exhaust Muffler	1.3	11.0
008	Compressor 21-1319 (4) Exhaust Pipe	-6.4	11.5
009	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
010	Mahalo Generator Exhaust Muffler	-7.1	12.6
011	Mahalo Generator Exhaust Muffler	-7.1	12.6
012	Mahalo Generator Exhaust Muffler	-7.1	12.6
013	Mahalo Generator Bldg Door ClosedEast2/west	-7.3	14.3
014	Compressor 21-1319 (4)C Cooler Inlet	-7.4	14.9
015	Mahalo Generator Cooler Inlet	-8.2	12.1
016	Compressor 21-1319 (4) Air Intake Pipe	-8.4	15.1
017	Compressor 21-1319 (4) Air Intake Pipe	-8.4	15.1
018	Mahalo Generator Bldg Door ClosedNorth	-8.8	15.9
019	P-1411 Train # 1 RO Stage 1 HP Pump	-8.8	5.2
020	Compressor 21-1319 (4)C Cooler Housing	-9.1	15.1
021	Mahalo Generator Cooler DischargeTop	-9.1	21.9
022	Mahalo Generator Cooler DischargeTop	-9.2	21.9
023	Mahalo Generator Cooler DischargeTop	-9.2	22.0
024	Mahalo Generator Bldg WallEast/West	-9.5	15.9
025	Mahalo Generator Bldg Door ClosedEast2/west	-10.1	14.5
026	Mahalo Generator Cooler Inlet	-10.1	13.3
027	Mahalo Generator Bldg Door ClosedEast2/west	-10.1	14.4
028	Compressor 21-1319 (4)C Cooler Housing	-10.2	15.5
029	Mahalo Generator Cooler Inlet	-10.3	13.3
030	P-1412 Train # 1 RO Stage 2 Feed Pump	-10.9	4.8
031	Mahalo Generator Cooler HousingTop	-11.1	11.7
032	Compressor 21-1319 (4)C Cooler Discharge	-11.2	15.6
033	P-1421 Train # 2 RO Stage 1 HP Pump	-11.2	6.1
034	Compressor 21-1319 (4)C Cooler Discharge	-11.3	15.6
035	Mahalo Generator Cooler HousingTop	-11.3	11.7
036	Mahalo Generator Bldg Door ClosedNorth	-11.4	16.1
036	Mahalo Generator Cooler HousingTop	-11.4	11.8
038	Mahalo Generator Bldg Door ClosedNorth	-11.4	16.0
038	Mahalo Generator Air Intake PipeWest	-11.5	17.0
040	Compressor 21-1319 (4)C Cooler Housing	-11.5	15.7
040	Compressor 21-1319 (4)C Cooler Housing	-11.5	15.7
042	P-1422 Train # 2 RO Stage 2 Feed Pump	-11.8	5.1
043	Mahalo Generator Bldg WallEast/West	-12.0	16.1
044	Mahalo Generator Bldg WallEast/West	-12.1	16.0
045	Mahalo Generator Bldg WallTop	-12.2	15.3
045	Compressor 21-1319 (4)C Cooler Discharge	-12.3	15.6
047	Compressor 21-1319 (4)C Cooler Discharge	-12.3	15.6
047	Compressor 21-1319 (4) Exhaust Tip	-12.5	14.9

Table E7: Source Order Ranking - Receiver R06 (Scenario S3AG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
049	Compressor 21-1319 (4) Exhaust Tip	-12.6	14.9
050	Mahalo Generator Bldg WallTop	-13.2	15.9
051	Mahalo Generator Bldg WallTop	-13.3	15.9
052	Compressor 21-1319 (4)C Cooler Inlet	-13.4	17.2
053	Mahalo Generator Air IntakeNorth top	-14.3	15.7
054	Mahalo Generator Air IntakeNorth top	-14.3	15.7
055	Mahalo Generator Air IntakeNorth top	-14.3	15.7
056	P-1413 Train # 1 RO Stage 3 Feed Pump	-14.6	3.9
057	Load bank Air Intake	-14.7	12.4
058	Load bank Air Intake	-14.8	12.4
059	P-1423 Train # 2 RO Stage 3 Feed Pump	-14.9	4.0
060	Mahalo Generator Air Intake PipeWest	-15.9	17.3
061	Compressor 21-1319 (4)C Cooler Inlet	-15.9	17.3
062	Compressor 21-1319 (4)C Cooler Inlet	-16.0	17.2
063	Mahalo Generator Air Intake PipeWest	-16.3	17.3
064	Combined Dosing Skid	-16.5	4.3
065	KX-1003 Membrane Aeration Blower Skid 1	-16.5	7.5
066	KX-1004 Membrane Aeration Blower Skid 1	-16.7	7.6
067	Load bank Air Intake	-17.0	12.5
068	Mahalo Generator Bldg Fan Louver OpenSouth	-17.6	17.5
069	P-1101 UF Feed Pump #1	-17.9	5.7
070	P-1102 UF Feed Pump #2	-17.9	5.7
071	Load bank Cooler Discharge	-18.1	11.7
071	Load bank Cooler Discharge	-18.2	11.7
073	Compressor 21-1319 (4) Air Intake E	-18.6	24.3
074	Compressor 21-1319 (4) Air Intake E	-18.7	24.3
075	KX-1001 Air Compressor # 1	-19.3	10.1
076	Mahalo Generator Bldg Door ClosedEast	-19.6	14.3
076	P-1301 RO Feed Pump # 1	-19.9	5.6
078	P-1302 RO Feed Pump # 2	-19.9	5.6
079	Mahalo Generator Bldg Fan Louver OpenSouth	-20.2	17.9
080	Mahalo Generator Bldg Fan Louver OpenSouth	-20.2	17.8
081	Load bank Cooler Discharge	-20.4	11.8
082	Irrigation Pumps #1 - CRN155 PW	-20.5	8.6
082	P-1511 RO Permeate Recycle Pump	-20.5	5.7
084	Mahalo Comp Air Bldg Open Area (Doors Closed)	-20.5	5.3
084	Irrigation Pumps #2 - CRN155 PW	-20.7	8.7
086	Mahalo Generator Exhaust Tip	-21.0	19.2
087	Mahalo Generator Exhaust Tip	-21.1	19.2
087	Mahalo Generator Exhaust Tip	-21.1	19.2
087	Mahalo Comp Air Bldg Wall and Roof	-21.3	14.6
090	Mahalo Generator Bldg Door ClosedEast	-22.5	14.6
091	Mahalo Generator Bldg Door ClosedEast	-22.5	14.6
092	P-1531 CIP Pump	-23.1	6.0
093	P-1532 CIP Pump	-23.3	6.1
094	Irrigation Pumps Booster NBG150	-23.4	5.2
094	Dam Transfer NBG150	-23.5	5.3
095	Irrigation Pumps #3 CRN 45 AW	-26.8	5.2

Table E7: Source Order Ranking - Receiver R06 (Scenario S3AG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
096	Irrigation Pumps #4 CRN 45 AW	-26.9	5.2
097	Mahalo TEG Dehydration Package Unit 1	-27.4	12.2
098	P-1512 Flush / Backwash Pump	-28.5	5.3
099	P-1513 Flush / Backwash Pump	-28.7	5.4
100	Truck Pumps #7 CRN 95	-29.8	4.3
101	Truck Pumps #8 CRN 95	-29.8	4.3
102	Mahalo HV VSD Transformer #1	-36.0	10.4
103	5344-Futjisu ASTG30KMTA #1	-36.3	7.7
104	5344-Futjisu ASTG30KMTA #2	-36.3	7.7
105	5344-Futjisu ASTG30KMTA #3	-36.3	7.7
106	Mahalo TEG Dehydration Package Unit 2	-36.5	19.1
107	Mahalo Transformer #4	-38.8	11.9
108	Mahalo Transformer #3	-39.5	12.2
109	Mahalo HV VSD Transformer #2	-43.6	12.8
110	Mahalo HV VSD Transformer #3	-43.7	12.8
111	Desiccant Dryer DX1001	-44.2	1.5
112	CAT 3608 Compressor Engine unit no enclosure	21.2	5.7
	Facility SPL	23.2	7.2
	ASL	25.0	-
	Cumulative SPL	27.2	-
	PSL	28.0	-

Appendix F: Noise Control Acoustic Specifications

Summary

The table below lists the noise control items designed to bring the subject facility in compliance with the regulations.

Noise Control Recommendations

Item	Noise Source	Noise Control
1	Cooler	1.AXH 168-2ZF, 24.5 HP, 14' fan diameter, 2.AXH 132-2ZF, two (2) 30kW motors
2	Engine Air Intake	Air intake AFS3-20S1 Size 20 inches, critical grade
3	Engine exhaust silencer	Exhaust silencer MSA77-22C2-D40-142-8A21222 Size: 20.0 inches, Super Extreme grade, attenuation: 45-60 dbA

Appendix G: Technical Details and Best Practices Approach

Technical Details

Sound is the phenomena of vibrations transmitted through air, or other medium such as water or a building structure. The range of pressure amplitudes, intensities, and frequencies of the sound energy is very wide, and many specialized fields have developed using different ranges of these variables, such as room acoustics and medical ultrasound.

Due to the wide range of intensities, which are perceived as sound, standard engineering units become inconvenient. Sound levels are commonly measured on a logarithmic scale, with the level (in decibels, or dB) being proportional to ten times the common logarithm of the sound energy or intensity. Normal human hearing covers a range of about twelve to fourteen orders of magnitude in energy, from the threshold of hearing to the threshold of pain. On the decibel scale, the threshold of hearing is set as zero, written as 0 dB, while the threshold of pain varies between 120 to 140 dB. The most usual measure of sound is the sound pressure level (SPL), with 0 dB SPL set at 2.0×10^{-5} N/m^2 (also written 20 μPa), which corresponds to a sound intensity of 10^{-12} Watts/m^2 (or 1 picoWatt/m^2, written 1 pW/m^2).

Normal human hearing spans a frequency range from about 20 Hertz (Hz, or cycles per second) to about 20,000 Hz (written 20 kHz). However, the sensitivity of human hearing is not the same at all frequencies. To accommodate the variation in sensitivity, various frequency-weighting scales have been developed. The most common is the A-weighting scale, which is based on the sensitivity of human hearing at moderate levels; this scale reflects the low sensitivity to sounds of very high or very low frequencies. Sound levels measured on the A-weighted scale are written in A-weighted decibels, commonly shown as dBA or dB(A).

Human hearing becomes more sensitive to lower frequency sounds as the level of the sound increases. For this purpose, the C-weighing scale was developed to assess reaction to higher levels sounds. Although the C-weighting scale, or the sound level in dBC, is seldom used on its own, the levels in dBC and dBA are often used together to assess the significance of the low-frequency components of sound. In some cases, a limit is placed on the dBC level at a location in order to limit the amount of low-frequency noise.

When sound is measured using the A-weighting scale, the reading is often called the “Noise level”, to confirm that human sensitivity and reactions are being addressed. A table of some common noise sources and their associated noise levels are shown in the table below.

When the A-weighting scale is not used, the measurement is said to have a “linear” weighting, or to be unweighted, and may be called a “linear” level. As the linear reading is an accurate measurement of the physical (sound) pressure, the term “Sound Pressure Level”, or SPL, is usually (but not universally) reserved for unweighted measurements.

Noise is usually defined as “unwanted sound”, which indicates that it is not just the physical sound that is important, but also the human reaction to the sound that leads to the perception of sound as noise. It implies a judgment of the quality or quantity of sound experienced. As a human reaction to sound is involved, noise levels are usually given in A-weighted decibels (dBA). However, use of the C-weighting scale, usually in combination with the dBA level, is becoming more common as well. An alternate definition of noise is “sound made by somebody else”, which emphasizes that the ability to control the level of the sound alters the perception of noise.

Noise Levels of Familiar Sources

Source or Environment	Noise Level (dBA)
High Pressure Steam Venting to Atmosphere (3 m)	121
Steam Boiler (2 m)	90-95
Drilling Rig (10 m)	80-90
Pneumatic Drill (15 m)	85
Pump Jack (10 m)	68-72
Truck (15 m)	65-70
Business Office	65
Conversational Speech (1 m)	60
Light Auto Traffic (30 m)	50
Living Room	40
Library	35
Soft Whisper (5 m)	20-35

The single number A-weighted level is often inadequate for engineering purposes, although it does supply a good estimate of people's reaction to a noise environment. As noise sources, control measures, and materials differ in the frequency dependence of their noise responses or production, sound is measured with a narrower frequency bandwidth; the specific methodology varies with the application. For most work, the acoustic frequency range is divided into frequency bands where the center frequency of each band is twice the frequency of the next lower band; these are called "Octave" bands, as their frequency relation is called an "Octave" in music, where the field of acoustics has its roots. For more detailed work, the octave bands, and certain standard octave and 1/3 octave bands have been specified by international agreements.

Where the noise at the receiver is steady, it is easy to assess the noise level. However, both the production of noise at the source and the transmission of noise can vary with time; most noise levels are not constant, either because of the motion of the noise source (as in traffic noise), because the noise source itself varies, or because the transmission of sound to the receiver location is not steady as over long distances. This is almost always the case for environmental noise studies. Several single number descriptors have been developed and are used to assess noise in these conditions.

The most common is the measurement of the "equivalent continuous" sound level, or L_{eq}, which is the level of a hypothetical source of a constant level which would give the same total sound energy as is measured during the sampling period. This is the "energy" average noise level. Typical sampling periods are one hour, night-time (9 hours) or one day (24 hours); the sampling period used must be reported when using this unit.

The greatest value of the L_{eq} is that the contributions of different sources to the total noise level can be assessed, or in a case where a new noise source is to be added to an existing environment, the total noise level from new and old sources can be easily calculated. It is also sensitive to short term high noise levels.

Statistical noise levels are sometimes used to assess an unsteady noise environment. They indicate the levels that are exceeded a fixed percentage of the measurement time period measured. For example, the 10^{th} percentile level, written L_{10}, is the levels exceeded 10% of the time; this level is a good measure of frequent noisy occurrences such as steady road traffic. The 90% level, L_{90}, is the level exceeded 90% of the time, and is the background level, or noise floor. A steady noise source will modify the background level, while an intermittent noise source such as road or rail traffic will affect the short-term levels only.

One disadvantage with the L_{eq} measure, when used alone, is that nearby loud sources (e.g. dogs barking, or birds singing) can confuse the assessment of the situation when it is the noise from a distant plant that is the concern. For this reason, the equivalent level and the statistical levels can be used together to better understand the noise environment. One such indication is the difference between the L_{eq} and the L_{90} levels. A large difference between the L_{eq} and L_{90}, greater than 10 dB, indicates the intrusion of short-term noise events on the general background level. A small difference, less than 5 dB, indicates a very steady noise environment. If the L_{eq} value exceeds the L_{10} value this indicates the presence of significant short-term loud events.

For most noise measurement, instruments are adjusted so that the time response of the instrument is similar to the response of the human ear; this is the "Fast" setting. Measurement with the "Fast" setting therefore assesses the sound environment according to the way humans would hear it and react to it. Where the noise level varies substantially and an average level is wanted without the complexity of and L_{eq} or statistical measurement, the "Slow" setting is used on the sound level meter. The "Slow" setting is also typically used in industrial settings where hearing damage is a concern. Where the noise level changes very rapidly, for example due to impacts or detonations, the "Fast" and "Slow" settings do not respond quickly enough to assess the maximum levels, and the "Impulse" meter setting us used.

The Sound Power Level (abbreviated L_w, SWL or PWL) is the decibel equivalent of the total energy emitted from a source in the form of noise. The reference level for the sound power is 10^{-12} Watts, or 1 picoWatt (abbreviated pW). The sound power level is given by:

$$L_w, \text{SWL, PWL} = 10 \times \log_{10} (\text{Emitted Power} / 1 \text{ pW}) \text{ dB}$$

Therefore, a source emitting 1 Watt of power in the form of sound would have a sound power level of 120 dB. Sound power levels can be expressed in terms of frequency bands, an overall linear-weighted level or A-weighted, as is the case for sound pressure levels. However, sound power levels are inherent to the source of noise, whereas the sound pressure level is dependent on the source, but also on the distance from the source and other environmental factors.

Note that according to the acoustical literature (E.g. Noise Control Engineering from Bies and Hansen), the subjective effect of changes in SPL is as follows:

- A 3-dB change is "just perceptible".
- A 5-dB change is "clearly noticeable".
- A 10-dB change is "twice as loud or half as loud".
- A 20-dB change is "much louder or much quieter".

Appendix F: MSES Report

Queensland Government

Department of the Environment, Tourism, Science and Innovation

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest

PL: 1083

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 2020). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and a field survey may be required to validate values on the ground.

Please direct queries about these reports to: Planning.Support@des.qld.gov.au

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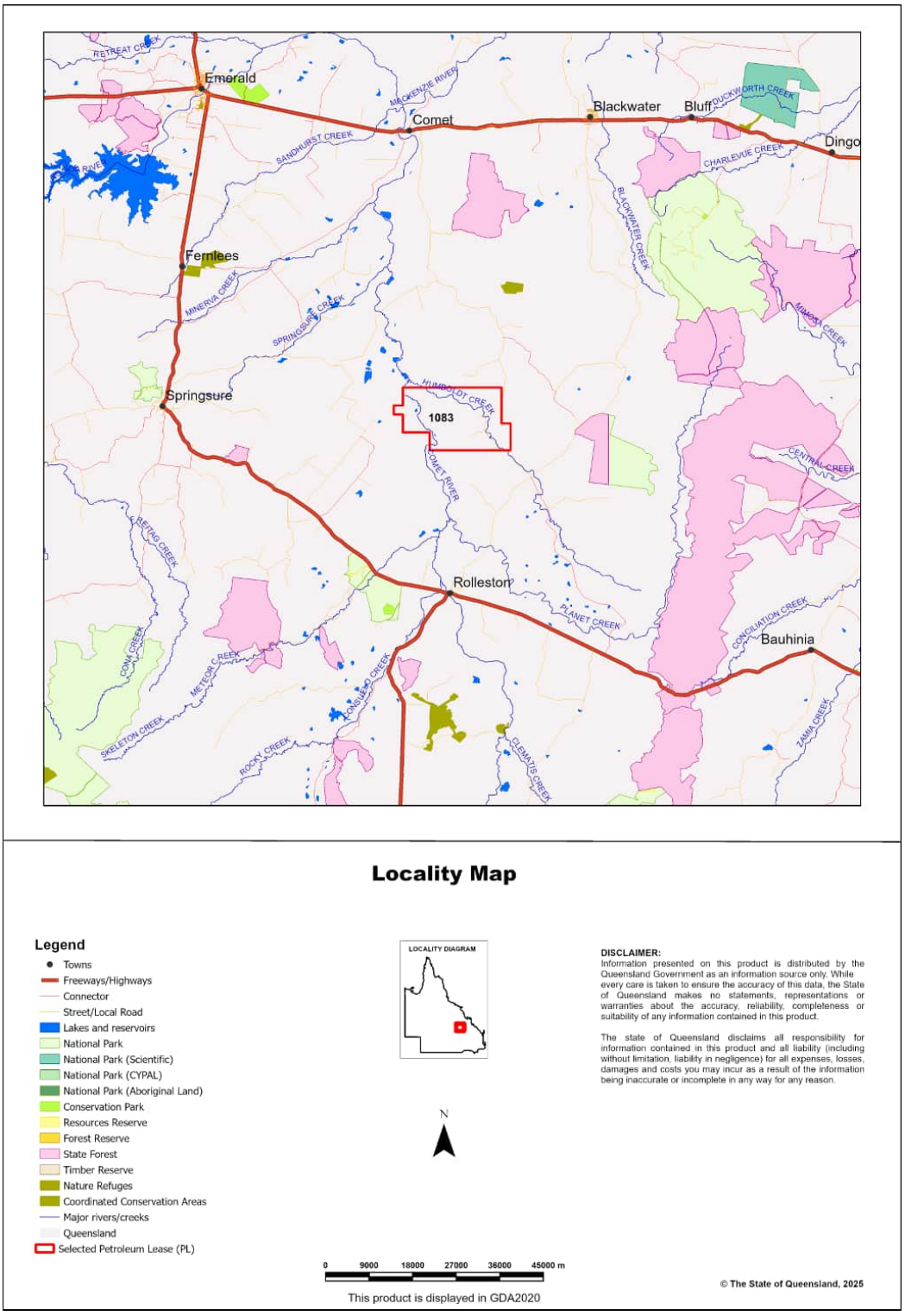
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Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

Table 1: Summary table, details for AOI: PL: 1083, with area 23453.62 ha

Local Government(s)	Catchment(s)	Bioregion(s)	Subregion(s)
Central Highlands Regional	Fitzroy	Brigalow Belt	Isaac - Comet Downs



Matters of State Environmental Significance (MSES)

MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

The MSES mapping product is a guide to assist implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations.

The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992;*

- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the Marine Parks Act 2004 ;

- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;

- *Threatened wildlife under the Nature Conservation Act 1992* and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;

- Regulated vegetation under the *Vegetation Management Act 1999* that is:

  - Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;
  - Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;
  - Category R areas on the regulated vegetation management map;
  - Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;
  - Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;

- Strategic Environmental Areas under the *Regional Planning Interests Act 2014* ;

- Wetlands in a wetland protection area of wetlands of high ecological significance shown on the Map of Queensland Wetland Environmental Values under the Environment Protection Regulation 2019;

- Wetlands and watercourses in high ecological value waters defined in the Environmental Protection (Water) Policy 2009, schedule 2;
- Legally secured offset areas.

MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

Table 2: Summary of MSES present within the AOI

1a Protected Areas- estates	0 ha	0.0%
1b Protected Areas- nature refuges	0 ha	0.0%
1c Protected Areas- special wildlife reserves	0 ha	0.0%
2 State Marine Parks- highly protected zones	0 ha	0.0%
3 Fish habitat areas (A and B areas)	0 ha	0.0%
4 Strategic Environmental Areas (SEA)	0 ha	0.0%
5 High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values	3.75 ha	0.0%
6a High Ecological Value (HEV) wetlands	0 ha	0.0%
6b High Ecological Value (HEV) waterways	0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	1053.01 ha	4.5%
7b Special least concern animals	0 ha	0.0%
7c i Koala habitat area - core (SEQ)	0 ha	0.0%
7c ii Koala habitat area - locally refined (SEQ)	0 ha	0.0%
7d Sea turtle nesting areas	0 km	Not applicable
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	861.98 ha	3.7%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	6.68 ha	0.0%
8c Regulated Vegetation - Category R (GBR riverine regrowth)	28.28 ha	0.1%
8d Regulated Vegetation - Essential habitat	885.84 ha	3.8%
8e Regulated Vegetation - intersecting a watercourse	230.2 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	91.78 ha	0.4%
9a Legally secured offset areas- offset register areas	0 ha	0.0%
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0 ha	0.0%

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(No results)

1b. Protected Areas - nature refuges

(No results)

1c. Protected Areas - special wildlife reserves

(No results)

2. State Marine Parks - highly protected zones

(No results)

3. Fish habitat areas (A and B areas)

(No results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

4. Strategic Environmental Areas (SEA)

(No results)

5. High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values
Natural wetlands that are 'High Ecological Significance' (HES) on the Map of Queensland Wetland Environmental Values are present.

6a. Wetlands in High Ecological Value (HEV) waters

(no results)

6b. Waterways in High Ecological Value (HEV) waters

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

7a. Threatened (endangered or vulnerable) wildlife

Values are present

7b. Special least concern animals

Not applicable

7c i. Koala habitat area - core (SEQ)

Not applicable

7c ii. Koala habitat area - locally refined (SEQ)

Not applicable

7d. Wildlife habitat (sea turtle nesting areas)

Not applicable

Threatened (endangered or vulnerable) wildlife habitat suitability models

Species	Common name	NCA status	Presence
Boronia keysii	Keys boronia	V	None
Calyptorhynchus lathami	Glossy black cockatoo	V	None
Casuarius casuarius johnsonii	Sthn population cassowary	E	None
Crinia tinnula	Wallum froglet	V	None
Denisonia maculata	Ornamental snake	V	Core
Euastacus bindal	Mount Elliot crayfish	CR	None
Euastacus binzayedi		CR	None
Euastacus eungella		E	None
Euastacus hystricosus		E	None
Euastacus jagara	Jagara hairy crayfish	CR	None
Euastacus maidae		CR	None
Euastacus monteithorum		E	None
Euastacus robertsi		E	None
Taudactylus pleione	Kroombit tinkerfrog	E	None
Litoria freycineti	Wallum rocketfrog	V	None
Litoria olongburensis	Wallum sedgefrog	V	None
Macadamia integrifolia		V	None
Melaleuca irbyana	swamp tea-tree	E	None
Macadamia ternifolia		V	None
Macadamia tetraphylla	bopple nut	V	None
Petrogale penicillata	brush-tailed rock-wallaby	V	None
Petrogale coenensis	Cape York rock-wallaby	E	None
Petrogale purpureicollis	purple-necked rock-wallaby	V	None
Petrogale sharmani	Sharmans rock-wallaby	V	None
Petrogale xanthopus celeris	yellow-footed rock-wallaby (Qld subspecies)	V	None
Petaurus gracilis	Mahogany Glider	E	None
Petrogale persephone	Proserpine rock-wallaby	E	None
Phascolarctos cinereus	Koala - outside SEQ*	E	None
Pezoporus wallicus wallicus	Eastern ground parrot	V	None
Xeromys myoides	Water Mouse	V	None

*For koala model, this includes areas outside SEQ. Check 7c SEQ koala habitat for presence/absence.

Threatened (endangered or vulnerable) wildlife species records

Scientific name	Common name	NCA status	EPBC status	Migratory status
Phascolarctos cinereus	koala	E	E	None

Special least concern animal species records

(No results)

Shorebird habitat (critically endangered/endangered/vulnerable)

Not applicable

Shorebird habitat (special least concern)

Not applicable

**Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL). Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)*

Migratory status (M) - China and Australia Migratory Bird Agreement (C), Japan and Australia Migratory Bird Agreement (J), Republic of Korea and Australia Migratory Bird Agreement (R), Bonn Migratory Convention (B), Eastern Flyway (E)

To request a species list for an area, or search for a species profile, access Wildlife Online at:

https://www.qld.gov.au/environment/plants-animals/species-list/

Refer to **Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals** and **Map 3b - MSES - Species - Koala habitat area (SEQ)** and **Map 3c - MSES - Wildlife habitat (sea turtle nesting areas)** for an overview of the relevant MSES.

MSES - Regulated Vegetation

For further information relating to regional ecosystems in general, go to:

https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/

For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:

https://environment.ehp.qld.gov.au/regional-ecosystems/

8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)

Regional ecosystem	Vegetation management polygon	Vegetation management status
11.3.1	E-dom	rem_end
11.3.1/11.3.3	E-dom	rem_end
11.3.11	E-dom	rem_end
11.3.2	O-dom	rem_oc
11.3.2/11.3.1	E-subdom	rem_end
11.3.3	O-dom	rem_oc
11.3.3/11.3.1	E-subdom	rem_end
11.4.8	E-dom	rem_end
11.4.9a	E-dom	rem_end
11.8.4/11.8.5/11.8.11	O-subdom	rem_oc
11.9.4a	O-dom	rem_oc

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Regional ecosystem	Vegetation management polygon	Vegetation management status
11.3.1/11.3.3	E-dom	hvr_end
11.3.11	E-dom	hvr_end
11.3.2/11.3.1	E-subdom	hvr_end
11.4.9a	E-dom	hvr_end

8c. Regulated Vegetation - Category R (GBR riverine regrowth)

Regulated vegetation map category	Map number
R	8649

8d. Regulated Vegetation - Essential habitat

Values are present

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Regulated vegetation map category	Map number
A	8649
B	8649
R	8649

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets

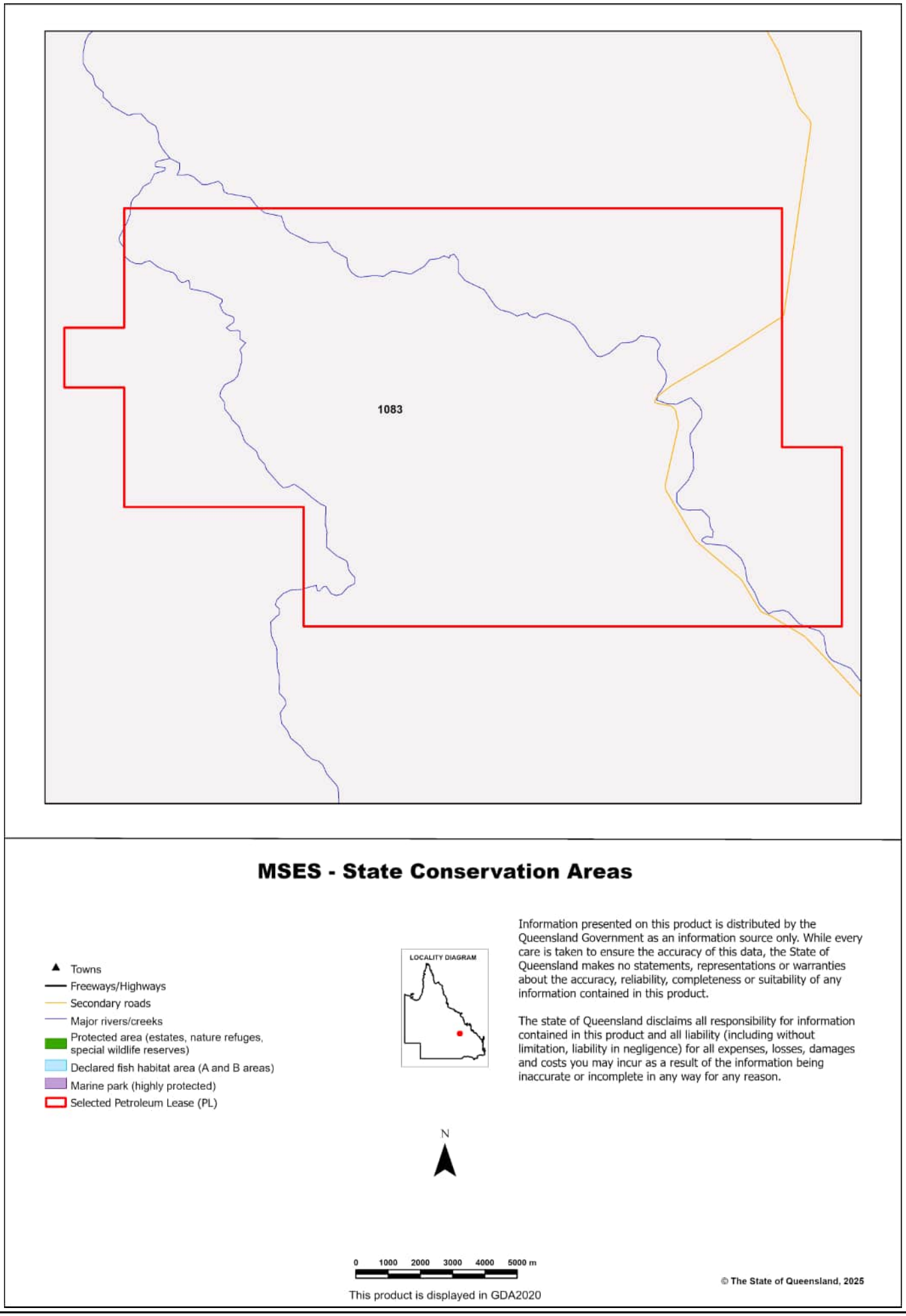
9a. Legally secured offset areas - offset register areas

(No results)

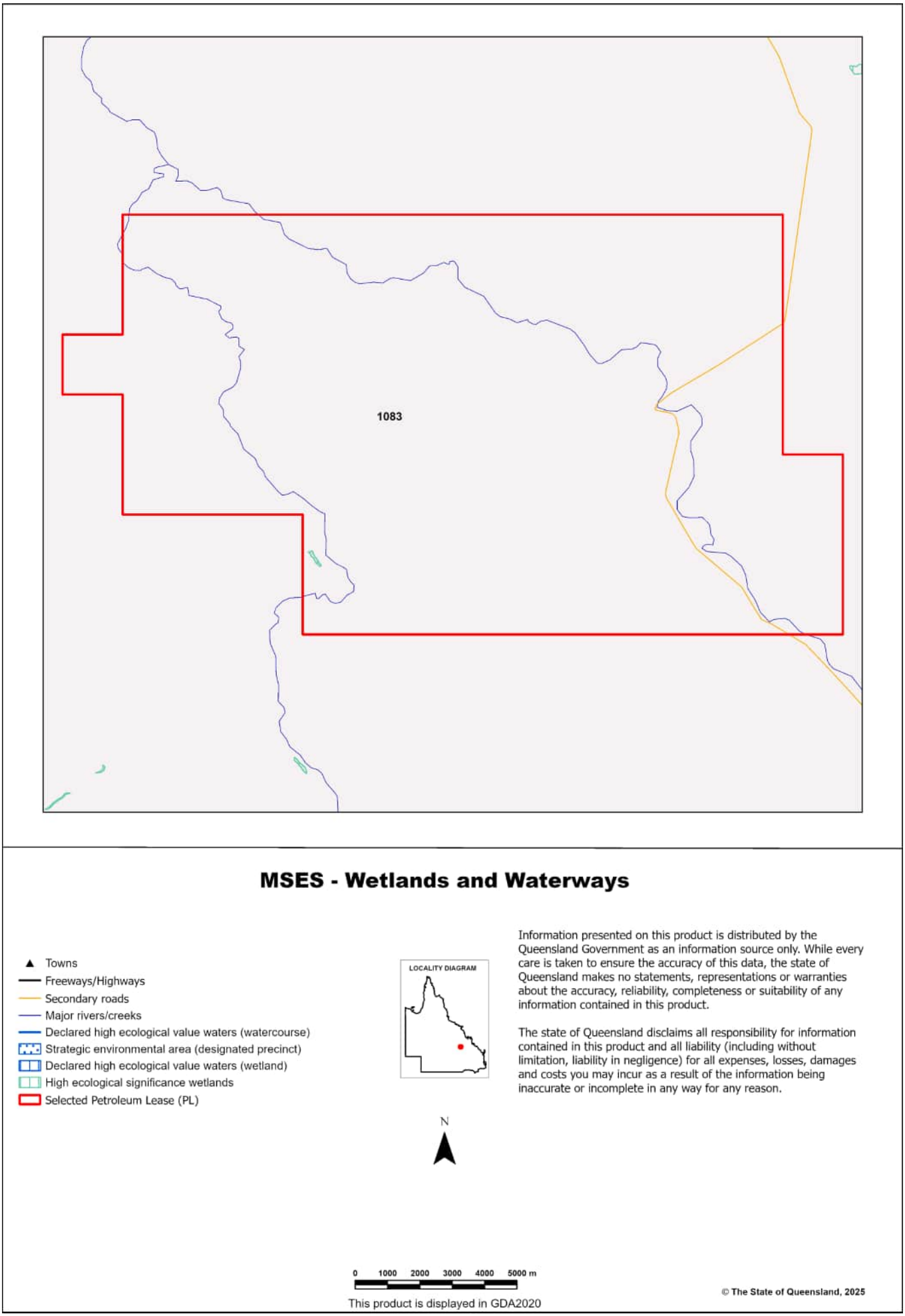
9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation
(No results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

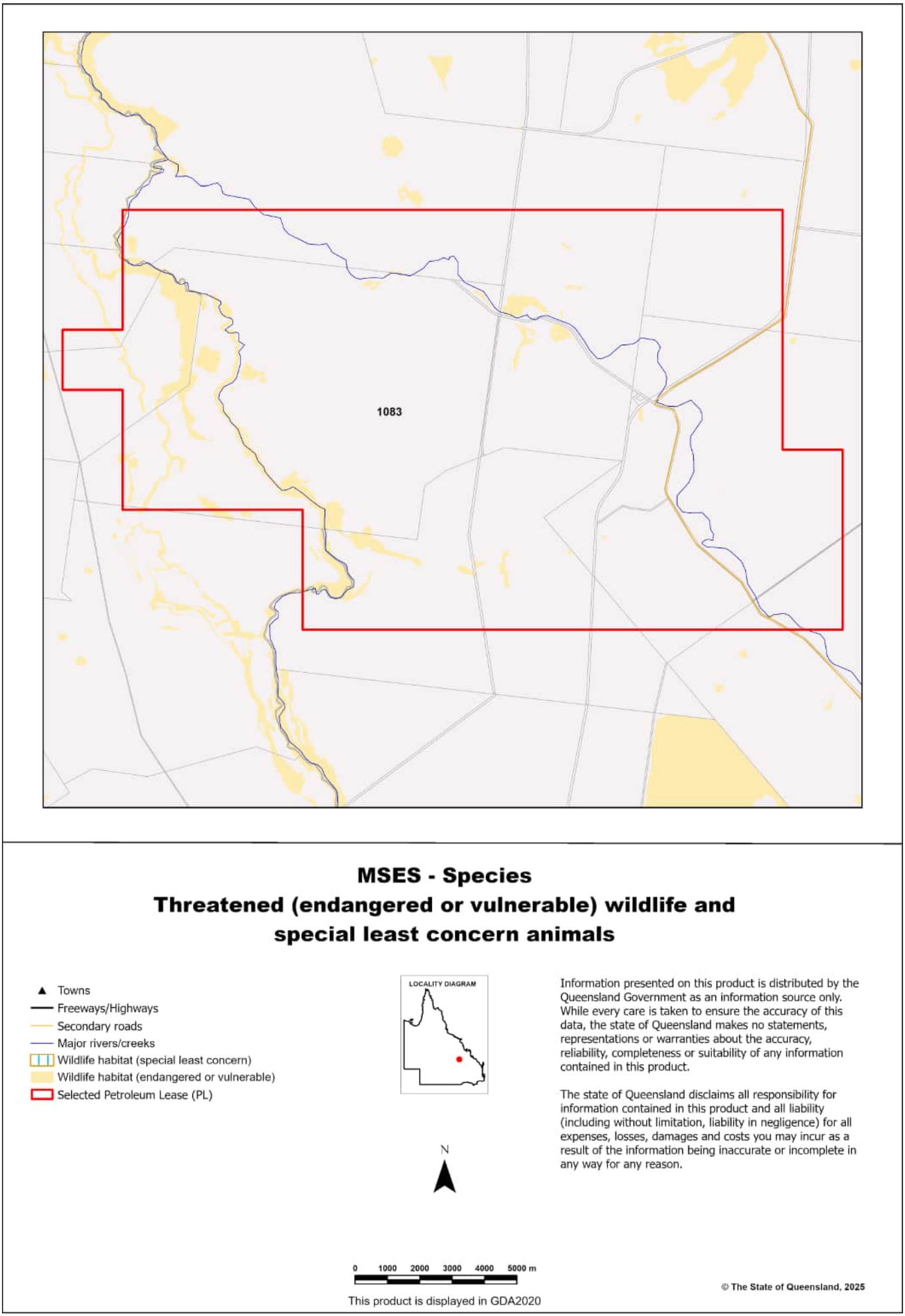
Map 1 - MSES - State Conservation Areas



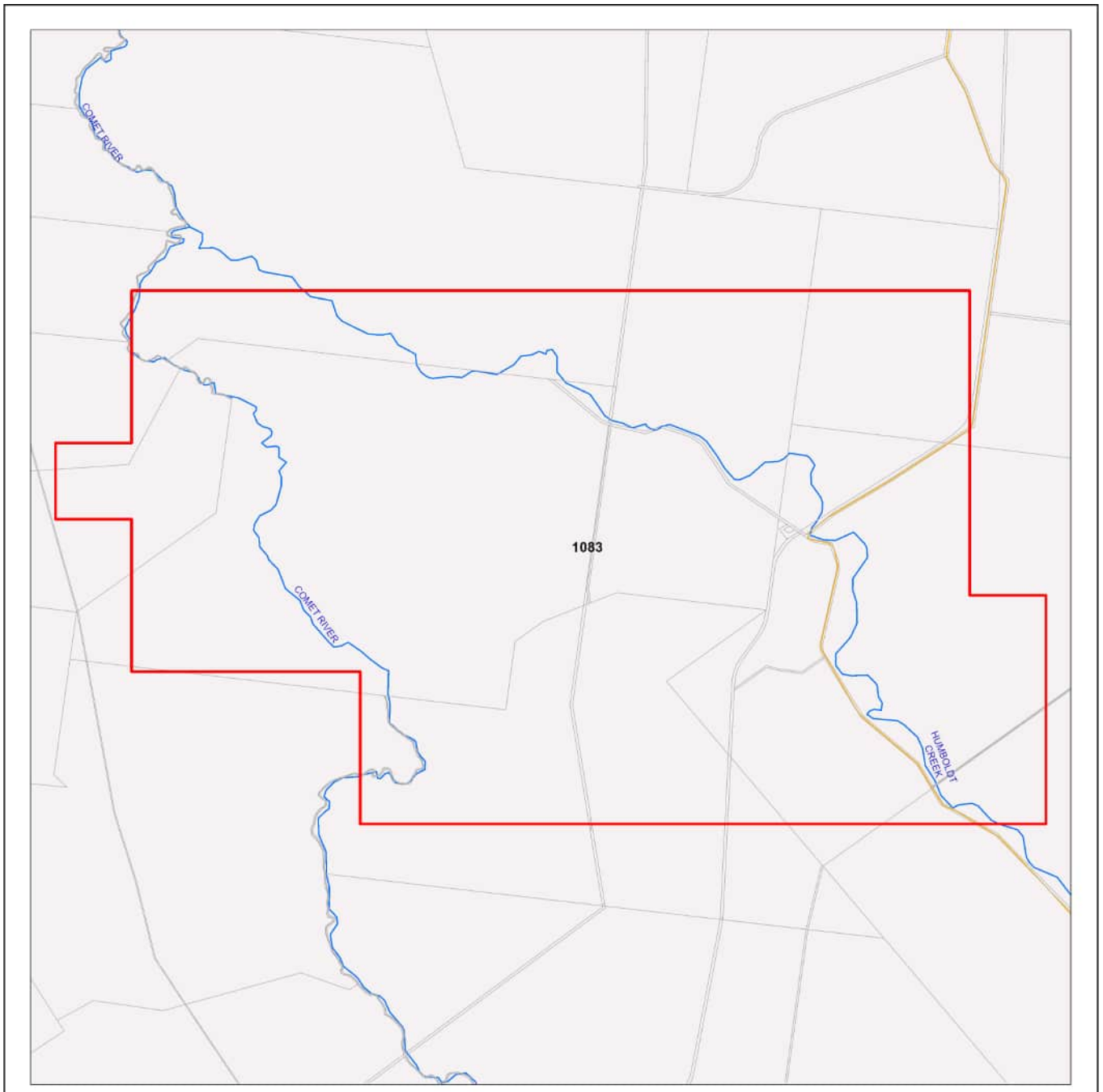
Map 2 - MSES - Wetlands and Waterways



Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals



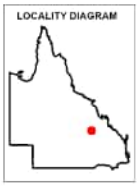
Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species
Koala habitat area (SEQ)

- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)
- Selected Petroleum Lease (PL)

LOCALITY DIAGRAM



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The represented layers for SEQ 'koala habitat area-core' and 'koala habitat area- locally refined' in MSES are sourced directly from the regulatory mapping under the Nature Conservation (Koala) Conservation Plan 2017. Whilst every effort is made to ensure the information remains current, there may be delays between updating versions. Please refer to the original mapping for the most recent version. See https://environment.des.qld.gov.au/wildlife/animals/living-with/koalas/mapping

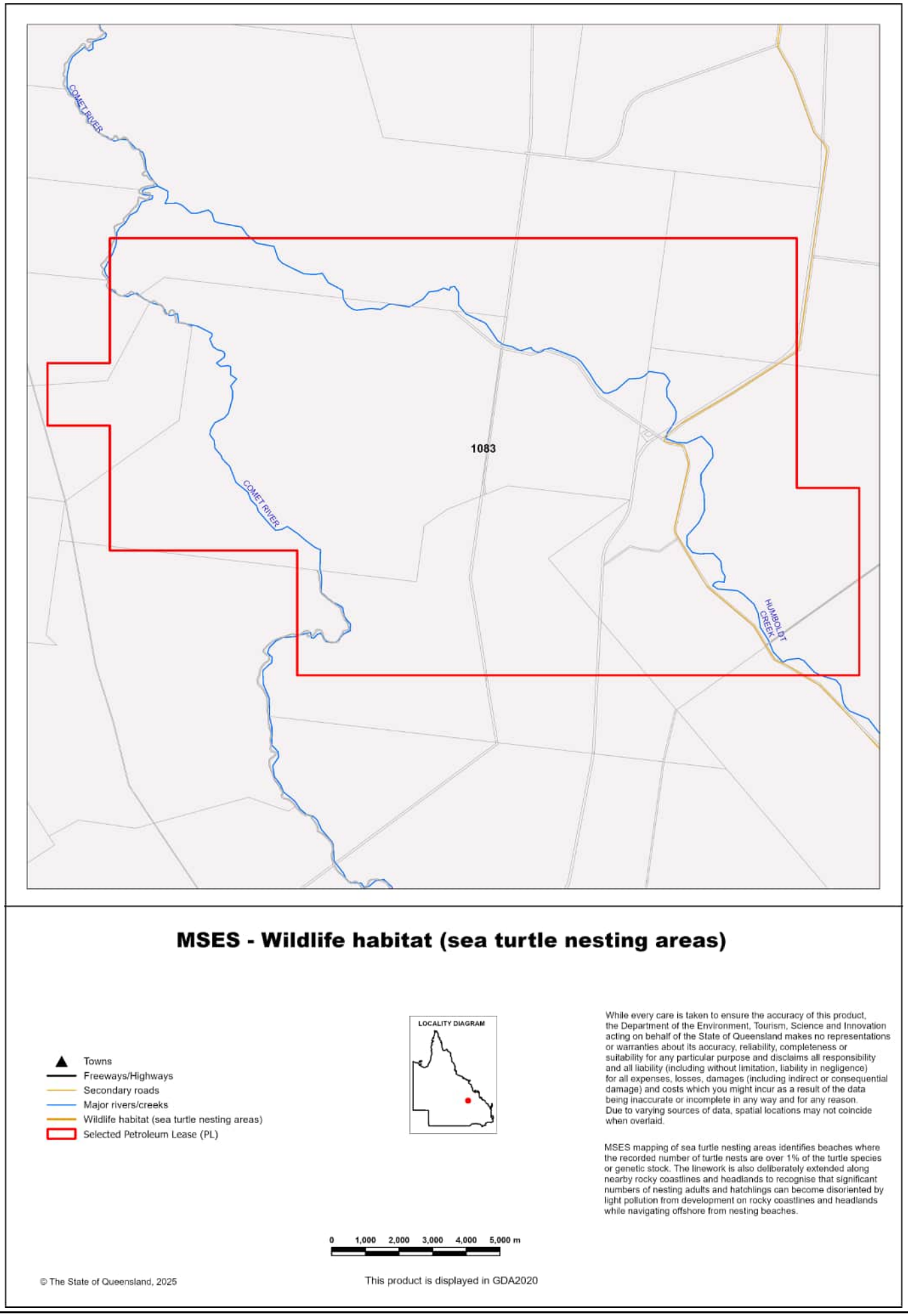
The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.

0 1,000 2,000 3,000 4,000 5,000 m

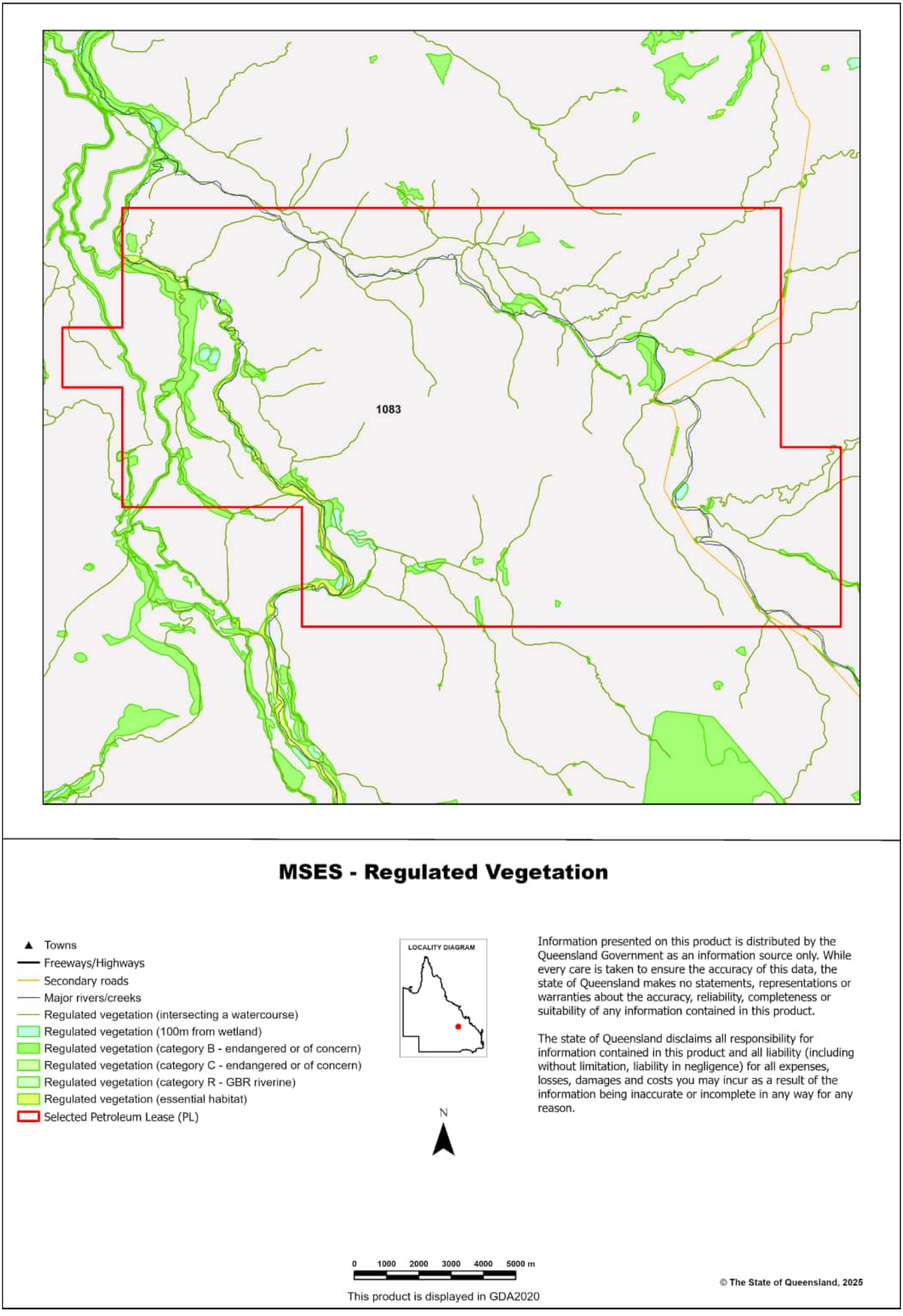
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This product is displayed in GDA2020

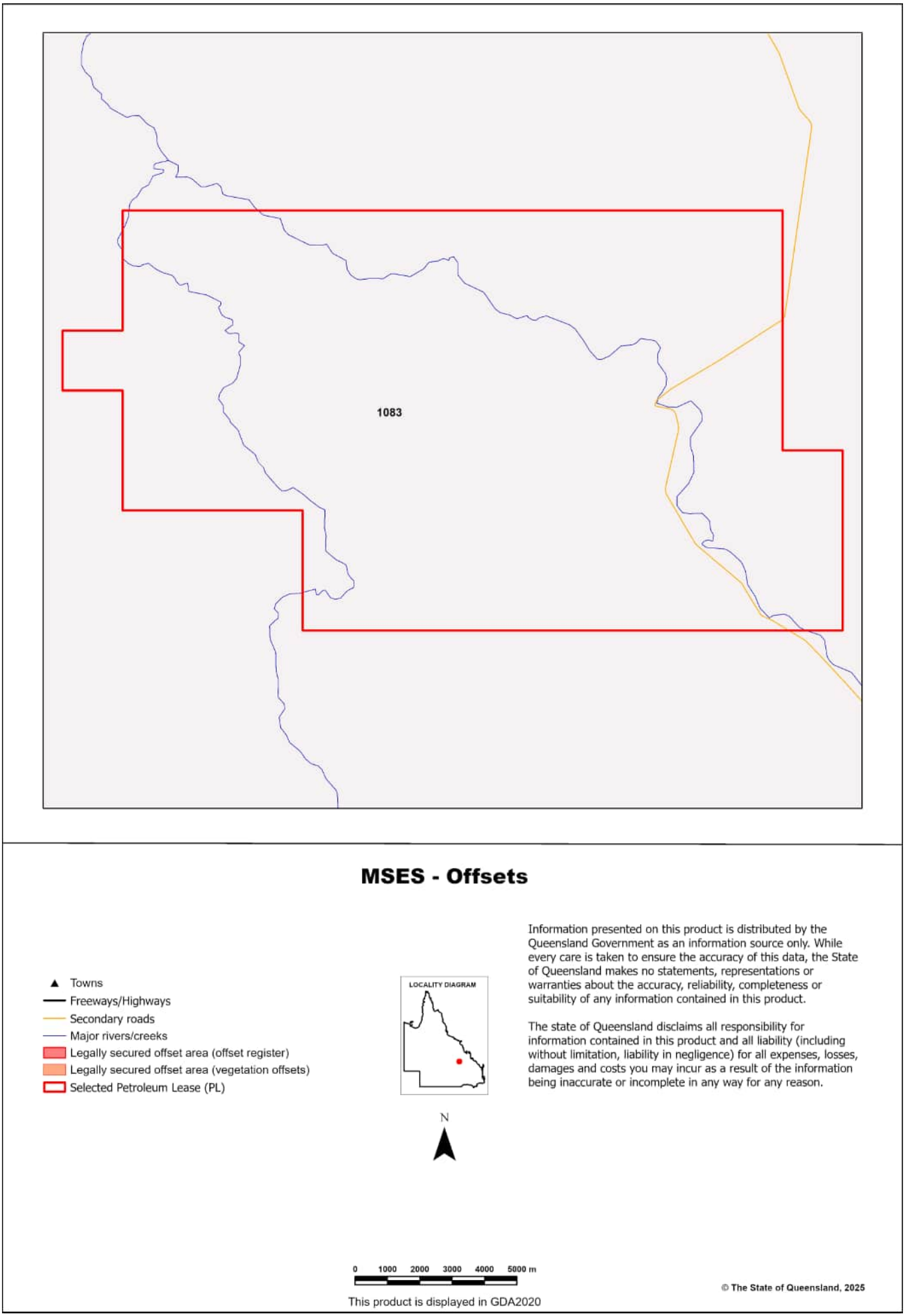
Map 3c - MSES - Species - Wildlife habitat (sea turtle nesting areas)



Map 4 - MSES - Regulated Vegetation



Map 5 - MSES - Offset Areas



Appendices

Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). Its primary purpose is to support implementation of the SPP biodiversity policy.

MSES mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations.

MSES mapping does not determine whether state or local development assessment is required. For state assessment triggers refer to the Development Assessment Mapping System (DAMS). For local assessment triggers, refer to the relevant local planning scheme.

The Queensland Government's "Method for mapping - matters of state environmental significance can be downloaded from:

http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html .

Appendix 2 - Source Data

The datasets listed below are available on request from:

http://qldspatial.information.qld.gov.au/catalogue/custom/index.page

- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

Individual MSES layers can be attributed to the following source data available at QSpatial:

MSES layers	**current QSpatial data (http://qspatial.information.qld.gov.au)**
Protected Areas-Estates, Nature Refuges, Special Wildlife Reserves	- Protected areas of Queensland - Nature Refuges - Queensland - Special Wildlife Reserves- Queensland
Marine Park-Highly Protected Zones	Moreton Bay marine park zoning 2008
Fish Habitat Areas	Queensland fish habitat areas
Strategic Environmental Areas-designated	Regional Planning Interests Act - Strategic Environmental Areas
HES wetlands	Map of Queensland Wetland Environmental Values
Wetlands in HEV waters	HEV waters: - EPP Water intent for waters Source Wetlands: - Queensland Wetland Mapping (Current version 5) Source Watercourses: - Vegetation management watercourse and drainage feature map (1:100000 and 1:250000)
Wildlife habitat (threatened and special least concern)	-WildNet database species records - habitat suitability models (various) - SEQ koala habitat areas under the Koala Conservation Plan 2019
VMA regulated regional ecosystems	Vegetation management regional ecosystem and remnant map
VMA Essential Habitat	Vegetation management - essential habitat map
VMA Wetlands	Vegetation management wetlands map
Legally secured offsets	Vegetation Management Act property maps of assessable vegetation. For offset register data-contact DETSI
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DETSI	- Department of the Environment, Tourism, Science and Innovation
EP Act	- Environmental Protection Act 1994
EPP	- Environmental Protection Policy
GDA2020	- Geocentric Datum of Australia 2020
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- Nature Conservation Act 1992
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- Vegetation Management Act 1999

Queensland Government

Department of the Environment, Tourism, Science and Innovation

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest

PL: 1082

Environmental Reports - General Information

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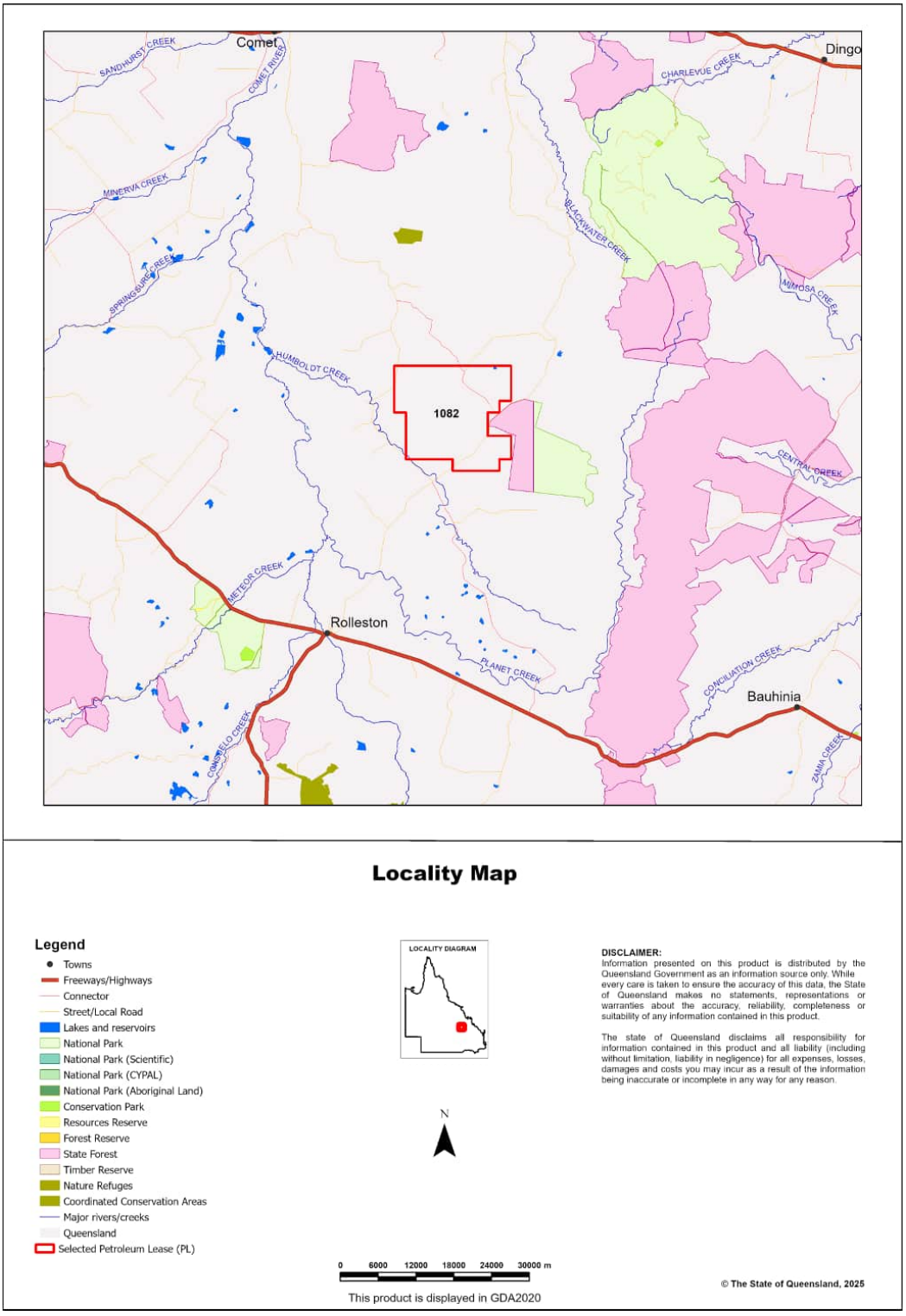
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Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

Table 1: Summary table, details for AOI: PL: 1082, with area 23451.41 ha

Local Government(s)	Catchment(s)	Bioregion(s)	Subregion(s)
Central Highlands Regional	Fitzroy	Brigalow Belt	Isaac - Comet Downs



Matters of State Environmental Significance (MSES)

MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

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  - Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;

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1b Protected Areas- nature refuges	0 ha	0.0%
1c Protected Areas- special wildlife reserves	0 ha	0.0%
2 State Marine Parks- highly protected zones	0 ha	0.0%
3 Fish habitat areas (A and B areas)	0 ha	0.0%
4 Strategic Environmental Areas (SEA)	0 ha	0.0%
5 High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values	0 ha	0.0%
6a High Ecological Value (HEV) wetlands	0 ha	0.0%
6b High Ecological Value (HEV) waterways	0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	1575.68 ha	6.7%
7b Special least concern animals	0 ha	0.0%
7c i Koala habitat area - core (SEQ)	0 ha	0.0%
7c ii Koala habitat area - locally refined (SEQ)	0 ha	0.0%
7d Sea turtle nesting areas	0 km	Not applicable
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	1737.9 ha	7.4%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0 ha	0.0%
8c Regulated Vegetation - Category R (GBR riverine regrowth)	15.93 ha	0.1%
8d Regulated Vegetation - Essential habitat	1474.71 ha	6.3%
8e Regulated Vegetation - intersecting a watercourse	148.1 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	0 ha	0.0%
9a Legally secured offset areas- offset register areas	0 ha	0.0%
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0 ha	0.0%

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(No results)

1b. Protected Areas - nature refuges

(No results)

1c. Protected Areas - special wildlife reserves

(No results)

2. State Marine Parks - highly protected zones

(No results)

3. Fish habitat areas (A and B areas)

(No results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

4. Strategic Environmental Areas (SEA)

(No results)

5. High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values

(no results)

6a. Wetlands in High Ecological Value (HEV) waters

(no results)

6b. Waterways in High Ecological Value (HEV) waters

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

7a. Threatened (endangered or vulnerable) wildlife

Values are present

7b. Special least concern animals

Not applicable

7c i. Koala habitat area - core (SEQ)

Not applicable

7c ii. Koala habitat area - locally refined (SEQ)

Not applicable

7d. Wildlife habitat (sea turtle nesting areas)

Not applicable

Threatened (endangered or vulnerable) wildlife habitat suitability models

Species	Common name	NCA status	Presence
Boronia keysii	Keys boronia	V	None
Calyptorhynchus lathami	Glossy black cockatoo	V	None
Casuarius casuarius johnsonii	Sthn population cassowary	E	None
Crinia tinnula	Wallum froglet	V	None
Denisonia maculata	Ornamental snake	V	Core
Euastacus bindal	Mount Elliot crayfish	CR	None
Euastacus binzayedi		CR	None
Euastacus eungella		E	None
Euastacus hystricosus		E	None
Euastacus jagara	Jagara hairy crayfish	CR	None
Euastacus maidae		CR	None
Euastacus monteithorum		E	None
Euastacus robertsi		E	None
Taudactylus pleione	Kroombit tinkerfrog	E	None
Litoria freycineti	Wallum rocketfrog	V	None
Litoria olongburensis	Wallum sedgefrog	V	None
Macadamia integrifolia		V	None
Melaleuca irbyana	swamp tea-tree	E	None
Macadamia ternifolia		V	None
Macadamia tetraphylla	bopple nut	V	None
Petrogale penicillata	brush-tailed rock-wallaby	V	None
Petrogale coenensis	Cape York rock-wallaby	E	None
Petrogale purpureicollis	purple-necked rock-wallaby	V	None
Petrogale sharmani	Sharmans rock-wallaby	V	None
Petrogale xanthopus celeris	yellow-footed rock-wallaby (Qld subspecies)	V	None
Petaurus gracilis	Mahogany Glider	E	None
Petrogale persephone	Proserpine rock-wallaby	E	None
Phascolarctos cinereus	Koala - outside SEQ*	E	None
Pezoporus wallicus wallicus	Eastern ground parrot	V	None
Xeromys myoides	Water Mouse	V	None

*For koala model, this includes areas outside SEQ. Check 7c SEQ koala habitat for presence/absence.

Threatened (endangered or vulnerable) wildlife species records

Scientific name	Common name	NCA status	EPBC status	Migratory status
Phascolarctos cinereus	koala	E	E	None

Special least concern animal species records

(No results)

Shorebird habitat (critically endangered/endangered/vulnerable)

Not applicable

Shorebird habitat (special least concern)

Not applicable

**Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL). Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)*

Migratory status (M) - China and Australia Migratory Bird Agreement (C), Japan and Australia Migratory Bird Agreement (J), Republic of Korea and Australia Migratory Bird Agreement (R), Bonn Migratory Convention (B), Eastern Flyway (E)

To request a species list for an area, or search for a species profile, access Wildlife Online at:

https://www.qld.gov.au/environment/plants-animals/species-list/

Refer to **Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals** and **Map 3b - MSES - Species - Koala habitat area (SEQ)** and **Map 3c - MSES - Wildlife habitat (sea turtle nesting areas)** for an overview of the relevant MSES.

MSES - Regulated Vegetation

For further information relating to regional ecosystems in general, go to:

https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/

For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:

https://environment.ehp.qld.gov.au/regional-ecosystems/

8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)

Regional ecosystem	Vegetation management polygon	Vegetation management status
11.3.2	O-dom	rem_oc
11.3.2/11.3.1	E-subdom	rem_end
11.4.8	E-dom	rem_end
11.4.8/11.4.9a	E-dom	rem_end
11.4.8/11.5.3	E-dom	rem_end
11.4.9a	E-dom	rem_end
11.5.5c/11.4.8	E-subdom	rem_end
11.9.5a	E-dom	rem_end

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Not applicable

8c. Regulated Vegetation - Category R (GBR riverine regrowth)

Regulated vegetation map category	Map number
R	8649

8d. Regulated Vegetation - Essential habitat

Values are present

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Not applicable

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets

9a. Legally secured offset areas - offset register areas

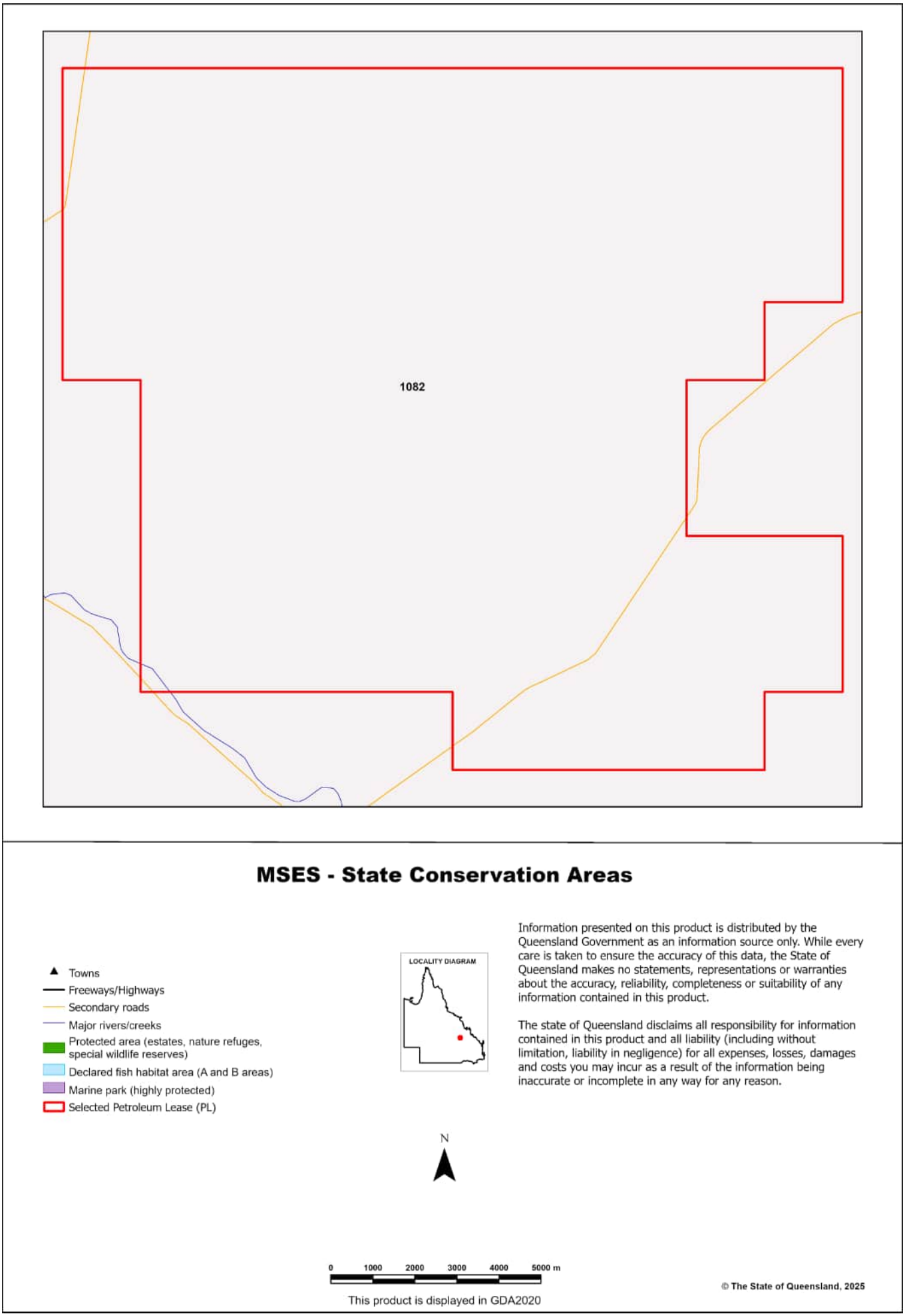
(No results)

9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation

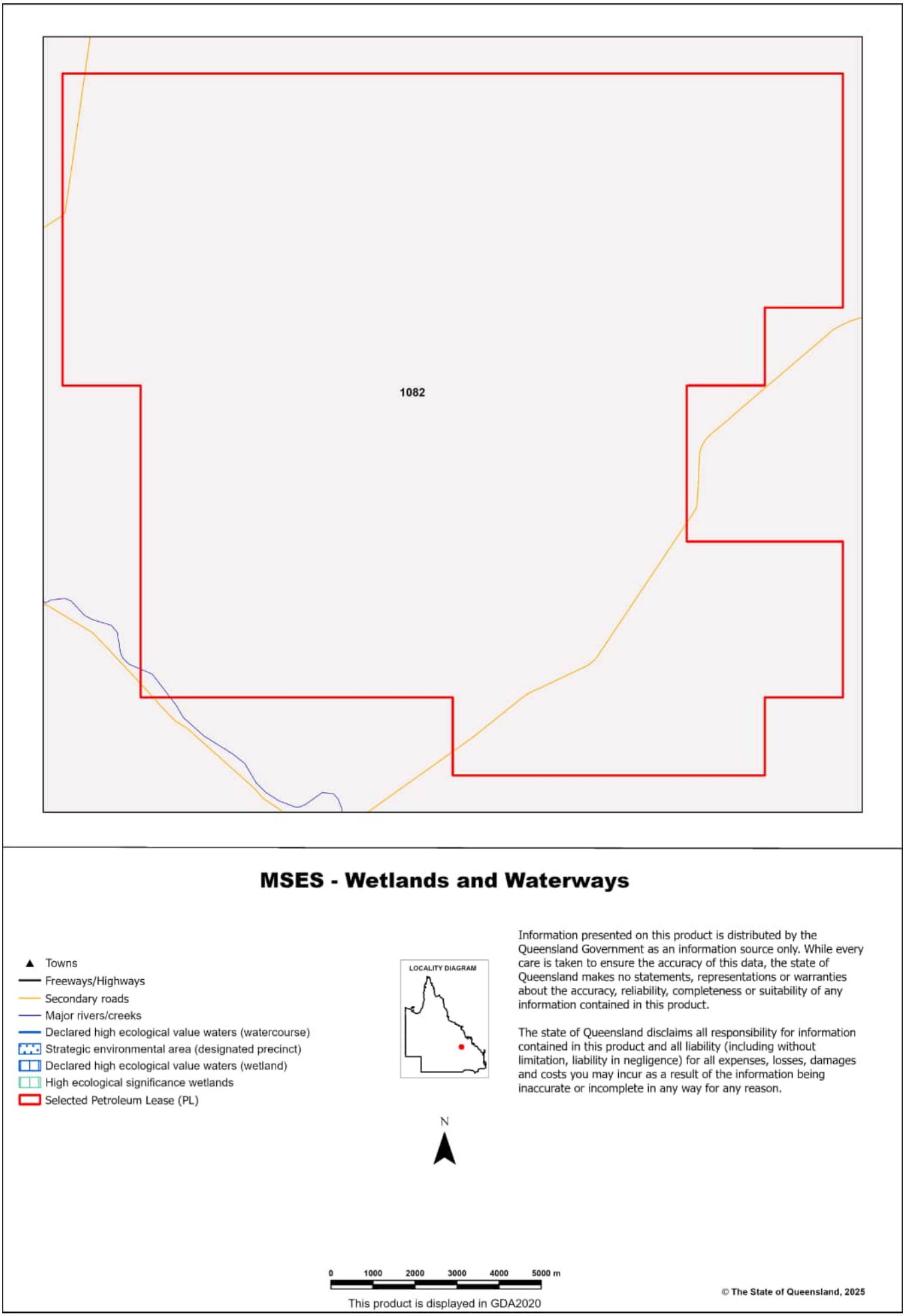
(No results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

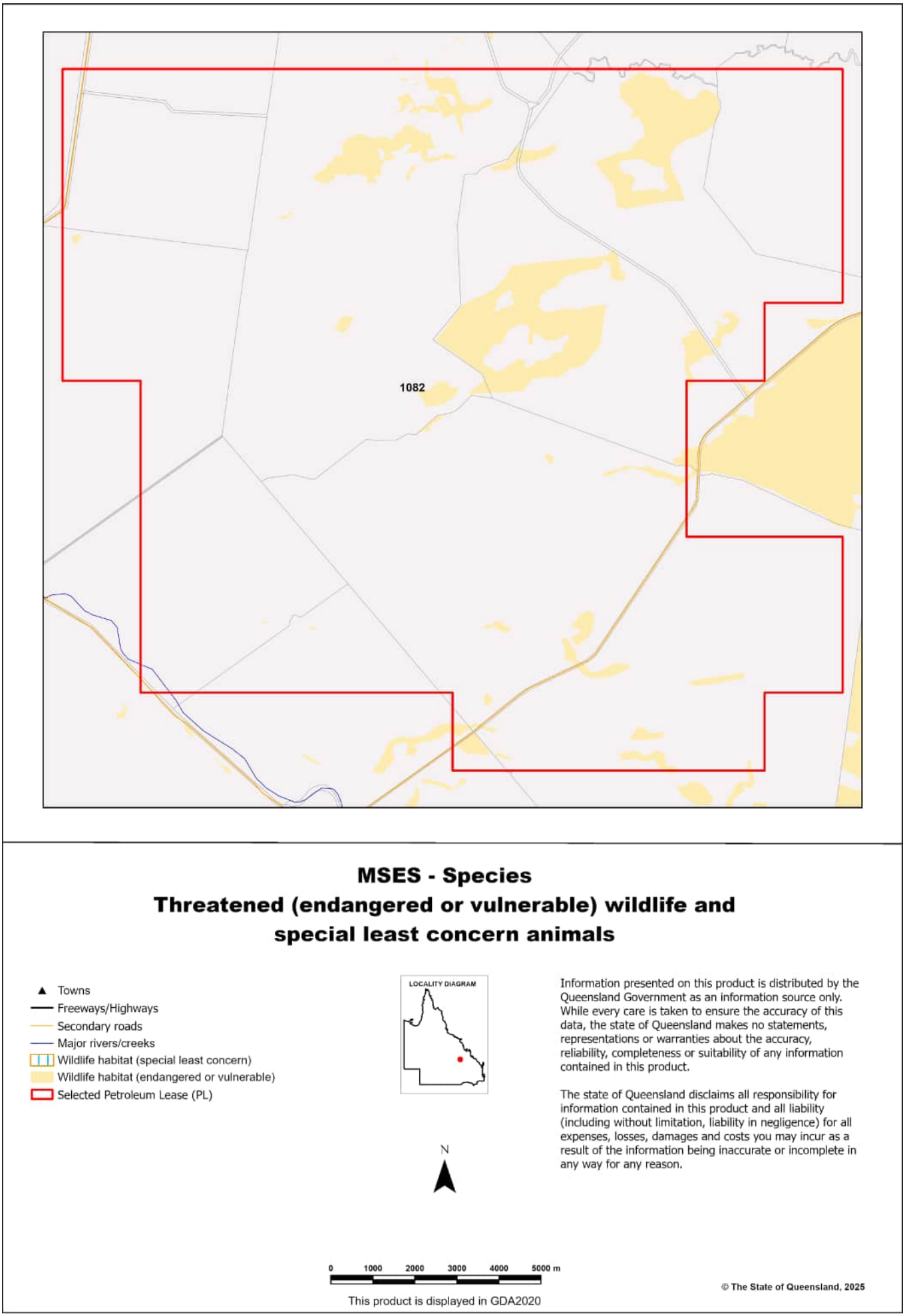
Map 1 - MSES - State Conservation Areas



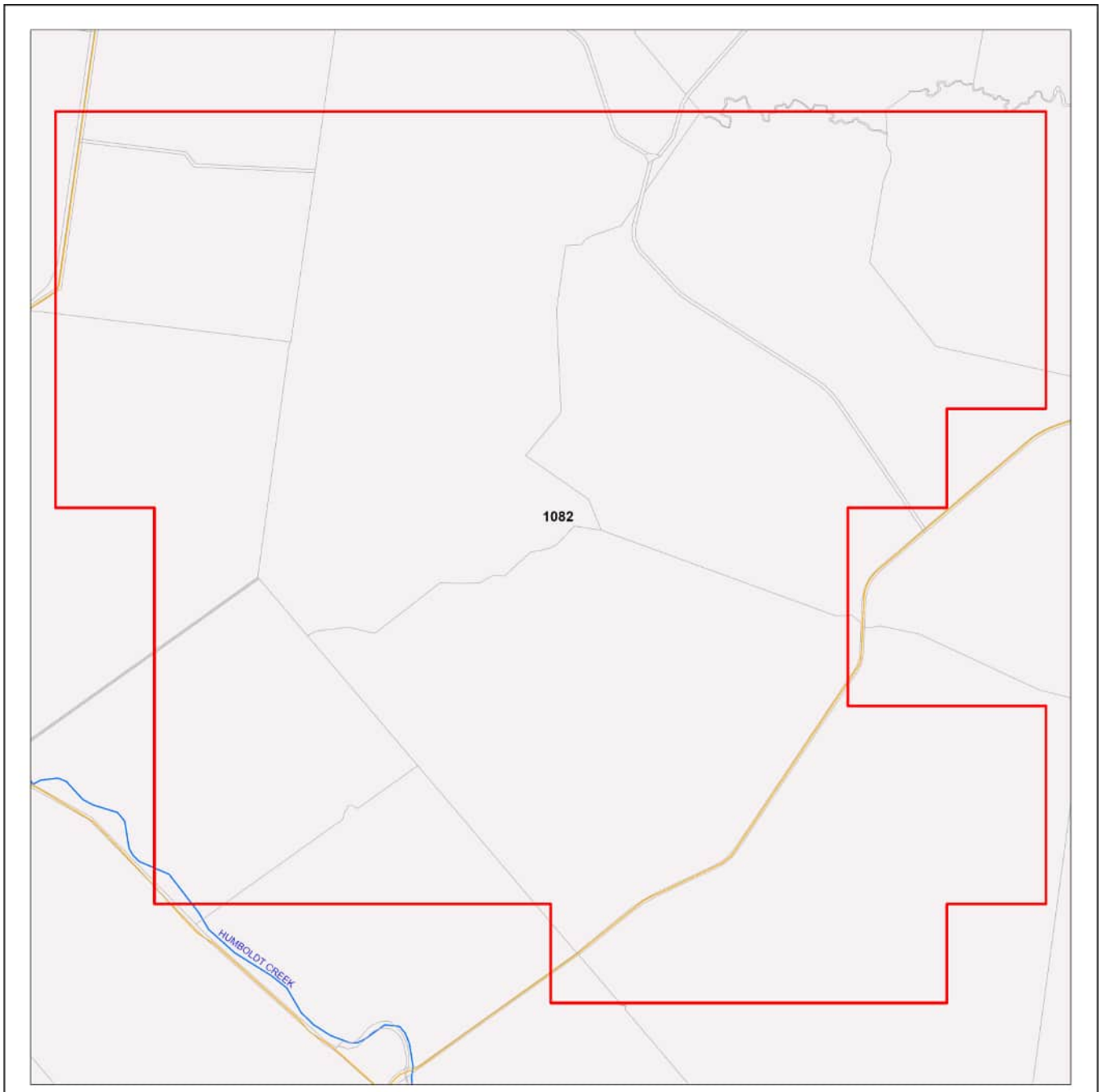
Map 2 - MSES - Wetlands and Waterways



Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals



Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species
Koala habitat area (SEQ)

- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)
- Selected Petroleum Lease (PL)

LOCALITY DIAGRAM



While every care is taken to ensure the accuracy of this product, the Department of the Environment, Tourism, Science and Innovation acting on behalf of the State of Queensland makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the data being inaccurate or incomplete in any way and for any reason. Due to varying sources of data, spatial locations may not coincide when overlaid.

The represented layers for SEQ 'koala habitat area-core' and 'koala habitat area- locally refined' in MSES are sourced directly from the regulatory mapping under the Nature Conservation (Koala) Conservation Plan 2017. Whilst every effort is made to ensure the information remains current, there may be delays between updating versions. Please refer to the original mapping for the most recent version. See https://environment.des.qld.gov.au/wildlife/animals/living-with/koalas/mapping

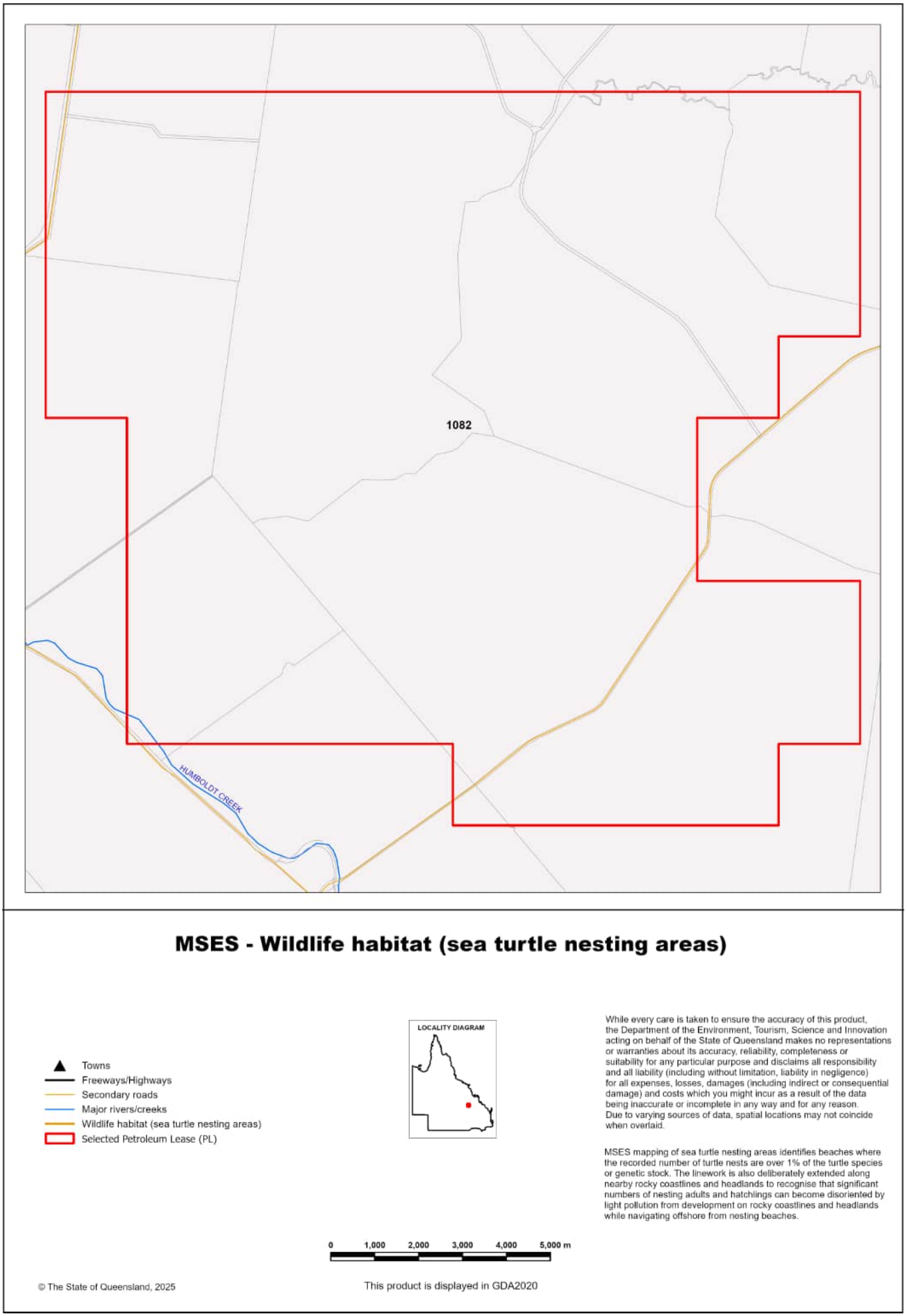
The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.

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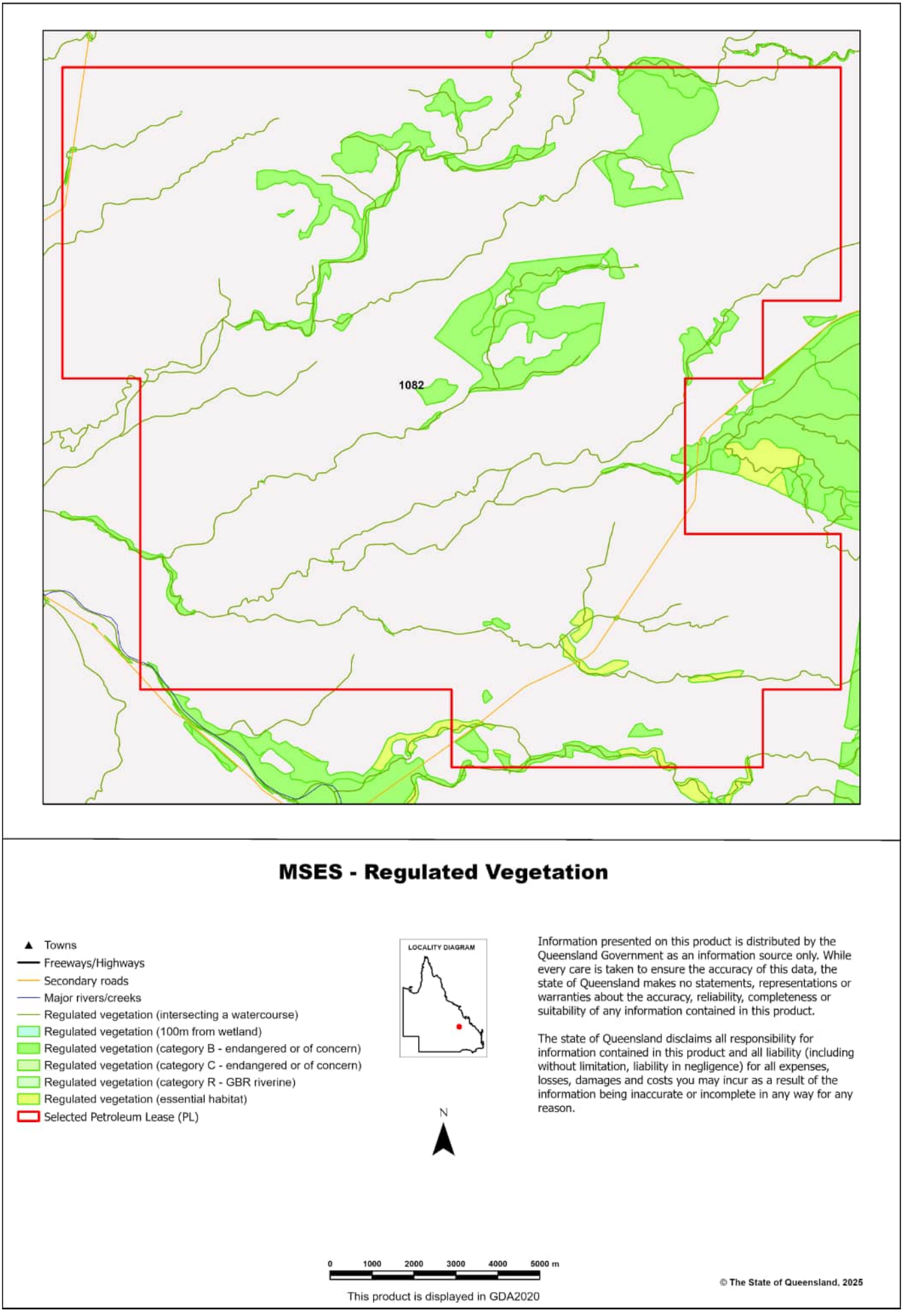
0 1,000 2,000 3,000 4,000 5,000 m

This product is displayed in GDA2020

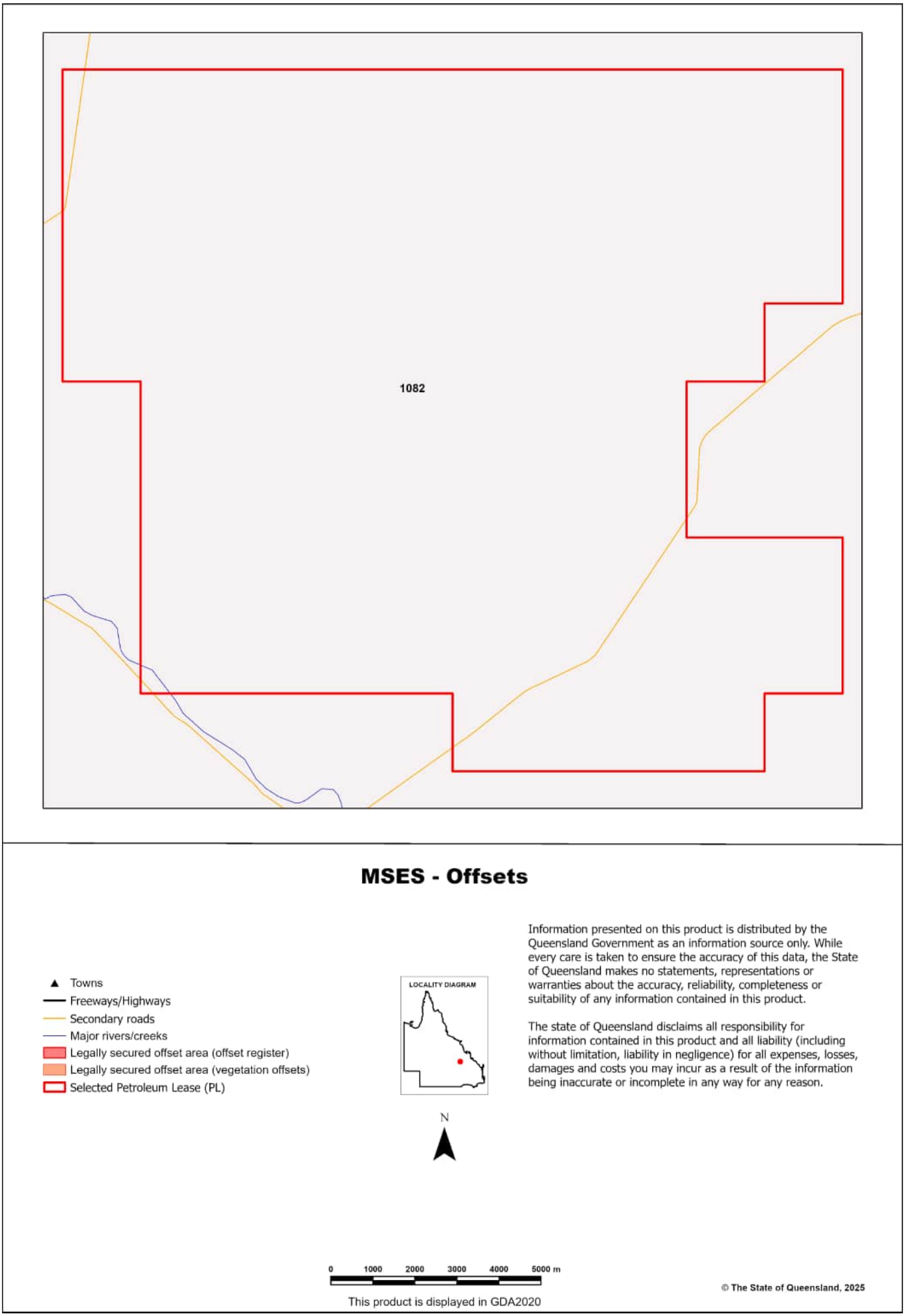
Map 3c - MSES - Species - Wildlife habitat (sea turtle nesting areas)



Map 4 - MSES - Regulated Vegetation



Map 5 - MSES - Offset Areas



Appendices

Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). Its primary purpose is to support implementation of the SPP biodiversity policy.

MSES mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations.

MSES mapping does not determine whether state or local development assessment is required. For state assessment triggers refer to the Development Assessment Mapping System (DAMS). For local assessment triggers, refer to the relevant local planning scheme.

The Queensland Government's "Method for mapping - matters of state environmental significance can be downloaded from:

http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html .

Appendix 2 - Source Data

The datasets listed below are available on request from:

http://qldspatial.information.qld.gov.au/catalogue/custom/index.page

- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

Individual MSES layers can be attributed to the following source data available at QSpatial:

MSES layers	**current QSpatial data (http://qspatial.information.qld.gov.au)**
Protected Areas-Estates, Nature Refuges, Special Wildlife Reserves	- Protected areas of Queensland - Nature Refuges - Queensland - Special Wildlife Reserves- Queensland
Marine Park-Highly Protected Zones	Moreton Bay marine park zoning 2008
Fish Habitat Areas	Queensland fish habitat areas
Strategic Environmental Areas-designated	Regional Planning Interests Act - Strategic Environmental Areas
HES wetlands	Map of Queensland Wetland Environmental Values
Wetlands in HEV waters	HEV waters: - EPP Water intent for waters Source Wetlands: - Queensland Wetland Mapping (Current version 5) Source Watercourses: - Vegetation management watercourse and drainage feature map (1:100000 and 1:250000)
Wildlife habitat (threatened and special least concern)	-WildNet database species records - habitat suitability models (various) - SEQ koala habitat areas under the Koala Conservation Plan 2019
VMA regulated regional ecosystems	Vegetation management regional ecosystem and remnant map
VMA Essential Habitat	Vegetation management - essential habitat map
VMA Wetlands	Vegetation management wetlands map
Legally secured offsets	Vegetation Management Act property maps of assessable vegetation. For offset register data-contact DETSI
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DETSI	- Department of the Environment, Tourism, Science and Innovation
EP Act	- Environmental Protection Act 1994
EPP	- Environmental Protection Policy
GDA2020	- Geocentric Datum of Australia 2020
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- Nature Conservation Act 1992
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- Vegetation Management Act 1999

Appendix G: Project Waste streams, source and management method

Waste	Description	Type	Management Method
Air emissions (dust, oxides of nitrogen (NOx), Carbon monoxide (CO), greenhouse gas GHG) Volatile organic compounds (VOC)	Dust generation through construction and operation activities, combustion of fuel (gas petrol and diesel) by vehicles and fuel burning equipment and compressor station	General	• Dust suppression measures will be taken • Implementation of preventative maintenance program to ensure gas turbines are operating efficiently to minimise CO emissions and un-combusted hydrocarbons (primarily methane with minor VOC) • Optimisation of gas turbine operations to minimise time periods of operation at low efficiency levels that may result in excess GHG emissions and higher than normal levels of NOx • Implementation of the proposed monitoring program. Compliance with the proposed EA conditions
Asbestos and synthetic mineral fibres (SMF) Insulation	Asbestos can be found in materials such as lagging, insulation, gaskets and brake pads. Examples of SMF include waste insulation and rock wool.	Regulated	Collected by a licenced waste transporter and sent to a licenced waste disposal facility.
Batteries	Lead acid batteries, gel type batteries, nickel cadmium batteries and alkaline batteries generated from equipment, vehicles, generators and electronics.	Regulated	Returned to supplier where possible. Otherwise collected by a licenced waste transporter and sent to a licenced waste recycling or disposal facility. The local council should be contacted for disposal requirements.
Brine and Reverse osmosis concentrate (ROC)	Brine and ROC are generated from the treatment of CS water. ROC is where the electrical conductivity is between 15,000 and 40,000 µS/cm. Brine is where the electrical conductivity is ≥ 40 000 µS/cm.	Regulated	Stored on-site in purpose-built dams. Some brine and ROC may be used for re-injection. Final brine disposal options remain under assessment. Refer to CSG Water Management section for more detail.
Chemical Waste	Regulated chemical wastes may include herbicides, pesticides, water treatment chemicals, paints and solvents.	Regulated	Returned to supplier where possible. Otherwise collected by a licenced waste transporter and sent to a licenced waste disposal facility.
Chemical Containers	Chemical containers are those containing any volume of free chemical that is a regulated waste, including oils, aerosols, solvents and paints.	Regulated	Where possible, reused on site or returned to supplier. Otherwise collected by a licenced waste transporter and sent to a licenced waste recycling or disposal facility.
Contaminated Soil	Contaminated soils may be generated where localised spills of hydrocarbons and other contaminants occurs.	Regulated	Treated in-situ. Otherwise collected by a licenced waste transporter and sent to a licenced waste disposal facility. The local council should be contacted for disposal requirements.
Cooking Oil and Grease Trap Waste	Generated from kitchen facilities at camps.	Regulated	Collected by a licenced waste transporter and sent to a licenced waste recycling or disposal facility. The local council should be contacted for disposal requirements.

CSG Water	Generated from gas processing, decommissioning and abandonment. CSG water is a regulated waste when the water possesses an electrical conductivity >= 15,000 µS/cm and a pH < 6.0 or > 10.5.	Regulated	Temporarily stored in aggregation dams prior to treatment and reuse in dust suppression, construction operational purposes) and onsite irrigation.
Drilling Fluid	Generated from the drilling process.	May be regulated	Reused by land application or collected by a licenced waste transporter and sent to a licenced waste disposal facility.
Drilling Muds and Cuttings	Generated from the drilling process.	May be regulated	Fit-for-purpose drill cuttings and muds are disposed of in-situ or used in well lease construction and/or rehabilitation.
Hydrostatic Test Water	Spent water used in the hydrotesting of pipelines, to test pipeline integrity. It is a regulated waste dependent on the constituents of any additives.	May be regulated	Disposed to land if it meets acceptable standards for release to land
Oily Filters, Rags, Absorbents	Generated from routine equipment and vehicle servicing, repair and filter changes.	Regulated	Recycled on-site where possible. Otherwise collected by a licenced waste transporter and sent to a licenced waste recycling or disposal facility.
Oily Water and Oily Water Treatment Sludge	Primarily generated at gas treatment and processing at compressor stations. Oily water may also be produced from servicing equipment, machinery and vehicles.	Regulated	Collected by a licenced waste transporter and sent to a licenced waste recycling or disposal facility. The local council should be contacted for disposal requirements.
Septic Waste	Generated from on-site sewage treatment plants (STPs) and septic systems.	Regulated	Disposed of to land (in accordance with a land release management plan). Otherwise collected by a licenced waste transporter and sent to a licenced waste disposal facility.
TEG / Glycol / Coolant	Generated as part of the gas dehydration process and from equipment and vehicle fluid changes.	Regulated	Collected by a licenced waste transporter and sent to a licenced waste disposal facility.
Tyres	Generated from tyre changes on work vehicles and equipment.	Regulated	Collected by a licenced waste transporter and sent to a licenced waste recycling or disposal facility. The local council should be contacted for disposal requirements.
Used Spill Kits	Generated from spill clean-up of chemicals and hydrocarbons.	Regulated	Transported by a licensed contractor to a licensed regulated waste facility.
Waste Oil	Generated routinely from vehicle and equipment oil changes.	Regulated	Returned to supplier where possible. Otherwise collected by a licenced waste transporter and sent to a licenced waste disposal facility.
Green Waste	Whole or parts of trees, bushes, shrubs, grass or similar, produced from vegetation clearing activities.	General disposable waste	If not contaminated with weeds, stockpiled or mulched for rehabilitation, erosion control works or fauna habitat. If contaminated with weeds, managed in accordance with local council requirements (e.g. in-situ management, disposal at landfill).
Putrescible and other domestic wastes	• Food scraps, tea bags, coffee grounds etc. • Food wrappers and packaging materials • Textile materials • Plastic wrapping or film, plastic bags • Facial tissues, ear plugs • Pens and pencils • Polystyrene • Aluminium foil, waxy paper or cardboard • Non-recyclable plastics	General disposable waste	Collected by a waste contractor and sent to landfill.

Permeate	Permeate is the treated CSG water generated by water treatment plants.	General recyclable/ disposable waste	Will be blended with CSG water to be beneficially reused in dust suppression and construction activities
Timber	Untreated timber derived from packaging and other uses that cannot be reused or recycled.	General disposable waste	Collected by a waste contractor and sent to landfill.
Treatment Filters and Membranes	Cartridge filters generated from the water treatment process.	General disposable waste	Collected by a waste contractor and sent to landfill.
Wellhead Separator Waste (Coal Fines)	Separators at wellheads separate gas and water and remove other materials.	General disposable waste	Collected by a waste contractor and sent to landfill.
Concrete / Aggregate / Asphalt	Concrete, aggregate and asphalt materials recovered from demolished infrastructure.	General recyclable waste	Collected by a waste contractor and sent to a recycling facility (or landfill if not suitable for recycling or recycling facilities are available).
General Recycling	• Plastic bottles and food containers • Glass bottles and jars, milk cartons, aluminium bottles and cans, metal lids from jars, tin cans, aluminium cans, plastic cups • Cardboard and paper packaging • Folders, phone books, envelopes, office paper, magazines, cereal boxes, clean paper towels • Steel scraps	General recyclable waste	Reused on site where possible. Otherwise, collected by a waste contractor and sent to a recycling facility, or dropped off at a local recycling facility by Santos personnel.
IBC	Containers used for transport of fluids and bulk materials.	General recyclable waste	Where possible, reused on site or returned to supplier. Otherwise, collected by a waste contractor and sent to a recycling facility.
HDPE	Waste HDPE includes dam liner material, flowlines and drip tubes from irrigation activities.	General recyclable waste	Collected by a waste contractor and sent to a recycling facility (or landfill if not suitable for recycling or recycling facilities are available).
Scrap Steel and Metal	Scrap steel and metal may include steel piping, valves and cabling.	General recyclable waste	Where possible, reused on site or returned to supplier. Otherwise, collected by a waste contractor and sent to a recycling facility.
Timber	Scrap timber that suitable for reuse or recycling.	General recyclable waste	Where possible, reused on site or returned to supplier. Otherwise, collected by a waste contractor and sent to a recycling facility.
Plastic Liners	Waste plastic liners associated with sumps and turkeys nests dams.	General recyclable waste	Collected by a waste contractor and sent to a recycling facility (or landfill if not suitable for recycling or recycling facilities are available).

Appendix H: Field Mapped Regional Ecosystems within the Survey Area

RE Code	VM Act Class	BD Status	RE Short Description	Field Mapped Area (Ha)
11.3.1	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	561.3
11.3.2	OC	OC	*Eucalyptus populnea* woodland on alluvial plains	179.4
11.3.25	LC	OC	*Eucalyptus tereticornis or E. camaldulensis* woodland to open forest. Other tree species, including *Casuarina cunninghamiana, E. coolabah, Melaleuca bracteata, Melaleuca viminalis, Livistona spp. (in north), Melaleuca spp. and Angophora floribunda,* may occur. A tall shrub layer may occur, including *Acacia salicina, A. stenophylla and Lysiphyllum carronii.* Low shrubs are present but rarely form a conspicuous layer. The ground layer is open to sparse and dominated by perennial grasses, sedges or forbs. Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays with or without some texture contrast. These are usually moderately deep to deep, soft or firm, acid, neutral or alkaline brown sands, loams or black cracking or non-cracking clays, and may be sodic at depth (Burgess 2003). Riverine.	241.2
11.3.27b	LC	OC	Vegetation ranges from open water +/- aquatics and emergents such as *Potamogeton crispus, Myriophyllum verrucosum, Chara spp., Nitella spp. Nymphaea violacea, Ottelia ovalifolia, Nymphoides indica, N. crenata, Potamogeton tricarinatus, Cyperus difformis, Vallisneria caulescens* and *Hydrilla verticillata.* Often with fringing woodland, commonly Eucalyptus camaldulensis or E. coolabah but also a wide range of other species including *Eucalyptus platyphylla, E. tereticornis, Melaleuca spp., Acacia holosericea or other Acacia spp.* Occurs on billabongs. Palustrine.	63.6
11.3.3	OC	OC	Eucalyptus coolabah woodland to open woodland. A secondary tree or shrub layer may occur, including *E. populnea, Melaleuca bracteata, Acacia stenophylla, Alectryon oleifolius, Terminalia oblongata* (in the north), *Acacia pendula*, *A. cambagei* and *Duma florulenta*. The ground layer is dominated by a range of grass and forb species depending on season. Occurs on Cainozoic alluvial plains or levees with clay or sometimes texture contrast soils.	65.1
11.4.8	E	E	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains	66.3
11.4.9a	E	E	*Acacia harpophylla, Lysiphyllum carronii +/- Casuarina cristata* open forest to woodland. Occurs on level to gently undulating Cainozoic plains, including weathered basalt. Associated soils are predominantly moderately deep to deep cracking clays that may be brown, red-brown or grey-brown, and with much surface gravel in some areas.	37.4

RE Code	VM Act Class	BD Status	RE Short Description	Field Mapped Area (Ha)
11.5.3	LC	NCP	*Eucalyptus populnea* +/- *E. melanophloia* +/- *Corymbia clarksoniana* woodland on Cainozoic sand plains and/or remnant surfaces	14.1
11.8.4	LC	NCP	*Eucalyptus melanophloia and/or E. crebra* +/- *E. orgadophila* +/- *Corymbia erythrophloia* woodland to open woodland. *Macrozamia moorei* is a conspicuous element of the mid layer in the Central Highlands. Localised patches of *Corymbia citriodora* occur on volcanic plugs such as Minerva Hills. Generally, occurs on slopes of mountains and hills formed from Cainozoic igneous rocks usually with shallow stony soils and extensive outcropping. Not a Wetland. (BVG1M: 11a).	15.9
11.8.5	LC	NCP	*Eucalyptus orgadophila* open woodland. *Eucalyptus orgadophila* predominates and forms a distinct but discontinuous canopy sometimes with other sub-dominant species such as *Corymbia erythrophloia, E. melanophloia* and occasionally *E. crebra.* Shrubs are usually scarce and scattered although a well-defined shrubby layer does develop in some areas. On the lower slopes at better sites, softwood scrub species may form tall and low shrub layers under the canopy of *Eucalyptus orgadophila.* The ground layer is moderately dense to dense, and dominated by species that include the grasses *Aristida lazaridis, A. ramosa, Bothriochloa ewartiana, Dichanthium sericeum, Chrysopogon fallax, Heteropogon contortus, Enneapogon gracilis, Themeda triandra and Tragus australianus* and the herbs *Brunoniella australis, Evolvulus alsinoides, Galactia tenuiflora* and *Indigofera linnaei.* Occurs on undulating plains, rises, low hills or sometimes flat tablelands on top of mountains, formed from basalt. Generally, soils are shallow to moderately shallow, often rocky or stony clays. Not a Wetland. (BVG1M: 11a).	5.4
11.9.5a	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on fine-grained sedimentary rocks	101.1
11.10.3	LC	NCP	*Acacia shirleyi or A. catenulata* open forest on coarse-grained sedimentary rocks. Crests and scarps	90.3
Regrowth 11.3.1	NA	NA	See remnant description above	93.3
Regrowth 11.3.2	NA	NA	See remnant description above	198.1
Regrowth 11.3.3	NA	NA	See remnant description above	29.6
Regrowth 11.4.8	NA	NA	See remnant description above	56.1
Regrowth 11.9.4	E	E	See remnant description above	860.5
Regrowth 11.5.3	NA	NA	See remnant description above	109.7
Regrowth 11.7.2	NA	NA	See remnant description above	13
Regrowth 11.8.4	NA	NA	See remnant description above	16.1

RE Code	VM Act Class	BD Status	RE Short Description	Field Mapped Area (Ha)
Non-rem 11.3.2	NA	NA	Scattered relicted canopy trees that do not meet the required 50% canopy cover of the ecologically dominant layer	4.7
Non-rem 11.3.3	NA	NA	Scattered relicted canopy trees that do not meet the required 50% canopy cover of the ecologically dominant layer	0.8
Non-rem 11.4.8	NA	NA	Scattered relicted canopy trees that do not meet the required 50% canopy cover of the ecologically dominant layer	1.9
Non-rem 11.5.3	NA	NA	Scattered relicted canopy trees that do not meet the required 50% canopy cover of the ecologically dominant layer	106.3
Non-Remnant	**NA**	**NA**	**Mostly cleared exotic pasture**	**27123.0**

Queensland Government

Department of the Environment, Tourism, Science and Innovation

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
PL: 1083

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the input coordinates.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 2020). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Important Note to User

Information presented in this report is based upon the Queensland Herbarium & Biodiversity Science's Regional Ecosystem framework. The Biodiversity Status has been used to depict the extent of "Endangered", "Of Concern" and "No Concern at Present" regional ecosystems in all cases, rather than the classes used for the purposes of the *Vegetation Management Act 1999* (VMA). Mapping and figures presented in this document reflect the Queensland Herbarium & Biodiversity Science's Remnant and Pre-clearing Regional Ecosystem Datasets, and not the certified mapping used for the purpose of the VMA.

For matters relevant to vegetation management under the VMA, please refer to the Department of Natural Resources and Mines, Manufacturing, and Regional and Rural Development website https://www.nrmmrrd.qld.gov.au/

Please direct queries about these reports to: Queensland.Herbarium@qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.

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Summary Information

The following table provides an overview of the AOI with respect to selected topographic and environmental themes. Refer to **Map 1** for locality information.

Table 1: Details for area of interest:
PL: 1083, with area 23453.62 ha

Local Government(s)	Catchment(s)	Bioregion(s)	Subregion(s)
Central Highlands Regional	Fitzroy	Brigalow Belt	Isaac - Comet Downs

The table below summarizes the extent of remnant vegetation classed as "Endangered", "Of concern" and "No concern at present" regional ecosystems classified by Biodiversity Status within the area of interest (AOI).

Table 2: Summary table, biodiversity status of regional ecosystems within the AOI

Biodiversity Status	Area (Ha)	% of AOI
Endangered	374.62	1.60
Of concern	819.47	3.49
No concern at present	46.03	0.20
Total remnant vegetation	1,240.12	5.29

Refer to **Map 2** for further information.

Regional Ecosystems

1. Introduction

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with particular combinations of geology, landform and soil (Sattler and Williams 1999). Descriptions of Queensland's Regional ecosystems are available online from the Regional Ecosystem Description Database (REDD). Descriptions are compiled from a broad range of information sources including vegetation, land system and geology survey and mapping and detailed vegetation site data. The regional ecosystem classification and descriptions are reviewed as new information becomes available. A number of vegetation communities may form a single regional ecosystem and may be distinguished by differences in structure or sub-dominant species in the ecologically dominant layer. Vegetation communities with different dominant species in the ecologically dominant layer may be amalgamated in to a regional ecosystem if they are not mappable and predictable in the landscape at 1:100 000 scale. Vegetation communities may be mappable at a scale larger than 1:100 000. Vegetation communities within a regional ecosystem are denoted by a letter following the regional ecosystem code (e.g. a, b, c). Vegetation communities and regional ecosystems are amalgamated into a higher level classification of broad vegetation groups (BVGs).

A published methodology for survey and mapping of regional ecosystems across Queensland (Neldner et al 2023) provides further details on regional ecosystem concepts and terminology.

This report provides information on the type, status, and extent of vegetation communities, regional ecosystems and broad vegetation groups present within a user specified area of interest. Please note, for the purpose of this report, the Biodiversity Status is used. This report has not been developed for application of the *Vegetation Management Act 1999* (VMA). Additionally, information generated in this report has been derived from the Queensland Herbarium & Biodiversity Science's Regional Ecosystem Mapping, and not the regulated mapping certified for the purposes of the VMA. If your interest/matter relates to regional ecosystems and the VMA, users should refer to the Department of Natural Resources and Mines, Manufacturing, and Regional and Rural Development website https://www.nrmmrrd.qld.gov.au/.

With respect to the Queensland Biodiversity Status,

"Endangered" regional ecosystems are described as those where:

- remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares, or
- less than 10 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss*, or
- 10-30 percent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
- it is a rare** regional ecosystem subject to a threatening process.***

"Of concern" regional ecosystems are described as those where:

- the degradation criteria listed above for 'Endangered' regional ecosystems are not met and,
- remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 20 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares, or
- 10-30 percent of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.****

and "No concern at present" regional ecosystems are described as those where:

- remnant vegetation is over 30 percent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares, and
- the degradation criteria listed above for 'Endangered' or 'Of concern' regional ecosystems are not met.

**Severe degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 50 years even with the removal of threatening processes; or soil surface is severely degraded, for example, by loss of A horizon, surface expression of salinity; surface compaction, loss of organic matter or sheet erosion.*

***Rare regional ecosystem: pre-clearing extent (<1000 ha); or patch size (<100 ha and of limited total extent across its range).*

****Threatening processes are those that are reducing or will reduce the biodiversity and ecological integrity of a regional ecosystem. For example, clearing, weed invasion, fragmentation, inappropriate fire regime or grazing pressure, or infrastructure development.*

*****Moderate degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 20 years even with the removal of threatening processes; or soil surface is moderately degraded.*

2. Remnant Regional Ecosystems

The following table identifies the remnant regional ecosystems and vegetation communities mapped within the AOI and provides their short descriptions, Biodiversity Status, and remnant extent within the selected AOI. Please note, where heterogeneous vegetated patches (mixed patches of remnant vegetation mapped as containing multiple regional ecosystems) occur within the AOI, they have been split and listed as individual regional ecosystems (or vegetation communities where present) for the purposes of the table below. In such instances, associated area figures have been generated based upon the estimated proportion of each regional ecosystem (or vegetation community) predicted to be present within the larger mixed patch.

Table 3: Remnant regional ecosystems, description and status within the AOI

Regional Ecosystem	Short Description	BD Status	Area (Ha)	% of AOI
11.3.1	Acacia harpophylla and/or Casuarina cristata open forest on alluvial plains	Endangered	306.10	1.31
11.3.11	Semi-evergreen vine thicket on alluvial plains	Endangered	32.11	0.14
11.3.2	Eucalyptus populnea woodland on alluvial plains	Of concern	149.72	0.64
11.3.25	Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines	Of concern	341.17	1.45
11.3.3	Eucalyptus coolabah woodland on alluvial plains	Of concern	325.40	1.39
11.4.8	Eucalyptus cambageana woodland to open forest with Acacia harpophylla or A. argyrodendron on Cainozoic clay plains	Endangered	3.66	0.02
11.4.9a	Acacia harpophylla shrubby woodland with Terminalia oblongata on Cainozoic clay plains	Endangered	22.16	0.09
11.5.3	Eucalyptus populnea +/- E. melanophloia +/- Corymbia clarksoniana woodland on Cainozoic sand plains and/or remnant surfaces	No concern at present	33.32	0.14
11.8.11	Dichanthium sericeum grassland on Cainozoic igneous rocks	Of concern	3.18	0.01
11.8.4	Eucalyptus melanophloia woodland to open woodland on Cainozoic igneous rocks.	No concern at present	9.54	0.04
11.8.5	Eucalyptus orgadophila open woodland on Cainozoic igneous rocks	No concern at present	3.18	0.01
11.9.4a	Semi-evergreen vine thicket or Acacia harpophylla with a semi-evergreen vine thicket understorey on fine-grained sedimentary rocks	Endangered	10.59	0.05
non-remnant	None	None	22,213.50	94.71

Refer to **Map 2** for further information. **Map 3** also provides a visual estimate of the distribution of regional ecosystems present before clearing.

Table 4 provides further information in regards to the remnant regional ecosystems present within the AOI. Specifically, the extent of remnant vegetation remaining within the bioregion, the 1:1,000,000 broad vegetation group (BVG) classification, whether the regional ecosystem is identified as a wetland, and extent of representation in Queensland's Protected Area Estate. For a description of the vegetation communities within the AOI and classified according to the 1:1,000,000 BVG, refer to **Table 6**.

Table 4: Remnant regional ecosystems within the AOI, additional information

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
11.3.1	Pre-clearing 785000 ha; Remnant 2021 80000 ha	25a	Not a Wetland	Low
11.3.11	Pre-clearing 18000 ha; Remnant 2021 2000 ha	7a	Not a Wetland	Low
11.3.2	Pre-clearing 1905000 ha; Remnant 2021 499000 ha	17a	Contains Palustrine	Low
11.3.25	Pre-clearing 813000 ha; Remnant 2021 531000 ha	16a	Riverine	Low
11.3.3	Pre-clearing 933000 ha; Remnant 2021 271000 ha	16c	Not a Wetland	Low
11.4.8	Pre-clearing 728000 ha; Remnant 2021 67000 ha	25a	Contains Palustrine	Low
11.4.9a	Pre-clearing 989000 ha; Remnant 2021 89000 ha	25a	Not a Wetland	Low
11.5.3	Pre-clearing 975000 ha; Remnant 2021 366000 ha	17a	Not a Wetland	Low
11.8.11	Pre-clearing 601000 ha; Remnant 2021 169000 ha	30b	Not a Wetland	Low
11.8.4	Pre-clearing 217000 ha; Remnant 2021 151000 ha	11a	Not a Wetland	High
11.8.5	Pre-clearing 631000 ha; Remnant 2021 344000 ha	11a	Not a Wetland	Low
11.9.4a	Pre-clearing 189000 ha; Remnant 2021 33000 ha	7a	Not a Wetland	Low
non-remnant	None	None	None	None

Representation in Protected Area Estate: High greater than 10% of pre-clearing extent is represented; Medium 4 - 10% is represented; Low less than 4% is represented, No representation.

The distribution of mapped wetland systems within the area of interest is displayed in **Map 6**.

The following table lists known special values associated with a regional ecosystem type.

Table 5: Remnant regional ecosystems within the AOI, special values

Regional Ecosystem	Special Values
11.3.1	11.3.1: Habitat for threatened fauna species including painted honeyeater, Grantiella picta particularly in subregion 35 (Oliver et al. 2003).
11.3.11	11.3.11: Potential habitat for NCA listed species: Macropteranthes leiocaulis.
11.3.2	11.3.2: Habitat for threatened flora species Homopholis belsonii. This ecosystem is also known to provide suitable habitat for koalas (Phascolarctos cinereus).
11.3.25	11.3.25: Shown to be associated with a high fauna species richness in the Taroom area (Venz et al. 2002). Within parts of the Fitzroy catchment, this RE is known habitat for the threatened freshwater turtle Rheodytes leukops. Known to be important habitat for other riparian freshwater turtle species. This ecosystem is also known to provide suitable habitat for koalas (Phascolarctos cinereus).
11.3.3	11.3.3: Mature trees provide hollows for fauna especially nesting birds. Associated with a high number fauna species (Dick 1992, Venz et al. 2002). 11.3.3c: Mature trees provide hollows for fauna especially nesting birds. Associated with a high number of fauna species (Dick 1992, Venz et al. 2002).
11.4.8	11.4.8a: Larger gilgai provides ephemeral wetland habitat.
11.4.9a	11.4.9: Potential habitat for NCA listed species: Cadellia pentastylis, Solanum adenophorum, Solanum dissectum, Solanum elachophyllum, Solanum johnsonianum, Xerothamnella herbacea.
11.5.3	11.5.3: Potential habitat for NCA listed species: Sannantha brachypoda. 11.5.3x1: Potential habitat for NCA listed species: Sannantha brachypoda.
11.8.11	11.8.11: Habitat for threatened plant species including Trioncinia retroflexa and Dichanthium queenslandicum. T. retroflexa is currently known from three small populations.
11.8.4	11.8.4: Potential habitat for NCA listed species: Acacia arbiana, Acacia islana, Bertya pedicellata, Grevillea hockingsii, Haloragis exalata subsp. velutina, Marsdenia brevifolia, Sannantha brachypoda. This ecosystem is also known to provide suitable habitat for koalas (Phascolarctos cinereus).
11.8.5	11.8.5: In southern part of bioregion, habitat for a number of threatened plant species including Picris evae and Thesium australe and near threatened species Digitaria porrecta and Discaria pubescens. This ecosystem is also known to provide suitable habitat for koalas (Phascolarctos cinereus). 11.8.5a: This ecosystem is known to provide suitable habitat for koalas (Phascolarctos cinereus).
11.9.4a	11.9.4: Habitat for threatened plant species including Cadellia pentastylis.
non-remnant	None

3. Remnant Regional Ecosystems by Broad Vegetation Group

BVGs are a higher-level grouping of vegetation communities. Queensland encompasses a wide variety of landscapes across temperate, wet and dry tropics and semi-arid climatic zones. BVGs provide an overview of vegetation communities across the state or a bioregion and allow comparison with other states. There are three levels of BVGs which reflect the approximate scale at which they are designed to be used: the 1:5,000,000 (national), 1:2,000,000 (state) and 1:1,000,000 (regional) scales.

A comprehensive description of BVGs is available at: https://publications.qld.gov.au/dataset/redd/resource/

The following table provides a description of the 1:1,000,000 BVGs present and their associated extent within the AOI.

Table 6: Broad vegetation groups (1 million) within the AOI

BVG (1 Million)	Description	Area (Ha)	% of AOI
None	None	22,213.50	94.71
11a	Moist to dry open forests to woodlands dominated by Eucalyptus orgadophila (mountain coolibah). Some areas dominated by E. tereticornis (blue gum), E. melliodora (yellow box), E. albens (white box), E. crebra (narrow-leaved red ironbark) or E. melanophloia (silver-leaved ironbark).	12.71	0.05
16a	Open forest and woodlands dominated by Eucalyptus camaldulensis (river red gum) (or E. tereticornis (blue gum)) and/or E. coolabah (coolabah) (or E. microtheca (coolabah)) fringing drainage lines. Associated species may include Melaleuca spp., Corymbia tessellaris (carbeen), Angophora spp., Casuarina cunninghamiana (riveroak). Does not include alluvial areas dominated by herb and grasslands or alluvial plains that are not flooded.	341.17	1.45
16c	Woodlands and open woodlands dominated by Eucalyptus coolabah (coolabah) or E. microtheca (coolabah) or E. largiflorens (black box) or E. tereticornis (blue gum) or E. chlorophylla on floodplains. Does not include alluvial areas dominated by herb and grasslands or alluvial plains that are not flooded.	325.40	1.39
17a	Woodlands dominated by Eucalyptus populnea (poplar box) (or E. brownii (Reid River box)) on alluvium, sand plains and footslopes of hills and ranges.	183.04	0.78
25a	Open forests to woodlands dominated by Acacia harpophylla (brigalow) sometimes with Casuarina cristata (belah) on heavy clay soils. Includes areas co-dominated with A. cambagei (gidgee) and/or emergent eucalypts.	331.92	1.42
30b	Tussock grasslands dominated by Astrebla spp. (mitchell grass) or Dichanthium spp. (bluegrass) often with Iseilema spp. on undulating downs or clay plains.	3.18	0.01
7a	Semi-evergreen vine thickets on wide range of substrates.	42.70	0.18

Refer to **Map 4** for further information. **Map 5** also provides a representation of the distribution of vegetation communities as per the 1:5,000,000 BVG believed to be present prior to European settlement.

4. Technical and BioCondition Benchmark Descriptions

Technical descriptions provide a detailed description of the full range in structure and floristic composition of regional ecosystems (e.g. 11.3.1) and their component vegetation communities (e.g. 11.3.1a, 11.3.1b). See: http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/

The descriptions are compiled using site survey data from the Queensland Herbarium & Biodiversity Science's QBEIS database. Distribution maps, representative images (if available) and the pre-clearing and remnant extent (hectares) of each vegetation community derived from the regional ecosystem mapping data are included. The technical descriptions should be used in conjunction with the fields from the regional ecosystem description database (REDD) for a full description of the regional ecosystem.

Technical descriptions include data on canopy height, canopy cover and native plant species composition of the predominant layer, which are attributes relevant to assessment of the remnant status of vegetation under the *Vegetation Management Act 1999*. However, as technical descriptions reflect the full range in structure and floristic composition across the climatic, natural disturbance and geographic range of the regional ecosystem, local reference sites should be used for remnant assessment where possible (Neldner et al. 2023 (PDF)* section 3.3 of: https://www.qld.gov.au/__data/assets/pdf_file/0033/459186/methodology-mapping-surveying-v7.pdf

The technical descriptions are subject to review and are updated as additional data becomes available.

When conducting a BioCondition assessment, these technical descriptions should be used in conjunction with BioCondition benchmarks for the specific regional ecosystem, or component vegetation community. http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/

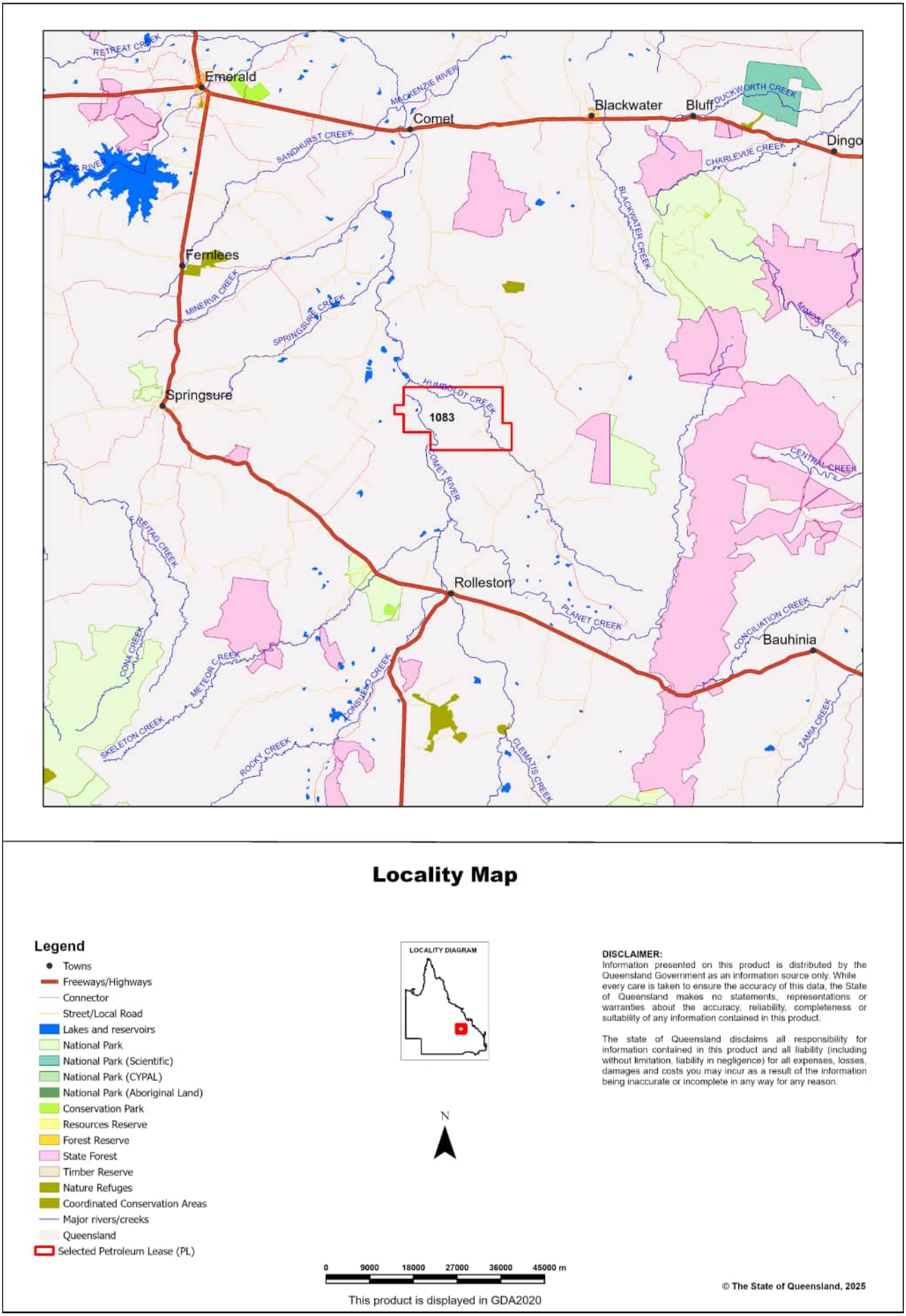
Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes has been considered throughout the geographic extent of the regional ecosystem. Local reference sites should be used for this spatial and temporal (seasonal and annual) variability.

Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available

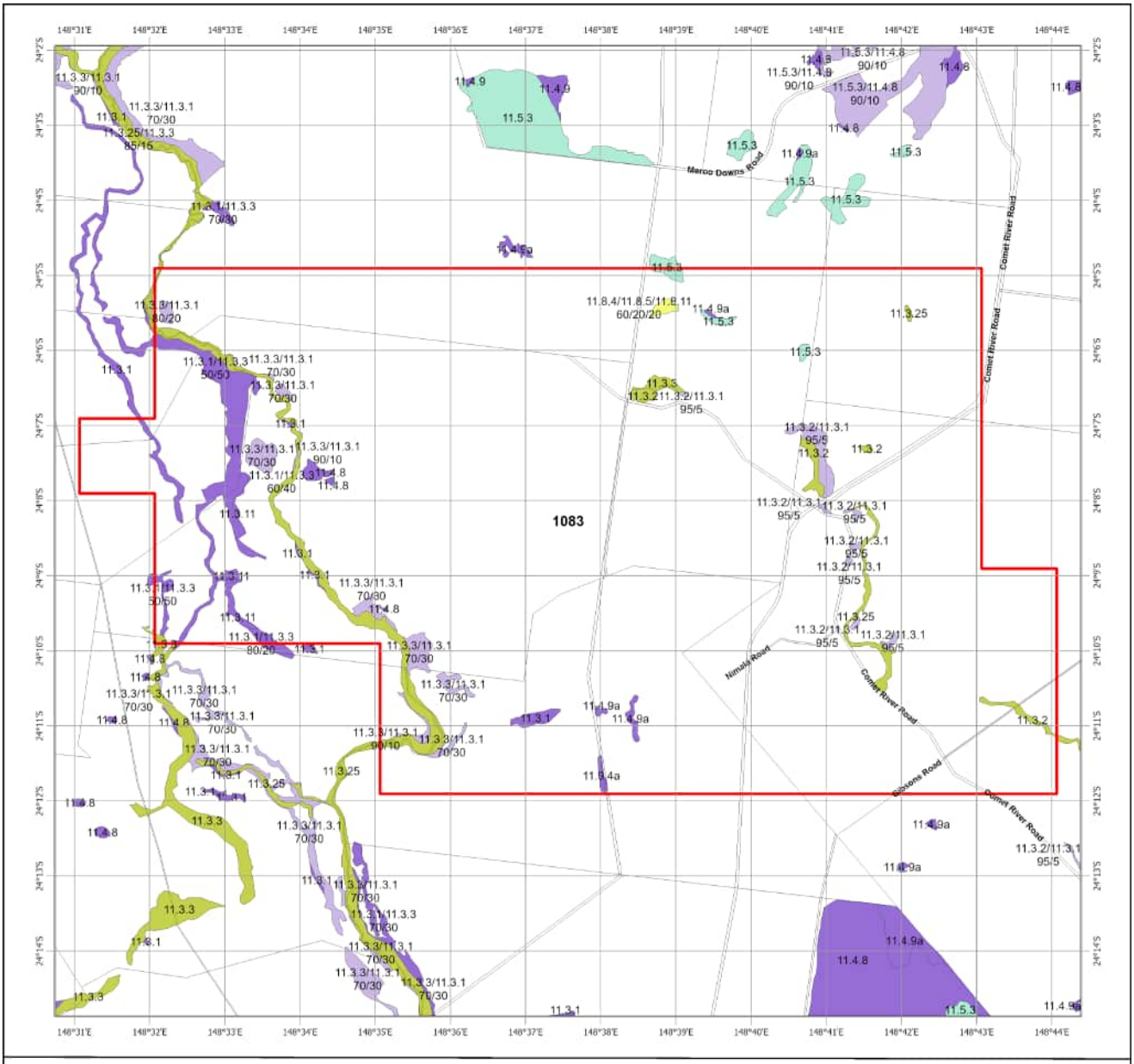
Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
11.3.1	Available	Available
11.3.11	Available	Available
11.3.2	Available	Available
11.3.25	Available	Available
11.3.3	Available	Available
11.4.8	Available	Available
11.4.9a	Available	Not currently available
11.5.3	Available	Available
11.8.11	Available	Available
11.8.4	Available	Available
11.8.5	Available	Available
11.9.4a	Available	Available
non-remnant	Not currently available	Not currently available

Maps

Map 1 - Location



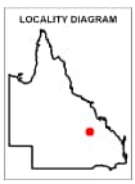
Map 2 - Remnant 2021 regional ecosystems



Remnant 2021 Regional Ecosystems

Biodiversity Status

- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Non-remnant vegetation, cultivated or built environment
- Plantation
- Water
- Cadastral Boundaries
- Selected Petroleum Lease (PL)



N

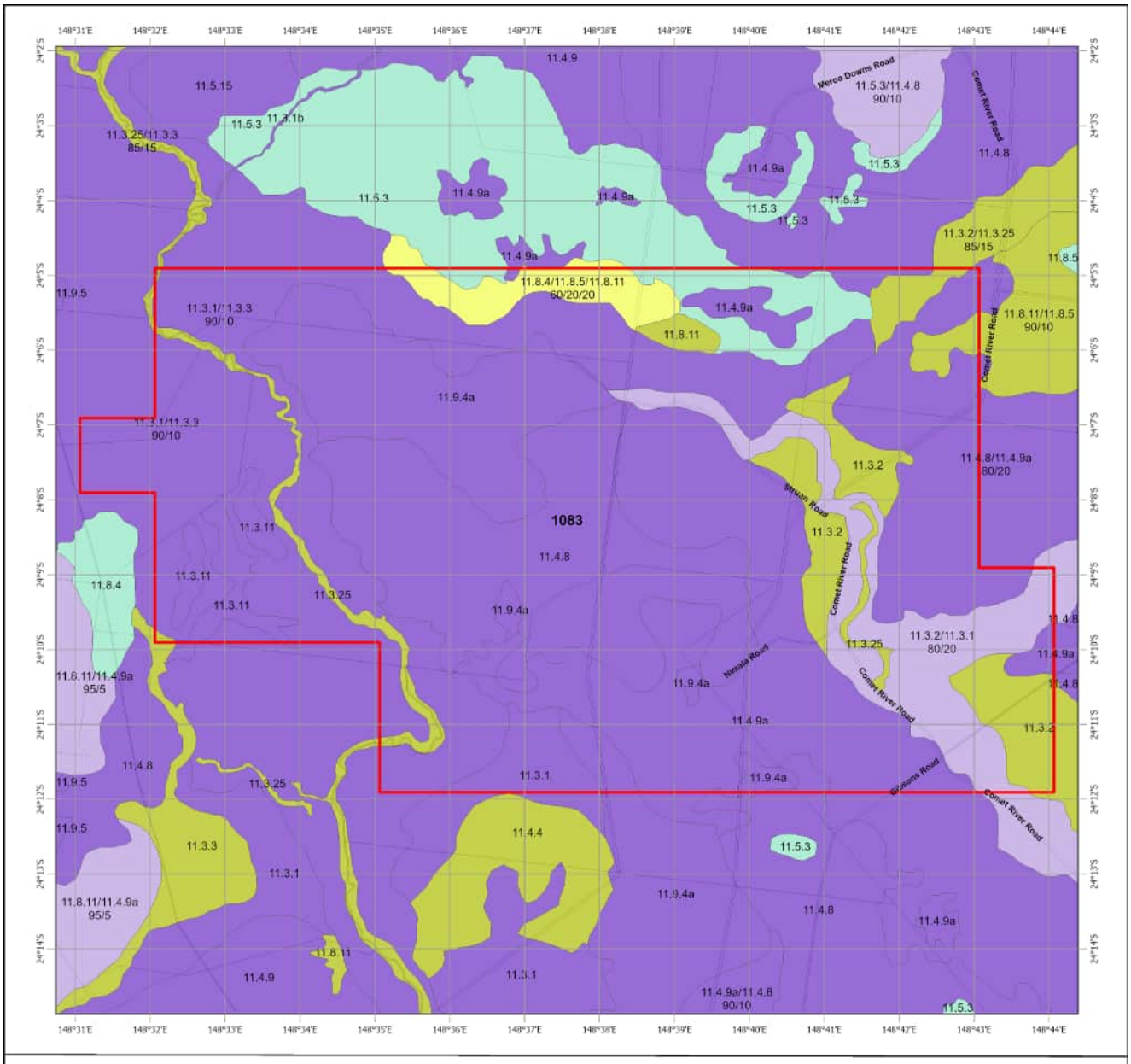
0 1.55 3.1 4.65 6.2 km

This product is projected into GDA2020

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

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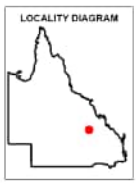
Map 3 - Pre-clearing regional ecosystems



Pre-clearing Regional Ecosystems

Biodiversity Status

- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Water
- Cadastral Boundaries
- Selected Petroleum Lease (PL)



N

0 1.55 3.1 4.65 6.2 km

This product is displayed in GDA2020

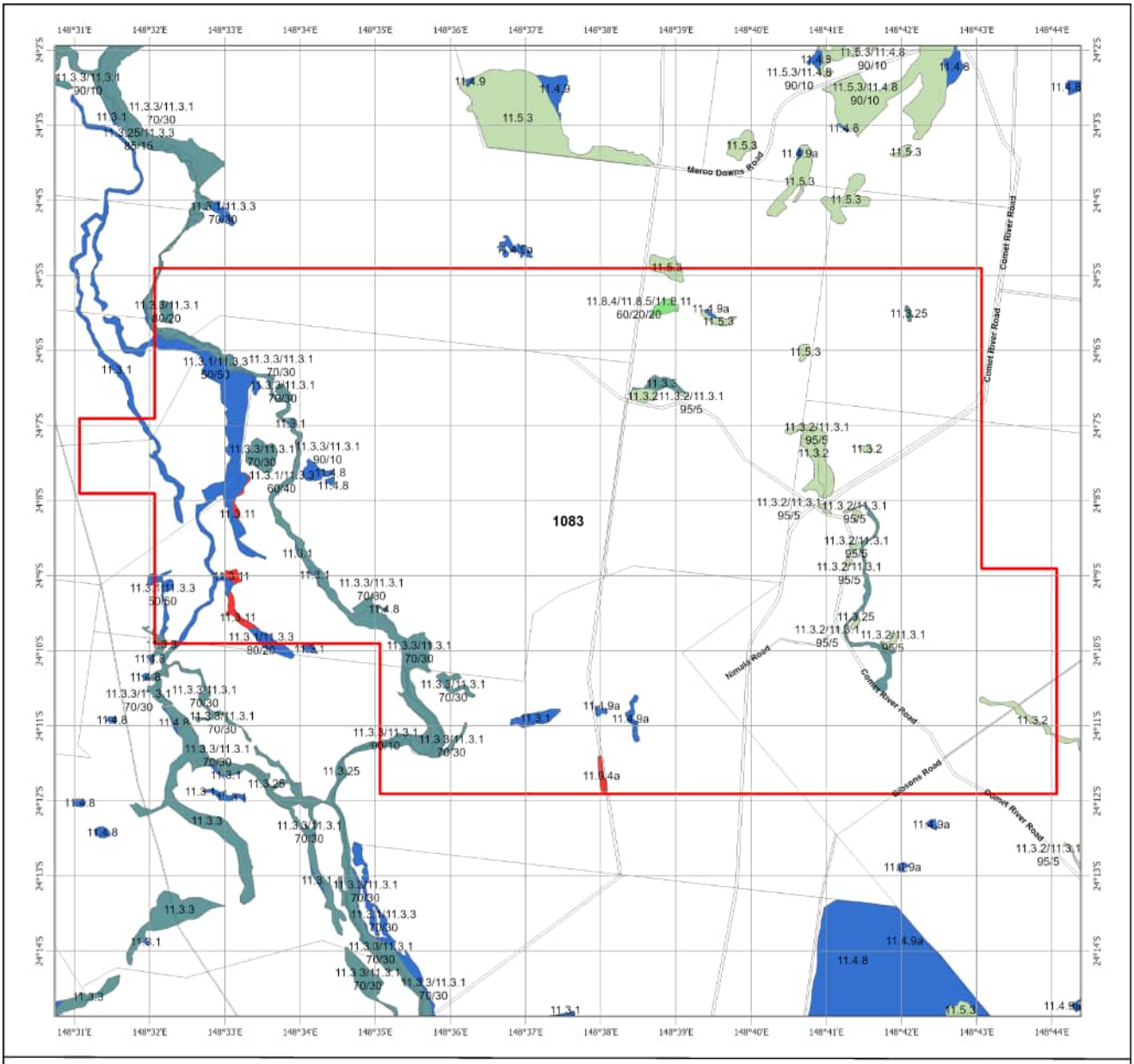
Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

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Map 4 - Remnant 2021 regional ecosystems by BVG (5M)



Remnant 2021 Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups
BVG5M Description (BVG1M codes)

1. Rainforests and scrubs (1-7b)
2. Wet eucalypt open forests (8-8b)
3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
4. Eucalypt open forests to woodlands on floodplains (16-16d)
5. Eucalypt dry woodlands on inland depositional plains (17-18d)
6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
7. Callitris woodland - open forests (20a)
8. Melaleuca open woodlands on depositional plains (21-22c)
9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
12. Other coastal communities or heaths (28-29b)
13. Tussock grasslands, forblands (30-32b)
14. Hummock grasslands (33-33b)
15. Wetlands (swamps and lakes) (34-34g)
16. Mangroves and saltmarshes (35-35b)

Non-remnant vegetation, cultivated or built environment
Water
Cadastral Boundaries
Selected Petroleum Lease (PL)

LOCALITY DIAGRAM

N

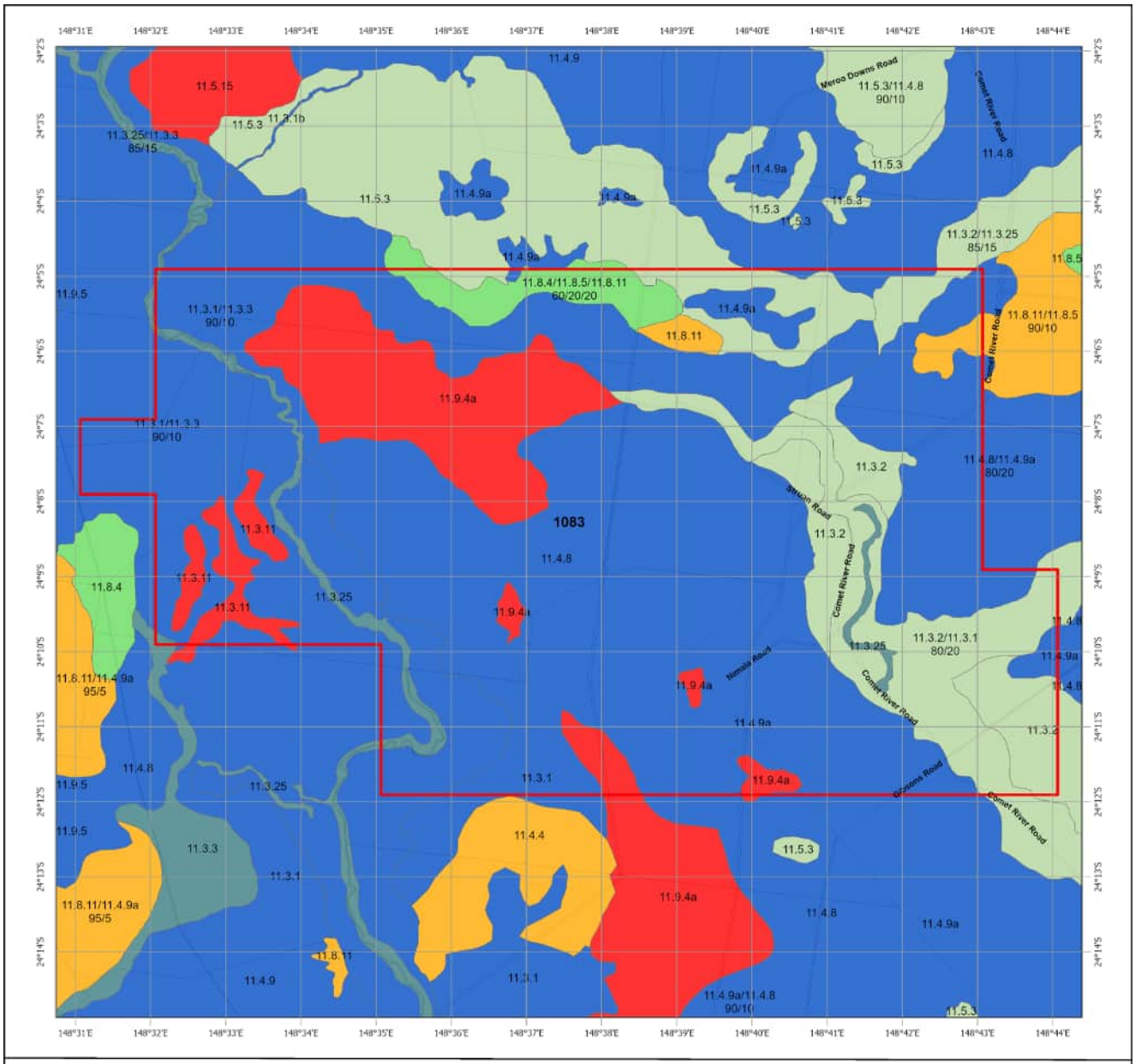
0 1.55 3.1 4.65 6.2 km

This product is displayed in GDA2020

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled. Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.
The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.
Remnant woody vegetation is defined as 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.
Non-remnant vegetation includes regrowth and disturbed native vegetation.

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Map 5 - Pre-clearing regional ecosystems by BVG (5M)

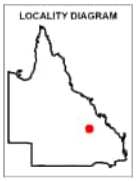


Pre-clearing Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups
BVG5M Description (BVG1M codes)

1. Rainforests and scrubs (1-7b)
2. Wet eucalypt open forests (8-8b)
3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
4. Eucalypt open forests to woodlands on floodplains (16-16d)
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14. Hummock grasslands (33-33b)
15. Wetlands (swamps and lakes) (34-34g)
16. Mangroves and saltmarshes (35-35b)

Water
Cadastral Boundaries
Selected Petroleum Lease (PL)



N

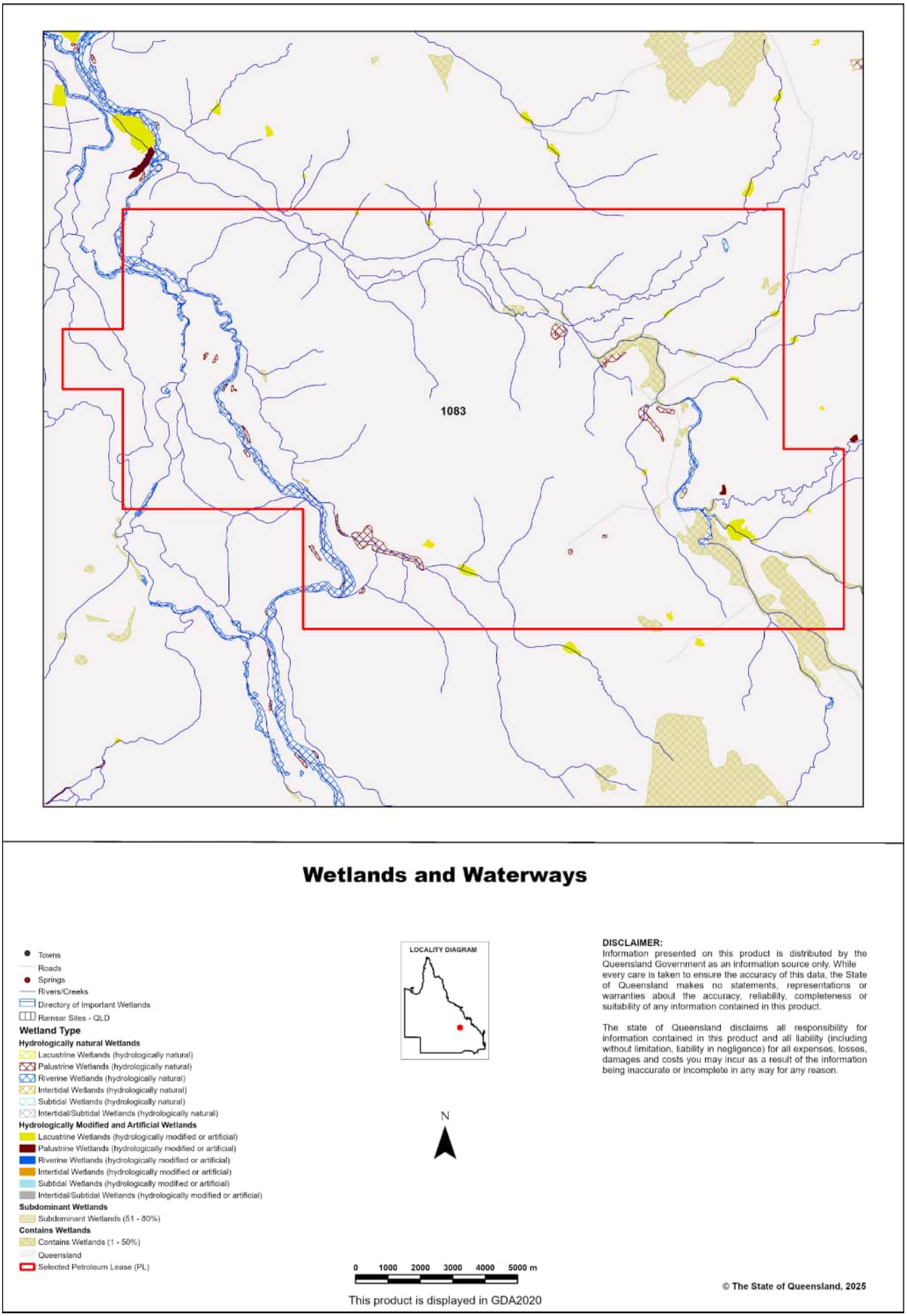
0 1.5 3 4.5 6 km

This product is displayed in GDA2020

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.
Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

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Map 6 - Wetlands and waterways



Links and Other Information Sources

The Department of the Environment, Tourism, Science and Innovation's Website - http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/ provides further information on the regional ecosystem framework, including access to links to the Regional Ecosystem Database, Broad Vegetation Group Definitions, Regional Ecosystem and Land zone descriptions.

Descriptions of the broad vegetation groups of Queensland can be downloaded from: https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/broad-vegetation

The methodology for mapping regional ecosystems can be downloaded from: https://www.qld.gov.au/__data/assets/pdf_file/0033/459186/methodology-mapping-surveying-v7.pdf

Technical descriptions for regional ecosystems can be obtained from: http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/

Benchmarks can be obtained from: http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/

For further information associated with the remnant regional ecosystem dataset used by this report, refer to the metadata associated with the Biodiversity status of pre-clearing and Remnant Regional Ecosystems of Queensland dataset (version listed in **Appendix 1**) which is available through the Queensland Spatial Catalogue, Queensland Spatial Catalogue : Queensland Government (information.qld.gov.au)

The Queensland Globe is a mapping and data application. As an interactive online tool, Queensland Globe allows you to view and explore Queensland maps, imagery (including up-to-date satellite images) and other spatial data, including regional ecosystem mapping. To further view and explore regional ecosystems over an area of interest, access the Biota Globe (a component of the Queensland Globe). The Queensland Globe can be accessed via the following link: https://qldglobe.information.qld.gov.au/

References

Neldner, V.J., Niehus, R.E., Wilson, B.A., McDonald, W.J.F., Ford, A.J. and Accad, A. (2023). The Vegetation of Queensland. Descriptions of Broad Vegetation Groups. Version 6.0. Queensland Herbarium, Department of Environment and Science. (https://publications.qld.gov.au/dataset/redd/resource/78209e74-c7f2-4589-90c1-c33188359086)

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F, Richter,D., Addicott, E.P. and Appelman, C.N. (2023) Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 7.0. Updated December 2023. Queensland Herbarium, Queensland Department of Environment, Science and Innovation, Brisbane. (https://www.qld.gov.au/__data/assets/pdf_file/0033/459186/methodology-mapping-surveying-v7.pdf).

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems.* Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

The dataset listed below is available for download from:
http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/download/

- Regional Ecosystem Description Database

The datasets listed below are available for download from:
Queensland Spatial Catalogue : Queensland Government (information.qld.gov.au)

- Biodiversity status of pre-clearing and 2021 remnant regional ecosystems of Queensland
- Pre-clearing Vegetation Communities and Regional Ecosystems of Queensland
- Queensland Wetland Data Version - Wetland lines
- Queensland Wetland Data Version - Wetland points
- Queensland Wetland Data Version - Wetland areas
- Pre-clearing broad vegetation groups of Queensland
- Remnant 2021 broad vegetation groups of Queensland

Appendix 2 - Acronyms and Abbreviations

AOI - Area of Interest
GIS - Geographic Information System
RE - Regional Ecosystem
REDD - Regional Ecosystem Description Database
VMA - *Vegetation Management Act 1999*

Queensland Government

Department of the Environment, Tourism, Science and Innovation

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
PL: 1082

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the input coordinates.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 2020). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Important Note to User

Information presented in this report is based upon the Queensland Herbarium & Biodiversity Science's Regional Ecosystem framework. The Biodiversity Status has been used to depict the extent of "Endangered", "Of Concern" and "No Concern at Present" regional ecosystems in all cases, rather than the classes used for the purposes of the *Vegetation Management Act 1999* (VMA). Mapping and figures presented in this document reflect the Queensland Herbarium & Biodiversity Science's Remnant and Pre-clearing Regional Ecosystem Datasets, and not the certified mapping used for the purpose of the VMA.

For matters relevant to vegetation management under the VMA, please refer to the Department of Natural Resources and Mines, Manufacturing, and Regional and Rural Development website https://www.nrmmrrd.qld.gov.au/

Please direct queries about these reports to: Queensland.Herbarium@qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.

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Summary Information

The following table provides an overview of the AOI with respect to selected topographic and environmental themes. Refer to **Map 1** for locality information.

Table 1: Details for area of interest:
PL: 1082, with area 23451.41 ha

Local Government(s)	Catchment(s)	Bioregion(s)	Subregion(s)
Central Highlands Regional	Fitzroy	Brigalow Belt	Isaac - Comet Downs

The table below summarizes the extent of remnant vegetation classed as "Endangered", "Of concern" and "No concern at present" regional ecosystems classified by Biodiversity Status within the area of interest (AOI).

Table 2: Summary table, biodiversity status of regional ecosystems within the AOI

Biodiversity Status	Area (Ha)	% of AOI
Endangered	1,431.83	6.11
Of concern	272.84	1.16
No concern at present	201.10	0.86
Total remnant vegetation	1,905.77	8.13

Refer to **Map 2** for further information.

Regional Ecosystems

1. Introduction

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with particular combinations of geology, landform and soil (Sattler and Williams 1999). Descriptions of Queensland's Regional ecosystems are available online from the Regional Ecosystem Description Database (REDD). Descriptions are compiled from a broad range of information sources including vegetation, land system and geology survey and mapping and detailed vegetation site data. The regional ecosystem classification and descriptions are reviewed as new information becomes available. A number of vegetation communities may form a single regional ecosystem and may be distinguished by differences in structure or sub-dominant species in the ecologically dominant layer. Vegetation communities with different dominant species in the ecologically dominant layer may be amalgamated in to a regional ecosystem if they are not mappable and predictable in the landscape at 1:100 000 scale. Vegetation communities may be mappable at a scale larger than 1:100 000. Vegetation communities within a regional ecosystem are denoted by a letter following the regional ecosystem code (e.g. a, b, c). Vegetation communities and regional ecosystems are amalgamated into a higher level classification of broad vegetation groups (BVGs).

A published methodology for survey and mapping of regional ecosystems across Queensland (Neldner et al 2023) provides further details on regional ecosystem concepts and terminology.

This report provides information on the type, status, and extent of vegetation communities, regional ecosystems and broad vegetation groups present within a user specified area of interest. Please note, for the purpose of this report, the Biodiversity Status is used. This report has not been developed for application of the *Vegetation Management Act 1999* (VMA). Additionally, information generated in this report has been derived from the Queensland Herbarium & Biodiversity Science's Regional Ecosystem Mapping, and not the regulated mapping certified for the purposes of the VMA. If your interest/matter relates to regional ecosystems and the VMA, users should refer to the Department of Natural Resources and Mines, Manufacturing, and Regional and Rural Development website https://www.nrmmrrd.qld.gov.au/.

With respect to the Queensland Biodiversity Status,

"Endangered" regional ecosystems are described as those where:

- remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares, or
- less than 10 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss*, or
- 10-30 percent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
- it is a rare** regional ecosystem subject to a threatening process.***

"Of concern" regional ecosystems are described as those where:

- the degradation criteria listed above for 'Endangered' regional ecosystems are not met and,
- remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 20 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares, or
- 10-30 percent of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.****

and "No concern at present" regional ecosystems are described as those where:

- remnant vegetation is over 30 percent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares, and
- the degradation criteria listed above for 'Endangered' or 'Of concern' regional ecosystems are not met.

**Severe degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 50 years even with the removal of threatening processes; or soil surface is severely degraded, for example, by loss of A horizon, surface expression of salinity; surface compaction, loss of organic matter or sheet erosion.*

***Rare regional ecosystem: pre-clearing extent (<1000 ha); or patch size (<100 ha and of limited total extent across its range).*

****Threatening processes are those that are reducing or will reduce the biodiversity and ecological integrity of a regional ecosystem. For example, clearing, weed invasion, fragmentation, inappropriate fire regime or grazing pressure, or infrastructure development.*

*****Moderate degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 20 years even with the removal of threatening processes; or soil surface is moderately degraded.*

2. Remnant Regional Ecosystems

The following table identifies the remnant regional ecosystems and vegetation communities mapped within the AOI and provides their short descriptions, Biodiversity Status, and remnant extent within the selected AOI. Please note, where heterogeneous vegetated patches (mixed patches of remnant vegetation mapped as containing multiple regional ecosystems) occur within the AOI, they have been split and listed as individual regional ecosystems (or vegetation communities where present) for the purposes of the table below. In such instances, associated area figures have been generated based upon the estimated proportion of each regional ecosystem (or vegetation community) predicted to be present within the larger mixed patch.

Table 3: Remnant regional ecosystems, description and status within the AOI

Regional Ecosystem	Short Description	BD Status	Area (Ha)	% of AOI
11.10.3	Acacia shirleyi or A. catenulata open forest on coarse-grained sedimentary rocks. Crests and scarps	No concern at present	49.32	0.21
11.3.1	Acacia harpophylla and/or Casuarina cristata open forest on alluvial plains	Endangered	12.99	0.06
11.3.2	Eucalyptus populnea woodland on alluvial plains	Of concern	272.84	1.16
11.4.8	Eucalyptus cambageana woodland to open forest with Acacia harpophylla or A. argyrodendron on Cainozoic clay plains	Endangered	652.43	2.78
11.4.9a	Acacia harpophylla shrubby woodland with Terminalia oblongata on Cainozoic clay plains	Endangered	673.22	2.87
11.5.3	Eucalyptus populnea +/- E. melanophloia +/- Corymbia clarksoniana woodland on Cainozoic sand plains and/or remnant surfaces	No concern at present	84.60	0.36
11.5.5c	Eucalyptus melanophloia, Callitris glaucophylla woodland on Cainozoic sand plains and/or remnant surfaces. Deep red sands	No concern at present	67.19	0.29
11.9.5a	Acacia harpophylla and/or Casuarina cristata open forest to woodland on fine-grained sedimentary rocks	Endangered	93.19	0.40
non-remnant	None	None	21,545.64	91.87

Refer to **Map 2** for further information. **Map 3** also provides a visual estimate of the distribution of regional ecosystems present before clearing.

Table 4 provides further information in regards to the remnant regional ecosystems present within the AOI. Specifically, the extent of remnant vegetation remaining within the bioregion, the 1:1,000,000 broad vegetation group (BVG) classification, whether the regional ecosystem is identified as a wetland, and extent of representation in Queensland's Protected Area Estate. For a description of the vegetation communities within the AOI and classified according to the 1:1,000,000 BVG, refer to **Table 6**.

Table 4: Remnant regional ecosystems within the AOI, additional information

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
11.10.3	Pre-clearing 381000 ha; Remnant 2021 335000 ha	24a	Not a Wetland	Medium
11.3.1	Pre-clearing 785000 ha; Remnant 2021 80000 ha	25a	Not a Wetland	Low
11.3.2	Pre-clearing 1905000 ha; Remnant 2021 499000 ha	17a	Contains Palustrine	Low
11.4.8	Pre-clearing 728000 ha; Remnant 2021 67000 ha	25a	Contains Palustrine	Low
11.4.9a	Pre-clearing 989000 ha; Remnant 2021 89000 ha	25a	Not a Wetland	Low
11.5.3	Pre-clearing 975000 ha; Remnant 2021 366000 ha	17a	Not a Wetland	Low
11.5.5c	Pre-clearing 395000 ha; Remnant 2021 138000 ha	17b	Not a Wetland	Low
11.9.5a	Pre-clearing 2276000 ha; Remnant 2021 161000 ha	25a	Not a Wetland	Low
non-remnant	None	None	None	None

Representation in Protected Area Estate: High greater than 10% of pre-clearing extent is represented; Medium 4 - 10% is represented; Low less than 4% is represented, No representation.

The distribution of mapped wetland systems within the area of interest is displayed in **Map 6**.

The following table lists known special values associated with a regional ecosystem type.

Table 5: Remnant regional ecosystems within the AOI, special values

Regional Ecosystem	Special Values
11.10.3	11.10.3: Habitat for threatened flora species including Acacia deuteroneura, A. wardellii and Bertya calycina.
11.3.1	11.3.1: Habitat for threatened fauna species including painted honeyeater, Grantiella picta particularly in subregion 35 (Oliver et al. 2003).
11.3.2	11.3.2: Habitat for threatened flora species Homopholis belsonii. This ecosystem is also known to provide suitable habitat for koalas (Phascolarctos cinereus).
11.4.8	11.4.8a: Larger gilgai provides ephemeral wetland habitat.

Regional Ecosystem	Special Values
11.4.9a	11.4.9: Potential habitat for NCA listed species: Cadellia pentastylis, Solanum adenophorum, Solanum dissectum, Solanum elachophyllum, Solanum johnsonianum, Xerothamnella herbacea.
11.5.3	11.5.3: Potential habitat for NCA listed species: Sannantha brachypoda. 11.5.3x1: Potential habitat for NCA listed species: Sannantha brachypoda.
11.5.5c	11.5.5: Potential habitat for NCA listed species: Vincetoxicum forsteri.
11.9.5a	11.9.5: Habitat for threatened fauna species including Jalmenus eubulus, pale imperial hairstreak butterfly (Eastwood et al. 2008).
non-remnant	None

3. Remnant Regional Ecosystems by Broad Vegetation Group

BVGs are a higher-level grouping of vegetation communities. Queensland encompasses a wide variety of landscapes across temperate, wet and dry tropics and semi-arid climatic zones. BVGs provide an overview of vegetation communities across the state or a bioregion and allow comparison with other states. There are three levels of BVGs which reflect the approximate scale at which they are designed to be used: the 1:5,000,000 (national), 1:2,000,000 (state) and 1:1,000,000 (regional) scales.

A comprehensive description of BVGs is available at: https://publications.qld.gov.au/dataset/redd/resource/

The following table provides a description of the 1:1,000,000 BVGs present and their associated extent within the AOI.

Table 6: Broad vegetation groups (1 million) within the AOI

BVG (1 Million)	Description	Area (Ha)	% of AOI
None	None	21,545.64	91.87
17a	Woodlands dominated by Eucalyptus populnea (poplar box) (or E. brownii (Reid River box)) on alluvium, sand plains and footslopes of hills and ranges.	357.44	1.52
17b	Woodlands to open woodlands dominated by Eucalyptus melanophloia (silver-leaved ironbark) (or E. shirleyi (shirley's silver-leaved ironbark)) on sand plains and footslopes of hills and ranges.	67.19	0.29
24a	Low woodlands to tall shrublands dominated by Acacia spp. on residuals. Species include A. shirleyi (lancewood), A. catenulata (bendee), A. microsperma (bowyakka), A. clivicola, A. sibirica, A. rhodoxylon (rosewood) and A. leptostachya (Townsville wattle).	49.32	0.21
25a	Open forests to woodlands dominated by Acacia harpophylla (brigalow) sometimes with Casuarina cristata (belah) on heavy clay soils. Includes areas co-dominated with A. cambagei (gidgee) and/or emergent eucalypts.	1,431.83	6.11

Refer to **Map 4** for further information. **Map 5** also provides a representation of the distribution of vegetation communities as per the 1:5,000,000 BVG believed to be present prior to European settlement.

4. Technical and BioCondition Benchmark Descriptions

Technical descriptions provide a detailed description of the full range in structure and floristic composition of regional ecosystems (e.g. 11.3.1) and their component vegetation communities (e.g. 11.3.1a, 11.3.1b). See: http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/

The descriptions are compiled using site survey data from the Queensland Herbarium & Biodiversity Science's QBEIS database. Distribution maps, representative images (if available) and the pre-clearing and remnant extent (hectares) of each vegetation community derived from the regional ecosystem mapping data are included. The technical descriptions should be used in conjunction with the fields from the regional ecosystem description database (REDD) for a full description of the regional ecosystem.

Technical descriptions include data on canopy height, canopy cover and native plant species composition of the predominant layer, which are attributes relevant to assessment of the remnant status of vegetation under the *Vegetation Management Act 1999*. However, as technical descriptions reflect the full range in structure and floristic composition across the climatic, natural disturbance and geographic range of the regional ecosystem, local reference sites should be used for remnant assessment where possible (Neldner et al. 2023 (PDF)* section 3.3 of: https://www.qld.gov.au/__data/assets/pdf_file/0033/459186/methodology-mapping-surveying-v7.pdf

The technical descriptions are subject to review and are updated as additional data becomes available.

When conducting a BioCondition assessment, these technical descriptions should be used in conjunction with BioCondition benchmarks for the specific regional ecosystem, or component vegetation community. http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/

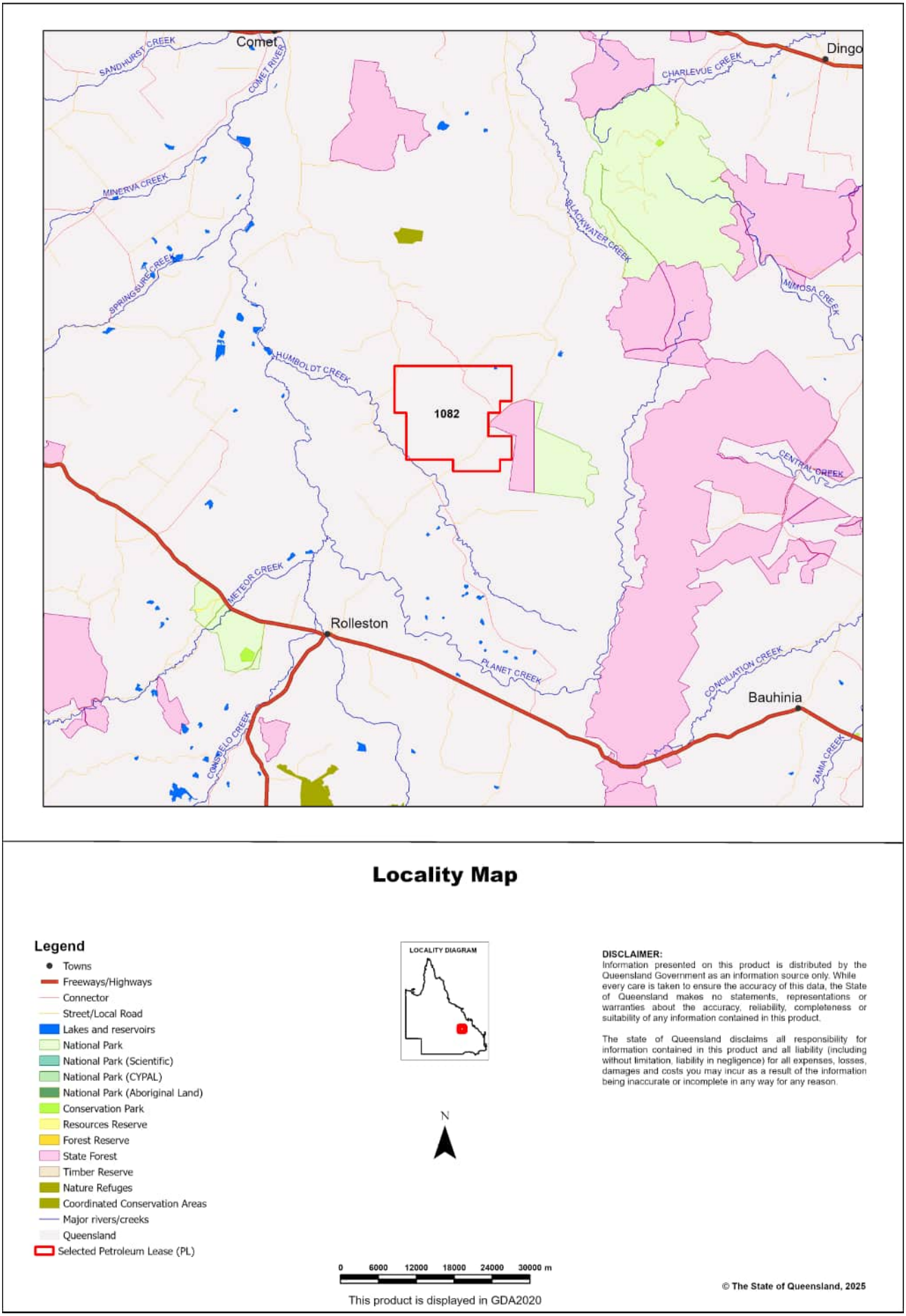
Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes has been considered throughout the geographic extent of the regional ecosystem. Local reference sites should be used for this spatial and temporal (seasonal and annual) variability.

Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available

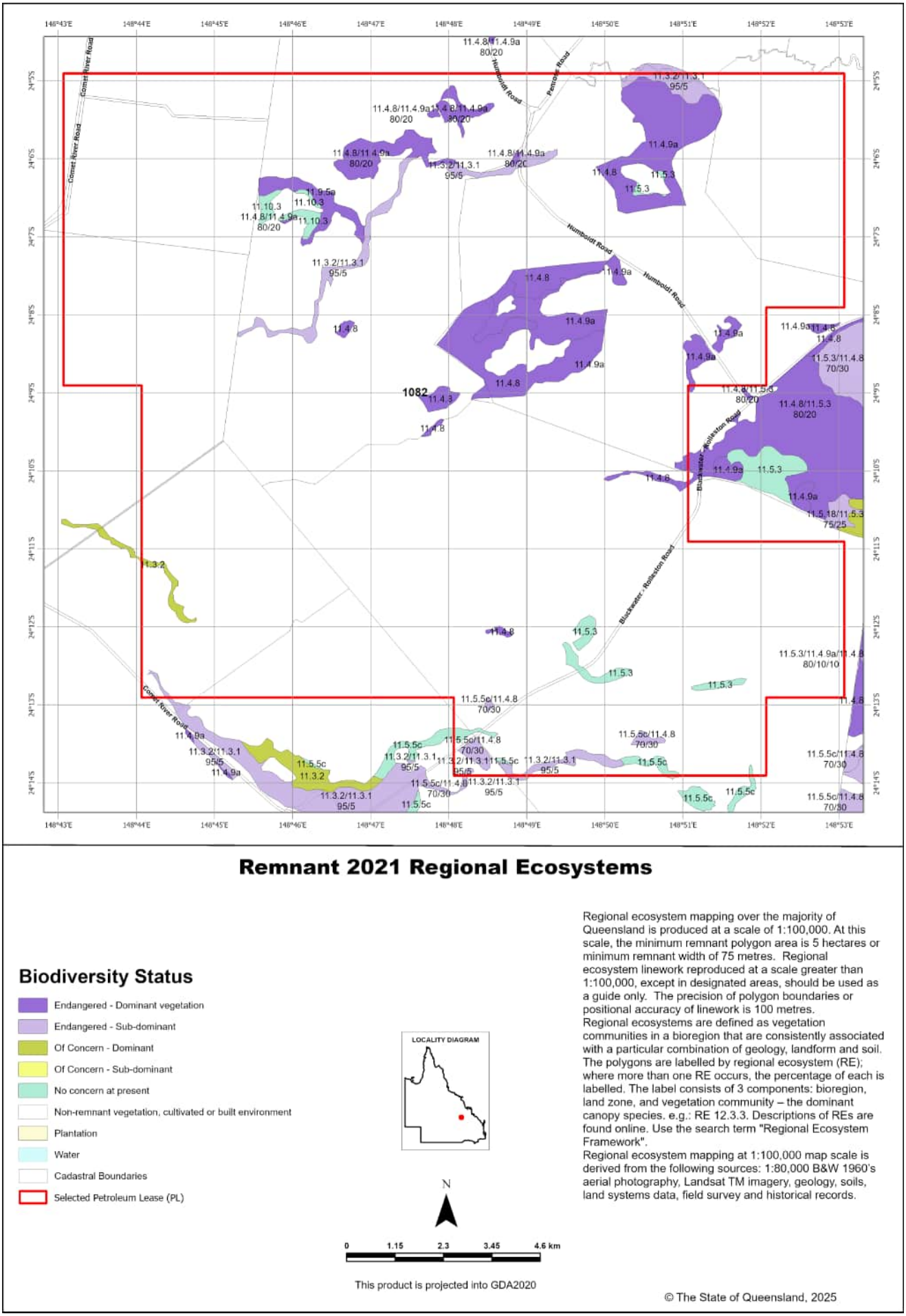
Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
11.10.3	Available	Available
11.3.1	Available	Available
11.3.2	Available	Available
11.4.8	Available	Available
11.4.9a	Available	Not currently available
11.5.3	Available	Available
11.5.5c	Available	Not currently available
11.9.5a	Available	Available
non-remnant	Not currently available	Not currently available

Maps

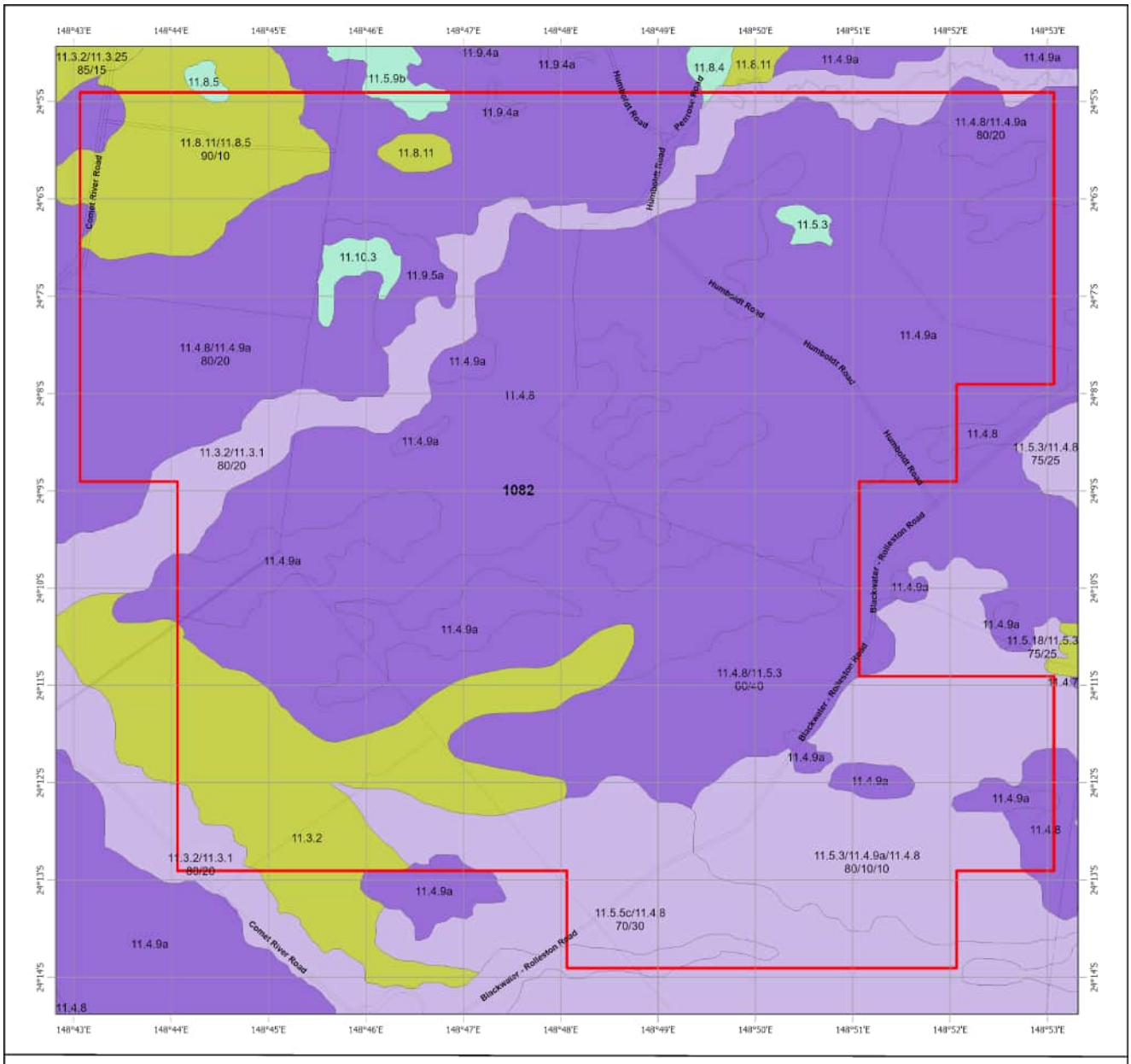
Map 1 - Location



Map 2 - Remnant 2021 regional ecosystems



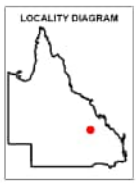
Map 3 - Pre-clearing regional ecosystems



Pre-clearing Regional Ecosystems

Biodiversity Status

- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Water
- Cadastral Boundaries
- Selected Petroleum Lease (PL)



N

0 1.15 2.3 3.45 4.6 km

This product is displayed in GDA2020

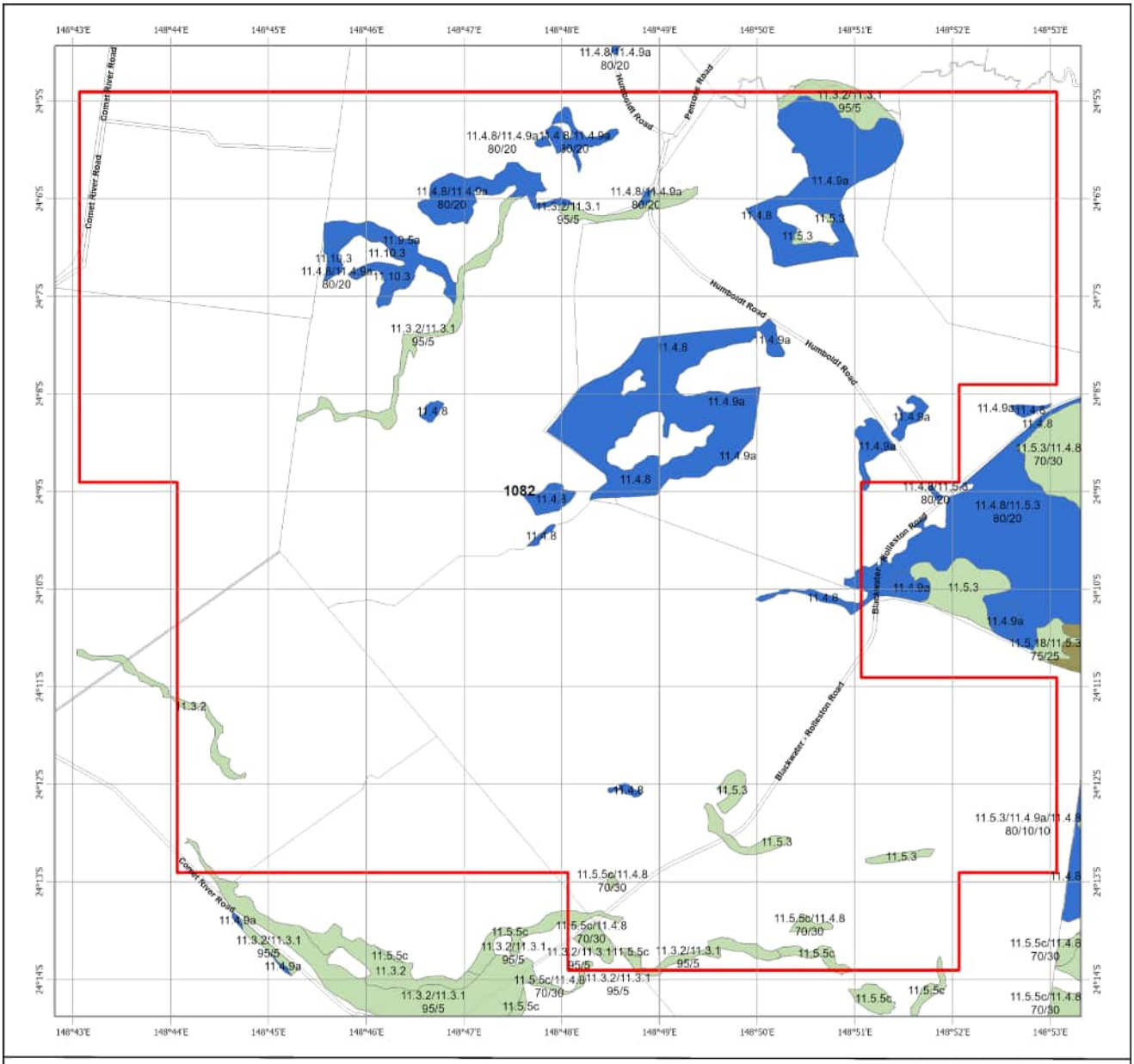
Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

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Map 4 - Remnant 2021 regional ecosystems by BVG (5M)

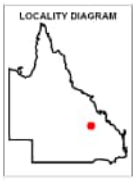


Remnant 2021 Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups
BVG5M Description (BVG1M codes)

1. Rainforests and scrubs (1-7b)
2. Wet eucalypt open forests (8-8b)
3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
4. Eucalypt open forests to woodlands on floodplains (16-16d)
5. Eucalypt dry woodlands on inland depositional plains (17-18d)
6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
7. Callitris woodland - open forests (20a)
8. Melaleuca open woodlands on depositional plains (21-22c)
9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
12. Other coastal communities or heaths (28-29b)
13. Tussock grasslands, forblands (30-32b)
14. Hummock grasslands (33-33b)
15. Wetlands (swamps and lakes) (34-34g)
16. Mangroves and saltmarshes (35-35b)

Non-remnant vegetation, cultivated or built environment
Water
Cadastral Boundaries
Selected Petroleum Lease (PL)



N

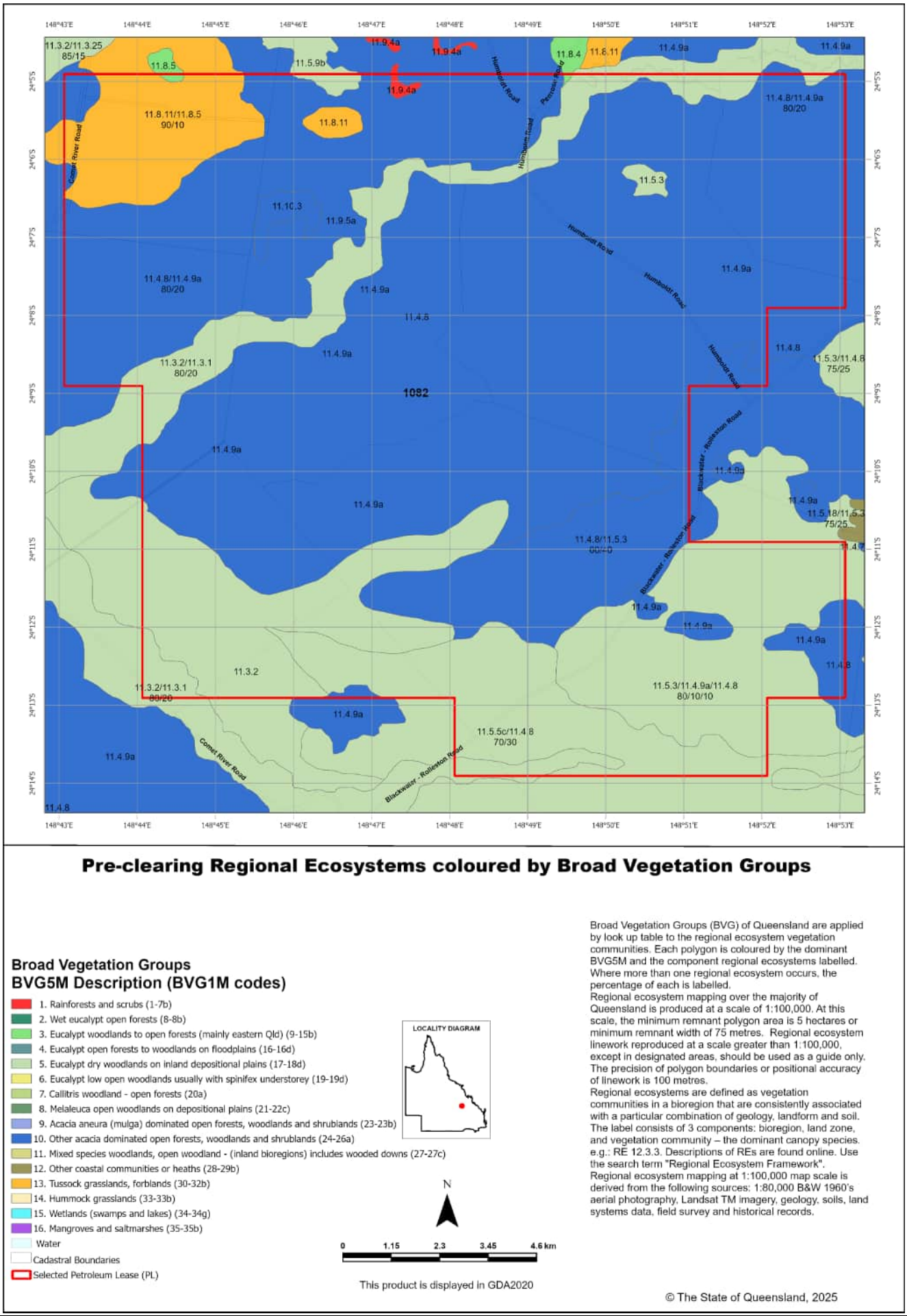
0 1.15 2.3 3.45 4.6 km

This product is displayed in GDA2020

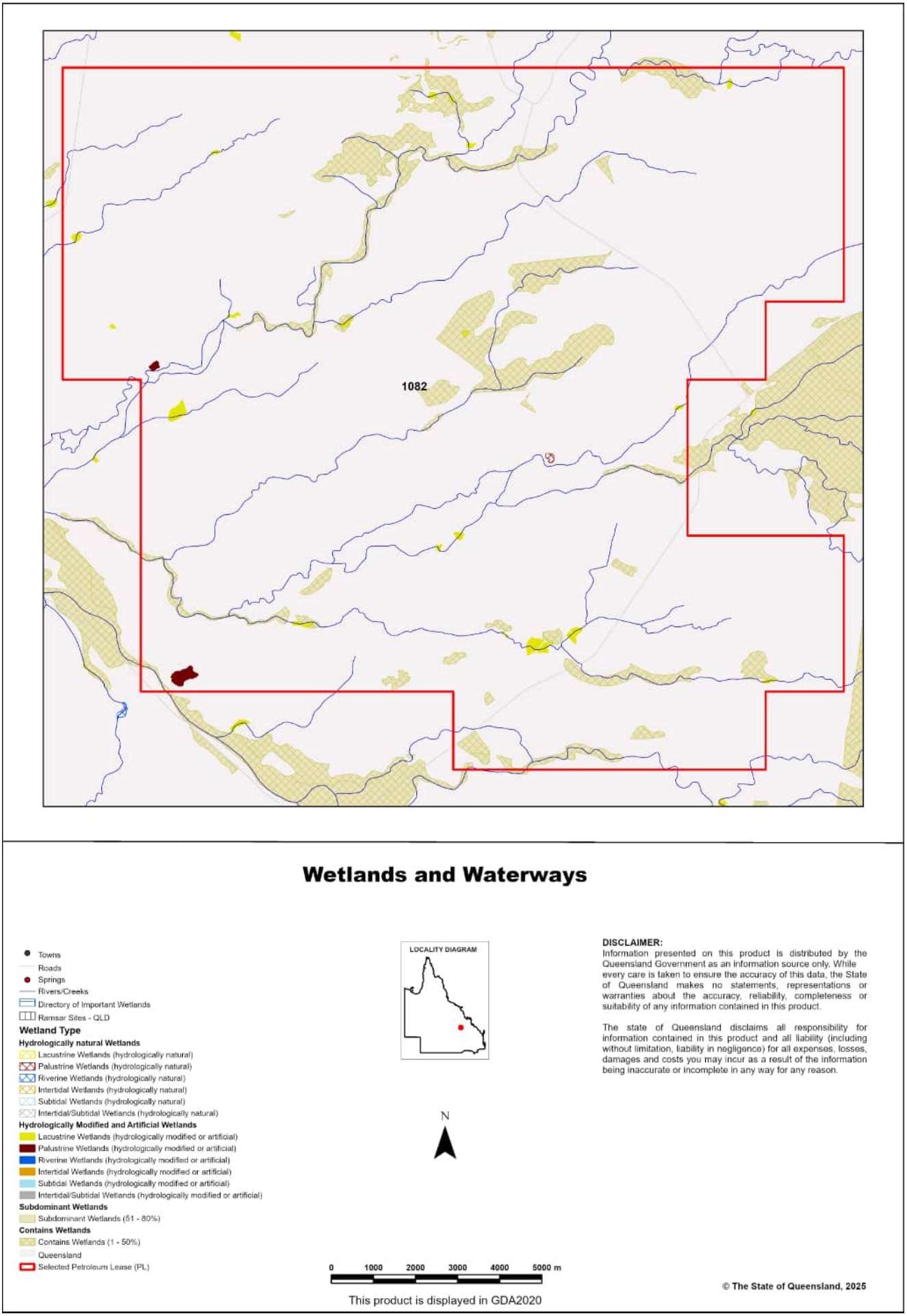
Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled. Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.
The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.
Remnant woody vegetation is defined as 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.
Non-remnant vegetation includes regrowth and disturbed native vegetation.

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Map 5 - Pre-clearing regional ecosystems by BVG (5M)



Map 6 - Wetlands and waterways



Links and Other Information Sources

The Department of the Environment, Tourism, Science and Innovation's Website - http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/ provides further information on the regional ecosystem framework, including access to links to the Regional Ecosystem Database, Broad Vegetation Group Definitions, Regional Ecosystem and Land zone descriptions.

Descriptions of the broad vegetation groups of Queensland can be downloaded from: https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/broad-vegetation

The methodology for mapping regional ecosystems can be downloaded from: https://www.qld.gov.au/__data/assets/pdf_file/0033/459186/methodology-mapping-surveying-v7.pdf

Technical descriptions for regional ecosystems can be obtained from: http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/

Benchmarks can be obtained from: http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/

For further information associated with the remnant regional ecosystem dataset used by this report, refer to the metadata associated with the Biodiversity status of pre-clearing and Remnant Regional Ecosystems of Queensland dataset (version listed in **Appendix 1**) which is available through the Queensland Spatial Catalogue, Queensland Spatial Catalogue : Queensland Government (information.qld.gov.au)

The Queensland Globe is a mapping and data application. As an interactive online tool, Queensland Globe allows you to view and explore Queensland maps, imagery (including up-to-date satellite images) and other spatial data, including regional ecosystem mapping. To further view and explore regional ecosystems over an area of interest, access the Biota Globe (a component of the Queensland Globe). The Queensland Globe can be accessed via the following link: https://qldglobe.information.qld.gov.au/

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Neldner, V.J., Niehus, R.E., Wilson, B.A., McDonald, W.J.F., Ford, A.J. and Accad, A. (2023). The Vegetation of Queensland. Descriptions of Broad Vegetation Groups. Version 6.0. Queensland Herbarium, Department of Environment and Science. (https://publications.qld.gov.au/dataset/redd/resource/78209e74-c7f2-4589-90c1-c33188359086)

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F, Richter,D., Addicott, E.P. and Appelman, C.N. (2023) Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 7.0. Updated December 2023. Queensland Herbarium, Queensland Department of Environment, Science and Innovation, Brisbane. (https://www.qld.gov.au/__data/assets/pdf_file/0033/459186/methodology-mapping-surveying-v7.pdf).

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems.* Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

The dataset listed below is available for download from:
http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/download/

- Regional Ecosystem Description Database

The datasets listed below are available for download from:
Queensland Spatial Catalogue : Queensland Government (information.qld.gov.au)

- Biodiversity status of pre-clearing and 2021 remnant regional ecosystems of Queensland
- Pre-clearing Vegetation Communities and Regional Ecosystems of Queensland
- Queensland Wetland Data Version - Wetland lines
- Queensland Wetland Data Version - Wetland points
- Queensland Wetland Data Version - Wetland areas
- Pre-clearing broad vegetation groups of Queensland
- Remnant 2021 broad vegetation groups of Queensland

Appendix 2 - Acronyms and Abbreviations

AOI - Area of Interest
GIS - Geographic Information System
RE - Regional Ecosystem
REDD - Regional Ecosystem Description Database
VMA - *Vegetation Management Act 1999*

Appendix I: GHG Report

Mahalo Gas Project: Greenhouse Gas Assessment

Prepared for:

Santos Ltd

July 2025

Final

Prepared by:

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Glossary

Term	Definition
°	degrees
°C	degrees Celsius
GJ	gigajoules
kL	kilolitres
km	kilometres
km^2	squared kilometres
m	metres
m^3	cubic metres
t	tonnes
TJ	terajoules
Nomenclature	**Definition**
CH_4	Methane
CO_2	carbon dioxide
CO_2-e	carbon dioxide equivalents
IPCC	Intergovernmental Panel on Climate Change
N_2O	nitrous oxide
Abbreviation	**Definition**
AR5	Fifth Assessment Report
CC Act	*Climate Change Act 2022*
CCCA Act	*Climate Change (Consequential Amendments) Act 2022*
CEJ ACT	*Clean Economy Jobs Act 2024*
CSG	Coal seam gas
Cwlth	Commonwealth
DETSI	Department of Environment, Tourism, Science and Innovation
DISR	Department of Industry Science and Resources
EA	Environmental Authority
EF	Emission factor
EP Act	*Environmental Protection Act 1994*
ERA	Environmentally Relevant Activity
GHG	Greenhouse gases
GHG Guideline	*Guideline Greenhouse gas emissions ESR/2024/6819*
GTG	Gas turbine generator
IPCC	Intergovernmental Panel on Climate Change
LOP	life of project
LULUCF	land use, land use change, and forestry
NGER	National Greenhouse and Energy Reporting
NGER Act	*National Greenhouse and Energy Reporting Act 2007*
NGER Determination	*National Greenhouse and Energy Reporting (Measurement) Determination*
NGER Regulation	*National Greenhouse and Energy Reporting Regulations 2008*
PL	petroleum lease
PPA	power purchase agreement
QLD	Queensland
UNFCCC	United Nations Framework Convention on Climate Change

EXECUTIVE SUMMARY

Katestone Environmental Australia Pty Ltd (Katestone) was commissioned by Santos Limited (Santos) to complete a Greenhouse Gas (GHG) Assessment of the Mahalo Gas Project (the Project), a proposed gas compression facility and coal seam gas (CSG) field in the Mahalo Gas Hub in Queensland. The GHG assessment is required to support an application for an Environmentally Relevant Activity (ERA) 15 – fuel burning.

The Mahalo Gas Project is located within the Central Highlands Regional Council area, approximately 40 km north of Rolleston in Central Queensland. The Project is a joint venture between Santos QNT Pty Ltd and Comet Ridge Mahalo Pty Ltd and is comprised of two petroleum leases (PL) (PL1082 and PL1083) over a combined area of approximately 470 km^2. The Project has an Environmental Authority (EA) P-EA-100178150 from the Department of Environment, Tourism, Science and Innovation (DETSI) and will be constructed in two phases. The EA provides for the construction of 190 CSG development wells but does not permit fuel burning or a combustion facility.

The proposed development will include:

- The construction of up to 68 wells (to be electrified)
- A compressor station package
- Triethylene glycol regeneration boilers
- Gas engine generators
- Backup diesel generator
- Enclosed ground flare.

The GHG assessment considers only emissions relating to the amendment sought, which includes the proposed compressor station, its flare, the gas engine generators, and a sewage treatment plant. The GHG assessment was conducted in accordance with the requirements of the *Guideline Greenhouse gas emissions ESR/2024/6819* (GHG Guideline) and estimated the GHG emissions that will be generated as a result of the activity.

Key sources of GHG emissions include the following:

- CSG boosting and gathering station (gas compressor station), including
    - 3 x G3612 gas compressor engines
    - 3 x G3512 gas engines for power generation
    - CSG flaring
- Sewage treatment.

The GHG assessment has estimated the total Life of Project (LOP) Scope 1 emissions to be 383,661 tonnes of carbon dioxide equivalent (t CO_2-e) with average annual Scope 1 emissions of 9,592 t CO_2-e. The maximum annual Scope 1 emissions to occur are estimated as 16,330 t CO_2-e.

Consequently, the proposed activity is classified as a low emitter under the GHG Guideline (i.e., < 25,000 t CO_2-e in all project years). The proposed development will add to the Mahalo Gas Project's total emissions.

A GHG emission inventory of the Mahalo Gas Hub was completed to identify opportunities to reduce GHG emissions for the Project. The Mahalo Gas Hub includes Phase 1 and 2 schedules for gas exploration, development, and production.

The Mahalo Gas Hub's total Scope 1 emissions for the LOP was estimated as 513,046 t CO_2-e, with average annual Scope 1 emissions of 12,826 t CO_2-e and maximum annual Scope 1 emissions of 27,970 t CO_2-e occurring in 2028. No Scope 2 emissions are projected as electricity will be generated on-site. The Mahalo Gas Hub will be subject to NGER reporting requirements; however, will not trigger the Safeguard Mechanism.

The following areas of opportunity were identified to reduce GHG emissions associated with the Project:

- Minimise and avoid fugitive emissions across operations
- Minimise gas combustion for power generation
- Engage staff in identifying and implementing emissions reduction and energy efficient practices.

1. INTRODUCTION

Katestone Environmental Australia Pty Ltd (Katestone) was commissioned by Santos Limited (Santos) to complete a Greenhouse Gas (GHG) Assessment of the Mahalo Gas Project (the Project), a proposed gas compression facility and coal seam gas (CSG) field in the Mahalo Gas Hub in Queensland. The Project's current Environmental Authority (EA) P-EA-100178150 provides for the construction of up to 190 conventional CSG development wells; however, it does not permit fuel burning or a combustion facility. A GHG assessment is required to support an application for the Environmental Relevant Activity (ERA) 15 – fuel burning.

The Project is located within the Central Highlands Regional Council area, approximately 40 km north of Rolleston in Central Queensland (Figure 1). The Project is a joint venture between Santos QNT Pty Ltd and Comet Ridge Mahalo Pty Ltd and is comprised of two petroleum leases (PL) (PL1082 and PL1083) over a combined area of approximately 470 km^2.

Proposed amendments to the existing EA include development of a compressor station with a flare for emergency releases, accommodation camp, reverse osmosis facility and sewage treatment plant. The 68 wells that are part of the Project have been approved.

The proposed development will include:

- A compressor station package
- Triethylene glycol regeneration boilers
- Gas engine generators
- Backup diesel generator
- Enclosed ground flare

Key sources of GHG emissions include the following:

- CSG boosting and gathering (gas compressor station), including
    - 3 x G3612 gas compressor engines
    - 3 x G3512 gas engines for power generation
    - CSG flaring
- Sewage treatment.

The up to 68 gas extraction wells, reverse osmosis facility, and sewage treatment plant will be operated using power generated at the compressor station.

This assessment is required to consider only activities relating to the amendment sought, as per the *Guideline Greenhouse gas emissions ESR/2024/6819* (GHG Guideline). However, the assessment also presents the approved emissions associated with the Mahlo Gas Hub, which consists of the Mahlo Phase 1 (68 wells) and 2 (48 wells) schedules for gas exploration, development, and production.

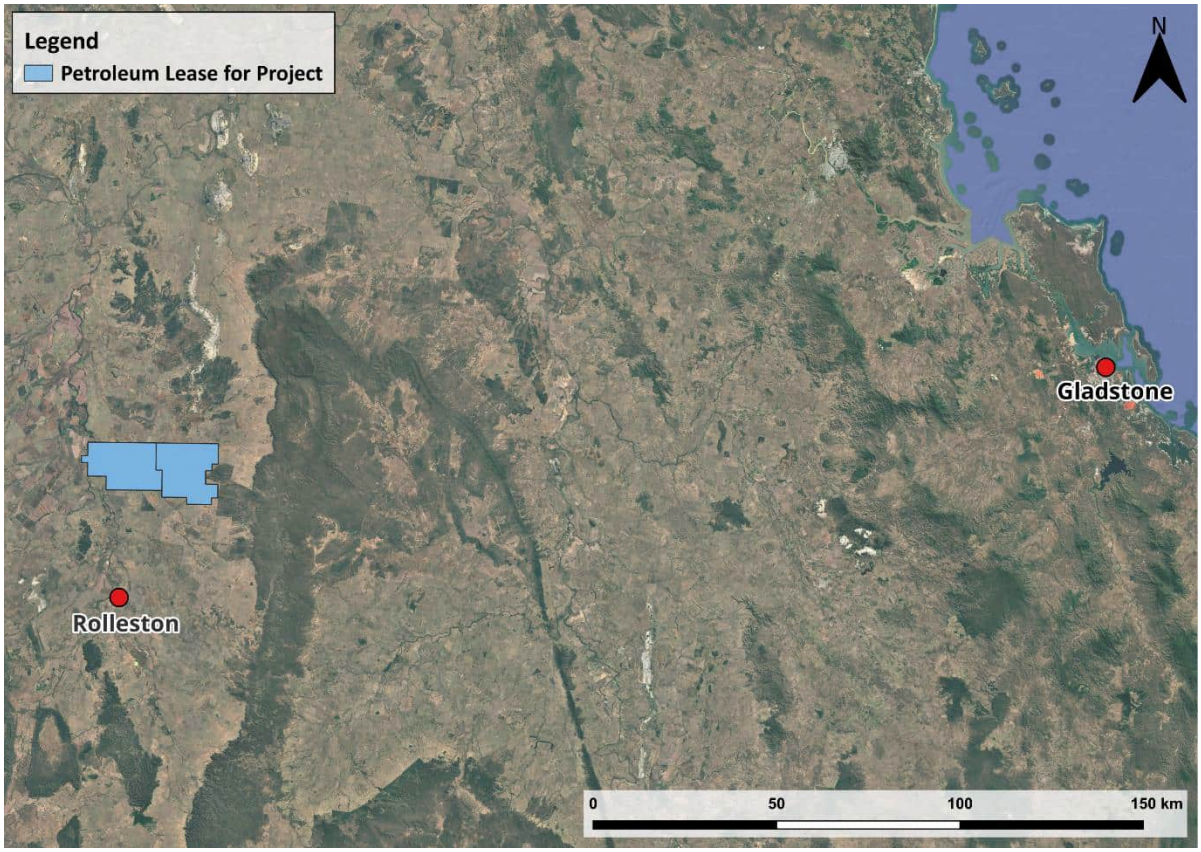


Figure 1 **Mahalo gas project setting (area in blue) in relation to Rolleston and Gladstone**

2. REGULATORY FRAMEWORK

2.1 International Agreements

2.1.1 Paris Agreement

The Australian Government signed the legally binding Paris Agreement (UNFCC 2016) to take actions to keep global warming to 'well below' 2°C and strive to limit warming to 1.5°C. The current Australian target (Nationally Determined Contribution) is to reduce emissions by 43% below 2005 levels by 2030, including land use, land use change, and forestry (LULUCF) and using Global Warming Potential (GWP) values from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5). The intention is to have net zero GHG emissions by 2050.

2.1.2 Global Methane Pledge

The Australian Government has signed the Global Methane Pledge[1] to reduce Australia's methane emissions by at least 30% below 2020 levels by 2030.

2.2 Legislation and Regulation

2.2.1 Climate Change Act 2022 (Cwlth)

The *Climate Change Act 2022* (CC Act) provides the legislative framework to implement Australia's net-zero commitments and codifies Australia's 2030 and 2050 net GHG emissions reductions targets under the Paris Agreement. The legislated targets are to reduce net GHG emissions to 43% below 2005 levels by 2030, and to reduce net GHG emissions to zero by 2050.

The CC Act establishes the 2030 GHG emissions reduction target as a national point target and an emissions budget. The CC Act does not impose obligations directly on companies; the emissions reduction targets are given effect through the *Climate Change (Consequential Amendments) Act 2022*, the *National Greenhouse and Energy Reporting Act 2007*, and the *Safeguard Mechanism (Crediting) Amendment Act 2023*.

2.2.2 Climate Change (Consequential Amendments) Act 2022 (Cwlth)

The *Climate Change (Consequential Amendments) Act 2022* (CCCA Act) embeds the GHG emissions reduction targets into fourteen Commonwealth acts, including the *Clean Energy Regulator Act 2011*, *Infrastructure Australia Act 2008*, *National Greenhouse and Energy Reporting Act 2007*, and the *Renewable Energy (Electricity) Act 2000*.

2.2.3 Clean Energy and Jobs Act 2024 (Qld)

The objective of the *Clean Energy and Jobs Act 2024* (CEJ Act) is to reduce GHG emissions in Queensland and legislate emissions reduction targets. The emissions reduction targets are the following:

- by 30 June 2030, net greenhouse gas emissions in Queensland are reduced to an amount that is at least 30% below the net greenhouse gas emissions in Queensland for 2005
- by 30 June 2035, net greenhouse gas emissions in Queensland are reduced to an amount that is at least 75% below the net greenhouse gas emissions in Queensland for 2005

[1] https://www.globalmethanepledge.org/

- by 30 June 2050, net greenhouse gas emissions in Queensland are reduced to zero (the ***2050 net zero emissions target***).

The CEJ Act includes recommendations regarding interim GHG reductions targets, the methodology for calculating GHG emissions inventories, the provision of annual progress statements towards stated goals, and stipulations regarding emissions reductions plans.

2.2.4 Environmental Protection Act 1994 (Qld)

The *Environmental Protection Act 1994* (EP Act) seeks to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

The EP Act does not explicitly regulate the emission of GHG, other than with reference to the storage of GHG regulated under the *Greenhouse Gas Storage Act 2009*. However:

- Regarding air emissions, a contaminant can be a gas (11(a))
- GHG emissions may constitute an environmental harm (14(1)(2)), i.e., "… any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value …" "whether the harm is a direct or indirect result of the activity; or whether the harm results from the activity alone or from the combined effects of the activity and other activities or factors".

2.2.5 National Greenhouse and Energy Reporting Act 2007 (Cwlth)

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) established a national framework for corporations to report GHG emissions and energy consumption.

NGER registration and emissions reporting are mandatory for facilities that have energy production or consumption in excess of 100 terajoules (TJ) or GHG emissions that exceed 25,000 t CO_2-e in a financial year. The reporting thresholds for corporate groups are energy production or consumption in excess of 200 TJ or GHG emissions that exceed 50,000 t CO_2-e in a financial year. These entities are required to report on their Scope 1 and Scope 2 emissions. Scope 3 emissions are not included in NGER reporting due to the potential for double counting.

2.2.6 National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Cwlth)

The National Greenhouse and Energy Reporting (Measurement) Determination 2008 (NGER Determination) provides methods, criteria, and measurement standards for calculating greenhouse gas emissions and energy data under the NGER Act. It covers Scope 1 and Scope 2 emissions and energy production and consumption.

2.3 Guidelines and Strategies

2.3.1 GHG Guidelines

The *Guideline Greenhouse gas emissions ESR/2024/6819* (GHG Guideline) gives effect to the requirements under the EP Act and provides information about how to meet these requirements in relation to GHG emissions for new and amended EA applications.

The GHG Guideline sets out the minimum expectations for GHG emissions information to be provided with applications and supports rigorous, defensible, and transparent decision making in relation to GHG emissions.

There are different levels of requirements for projects considered “low emitters” versus “medium to high emitters”. The required information for a “low emitter” includes:

- An inventory of expected GHG emissions resulting from the Project including the stage at which the emissions will occur and a breakdown by source
- An estimate of projected Scope 1 and Scope 2 GHG emissions over the life of the project
- A description of the methodology used for estimating GHG emissions
- GHG emission mitigation and management practices for the Project
- A description of risks and the likely magnitude of impacts on environmental values resulting from the Project, including qualitatively describing the impacts of climate change on environmental values and the likely magnitude of such impacts based on the relative scale of the Project’s net GHG emissions.

2.3.2 Australia’s Future Gas Strategy

The Department of Industry, Science and Resources’ (DISR) *Future Gas Strategy* describes the Australian Government’s plan for national gas production and consumption. It focuses on ensuring a secure and affordable gas supply while aligning with the national commitment to achieve net zero emissions by 2050. Key priorities include maintaining energy reliability, fostering the adoption of low-emission gases, advancing carbon capture and storage technologies, and supporting decarbonisation across industries to facilitate a sustainable energy transition.

3. METHOD

3.1 Scope 1, Scope 2, and Scope 3 emissions

GHG emissions are classified into three Scopes for monitoring, reporting, and management purposes. In Australia, these are defined in the NGER Act as:

- Scope 1. GHG emissions released to the atmosphere as a direct result of an activity or series of activities that are controlled by a company, and which are reported at a facility level. This would include emissions from combustion of diesel and fugitive emissions from gas exploration, development and production during the Project. These direct emissions are reported annually if the emissions exceed a legislated threshold (section 2.2.5).
- Scope 2. GHG emissions released to the atmosphere because of the generation of electricity that has been purchased by a company for use at a facility such as the Project. These are considered indirect emissions and are reported annually if the facility exceeds a legislated threshold (section 2.2.5).
- Scope 3. GHG emissions released to the atmosphere upstream or downstream in an organisation's supply or value chain. These indirect emissions are not reported under the NGER Act as they are another company or organisation's Scope 1 or Scope 2 emissions.

The purpose of monitoring and reporting GHG emissions is threefold:

- Allow Queensland and Australian governments to determine an annual inventory of GHG emissions against international agreements and legislated emissions reduction targets.
- Allow a company or organisation to manage or offset its Scope 1 and Scope 2 emissions to meet corporate or regulatory targets.
- Allow a company or organisation to influence Scope 3 emissions reduction through procurement or supply decisions.

3.2 Activities that result in GHG emissions

Activities that will result in GHG emissions include:

- CSG combustion by Gas Turbine Generators (GTG) for electricity generation
- Fugitive emissions from the compressor station (gathering and boosting station)
- Flaring of CSG.

Activities that will result in GHG emissions for the Project, not included in the application for ERA 15 are:

- Diesel combustion by Facility machinery / plant (stationary) and light vehicles (transport)
- Fugitive emissions from exploration, development and production of CSG.

There are no projected scope 2 emissions resulting from the Project or Facility as no electricity will be purchased from the National Electricity Market. Scope 3 emissions are not considered in this assessment due to the Project being classed as a low emitter under the GHG guideline.

3.3 Method for calculation of GHG emissions

The NGER Act establishes a national framework for corporations to report GHG emissions and energy consumption. Scope 1 emissions have been calculated using the allowable calculation methods contained in the *National Greenhouse and Energy Reporting Regulations 2008* (NGER Regulation) and the NGER Determination.

The Scope 1 GHG assessment for the project considers NG consumption by GTGs and flares. It also accounts for fugitive methane emissions relating to NG gathering and boosting station.

The Scope 1 GHG assessment for the facility includes diesel combustion consumption by machinery / plant for construction and fugitive methane emissions related to the exploration, development and production of CSG.

The assessments were conducted using data provided by Santos. Emissions factors in the NGER Determination were applied (Table 1 and Table 2).

Emission factors may change in the future, which would affect the quantity of emissions that are estimated and reported in future years. This assessment is conducted relative to the NGER Determination for 2024-2025.

GHG emissions are typically calculated using Method 1, which applies emission factors and the energy content of the emission source. The formula for Method 1 is:

$$E = \frac{Q \times ECF \times EF}{1000},$$

Where: E represents the total emissions in t CO_2-e,

Q is the quantity of the emission source (e.g., with units kilolitres (kL))

ECF is the energy content factor of the emission source (e.g., with units gigajoules (GJ) /kL)

EF is the emission factor that describes the total amount of equivalent carbon dioxide emissions associated with the emission source (e.g., with units kilograms (kg) CO_2-e/GJ)

1000 returns the correct units for the emissions.

In the NGER Determination, each emission source has an emission factor associated with CO_2, CH_4, and N_2O. The total emissions are given by the sum of these three quantities applied in the above formula.

The methods for estimating fugitive emissions and GHG emissions from vegetation clearance and sewage treatment are outlined in sections 3.3.1, 3.3.2 and 3.3.3, respectively.

3.3.1 Fugitive emissions

Fugitive emissions have been calculated using the relevant variation of Method 1 for categories of fugitive emissions applicable to the Project as described in the NGER Determination. Method 1 per Division 3.3.6A of the NGER Determination is:

$$E = \sum_{k} \left(Q_{ik} \times EF_{ijk} \times S_{ij} / SD_{ij} \right),$$

Where: E represents the fugitive emissions released at the wellhead (t CO_2-e)

j represents gas type CO_2 or CH_4

Q represents the total quantity of gas that passes through the wellhead (in tonnes)

EF is the emission factor that describes the total amount of equivalent carbon dioxide emissions associated with the emission source (e.g., with units t CO_2-e / t CSG that passes through each equipment type)

S is the measured share of each gas type

SD is the default share of the gas type.

The following fugitive emission sources have been assessed in accordance with the NGER Determination:

- Well completion without hydraulic fracturing
- Production – onshore gas wellheads
- Well workovers without hydraulic fracturing
- Produced water
- Gathering and boosting stations
- Gathering and boosting pipelines.

3.3.2 Emissions from vegetation clearance

Santos has identified that all activities associated with the Project will occur on land with non-remnant vegetation. The Project will avoid environmentally sensitive areas; therefore land clearing emissions are classified as zero within this assessment.

3.3.3 Emissions from sewage treatment plant

The Project's application includes the operation of a sewage treatment plant. Emissions from sewage treatment were assessed using the Clean Energy Regulator's (CER's) NGER wastewater domestic and commercial calculator [2].

3.4 Emission factors

Table 1 summarises the energy contents and emission factors used to determine Scope 1 emissions from the combustion of fuels.

Table 2 summarises the emission factors, standard gas compositions and Project gas compositions used to determine scope 1 fugitive emissions relating to CSG.

[2] Clean Energy Regulator (CER) (2023) NGER wastewater domestic and commercial calculator. https://cer.gov.au/document/nger-wastewater-domestic-and-commercial-calculator-2023-24

Table 1 Summary of energy content and emission factors for Scope 1 emissions from the combustion of fuels

Emission source	Energy content	Units	Emission factor		Units
			Scope 1	Scope 3	
Coal seam methane that is captured for combustion [1]	0.0377	GJ/m^3	51.63	-	kg CO_2-e/GJ
[1] (Schedule 1, NGER Determintion)					

Table 2 Emission factors, standard gas compositions, and Project gas compositions for Scope 1 fugitive emissions

Fugitive Emission Source	Emission Factors				Standard Gas Composition (%)		Project Gas Composition (%)	
	CO_2	CH_4	N_2O	Unit	CO_2	CH_4	CO_2	CH_4
Well completion without hydraulic fracturing	1.1×10^{-2}	5.5	-	t CO_2-e	3.45	83.20	0.6	97.5
Production -Onshore gas wellheads	1.32×10^{-3}	2.60×10^{-6}	-	t CO_2-e	2.00	98.00	0.6	97.5
Well Workover without hydraulic fracturing	1.1×10^{-2}	5.5	-	t CO_2-e	3.45	82.5	0.6	97.5
Produced Water	-	7.99	-	t CO_2-e	-	83.20	-	97.5
Gathering and Boosting Stations [3]	5.80×10^{-6} – 6.94×10^{-5}	3.91×10^{-3} – 4.69×10^{-2}	-	t CO_2-e	3.45	83.20	0.6	97.5
Gathering and Boosting Pipelines	2.65 × 10-2	6.52	-	t CO_2-e	3.45	83.20	0.6	97.5
Gas Flared from NG Production	2.7	0.133	0.026	t CO_2-e	-	-	-	-

[3] Emissions factors derived for the Project in accordance with subsections 2 and 3 of Method 3.73KA of the NGER Determination

3.5 Limitations and assumptions

This assessment has been prepared by Katestone based on information, data, and assumptions provided by Santos. Katestone has not independently verified the accuracy, completeness, or validity of the data supplied and makes no representation or warranty regarding its accuracy. The findings and conclusions presented in this assessment are based on the information available at the time of reporting.

The following assumptions have been made across assessments in accordance with data supplied by Santos:

LOP time frames:

- All construction of the Facility occurs across the first 2 years
- Well completion and operation are assumed to occur when projected gas production starts
- A total of 116 wells is constructed over the LOP
- Well life is assumed through to 2066, with end of life varying by year of commencement
- Well workovers occur every 2 years after the construction and operation of each well.

Gas Combustion:

Gas combustion for on-site electricity generation is based on the following GTG operation schedule:

- 3 GTGs operate when annual gas production exceeds 66% of maximum production
- 2 GTGs operate when annual gas production is between 33 – 66%
- 1 GTG operates when annual gas production is below 33%.

Fugitive Emissions:

- The total annual quantity of gas production passes through the gathering and boosting station annually
- Gathering and boosting pipeline length is assumed 130 km in the first year and 300km for all other years.

4. GREENHOUSE GAS ASSESMENT

4.1 Summary of emissions from the Project

Total cumulative Project Scope 1 emissions resulting from the amendment are estimated to be 383,661 t CO_2-e (Table 3), with average annual emissions of 9,592 t CO_2-e. The maximum annual emissions are expected to occur in 2032 and 2034 (16,330 t CO_2-e). Emissions resulting from the combustion of gas is the largest contributor to the Project's total emission inventory (77%) estimated to be 295,919 t CO_2-e.

Fugitive emissions resulting from the compressor station are the second largest contributor to the total LOP emission inventory (12%) estimated as 47,671 t CO_2-e. Emissions from the compressor station's pilot flare are estimated as 40,072 t CO_2-e and contribute 10% to the emissions inventory of the proposed development.

The emissions expected from the managed aerobic treatment plant serving 100 people was estimated as ≈ 1 t CO_2-e and is considered immaterial to this assessment.

Table 3 Summary of GHG Emissions (t CO_2-e, rounded to nearest tonne) associated with the proposed development

Activity	Total for LOP	Annual Average	Annual Maximum
	GHG Emissions (t CO_2-e)		
Gathering and Boosting Station	47,671	1,192	1,671
Flaring	40,072	1,002	1,002
Gas Combustion	295,919	7,398	13,658
Total (All Activities)	383,661	9,592	16,330

4.2 Summary of Emissions from the Mahalo Gas Hub

Table 4 provides a breakdown of the GHG emission sources resulting from the entire Mahalo Gas Hub. The total LOP emissions are estimated as 513,046 t CO_2-e. The combustion of gas to generate electricity for the facility is the largest source of emissions from the facility (295,919 t CO_2-e). Boosting and gathering pipelines are the second largest source of emissions estimated as 90,443 t CO_2-e followed by the gathering and boosting station. The maximum annual emissions from the Mahalo Gas Hub are estimated to be 27,970 t CO_2-e occurring in 2028.

4.3 NGER Obligations

GHG emissions and energy use/production associated with the Project would need to be accounted for in annual facility and corporate NGER scheme reporting in accordance with the NGER Act and supporting instruments.

At a facility level (i.e., Mahalo Gas Hub):

- The NGER scheme facility reporting threshold of 25 kt CO_2-e of GHG emissions is exceeded in project year 2 (2028).
- The NGER scheme facility reporting threshold of 100 TJ of energy consumption is exceeded in project years 2028 – 2042 (where two or more GTGs are operational).

4.4 Safeguard Mechanism

Scope 1 GHG emissions associated with the proposed development and / or Mahalo Gas Hub are not expected to exceed the Safeguard Mechanism threshold of 100,000 t CO_2-e in any Project year and as such the Mahalo Gas Hub will not be required to progressively reduce its GHG emissions baseline under this instrument.

Table 4 Summary of GHG Emissions (t CO_2-e, rounded to nearest tonne) for Mahalo Gas Hub

Year	Construction	Boosting Station	Flaring	Gas Combustion	Well Completion	Production - Wellheads	Well Workovers	Produced Water	Boosting/ Gathering Pipeline	Amendment Total	CSG Field Total
2027	8,936	887	1,002	4,553	155	34	-	11	994	6,441	16,571
2028	8,936	1,591	1,002	13,658	84	390	-	16	2,294	16,251	27,970
2029	-	1,668	1,002	13,658	103	475	156	9	2,294	16,327	19,365
2030	-	1,669	1,002	13,658	52	476	85	9	2,294	16,329	19,244
2031	-	1,670	1,002	13,658	32	477	260	9	2,294	16,329	19,401
2032	-	1,671	1,002	13,658	13	479	137	4	2,294	16,330	19,256
2033	-	1,666	1,002	13,658	213	472	293	3	2,294	16,325	19,599
2034	-	1,670	1,002	13,658	97	477	150	2	2,294	16,330	19,349
2035	-	1,668	1,002	13,658	-	475	507	1	2,294	16,328	19,604
2036	-	1,633	1,002	13,658	-	434	247	1	2,294	16,292	19,268
2037	-	1,568	1,002	13,658	-	367	507	1	2,294	16,228	19,397
2038	-	1,504	1,002	9,105	-	308	247	1	2,294	11,611	14,461
2039	-	1,444	1,002	9,105	-	260	507	1	2,294	11,551	14,612
2040	-	1,391	1,002	9,105	-	222	247	1	2,294	11,498	14,262
2041	-	1,342	1,002	9,105	-	191	507	1	2,294	11,449	14,442
2042	-	1,299	1,002	9,105	-	167	247	1	2,294	11,406	14,114
2043	-	1,259	1,002	4,553	-	146	507	1	2,294	6,813	9,761
2044	-	1,223	1,002	4,553	-	130	247	1	2,294	6,777	9,449
2045	-	1,188	1,002	4,553	-	115	507	1	2,294	6,742	9,658
2046	-	1,157	1,002	4,553	-	103	247	1	2,294	6,711	9,355
2047	-	1,128	1,002	4,553	-	92	507	1	2,294	6,682	9,577
2048	-	1,099	1,002	4,553	-	83	247	1	2,294	6,653	9,278
2049	-	1,075	1,002	4,553	-	76	507	1	2,294	6,629	9,506
2050	-	1,050	1,002	4,553	-	68	247	1	2,294	6,604	9,214
2051	-	1,024	1,002	4,553	-	62	507	1	2,294	6,579	9,442
2052	-	1,004	1,002	4,553	-	57	247	1	2,294	6,559	9,157
2053	-	980	1,002	4,553	-	51	507	1	2,294	6,534	9,387

Year	Construction	Boosting Station	Flaring	Gas Combustion	Well Completion	Production - Wellheads	Well Workovers	Produced Water	Boosting/ Gathering Pipeline	Amendment Total	CSG Field Total
2054	-	961	1,002	4,553	-	47	247	1	2,294	6,516	9,105
2055	-	946	1,002	4,553	-	44	507	1	2,294	6,501	9,347
2056	-	924	1,002	4,553	-	40	247	1	2,294	6,479	9,060
2057	-	902	1,002	4,553	-	36	507	1	2,294	6,456	9,294
2058	-	882	1,002	4,553	-	33	247	1	2,294	6,436	9,011
2059	-	873	1,002	4,553	-	32	507	1	2,294	6,427	9,260
2060	-	857	1,002	4,553	-	29	247	1	2,294	6,412	8,983
2061	-	833	1,002	4,553	-	26	507	1	2,294	6,387	9,215
2062	-	820	1,002	4,553	-	24	247	1	2,294	6,374	8,940
2063	-	805	1,002	4,553	-	22	507	1	2,294	6,359	9,183
2064	-	793	1,002	4,553	-	21	247	1	2,294	6,347	8,910
2065	-	783	1,002	4,553	-	20	507	1	2,294	6,338	9,159
2066	-	766	1,002	4,553	-	18	247	1	2,294	6,321	8,880
Total [1]	**17,872**	**47,671**	**40,072**	**295,919**	**748**	**7,082**	**13,147**	**93**	**90,443**	**383,661**	**513,046**

Table note:

[1] Total GHG emissions per activity have been calculated from unrounded data for each year. Consequently, total emissions for each activity may be slightly different to the sum of the rounded values.

5. GREENHOUSE EMISSION MITIGATION AND MANAGEMENT PRACTICES

5.1 GHG emissions management priorities

Santos will work to:

- Minimise and avoid where possible fugitive emissions across operations, including investigating and implementing opportunities to:
    - Optimise equipment and design to enhance longevity, reliability, and integrity, minimizing leaks and well workovers.
    - Adopt best practice procedures such as Leak Detection and Repair (LDAR) to prevent fugitive emission leaks.
- Minimise GHG emissions resulting from NG combustion by adopting the following where cost effective and feasible:
    - On-site renewable electricity generation such as solar and wind coupled with battery storage
    - Renewable power purchase agreements.

Santos will promote staff engagement in identifying and implementing emissions reduction and energy efficient practices. Santos will investigate adoption of higher tier methods in accordance with the NGER Determination to accurately measure fugitive emission rates and reductions.

Santos will regularly review opportunities to reduce GHG emissions associated with the Project in alignment with recommendations of the GHG Guideline and Queensland's emission reduction targets.

5.2 Advancing technologies and opportunities

Santos will regularly review market progress and cost-effective opportunities in relation to priority GHG emissions reduction areas identified in Section 5.1. This may include but is not limited to:

- Alternative power generation
- Optimising vapour recovery and recompression systems
- Improvements in methods for assessing and managing fugitive methane emissions.

5.3 Monitoring and Reporting

Santos will annually report its GHG emissions and energy production in accordance with requirements of the NGER scheme. It will use this reporting to monitor GHG emissions and the effectiveness of any conditional GHG emissions management measures implemented for the Project.

6. RISKS AND LIKELY MAGNITUDE OF IMPACTS ON ENVIRONMENTAL VALUES

6.1 Impacts of GHG emissions on environmental values

The increasing concentration of greenhouse gases in the atmosphere, primarily due to the combustion of fossil fuels and deforestation, is leading to the warming of oceans, land, and atmosphere. This warming increases the heat energy available in the climate system leading to changed weather patterns including more frequent and intense extreme weather events. Australia is required to provide the UNFCCC with National Inventory Reports annually, biennial reports every 2 years, and National Communications every 4 years. These reports include details on total and sectoral GHG emissions, progress against reduction targets, and mitigation actions.

Key climate hazards for the Project's region of Central Queensland due to global warming include:

- increased frequency of hot days (>35 ºC) and very hot days (>40 ºC)
- likelihood of increased bushfire frequencies and intensity
- variable rainfall and increased likelihood of reduced rainfall
- likelihood of less frequent but more intense extreme weather events
- increased pan evaporation rates
- increased frequency and severity of drought
- increased sea level rises and more frequent sea level extremes
- increased ocean temperatures and acidity.

The projected GHG emissions of the project are assessed as relatively low and thus unlikely to contribute significantly to climate change impacts on Queensland's environmental values although they add to Queensland's cumulative emissions.

7. SUMMARY

Katestone was commissioned by Santos to complete a Greenhouse Gas (GHG) Assessment of a compressor station in the Mahalo Gas Project to support the application for the Environmental Relevant Activity (ERA) 15 – fuel burning. The proposed development will include:

- The construction of up to 68 wells (to be electrified)
- A compressor station package
- Triethylene glycol regeneration boilers
- Gas engine generators
- Backup diesel generator
- Enclosed ground flare.

The GHG assessment was conducted in accordance with the requirements of the *Guideline Greenhouse gas emissions ESR/2024/6819* (GHG Guideline) to estimate the GHG emissions that will be generated as a result of the proposed development. The GHG assessment considered potential emissions from the proposed compressor station, its flare, the gas engine generators and sewage treatment plant.

Key sources of GHG emissions include the following:

- CSG boosting and gathering station (gas compressor station), including
    - 3 x G3612 gas compressor engines
    - 3 x G3512 gas engines for power generation
    - CSG flaring
- Sewage treatment.

The GHG assessment has estimated the total life of Project (LOP) Scope 1 emissions to be 383,661 tonnes of carbon dioxide equivalents (t CO_2-e) with average annual Scope 1 emissions of 9,592 t CO_2-e. The maximum annual Scope 1 emissions to occur was estimated as 16,330 t CO_2-e.

Consequently, the proposed development is classified as a low emitter under the GHG Guideline (i.e., < 25,000 t CO2-e in all project years) however it will add to the Mahlo Gas Project's total emissions.

A GHG emission inventory of the Mahalo Gas Hub (includes Phase 1 (68 wells) and 2 (48 wells) schedules for gas exploration, development, and production) was also completed to identify opportunities to reduce GHG emissions for the whole Project. Total Scope 1 emissions for the Life of Project (LOP) was estimated as 513,046 t CO_2-e, with average annual Scope 1 emissions of 12,826 t CO_2-e and maximum annual Scope 1 emissions of 27,970 t CO_2-e occurring in 2028. No Scope 2 emissions are projected as electricity will be generated on-site from project gas. The Mahalo Gas Hub will be subject to NGER reporting requirements; however, it will not trigger the Safeguard Mechanism or require progressive emissions reduction under this instrument.

The following areas of opportunity were identified to reduce GHG emissions associated with the Project:

- Minimise and avoid fugitive emissions across operations
- Minimise gas combustion for power generation
- Engage staff in identifying and implementing emissions reduction and energy efficient practices.

APPENDIX A SUPPLIED ACTIVITY DATA

A1 Construction

- 12,468 t CO_2-e for trenching
- 5402 t CO_2-e for gathering construction
- Total construction emissions occur evenly distributed across the first two years of facility operation (8,396 t CO_2-e a year)

A2 Coal seam gas field activity data

Table A1 summarises activity data that was supplied by Santos and used to estimate Scope 1 emissions over the Project's lifecycle.

Table A1 Gas field activity data summary

Year	Well Construction Schedule	Total Wells	Total workovers	Gas Production (t)	Gas production (m^3)	Produced Water (ML/day)	Gas Combusted (m^3)	Gathering and boosting pipeline Length (km)	Boosting quantity of Gas (m^3)	Flaring of Gas (t)
2027	24	24	-	25,679	37,524,636	1.2	2,338,920	130	37,524,636	350
2028	13	37	-	297,011	434,020,237	1.7	7,016,760	300	434,020,237	350
2029	16	53	24	361,417	528,136,090	1.0	7,016,760	300	528,136,090	350
2030	8	61	13	362,584	529,841,047	1.0	7,016,760	300	529,841,047	350
2031	5	66	40	362,901	530,304,594	1.0	7,016,760	300	530,304,594	350
2032	2	68	21	364,157	532,140,659	0.4	7,016,760	300	532,140,659	350
2033	33	101	45	359,428	525,230,215	0.3	7,016,760	300	525,230,215	350
2034	15	116	23	363,381	531,006,286	0.2	7,016,760	300	531,006,286	350
2035	-	116	78	361,465	528,206,033	0.1	7,016,760	300	528,206,033	350
2036	-	116	38	330,427	482,850,656	0.1	7,016,760	300	482,850,656	350
2037	-	116	78	279,444	408,349,882	0.1	7,016,760	300	408,349,882	350
2038	-	116	38	234,496	342,667,824	0.1	4,677,840	300	342,667,824	350
2039	-	116	78	197,650	288,825,039	0.1	4,677,840	300	288,825,039	350
2040	-	116	38	169,281	247,369,742	0.1	4,677,840	300	247,369,742	350
2041	-	116	78	145,457	212,555,595	0.1	4,677,840	300	212,555,595	350
2042	-	116	38	126,798	185,288,737	0.1	4,677,840	300	185,288,737	350
2043	-	116	78	111,320	162,670,656	0.1	2,338,920	300	162,670,656	350
2044	-	116	38	98,681	144,202,125	0.1	2,338,920	300	144,202,125	350
2045	-	116	78	87,289	127,554,935	0.1	2,338,920	300	127,554,935	350
2046	-	116	38	78,120	114,156,252	0.1	2,338,920	300	114,156,252	350
2047	-	116	78	70,361	102,817,904	0.1	2,338,920	300	102,817,904	350
2048	-	116	38	63,071	92,164,823	0.1	2,338,920	300	92,164,823	350
2049	-	116	78	57,471	83,982,670	0.1	2,338,920	300	83,982,670	350
2050	-	116	38	52,091	76,119,648	0.1	2,338,920	300	76,119,648	350

Year	Well Construction Schedule	Total Wells	Total workovers	Gas Production (t)	Gas production (m^3)	Produced Water (ML/day)	Gas Combusted (m^3)	Gathering and boosting pipeline Length (km)	Boosting quantity of Gas (m^3)	Flaring of Gas (t)
2051	-	116	78	46,971	68,638,903	0.1	2,338,920	300	68,638,903	350
2052	-	116	38	43,305	63,281,922	0.1	2,338,920	300	63,281,922	350
2053	-	116	78	39,012	57,007,476	0.1	2,338,920	300	57,007,476	350
2054	-	116	38	36,046	52,674,149	0.1	2,338,920	300	52,674,149	350
2055	-	116	78	33,722	49,277,826	0.1	2,338,920	300	49,277,826	350
2056	-	116	38	30,574	44,676,905	0.1	2,338,920	300	44,676,905	350
2057	-	116	78	27,599	40,330,552	0.1	2,338,920	300	40,330,552	350
2058	-	116	38	25,098	36,674,847	0.1	2,338,920	300	36,674,847	350
2059	-	116	78	24,039	35,128,747	0.1	2,338,920	300	35,128,747	350
2060	-	116	38	22,311	32,602,601	0.1	2,338,920	300	32,602,601	350
2061	-	116	78	19,785	28,911,784	0.1	2,338,920	300	28,911,784	350
2062	-	116	38	18,531	27,079,684	0.1	2,338,920	300	27,079,684	350
2063	-	116	78	17,112	25,005,191	0.1	2,338,920	300	25,005,191	350
2064	-	116	38	16,064	23,474,949	0.1	2,338,920	300	23,474,949	350
2065	-	116	78	15,295	22,349,921	0.1	2,338,920	300	22,349,921	350
2066	-	116	38	13,946	20,378,785	0.1	2,338,920	300	20,378,785	350

Appendix J: Risk Assessment

Table 11: Environmental Risk Assessment Table

Identification				Unmitigated Risk			Control Strategies	Residual Risk		
Risk Event / Activity	Relevant EV	Potential Impact	Risk Source	Consequence	Likelihood	Risk		Consequence	Likelihood	Risk

Construction and operation of petroleum activities in the proposed amendment	Land Resources	Soil erosion, topsoil loss, inversion and compaction
		Disturbance to land use and suitability changes
		Reduction in land agricultural productivity
		Waste management
		Introduction of pests and weeds
		Visual amenity
		Contamination of soil
			Earthworks and grading
			Vehicle and plant movements
			Flood (natural event)
			Fire (ignition sources resulting from activities)
			Loss of containment including minor spills of fuel and other chemicals from plant and equipment
				II	c	Low	• Compliance with relevant EA conditions, and all relevant internal and external approvals are in place before work is undertaken
							• Induction to site personnel (including sub-contractors) addressing the requirements and their responsibilities with regards land resource management and appropriate mitigation and management measures are being utilised
							• Any short-term reduction in the agricultural availability of the land for pasture or cropping would be offset by commercial agreements between the Santos and the property owner
							• Appropriate emergency and incident response plans and management procedures in place and staff trained
							• Infrastructure will be located to minimise impacts to drainage patterns, soil and vegetation, and avoid significant cut and fill requirements
							• Industry standards and good industry practices are followed such as best practice erosion and sediment control guidelines published by IECA, DETSI guideline on erosion and sediment control from construction sites
							• Existing disturbed areas are used instead of new areas to reduce the total disturbed area
							• Surface disturbance restricted to the minimum area required to safely carry out the activities
							• Management of sensitive areas (e.g. sloped areas and stormwater drainage channels) is detailed in scope of works, approval documents and Santos procedures and standards
							• Dust suppression measures will be carried out where required e.g. water sprays
							• Active promotion of appropriate road use behaviours, and the setting of appropriate speed limits for Santos personnel and contractors
							• Activity planning will consider seasonal conditions and risk of fire and flood
							• Personnel are informed on the fire danger season and associated restrictions through daily toolbox briefings and site induction
							• Ignition sources are controlled via permit to work
							• Measures undertaken to reduce potential impacts of fire and flood where appropriate (e.g. removal of fuels/chemicals/equipment from site or above flood level prior to arrival of fire or flood event)
							• Construction activity not undertaken during or immediately prior to high rainfall events
							• Fuel, oil and chemical storage and handling undertaken in accordance with Australian standards and guidelines (i.e. in bunded areas) and in small volumes
							• Spill leak and drip trays provided to address minor drips and spills resulting from re-fuelling operations
							• Spill response equipment and materials kept on site and in operational vehicles (where appropriate)
							• Maintain a register of incidents and implement corrective actions based on outcome of investigations
							• Vehicles and equipment are operated and maintained in accordance with specifications to minimise the potential for a spill or leak (e.g. oil leak or hydraulic hose failure)
							• Flammable materials are kept away from ignition sources
							• Designation of no smoking areas and butt bins
							• Segregation of wastes and use of effective signage designating waste type and quantity to be stored in each location
							• Provision of firefighting intervention
							• Maintain high standards of housekeeping to ensure the site is free from loose/discarded combustible wastes
							• Prevent the introduction and / or spread of weeds, pest plants, animals and pathogens through the following:
							  ○ Hygiene protocols implemented as appropriate to minimise the introduction, spread and persistence of weeds, pest plants, animals and pathogens
							  ○ Access to and from the site via designated access tracks only
							  ○ Vehicle and equipment wash-down when operations have been undertaken in areas of known weed infestations
							  ○ Monitor for presence of weeds within the construction area, and where necessary implement control measures
							  ○ Ensure that imported material is from an area or source considered to be pest plant/disease free.
								II	b	Very Low

Identification				Unmitigated Risk			Control Strategies	Residual Risk		
Risk Event / Activity	Relevant EV	Potential Impact	Risk Source	Consequence	Likelihood	Risk		Consequence	Likelihood	Risk
	Air – particulate matter (dust) and odour (fumes, diesel emissions from machinery) NOx, GHG, CO, VOC	Potential reduction in ambient air quality due to dust Complaints about air nuisance from the community	Vehicle and plant movements Fire (ignition sources resulting from activities) Earthworks activities including grading of roads etc. Fuel burning equipment Compressor station Wells and gas gathering flow lines	II	c	Low	• Compliance with relevant EA conditions, and all relevant internal and external approvals in place before work undertaken • All plant and equipment will be fit for purpose by making sure that they are appropriately maintained and used correctly • Vehicles, engines and equipment will be operated and maintained in accordance with their manufacturer specifications and maintenance schedules • Induction to site personnel (including sub-contractors) addressing the requirements and their responsibilities with regards to air emissions management and appropriate mitigation and management measures are being utilised • Identification of sensitive receptors during planning, and landholders will be consulted as required where activities may affect sensitive receptors • Active promotion of appropriate road use behaviours, and the setting of appropriate speed limits for Santos personnel and contractors • Revegetation is undertaken as soon as practicable to minimise wind erosion • Efficient combustion and proper dispersion (reduce smoke emissions) • Dust suppression curtain (hessian, shade cloth) to minimise dust emissions • Vertical barriers (or covering the pile if it is small) • Gravel, concrete or bitumen to seal main trafficable areas • Dust suppression measures will be carried out where required e.g. water sprays • Personnel are informed of fire danger season and associated restriction, and ignition sources are controlled via permit to work • Activity planning will consider seasonal conditions and risk of fire • Managing stockpiles (sand, gravel) by using water sprays (when emptying cement bags into mixer) • Use windbreaks (temporary cyclone fence with fine shade cloth attached) • Limiting the size of stockpiles • Limiting idling time for diesel vehicles • Avoid overloading vehicles • Correct fuel specification • Proper maintenance and tuning of diesel engines • Maintain high standards of housekeeping to ensure the site is free from loose/discarded combustible wastes	**II**	**b**	**Very low**
	Noise and vibration	Complaints about air nuisance from members of the public	Plant and equipment Earthworks Compaction Construction traffic and deliveries Flaring	II	c	Low	• Compliance with relevant EA conditions, and all relevant internal and external approvals in place before work undertaken • Identification of sensitive receptors during planning, and landholders will be consulted as required where activities may affect sensitive receptors • Avoiding unnecessary revving of engines and switching off equipment when not required • Turning off plant and equipment or throttling them down to a minimum when not in use • Selecting appropriately sized equipment for the task, such as vibratory compactors and rock excavation equipment • Ensuring equipment is operated in the correct manner and correctly maintained, including replacement of engine covers, repair of defective silencing equipment, tightening of rattling components, repair of leakages in compressed air lines and shutting down of equipment not in use • Work to occur within approved hours only • Selecting plant and equipment based on noise and vibration emission levels • Regularly grading unsealed areas or filling potholes in sealed access roads and hardstand areas to reduce noise and vibration from vehicles • Ensuring traffic movement is kept to a minimum (for example, ensuring trucks are fully loaded so that the volume of each delivery is maximised) and nighttime construction traffic is redirected away from sensitive receptors where possible • Maximising acoustic shielding from existing topography and buildings and from structures and buildings associated with the facility (for example, storage units and temporary offices may be grouped together to form an effective acoustic barrier), for the nearest adjacent sensitive sites • Enclosing standby generators or fitting them with an effective muffler where required • Avoiding dynamic compaction using large tamping weights near sensitive receptors, buildings, structures and building contents • Minimising drop height of materials when transferring (for example, loading and unloading vehicles and storage areas) • Avoiding where possible the nighttime use of equipment which generates impulsive noise: dropping materials from a height and metal-to-metal contact on equipment • Induction will be provided to site personnel (including sub-contractors) addressing their responsibilities with regards to noise management • Avoiding use of noisy plant and equipment adjacent to sensitive receptors where possible • Locating noisy equipment away from sensitive receptors where required • Use of noise attenuation/suppression devises where required e.g. silencing equipment • Vehicles, engines and equipment will be operated and maintained in accordance with their manufacturer specifications and maintenance schedules • Active promotion of appropriate road use behaviours, and the setting of appropriate speed limits for Santos personnel and contractors • Enclosing standby generators or fitting them with an effective muffler where required • Provide ongoing education of supervisors, operators and sub-contractors on the need to minimise noise and vibration through toolbox meetings and on-site training	**II**	**b**	**Very low**

Identification				Unmitigated Risk			Control Strategies	Residual Risk		
Risk Event / Activity	Relevant EV	Potential Impact	Risk Source	Consequence	Likelihood	Risk		Consequence	Likelihood	Risk
							• Avoid shouting and minimise talking loudly and slamming vehicle doors.			

	Flora, Regional Ecosystems and ESAs	Damage to and/or loss of native vegetation and habitat
		Damage to and/or loss of high value flora and fauna
		Introduction and / or spread of weeds, pest plants, animals and pathogens
			Earthworks
			Vehicle and plant movements
			Fire (ignition sources resulting from activities)
				II	c	Low	• Compliance with relevant EA conditions, and all relevant internal and external approvals in place before work undertaken.
							• Use of pre-existing disturbance has been maximised
							• Pre-clearing surveys will be undertaken before ground disturbance can occur
							• Disturbance footprint will be minimised to the greatest extent possible
							• Disturbance will include exclusion zones to sensitive areas including REs and ESAs
							• Infrastructure micro-sited to avoid impacts to threatened species and habitat
							• Active promotion of appropriate road use behaviours, and the setting of appropriate speed limits for Santos personnel and contractors
							• Prevent the introduction and / or spread of weeds, pest plants, animals and pathogens through the following:
							  ○ Hygiene protocols implemented as appropriate to minimise the introduction, spread and persistence of weeds, pest plants, animals and pathogens
							  ○ Access to and from the site via designated access tracks only
							  ○ Vehicle and equipment wash-down when operations have been undertaken in areas of known weed infestations
							  ○ Monitor for presence of weeds within the construction area, and where necessary implement control measures
							  ○ Ensure that imported material is from an area or source considered to be pest plant/disease free.
							• Refer to Control Strategies listed under ‘Fire and Flood’ under Land Resources
								II	b	Very Low

	Fauna	Damage to and/or loss of native vegetation and habitat Disturbance, injury or loss of fauna and livestock Damage to and/or loss of high value flora and fauna	Earthworks Vehicle and plant movements Fire (ignition sources resulting from activities)	II	c	Low	• Compliance with relevant EA conditions, and all relevant internal and external approvals in place before work undertaken • Hygiene protocols implemented as appropriate to minimise the introduction, spread and persistence of weeds, pest plants, animals and pathogens • Use of pre-existing disturbance area will be maximised • Access to site via designated access tracks only • Active promotion of appropriate road use behaviours, and the setting of appropriate speed limits for personnel • Vehicle and equipment wash-down when operations to be undertaken in areas of known weed infestations • Monitor for presence of weeds within the construction area, and where necessary implement control measures • Ensure that imported material is from an area or source considered to be pest plant/disease free • Any fauna injured during the proposed development will be handled by a suitably qualified Fauna Spotter/Catcher, and treated (i.e. rehabilitated, relocated or euthanised) in accordance with the catchers’ approvals (e.g. damage mitigation permit) • Hollow logs (located on ground) within disturbance areas retained and shifted to adjacent undisturbed areas where feasible • Measures implemented to reduce risks to fauna from earthworks, vegetation clearing, and entrapment in excavations. For example, checking of open trench for trapped fauna, use of trench ladders, ramps, sticks, ropes (or similar) to assist trapped fauna escape / survive until removed • Fuel, oil and chemical storage and handling undertaken in accordance with Australian standards / guidelines (i.e. in bunded areas) • Spill leak and drip trays provided to address potential minor drips and spills because of re-fuelling operations • Spill response equipment and materials kept on site in operational vehicles (where appropriate)	II	b	Very Low

Identification				Unmitigated Risk			Control Strategies	Residual Risk		
Risk Event / Activity	Relevant EV	Potential Impact	Risk Source	Consequence	Likelihood	Risk		Consequence	Likelihood	Risk
	Surface Water and Wetlands	Disturbance to natural drainage patterns Degradation of downstream water quality from sediment releases / minor spills or leaks of fuels and chemicals Contamination of soil and/or watercourses Damage to and/or loss of native vegetation and habitat	Earthworks Vehicle and plant movements Flood (natural event) Minor spills or leaks of fuels and chemicals from vehicles and equipment	II	c	Low	• Compliance with relevant EA conditions, and all relevant internal and external approvals in place before work undertaken • Access via designated access tracks only • Vehicle and equipment wash-down when operations to be undertaken in areas of known weed infestations • Erosion and sediment controls, commensurate with the site-specific risk of erosion and release of sediment to waters, will be implemented. • Chemicals and fuels will be stored and handled in accordance with the relevant Australian Standards • Contingency procedures for emergency environmental incidents will be developed and implemented • Significantly disturbed areas that are no longer required for on-going petroleum activities will be rehabilitated to meet the acceptance criteria and final acceptance criteria in Schedule J of EA EPPG00892113 which includes re-establishing any surface drainage lines that have been disturbed by petroleum activities • Spill leak and drip trays provided to address potential minor drips and spills because of re-fuelling operations • Spill response equipment and materials kept on site in operational vehicles (where appropriate)	II	b	Very Low
	Groundwater	Reduction in groundwater quality	Earthworks Spills of fuels and chemicals Effluent and CSG water Irrigation Application residual drilling material Low point drains water to land	II	c	Low	• Compliance with relevant EA conditions, and all relevant internal and external approvals in place before work can be undertaken • Contingency procedures for emergency environmental incidents will be developed and implemented • Spill leak and drip trays provided to address potential minor drips and spills because of re-fuelling operations • Spill response equipment and materials kept on site in operational vehicles (where appropriate) • Appropriate application rates to prevent site runoff and leaching into groundwater • Storage containers and dams are accordance with applicable Australian standards and engineering manuals	II	b	Very low
	Waste	Water and soil contamination	Improper storage or disposal of waste	II	c	Low	• All waste generated will be managed in accordance with the EA conditions • Noise and air emissions are managed in accordance with the EA conditions • Waste will be managed in accordance with the waste and resource management hierarchy • Where required, waste will be disposed off-site in accordance with the EA conditions • Green waste will be used on-site for either rehabilitation or erosion and sediment control • Spill leak and drip trays provided to address potential minor drips and spills because of re-fuelling operations • Spill response equipment and materials kept on site in operational vehicles (where appropriate)	II	b	Very low

Appendix K: Proposed amended EA

Permit

Environmental Protection Act 1994

Environmental authority P-EA-100178150

This environmental authority is issued by the administering authority under Chapter 5 of the Environmental Protection Act 1994.

Environmental authority number: P-EA-100178150

Environmental authority takes effect on 16 December 2021**.**

The anniversary date of this environmental authority is 3 November each year.

Environmental authority holder(s)

Name(s)	Registered address
SANTOS QNT PTY. LTD.	Ground Floor, Santos Centre 60 Flinders Street ADELAIDE SA 5000
AUSTRALIA PACIFIC LNG PTY LIMITED	Level 4 139 Coronation Drive MILTON QLD 4064

Environmentally relevant activity and location details

Environmentally relevant activity/activities	Location(s)
Schedule 3 - 06 - A petroleum activity carried out on a site containing a high hazard dam or a significant hazard dam	PL1083
Schedule 3 - 08 - A petroleum or GHG storage activity,other than items 1 to 7, that includes an activity from Schedule 2 with an AES	PL1082 PL1083
Ancillary 08 - Chemical Storage - 3 - Storing more than 500 cubic meters of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	PL1083
Ancillary 15 - Fuel burning - Using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour	PL1083
Ancillary 55 - Other waste reprocessing or treatment - 2(c) - Operating a facility for receiving and either reprocessing or treating, in a year, the following quantity of category 2 regulated waste - more than 10,000t	PL1083

Environmentally relevant activity/activities	Location(s)
Ancillary 62 - Resource recovery and transfer facility operation - 1(c) - Operating a facility for receiving and sorting, dismantling, baling or temporarily storing category 2 regulated waste	PL1082 PL1083
Ancillary 63 - Sewage Treatment - 1(b-i) - Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of more than 100 but not more than 1500EP if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme	PL1083
Ancillary 63 - Sewage Treatment - 1(a-i) – Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of 21 to 100EP - if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme	PL1083

Additional information for applicants

Environmentally relevant activities

The description of any environmentally relevant activity (ERA) for which an environmental authority (EA) is issued is a restatement of the ERA as defined by legislation at the time the EA is issued. Where there is any inconsistency between that description of an ERA and the conditions stated by an EA as to the scale, intensity or manner of carrying out an ERA, the conditions prevail to the extent of the inconsistency.

An EA authorises the carrying out of an ERA and does not authorise any environmental harm unless a condition stated by the EA specifically authorises environmental harm.

A person carrying out an ERA must also be a registered suitable operator under the *Environmental Protection Act 1994* (EP Act).

Contaminated land

It is a requirement of the EP Act that an owner or occupier of contaminated land give written notice to the administering authority if they become aware of the following:

- the happening of an event involving a hazardous contaminant on the contaminated land (notice must be given within 24 hours); or
- a change in the condition of the contaminated land (notice must be given within 24 hours); or
- a notifiable activity (as defined in Schedule 3) having been carried out, or is being carried out, on the contaminated land (notice must be given within 20 business days)

that is causing, or is reasonably likely to cause, serious or material environmental harm.

For further information, including the form for giving written notice, refer to the Queensland Government website www.qld.gov.au, using the search term 'duty to notify'.

Take effect

Please note that, in accordance with section 200 of the EP Act, an EA has effect:

a) if the authority is for a prescribed ERA and it states that it takes effect on the day nominated by the holder of the authority in a written notice given to the administering authority - on the nominated day; or

b) if the authority states a day or an event for it to take effect-on the stated day or when the stated event happens; or

c) otherwise on the day the authority is issued.

However, if the EA is authorising an activity that requires an additional authorisation (a relevant tenure for a resource activity, a development permit under the *Planning Act 2016* or an SDA Approval under the *State Development and Public Works Organisation Act 1971*), this EA will not take effect until the additional authorisation has taken effect.

If this EA takes effect when the additional authorisation takes effect, you must provide the administering authority written notice within 5 business days of receiving notification of the related additional authorisation taking effect.

The anniversary day of this environmental authority is the same day each year as the original take effect date unless you apply to change the anniversary day. The payment of the annual fee will be due each year on this day.

If you have incorrectly claimed that an additional authorisation is not required, carrying out the ERA without the additional authorisation is not legal and could result in your prosecution for providing false or misleading information or operating without a valid environmental authority.

Department of Environment, Tourism,
Science and Innovation
Delegate of the administering authority
Environmental Protection Act 1994

Enquiries:
Energy and Extractive Resources
Department of Environment, Tourism,
Science and Innovation
GPO Box 2454, Brisbane QLD 4001
Phone (07) 3330 5715
Email: energyandextractive@des.qld.gov.au

Privacy statement

Pursuant to section 540 of the EP Act, the Department is required to maintain a register of certain documents and information authorised under the EP Act. A copy of this document will be kept on the public register. The register is available for inspection by members of the public who are able take extracts, or copies of the documents from the register. Documents that are required to be kept on the register are published in their entirety, unless alteration is required by the EP Act. There is no general discretion allowing the Department to withhold documents or information required to be kept on the public register. For more information on the Department's public register, search 'public register' at www.qld.gov.au. For queries about privacy matters please email privacy@des.qld.gov.au or telephone 13 74 68.

Obligations under the *Environmental Protection Act 1994*

In addition to the requirements found in the conditions of this environmental authority, the holder must also meet their obligations under the EP Act, and the regulations made under the EP Act. For example, the holder must comply with the following provisions of the Act:

- general environmental duty (section 319)
- duty to notify environmental harm (section 320-320G)
- offence of causing serious or material environmental harm (sections 437-439)
- offence of causing environmental nuisance (section 440)
- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG)
- offence to place contaminant where environmental harm or nuisance may be caused (section 443)

Other permits required

This permit only provides an approval under the *Environmental Protection Act 1994*. In order to lawfully operate you may also require permits / approvals from your local government authority, other business units within the department and other State Government agencies prior to commencing any activity at the site. For example, this may include permits / approvals with your local Council (for planning approval), the Department of Transport and Main Roads (to access state controlled roads), the Department of Resources (to clear vegetation), and the Department of Agriculture and Fisheries (to clear marine plants or to obtain a quarry material allocation).

ENVIRONMENTAL AUTHORITY CONDITIONS

This environmental authority consists of the following Schedules:

SCHEDULE A – GENERAL CONDITIONS **6**
SCHEDULE B - WASTE **9**
SCHEDULE C - NOISE **12**
SCHEDULE D – AIR **14**
SCHEDULE E – LAND **15**
SCHEDULE F – BIODIVERSITY **16**
SCHEDULE G - WATER **19**
SCHEDULE H – WELL CONSTRUCTION, MAINTENANCE AND STIMULATION ACTIVITIES **22**
SCHEDULE I – DAMS **26**
SCHEDULE J – REHABILITATION **27**
SCHEDULE K – DEFINITIONS **29**

1 SCHEDULE A – GENERAL CONDITIONS

(A1) This environmental authority authorises the carrying out of the following resource activity(ies):

(a) the petroleum activities listed in *Schedule A Table 1 – Scale and Intensity for the Activities* to the extent they are carried out in accordance with the activity's scale and intensity; and

(b) the following specified relevant activity(ies):

(i) Sewage treatment - operating sewage treatment works, other than no-release works; and

(ii) Stimulation activities;

(c) seismic survey activities, appraisal and exploration wells; and

(d) incidental petroleum activities that are not otherwise specified relevant activities.

Schedule A, Table 1 – Scale and Intensity for the Activities

Tenure Number(s)	Petroleum Activity	Scale of activities	Intensity (maximum size in total)
PL1082 PL1083	Coal seam gas development wells	190 wells	228 ha
PL1083 PL1082	Access roads	As required	As required
PL1083 PL1082	Gathering and transmission lines	As required	As required
PL1083	Compressor station and water treatment plant	1	10.42ha
PL1083	Regulated structures	4	22ha
PL1083	Communication tower	1	0.06ha
PL1083	Vehicle washdown and laydown areas	3	18ha
PL1083	Sewage treatment plant	1	>100 EP <450EP
PL1083 PL1082	Sewage treatment plant	As required	>21 EP <100EP
PL1083	Water treatment plant	1	<10ML of raw water per day

(A2) The resource activities in condition (A1) are authorised subject to the conditions of this environmental authority.

(A3) This environmental authority does not authorise a relevant act[1] to occur in carrying out an authorised resource activity unless a condition of this environmental authority expressly authorises the relevant act to occur. Where there is no condition, the lack of a condition must not be construed as authorising the relevant act.

Monitoring standards

(A4) All monitoring must be undertaken by a suitably qualified person.

(A5) If requested by the administering authority in relation to investigating a complaint, monitoring must be commenced within 10 business days.

(A6) All laboratory analyses and tests must be undertaken by a laboratory that has NATA accreditation for such analyses and tests.

(A7) Notwithstanding condition (A6), where there are no NATA accredited laboratories for a specific analyte or substance, then duplicate samples must be sent to at least two separate laboratories for independent testing or evaluation.

(A8) Monitoring and sampling must be carried out in accordance with the requirements of the following documents (as relevant to the sampling being undertaken), as amended from time to time:

(a) for waters and aquatic environments, the Queensland Government's Monitoring and Sampling Manual 2009 – Environmental Protection (Water and Wetland Biodiversity) Policy 2019

(b) for groundwater, *Groundwater Sampling and Analysis – A Field Guide* (2009:27 GeoCat #6890.1)

(c) for noise, the Environmental Protection Regulation 2019

[1] See section 493A of the *Environmental Protection Act 1994*

(d) for air, the *Queensland Air Quality Sampling Manual* and/or Australian Standard 4323.1:1995 *Stationary source emissions method 1: Selection of sampling positions*, as appropriate for the relevant measurement
(e) for soil, the *Guidelines for Surveying Soil and Land Resources, 2nd edition* (McKenzie *et al.* 2008), and/or the *Australian Soil and Land Survey Handbook, 3rd edition* (National Committee on Soil and Terrain, 2009)
(f) for dust, Australian Standard AS3580.

Notification

(A9) In addition to the requirements under Chapter 7, Part 1, Division 2 of the *Environmental Protection Act 1994*, the administering authority must be notified through the Pollution Hotline and in writing, as soon as possible, but within 48 hours of becoming aware of any of the following events:
(a) any unauthorised significant disturbance to land
(b) potential or actual loss of structural or hydraulic integrity of a dam
(c) potential or actual loss of well integrity
(d) when the seepage trigger action response procedure required under condition (G14(g)) is or should be implemented
(e) unauthorised releases of any volume of prescribed contaminants to waters
(f) unauthorised releases of volumes of contaminants, in any mixture, to land greater than:
  i. 200 L of hydrocarbons; or
  ii. 1000L of brine; or
  iii. 5 000 L of untreated coal seam gas water; or
  iv. 5 000 L of raw sewage; or
  v. 10 000 L of treated sewage effluent.
(g) monitoring results where two out of any five consecutive samples do not comply with the relevant limits in the environmental authority.
(h) when the level of the contents of any regulated dam reaches the mandatory reporting level; or
(i) when a regulated dam will not have available storage to meet the design storage allowance on the 1 November of any year.

Contingency procedures for emergency environmental incidents

(A10) ~~From 1 January 2016,~~ Petroleum activities involving significant disturbance to land cannot be conducted until written contingency procedures for emergency environmental incidents have been developed which include, but are not necessarily limited to:
(a) A clear definition of what constitutes an environmental emergency incident or near miss for the petroleum activity.
(b) Consideration of the risks caused by the petroleum activity including the impact of flooding and other natural events on the petroleum activity.
(c) Response procedures to be implemented to prevent or minimise the risks of environmental harm occurring.
(d) The practices and procedures to be employed to restore the environment or mitigate any environmental harm caused.
(e) Procedures to investigate causes and impacts including impact monitoring programs for releases to waters and/or land.
(f) Training of staff to enable them to effectively respond.
(g) Procedures to notify the administering authority, local government and any potentially impacted landholder.

Maintenance of plant and equipment

(A11) All plant and equipment must be maintained and operated in their proper and effective condition.

(A12) The following infrastructure must be signed with a unique reference name or number in such a way that it is clearly observable:
- (a) Regulated dams and low consequence dams
- (b) exploration, appraisal and development wells; and
- (c) sewage treatment facilities.
- (d) Water treatment facilities
- (e) Compressor stations
- (f) Specifically authorised discharge points to air
- (g) Any chemical storage facility associated with the environmentally relevant activity
- (h) Gas processing facilities

(A13) Measures to prevent fauna being harmed from entrapment must be implemented during the construction and operation of well infrastructure, dams and pipeline trenches.

Erosion and sediment control

(A14) For activities involving significant disturbance to land, control measures that are commensurate to the site-specific risk of erosion, and risk of sediment release to waters must be implemented to:
- (a) allow stormwater to pass through the site in a controlled manner and at non-erosive flow velocities
- (b) minimise soil erosion resulting from wind, rain, and flowing water
- (c) minimise the duration that disturbed soils are exposed to the erosive forces of wind, rain, and flowing water
- (d) minimise work-related soil erosion and sediment runoff; and
- (e) minimise negative impacts to land or properties adjacent to the activities (including roads).

Complaints

(A15) Petroleum activities must not cause environmental nuisance at a sensitive place, other than where an alternative arrangement is in place.

Documentation

(A16) A certification must be prepared by a suitably qualified person within 30 business days of completing every plan, procedure, program and report required to be developed under this environmental authority, which demonstrates that:
- (a) relevant material, including current published guidelines (where available) have been considered in the written document
- (b) the content of the written document is accurate and true; and
- (c) the document meets the requirements of the relevant conditions of the environmental authority.

(A17) All plans, procedures, programs, reports and methodologies required under this environmental authority must be written and implemented.

(A18) All documents required to be developed under this environmental authority must be kept for five years.

(A19) All documents required to be prepared, held or kept under this environmental authority must be provided to the administering authority upon written request within the requested timeframe.

(A20) A record of all complaints must be kept including the date, complainant's details, source, reason for the complaint, description of investigations and actions undertaken in resolving the complaint.

2 SCHEDULE B - WASTE

General waste management

(B1) Measures must be implemented so that waste is managed in accordance with the waste and resource management hierarchy and the waste and resource management principles.

(B2) Waste, including waste fluids, but excluding waste used in closed-loop systems, must be transported off-site for lawful re-use, remediation, recycling or disposal, unless the waste is specifically authorised by conditions of the environmental authority to be disposed of or used on site.

(B3) Waste fluids, other than flare precipitant stored in flare pits, or residual drilling material or drilling fluids stored in sumps, must be contained in either:
- (a) an above ground container; or
- (b) a structure which contains the wetting front.

(B4) Green waste may be used on-site for either rehabilitation or sediment and erosion control, or both.

(B5) Vegetation waste may be burned if it relates to a state forest, timber reserve or forest entitlement area administered by the *Forestry Act 1959* and a permit has been obtained under the *Fire and Rescue Service Act 1990*.

Pipeline wastewater

(B6) Pipeline waste water, may be released to land provided that it:
- (a) can be demonstrated it meets the acceptable standards for release to land; and
- (b) is released in a way that does not result in visible scouring or erosion or pooling or run-off or vegetation die-off.

Authorised uses of produced water for petroleum activities

(B7) Produced water may be re-used in drilling and well hole activities.

(B8) Produced water may be used for dust suppression provided the following criteria are met:
- (a) the amount applied does not exceed the amount required to effectively suppress dust; and
- (b) the application:
  - i. does not cause on-site ponding or runoff
  - ii. is directly applied to the area being dust suppressed
  - iii. does not harm vegetation surrounding the area being dust suppressed; and
  - iv. does not cause visible salting.

(B9) Produced water may be used for construction purposes provided the use:
- (a) does not result in negative impacts on the composition and structure of soil or subsoils
- (b) is not directly or indirectly released to waters
- (c) does not result in runoff from the construction site; and
- (d) does not harm vegetation surrounding the construction site.

(B10) If there is any indication that any of the circumstances in condition (B8)(b)(i) to (B8(b)(iv) or (B9)(a) to (B9)(d) is occurring the use must cease immediately and the affected area must be remediated without delay.

Use of produced water for irrigation activities

~~(B11) Irrigation of produced water is authorised providing it ensures:~~
~~(a) that soil structure, stability and productive capacity can be maintained or improved~~
~~(b) toxic effects to crops do not result; and~~
~~(c) yields and produce quality are maintained or improved.~~

B11 Produced water irrigated to land must:
a. not exceed the release limits specified in Schedule B, Table 1a – Irrigation water quality monitoring; and
b. be monitored at the frequency and for the quality characteristics at the monitoring point specified in Schedule B, Table 1a – Irrigation water quality monitoring; or
c. the process under (B12) has been completed.

Schedule B, Table 1a – Irrigation water quality monitoring

Quality Characteristic	Release Limit	Limit Type	Frequency	Monitoring Point
Electrical conductivity (EC)	<950 µs/cm	95th percentile over a one-year period	Fortnightly	At a location following final treatment and prior to release.
Sodium adsorption ratio (SAR) for heavy soils	≤6			
SAR for light soils	≤12			
Ph	6.0 – 8.5			
Aluminium	20 mg/L	Maximum	Bi-annually	
Arsenic	2.0 mg/L			
Boron	Refer to table 9.2.18 of ANZECC	Refer to table 9.2.18 of ANZECC		
Cadmium	0.05 mg/L	Maximum		
Chromium	1 mg/L			
Cobalt	0.1 mg/L			
Copper	5 mg/L			
Fluoride	2 mg/L			
Iron	10 mg/L			
Lithium	2.5 mg/L			
Lead	5 mg/L			
Manganese	10 mg/L			
Mercury	0.002 mg/L			
Molybdenum	0.05 mg/L			
Nickel	2 mg/L			
Zinc	5 mg/L			

(B12) Produced water for irrigation which does not meet criteria in condition (B11) (a) and (b) may be used for irrigation provided a report has been completed which:
a. determines soil structure, stability and productive capacity will be maintained or improved;
b. determines there are no toxic effects to crops;
c. determines yields and produce quality are maintained or improved;
d. states water quality criteria, which has been determined in accordance with the assessment procedures outlined in Schedule B, Table 1b Assessment procedures for water quality criteria; and
e. includes a water monitoring program to ensure that condition (B12) (a)(b) and (c) are being achieved.

Schedule B, Table 1b — Assessment procedures for water quality criteria

Water quality criteria	Assessment procedure
electrical conductivity sodium adsorption ratio pH	Salinity Management Handbook, with reference to Chapter 11; and/or Australian and New Zealand Guidelines for Fresh and Marine Water Quality, with reference to Volume 1 Chapter 4 and Volume 3 Chapter 9. The assessment should consider: • soil properties within the root zone to be irrigated (e.g. clay content, cation exchange capacity, exchangeable sodium percentage) • water quality of the proposed resource (e.g. salinity, sodicity) • climate conditions (e.g. rainfall) • leaching fractions • average root zone salinity (calculated) • crop salt tolerance (e.g. impact threshold and yield decline) • management practices and objectives (e.g. irrigation application rate, amelioration techniques) • broader landscape issues (e.g. land use, depth to groundwater) • any additional modelling and tests undertaken to support the varied water quality parameters.
heavy metals	Australian and New Zealand Guidelines for Fresh and Marine Water Quality, with reference to Volume 1 Chapters 3 and 4 and Volume 3 Chapter 9. The assessment should aim to derive site specific trigger values (e.g. cumulative contaminant loading limit) based on the methodology provided in the above mentioned procedure.

(B13) Produced water may be used for domestic or stock purposes provided the water quality complies with the criteria specified in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000).

(B14) Produced water may be transferred to a third party to be used for the following purposes, subject to condition B15:

a. dust suppression;
b. construction and operational purposes; or
c. domestic or stock purposes provided the water quality complies with criteria specified in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000).

(B15) If the responsibility of produced water is given or transferred to a third party in accordance with condition (B14), the holder of the environmental authority must ensure:

a. the responsibility of the produced water is given or transferred in accordance with a written agreement (third party agreement);
b. the third party is made aware of the General Environmental Duty under section 319 of the *Environmental Protection Act 1994*.

Investigation into Alternative CSG Water Management Options

(B16) The Salt and Brine Management Plan must be developed by December 2030 that has investigated the following:

a. the viability of waste reuse or recycling through chemically processing or treating brine or salt residues to create useable or saleable products;
b. the viability of the injection of brine into a natural underground structure that is geologically isolated and does not contain groundwater and does or could supply water for potable or agricultural

purposes;

c. the outcomes of the investigations and proposed actions forward, and identified methods for the beneficial use and of brine and salt; and
d. procedures for identifying and implementing opportunities to improve the CSG water management practices.

Sewage treatment

(B17) Treated sewage effluent or greywater from a treatment system with a daily peak design capacity of equal to or less than100 equivalent persons (EP) may be released to land provided it:

(a) be to a fenced and signed contaminant release area(s);
(b) does not contain any properties nor contain any organisms or other contaminants in concentrations that are capable of causing environmental harm;
(c) not result in pooling or run-off or aerosols or spray drift or vegetation die-off;
(d) minimises deep drainage below the root zone of any vegetation;
(e) does not adversely affect the quality of shallow aquifers;
(f) be to a contaminant release area(s) that is kept vegetated with groundcover, that is:
  i. not a declared pest species; and
  ii. kept in a viable state for transpiration and nutrient uptake.

(B18) Prior to construction of a sewage treatment works with a daily peak design capacity of greater than 100EP, the minimum area of land and location to be utilised for irrigation of treated sewage effluent, excluding any necessary buffer zones, must be nominated

(B19) All nominated locations and minimum areas of land in condition (B14) for sewage treatment works with a daily peak design capacity of greater than 100EP, must be determined using the Model for Effluent Disposal using Land Irrigation (MEDLI) program or recognised equivalent and use model inputs representative of the activity and release location including but not limited to effluent quality, soil and vegetation types, and climatic conditions.

(B20) Treated sewage effluent must only be released to the nominated locations and minimum areas of land determined by the MEDLI program or recognised equivalent identified in condition (B15).

(B21) Treated sewage effluent released to land must comply, at the monitoring point(s), with each of the release limits specified in Schedule B, Table 1 – Treated sewage effluent standards for release to land from sewage treatment works with a daily peak design capacity of greater than100EP for each quality characteristic

Schedule B, Table 1 – Treated sewage effluent standards for release to land from sewage treatment works with a daily peak design capacity of greater than 100EP

Quality Characteristic	Monitoring Point Location	Limit Type	Release Limit	Frequency
5-day Biochemical oxygen demand (BOD)	Release pipe from sewage treatment works	Maximum	20 mg/L	Quarterly
E. coli		80th percentile based on at least 5 samples with not less than	1000 cfu per 100 mL	
		Maximum	10,000 cfu per 100 mL	
pH		Range	6.0–8.5	Monthly
Dissolved Oxygen		Minimum	2 mg/L	
Electrical Conductivity		Monitor only		

Residual drilling material

(B22) If sumps are used to store residual drilling material or drilling fluids, they must only be used for the duration of drilling activities.

(B23) Records must be kept to demonstrate compliance with condition (B14).

(B24) Residual drilling material can only be disposed of on-site:
a. by mix-bury-cover method if the residual drilling material meets the approved quality criteria; or
b. if it is certified by a suitably qualified third party as being of acceptable quality for disposal to land by the proposed method and that environmental harm will not result from the proposed disposal.

3 SCHEDULE C - NOISE

(C1) Notwithstanding condition (A18), emission of noise from the petroleum activity(ies) at levels less than those specified in *Schedule C, Table 1—Noise nuisance limits at a sensitive receptor* are not considered to be environmental nuisance.

Schedule C, Table 1—Noise nuisance limits at a sensitive receptor

Time period	Metric	Short term noise event	Medium term noise event	Long term noise event
7:00am—6:00pm	$L_{Aeq,adj,15\ min}$	45 dBA	43 dBA	40 dBA
6:00pm—10:00pm	$L_{Aeq,adj,15\ min}$	40 dBA	38 dBA	35 dBA
10:00pm—6:00am	$L_{Aeq,adj,15\ min}$	28 dBA	28 dBA	28 dBA
	Max $L_{pA,\ 15\ mins}$	55 dBA	55 dBA	55 dBA

6:00am—7:00am	$L_{Aeq,adj,15\ min}$	40 dBA	38 dBA	35 dBA

1. The noise limits in Table 1 have been set based on the following deemed background noise levels (L_{ABG})*:*

7:00am—6:00 pm: 35 dBA
6:00pm—10:00 pm: 30 dBA
10:00pm—6:00 am: 25 dBA
6:00am—7:00 am: 30 dBA

(C2) If the noise subject to a valid complaint is tonal or impulsive, the adjustments detailed in *Schedule C, Table 2—Adjustments to be added to noise levels at sensitive receptors* are to be added to the measured noise level(s) to derive $L_{Aeq,\ adj,\ 15\ min}$.

Schedule C, Table 2—Adjustments to be added to noise levels at sensitive receptors

Noise characteristic	Adjustment to noise
Tonal characteristic is just audible	+ 2 dBA
Tonal characteristic is clearly audible	+ 5 dBA
Impulsive characteristic is detectable	+ 2 to + 5 dBA

(C3) Notwithstanding condition (C1), emission of any low frequency noise must not exceed either (C3)(a) and (C3)(b), or (C3)(c) and (C3)(d) in the event of a valid complaint about low frequency noise beingmade to the administering authority:

(a) 60 dB(C) measured outside the sensitive receptor; and
(b) the difference between the external A-weighted and C-weighted noise levels is no greater than 20 dB; or
(c) 50 dB(Z) measured inside the sensitive receptor; and
(d) the difference between the internal A-weighted and Z-weighted (Max $L_{pZ,\ 15\ min}$) noise levels is no greater than 15 dB.

(C4) A Blast Management Plan must be developed for each blasting activity in accordance with Australian Standard 2187.

(C5) Blasting operations must be designed to not exceed an airblast overpressure level of 120 dB (linear peak) at any time, when measured at or extrapolated to any sensitive place.

(C6) Blasting operations must be designed to not exceed a ground-borne vibration peak particle velocity of 10mm/s at any time, when measured at or extrapolated to any sensitive place.

4 SCHEDULE D – AIR

Venting and flaring

(D1) Unless venting is authorised under the *Petroleum and Gas (Production and Safety) Act 2004* or the *Petroleum Act 1923*, waste gas must be flared in a manner that complies with all of (D1)(a) and (D1)(b) and (D1)(c), or with (D1)(d):

(a) an automatic ignition system is used, and

(b) a flame is visible at all times while the waste gas is being flared, and

(c) there are no visible smoke emissions other than for a total period of no more than 5 minutes in any 2 hours, or

(d) it uses an enclosed flare.

Fuel burning and combustion facilities – authorised release point sources

~~(D2) A fuel burning or combustion facility must not be operated on any of the petroleum tenures related to this environmental authority.~~

(D2) Fuel burning or combustion equipment must:

a. not be operated unless listed in Schedule D, Table 1 – Authorised point sources
b. not exceed the release limits specified in Schedule D, Table 1 - Authorised point sources
c. be monitored for the release limits at the release point locations and at the monitoring frequency specified in Schedule G, Table 1 – Authorised point Sources

Schedule D, Table 1 – Authorised point sources

Tenure	Facility	Release Point Locations	Release Limits			Monitoring Frequency
			Minimum Release Height (m)	Minimum Efflux Velocity (m/sec)	NOx as Nitrogen Dioxide Maximum Mass Emission Rate (g/s)	
PL1083	Compressor station	Compressor 1	8.0	17	2	At least one release point must be monitored per year on a rotational basis, with all release points monitored at least once in a 6 year period
		Compressor 2	8.0	17	2	
		Compressor 3	8.0	17	2	
		Generator 1	8.0	6	2	
		Generator 2	8.0	6	2	
		Generator 3	8.0	6	2	

Note: The above NOx release limits are applicable during all timings except start-up, shut down and calibration of emission monitoring devices. The start-up duration is allowed up to 30 minutes.

5 SCHEDULE E – LAND

(E1) Contaminants must not be directly or indirectly released to land except for those releases authorised by conditions of this environmental authority.

Top soil management

(E2) Top soil must be managed in a manner that preserves its biological and chemical properties.

Land management

(E3) Land that has been significantly disturbed by the petroleum activities must be managed to ensure that mass movement, gully erosion, rill erosion, sheet erosion and tunnel erosion do not occur on that land.

Acid sulfate soils

(E4) Acid sulfate soils must be treated and managed in accordance with the latest edition of the *Queensland Acid Sulfate Soil Technical Manual*.

Chemical storage

(E5) Chemicals and fuels stored, must be effectively contained and where relevant, meet Australian Standards, where such a standard is applicable.

Pipeline operation and maintenance

(E6) Pipeline operation and maintenance must be in accordance, to the greatest practicable extent, with the relevant section of the APIA Code of Environmental Practice: Onshore Pipelines (2009).

Pipeline reinstatement and revegetation

(E7) Pipeline trenches must be backfilled and topsoils reinstated within three months after pipe laying.

(E8) Reinstatement and revegetation of the pipeline right of way must commence within 6 months after cessation of petroleum activities for the purpose of pipeline construction.

(E9) Backfilled, reinstated and revegetated pipeline trenches and right of ways must be:
- (a) a stable landform
- (b) re-profiled to a level consistent with surrounding soils
- (c) re-profiled to original contours and established drainage lines; and
- (d) vegetated with groundcover which is not a declared pest species, and which is established and growing.

6 SCHEDULE F – BIODIVERSITY

Confirming biodiversity values

(F1) Prior to undertaking activities that result in significant disturbance to land in areas of native vegetation, confirmation of on-the-ground biodiversity values of the native vegetation communities at that location must be undertaken by a suitably qualified person.

(F2) A suitably qualified person must develop and certify a methodology so that condition (F1) can be complied with and which is appropriate to confirm on-the-ground biodiversity values.

(F3) Where mapped biodiversity values differ from those confirmed under conditions (F1) and (F2), petroleum activities may proceed in accordance with the conditions of the environmental authority based on the confirmed on-the-ground biodiversity value.

Planning for land disturbance

(F4) The location of the petroleum activity(ies) must be selected in accordance with the following site planning principles:
- (a) maximise the use of areas of pre-existing disturbance
- (b) in order of preference, avoid, minimise or mitigate any impacts, including cumulative impacts, on areas of native vegetation or other areas of ecological value
- (c) minimise disturbance to land that may result in land degradation
- (d) in order of preference, avoid then minimise isolation, fragmentation, edge effects or dissection of tracts of native vegetation; and
- (e) in order of preference, avoid then minimise clearing of native mature trees.

Planning for land disturbance—linear infrastructure

(F5) Linear infrastructure construction corridors must:
- (a) maximise co-location
- (b) be minimised in width to the greatest practicable extent; and
- (c) for linear infrastructure that is an essential petroleum activity authorised in an environmentally sensitive area or its protection zone, be no greater than 40m in total width.

Authorised disturbance to Environmentally Sensitive Areas

(F6) Where petroleum activities are to be carried out in environmentally sensitive areas or their protection zones, the petroleum activities must be carried out in accordance with *Schedule F, Table 1—Authorised petroleum activities in environmentally sensitive areas and their protection zones*

Schedule F, Table 1—Authorised petroleum activities in environmentally sensitive areas and their protection zones

Environmentally sensitive area	**Within the environmentally sensitive area**	**Primary protection zone of the environmentally sensitive area**	**Secondary protection zone of the environmentally sensitive area**
Category A environmentally sensitive areas	No petroleum activities permitted.	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.
Category B environmentally sensitive areas that are other than 'endangered' regional ecosystems	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.
Category B environmentally sensitive areas that are 'endangered' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	Only essential petroleum activities permitted.
Category C environmentally sensitive areas that are 'nature refuges' or 'koala habitat'	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	
Category C environmentally sensitive areas that are 'essential habitat', 'essential regrowth habitat', or 'of concern' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	
Category C environmentally sensitive areas that are 'regional parks' (previously known as 'resources reserves')	Only essential petroleum activities permitted.	Only essential petroleum activities permitted.	
Category C environmentally sensitive areas that are 'state forests' or 'timber reserves'	Only essential petroleum activities permitted.	Petroleum activities permitted.	
Areas of vegetation that are 'critically limited'	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	

(F7) A report must be prepared for each annual return period for all petroleum activities that involved clearing of any environmentally sensitive area or protection zone which includes:

(a) records able to demonstrate compliance with condition (F4), (F5), (F6) and (F7)

(b) a description of the works

(c) a description of the area and its pre-disturbance values (which may include maps or photographs, but must include GPS coordinates for the works); and

(d) based on the extent of environmentally sensitive areas and primary protection zones on the relevant resource authority(ies), the proportion of native vegetation cleared per environmentally

sensitive area and primary protection zone, including regional ecosystem type, over the annual return period.

Impacts to prescribed environmental matters

(F8) Significant residual impacts to prescribed environmental matters, other than if the impacts were authorised by an existing authority issued before the commencement of the *Environmental Offsets Act 2014*, are not authorised under this environmental authority.

7 SCHEDULE G - WATER

(G1) Contaminants must not be directly or indirectly released to waters.

Authorised impacts to wetlands

(G2) The extraction of groundwater as part of the petroleum activity(ies) from underground aquifers must not directly or indirectly cause environmental harm to a wetland.

Authorised activities in waters

(G3) Petroleum activities must not occur in or within 200m of a:
- (a) wetland of high ecological significance
- (b) Great Artesian Basin Spring
- (c) subterranean cave GDE

(G4) Only construction or maintenance of linear infrastructure is permitted in or within any wetland of other environmental value or in a watercourse.

(G5) The construction or maintenance of linear infrastructure in a wetland of other environmental value must not result in the:
- (a) clearing of riparian vegetation outside of the minimum area practicable to carry out the works; or
- (b) ingress of saline water into freshwater aquifers; or
- (c) draining or filling of the wetland beyond the minimum area practicable to carry out the works.

(G6) After the construction or maintenance works for linear infrastructure in a wetland of other environmental value are completed, the linear infrastructure must not:
- (a) drain or fill the wetland
- (b) prohibit the flow of surface water in or out of the wetland
- (c) lower or raise the water table and hydrostatic pressure outside the bounds of natural variability that existed before the activities commenced
- (d) result in ongoing negative impacts to water quality
- (e) result in bank instability; or
- (f) result in fauna ceasing to use adjacent areas for habitat, feeding, roosting or nesting.

(G7) The construction or maintenance of linear infrastructure activities in a watercourse must be conducted in the following preferential order:
- (a) firstly, in times where there is no water present
- (b) secondly, in times of no flow
- (c) thirdly, in times of flow, providing a bankfull situation is not expected and that flow is maintained.

(G8) The construction or maintenance of linear infrastructure authorised under condition (G4) must comply with the water quality limits as specified in *Schedule G, Table 1—Release limits for construction or maintenance of linear infrastructure.*

Schedule G, Table 1—Release limits for construction or maintenance of linear infrastructure

Water quality parameters	Units	Water quality limits

Turbidity	Nephelometric Turbidity Units (NTU)	For a wetland of other environmental value, if background water turbidity is above 45 NTU, no greater than 25% above background water turbidity measured within a 50m radius of the construction or maintenance activity. For a watercourse, if background water turbidity is above 45 NTU, no greater than 25% above background water turbidity measured within 50m downstream of the construction or maintenance activity.
		For a wetland of other environmental value, if background water turbidity is equal to, or below 45 NTU, a turbidity limit of no greater than 55 NTU applies, measured within a 50m radius of the construction or maintenance activity. For a watercourse, if background water turbidity is equal to, or below 45 NTU, a turbidity limit of no greater than 55 NTU applies, measured within 50m downstream of the construction or maintenance activity.
Hydrocarbons	-	For a wetland of other environmental value, or watercourse, no visible sheen or slick

(G9) Monitoring must be undertaken at a frequency that is appropriate to demonstrate compliance with condition (G7).

Register of activities in wetlands and watercourses

(G10) A register must be kept of all linear infrastructure construction and maintenance activities in a wetland of other environmental value and watercourses, which must include:
- (a) location of the activity (e.g. GPS coordinates (GDA94) and watercourse name)
- (b) estimated flow rate of surface water at the time of the activity
- (c) duration of works, and
- (d) results of impact monitoring carried out under condition (G8).

Activities in River Improvement Areas

(G11) Measures must be taken to minimise negative impacts to, or reversal of, any river improvement works carried out in River Improvement Areas by Queensland's River Improvement Trusts.

Activities in Floodplains

(G12) Petroleum activity(ies) on floodplains must be carried out in a way that does not:
- (a) concentrate flood flows in a way that will or may cause or threaten a negative environmental impact; or
- (b) divert flood flows from natural drainage paths and alter flow distribution; or
- (c) increase the local duration of floods; or
- (d) increase the risk of detaining flood flows.

Seepage Monitoring Program

(G13) A seepage monitoring program must be developed by a suitably qualified person by 1 January 2016 which is commensurate with the site-specific risks of contaminant seepage from containment facilities, and which requires and plans for detection of any seepage of contaminants to groundwater as a result of storing contaminants.

(G14) The seepage monitoring program required by condition (G13) must include but not necessarily be limited to:
- (a) identification of the containment facilities for which seepage will be monitored
- (b) identification of trigger parameters that are associated with the potential or actual contaminants held in the containment facilities
- (c) identification of trigger concentration levels that are suitable for early detection of contaminant releases at the containment facilities
- (d) installation of background seepage monitoring bores where groundwater quality will not have been affected by the petroleum activities authorised under this environmental authority to use as reference sites for determining impacts
- (e) installation of seepage monitoring bores that:
  - i. are within formations potentially affected by the containment facilities authorised under this environmental authority (i.e. within the potential area of impact)
  - ii. provide for the early detection of negative impacts prior to reaching groundwater dependent ecosystems, landholder's active groundwater bores, or water supply bores
  - iii. provide for the early detection of negative impacts prior to reaching migration pathways to other formations (i.e. faults, areas of unconformities known to connect two or more formations)
- (f) monitoring of groundwater at each background and seepage monitoring bore at least quarterly for the trigger parameters identified in condition (G14(b))
- (g) seepage trigger action response procedures for when trigger parameters and trigger levels identified in conditions (G14(b)) and (G14(c)) trigger the early detection of seepage, or upon becoming aware of any monitoring results that indicate potential groundwater contamination
- (h) a rationale detailing the program conceptualisation including assumptions, determinations, monitoring equipment, sampling methods and data analysis; and
- (i) provides for annual updates to the program for new containment facilities constructed in each annual return period.

Seepage monitoring bore drill logs

(G15) A bore drill log must be completed for each seepage monitoring bore in condition (G14) which must include:
- (a) bore identification reference and geographical coordinate location
- (b) specific construction information including but not limited to depth of bore, depth and length of casing, depth and length of screening and bore sealing details
- (c) standing groundwater level and water quality parameters including physical parameter and results of laboratory analysis for the possible trigger parameters
- (d) lithological data, preferably a stratigraphic interpretation to identify the important features including the identification of any aquifers; and
- (e) target formation of the bore.

8 SCHEDULE H – WELL CONSTRUCTION, MAINTENANCE AND STIMULATION ACTIVITIES

Drilling activities

(H1) Oil based or synthetic based drilling muds must not be used in the carrying out of the petroleum activity(ies).

(H2) Drilling activities must not result in the connection of the target gas producing formation and another aquifer.

(H3) Practices and procedures must be in place to detect, as soon as practicable, any fractures that have or may result in the connection of a target formation and another aquifer as a result of drilling activities.

Stimulation activities

(H4) Polycyclic aromatic hydrocarbons or products that contain polycyclic aromatic hydrocarbons must not be used in stimulation fluids in concentrations above the reporting limit.

(H5) Stimulation activities must not negatively affect water quality, other than that within the stimulation impact zone of the target gas producing formation.

(H6) Stimulation activities must not cause the connection of the target gas producing formation and another aquifer.

(H7) The internal and external mechanical integrity of the well system prior to and during stimulation must be ensured such that there is:
- (a) no significant leakage in the casing, tubing, or packer; and
- (b) there is no significant fluid movement into another aquifer through vertical channels adjacent to the well bore hole.

(H8) Practices and procedures must be in place to detect, as soon as practicable, any fractures that cause the connection of a target gas producing formation and another aquifer.

Stimulation risk assessment

(H9) Prior to undertaking stimulation activities, a risk assessment must be developed to ensure that stimulation activities are managed to prevent environmental harm.

(H10) The stimulation risk assessment must be carried out for every well to be stimulated prior to stimulation being carried out at that well and address issues at a relevant geospatial scale such that changes to features and attributes are adequately described and must include, but not necessarily be limited to:
- (a) a process description of the stimulation activity to be applied, including equipment and a comparison to best international practice
- (b) provide details of where, when and how often stimulation is to be undertaken on the tenures covered by this environmental authority
- (c) a geological model of the field to be stimulated including geological names, descriptions and depths of the target gas producing formation(s)
- (d) naturally occurring geological faults
- (e) seismic history of the region (e.g. earth tremors, earthquakes)
- (f) proximity of overlying and underlying aquifers

(g) description of the depths that aquifers with environmental values occur, both above and below the target gas producing formation
(h) identification and proximity of landholder' active groundwater bores in the area where stimulation activities are to be carried out
(i) the environmental values of groundwater in the area
(j) an assessment of the appropriate limits of reporting for all water quality indicators relevant to stimulation monitoring in order to accurately assess the risks to environmental values of groundwater
(k) description of overlying and underlying formations in respect of porosity, permeability, hydraulic conductivity, faulting and fracture propensity
(l) consideration of barriers or known direct connections between the target gas producing formation and the overlying and underlying aquifers
(m) a description of the well mechanical integrity testing program
(n) process control and assessment techniques to be applied for determining extent of stimulation activities (e.g. microseismic measurements, modelling etc.)
(o) practices and procedures to ensure that the stimulation activities are designed to be contained within the target gas producing formation
(p) groundwater transmissivity, flow rate, hydraulic conductivity and direction(s) of flow
(q) a description of the chemical compounds used in stimulation activities (including estimated total mass, estimated composition, chemical abstract service numbers and properties), their mixtures and the resultant compounds that are formed after stimulation
(r) a mass balance estimating the concentrations and absolute masses of chemical compounds that will be reacted, returned to the surface or left in the target gas producing formation subsequent to stimulation
(s) an environmental hazard assessment of the chemicals used including their mixtures and the resultant chemicals that are formed after stimulation including:
    i. toxicological and ecotoxicological information of chemical compounds used
    ii. information on the persistence and bioaccumulation potential of the chemical compounds used; and
    iii. identification of the chemicals of potential concern in stimulation fluids derived from the risk assessment
(t) an environmental hazard assessment of use, formation of, and detection of polycyclic aromatic hydrocarbons in stimulation activities
(u) if used, identification and an environmental hazard assessment of using radioactive tracer beads in stimulation activities
(v) an environmental hazard assessment of leaving chemical compounds in stimulation fluids in the target gas producing formation for extended periods subsequent to stimulation
(w) human health exposure pathways to operators and the regional population
(x) risk characterisation of environmental impacts based on the environmental hazard assessment
(y) potential impacts to landholder bores as a result of stimulation activities
(z) an assessment of cumulative underground impacts, spatially and temporally of the stimulation activities to be carried out on the tenures covered by this environmental authority; and
(aa) potential environmental or health impacts which may result from stimulation activities including but not limited to water quality, air quality (including suppression of dust and other airborne contaminants), noise and vibration.

Water quality baseline monitoring

(H11) Prior to undertaking any stimulation activity, a baseline bore assessment must be undertaken of the water quality of:

(a) all landholder's active groundwater bores (subject to access being permitted by the landholder) that are spatially located within a two (2) kilometre horizontal radius from the location of the stimulation initiation point within the target gas producing formation; and
(b) all landholders' active groundwater bores (subject to access being permitted by the landholder) in any aquifer that is within 200m above or below the target gas producing formation and is spatially located with a two (2) kilometre radius from the location of the stimulation initiation point; and
(c) any other bore that could potentially be adversely impacted by the stimulation activities in accordance with the findings of the risk assessment required by conditions (H9) and (H10).

(H12) Prior to undertaking stimulation activities at a well, there must be sufficient water quality data to accurately represent the water quality in the well to be stimulated. The data must include as a minimum the results of analyses for the parameters in condition (H13).

(H13) Stimulation Baseline bore and well assessments must include relevant analytes and physico-chemical parameters to be monitored in order to establish baseline water quality and must include, but not necessarily be limited to:

(a) pH
(b) electrical conductivity [μS/m]
(c) turbidity [NTU]
(d) total dissolved solids [mg/L]
(e) temperature [ºC]
(f) dissolved oxygen [mg/L]
(g) dissolved gases (methane, chlorine, carbon dioxide, hydrogen sulfide) [mg/L]
(h) alkalinity (bicarbonate, carbonate, hydroxide and total as $CaCO_3$) [mg/L]
(i) sodium adsorption ratio (SAR)
(j) anions (bicarbonate, carbonate, hydroxide, chloride, sulphate) [mg/L]
(k) cations (aluminium, calcium, magnesium, potassium, sodium) [mg/L]
(l) dissolved and total metals and metalloids (including but not necessarily being limited to: aluminium, arsenic, barium, borate (boron), cadmium, total chromium, copper, iron, fluoride, lead, manganese, mercury, nickel, selenium, silver, strontium, tin and zinc) [μg/L]
(m) total petroleum hydrocarbons [μg/L]
(n) BTEX (as benzene, toluene, ethylbenzene, ortho-xylene, para- and meta-xylene, and total xylene) [μg/L]
(o) polycyclic aromatic hydrocarbons (including but not necessarily being limited to: naphthalene, phenanthrene, benzo[a]pyrene) [μg/L]
(p) formaldehyde [mg/L]
(q) ethanol [mg/L]; and
(r) gross alpha + gross beta or radionuclides by gamma spectroscopy [Bq/L].

(H14) A stimulation impact monitoring program must be developed prior to the carrying out of stimulation activities which must be able to detect adverse impacts to water quality from stimulation activities and must consider the findings of the risk assessment required by conditions (H9) and (H10) that relate to stimulation activities and must include, as a minimum, monitoring of:

(a) the stimulation fluids to be used in stimulation activities at sufficient frequency and which sufficiently represents the quantity and quality of the fluids used; and

(b) flow back waters from stimulation activities at sufficient frequency and which sufficiently represents the quality of that flow back water; and

(c) flow back waters from stimulation activities at sufficient frequency and accuracy to demonstrate that 150% of the volume used in stimulation activities has been extracted from the stimulated well; and

(d) all bores in accordance with condition (H11) at the following minimum frequency:

i. Monthly for the first six months subsequent to stimulation activities being undertaken; and

ii. annually for the first five (5) years subsequent to stimulation activities being undertaken or until analytes and physico-chemical parameters identified in condition (H13) are not detected in concentrations above baseline bore monitoring data on two (2) consecutive monitoring occasions, whichever is shorter.

(H15) The stimulation impact monitoring program must provide for monitoring of:

(a) analytes and physico-chemical parameters relevant to baseline bore and well assessments to enable data referencing and comparison including, but not necessarily being limited to the analytes and physico-chemical parameters in condition (H13); and

(b) any other analyte or physico-chemical parameters that will enable detection of adverse water quality impacts and the inter-connection with a non-target aquifer as a result of stimulation activities including chemical compounds, identified in the respective Stimulation Risk Assessment, that are actually or potentially formed by chemical reactions with each other or coal seam materials during stimulation activities.

(H16) The results of the stimulation impact monitoring program must be made available to any potentially affected landholder upon request by that landholder.

9 SCHEDULE I – ~~DAMS~~ REGULATED STRUCTURES

Assessment of consequence category

(I1) The consequence category of any structure must be assessed by a suitably qualified and experienced person in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (~~EM635~~ ESR/2016/1933) at the following times:

(a) prior to the design and construction of the structure**,** if it is not an existing structure; or

~~(b) if it is an existing structure, prior to the adoption of this schedule; or~~

(c) prior to any change in its purpose or the nature of its stored contents.

(I2) A consequence assessment report and certification must be prepared for each structure assessed and the report may include a consequence assessment for more than one structure.

(I3) Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (~~EM635~~ ESR/2016/1933)*.

Design and construction of regulated structures

(I4) ~~Regulated structures are not authorised under this environmental authority~~. All regulated structures must be designed by, and constructed under the supervision of, a suitably qualified and experienced person in accordance with the requirements of the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933).

(I5) Construction of a regulated structure is prohibited unless:

a. the holder has submitted a consequence category assessment report and certification to the administering authority; and
b. certification for the design, design plan and the associated operating procedures has been certified by a suitably qualified and experienced person in compliance with the relevant condition of this authority.

(I6) Certification must be provided by the suitably qualified and experienced person who oversees the preparation of the design plan in the form set out in the Manual for assessing categories and hydraulic performance of structures (ESR/2016/1933) and must be recorded in the Register of Regulated Structures.

(I7) Regulated structures must:

a. be designed and constructed in compliance with the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933);
b. be designed and constructed with due consideration given to ensuring that the design integrity would not be compromised on account of:
    - floodwaters from entering the regulated dam from any watercourse or drainage line; and
    - wall failure due to erosion by floodwaters arising from any watercourse or drainage line.
c. have the floor and sides of the dam designed and constructed to prevent or minimise the passage of the wetting front and any entrained contaminants through either the floor or sides of the dam during the operational life of the dam and for any period of decommissioning and rehabilitation of the dam.

(I8) Certification by a suitably qualified and experienced person who supervises the construction must be submitted to the administering authority on the completion of construction of the regulated structure, and state that:

a. the 'as constructed' drawings and specifications meet the original intent of the design plan for that regulated structure; and
b. construction of the regulated structure is in accordance with the design plan.

Notification of affected persons

(I9) All affected persons must be provided with a copy of the emergency action plan in place for each regulated structure:

a. prior to the operation of the new regulated structure; and
b. if the emergency action plan is amended, within 5 business days of it being amended.

Operation of a Regulated Structure

(I10) Operation of a regulated structure is prohibited unless:

a. one paper copy and one electronic copy of the design plan and certification, and a set of 'as constructed' drawings and specifications has been submitted to the administering authority, together with certification that the structure:
    - has been constructed in accordance with the design plan;
    - is capable of delivering the performance stated in the design plan; and
    - is compliant with the relevant conditions of this environmental authority.
b. the requirements of this environmental authority relating to the construction of the structure have been met; and
c. the details required under this environmental authority have been entered into a Register of Regulated structures.

(I11) Each regulated structure must be maintained and operated, for the duration of its operational life until decommissioned and rehabilitated, in compliance with the current operational plan and, if applicable, the current design plan and associated certified 'as constructed' drawings.

Regulated structure register

(I12) A Register of Regulated Structures must be established and maintained by the holder for each regulated structure.

(I13) The information contained in the register of regulated structures must always be current and complete on any given day.

Mandatory Reporting Level

(I14) The mandatory reporting level must be marked on each regulated structure in such a way that it is clearly observable during routine inspections of each dam.

(I15) On becoming aware that the mandatory reporting level has been reached, action must be taken to prevent or, if unable to prevent, to minimise any actual or potential environmental harm.

Design Storage Allowance

(I16) On 1 November of each year, storage must be available in each regulated structure to meet the design storage allowance in accordance with the *Manual for Assessing consequence categories and hydraulic performance of structures (ESR/2016/1933)*.

(I17) On becoming aware that the regulated structure will not have the available storage to meet the design storage allowance on 1 November of any year, action must be taken to prevent or, if unable to prevent, to minimise any actual or potential of any unauthorised release.

Annual Inspection and Report

(I18) Each regulated structure must be inspected each calendar year by a suitably qualified and experienced person.

(I19) At each annual inspection, the condition and adequacy of all components of the regulated structure must be assessed and a suitably qualified and experienced person must prepare an annual inspection report containing details of the assessment and include a recommendations section, with any recommended

actions to ensure the integrity of the regulated structure or a positive statement that no recommendations are required.

(I20) The suitably qualified and experienced person who prepared the annual inspection report must certify the report in accordance with the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933).

(I21) The holder of the environmental authority must within 20 business days of receipt of the annual inspection report, provide to the administering authority:
a. The recommendations section of the annual inspection report; and
b. If applicable, any actions being taken in response to those recommendations; and
c. If, following receipt of the recommendations and (if applicable) recommended actions, the administering authority requests a copy of the annual inspection report from the holder, provide this to the administering authority within 10 business days of receipt of the request.

Decommissioning and Rehabilitation

(I22) Regulated structures must not be abandoned but be either:
a. decommissioned and rehabilitated to achieve compliance with condition I23; or
b. be left in-situ for a use by the landholder provided that:
   - it no longer contains contaminants that will migrate into the environment; and
   - it contains water of a quality that is demonstrated to be suitable for its intended use(s);
c. the holder of the environmental authority and the landholder agree in writing that the;
   - dam will be used by the landholder following the cessation of the environmentally relevant activity(ies); and
   - landholder is responsible for the dam, on and from an agreed date.

(I23) Before surrendering this environmental authority the site must be rehabilitated to achieve a safe, stable, non-polluting landform and be suitable for the relevant final land use.

10 SCHEDULE J – REHABILITATION

Rehabilitation planning

(J1) A Rehabilitation Plan must be developed by a suitably qualified person and must include the:
(a) rehabilitation goals; and
(b) procedures to be undertaken for rehabilitation that will:
   i. achieve the requirements of conditions (J2) to (J8), inclusive; and
   ii. provide for appropriate monitoring and maintenance.

Transitional rehabilitation

(J2) Significantly disturbed areas that are no longer required for the on-going petroleum activities, must be rehabilitated within 12 months (unless an exceptional circumstance in the area to be rehabilitated (e.g. a flood event) prevents this timeframe being met) and be maintained to meet the following acceptance criteria:
(a) contaminated land resulting from petroleum activities is remediated and rehabilitated
(b) the areas are:
   i. non-polluting
   ii. a stable landform
   iii. re-profiled to contours consistent with the surrounding landform
(c) surface drainage lines are re-established
(d) top soil is reinstated; and
(e) either:
   i. groundcover, that is not a declared pest species, is growing; or
   ii. an alternative soil stabilisation methodology that achieves effective stabilisation is implemented and maintained.

Final rehabilitation acceptance criteria

(J3) All significantly disturbed areas caused by petroleum activities which are not being or intended to be utilised by the landholder or overlapping tenure holder, must be rehabilitated to meet the following final acceptance criteria measured either against the highest ecological value adjacent land use or the pre-disturbed land use:

(a) greater than or equal to 70% of native ground cover species richness
(b) greater than or equal to the total per cent of ground cover
(c) less than or equal to the per cent species richness of declared plant pest species; and
(d) where the adjacent land use contains, or the pre-clearing land use contained, one or more regional ecosystem(s), then at least one regional ecosystem(s) from the same broad vegetation group, and with the equivalent biodiversity status or a biodiversity status with a higher conservation value as any of the regional ecosystem(s) in either the adjacent land or pre-disturbed land, must be present.

Final rehabilitation acceptance criteria in environmentally sensitive areas

(J4) Where significant disturbance to land has occurred in an environmentally sensitive area, the following final rehabilitation criteria as measured against the pre-disturbance biodiversity values assessment (required by conditions (F1) and (F2)) must be met:

(a) greater than or equal to 70% of native ground cover species richness
(b) greater than or equal to the total per cent ground cover
(c) less than or equal to the per cent species richness of declared plant pest species

(d) greater than or equal to 50% of organic litter cover
(e) greater than or equal to 50% of total density of coarse woody material; and
(f) all predominant species in the ecologically dominant layer, that define the pre-disturbance regional ecosystem(s) are present.

Continuing conditions

(J5) Conditions (J2), (J3) and (J4) continue to apply after this environmental authority has ended or ceased to have effect.

Rehabilitation reporting for relinquishment of part of an authority to prospect area under the *Petroleum and Gas (Production and Safety) Act 2004*

(J6) Prior to relinquishing all or part of an authority to prospect area, a rehabilitation report must be prepared which specifically relates to the area to be relinquished and demonstrates condition (J2), (J3) and (J4) has been met.

(J7) The report required under condition (J6) must be submitted to the administering authority at least 40 business days prior to the relinquishment notice being lodged with the administering authority for the *Petroleum and Gas (Production and Safety) Act 2004*.

Remaining dams

(J8) Where there is a dam (including a low consequence dam) that is being or intended to be utilised by the landholder or overlapping tenure holder, the dam must be decommissioned to no longer accept inflow from the petroleum activity(ies) and the contained water must be of a quality suitable for the intended on-going uses(s) by the landholder or overlapping tenure holder.

11 SCHEDULE K – DEFINITIONS

Note: Where a term is not defined in this environmental authority, the definition in the Environmental Protection Act 1994*, its regulations and Environmental Protection Policies, then the* Acts Interpretation Act 1954*, then the Macquarie Dictionary then the* Petroleum and Gas (Production and Safety) Act 2004 *or its regulations must be used in that order.*

"acceptable standards for release to land" means wastewater of the following quality as determined by monitoring results or by characterisation:

(a) electrical conductivity (EC) not exceeding 3000µS/cm
(b) sodium adsorption ratio (SAR) not exceeding 8
(c) pH between 6.0 and 9.0
(d) heavy metals (measured as total) meets the respective short term trigger value in section 4.2.6, Table 4.2.10—Heavy metals and metalloids in Australian and New Zealand Guidelines for Fresh and Marine Water Quality
(e) does not contain biocides.

"acid sulfate soil(s)" means a soil or soil horizon which contains sulfides or an acid soil horizon affected by oxidation of sulfides.

"adjacent land use(s)" means the **ecosystem function** adjacent to an area of significant disturbance, or where there is no ecosystem function, the use of the land. An adjacent land use does not include an adjacent area that shows evidence of edge effect.

"administering authority" means:

(a) for a matter, the administration and enforcement of which has been devolved to a local government under section 514 of the *Environmental Protection Act 1994*—the local government; or
(b) for all other matters—the Chief Executive of the Department of Environment, Tourism, Science and Innovation;or
(c) another State Government Department, Authority, Storage Operator, Board or Trust, whose role is to administer provisions under other enacted legislation.

"alternative arrangement" means a written agreement about the way in which a particular environmental nuisance impact will be dealt with at a sensitive place, and may include an agreed period of time for which the arrangement is in place. An alternative arrangement may include, but is not limited to, a range of nuisance abatement measures to be installed at the sensitive place, or provision of alternative accommodation for the duration of the relevant nuisance impact.

"analogue site(s)" means an area of land which contains values and characteristics representative of an area to be rehabilitated prior to disturbance. Such values must encompass land use, topographic, soil, vegetation, vegetation community attributes and other ecological characteristics. Analogue sites can be the pre-disturbed site of interest where significant surveying effort has been undertaken to establish benchmark parameters.

"annual return period" means the most current 12-month period between two anniversary dates.

"appraisal well" means a petroleum well to test the potential of one (1) or more natural underground reservoirs for producing or storing petroleum. For clarity, an appraisal well does not include an exploration well.

"approved quality criteria" for the purposes of residual drilling materials, means the residual drilling material meet the following quality standards:

Part A In all cases:

Parameter	Maximum concentration
pH	6–10.5 (range)
Electrical Conductivity	20dS/m (20,000µS/cm)
Chloride*	8000mg/L

*Chloride analysis is only required if an additive containing chloride was used in the drilling process

The limits in Part A must be measured in the clarified filtrate of oversaturated solids prior to mixing.

Part B If any of the following metals are a component of the drilling fluids, then for that metal:

Parameter	Maximum concentration
Arsenic	20mg/kg
Selenium	5mg/kg
Boron	100mg/kg
Cadmium	3mg/kg
Chromium (total)	400mg/kg
Copper	100mg/kg
Lead	600mg/kg

The limits in Part B and Part C refer to the post soil/by-product mix.

Part C If a hydrocarbon sheen is visible, the following hydrocarbon fractions:

TPH	Maximum concentration
C6-C10	170mg/kg
C10-C16	150mg/kg
C16-C34	1300mg/kg
C34-C40	5600mg/kg
Total Polycyclic Aromatic Hydrocarbons (PAHs)	20mg/kg
Phenols (halogenated)	1mg/kg
Phenols (non-halogenated)	60mg/kg
Monocyclic aromatic hydrocarbons *(Total sum of benzene, toluene, ethyl benzene, xylenes (includes ortho, para and meta xylenes) and styrene)*	7mg/kg
Benzene	1mg/kg

"areas of pre-existing disturbance" means areas where environmental values have been negatively impacted as a result of anthropogenic activity and these impacts are still evident. Areas of pre-disturbance may include areas where legal clearing, logging, timber harvesting, or grazing activities have previously occurred, where high densities of weed or pest species are present which have inhibited re-colonisation of native regrowth, or where there is existing infrastructure (regardless of whether the infrastructure is associated with the authorised petroleum activities). The term 'areas of pre-disturbance' does not include areas that have been impacted by wildfire/s, controlled burning, flood or natural vegetation die-back.

"assessed or assessment" by a suitably qualified and experienced person in relation to a consequence assessment of a dam, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit of the assessment:

(a) exactly what has been assessed and the precise nature of that determination;

(b) the relevant legislative, regulatory and technical criteria on which the assessment has been based;

(c) the relevant data and facts on which the assessment has been based, the source of that material, and the efforts made to obtain all relevant data and facts; and

(d) the reasoning on which the assessment has been based using the relevant data and facts, and the relevant criteria.

"associated water" means underground water taken or interfered with, if the taking or interference happens during the course of, or results from, the carrying out of another authorised activity under a petroleum authority,

such as a petroleum well, and includes waters also known as produced formation water. The term includes all contaminants suspended or dissolved within the water.

"associated works" in relation to a dam, means:
(a) operations of any kind and all things constructed, erected or installed for that dam; and
(b) any land used for those operations.

"Australian Standard 3580" means any of the following publications:
- AS3580.10.1 Methods for sampling and analysis of ambient air—Determination of particulate matter—Deposited matter—Gravimetric method.
- AS3580.9.6 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—PM10 high volume sampler with size-selective inlet—Gravimetric method.
- AS3580.9.9 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter— PM10 low volume sampler—Gravimetric sampler.

"background noise level" means the sound pressure level, measured in the absence of the noise under investigation, as the $L_{A90,T}$ being the A-weighted sound pressure level exceeded for 90% of the measurement time period T of not less than 15 minutes (or $L_{A\ 90,\ adj,\ 15\ mins}$), using Fast response.

"bankfull" means the channel flow rate that exists when the water is at the elevation of the channel bank above which water begins to spill out onto the floodplain. The term describes the condition of the channel relative to its banks (e.g. overbank, in-bank, bankfull, low banks, high bank).

"bed" of any waters, has the meaning in Schedule 19 of the Environmental Protection Regulation 2019 and—
(a) includes an area covered, permanently or intermittently, by tidal or non-tidal waters; but
(b) does not include land adjoining or adjacent to the bed that is from time to time covered by floodwater.

"being or intended to be utilised by the landholder or overlapping tenure holder" for significantly disturbed land, means there is a written agreement (e.g. land and compensation agreement) between the landholder or the overlapping tenure holder and the holder of the environmental authority identifying that the landholder or the overlapping tenure holder has a preferred use of the land such that rehabilitation standards for revegetation by the holder of the environmental authority are not required.

For dams, means there is a written agreement (e.g. land and compensation agreement) between the landholder or the overlapping tenure holder and the holder of the environmental authority identifying that the landholder or the overlapping tenure holder has a preferred use for the dam such that rehabilitation standards for revegetation by the holder of the environmental authority are not required.

"biodiversity values" for the purposes of this environmental authority, means environmentally sensitive areas, prescribed environmental matters and wetlands.

"**Brine**" means saline water with a total dissolved solid concentration greater than 40,000 mg/l.

"**Brine dam"** means a regulated dam that is designed to receive, contain or evaporate brine.

"BTEX" means benzene, toluene, ethylbenzene, ortho-xylene, para-xylene, meta-xylene and total xylene.

"Category A Environmentally Sensitive Area" means any area listed in Schedule 19, Part 1 of the Environmental Protection Regulation 2019.

"Category B Environmentally Sensitive Area" means any area listed in Schedule 19, Part 2 of the Environmental Protection Regulation 2019.

"Category C Environmentally Sensitive Area" means any of the following areas:
- nature refuges as defined in the conservation agreement for that refuge under *the Nature Conservation Act 1992*
- koala habitat areas as defined under the Nature Conservation (Koala) Conservation Plan 2006
- state forests or timber reserves as defined under the *Forestry Act 1959*
- regional parks (previously known as resource reserves) under the *Nature Conservation Act 1992*
- an area validated as 'essential habitat' or 'essential regrowth habitat' from ground-truthing surveys in

accordance with the *Vegetation Management Act 1999* for a species of wildlife listed as endangered or vulnerable under the *Nature Conservation Act 1992*

- *'*of concern regional ecosystems' that are remnant vegetation and identified in the database called 'RE description database' containing regional ecosystem numbers and descriptions.

"certified or certification" in relation to any matter other than a design plan, 'as constructed' drawings or an annual report regarding dams means, a Statutory Declaration by a suitably qualified person or suitably qualified third party accompanying the written document stating:

- the person's qualifications and experience relevant to the function
- that the person has not knowingly included false, misleading or incomplete information in the document
- that the person has not knowingly failed to reveal any relevant information or document to the administering authority
- that the document addresses the relevant matters for the function and is factually correct; and
- that the opinions expressed in the document are honestly and reasonably held.

"certification" in relation to dams means assessment and approval must be undertaken by a suitably qualified and experienced person in relation to any assessment or documentation required by this Manual, including design plans, 'as constructed' drawings and specifications, construction, operation or an annual report regarding regulated structures, undertaken in accordance with the Board of Professional Engineers of Queensland Policy Certification by RPEQs (ID: 1.4 (2A)).

"certifying, **certify or certified"** in relation to dams have a corresponding meaning as 'certification'.

"clearing" has the meaning in the dictionary of the *Vegetation Management Act 2000* and for vegetation—
(a) means remove, cut down, ringbark, push over, poison or destroy in any way including by burning, flooding or draining; but
(b) does not include destroying standing vegetation by stock, or lopping a tree.

"closed-loop systems" means using waste on site in a way that does not release waste or contaminants in the waste to the environment.

"coal seam gas water" means groundwater that is necessarily or unavoidably brought to the surface in the process of coal seam gas exploration or production.

"consequence" in relation to a structure as defined, means the potential for environmental harm resulting from the collapse or failure of the structure to perform its primary purpose of containing, diverting or controlling flowable substances.

"consequence category" means a category, either low, significant or high, into which a dam is assessed as a result of the application of tables and other criteria in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*.

"construction or constructed" in relation to a dam includes building a new dam and modifying or lifting an existing dam, but does not include investigations and testing necessary for the purpose of preparing a design plan.

"control measure" has the meaning in section 31 of the Environmental Protection Regulation 2019 and means a device, equipment, structure, or management strategy used to prevent or control the release of a contaminant or waste to the environment.

"critically limited regional ecosystem" means the regional ecosystems defined and listed in Appendix 5 of the Queensland Biodiversity Offset Policy.

"daily peak design capacity" for sewage treatment works, has the meaning in Schedule 2, section 63(4) of the Environmental Protection Regulation 2019 as the higher equivalent person (EP) for the works calculated using each of the formulae found in the definition for EP.

"dam(s)" means a land-based structure or a void that contains, diverts or controls flowable substances, and includes any substances that are thereby contained, diverted or controlled by that land-based structure or void and associated works.

"declared pest species" has the meaning in the Land Protection (Pest and Stock Route Management) Regulation 2003 and is a live animal or plant declared to be a declared pest under section 36 (Declaring Pests by Regulation) or section 37(2) (Declaring Pest under Emergency Pest Notice) of that Act and includes reproductive material of the animal or plant.

"declared plant pest species" has the meaning in the Land Protection (Pest and Stock Route Management) Regulation 2003 and is a plant declared to be a declared pest under section 36 (Declaring Pests by Regulation) or section 37(2) (Declaring Pest under Emergency Pest Notice) of that Act and includes reproductive material of the plant.

"design plan" is a document setting out how all identified consequence scenarios are addressed in the planned design and operation of a regulated structure.

"development wells" means a petroleum well which produces or stores petroleum. For clarity, a development well does not include an appraisal well.

"document" has the meaning in the *Acts Interpretation Act 1954* and means:
- any paper or other material on which there is writing; and
- any paper or other material on which there are marks; and
- figures, symbols or perforations having a meaning for a person qualified to interpret them; and
- any disc, tape or other article or any material from which sounds, images, writings or messages are capable of being produced or reproduced (with or without the aid of another article or device).

"ecologically dominant layer" has the meaning in the Methodology for Surveying and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Version 3.2 August 2012) and means the layer making the greatest contribution to the overall biomass of the site and the vegetation community (NLWRA 2001). This is also referred to as the ecologically dominant stratum or the predominant canopy in woody ecosystems.

"ecosystem function" means the interactions between and within living and nonliving components of an ecosystem and generally correlates with the size, shape and location of the vegetation community.

"enclosed flare" means a device where the residual gas is burned in a cylindrical or rectilinear enclosure that includes a burning system and a damper where air for the combustion reaction is admitted.

"environmental harm" has the meaning in section 14 of the *Environmental Protection Act 1994* and means any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value, and includes environmental nuisance.

Environmental harm may be caused by an activity—
(a) whether the harm is a direct or indirect result of the activity; or
(b) whether the harm results from the activity alone or from the combined effects of the activity and other activities or factors.

"environmental nuisance" has the meaning in section 15 of the *Environmental Protection Act 1994 and means* unreasonable interference or likely interference with an environmental value caused by—
(a) aerosols, fumes, light, noise, odour, particles or smoke; or
(b) an unhealthy, offensive or unsightly condition because of contamination; or
(c) another way prescribed by regulation.

"environmentally sensitive area" means Category A, B or C environmentally sensitive areas (ESAs)

"equivalent person or EP" has the meaning under section 3 of the Planning Guidelines For Water Supply and Sewerage, 2005, published by the Queensland Government. It is calculated in accordance with Schedule 2, Section 63(4) of the Environmental Protection Regulation 2019 where:
- EP = V/200 where V is the volume, in litres, of the average dry weather flow of sewage that can be treated at the works in a day; or

- EP = M/2.5 where M is the mass, in grams, of phosphorus in the influent that the works are designed to treat as the inlet load in a day.

"essential petroleum activities" means activities that are essential to bringing the resource to the surface and are only the following:

- low impact petroleum activities
- geophysical, geotechnical, geological, topographic and cadastral surveys (including seismic, sample /test / geotechnical pits, core holes)
- single well sites not exceeding 1 hectare disturbance and multi-well sites not exceeding 1.5 hectare disturbance
- well sites with monitoring equipment (including monitoring bores):
  - for single well sites, not exceeding 1.25 hectares disturbance
  - for multi-well sites, not exceeding 1.75 hectares disturbance
- well sites with monitoring equipment (including monitoring bores) and tanks (minimum 1 ML) for above ground fluid storage:
  - for single well sites, not exceeding 1.5 hectares disturbance
  - for multi-well sites, not exceeding 2.0 hectares disturbance
- associated infrastructure located on a well site necessary for the construction and operations of wells:
  - water pumps and generators
  - flare pits
  - chemical / fuel storages
  - sumps for residual drilling material and drilling fluids
  - tanks, or dams which are not significant or high consequence dams to contain wastewater (e.g. stimulation flow back waters, produced water)
  - pipe laydown areas
  - soil and vegetation stockpile areas
  - a temporary camp associated with a drilling rig that may involve sewage treatment works that are no release works
  - temporary administration sites and warehouses
  - dust suppression activities using water that meets the quality and operational standards approved under the environmental authority
- communication and power lines that are necessary for the undertaking of petroleum activities and that are located within well sites, well pads and pipeline right of ways without increasing the disturbance area of petroleum activities
- supporting access tracks
- gathering / flow pipelines from a well head to the initial compression facility
- activities necessary to achieve compliance with the conditions of the environmental authority in relation to another essential petroleum activity (e.g. sediment and erosion control measures, rehabilitation).

"existing authority' has the meaning in section 94 of the *Environmental Offsets Act 2014.*

"existing structure" means a structure that was in existence prior to the adoption of this schedule of conditions under the authority.

"exploration well" means a petroleum well that is drilled to:

- explore for the presence of petroleum or natural underground reservoirs suitable for storing petroleum; or
- obtain stratigraphic information for the purpose of exploring for petroleum.

For clarity, an exploration well does not include an appraisal or development well.

"flare pit" has the meaning in the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635), and means containment area where any hydrocarbon that is discovered in an over-pressured reservoir during a drilling operation is diverted to, and combusted. The flare pit is only used during the drilling and work over process on a petroleum well.

"flare precipitant" means waste fluids which result from the operation of a flare.

"floodplains" has the meaning in the *Water Act 2000* and means an area of reasonably flat land adjacent to a watercourse that—

- is covered from time to time by floodwater overflowing from the watercourse; and
- does not, other than in an upper valley reach, confine floodwater to generally follow the path of the watercourse; and
- has finer sediment deposits than the sediment deposits of any bench, bar or in-stream island of the watercourse.

"flowable substance" means matter or a mixture of materials which can flow under any conditions potentially affecting that substance. Constituents of a flowable substance can include water, other liquids fluids or solids, or a mixture that includes water and any other liquids fluids or solids either in solution or suspension.

"fuel burning or combustion facility" means a permanent fuel burning or combustion equipment which in isolation, or combined in operation, or which are interconnected, is, or are capable of burning more than 500 kg of fuel in an hour.

"GDA" means Geocentric Datum of Australia.

"Great Artesian Basin (GAB) spring" means an area protected under the *Environment Protection and Biodiversity Conservation Act 1999* because it is considered to be a Matter of National Environmental Significance and identified as a:

- community of native species dependent on natural discharge of groundwater from the Great Artesian Basin; or
- Great Artesian Basin spring; or
- Great Artesian Basin discharge spring wetland.

A GAB spring includes a spring vent, spring complex or watercourse spring and includes the land to which water rises naturally from below the ground and the land over which the water then flows.

Note: The Australian Government's Protected Matters Search Tool should be used to get an indication of whether the area of interest may contain an MNES spring.

Note: The GAB springs dataset can be requested from the Queensland Government Herbarium

"green waste" means waste that is grass cuttings, trees, bushes, shrubs, material lopped from trees, untreated timber or other waste that is similar in nature but does not include declared pest species.

"greywater" means wastewater generated from domestic activities such as laundry, dishwashing, and bathing. Greywater does not include sewage.

"growing" means to increase by natural development, as any living organism or part thereof by assimilation of nutriment; increase in size or substance.

"hydraulic integrity" refers to the capacity of a dam to contain or safely pass flowable substances based on its design.

"impacts to state significant biodiversity values" means to have a negative effect on a state significant biodiversity value as identified by the Queensland Biodiversity Offset Policy (Department of Environment and Heritage Protection, 2014). Examples may include, but are not necessarily limited to:

- clearing, removal or fragmentation of vegetation
- interference or disturbance of fauna habitat.

"impulsive (for noise)" means sound characterised by brief excursions of sound pressure (acoustic impulses) that significantly exceed the background sound pressure. The duration of a single impulsive sound is usually less than one second.

"incidental activity" for this environmental authority means an activity that is not a specified relevant activity and is necessary to carry out the activities authorised under this environmental authority.

"LA 90, adj, 15 mins" means the A-weighted sound pressure level, adjusted for tonal character that is equal to or exceeded for 90% of any 15 minutes sample period equal, using Fast response.

"land degradation" has the meaning in the *Vegetation Management Act 1999* and means the following:
- soil erosion
- rising water tables
- the expression of salinity
- mass movement by gravity of soil or rock
- stream bank instability
- a process that results in declining water quality.

"landholder's active groundwater bore" means bores that are able to continue to provide a reasonable yield of water in terms of quantity for the bores authorised purpose or use. This term does not include monitoring bores owned by the administering authority of the *Water Act 2000*.

"linear infrastructure" means powerlines, pipelines, flowlines, roads and access tracks.

"liquid" means a substance which is flowing and offers no permanent resistance to changes of shape.

"long term noise event" means a noise exposure, when perceived at a sensitive receptor, persists for a period of greater than five (5) days, even when there are respite periods when the noise is inaudible within those five (5) days.

"low consequence dam" means any dam that is not classified as high or significant as assessed using the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures, published by the administering authority, as amended from time to time.

"low impact petroleum activities" means petroleum activities which do not result in the clearing of native vegetation, cause disruption to soil profiles through earthworks or excavation or result in significant disturbance to land which cannot be rehabilitated immediately using hand tools after the activity is completed. Examples of such activities include but are not necessarily limited to soil surveys (excluding test pits), topographic surveys, cadastral surveys and ecological surveys, may include installation of monitoring equipment provided that it is within the meaning of low impact and traversing land by car or foot via existing access tracks or routes or in such a way that does not result in permanent damage to vegetation.

"manual" means the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* published by the administering authority.

"Max $L_{pA, 15\ min}$" means the absolute maximum instantaneous A-weighted sound pressure level, measured over 15 minutes.

"Max $L_{pZ, 15\ min}$" means the maximum value of the Z-weighted sound pressure level measured over 15 minutes.

"medium term noise event" is a noise exposure, when perceived at a sensitive receptor, persists for an aggregate period not greater than five (5) days and does not re-occur for a period of at least four (4) weeks. Re-occurrence is deemed to apply where a noise of comparable level is observed at the same receptor location for a period of one hour or more, even if it originates from a difference source or source location.

"methodology" means the science of method, especially dealing with the logical principles underlying the organisation of the various special sciences, and the conduct of scientific inquiry.

"month" has the meaning in the *Acts Interpretation Act 1954* and means a calendar month and is a period starting at the beginning of any day of one (1) of the 12 named months and ending—
- immediately before the beginning of the corresponding day of the next named month; or
- if there is no such corresponding day—at the end of the next named month.

"NATA accreditation" means accreditation by the National Association of Testing Authorities Australia.

"pipeline waste water" means hydrostatic testing water, flush water or water from low point drains.

"pre-disturbed land use" means the function or use of the land as documented prior to significant disturbance occurring at that location.

"predominant species" has the meaning in the Methodology for Surveying and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Version 3.2 August 2012) and means a species that contributes most to the overall above-ground biomass of a particular stratum.

"prescribed contaminants" has the meaning in section 440ZD of the *Environmental Protection Act 1994* and means:
(a) earth; or
(b) a contaminant prescribed under section 440ZF.

"prescribed environmental matters" has the meaning in section 10 of the *Environmental Offsets Act 2014*, limited to the matters of State environmental significant listed in schedule 2 of the Environmental Offsets Regulation 2014.
"primary protection zone" means an area within 200m from the boundary of any Category A, B or C ESA.

"produced water" has the meaning in Section 15A of the *Petroleum and Gas (Production and Safety) Act 2004* and means CSG water or associated water for a petroleum tenure.

"protection zone" means the primary protection zone of any Category A, B or C ESA or the secondary protection zone of any Category A or B ESA.

"regional ecosystem" has the meaning in the Methodology for Surveying and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Version 3.2 August 2012) and means a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil. Regional ecosystems of Queensland were originally described in Sattler and Williams (1999). The Regional Ecosystem Description Database (Queensland Herbarium 2013) is maintained by Queensland Herbarium and contains the current descriptions of regional ecosystems.

"regulated structure" includes land-based containment structures, levees, bunds and voids, but not a tank or container designed and constructed to an Australian Standard that deals with strength and structural integrity.

"rehabilitation or rehabilitated" means the process of reshaping and revegetating land to restore it to a stable landform and in accordance with acceptance criteria and, where relevant, includes remediation of contaminated land. For the purposes of pipeline rehabilitation, rehabilitation includes reinstatement, revegetation and restoration.

"reinstate or reinstatement" for pipelines, means the process of bulk earth works and structural replacement of pre-existing conditions of a site (i.e. soil surface typography, watercourses, culverts, fences and gates and other landscape(d) features) and is detailed in the Australian Pipeline Industry Association (APIA) Code of Environmental Practice: Onshore Pipelines (2013).

"reporting limit" means the lowest concentration that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions. For many analytes, the reporting limit is selected as the lowest non-zero standard in the calibration curve. Results that fall below the reporting limit will be reported as "less than" the value of the reporting limit. The reporting limit is also referred to as the practical quantitation limit or the limit of quantitation. For polycyclic aromatic hydrocarbons, the reporting limit must be based on super-ultra trace methods and, depending on the specific polycyclic aromatic hydrocarbon, will range between 0.005 µg/L–0.02 µg/L.

"residual drilling material" means waste drilling materials including muds and cuttings or cement returns from well holes and which have been left behind after the drilling fluids are pumped out.

"restoration" means the replacement of structural habitat complexity, ecosystem processes, services and function from a disturbed or degraded site to that of a pre-determined or analogue site. For the purposes of pipelines, restoration applies to final rehabilitation after pipeline decommissioning.

"restricted stimulation fluids" has the meaning in section 206 of the *Environmental Protection Act 1994* and means fluids used for the purpose of stimulation, including fracturing, that contain the following chemicals in more than the maximum amount prescribed under a regulation —

(a) petroleum hydrocarbons containing benzene, ethylbenzene, toluene or xylene
(b) chemicals that produce, or are likely to produce, benzene, ethylbenzene, toluene or xylene as the chemical breaks down in the environment.

The amount of any chemical is not measured in relation to water included in the restricted stimulation fluid.

"revegetation or revegetating or revegetate" means to actively re-establish vegetation through seeding or planting techniques in accordance with site specific management plans.

"secondary protection zone" in relation to a Category A or Category B ESA means an area within 100 metres from the boundary of the primary protection zone.

"sensitive place" means:

- a dwelling (including residential allotment, mobile home or caravan park, residential marina or other residential premises, motel, hotel or hostel)
- a library, childcare centre, kindergarten, school, university or other educational institution
- a medical centre, surgery or hospital
- a protected area
- a public park or garden that is open to the public (whether or not on payment of money) for use other than for sport or organised entertainment
- a work place used as an office or for business or commercial purposes, which is not part of the petroleum activity(ies) and does not include employees accommodation or public roads
- for noise, a place defined as a sensitive receptor for the purposes of the Environmental Protection (Noise) Policy 2019.

"sensitive receptor" is defined in Schedule 2 of the Environmental Protection (Noise) Policy 2019, and means an area or place where noise is measured.

"short term noise event" is a noise exposure, when perceived at a sensitive receptor, persists for an aggregate period not greater than eight hours and does not re-occur for a period of at least seven (7) days. Re-occurrence is deemed to apply where a noise of comparable level is observed at the same receptor location for a period of one hour or more, even if it originates from a different source or source location.

"significantly disturbed or significant disturbance or significant disturbance to land or areas" means land is significantly disturbed if—

(a) it is contaminated land; or
(b) it has been disturbed and human intervention is needed to rehabilitate it—
    (i) to a condition required under the relevant environmental authority; or
    (ii) if the environmental authority does not require the land to be rehabilitated to a particular condition—to the condition it was in immediately before the disturbance.

Without limiting subsection (1)(b), land requires human intervention to rehabilitate it if–

(a) the disturbance has made the land more susceptible to erosion; or
(b) the land use capability or suitability of the land is diminished; or
(c) the quality of water in a watercourse downstream of the land has been significantly reduced.

"significant residual impact" has the meaning in section 8 *Environmental Offsets Act 2014*.

"species richness" means the number of different species in a given area.

"specified relevant activities" for this environmental authority means an activity that:

(a) but for being carried out as a resource activity, would be an activity prescribed under Section 19A of the *Environmental Protection Act 1994* as an environmentally relevant activity; or
(b) stimulation activities.

"stable" has the meaning in Schedule 5 of the Environmental Protection Regulation 2008 and, for a site, means the rehabilitation and restoration of the site is enduring or permanent so that the site is unlikely to collapse, erode or subside.

"stimulation" means a technique used to increase the permeability of natural underground reservoir that is undertaken above the formation pressure and involves the addition of chemicals. It includes hydraulic fracturing / hydrofraccing, fracture acidizing and the use of proppant treatments.

Note: This definition is restricted from that in the *Petroleum and Gas (Production and Safety) Act 2004* in order to only capture the types of stimulation activities that pose a risk to environmental values of water quality in aquifers.

"stimulation fluid" means the fluid injected underground to increase permeability of a natural underground reservoir. For clarity, the term stimulation fluid only applies to fluid injected down well post-perforation.

"**stimulation impact zone"** means a 100m maximum radial distance from the stimulation target location within a gas producing formation.

"structure" means a dam or levee.

"subterranean cave GDE"
- means an area identified as a subterranean cave in the mapping produced by the Queensland Government and identified in the Queensland Government Information System, as amended from time to time; and
- means a cave ecosystem which requires access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to matraintain its communities of plants and animals, ecological processes and ecosystem services. Subterranean cave GDEs are caves dependent on the subterranean presence of groundwater. Subterranean cave GDEs have some degree of groundwater connectivity and are indicated by either high moisture levels or the presence of stygofauna, or both, referred to in the Queensland Government WetlandsInfo mapping program, as amended from time to time.

Note: the Subterranean GDE (caves) dataset can be displayed through the Queensland Government WetlandInfo mapping program.

Note: the Subterranean GDE (caves) dataset can be obtained from the Queensland Government Information System.

"suitably qualified and experienced person" in relation to regulated structures means a person who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the *Professional Engineers Act 2002*, and has demonstrated competency and relevant experience:
- for regulated dams, an RPEQ who is a civil engineer with the required qualifications in dam safety and dam design.
- for regulated levees, an RPEQ who is a civil engineer with the required qualifications in the design of flood protection embankments.

Note: It is permissible that a suitably qualified and experienced person obtain subsidiary certification from an RPEQ who has demonstrated competence and relevant experience in either geomechanics, hydraulic design or engineering hydrology.

"suitably qualified person" means a person who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature.

"suitably qualified third party" means a person who:

(a) has qualifications and experience relevant to performing the function including but not limited to:
    i. a bachelor's degree in science or engineering; and
    ii. 3 years' experience in undertaking soil contamination assessments; and
(b) is a member of at least one organisation prescribed in Schedule 14 of the Environmental Protection Regulation 2019; and
(c) not be an employee of, nor have a financial interest or any involvement which would lead to a conflict of interest with the holder(s) of the environmental authority.

"sump" means a pit in which waste residual drilling material or drilling fluids are stored only for the duration of drilling activities.

"synthetic based drilling mud" means a mud where the base fluid is a synthetic oil, consisting of chemical compounds which are artificially made or synthesised by chemically modifying petroleum components or other raw materials rather than the whole crude oil.

"top soil" means the surface (top) layer of a soil profile, which is more fertile, darker in colour, better structured and supports greater biological activity than underlying layers. The surface layer may vary in depth depending on soil forming factors, including parent material, location and slope, but generally is not greater than about 300mm in depth from the natural surface.

"total density of coarse woody material" means the total length of logs on the ground greater than or equal to 10cm diameter per hectare and number of logs on the ground greater than or equal to 10cm diameter per hectare.

"transmissivity" means the rate of flow of water through a vertical strip of aquifer which is one unit wide and which extends the full saturated depth of the aquifer.

"valid complaint" means all complaints unless considered by the administering authority to be frivolous, vexatious or based on mistaken belief.

"void" means any constructed, open excavation in the ground.

"waste and resource management hierarchy" has the meaning provided in section 9 of the *Waste Reduction and Recycling Act 2011 and* is the following precepts, listed in the preferred order in which waste and resource management options should be considered—
(a) AVOID unnecessary resource consumption
(b) REDUCE waste generation and disposal
(c) RE-USE waste resources without further manufacturing
(d) RECYCLE waste resources to make the same or different products
(e) RECOVER waste resources, including the recovery of energy
(f) TREAT waste before disposal, including reducing the hazardous nature of waste
(g) DISPOSE of waste only if there is no viable alternative.

"waste and resource management principles" has the meaning provided in section 4(2)(b) of the *Waste Reduction and Recycling Act 2011* and means the:
(a) polluter pays principle
(b) user pays principle
(c) proximity principle
(d) product stewardship principle.

"waste fluids" has the meaning in section 13 of the *Environmental Protection Act 1994* in conjunction with the common meaning of "fluid" which is "a substance which is capable of flowing and offers no permanent resistance to changes of shape". Accordingly, to be a waste fluid, the waste must be a substance which is capable of flowing and offers no permanent resistance to changes of shape.

"watercourse" has the meaning in Schedule 4 of the *Environmental Protection Act 1994* and means:
1) a river, creek or stream in which water flows permanently or intermittently—

a) in a natural channel, whether artificially improved or not; or
b) in an artificial channel that has changed the course of the watercourse.

2) Watercourse includes the bed and banks and any other element of a river, creek or stream confining or containing water.

"waters" includes all or any part of a creek, river, stream, lake, lagoon, swamp, wetland, spring, unconfined surface water, unconfined water in natural or artificial watercourses, bed and bank of any waters, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and underground water.

"well integrity" the ability of a well to contain the substances flowing through it.

"wetland" for the purpose of this environmental authority, wetland means an area shown as a wetland on the map of Queensland Wetland Environmental Values.
Note: The Environmental Protection (Water and Wetland Biodiversity) Policy 2019 Schedule 2, Map of Queensland Wetland Environmental Values means the document 'Map of Queensland Wetland Environmental Values' made by the Chief Executive and published on the website.
Environmental values in section 8 of the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 apply to wetland areas on the map, which are categorised as wetlands of high or general ecological significance.

"wetland of high ecological significance" means a wetland that meets the definition of a wetland and that is shown as a wetland of 'high ecological significance' or wetland of 'high ecological value' on the Map of Queensland Wetland Environmental Values.

"wetland of other environmental value" means a wetland that meets the definition of a wetland and that is shown as a wetland of 'general environmental significance' or wetland of 'other environmental value' on the Map of Queensland Wetland Environmental Values.

END OF ENVIRONMENTAL AUTHORITY